

# **INTERMEDIATE FIRST YEAR**

## **NEET ZOOLOGY MATERIAL**

**UNIT-I Diversity of living world**

**UNIT-II Structural Organisation in Animals**

**UNIT-III Animal Diversity-I**

**(Invertebrate Phyla)**

**UNIT-IV Animal Diversity-II**

**(Chordata Phylum)**

**UNIT-V Locomotion and Reproduction**

**UNIT-VI Biology in Human Welfare**

**UNIT-VII Periplaneta Americana**

**(Cockroach)**

**UNIT-VIII(Ecology and Environment)**

**By**

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# **UNIT-I**

## **DIVERSITY IN THE LIVING WORLD**

### **(CHAPTER 1 THE LIVING WORLD)**

## SYNOPSIS

- Living organisms show certain key characteristics which distinguish them from non-living things. These are
  - **Growth** is shown by living organism by an increase in mass and an increase in the number of individuals. A multicellular organism grows by cell division.
  - **Reproduction** is the process of producing offspring possessing features similar to those of their parents. It takes place by sexual or asexual mode.
  - **Metabolism** comprises of both constructive reactions (anabolism) and destructive reactions (catabolism), continuously occurring in the body.
  - **Cellular organisation** The cells are the building blocks of all living organisms may it be plants, animals or humans. Thus, organisms can be **unicellular** or **multicellular**.
  - **Consciousness** is the ability of living organisms to sense their surroundings or environment and respond to these environmental stimuli, which could be physical, chemical and biological.
  - **Biodiversity** refers to the number and types of organisms present on earth. Our earth possesses a wide range of living organisms. A number of plants and animals have been identified and described. However, a large number of organisms are still unknown to us.
  - A rich diversity among organisms or biodiversity in terms of size, colour, habitat, physiological and morphological features can be observed on earth. Therefore, it is necessary to standardise the methods to identify and classify them on the basis of their defining characteristics
  - Certain rules and principles have been formulated for the **identification, nomenclature** and **classification** of organisms, which facilitate the study of vast diversity of organisms present on earth.
  - **Identification** involves the process of finding the correct name and place of an organism. The morphological and anatomical characters are examined for proper identification.
  - **Nomenclature** involves standardising appropriate naming of living organisms, so that they can be recognised and differentiated from others easily across the world.
  - To ease the process of studying different organisms, a scientific name is assigned to each organism.
  - The principles of naming have been established by **International Code for Botanical Nomenclature** (ICBN) and **International Code for Zoological Nomenclature** (ICZN) for plants and animals, respectively.
  - Organisms are identified on the basis of their resemblance and distinct differences from others. They are assigned a correct **scientific/biological** name.
  - **Binomial System of Nomenclature** was developed by **Carolus Linnaeus** in 1751 and was published in his book *Species Plantarum* (1753). As per this system, a biological name comprises of two words namely, **generic name** and the **specific epithet**.
- **Nomenclature of organisms** follows certain universal rules, which are as follows

- Biological names are generally in Latin and are written in Italics. These are latinised or derived from Latin irrespective of their origin.
- Both the words in a biological name, when handwritten are separately underlined or printed in Italics to indicate their Latin origin.
- The first letter of the generic name is written in capital letter while that of specific epithet is written in small letter, e.g. *Mangifera indica*.
- Name of the author appears after the specific epithet at the end of the biological name and is written in an abbreviated form, e.g. *Mangifera indica* Linn, where Linn is for Linnaeus
- **Classification** is the process by which organisms are grouped into convenient categories based on some easily observable characters. The scientific term used for different categories is **taxa**.
- **Taxonomy** is the branch of science which deals with different aspects of identification, nomenclature and classification of organisms. **Linnaeus** is known as the Father of Taxonomy.
- **Systematics** is the study of systematic arrangement of organisms and the evolutionary relationships amongst them.
- The system of arranging different categories or ranks, which are referred to as **taxonomic categories** in a proper ascending or descending order is called as **taxonomic hierarchy**. Every organism occupies a distinct position in a taxonomic hierarchy.
- Each category in taxonomical hierarchy is commonly called **taxon**. The term 'taxon' was first introduced by ICBN during 1956 and it is the basic unit of classification.
- Taxonomic hierarchy was first proposed by **Linnaeus** and thus it is also called as **Linnaeus hierarchy**. This hierarchy constitutes the following components in an ascending order.
  - **Species** It is the smallest unit of taxonomic hierarchy consisting of groups of morphologically similar individuals which can interbreed to produce offspring, e.g. *nigrum* and *melongena* are the two species of genus–*Solanum*.
  - **Genus** It comprises of a group of related species having more characters in common in comparison to species of other genera, e.g. lion, leopard and tiger are all species of the genus–*Panthera*, while cats belong to the genus–*Felis*.
  - **Family** It is a group of related genera with a few common features but less number of similarities as compared to genus and species. Plant families are categorised on the basis of both vegetative and reproductive features of species, e.g. family–Solanaceae possesses different genera like *Solanum*, *Petunia* and *Datura*. Similarly, in animals, cats and dogs belong to two different families–Felidae and Canidae, respectively.
  - **Order** It is the assemblage of families which exhibit a few similar characters, e.g. order–Polymoniales contains different plant families like Solanaceae and Convolvulaceae. In animals, order–Carnivora includes families Felidae and Canidae.

- **Class** It includes one or more related orders, e.g. class–Mammalia includes order–Primata and Carnivora.
- **Phylum or Division** It includes classes with a few similar characters, e.g. phylum–Chordata includes animals possessing notochord and dorsal neural system
- In plants, classes with few similar characters are placed under higher category called **division**, e.g. the division–Angiospermae includes wheat, onion, etc.
- **Kingdom** It is the highest taxonomic category. All animals belong to the kingdom–Animalia, while all plants belong to the kingdom–Plantae.

## Taxonomical Aids

Biologists have established certain procedures and techniques to store and preserve information as well as the specimens which are useful in identification and classification of organisms. These techniques stored information and procedures are called **taxonomic tools** or **taxonomic aids**. Following are some of the main taxonomical aids used to study taxonomy

- **Herbarium** is the storehouse of collected plant specimens that are dried, pressed and preserved on herbarium sheets. The biggest herbarium of the world is the Royal Botanical Garden in Kew (England), while the biggest herbarium of India is the Central National Herbarium at Shibpur (Kolkata).
- **Botanical garden** is essentially a collection of living plants maintained for both pure and applied studies. The famous botanical gardens are Royal Botanical Garden in Kew (England), Indian Botanical Garden, Howrah (India) and National Botanical Research Institute, Lucknow (India).
- **Museums** have a collection of preserved plants and animals for study and reference purposes. Specimens are preserved in containers or jars in preservative solutions. Insects are preserved in insect boxes after collecting, killing and pinning them. Larger animals like birds and mammals are usually stuffed and preserved.
- **Zoological parks** are the places where wild animals are kept in protected environments under human care. This enables us to learn about their food habits and behaviour.
- **Keys** are used for identification of plants and animals based on similarities and dissimilarities. The keys are based on the contrasting characters generally in a pair called **couplet**. Each statement in the key is called a **lead**. Keys are generally analytical in nature.
- **Monograph** contains information on any one taxon.
- **Manuals** are useful in providing information for identification of names of species found in an area.
- **Flora** contains the actual account of habitat and distribution of plants of a given area.
- **Catalogue** is a list that enumerates methodically all the species found in an area with brief description aiding identification

## MULTIPLE CHOICE QUESTIONS

- 1** The characteristics of growth include
  - (a) increase in mass
  - (b) increase in number of individuals
  - (c) Both (a) and (b)
  - (d) ability to reproduce
- 2** Plants grow throughout life by which method?
  - (a) Cell dedifferentiation
  - (b) Cell differentiation
  - (c) Cell division
  - (d) None of the above
- 3** Growth in unicellular organisms can be observed by
  - (a) counting the mass of cultured cells
  - (b) analysing the amount of nutrients absorbed by living organism
  - (c) growth cannot be observed
  - (d) simply counting the number of cells under microscope during *in vitro* culture
- 4** In majority of higher animals and plants, reproduction and growth are
  - (a) mutually exclusive events
  - (b) synonymous events
  - (c) synonymous events during *in vitro* culture
  - (d) None of the above
- 5** Among the following, which is a common phenomenon exhibited by living and non-living organisms to show the feature of growth?
  - (a) Increase in mass
  - (b) Cell division
  - (c) Increase in replication rate
  - (d) Cell differentiation
- 6** What kind of growth is exhibited by non-living organisms?
  - (a) Accumulation of material on surface
  - (b) Accumulation of material inside
  - (c) Growth from inside
  - (d) None of the above
- 7** A true regeneration was observed in
  - (a) *Hydra*
  - (b) *Planaria*
  - (c) Sponges
  - (d) *Amoeba*
- 8** Which of the following set of organisms reproduce by fragmentation (asexual mode of reproduction)?
  - (a) *Amoeba*, fungi and earthworm
  - (b) Fungi, filamentous algae and protonema of mosses
  - (c) *Hydra*, fungi, *Amoeba* and bacteria
  - (d) Earthworm, bacteria and fungi
- 9** Reproduction is synonymous with growth in which of the following set of organisms?
  - (a) Bacteria, unicellular algae and *Amoeba*
  - (b) Bacteria, *Amoeba* and fungi
  - (c) Unicellular algae and fungi
  - (d) Unicellular algae and filamentous algae
- 10** Why reproduction cannot be considered as an inclusive defining characteristic of all living organisms?
  - (a) Non-living organisms also reproduce
  - (b) Many living organisms are sterile
  - (c) Reproduction is synonym to growth in all organisms
  - (d) Both (a) and (b)
- 11** Which of the following characteristics is not a defining character of living organisms?
  - (a) Growth
  - (b) Growth and reproduction
  - (c) Reproduction
  - (d) Growth and metabolism
- 12** Metabolism can be best defined as
  - (a) the process in which a chemical is formed inside the body
  - (b) the process in which a chemical is destroyed inside the body
  - (c) the sum total of all chemical reactions occurring in the body
  - (d) a complex construction process only
- 13** In which of the following, metabolic reactions take place?
  - (a) In living organisms only
  - (b) Both in living and non-living organisms
  - (c) In cell-free systems
  - (d) Both (a) and (c)
- 14** Consciousness is the defining property of living organisms because
  - (a) photoperiod affects reproduction in seasonal breeders in both plants and animals
  - (b) plants respond to external factors like temperature and light
  - (c) human is aware of himself
  - (d) All of the above
- 15** Higher level of organisation emerges from
  - (a) a tissue itself
  - (b) interactions among organelles
  - (c) molecular constituent of an organelle
  - (d) None of the above
- 16** Hierarchy of biological organisation in living beings can be represented as
  - (a) Subcellular → Cellular → Individual → Population
  - (b) Atomic → Molecular → Cellular → Tissue → Organ → Organ system → Individual
  - (c) Organ system → Tissue → Cellular → Molecular → Atomic
  - (d) Individual → Molecular → Tissue → Organ system → Population
- 17** Biodiversity can be best defined as
  - (a) occurrence of the number and types of organisms
  - (b) species and ecosystem of a region
  - (c) variety of life in an ecosystem
  - (d) totality of genes, species and ecosystem of a given region
- 18** The number of species that are known and described ranges between
  - (a) 1.7-1.8 million
  - (b) 1 million
  - (c) 50 million
  - (d) 2 million
- 19** Standardising the name of living organism is known as
  - (a) classification
  - (b) identification
  - (c) nomenclature
  - (d) Both (a) and (c)

- 20** Which is first step in taxonomy?  
 (a) Description of the organism  
 (b) Identification of the organism  
 (c) Nomenclature of the organism  
 (d) Classification of the organism
- 21** ICBN stands for  
 (a) Indian Congress of Biological Name  
 (b) International Code for Botanical Nomenclature  
 (c) International Congress of Biological Name  
 (d) Indian Code of Botanical Nomenclature
- 22** Expand ICZN  
 (a) International Code for Zoological Nomenclature  
 (b) Intranational Code for Zoological Nomenclature  
 (c) International Code for Zoological Naming  
 (d) Interregional Code for Zoological Naming
- 23** Organisms are given scientific names because  
 (a) it ensures that each organism has only one name  
 (b) it ensures that no name is used twice  
 (c) it ensures desired name for the organisms  
 (d) Both (a) and (b)
- 24** According to the binomial nomenclature, scientific name of an organism consists of  
 (a) generic name (b) specific epithet  
 (c) Both (a) and (b) (d) None of these
- 25** The binomial nomenclature system was given by  
 (a) Carol Linnaeus  
 (b) Carolus Linnaeus  
 (c) Aristotle  
 (d) Whittaker
- 26** In *Mangifera indica*, the word *Mangifera* is a  
 (a) genus (b) species  
 (c) variety (d) order
- 27** Scientific names are printed in ..... and are derived from .....  
 (a) Bold and English  
 (b) Italics and Latin  
 (c) Italics and German  
 (d) Italics and French
- 28** Which of the following is against the rules of ICBN?  
 (a) Handwritten scientific names should be underlined  
 (b) Every species should have a generic name and a specific epithet  
 (c) Scientific names are in Latin and should be italicised  
 (d) Generic and specific names should be written starting with small letters
- 29** Which one is the incorrectly written scientific name?  
 (a) *Panthera tigris* (b) *Mangifera indica*  
 (c) *Panthera leo* (d) *Columba LIVEA*
- 30** In binomial nomenclature, the name of author appears after the  
 (a) genus (b) family  
 (c) species (d) taxa
- 31** Select the correctly written scientific name of mango which was first described by Carolus Linnaeus.  
 (a) *Mangifera indica* Linn.  
 (b) *Mangifera indica*  
 (c) *Mangifera Indica*  
 (d) *Mangifera indica* Car. Linn.
- 32** The process by which anything is grouped into convenient categories based on some easily observable characters is  
 (a) identification  
 (b) classification  
 (c) sorting  
 (d) grouping
- 33** The scientific term for different categories like plants and mammals is  
 (a) phylum (b) taxa  
 (c) genus (d) epithet
- 34** What are the basis of modern taxonomic studies?  
 (a) Internal structure  
 (b) Ecological information  
 (c) Structure of cell  
 (d) All of the above
- 35** Earliest classifications were based on  
 (a) 'uses' or basic amenities of organisms  
 (b) morphological features of organisms  
 (c) ecological interactions of organisms  
 (d) phylogenetic relations of organisms
- 36** All the given options represent the basic process of taxonomy except  
 (a) nomenclature (b) identification  
 (c) speciation (d) classification
- 37** Diversity of organisms and their evolutionary relationship is studied scientifically under  
 (a) morphology (b) anatomy  
 (c) taxonomy (d) systematics
- 38** Who had written *Systema Naturae*?  
 (a) Ernst Mayr (b) Carolus Linnaeus  
 (c) RH Whittaker (d) WM Stanley
- 39** Ascending or descending arrangement of taxonomic categories is known as  
 (a) classification (b) key  
 (c) taxonomy (d) hierarchy
- 40** A taxon is a  
 (a) group of related species  
 (b) group of related families  
 (c) type of living organisms  
 (d) taxonomic group of any ranking
- 41** A 'taxa' differs from 'taxon' due to  
 (a) being a higher taxonomic category than taxon  
 (b) being a lower taxonomic category than taxon  
 (c) being plural of taxon  
 (d) being singular of taxon

- 42** What is the basic unit of classification?  
 (a) Family (b) Order  
 (c) Species (d) Genus
- 43** Species is considered as  
 (a) the largest taxon of taxonomy/classification  
 (b) the smallest taxon of taxonomy/classification  
 (c) Both smallest and the largest unit of taxonomy/classification  
 (d) None of the above
- 44** Individuals of which taxa can interbreed freely?  
 (a) Genus (b) Species  
 (c) Family (d) Order
- 45** Which one is species?  
 (a) *Cannis* (b) *Pisum*  
 (c) *leo* (d) Carnivora
- 46** In *Solanum tuberosum*, first and second words stand for, respectively  
 (a) genus, generic name  
 (b) specific epithet, species  
 (c) specific name and generic name  
 (d) genus and species
- 47** *Solanum* and *Panthera* are  
 (a) genus and species  
 (b) genus and genus  
 (c) species and species  
 (d) only species
- 48** Choose the organism which does not belong to genus *Solanum*.  
 (a) Potato  
 (b) Tomato  
 (c) Brinjal  
 (d) Bottle gourd
- 49** A group of related genera is called a  
 (a) family (b) class  
 (c) phylum (d) order
- 50** For naming different families in taxonomy.  
 (a) Animal families ends with suffix – idea  
 (b) Plant families ends with suffix – accae  
 (c) both vegetative and reproductive features are taken as the basis of plant classification  
 (d) All of the above
- 51** Which is not a taxonomic category?  
 (a) Asteraceae/Fabaceae (b) Species  
 (c) Phylum (d) Class
- 52** The plant family–Solanaceae is included in which order?  
 (a) Felidae (b) Conidae  
 (c) Polymoniales (d) Dimoniales
- 53** The order–Carnivora includes family  
 (a) Felidae  
 (b) Convolvulaceae  
 (c) Felidae and Canidae  
 (d) Canidae
- 54** In hierarchical classification, class is placed between  
 (a) kingdom and phylum  
 (b) order and family  
 (c) phylum and order  
 (d) family and genus
- 55** The taxonomic category assigned to Mammalia is  
 (a) Family (b) Genus  
 (c) Class (d) Order
- 56** Which of the following taxonomic categories includes all the other categories?  
 (a) Class (b) Order  
 (c) Family (d) Genus
- 57** Higher taxa share  
 (a) least common characters  
 (b) maximum common characters  
 (c) no common characters  
 (d) exactly similar common characters
- 58** Which one of the following taxonomic categories top the hierarchy of categories?  
 (a) Order (b) Division  
 (c) Class (d) Family
- 59** In case of plants, classes with a few similar characters are assigned to higher category called  
 (a) division (b) phylum  
 (c) order (d) family
- 60** Which one of the following categories contains the least similar characteristics?  
 (a) Class (b) Order  
 (c) Family (d) Division
- 61** Choose the incorrect match.  
 (a) Order – a group of related families  
 (b) Genus – a group of related species  
 (c) Class – a group of related orders  
 (d) Division – a group of related phyla
- 62** Arrange the following in ascending order of similar characteristics.  
 I. Family II. Genus  
 III. Class IV. Species  
 (a) Class < Family < Genus < Species  
 (b) Family < Class < Genus < Species  
 (c) Species < Order < Family < Class  
 (d) Class < Genus < Species < Family
- 63** Sapindales represents one of the taxonomic category of mango. The similar taxonomic category of man is  
 (a) Mammalia (b) Chordata  
 (c) Primata (d) Eutheria
- 64** The scientific name of wheat is  
 (a) *Mangifera indica* (b) *Triticum aestivum*  
 (c) *Triticum poales* (d) None of these
- 65** The housefly belongs to which family in taxonomical classification?  
 (a) Musca (b) Diptera  
 (c) Muscidae (d) Insecta



- 66** Which taxonomic category of mango and wheat is similar?  
 (a) Order and Family (b) Only Division  
 (c) Division and Class (d) Division, Class and Order
- 67** The odd taxonomic category among the given options is  
 (a) *Triticum* (b) *Homo*  
 (c) *Musca* (d) Poaceae
- 68** Why hierarchical taxonomic system is used?  
 (a) As each higher taxonomic category contains groups/categories below it  
 (b) It is helpful to establish classifications  
 (c) All taxonomic categories reflect common habitats  
 (d) Taxonomic groups show similar characters and have no evolutionary relationship
- 69** Which one of the following features is shared by all the living organisms at all the hierarchical levels?  
 (a) Mode of nutrition  
 (b) Cellular organisation  
 (c) Nature of protoplasmic composition  
 (d) Growth by cell division
- 70** Poales and Sapindales represent  
 (a) Genus (b) Class  
 (c) Order (d) Species
- 71** What is the prime source of taxonomic studies?  
 (a) Collection of actual specimen of organism  
 (b) Identification of actual specimen of organism  
 (c) Both (a) and (b)  
 (d) None of the above
- 72** The taxonomical aids in which dried pressed plant specimens are preserved is  
 (a) botanical garden (b) herbarium  
 (c) sheets (d) specimen sheets
- 73** The label of a herbarium sheet does not carry information on  
 (a) date of collection (b) name of collector  
 (c) local names (d) height of plant
- 74** Largest herbarium in India is  
 (a) Madras Herbarium, Coimbatore (Tamil Nadu)  
 (b) Central National Herbarium (Indian Botanical Garden) Shibpur, Kolkata (WB)  
 (c) Herbarium of National Botanical Research Institute, Lucknow (UP)  
 (d) Forest Research Institute, Dehradun (UK)
- 75** A taxonomical aid having collection of living plants for reference is  
 (a) herbarium (b) zoological park  
 (c) botanical garden (d) museum
- 76** In a botanical garden, labelling of plants indicates  
 (a) scientific name only  
 (b) scientific name and family  
 (c) common name, scientific name and order  
 (d) common name only
- 77** Which of the following is an advantage of establishing botanical gardens?  
 (a) These have collections of living plants for reference  
 (b) These are *ex situ* conservation strategy  
 (c) These contain labelled plants indicating its botanical/scientific name and family  
 (d) All of the above
- 78** The Indian Botanical Garden is located at  
 (a) Howrah (b) London (c) Lucknow (d) Kew
- 79** Largest botanical garden in the world is  
 (a) Conservatory and Botanical Garden, Geneva  
 (b) New York Botanical Garden  
 (c) Royal Botanical Garden, Kew (London)  
 (d) British Museum of Natural History
- 80** Museums have the collection of  
 (a) living plants  
 (b) living animals and plants  
 (c) dead plant and animal remains  
 (d) preserved plant and animal specimens
- 81** Insects are preserved in museums  
 (a) in preservative solutions  
 (b) as dry specimens  
 (c) by collecting, killing and pinning  
 (d) Both (b) and (c)
- 82** Zoological park is a place  
 (a) where wild animals are kept in protected environment under human care  
 (b) which enable us to learn about the food habits and behaviour of wild animals  
 (c) where conditions similar to natural habitat of wild animal is provided  
 (d) All of the above
- 83** The taxonomical aid used for identification of plants and animals by applying diagnostic features is  
 (a) herbarium  
 (b) key  
 (c) museum  
 (d) monograph
- 84** The contrasting characteristics generally in a pair used for identification of animals in a taxonomic key are referred to as  
 (a) lead (b) couplet (c) doublet (d) alternate
- 85** Statement in the key is referred to as  
 (a) lead (b) clue  
 (c) proof (d) Both (a) and (b)
- 86** A book containing information about the habitat, climate, description and index of plants found in a specific area is  
 (a) flora (b) key  
 (c) manual (d) monograph
- 87** What is true about manual?  
 (a) It is a list that enumerates all species  
 (b) It is a book containing information for identification of names of species in a particular area  
 (c) It is based on similarities and dissimilarities  
 (d) Both (a) and (b)
- 88** Which taxonomical aid provides all information about a particular taxon like order or family?  
 (a) Herbarium (b) Catalogue  
 (c) Taxonomic key (d) Monograph
- 89** List containing names of all the species found in a particular area is referred to as  
 (a) monograph  
 (b) herbarium  
 (c) catalogue  
 (d) couplet



- (a) I and II (b) III and IV  
(c) II and IV (d) I, II, III and IV

13 Consider the following statements.

I. Couplet in a key represents a pair of similar characters among organisms.

II. Keys are generally analytical in nature.

Select the correct option.

- (a) I is true, but II is false (b) Both I and II are false  
(c) I is false, but II is true (d) Both I and II are true

14 Select true statements from the following and choose the right answer from the options given below.

I. Human's scientific name is *Homo sapiens*.

II. *Genera Plantarum* is written by John Ray.

III. Highest taxonomic category is division.

IV. Taxonomic group of any rank is taxon.

V. A group of closely related species of an organism represents genus.

VI. The term 'Systematics' was coined by de Candolle.

- (a) II, III, IV and VI (b) I, III, V and VI  
(c) I, IV and V (d) II, III and VI

15 Select true and false statements and choose the correct answer from the options given below.

I. Taxon is a group of related organisms.

II. Royal Botanical Garden is located in Bristol (England).

III. Dudhwa National Park is located at Lakhimpur in UP.

IV. There are about 89 Wildlife Sanctuaries and 492 National Parks in India.

V. When specific name is identical to generic name, it is an example of tautonym.

- (a) True-I, II, IV False-III, V  
(b) True-I, II False-III, IV, V  
(c) True-III, V False-I, II, IV  
(d) True-III, VI, V False-I, II

16 Match the following columns.

Column I	Column II
A. <i>Ex situ</i> conservation	1. Central National Herbarium
B. Quick referral system	2. Flora
C. Actual account of habitat and distribution of plants of a given area	3. Royal Botanical Garden

Codes

- A B C  
(a) 1 2 3  
(b) 3 1 2  
(c) 2 3 1  
(d) 3 2 1

17 Match the following columns.

Column I	Column II
A. Introduced binomial nomenclature	1. Ernst Mayr
B. The Darwin of the 20th century	2. Carolus Linnaeus
C. Gave the concept of new systematics	3. John Ray
D. First described species as a unit of classification	4. Julian Huxley

Codes

- A B C D A B C D  
(a) 1 2 3 4 (b) 2 1 4 3  
(c) 4 3 2 1 (d) 3 4 1 2

18 Match the following columns.

Column I (Taxonomic hierarchy)	Column II (Examples)
A. Family	1. Diptera
B. Order	2. Arthropoda
C. Class	3. Muscidae
D. Phylum	4. Insecta

Codes

- A B C D A B C D  
(a) 3 1 4 2 (b) 3 2 4 1  
(c) 4 3 2 1 (d) 4 2 1 3

19 Match the following columns.

Column I (Designation)	Column II (Scientists)
A. Father of Taxonomy	1. Hippocrates
B. Father of Zoology	2. Theophrastus
C. Father of Botany	3. Aristotle
D. Father of Medicine	4. Carolus Linnaeus

Codes

- A B C D A B C D  
(a) 1 2 3 4 (b) 4 3 2 1  
(c) 3 4 1 2 (d) 3 1 2 4

20. Match the following columns.

Column I (Taxonomical aids)	Column II (Features)
A. Monograph	1. Information for identification of name of species found in an area.
B. Botanical garden	2. Living wild animals in their natural habitat.
C. Zoological park	3. Information on any one taxon.
D. Manual	4. Place having diversity of living plants.

Codes

- A B C D A B C D  
(a) 3 4 2 1 (b) 1 4 2 3  
(c) 4 3 1 2 (d) 4 1 2 3

21 Match the items given in Column I with those in Column II and select the correct option given below.

Column I (Taxonomical aids)	Column II (Features)
A. Herbarium	1. It is a place having a collection of preserved plants and animals.
B. Key	2. A list that enumerates methodically all the species found in an area with brief description aiding identification.
C. Museum	3. It is a place where dried and pressed plant specimens mounted on sheets are kept.
D. Catalogue	4. A booklet containing a list of characters and their alternates which are helpful in identification of various taxa.

Codes

- A B C D A B C D  
(a) 2 4 3 1 (b) 3 2 1 4  
(c) 1 4 3 2 (d) 3 4 1 2

22 Match the following columns.

Column I (Botanical gardens/Institutes)	Column II (Places)
A. Royal Botanical Garden, Kew	1. Darjeeling
B. National Botanical Research Institute	2. Kolkata
C. Indian Botanical Garden	3. Lucknow
D. Forest Research Institute	4. Dehradun
E. Lloyd's Botanical Garden	5. England

**Codes**

	A	B	C	D	E
(a)	5	3	2	4	1
(b)	1	3	2	4	5
(c)	2	5	3	4	1
(d)	4	1	3	2	5

23 Match the following columns.

Column I (A group of specimens)	Column II (Description)
A. Holotype	1. A specimen cited with original description other than the holotype or isotype
B. Isotype	2. A duplicate of the holotype
C. Paratype	3. A specimen designated in the original description
D. Lectotype	4. A specimen selected from original material to serve as nomenclature type when the holotype was not designated

**Codes**

	A	B	C	D
(a)	3	2	1	4
(b)	3	1	2	4
(c)	3	2	4	1
(d)	3	4	1	2

## NCERT EXEMPLAR PROBLEMS

1. As we go from species to kingdom in a taxonomic hierarchy, the number of common characteristics
  - a. Will decrease
  - b. Will increase
  - c. Remain same
  - d. May increase or decrease
  
2. Which of the following 'suffixes' used for units of classification in plants indicates a taxonomic category of 'family'.
  - a. -Ales
  - b. -Onae
  - c. -Aceae
  - d. -Ae
  
3. The term 'systematics' refers to:
  - a. Identification and study of organ systems of plants and animals
  - b. Identification and preservation of plants and animals
  - c. Diversity of kinds of organisms and their relationship
  - d. Study of habitats of organisms and their classification
  
4. Genus represents
  - a. An individual plant or animal
  - b. A collection of plants or animals
  - c. A group of closely related species of plants or animals
  - d. None of these
  
5. The taxonomic unit 'Phylum' in the classification of animals is equivalent to which hierarchical level in classification of plants
  - a. Class
  - b. Order
  - c. Division
  - d. Family

6. Botanical gardens and zoological parks have
- Collection of endemic living species only
  - Collection of exotic living species only
  - Collection of endemic and exotic living species
  - Collection of only local plants and animals
7. Taxonomic key is one of the taxonomic tools in the identification and classification of plants and animals. It is used in the preparation of
- Monographs
  - Flora
  - Both a & b
  - None of these
8. All living organisms are linked to one another because
- They have common genetic material of the same type
  - They share common genetic material but to varying degrees
  - All have common cellular organization
  - All of above
9. Which of the following is a defining characteristic of living organisms?
- Growth
  - Ability to make sound
  - Reproduction
  - Response to external stimuli

10. Match the following and choose the correct option:

Column I	Column II
A. Family	i. <i>tuberosum</i>
B. Kingdom	ii. Polymoniales
C. Order	iii. <i>Solanum</i>
D. Species	iv. Plantae
E. Genus	v. Solanacea

## NEET PREVIOUS QUESTIONS

1. Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus.  
 (a) *Mangifera Indica*  
 (b) *Mangifera indica* Car. Linn.  
 (c) *Mangifera indica* Linn.  
 (d) *Mangifera indica* (NEET 2019)
2. Which of the following is against the rules of ICBN?  
 (a) Hand written scientific names should be underlined.  
 (b) Every species should have a generic name and a specific epithet.  
 (c) Scientific names are in Latin and should be italicized.  
 (d) Generic and specific names should be written starting with small letters.  
 (Odisha NEET 2019)
3. Match the items given in column I with those in column II and select the correct option given below.
- | Column I     | Column II  |
|--------------|--|
| A. Herbarium | (i) It is a place having a collection of preserved plants and animals.   |
| B. Key       | (ii) A list that enumerates methodically all the species found in an area with brief description aiding identification.  |
| C. Museum    | (iii) Is a place where dried and pressed plant specimens mounted on sheets are kept.                                     |
| D. Catalogue | (iv) A booklet containing a list of characters and their alternates which are helpful in identification of various taxa. |
- | A         | B    | C     | D    |
|-----------|------|-------|------|
| (a) (i)   | (iv) | (iii) | (ii) |
| (b) (iii) | (ii) | (i)   | (iv) |
| (c) (ii)  | (iv) | (iii) | (i)  |
| (d) (iii) | (iv) | (i)   | (ii) |
- (NEET 2018)
4. Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature?  
 (a) The names are written in Latin and are italicised.  
 (b) When written by hand the names are to be underlined.  
 (c) Biological names can be written in any language.  
 (d) The first word in a biological name represents the genus name and the second is a specific epithet.  
 (NEET-I 2016)
5. Match column I with column II for housefly classification and select the correct option using the codes given below.
- | Column I  | Column II       |
|-----------|-----------------|
| A. Family | (i) Diptera     |
| B. Order  | (ii) Arthropoda |
| C. Class  | (iii) Muscidae  |
| D. Phylum | (iv) Insecta    |
- (a) A-(iii), B-(i), C-(iv), D-(ii)  
 (b) A-(iii), B-(ii), C-(iv), D-(i)  
 (c) A-(iv), B-(iii), C-(ii), D-(i)  
 (d) A-(iv), B-(ii), C-(i), D-(iii) (NEET-II 2016)
6. The label of a herbarium sheet does not carry information on  
 (a) date of collection (b) name of collector  
 (c) local names (d) height of the plant.  
 (NEET-II 2016)
7. Which one of the following is not a correct statement?  
 (a) A museum has collection of photographs of plants and animals.  
 (b) Key is a taxonomic aid for identification of specimens.  
 (c) Herbarium houses dried, pressed and preserved plant specimens.  
 (d) Botanical gardens have collection of living plants for reference.  
 (NEET 2013)
8. The common characteristics between tomato and potato will be maximum at the level of their  
 (a) family (b) order  
 (c) division (d) genus.  
 (Karnataka NEET 2013)
9. Which one of the following organisms is scientifically correctly named, correctly printed according to the International Rules of Nomenclature and correctly described?  
 (a) *Musca domestica* - the common house lizard, a reptile  
 (b) *Plasmodium falciparum* - a protozoan pathogen causing the most serious type of malaria.  
 (c) *Felis tigris* - the Indian tiger, well protected in Gir forests.  
 (d) *E.coli* - full name *Entamoeba coli*, a commonly occurring bacterium in human intestine.  
 (Mains 2012)

10. Which one of the following aspects is an exclusive characteristic of living things?
- Isolated metabolic reactions occur *in vitro*
  - Increase in mass from inside only
  - Perception of events happening in the environment and their memory.
  - Increase in mass by accumulation of material both on surface as well as internally.

(Mains 2011)

11. Which one of the following animals is correctly matched with its particular taxonomic category?
- Tiger - *tigris*, species
  - Cuttlefish - mollusca, class
  - Humans - primata, family
  - Housefly - *Musca*, order

## AIIMS PREVIOUS QUESTIONS

- The system of classification based on evolutionary and genetic relationships among organisms, ignoring the morphological similarities or differences, is called [2009]
  - cladistics
  - phenetics
  - classical systematics
  - new systematics
- Scientific name of Mango plant is *Mangifera indica* (Linn.) Santapau. In the above name Santapau refers to [2012]
  - Variety of Mango
  - A taxonomist who proposed the present nomenclature in honour of Linnaeus
  - A scientist who for the first time described Mango plant
  - A scientist who changed the name proposed by Linnaeus and proposed present name
- The classification of Linnaeus was mainly based on [2012]
 

(a) Sepals	(b) Carpels
(c) Petals	(d) Stamens
- Which of the following is less general in characters as compared to genus? [2013]
 

(a) Species	(b) Division
(c) Class	(d) Family
- Read the following statements
  - Lower the taxon, more are the characteristics that the members within the taxon share.
  - Order is the assemblage of genera which exhibit a few similar characters.
  - Cat and dog are included in the same family Felidae.

- (iv) Binomial Nomenclature was introduced by Carolus Linnaeus. [2014]

Which of the following statements are NOT correct?

- |                         |                          |
|-------------------------|--------------------------|
| (a) (i), (ii) and (iii) | (b) (ii), (iii) and (iv) |
| (c) (i) and (iv)        | (d) (ii) and (iii)       |

6. Choose the correct one [2015]

- Growth cannot be taken as a defining property of living organism.
- Dead organism does not grow.
- Reproduction cannot be an all inclusive defining characteristic of living organisms.
- No non-living object is capable of replicating itself.
- Metabolism in a test tube is non-living.
- Metabolism is a defining feature of all living organisms.

- |                      |                    |
|----------------------|--------------------|
| (a) (i) and (iii)    | (b) All except (v) |
| (c) All except (iii) | (d) All of these   |

7. Match column I with column II and choose the correct option. [2017]

Column-I	Column-II
A. Family	I. <i>tuberosum</i>
B. Kingdom	II. Polymoniales
C. Order	III. <i>Solanum</i>
D. Species	IV. Plantae
E. Genus	V. Solanaceae

(a) A – IV; B – III; C – V; D – II; E – I  
 (b) A – V; B – IV; C – II; D – I; E – III  
 (c) A – IV; B – V; C – II; D – I; E – III  
 (d) A – V; B – III; C – II; D – I; E – IV

## KEY

### MULTIPLE CHOICE QUESTIONS

1 (c)	2 (c)	3 (d)	4 (a)	5 (a)	6 (a)	7 (b)	8 (b)	9 (a)	10 (b)
11 (b)	12 (c)	13 (d)	14 (d)	15 (b)	16 (b)	17 (a)	18 (a)	19 (c)	20 (b)
21 (b)	22 (a)	23 (d)	24 (c)	25 (b)	26 (a)	27 (b)	28 (d)	29 (d)	30 (c)
31 (a)	32 (b)	33 (b)	34 (d)	35 (a)	36 (c)	37 (d)	38 (b)	39 (d)	40 (d)
41 (c)	42 (c)	43 (b)	44 (b)	45 (c)	46 (d)	47 (b)	48 (d)	49 (a)	50 (d)
51 (a)	52 (c)	53 (c)	54 (c)	55 (c)	56 (a)	57 (a)	58 (b)	59 (a)	60 (d)
61 (d)	62 (a)	63 (c)	64 (b)	65 (c)	66 (b)	67 (d)	68 (a)	69 (c)	70 (c)
71 (a)	72 (b)	73 (d)	74 (b)	75 (c)	76 (b)	77 (d)	78 (a)	79 (c)	80 (d)
81 (d)	82 (d)	83 (b)	84 (b)	85 (a)	86 (a)	87 (b)	88 (d)	89 (c)	

### SPECIAL FORMAT QUESTIONS

1	d	5	c	9	d	13	c	17	b	21	d
2	b	6	a	10	a	14	c	18	a	22	a
3	d	7	c	11	c	15	c	19	b	23	a
4	d	8	b	12	d	16	b	20	a		

### NCERT EXEMPLAR PROBLEMS

1	a	5	c	9	d
2	c	6	c	10	a
3	c	7	c		
4	c	8	d		

### NEET PREVIOUS QUESTIONS

1	c	4	c	7	a	10	c
2	d	5	a	8	a	11	a
3	d	6	d	9	b		

### AIIMS PREVIOUS QUESTIONS

1	a	4	a	7	b
2	d	5	d		
3	d	6	b		





**UNIT-I**

**BIOLOGICAL**

**CLASSIFICATION**

**CHAPTER-2**

## SYNOPSIS

- **Biological classification** refers to the scientific procedure in which living organisms are classified and arranged into groups and sub-groups in a hierarchical manner on the basis of their similarities and dissimilarities.
- **Aristotle** was the earliest to attempt a scientific basis for classification. Later **Linnaeus** gave the **two kingdom system** of classification with **Plantae** and **Animalia** kingdoms.
- This system though used till very recently, but was unable to distinguish between the eukaryotes and prokaryotes, unicellular and multicellular organisms and photosynthetic (plants) and non-photosynthetic organisms (fungi).
- In 1969, **RH Whittaker** proposed a **five kingdom system of classification**. He divided all living organisms into **Monera, Protista, Fungi, Plantae** and **Animalia** as summarised in table below.

Characters	Kingdom–Monera	Kingdom–Protista	Kingdom–Fungi	Kingdom–Plantae	Kingdom–Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Complexity of body	Unicellular to multicellular	Unicellular	Unicellular to multicellular	Multicellular	Multicellular
Cell wall	Non-cellulosic and peptidoglycan	Present or Absent	Chitinous	Cellulosic	Absent
Nutrition	Autotrophic or Heterotrophic	Autotrophic or Heterotrophic	Heterotrophic (saprophytic/parasitic)	Autotrophic (photosynthetic)	Heterotrophic (holozoic or parasitic)

- Earlier classification systems considered bacteria, BGA (Blue-Green Algae), fungi, mosses, ferns, gymnosperms and angiosperms as plants due to the presence of cell wall in them. This classification system placed prokaryotic bacteria and BGA with other eukaryotic groups.
- It also grouped unicellular and multicellular, organisms together, e.g. Chlamydomonas and Spirogyra (in algae).
- This system did not consider the differences in mode of nutrition and cell wall composition, so grouped fungi (heterotroph, chitinous cell wall) with plants (autotroph, cellulosic cell wall).

### ➤ **Kingdom–Monera**

- Bacteria are the sole members of this kingdom.
- Bacteria are the most abundant microorganisms occurring in air, water, soil as well as in extreme habitats like deserts, snow, hot springs, etc.
- Bacteria have been grouped under four categories based on their shape
  - Coccus (cocci) – Spherical
  - Bacillus (bacilli) – Rod-shaped
  - Vibrium (vibrio) – Comma-shaped
  - Spirillum (spirilla) – Spiral-shaped.
- Bacteria show a wide range of mode of nutrition. They may be autotrophic (synthesise their own food from inorganic substrates), chemotrophic (photosynthetic autotrophic), saprophytic or heterotrophic (depend on other organisms for food).
- Bacteria are further divided into **Archaeobacteria** and **Eubacteria**

### ➤ Archaeobacteria

- Archaeobacteria live in extreme environmental conditions. These include
  - Halophiles Bacteria residing in salty areas.
  - Thermoacidophiles Bacteria residing in hot springs.
  - Methanogens Bacteria which survive in marshy areas (these are present in gut of many ruminant animals like cows and buffaloes).
- Archaeobacteria differ from other bacteria in having different cell wall structure. Their cell wall is made up of murein and contains high amount of unsaturated fatty acids, which is responsible for ensuring their survival in extreme conditions.

### ➤ Eubacteria

- Another class–Eubacteria is also known as ‘true bacteria’.
- These have rigid cell wall made up of peptidoglycan.
- They could be photosynthetic autotrophs, chemosynthetic, autotrophs and heterotrophic bacteria.
- Photosynthetic autotrophs include blue-green algae, which have chlorophyll-a similar to green plants. Also known as cyanobacteria.
- These could be unicellular, colonial or filamentous, freshwater/marine or terrestrial algae.
- Some bacteria can fix atmospheric nitrogen in specialised cells known as heterocyst, e.g. in Nostoc and Anabaena.
- Some bacteria utilise inorganic substances like nitrate, nitrite, ammonia, etc., for oxidation and release of energy for ATP production. These are known as chemosynthetic autotrophic bacteria.
- Heterotrophic bacteria (most abundant in nature) are dependent on other organisms for nutrition. These include N<sub>2</sub> -fixing bacteria, pathogens, etc.
- These reproduce asexually by binary fission.
- During unfavourable conditions, these form spores.
- These also show conjugation, a type of sexual reproduction in which DNA is transferred from one bacteria to another through a conjugal tube.
- Pleomorphic bacteria, which lack cell wall is known as mycoplasma. They are pathogenic and the smallest microorganism known.

### ➤ Kingdom–Protista

- All single-celled eukaryotes are placed under **Protista**.
- Members of kingdom–**Protista** are the connecting link between prokaryotic monerans and complex multicellular kingdoms–**Fungi, Plantae** and **Animalia**.
- These include chrysophytes, dinoflagellates, euglenoids, slime moulds and protozoans.
- These show a well-defined nucleus and membrane bound organelles.
- They reproduce asexually and sexually by a process involving cell fusion and zygote formation.

- Kingdom–Protista has been further divided into the following groups
- **Chrysophytes** include **diatoms** and **golden algae** known as **desmids**. They are found in marine environment.
  - The cell wall of diatoms is embedded with silica and forms two thin overlapping sheath as in soap box.
 

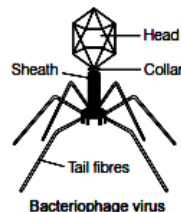
**Diatomaceous earth** is the large amount of cell wall deposits of diatoms in their habitat. These are used in polishing, filtration of oils and syrups.
- **Dinoflagellates** are marine and photosynthetic microorganisms.
  - Due to the presence of different pigments, they appear yellow, green, brown and red.
  - As the name suggest they have two flagella one lies longitudinally and other transversely in furrow between wall plates.
  - *Gonyaulax* is a red dinoflagellate, which undergoes rapid multiplication and forms red tides. Toxins released by these microorganisms when present in such large numbers may even kill other marine animals such as fishes.
- **Euglenoids** are freshwater organism found in stagnant water.
  - Cell wall is absent, a protein rich layer called pellicle is present over the surface.
  - In the presence of sunlight, they behave as autotrophs, while in its absence they behave as heterotrophs, e.g. *Euglena*.
  - **Slime moulds** are saprophyte, which are dependent on dead and decaying organic matter.
  - They form an aggregation called **plasmodium**.
  - During unfavourable conditions, they form spores, which are highly resistant
- **Protozoans** are heterotrophs and live as parasites or predators. These are grouped into
  - **Amoeboid protozoans** found in fresh or marine water or moist soil. They have pseudopodia (false feet) to capture prey as in *Amoeba*.
  - **Flagellated protozoans** either free-living or parasitic having flagella. The parasitic forms cause diseases, e.g. sleeping sickness by *Trypanosoma*.
  - **Ciliated protozoans** are aquatic, actively moving organisms due to thousands of cilia present on them. The coordinated ciliary movement drives food into cavity called **gullet**, e.g. *Paramecium*.
  - **Sporozoans** are non-motile forms with an infectious spore like stage in their life cycle, e.g. malaria causing parasite *Plasmodium*.
- **Kingdom–Fungi**
  - These are heterotrophic organisms with their cell wall made up of chitin.
  - These have cosmopolitan distribution and are found in warm and humid places.
  - Fungal body consists of long, thread-like structures called **hyphae**, which together form a network called **mycelium**. In certain organisms, hyphae are continuous tube with multinucleated cytoplasm (**coenocytic**), while others have septae or cross walls.

- Their mode of nutrition is **saprophytic** and **parasitic**. They can also live as **symbionts** in association with algae as lichen and with roots of higher plants as **mycorrhiza**.
- Reproduction in fungi occurring by vegetative means, includes fragmentation, fission and budding, asexually by zoospore production conidia, etc., and sexually by oospores, ascospores and basidiospores.
- Sexual cycle involves **plasmogamy** (fusion of two protoplasts), **karyogamy** (fusion of two haploid nuclei) and **meiosis**.
- In some fungi, two haploid cells result in diploid cells. In some cases, **dikaryon** stage occurs in which two nuclei are present within a cell. This phase is known as **dikaryophase** of fungus.
- Production of dikaryon ( $n + n$ , i.e. two nuclei per cell) is a characteristic of the classes—**Ascomycetes** and **Basidiomycetes**.
- Fungi are classified into classes—Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes.
  - **Phycomycetes** are lower fungi or algal fungi, their mycelium is aseptate and coenocytic, reproduce asexually through zoospores or aplanospores and sexually through isogamy or anisogamy, e.g. *Rhizopus*, *Mucor*, etc.
  - **Ascomycetes** are sac fungi, their mycelium is branched and septate, asexual spores are conidia and sexual spores are ascospores, e.g. *Aspergillus*, *Neurospora*, etc.
  - **Basidiomycetes** are club fungi, their mycelium is branched and septate, reproduce asexually by fragmentation and their vegetative cells fuse to form dikaryotic structure (plasmogamy), e.g. mushrooms, bracket fungi, etc.
  - **Deuteromycetes** are imperfect fungi, reproduce asexually by conidia and sexual forms absent in these e.g. *Alternaria*, *Trichoderma*, etc.
- **Heterothallism** is the condition in fungal organisms where different thalli exist within a single genus of fungus
- **Kingdom—Plantae**
  - These include chlorophyllous organisms with cellulosic cell wall.
  - Life cycle consists of a dominant sporophyte and a highly reduced gametophyte showing alternation of generations.
  - Few members are insectivorous plants, e.g. *Cuscuta*, bladderwort, etc.
  - Plants are classified into algae, bryophytes, pteridophytes, gymnosperms and angiosperms.
- **Kingdom—Animalia**

- Å Animals are motile organisms showing holozoic nutrition. They follow a definite growth pattern.
- Å They directly or indirectly depend on plants for food.
- Å Sexual reproduction is by copulation of male and female gametes followed by embryo development.

➤ **Viroids, Prions Viruses, and Lichens**

- Viruses and viroids are the non-cellular organisms, which are not characterised in the system of classification given by Whittaker.
- They have both living and non-living characteristics.
- They form inert crystalline structure outside the living cell, but inside the host cell they can multiply easily.
- They take over the host machinery and replicate themselves.
- Pasteur and DJ Ivanowsky gave the name virus, which means venom or poisonous fluid.
- MW Beijerinck in 1898, called fluid obtained from infected tobacco plant as Contagium vivum fluidum (infectious living fluid).
- Viruses are obligate parasite. These are inert outside specific host cell and exist in crystalline form as demonstrated by WM Stanley.
- Genetic material of viruses could be DNA or RNA.
- Virus contain a protein coat called **capsid**, which is made up of **capsomeres**. Capsomeres are arranged in a helical or polyhedral geometric form.



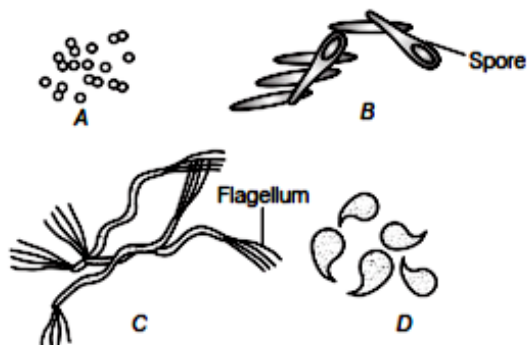
- Viruses which infect plants have *ssRNA*, while which infect animals are either *ssDNA/RNA* or *dsDNA/RNA*.
- Viruses which infect bacteria are known as **bacteriophage**. These are usually *dsDNA* viruses.

**Viroids, discovered by TO Diener are the smallest known agents of infectious disease. These are only naked nucleic acid without a protein coat.**

- **Prions are abnormally folded proteins with cause infectious neurological diseases, e.g. mad cow disease in cattle.**
- **Lichens are the symbiotic association of algae (phycobiont) and fungi (mycobiont). They are also not included in five kingdom system.**

## MULTIPLE CHOICE QUESTIONS

- 1 Aristotle classified the plants on the basis of their morphological characters and categorised them into
  - (a) trees, shrubs and herbs
  - (b) algae, bryophytes, pteridophytes, gymnosperms and angiosperms
  - (c) embryophytes and tracheophytes
  - (d) algae and embryophytes
- 2 Who proposed two kingdom system of classification and named kingdoms as Plantae and Animalia?
  - (a) Carolus Linnacus
  - (b) RH Whittaker
  - (c) Carl Woese
  - (d) Herbert Copeland
- 3 Which of the following characters served as the criteria for five kingdom system of classification proposed by Whittaker?
  - (a) Cell structure
  - (b) Body organisation and mode of nutrition
  - (c) Reproduction and phylogenetic relationships
  - (d) All of the above
- 4 In five kingdom system of classification of RH Whittaker, how many kingdoms contain eukaryotes?
  - (a) Four kingdoms
  - (b) One kingdom
  - (c) Two kingdoms
  - (d) Three kingdoms
- 5 In the five kingdom classification, *Chlamydomonas* and *Chlorella* are included in
  - (a) Plantae
  - (b) Algae
  - (c) Protista
  - (d) Monera
6. Cyanobacteria are classified under which of the following kingdom?
  - (a) Protista
  - (b) Monera
  - (c) Algae
  - (d) Plantae
- 7 Among the following, which one is the most abundant group of microorganisms?
  - (a) Algae
  - (b) Viruses
  - (c) Protists
  - (d) Bacteria
- 8 Bacteria are grouped under four categories based on their shape. Refer to the given figure. Identify A, B, C and D.



- (a) A-Vibrio, B-Cocci, C-Bacilli, D-Spirilla
  - (b) A-Cocci, B-Bacilli, C-Spirilla, D-Vibrio
  - (c) A-Bacilli, B-Spirilla, C-Vibrio, D-Cocci
  - (d) A-Spirilla, B-Vibrio, C-Cocci, D-Bacilli
- 9 Some bacteria thrive in extreme environmental conditions such as the absence of oxygen, high salt concentration, high temperature and acidic pH. Identify the type of bacteria.
    - (a) Cyanobacteria
    - (b) Eubacteria
    - (c) Archaeobacteria
    - (d) Mycobacteria
  - 10 Which of the following conditions would be favoured by thermoacidophiles?
    - (a) Hot and alkaline
    - (b) Snow and acidic
    - (c) Hot and sulphur spring
    - (d) Gut of cows
  - 11 Which of the following are found in extreme saline conditions?
    - (a) Archaeobacteria
    - (b) Eubacteria
    - (c) Cyanobacteria
    - (d) Mycobacteria
  - 12 The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the
    - (a) thermoacidophiles
    - (b) methanogens
    - (c) eubacteria
    - (d) halophiles
  - 13 Methanogens belong to
    - (a) eubacteria
    - (b) archaeobacteria
    - (c) dinoflagellates
    - (d) slime moulds
  - 14 *Thermococcus*, *Methanococcus* and *Methanobacterium* are
    - (a) archaeobacteria having eukaryotic histone homologue
    - (b) bacteria with cytoskeleton
    - (c) archaeobacteria with negatively supercoiled DNA as eukaryotes, but lack histones
    - (d) bacteria having positively coiled DNA, cytoskeleton, mitochondria
  - 15 Eubacteria include
    - (a) blue-green algae and bacteria
    - (b) archaeobacteria and blue-green algae
    - (c) cyanobacteria and eukaryotes
    - (d) bacteria and eukaryotes
  - 16 Pigment containing membranous extensions in some cyanobacteria are
    - (a) heterocysts
    - (b) basal bodies
    - (c) pneumatophores
    - (d) chromatophores
  - 17 The cyanobacteria are also referred to as
    - (a) protists
    - (b) golden algae
    - (c) slime moulds
    - (d) blue-green algae
  - 18 In cyanobacteria, which of the following is present?
    - (a) Chlorophyll-c
    - (b) Chlorophyll-b
    - (c) Chlorophyll-a
    - (d) Chlorophyll-c<sub>1</sub>

**19** ..... include blue-green algae, which have chlorophyll-*a* similar to green plants. Complete the given sentence with an appropriate option.

- (a) Chemosynthetic autotrophic bacteria
- (b) Photosynthetic autotrophic bacteria
- (c) Protista
- (d) Saprophytic

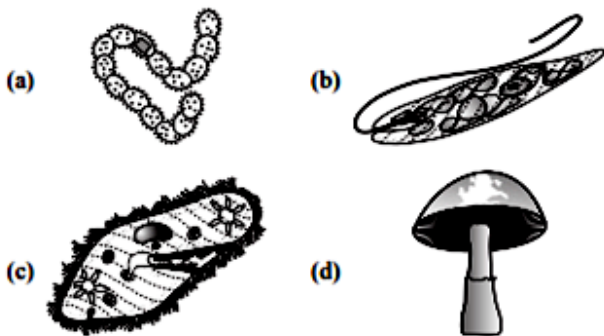
**20** Specialised cells called heterocysts are present in

- (a) dinoflagellates
- (b) chrysophytes
- (c) archaeobacteria
- (d) cyanobacteria

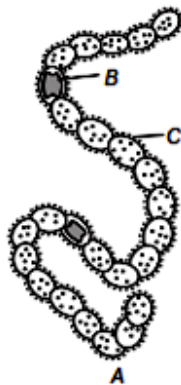
**21** Some of the cyanobacteria can fix atmospheric nitrogen in their specialised cells called

- (a) akinetes
- (b) heterocyst
- (c) endospores
- (d) homocyst

**22** Identify the diagram of heterocyst.



**23** Given figure is of a filamentous blue-green algae. Identify the algae and choose the option that is correct for *A*, *B* and *C* in the figure.



- (a) A-*Gelidium*, B-Vegetative cell, C-Heterocyst
- (b) A-*Volvox*, B-Somatic cell, C-Mucilaginous sheath
- (c) A-*Chara*, B-Mucilaginous sheath, C-Heterocyst
- (d) A-*Nostoc*, B-Heterocyst, C-Mucilaginous sheath

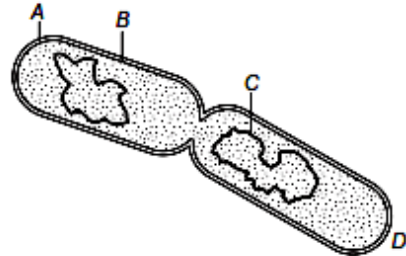
**24** *Nostoc* and *Anabaena* belong to

- (a) parasitic bacteria
- (b) archaeobacteria
- (c) cyanobacteria
- (d) coccobacteria

**25** Which of the following is photoautotrophic bacteria?

- (a) *Nostoc*
- (b) *Clostridium*
- (c) *Salmonella*
- (d) *Escherichia coli*

**26** Identify the label *A*, *B*, *C* and *D* in the following figure.



- (a) A-Plasma membrane, B-Cell wall, C-RNA, D-Spore formation
- (b) A-Cell wall, B-Cell membrane, C-DNA, D-Binary fission
- (c) A-Mucilaginous sheath, B-Cell membrane, C-RNA, D-Conjugation
- (d) A-Plasma membrane, B-Mucilaginous sheath, C-DNA, D-Transformation

**27** Which of the following bacteria play an important role in the recycling of nutrients like nitrogen, phosphorus, iron and sulphur?

- (a) Chemoheterotrophic bacteria
- (b) Chemosynthetic autotrophic bacteria
- (c) Parasitic bacteria
- (d) Saprophytic bacteria

**28** Oxygen is not produced during photosynthesis by

- (a) *Cycas*
- (b) *Nostoc*
- (c) Green sulphur bacteria
- (d) *Chara*

**29** Citrus canker is a

- (a) viral disease
- (b) bacterial disease
- (c) fungal disease
- (d) protozoan disease

**30** Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?

- (a) *Bacillus*
- (b) *Pseudomonas*
- (c) *Mycoplasma*
- (d) *Nostoc*

**31** *Mycoplasma* are classified under which of the following kingdoms?

- (a) Animalia
- (b) Protista
- (c) Monera
- (d) Fungi



**32** Which of the following is not a feature of Protista?

- (a) Protists are prokaryotic
- (b) Some protists have cell walls
- (c) Mode of nutrition is both autotrophic and heterotrophic
- (d) Body organisation is cellular

**33** Which of the following kingdoms have no well-defined boundaries?

- (a) Plantae (b) Protista
- (c) Monera (d) Algae

**34** Members of Protista are primarily

- (a) terrestrial (b) aquatic
- (c) pathogenic (d) photosynthetic

**35** Chrysophytes, euglenoids, dinoflagellates and slime moulds are included in the kingdom

- (a) Protista (b) Fungi
- (c) Animalia (d) Monera

**36** Which of the following groups of organisms is/are placed under the group—Chrysochyta?

- (a) Diatoms only
- (b) Desmids only
- (c) Diatoms and golden algae
- (d) Desmids and *Paramecium*

**37** Diatoms and desmids are found in

- (a) freshwater (b) marine water
- (c) Both (a) and (b) (d) terrestrial habitat

**38** Chrysophytes are

- (a) planktons
- (b) nektons
- (c) benthic organisms
- (d) active organisms

**39** Silica gel is obtained by

- (a) red algae
- (b) diatoms
- (c) *Euglena*
- (d) mycoplasma

**40** In which of the following organisms the cell wall is composed of two thin overlapping shells, which fit together like a soap-case?

- (a) Diatoms (b) Golden algae
- (c) Slime moulds (d) *Gonyaulax*

**41** Diatomaceous earth is used for all except

- (a) filtration of oils
- (b) filtration of syrups
- (c) cleaning agent in metal polishes
- (d) gobar gas production

**42** Which one of the following is a characteristic feature of the group—Chrysochyta?

- (a) They are parasitic forms, which cause diseases in animals
- (b) They have a protein rich layer called pellicle
- (c) They have indestructible wall layer deposited with silica
- (d) They are commonly called dinoflagellates

**43** Which of the following organisms are known as chief producers in the oceans?

- (a) Cyanobacteria (b) Diatoms
- (c) Dinoflagellates (d) Euglenoids

**44** Dinoflagellates have

- (a) two flagella, which lie longitudinally
- (b) only one flagellum in the transverse groove between the cell plates
- (c) only one flagellum in the longitudinal groove between the cell plates
- (d) one flagellum lies longitudinally and the other transversely in a furrow between the wall plates

**45** In which of the following groups, the cell wall has stiff cellulose plate on the outer surface?

- (a) Diatoms (b) Red algae
- (c) Dinoflagellates (d) Slime moulds

**46** Refer to diagram given along side and select the incorrect option regarding it.

- (a) It belongs to kingdom—Protista and is a dinoflagellate
- (b) It is mostly marine, photosynthetic with colour depending on main pigment present in its cells
- (c) They have two flagella, a short and a long one
- (d) These organisms release toxins in large number which kill other marine animals



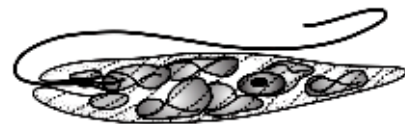
**47** Red tides in warm coastal water develop due to the presence of

- (a) dinoflagellates (b) euglenoid forms
- (c) diatoms and desmids (d) slime moulds

**48** Which of the following protists releases toxins that may even kill fishes and other marine animals?

- (a) *Euglena* (b) *Gonyaulax*
- (c) *Paramecium* (d) *Plasmodium*

**49** Which group of organisms is represented by the given figure?



- (a) Dinoflagellates (b) Protozoans
- (c) Slime mould (d) Euglenoids

**50** Plant-like nutrition is present in

- (a) *Amoeba* (b) *Paramecium*
- (c) *Euglena* (d) *Plasmodium*

**51** Slime moulds are

- (a) pathogenic (b) parasite
- (c) saprophytic protists (d) autotrophic

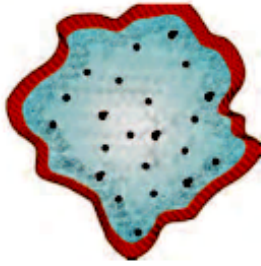
**52** The free-living thalloid body of the slime mould is known as

- (a) protonema (b) plasmodium
- (c) fruiting body (d) mycelium

**53** Under favourable conditions slime moulds form

- (a) protonema (b) plasmodium
- (c) mycelium (d) fruiting bodies

**54** Identify the given figure and select the correct option



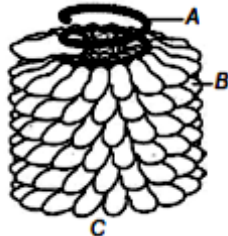
- (a) It is marine water plankton  
 (b) It is a saprophytic protist  
 (c) It is parasitic predator believed to be primary relative of animals  
 (d) Ciliated protozoan
- 55** Ciliates differ from all other protozoans in  
 (a) using pseudopodia for capturing prey  
 (b) having a contractile vacuole for removing excess water  
 (c) using flagella for locomotion  
 (d) having two types of nuclei
- 56** Protozoans are  
 (a) heterotrophs (b) autotrophs  
 (c) producers (d) saprophytes
- 57** Which of the following group is considered as primitive relatives of animals?  
 (a) Chrysophytes (b) Protozoans  
 (c) Euglenoids (d) Slime moulds
- 58** Protozoans are divided into ..... groups. Most suitable word to fill the blank is  
 (a) three (b) four  
 (c) two (d) eight
- 59** Which of the following groups belong to protozoans?  
 (a) Amocboid, flagellates, ciliates, sporozoans  
 (b) Diatoms, amocboid, ciliates, sporozoans  
 (c) Desmids, ciliates, flagellates, amocbiod  
 (d) Dinoflagellates, ciliates, *Plasmodium*, amocboid
- 60** Flagellate protozoans are  
 (a) free-living only  
 (b) parasites only  
 (c) either free-living or parasites  
 (d) saprophytes
- 61** Which of the following is a flagellated protozoan?  
 (a) *Amoeba* (b) *Entamoeba*  
 (c) *Plasmodium* (d) *Trypanosoma*
- 62** *Trypanosoma* causes  
 (a) sleeping sickness (b) cholera  
 (c) malaria (d) food poisoning
- 63** *Paramecium* is an aquatic and actively moving organism due to the presence of  
 (a) pseudopodia  
 (b) false feet  
 (c) thousands of cilia  
 (d) flagella
- 64** Which of the following groups always produce an infectious spore-like stage in their life cycle?  
 (a) Amocboid protozoans  
 (b) Ciliated protozoans  
 (c) Flagellated protozoans  
 (d) Sporozoans
- 65** *Plasmodium* is a  
 (a) ciliated protozoan (b) sporozoan  
 (c) flagellated protozoan (d) amocboid protozoan
- 66** Which one of the following organisms is scientifically incorrectly named and incorrectly described?  
 (a) *Plasmodium falciparum*—A protozoan pathogen causing the most serious type of malaria  
 (b) *Trypanosoma gambiense*—The parasite of sleeping sickness  
 (c) Diatoms—Very good pollution indicators  
 (d) *Noctiluca*—A chrysophyte, which shows bioluminescence
- 67** The body of a fungus is made up of a number of elongated, tubular filaments called  
 (a) hyphae (b) Woronin bodies  
 (c) mycelium (d) thallus
- 68** Cell wall of fungi is composed of  
 (a) chitin (b) pectin  
 (c) cellulose (d) mannans
- 69** Which one of the following is wrong for fungi?  
 (a) They are eukaryotic  
 (b) All fungi possess a purely cellulosic cell wall  
 (c) They are heterotrophic  
 (d) They are both unicellular and multicellular
- 70** Which of the following is a non-hyphal unicellular fungus?  
 (a) Yeast (b) *Puccinia*  
 (c) *Ustilago* (d) *Alternaria*
- 71** Which of the following options describe the coenocytic condition in fungus?  
 (a) Uninucleate hypha without septum  
 (b) Multinucleate hypha without septum  
 (c) Multicellular hypha  
 (d) Multiciliate hypha
- 72** Fungi that absorb soluble organic matter from dead substrates are called  
 (a) saprophytes  
 (b) parasites  
 (c) obligate parasite  
 (d) lichens
- 73** Fungi that absorb nutrients directly from the cytoplasm of living host are called  
 (a) saprophytes (b) parasites  
 (c) symbionts (d) mycorrhiza

- 74** Mycorrhizae are mutualistic and symbiotic associations between  
 (a) fungi and vascular plants  
 (b) fungi and non-vascular plants  
 (c) fungi and roots of higher plants  
 (d) fungi and bryophytes
- 75** Mycorrhiza promotes the plant growth by  
 (a) absorbing inorganic ions from soil  
 (b) helping the plant in utilising atmospheric nitrogen  
 (c) protecting the plant from infection  
 (d) serving as plant growth regulator
- 76** Fungi show vegetative reproduction by all of the following methods except  
 (a) by fragmentation (b) by fission  
 (c) by budding (d) by protonema
- 77** Fungi show asexual reproduction by all of the following kinds of spores except  
 (a) conidia (b) oospores  
 (c) sporangiospores (d) zoospores
- 78** Fungi show sexual reproduction by all of the following processes except  
 (a) oospores  
 (b) ascospores  
 (c) basidiospores  
 (d) zoospores
- 79** In fungi, the various types of spores are produced in distinct structures known as  
 (a) fruiting body (b) spore sac  
 (c) peristome (d) pollen sac
- 80** In fungi, the fusion of protoplasts between two motile or non-motile gametes is called  
 (a) plasmogamy (b) plasmokinesis  
 (c) karyogamy (d) cytokinesis
- 81** In fungi, karyogamy is the fusion of two  
 (a) gametes (b) nuclei (c) cells (d) cytoplasm
- 82** Which of the following is the correct sequence of Class → Mycelium → Fruiting body observed in the kingdom-Fungi?  
 (a) Phycomycetes → Septate, coenocytic → Not present  
 (b) Ascomycetes → Aseptate and branched → Ascocarp  
 (c) Basidiomycetes → Aseptate and branched → Basidiocarp  
 (d) Deuteromycetes → Septate and branched → Not present
- 83** In some fungi, two haploid cells result in a diploid cell. In some cases, dikaryon stage occurs in which two nuclei are present within a cell. This phase is known as  
 (a) monokaryophase (b) dikaryophase  
 (c) plasmogamy (d) karyogamy
- 84** Dikaryophase of fungus occurs in  
 (a) Ascomycetes and Basidiomycetes  
 (b) Phycomycetes and Ascomycetes  
 (c) Phycomycetes and Basidiomycetes  
 (d) Basidiomycetes and Deuteromycetes
- 85** Fungi are divided into four classes on the basis of  
 (a) morphology of the mycelium  
 (b) mode of spore formation  
 (c) fruiting bodies  
 (d) All of the above
- 86** *Rhizopus* is included in the class  
 (a) Ascomycetes (b) Phycomycetes  
 (c) Basidiomycetes (d) Deuteromycetes
- 87** Which of the following classes consists of coenocytic multinucleate and aseptate mycelium?  
 (a) Basidiomycetes (b) Ascomycetes  
 (c) Phycomycetes (d) Deuteromycetes
- 88** Phycomycetes are most commonly found as  
 (a) obligate parasite  
 (b) obligate saprophyte  
 (c) coprophilous component  
 (d) Both (a) and (b)
- 89** In Phycomycetes, asexual reproduction occurs by  
 (a) zoospores (b) aplanospores  
 (c) Both (a) and (b) (d) conidia
- 90** Isogamous means gametes  
 (a) similar in morphology  
 (b) similar in anatomy  
 (c) female gamete is bigger than male gamete  
 (d) male gamete is bigger than female gamete
- 91** Which of the following is a parasitic fungi on mustard?  
 (a) *Rhizopus* (b) *Albugo*  
 (c) *Agaricus* (d) *Neurospora*
- 92** All of the following fungi belong to Phycomycetes, except  
 (a) *Rhizopus* (b) *Mucor* (c) *Albugo* (d) *Agaricus*
- 93** The hyphae of *Rhizopus* are  
 (a) unbranched, aseptate and uninucleate  
 (b) branched, aseptate and multinucleate  
 (c) branched, septate and uninucleate  
 (d) unbranched, septate and coenocytic
- 94** Ascomycetes are commonly known as  
 (a) toad stool (b) sac fungi  
 (c) imperfect fungi (d) bracket fungi
- 95** Yeast and *Penicillium* are the examples of class  
 (a) Phycomycetes (b) Ascomycetes  
 (c) Deuteromycetes (d) Basidiomycetes
- 96** Members of Ascomycetes are  
 (a) saprophytic (b) decomposers  
 (c) parasitic or coprophilous (d) All of these
- 97** *Claviceps* is a member of  
 (a) Ascomycetes (b) Basidiomycetes  
 (c) Zygomycetes (d) Phycomycetes
- 98** Which of the following fungus is used extensively in biochemical and genetic work?  
 (a) *Neurospora* (b) *Mucor*  
 (c) *Rhizopus* (d) *Aspergillus*

- 99** Identify the edible and delicate Ascomycetes members.  
 (a) *Agaricus* and *Puccinia* (b) Morels and truffles  
 (c) Puffball and *Agaricus* (d) Puffball and mushrooms
- 100** Which of the following are the commonly known forms of Basidiomycetes?  
 (a) Mushrooms (b) Puffball  
 (c) Bracket fungi (d) All of these
- 101** Where the members of Basidiomycetes occur?  
 (a) Soil  
 (b) Logs  
 (c) Tree stumps and living plant bodies  
 (d) All of the above
- 102** In Basidiomycetes, the mycelium is  
 (a) branched and aseptate (b) branched and septate  
 (c) unbranched and septate (d) coenocytic
- 103** In Basidiomycetes, vegetative reproduction occurs by  
 (a) endospores (b) conidia  
 (c) akinetes (d) fragmentation
- 104** Among rust, smut and mushroom, all the three  
 (a) are pathogens (b) are saprobes  
 (c) bear ascocarps (d) bear basidiocarps
- 105** All of the following fungi belong to Basidiomycetes, except  
 (a) *Agaricus* (b) *Ustilago* (c) *Puccinia* (d) *Alternaria*
- 106** Which of the following are the common parasites of class-Basidiomycetes?  
 (a) *Ustilago* and *Puccinia*  
 (b) *Agaricus* and *Trichoderma*  
 (c) *Alternaria* and *Colletotrichum*  
 (d) *Colletotrichum* and *Puccinia*
- 107** In Deuteromycetes, the mycelium is  
 (a) septate and branched (b) septate and unbranched  
 (c) coenocytic (d) multinucleated
- 108** The imperfect fungi, which are decomposers of litter and help in mineral cycling belong to  
 (a) Deuteromycetes (b) Basidiomycetes  
 (c) Phycomycetes (d) Ascomycetes
- 109** Deuteromycetes reproduce only by asexual spores known as  
 (a) conidia (b) endospores  
 (c) zoospores (d) heterocyst
- 110** Sexual reproduction is present in all fungi classes, except  
 (a) Ascomycetes (b) Phycomycetes  
 (c) Basidiomycetes (d) Deuteromycetes
- 111** All the given fungi belong to Deuteromycetes, except  
 (a) *Alternaria*  
 (b) *Colletotrichum*  
 (c) *Trichoderma*  
 (d) *Ustilago*

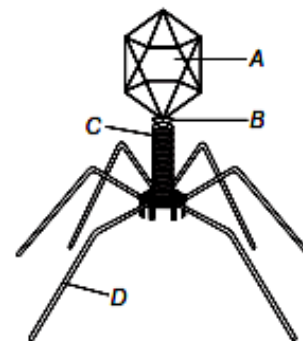
- 112** Which one of the following matches is correct?  
 (a) *Phytophthora* Aseptate mycelium Basidiomycetes  
 (b) *Alternaria* Sexual reproduction absent Deuteromycetes  
 (c) *Mucor* Reproduction by conjugation Ascomycetes  
 (d) *Agaricus* Parasitic fungus Basidiomycetes
- 113** Select the incorrect match.  
 (a) Morels and truffles — Phycomycetes  
 (b) Mushrooms and puffballs — Basidiomycetes  
 (c) Smut and rust — Basidiomycetes  
 (d) Bread mould — Phycomycetes
- 114** Insectivorous plants are  
 (a) autotrophic (b) partially heterotrophic  
 (c) parasitic (d) pathogenic
- 115** Which of the following are the examples of insectivorous plant?  
 (a) Bladderwort (b) Venus flytrap  
 (c) *Nepenthes* (d) All of these
- 116** *Cuscuta* is a/an  
 (a) parasite (b) pathogen  
 (c) saprophyte (d) autotroph
- 117** Plants show ..... in their life cycle.  
 (a) only sexual phase (b) only asexual phase  
 (c) alternation of generations (d) None of these
- 118** Which of the given options best describes the gametophyte in the alternation of generations of a plant's life cycle?  
 (a) Generation that produces gametes  
 (b) Generation that produces spores  
 (c) Generation that has xylem and phloem  
 (d) The diploid generation
- 119** Which of these best describe the sporophytic generation in plant's life cycle?  
 (a) The haploid generation  
 (b) Generation that produces gametes  
 (c) Generation that produces spores  
 (d) Generation that has xylem and phloem
- 120** Kingdom-Animalia includes  
 (a) heterotrophic organisms  
 (b) eukaryotic organisms  
 (c) multicellular organisms  
 (d) All of the above
- 121** The reserve food material of animals is  
 (a) glycogen or animal fat (b) glucose  
 (c) cellulose (d) chitin
- 122** Which of the following is not a feature of kingdom-Animalia?  
 (a) Lack cell wall  
 (b) Holozoic mode of nutrition  
 (c) A definite growth pattern  
 (d) Chlorophyllous

- 123** Viruses and viroids are the non-cellular organisms, which are not characterised in the classification of  
(a) Whittaker (b) Aristotle (c) Linnacus (d) Watson
- 124** Viruses did not find a place in classification since  
(a) they are not truly living (b) they are non-cellular  
(c) they are obligate parasite (d) they are pathogenic
- 125** Viruses are non-cellular organisms but replicate themselves once they infect the host cell. To which of the following kingdom viruses belong to?  
(a) Monera (b) Protista (c) Fungi (d) None of these
- 126** Which of the following phenomenon proves that viruses are living?  
(a) They carry metabolic activity  
(b) They carry anaerobic respiration  
(c) They multiply in host cells  
(d) They cause infection
- 127** Tobacco mosaic virus is  
(a) spherical (b) rod-shaped  
(c) cuboidal (d) oval
- 128** Given below is the diagram of a virus. In which one of the options, all the three *A*, *B* and *C* (name of the virus) are correct?



- (a) A-RNA, B-Capsomere, C-Tobacco mosaic virus  
(b) A-DNA, B-Capsid, C-Bacteriophage  
(c) A-RNA, B-Capsid, C-Tobacco mosaic virus  
(d) A-DNA, B-Capsid, C-Bacteriophage
- 129** The genetic material of viruses consists of  
(a) *ds* or *ss*DNA only  
(b) *ds* or *ss*RNA only  
(c) DNA or RNA (Both *ds* and *ss*)  
(d) *ss*DNA or *ss*RNA
- 130** The protein coat of a virus is known as  
(a) nucleoid (b) capsid  
(c) capsomere (d) outer envelope
- 131** The subunit of capsid is called  
(a) capsomere (b) core  
(c) nucleoside (d) nucleotide
- 132** Viruses are also known as  
(a) nucleoprotein particles (b) virion  
(c) lipoprotein particles (d) core

- 133** The latest view for the origin of viruses is  
(a) they have arisen from nucleic acid and proteins found in primitive soup  
(b) they arose from bacteria as a result of the loss of cell wall, ribosome, etc.  
(c) they arose from some bacteria, which had developed a nucleus only  
(d) they are modified plasmids, which are infect the fragments of the nucleic acids of the host
- 134** The genetic material of rabies virus is  
(a) double-stranded RNA (b) single-stranded RNA  
(c) double-stranded DNA (d) single-stranded DNA
- 135** The non-living characteristic of viruses is  
(a) ability to multiply only inside the host  
(b) ability to cause diseases in the host  
(c) ability to undergo mutation  
(d) ability of crystallisation
- 136** Which of the following groups of diseases is caused by viruses?  
(a) Mumps, smallpox, herpes, influenza  
(b) AIDS, diabetes, herpes, tuberculosis  
(c) Anthrax, cholera, tetanus, tuberculosis  
(d) Cholera, tetanus, smallpox, influenza
- 137** In plants, mosaic formation, leaf rolling and curling, yellowing and vein clearing are the symptoms of  
(a) viral diseases (b) bacterial diseases  
(c) protozoan diseases (d) fungal diseases
- 138** Which of the following plant viruses has DNA?  
(a) Tobacco mosaic virus (b) Potato mosaic virus  
(c) Tomato mosaic virus (d) Cauliflower mosaic virus
- 139** Bacteriophages are  
(a) bacteria that attack viruses  
(b) viruses that attack bacteria  
(c) free-living viruses  
(d) free-living bacteria
- 140** Identify the label *A*, *B*, *C* and *D* in the following figure.



- (a) A–Head, B–Collar, C–Sheath, D–Tail fibres
- (b) A–Collar, B–Head, C–Sheath, D–Tail fibres
- (c) A–Head, B–Collar, C–Tail fibres, D–Sheath
- (d) A–Collar, B–Tail fibres, C–Head, D–Sheath

- 141** A new infectious agent that is smaller than virus is  
 (a) prion (b) viroid (c) bacteria (d) mycoplasma
- 142** Viroids differ from viruses in having  
 (a) DNA molecules with protein coat  
 (b) DNA molecules without protein coat  
 (c) RNA molecules with protein coat  
 (d) RNA molecules without protein coat
- 143** Lichens are mutualistic and symbiotic associations between  
 (a) mycobiont and virus  
 (b) mycobiont and phycobiont  
 (c) mycobiont and root of higher plants  
 (d) mycobiont and mosses

**144** The advantage of fungus in lichen is

- (a) food
- (b) anchoring
- (c) mineral absorption
- (d) Both (b) and (c)

**145** The benefit given by algae in lichen is

- (a) food for fungi
- (b) shelter
- (c) mineral absorption
- (d) protection

**146** Which of the following are most suitable indicators of SO<sub>2</sub> pollution in the environment?

- (a) Lichens (b) Conifers (c) Algae (d) Fungi

**147** Which of the following would appear as the pioneer organisms on bare rocks?

- (a) Liverworts (b) Mosses
- (c) Green algae (d) Lichens

## SPECIAL FORMAT QUESTIONS

- 1** Which of the statements given below is correct?  
 (a) Biological classification is the scientific ordering of organisms in a hierarchical series of groups on the basis of their relationships, i.e. morphological, evolutionary and others  
 (b) Whittaker classified organisms on the basis of autotrophic and heterotrophic mode of nutrition  
 (c) In five kingdom system of classification, living organisms can be divided into prokaryotic and eukaryotic cells on the basis of cell structure  
 (d) All of the above
- 2** Consider the following statements. Which of the statements given below is incorrect?  
 (a) All prokaryotic organisms were grouped together under kingdom–Monera  
 (b) The unicellular eukaryotic organisms were placed in kingdom–Protista  
 (c) *Chlorella* and *Chlamydomonas*, both lack cell walls  
 (d) *Paramecium* and *Amoeba* lack cell walls
- 3** Choose the incorrect statement about members of kingdom–Monera.  
 (a) Many of them live in or on other organisms as parasites  
 (b) Some synthesise their own food from inorganic solutes  
 (c) Bacterial structure is very complex though they have very simple behaviour  
 (d) Hundreds of bacteria are present in handful of soil
- 4** Read the following statements about bacteria and select the correct option.  
 (a) Bacteria are simple in structure, but complex in behaviour  
 (b) Bacteria are complex in structure, but simple in behaviour  
 (c) Bacteria are simple in both structure and behaviour  
 (d) Bacteria are complex in both structure and behaviour

**5** Which of the following statements about methanogens is not correct?

- (a) They can be used to produce biogas
- (b) They are found in the rumen of cattle and their excreta
- (c) They grow aerobically and breakdown cellulose rich food
- (d) They produce methane gas

**6.** In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements is true about archaea?

- (a) Archaea resemble eukarya in all respects
- (b) Archaea have some noble features that are absent in other prokaryotes and eukaryotes
- (c) Archaea completely differ from both prokaryotes and eukaryotes
- (d) Archaea completely differ from prokaryotes

**7** Which of the following statements is/are incorrect?

- (a) Bacteria reproduce only by binary fission
- (b) Under unfavourable conditions, bacteria produce several types of spores
- (c) Bacteria reproduce by a sort of sexual reproduction by adopting a primitive type of RNA transfer from one bacterium to other
- (d) Both (a) and (b)

**8** Which one of the following statements is incorrect?

- (a) Golden algae are also called desmids
- (b) Eubacteria are also called false bacteria
- (c) Phycomycetes are also called algal fungi
- (d) Cyanobacteria are also called blue-green algae

**9.** Which statement is correct?

- (a) Mycoplasma is smallest and wall less living organism
- (b) Influenza and herpes are caused by virus having DNA and RNA
- (c) *Nostoc* and *Anabaena* are important decomposers
- (d) Methanogens are methane producing bacteria in wheat crops

10. Select the incorrect statement.  
 (a) Bacterial cell wall is made up of peptidoglycan  
 (b) Pili and fimbriae are mainly involved in motility of bacterial cells  
 (c) Cyanobacteria lack flagellated cells  
 (d) Mycoplasma is a wall-less microorganism
11. Consider the following statements about mycoplasma. Which of the statement given below is incorrect?  
 (a) They are pleomorphic bacteria, which lack cell wall  
 (b) Mycoplasma is the smallest living organism  
 (c) They cannot survive without oxygen  
 (d) Many mycoplasma are pathogenic in animals and plants
12. Select the incorrect statement.  
 (a) The walls of diatoms are easily destructible  
 (b) 'Diatomaceous earth' is formed by the cell walls of diatoms  
 (c) Diatoms are chief producers in the oceans  
 (d) Diatoms are microscopic and float passively in water
13. Which of the following following statement about *Euglena* is/are true?  
 (a) Euglenoids bear flagella  
 (b) *Euglena* when placed in continuous darkness, lose their photosynthetic activity and die  
 (c) The pigments of *Euglena* are quite different from those of green plants  
 (d) *Euglena* is a marine protist
14. Which of the following statement(s) given below is/are incorrect?  
 (a) Diatomite is porous and chemically inert. It is therefore, used in filtration of sugars, alcohols, oils, syrups and antibiotics  
 (b) Diatomite deposits are often accompanied by petroleum fields  
 (c) Both (a) and (b)  
 (d) Desmids are mainly found in dirty water and are usually indication of polluted water
15. Which of the statement(s) given below is/are correct for amoeboid protozoans?  
 (a) Live in freshwater, sea water or moist soil  
 (b) Has pseudopodia for locomotion and capturing prey  
 (c) Have silica shells on their surface in marine forms  
 (d) All of the above
16. Which of the following statements is correct?  
 (a) Slime moulds are haploid  
 (b) Protozoans lack cell wall  
 (c) Dinoflagellates are immotile  
 (d) Pellicle is absent in *Euglena*
17. Consider the following statements about Ascomycetes. Which one of the statement given below is false?  
 (a) They are saprophytic, decomposer, coprophilous and parasitic  
 (b) Include unicellular and multicellular forms  
 (c) Mycelium is coenocytic and aseptate  
 (d) *Aspergillus*, *Claviceps* and *Neurospora* are important examples of Ascomycetes
18. Which of the following statement is incorrect?  
 (a) *Claviceps* is a source of many alkaloids and LSD  
 (b) Conidia are produced exogenously and ascospores endogenously  
 (c) Yeasts have filamentous bodies with long thread-like hyphae  
 (d) Morels and truffles are edible delicacies
19. Which of the following statement is correct?  
 (a) Lichens do not grow in polluted areas  
 (b) Algal component of lichens is called mycobiont  
 (c) Fungal component of lichens is called phycobiont  
 (d) Lichens are not good pollution indicators
20. Which of the following statement(s) is/are incorrect?  
 (a) Protistan body includes a well-defined nucleus, and all cellular organelles  
 (b) Protists have nucleus along with flagella and cilia  
 (c) Protist cells have no nucleus but have some cellular organelles to perform basic functions  
 (d) All of the above
21. Which of the statement(s) given below is/are correct?  
 (a) Kingdom-Protista forms a link between monerans and the other organisms like plants, animal and fungi  
 (b) Protists reproduce asexually and sexually by a process involving cell fusion and zygote formation  
 (c) Being eukaryotes, the protistan cell body contains a well-defined nucleus and other membrane bound organelles  
 (d) All of the above
22. Which of the following statement about plant is false?  
 (a) Plants are heterotrophs  
 (b) Plants show alternation of generations during their life cycle  
 (c) Plants are multicellular eukaryotes  
 (d) Plants are non-motile
23. Which of the following statement is incorrect?  
 (a) Viruses are obligate parasites  
 (b) Infective constituent in viruses is the protein coat  
 (c) Prions consist of abnormally folded proteins  
 (d) Viroids lack a protein coat
24. Select incorrect statement.  
 (a) The viroids were discovered by DJ Ivanowsky  
 (b) WM Stanley showed that viruses could be crystallised  
 (c) The term '*Contagium vivum fluidum*' was coined by MW Beijerinck  
 (d) Mosaic disease in tobacco and AIDS in human being are caused by viruses
25. State whether the given statements are true or false.  
 I. Bacteria show both autotrophic and heterotrophic nutrition.  
 II. Some of the bacteria are autotrophic. They may be photosynthetic autotrophic or chemosynthetic autotrophic.  
 III. Heterotrophic nutrition involves obtaining of readymade organic food from outside sources.  
 (a) I and II are true  
 (b) I is true, II and III are false  
 (c) I, II and III are true  
 (d) Only I is true

- 26 Read the following statements regarding archaeobacteria and select the correct option.
- Archaeobacteria differ from other bacteria in having different cell wall structure.
  - Their cell wall is made up of cellulose and contains high amount of unsaturated fatty acid, which is responsible for their survival in extreme conditions.
  - Thermoacidophiles have dual ability to tolerate high temperature as well as high acidity.
- Which of the statements given above are correct?
- I and II
  - I and III
  - II and III
  - All of the above

- 27 Analyse the following statements and identify the correct option given below.
- In diatoms the walls are embedded with silica and thus the walls are indestructible.
  - Diatoms have left behind large amount of cell wall deposits in their habitat, this accumulation over billions of years is referred to as diatomaceous deposition or diatomaceous earth.
- I is true, but II is false
  - I is false, but II is true
  - I and II are true
  - I and II are false

- 28 The given statements describe a group of organisms.
- Instead of a cell wall, they have a protein rich layer called pellicle which makes their body flexible.
  - They have two flagella, a short and a long one.
  - They are photosynthetic in the presence of sunlight, when deprived of sunlight they behave like heterotrophs by preying on other smaller organisms.
  - They are connecting link between plants and animals.
- Which of the following group is referred to here by the above statements?
- Slime moulds
  - Dinoflagellates
  - Euglenoids
  - Protozoans

- 29 Consider the following statements about slime moulds.
- Plasmodium is found in acellular slime moulds.
  - Pseudoplasmodium is found in cellular slime moulds.
- Which of the statement(s) given above is/are correct?
- I is true, but II is false
  - Both I and II are false
  - I is false, but II is true
  - Both I and II are true

- 30 Consider the following statements.
- In this group, the plasmodium differentiates and forms fruiting bodies, bearing spores at their tips.
  - Spores possess true walls.
  - The spores are dispersed by air currents.
  - The spores are extremely resistant and survive for many years even under adverse conditions.
- The above statements are assigned to
- euglenoids
  - slime moulds
  - dinoflagellates
  - chrysophytes

- 31 Consider the following statements.
- Bruce discovered that the parasite of sleeping sickness is transmitted by tse-tse fly.
  - Sleeping sickness of *Trypanosoma gambiense* is also called gambian trypanosomiasis, which is found in Western and central parts of Africa.
  - Trichomonas vaginalis* inhabits vagina of women and causes the disease leucorrhoea.
  - Entamoeba histolytica* resides in the upper part of the human's large intestine and causes the disease known as amoebic dysentery.
- Which of the statements given above are correct?
- I, II and III
  - II, III and IV
  - I, II and IV
  - All of these

- 32 Consider the following statements and place them into true and false category.
- The fungi constitute a unique kingdom of heterotrophic organisms.
  - The common mushroom and toad stools are fungi.
  - White spots seen on mustard leaves are due to the presence of parasitic fungus.
  - Some unicellular fungi (*Ustilago*) are used to make bread and beer.
  - Puccinia graminis tritici* is responsible for yellow rust of wheat.
  - Penicillium* yields the antibiotic penicillin.
- | True               | False          |
|--------------------|----------------|
| (a) I, II, III     | IV, V, VI      |
| (b) I, II, III, VI | IV, V          |
| (c) II, III, VI    | I, IV, V       |
| (d) IV, V          | I, II, III, VI |

- 33 In Phycomycetes, asexual reproduction takes place by zoospores or by aplanospores. Regarding these spores, consider the following statements and choose the correct option.
- Zoospores are motile and aplanospores are non-motile in nature.
  - These spores are endogenously produced in sporangium.
- Which of the statements are true and false?
- I is true, but II is false
  - I is false, but II is true
  - I and II are true
  - I and II are false



34 Consider the following statements about sexual reproduction.

- I. In class–Phycomycetes, sexual reproduction produces a resting diploid spore called zygospore.
- II. Zygospores are formed by the fusion of two gametes.
- III. All zygospores are of isogamous type.

Which of the statements given above are correct?

- (a) I and II (b) I and III (c) II and III (d) All of these

35 Analyse the following statements about class–Ascomycetes.

- I. Mycelium is branched and septate.
- II. The asexual spores are conidia, produced on the special mycelium called conidiophores.
- III. Sexual spores are called ascospores, which are produced in sac-like asci.

Which of the statements given above are correct?

- (a) I and II (b) I and III (c) II and III (d) All of these

36 Consider the following statements.

- I. Mycelium is branched and septate.
- II. The asexual spores are generally not formed.
- III. Vegetative reproduction takes place by fragmentation.
- IV. Sex organs are absent, but sexual reproduction takes place by somatogamy.
- V. Karyogamy and meiosis take place in basidium to form four haploid basidiospores.
- VI. Basidia are arranged in fruiting bodies called basidiocarp.

The above statements are assigned to

- (a) sac fungi (b) bracket fungi  
(c) imperfecti fungi (d) club fungi

37 Consider the following statements about Deuteromycetes.

- I. Some members are saprophytes or parasites.
- II. A large number of members are decomposers of litter and help in mineral cycling.
- III. *Alternaria*, *Colletotrichum*, *Cercospora* and *Trichoderma* are examples of Deuteromycetes.

Which of the statements given above are correct?

- (a) I and II (b) I and III (c) II and III (d) All of these

38 Consider the following statements about plants.

- I. Kingdom–Plantae includes eukaryotic, autotrophic, chlorophyll containing organisms.
- II. It includes algae, bryophytes, pteridophytes, gymnosperms, but not angiosperms.
- III. Plants show alternation of generation [between haploid gametophytic ( $n$ ) phase and diploid sporophytic ( $2n$ ) phase].

Which of the statements given above are correct?

- (a) I and II (b) I and III (c) II and III (d) All of these

39 Organisms of kingdom–Animalia

- I. are capable of locomotion.
- II. have specialised sensory and neuromotor system.
- III. show sexual reproduction by copulation of male and female followed by embryological development.

Which of the statements given above is/are correct?

- (a) I and II (b) I and III  
(c) Only I (d) All of these

40 I. DJ Ivanowsky (1892) recognised certain microbes as causal organisms of the mosaic disease of tobacco.

II. MW Beijerinck (1898) demonstrated that the extract of infected plants of tobacco could cause infection in healthy plants and called the fluid as *Contagium vivum fluidum*.

III. WM Stanley (1935) showed that these microbes could be crystallised and crystals consist largely of protein.

The above statements are assigned to

- (a) Bacteria (b) Virus  
(c) Prions (d) Lichens

41 Which of the following statements are false about viruses?

- I. Viruses are facultative parasites.
- II. Viruses can multiply only when they are inside the living cells.
- III. Viruses cannot pass bacterial proof filters.
- IV. Viruses do not contain proteins, DNA and RNA.

- (a) I, II and III (b) II, III and IV  
(c) I, III and IV (d) All of these

42 TO Diener (1971) discovered a new infectious agent that was smaller than viruses.

Consider the following statements about this infectious agent.

- I. It causes potato spindle tuber disease.
- II. These are infectious RNA particles.
- III. It lacks a protein coat.
- IV. The molecular weight of its RNA is low.

The above statements are assigned to

- (a) viruses (b) viroids  
(c) prions (d) lichen

43 Study the following statements and identify the correct option given below.

- I. Viruses that infect plants have single-stranded RNA and viruses that infect animals have either single or double-stranded RNA or double-stranded DNA.
- II. Bacterial viruses or Bacteriophages are usually single-stranded RNA viruses.

- (a) I is true, but II is false  
(b) I is false, but II is true  
(c) I and II are true  
(d) I and II are false

44 Which of the following statements correctly describe viruses?

- I. Simple and unicellular organisms.
- II. Contain DNA or RNA and enclosed by protein coat.
- III. Possess own metabolic system and respond to stimuli.
- IV. Maintain genetic continuity and undergo mutations.

The correct combination is  
 (a) I and II (b) II and IV (c) II and III (d) I and III

45 Match the following columns.

Column I (Systems of classification)	Column II (Given by)
A. Two kingdom system of classification	1. RH Whittaker
B. Five kingdom system of classification	2. Carl Woese
C. Six kingdom system of classification	3. Carolus Linnaeus

Codes

- |       |   |   |       |   |   |
|-------|---|---|-------|---|---|
| A     | B | C | A     | B | C |
| (a) 2 | 1 | 3 | (b) 1 | 2 | 4 |
| (c) 4 | 3 | 1 | (d) 3 | 1 | 2 |

46 Match the following columns.

Column I (Names)	Column II (Shape)
A. Coccus	1. Rod-shaped
B. Bacillus	2. Spherical
C. Vibrio	3. Spiral-shaped
D. Spirillum	4. Comma-shaped

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 3 | 2 | 1 | 4 | (b) 4 | 3 | 2 | 1 |
| (c) 2 | 1 | 4 | 3 | (d) 1 | 4 | 3 | 2 |

47 Match the following bacterial nutrition with their representative organisms.

Column I (Types of bacteria)	Column II (Examples)
A. Chemoautotrophic bacteria	1. Nitrifying bacteria
B. Photoautotrophic bacteria	2. Purple bacteria, green sulphur bacteria
C. Symbiotic bacteria	3. <i>Rhizobium</i> , <i>Frankia</i>
D. Parasitic bacteria	4. <i>Vibrio cholerae</i>

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 2 | 3 | 4 | (b) 4 | 3 | 2 | 1 |
| (c) 3 | 2 | 4 | 1 | (d) 2 | 3 | 1 | 4 |

48 Match the organisms in Column I with habitats in Column II and choose the correct option from the codes given below.

Column I	Column II
A. Halophiles	1. Hot springs
B. Thermoacidophiles	2. Aquatic environment
C. Methanogens	3. Guts of ruminants
D. Cyanobacteria	4. Salty area

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 4 | 1 | 3 | 2 | (b) 1 | 2 | 3 | 4 |
| (c) 3 | 4 | 2 | 1 | (d) 2 | 4 | 3 | 1 |

49 Match the following columns.

Column I (Features)	Column II (Protista)
A. Chief producer in the oceans	1. Diatoms
B. Red tide	2. Dinoflagellates
C. Connecting link between plants and animals	3. Euglenoids
D. Fungus animals	4. Slime moulds

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 2 | 3 | 4 | 1 | (b) 1 | 2 | 3 | 4 |
| (c) 3 | 4 | 1 | 2 | (d) 4 | 1 | 2 | 3 |

50 Match the following columns.

Column I (Types)	Column II (Examples)
A. Amoeboid protozoans	1. <i>Plasmodium</i>
B. Flagellated protozoans	2. <i>Paramecium</i>
C. Ciliated protozoans	3. <i>Trypanosoma</i>
D. Sporozoans	4. <i>Entamoeba histolytica</i>

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 2 | 3 | 4 | (b) 4 | 3 | 2 | 1 |
| (c) 3 | 2 | 1 | 4 | (d) 2 | 1 | 4 | 3 |

51 Match the following columns and choose the correct option from the codes given below.

Column I (Categories)	Column II (Examples)
A. Chrysophyte	1. <i>Gonyaulax</i>
B. Dinoflagellate	2. <i>Euglena</i>
C. Euglenoids	3. Diatoms
D. Slime moulds	4. <i>Plasmodium</i>

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 3 | 2 | 4 | (b) 1 | 4 | 2 | 3 |
| (c) 3 | 2 | 4 | 1 | (d) 3 | 1 | 2 | 4 |

52 Match the following columns.

Column I (Categories)	Column II (Examples)
A. Phycomycetes	1. <i>Alternaria</i> and <i>Trichoderma</i>
B. Ascomycetes	2. <i>Agaricus</i> and <i>Ustilago</i>
C. Basidiomycetes	3. <i>Aspergillus</i> , <i>Claviceps</i> and <i>Neurospora</i>
D. Deuteromycetes	4. <i>Mucor</i> , <i>Rhizopus</i> and <i>Pythium</i>

Codes

A	B	C	D	A	B	C	D
(a) 1	4	3	2	(b) 2	1	4	3
(c) 4	3	2	1	(d) 3	2	1	4

53 Match the following columns.

Column I (Categories)	Column II (Common names)
A. Phycomycetes	1. Algal fungi
B. Ascomycetes	2. Imperfect fungi
C. Basidiomycetes	3. Bracket fungi
D. Deuteromycetes	4. Sac fungi

Codes

A	B	C	D	A	B	C	D
(a) 2	1	4	3	(b) 4	3	2	1
(c) 1	4	3	2	(d) 3	2	1	4

54 Match the following columns.

Column I (Features)	Column II (Related to)
A. Parasitic fungi on mustard	1. <i>Neurospora</i>
B. Rust and smut disease	2. <i>Puccinia</i> and <i>Ustilago</i>
C. Used in genetic work	3. Morels and truffles
D. Edible delicacies	4. <i>Albugo</i>
E. Bread mould	5. <i>Rhizopus</i>

Codes

A	B	C	D	E
(a) 3	5	4	2	1
(b) 1	3	5	4	2
(c) 2	1	3	5	4
(d) 4	2	1	3	5

55 Match the following columns.

Column I (Names of fungi)	Column II (Categories)
A. <i>Rhizopus</i>	1. Eurotiomycetes
B. <i>Penicillium</i>	2. Ustilagomycetes
C. <i>Ustilago</i>	3. Deuteromycetes
D. <i>Alternaria</i>	4. Zygomycetes

Codes

A	B	C	D	A	B	C	D
(a) 4	3	1	2	(b) 2	3	4	1
(c) 4	1	2	3	(d) 3	4	2	1

56 Match Column I with Column II.

Column I	Column II
A. Saprophyte	1. Symbiotic association of fungi with plant roots
B. Parasite	2. Decomposition of dead organic materials
C. Lichens	3. Living on living plants or animals
D. Mycorrhiza	4. Symbiotic association of algae and fungi

Codes

A	B	C	D	A	B	C	D
(a) 3	2	1	4	(b) 2	1	3	4
(c) 2	3	4	1	(d) 1	2	3	4

57 Match the following columns.

Column I (Scientists)	Column II (Related to)
A. DJ Ivanowsky (1892)	1. Viroids
B. MW Beijerinck (1898)	2. First crystallised TMV
C. WM Stanley (1935)	3. <i>Contagium vivum fluidum</i>
D. TO Diener (1971)	4. Mosaic disease of tobacco

Codes

A	B	C	D	A	B	C	D
(a) 1	4	3	2	(b) 2	1	4	3
(c) 4	3	2	1	(d) 3	2	1	4

58 Match the following columns.

Column I (Viruses)	Column II (Genetic materials)
A. M-13 bacteriophage	1. dsRNA
B. Rice dwarf virus	2. ssRNA
C. Cauliflower mosaic virus	3. ssDNA
D. Polio virus	4. dsDNA

Codes

A	B	C	D	A	B	C	D
(a) 3	1	4	2	(b) 2	1	3	4
(c) 3	4	2	1	(d) 4	3	1	2

59 Match the following columns and choose the correct combination from the given options.

Column I (Kingdoms)	Column II (Classes)
A. Plantae	1. Archaeobacteria
B. Fungi	2. Euglenoids
C. Protista	3. Phycomycetes
D. Monera	4. Algae

Codes

A	B	C	D	A	B	C	D
(a) 4	3	2	1	(b) 1	2	3	4
(c) 3	4	2	1	(d) 4	2	3	1

## NCERT EXEMPLAR PROBLEMS

1. All eukaryotic unicellular organisms belong to
  - a. Monera
  - b. Protista
  - c. Fungi
  - d. Bacteria
  
2. The five kingdom classification was proposed by
  - a. R.H. Whittaker
  - b. C.Linnaeus
  - c. A. Roxberg
  - d. Virchow
  
3. Organisms living in salty areas are called as
  - a. Methanogens
  - b. Halophiles
  - c. Hellophytes
  - d. Thermoacidophiles
  
4. Naked cytoplasm, multinucleated and saprophytic are the characteristics of
  - a. Monera
  - b. Protista
  - c. Fungi
  - d. Slime molds
  
5. An association between roots of higher plants and fungi is called
  - a. Lichen
  - b. Fern
  - c. Mycorrhiza
  - d. BGA
  
6. A dikaryon is formed when
  - a. Meiosis is arrested
  - b. The two haploid cells do not fuse immediately
  - c. Cytoplasm does not fuse
  - d. None of the above
  
7. *Contagium vivum fluidum* was proposed by
  - a. D.J. Ivanowsky
  - b. M.W. Beijerinck
  - c. Stanley
  - d. Robert Hook

8. Associations between Mycobiont and Phycobiont are found in
- Mycorrhiza
  - Root
  - Lichens
  - BGA
9. Difference between Virus and Viroid is
- Absence of protein coat in viroid but present in virus
  - Presence of low molecular weight RNA in virus but absent in viroid
  - Both a and b
  - None of the above
10. With respect to fungal sexual cycle, choose the correct sequence of events
- Karyogamy, Plasmogamy and Meiosis
  - Meiosis, Plasmogamy and Karyogamy
  - Plasmogamy, Karyogamy and Meiosis
  - Meiosis, Karyogamy and Plasmogamy
11. Viruses are non-cellular organisms but replicate themselves once they infect the host cell. To which of the following kingdom do viruses belong to?
- Monera
  - Protista
  - Fungi
  - None of the above
12. Members of phycomycetes are found in
- Aquatic habitats
  - On decaying wood
  - Moist and damp places
  - As obligate parasites on plants

Choose from the following options

- None of the above
- i and iv
- ii and iii
- All of the above

## NEET PREVIOUS QUESTIONS

1. Which of the following is correct about viroids?
  - (a) They have RNA with protein coat.
  - (b) They have free RNA without protein coat.
  - (c) They have DNA with protein coat.
  - (d) They have free DNA without protein coat.

(NEET 2020)
2. Mad cow disease in cattle is caused by an organism which has
  - (a) inert crystalline structure
  - (b) abnormally folded protein
  - (c) free RNA without protein coat
  - (d) free DNA without protein coat.

(Odisha NEET 2019)
3. Which of the following statements is incorrect?
  - (a) Prions consist of abnormally folded proteins.
  - (b) Viroids lack a protein coat.
  - (c) Viruses are obligate parasites.
  - (d) Infective constituent in viruses is the protein coat.

(NEET 2019)
4. Which of the following statements is incorrect?
  - (a) Yeasts have filamentous bodies with long thread like hyphae.
  - (b) Morels and truffles are edible delicacies.
  - (c) *Claviceps* is a source of many alkaloids and LSD.
  - (d) Conidia are produced exogenously and ascospores endogenously.

(NEET 2019)
5. Match column -I with column - II.
 

Column-I	Column-II
A. Saprophyte	(i) Symbiotic association of fungi with plant roots
B. Parasite	(ii) Decomposition of dead organic materials
C. Lichens	(iii) Living on living plants or animals
D. Mycorrhiza	(iv) Symbiotic association of algae and fungi

Choose the correct answer from the options given below.

(A)	(B)	(C)	(D)
(a) (ii)	(iii)	(iv)	(i)
(b) (i)	(ii)	(iii)	(iv)
(c) (iii)	(ii)	(i)	(iv)
(d) (ii)	(i)	(iii)	(iv)

(NEET 2019)
6. Which of the following organisms are known as chief producers in the oceans?
  - (a) Dinoflagellates
  - (b) Diatoms
  - (c) Cyanobacteria
  - (d) Euglenoids

(NEET 2018)
7. Ciliates differ from all other protozoans in
  - (a) using flagella for locomotion
  - (b) having a contractile vacuole for removing excess water
  - (c) using pseudopodia for capturing prey
  - (d) having two types of nuclei.

(NEET 2018)
8. Which among the following is not a prokaryote?
  - (a) *Saccharomyces*
  - (b) *Mycobacterium*
  - (c) *Nostoc*
  - (d) *Oscillatoria*

(NEET 2018)
9. After karyogamy followed by meiosis, spores are produced exogenously in
  - (a) *Neurospora*
  - (b) *Alternaria*
  - (c) *Agaricus*
  - (d) *Saccharomyces*.

(NEET 2018)
10. Select the wrong statement.
  - (a) Cell wall is present in members of fungi and plantae.
  - (b) Mushrooms belong to basidiomycetes.
  - (c) Pseudopodia are locomotory and feeding structures in sporozoans.
  - (d) Mitochondria are the powerhouse of the cell in all kingdoms except monera.

(NEET 2018)
11. Viroids differ from viruses in having
  - (a) DNA molecules without protein coat
  - (b) RNA molecules with protein coat
  - (c) RNA molecules without protein coat
  - (d) DNA molecules with protein coat.

(NEET 2018)
12. Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?
  - (a) *Pseudomonas*
  - (b) *Mycoplasma*
  - (c) *Nostoc*
  - (d) *Bacillus*

(NEET 2017)
13. Which of the following components provides stick character to the bacterial cell?
  - (a) Nuclear membrane
  - (b) Plasma membrane
  - (c) Glycocalyx
  - (d) Cell wall

(NEET 2017)
14. DNA replication in bacteria occurs
  - (a) within nucleolus
  - (b) prior to fission
  - (c) just before transcription
  - (d) during S phase.

(NEET 2017)
15. Methanogens belong to
  - (a) eubacteria
  - (b) archaeobacteria
  - (c) dinoflagellates
  - (d) slime moulds.

(NEET-II 2016)
16. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the
  - (a) methanogens
  - (b) eubacteria
  - (c) halophiles
  - (d) thermoacidophiles.

(NEET-I 2016)

17. Select the wrong statement.  
 (a) The walls of diatoms are easily destructible.  
 (b) 'Diatomaceous earth' is formed by the cell walls of diatoms.  
 (c) Diatoms are chief producers in the oceans.  
 (d) Diatoms are microscopic and float passively in water. (NEET-II 2016)
18. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the Kingdom  
 (a) Fungi (b) Animalia  
 (c) Monera (d) Protista. (NEET-I 2016)
19. Which one of the following statements is wrong?  
 (a) Eubacteria are also called false bacteria.  
 (b) Phycomycetes are also called algal fungi.  
 (c) Cyanobacteria are also called blue-green algae.  
 (d) Golden algae are also called desmids. (NEET-I 2016)
20. One of the major components of cell wall of most fungi is  
 (a) cellulose (b) hemicellulose  
 (c) chitin (d) peptidoglycan. (NEET-I 2016)
21. The imperfect fungi which are decomposers of litter and help in mineral cycling belong to  
 (a) Phycomycetes (b) Ascomycetes  
 (c) Deuteromycetes (d) Basidiomycetes. (2015)
22. Which of the following statements is wrong for viroids?  
 (a) They cause infections.  
 (b) Their RNA is of high molecular weight.  
 (c) They lack a protein coat.  
 (d) They are smaller than viruses. (NEET-I 2016)
23. Select the wrong statement.  
 (a) The term '*contagium vivum fluidum*' was coined by M. W. Beijerinck.  
 (b) Mosaic disease in tobacco and AIDS in human being are caused by viruses.  
 (c) The viroids were discovered by D.J. Ivanowsky.  
 (d) W.M. Stanley showed that viruses could be crystallised. (2015)
24. Choose the wrong statement.  
 (a) Morels and truffles are poisonous mushrooms.  
 (b) Yeast is unicellular and useful in fermentation.  
 (c) *Penicillium* is multicellular and produces antibiotics.  
 (d) *Neurospora* is used in the study of biochemical genetics. (2015)
25. In which group of organisms the cell walls form two thin overlapping shells which fit together?  
 (a) Dinoflagellates (b) Slime moulds  
 (c) Chrysophytes (d) Euglenoids (2015)
26. Five kingdom system of classification suggested by R.H. Whittaker is not based on  
 (a) presence or absence of a well defined nucleus  
 (b) mode of reproduction  
 (c) mode of nutrition  
 (d) complexity of body organisation. (2014)
27. Which one of the following fungi contains hallucinogens?  
 (a) *Morchella esculenta* (b) *Amanita muscaria*  
 (c) *Neurospora* sp. (d) *Ustilago* sp. (2014)
28. Which one of the following living organisms completely lacks a cell wall?  
 (a) Cyanobacteria (b) Sea-fan (*Gorgonia*)  
 (c) *Saccharomyces* (d) Blue-green algae (2014)
29. Which of the following shows coiled RNA strand and capsomeres?  
 (a) Polio virus (b) Tobacco mosaic virus  
 (c) Measles virus (d) Retrovirus (2014)
30. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the Kingdom  
 (a) Fungi (b) Animalia  
 (c) Monera (d) Protista. (NEET-I 2016)
31. Select the wrong statement.  
 (a) The walls of diatoms are easily destructible.  
 (b) 'Diatomaceous earth' is formed by the cell walls of diatoms.  
 (c) Diatoms are chief producers in the oceans.  
 (d) Diatoms are microscopic and float passively in water. (NEET-II 2016)

## PREVIOUS AIMS QUESTIONS

- Which of the following are likely to be present in deep sea water?  
(a) Blue-green algae      (b) Saprophytic fungi  
(c) Archaeobacteria      (d) Eubacteria  
(NEET 2013)
- Pigment containing membranous extensions in some cyanobacteria are  
(a) pneumatophores      (b) chromatophores  
(c) heterocysts      (d) basal bodies.  
(NEET 2013)
- The cyanobacteria are also referred to as  
(a) protists      (b) golden algae  
(c) slime moulds      (d) blue green algae.  
(2012)
- The most abundant prokaryotes helpful to humans in making curd from milk and in production of antibiotics are the ones categorised as  
(a) cyanobacteria  
(b) archaeobacteria  
(c) chemosynthetic autotrophs  
(d) heterotrophic bacteria.      (2012)
- In eubacteria, a cellular component that resembles eukaryotic cell is  
(a) plasma membrane      (b) nucleus  
(c) ribosomes      (d) cell wall.      (2011)
- Some hyperthermophilic organisms that grow in highly acidic (pH 2) habitats belong to the two groups  
(a) eubacteria and archaea  
(b) cyanobacteria and diatoms  
(c) protists and mosses  
(d) liverworts and yeasts.      (2010)
- Select the correct combination of the statements (i-iv) regarding the characteristics of certain organisms.  
(i) Methanogens are archaeobacteria which produce methane in marshy areas.  
(ii) *Nostoc* is a filamentous blue-green alga which fixes atmospheric nitrogen.  
(iii) Chemosynthetic autotrophic bacteria synthesize cellulose from glucose.  
(iv) *Mycoplasma* lack a cell wall and can survive without oxygen.

The correct statements are

- (a) (ii) and (iii)      (b) (i),(ii) and (iii)  
(c) (ii), (iii) and (iv)      (d) (i), (ii) and (iv).  
(Mains 2010)
- Bacterial leaf blight of rice is caused by a species  
(a) *Alternaria*      (b) *Erwinia*  
(c) *Xanthomonas*      (d) *Pseudomonas*. (2008)
- Thermococcus*, *Methanococcus* and *Methanobacterium* exemplify  
(a) bacteria whose DNA is relaxed or positively supercoiled but which have a cytoskeleton as well as mitochondria  
(b) bacteria that contain a cytoskeleton and ribosomes  
(c) archaeobacteria that contain protein homologous to eukaryotic core histones  
(d) archaeobacteria that lack any histones resembling those found in eukaryotes but whose DNA is negatively supercoiled.      (2008)
- In the light of recent classification of living organisms into three domains of life (bacteria, archaea and eukarya), which one of the following statements is true about archaea?  
(a) Archaea completely differ from both prokaryotes and eukaryotes.  
(b) Archaea completely differ from prokaryotes.  
(c) Archaea resemble eukarya in all respects.  
(d) Archaea have some novel features that are absent in other prokaryotes and eukaryotes.      (2008)



## KEY

### MULTIPLE CHOICE QUESTIONS

1 (a) 2 (a) 3 (d) 4 (a) 5 (c) 6 (b) 7 (d) 8 (b) 9 (c) 10 (c) 11 (a) 12 (b) 13 (b) 14 (c) 15 (a)  
16 (d) 17 (d) 18 (c) 19 (b) 20 (d) 21 (b) 22 (a) 23 (d) 24 (c) 25 (a) 26 (b) 27 (b) 28 (c) 29 (b) 30 (c)  
31 (c) 32 (a) 33 (b) 34 (b) 35 (a) 36 (c) 37 (c) 38 (a) 39 (b) 40 (a) 41 (d) 42 (c) 43 (b) 44 (d) 45 (c)  
46 (c) 47 (a) 48 (b) 49 (d) 50 (c) 51 (c) 52 (b) 53 (b) 54 (b) 55 (d) 56 (a) 57 (b) 58 (b) 59 (a) 60 (c)  
61 (d) 62 (a) 63 (c) 64 (d) 65 (b) 66 (d) 67 (a) 68 (a) 69 (b) 70 (a) 71 (b) 72 (a) 73 (b) 74 (c) 75 (a)  
76 (d) 77 (b) 78 (d) 79 (a) 80 (a) 81 (b) 82 (d) 83 (b) 84 (a) 85 (d) 86 (b) 87 (c) 88 (d) 89 (c) 90 (a)  
91 (b) 92 (d) 93 (b) 94 (b) 95 (b) 96 (d) 97 (a) 98 (a) 99 (b) 100 (d) 101 (d) 102 (b) 103 (d) 104 (d) 105 (d)  
106 (a) 107 (a) 108 (a) 109 (a) 110 (d) 111 (d) 112 (b) 113 (a) 114 (b) 115 (d) 116 (a) 117 (c) 118 (a) 119 (c) 120 (d)  
121 (a) 122 (d) 123 (a) 124 (a) 125 (d) 126 (c) 127 (b) 128 (c) 129 (c) 130 (b) 131 (a) 132 (a) 133 (d) 134 (b) 135 (d)  
136 (a) 137 (a) 138 (d) 139 (b) 140 (a) 141 (b) 142 (d) 143 (b) 144 (d) 145 (a) 146 (a) 147 (d)

### SPECIAL FORMAT QUESTIONS

1	d	13	a	25	c	37	d	49	b
2	c	14	d	26	b	38	b	50	b
3	c	15	d	27	c	39	d	51	d
4	a	16	b	28	c	40	b	52	c
5	c	17	c	29	d	41	c	53	c
6	b	18	c	30	b	42	b	54	d
7	a	19	a	31	d	43	a	55	c
8	b	20	c	32	b	44	b	56	c
9	a	21	d	33	c	45	d	57	c
10	b	22	a	34	d	46	c	58	a
11	c	23	b	35	d	47	a	59	a
12	a	24	a	36	b	48	a		

### NCERT EXEMPLAR PROBLEMS

1	b	5	c	9	a
2	a	6	b	10	c
3	b	7	b	11	d
4	d	8	c	12	d

### NEET PREVIOUS QUESTIONS

1	b	8	a	15	b	22	b	29	b	36	d
2	b	9	c	16	a	23	c	30	b	37	d
3	d	10	c	17	a	24	a	31	c	38	d
4	a	11	c	18	d	25	c	32	d	39	d
5	a	12	b	19	b	26	b	33	d		
6	b	13	c	20	a	27	b	34	d		
7	d	14	b	21	c	28	b	35	d		

### AIIMS PREVIOUS QUESTIONS

1	c	5	a	9	c
2	b	6	a	10	b
3	a	7	a		
4	d	8	a		

# **UNIT-II**

## **STRUCTURAL ORGNISATION IN ANIMALS**

### **CHAPTER-7**

## **SYNOPSIS**

- In multicellular animals, a group of similar cells having the same origin and performing a specific function form an organisation called **tissue**.
- Cells, tissues, organs and organ system exhibit division of labour and contribute to the survival of an organism.
- The structure of cells varies according to their functions. Therefore, animal tissues can be classified broadly as
- It possesses free surface and its cells are compactly packed with little intercellular matrix. It lines the body surfaces facing lumen, cavities, ducts, etc

**Epithelial tissue** is broadly classified into two categories

- **Simple epithelium** composed of single layer of cells, which lines body cavities, ducts and tubes.
- **Compound epithelium** composed of two or more layers of cell, which is protective in function.
- Based on structural modifications, simple epithelium is further divided into the following types
- **Squamous epithelium** is formed of single thin layer of flat cells with irregular boundaries. It forms diffusion boundaries in the air sacs of lungs and the walls of blood vessels.
- **Columnar epithelium** is composed of a single layer of tall and slender cells with nuclei located at the base and microvilli at the free surface and is called brush bordered columnar epithelium.
- **Ciliated epithelium** is derived from columnar or cuboidal cells which bear cilia on the free surface. Its function is to move particles or mucus in a specific direction over the epithelium. It is found in the inner surface of hollow organs like bronchioles and Fallopian tubes.
- **Glandular epithelium** is formed by the modification of columnar or cuboidal cells, which become specialised for secretion. Cells are mainly of two types, **unicellular** (e.g. goblet cells) and **multicellular** (e.g. salivary gland). Based on the mode of pouring of secretions, glands are either **exocrine** (pour secretions into ducts) or **endocrine** (ductless glands pour secretions directly into the fluid bathing glands).
- **Pseudostratified epithelium** It is one cell thick, yet it appears to be multilayered. It is of two types, i.e. **pseudostratified columnar epithelium** (in the large ducts of parotid glands) and **pseudostratified columnar ciliated epithelium** (in the large bronchi and trachea).
- Based on structural modifications, compound epithelium is of following types
- **Stratified squamous epithelium** its cells in the deepest layer are columnar or cuboidal with oval nuclei. It is of two types, i.e. **keratinised stratified squamous epithelium** (in skin epidermis) and **non-keratinised stratified squamous epithelium** (in pharynx, vagina, etc.)
- **Stratified cuboidal epithelium** its outer cells are cuboidal and basal cells are columnar. It lines the sweat gland
- ducts and large salivary ducts.

- **Stratified columnar epithelium** has columnar cells in both superficial and basal layer. It lines mammary glands, ducts and parts of urethra.
  - **Stratified ciliated columnar epithelium** whose outer layer has ciliated columnar cells and the basal layer consists of columnar cells. It lines the larynx and upper part of the soft palate.
  - **Transitional epithelium** appears stratified and consists of fewer layers of less flattened surface cells with remarkable flexibility. It is found in ureters, urinary bladder and urethra.
- Epithelium cells are structurally and functionally linked through cell junctions. The three types of cell junctions are
- **Tight junctions** stop leakage of substances across a tissue.
  - **Adhering junctions** cement the neighbouring cells together.
  - **Gap junctions** facilitate the cells to communicate by connecting cytoplasm of adjoining cells.

## **Connective Tissue**

It is the most abundant tissue and it helps in binding or linking, supporting and protecting other tissues in the body.

➤ The three types of connective tissues are

1. **Loose connective tissue** contains loosely arranged cells and fibres in a semi-fluid ground substance. It consists of two sub-types
  - **Areolar tissue** contains fibroblast, macrophages and mast cells. It supports the epithelium and is present beneath the skin
  - **Adipose tissue** located mainly beneath the skin and is specialised to store fats.
2. **Dense connective tissue** contains compactly packed fibres and fibroblasts. It also contain two sub-types
  - **Dense regular tissue** in which collagen fibres are found in rows between parallel bundles of fibres, e.g. **tendons** (attach skeletal muscles to bones) and **ligaments** (attach one bone to another).
  - **Dense irregular tissue** in which collagen fibres and fibroblasts are oriented differently, e.g. in deeper skin layers and sclera of eyes.
3. **Specialised connective tissue** comprises of cartilage, bones and blood.
  - **Cartilage** Intercellular material is solid and pliable. The cells, chondrocytes are enclosed in small cavities. Cartilage is found in nose tip, outer ear joints and between adjacent bones of vertebral column.
  - **Bones** have a hard and non-pliable ground substance, rich in calcium salts and collagen fibres. The osteoblasts (bone forming cells), osteocytes (bone maintaining cells and osteoclasts (bone cleaning cells) are found in lacunae. The **Osteon** or **Haversian system** is the cylindrical functional unit consisting of lamellae that surrounds the Haversian canal. Bone marrow in some long bones is the site of blood cell production.
  - **Blood** is a fluid connective tissue, consisting of plasma, RBCs, WBCs and platelets. It is the main circulating fluid which enables transport of various substances

## **Muscle Tissue**

It is made up of fibres which are composed of myofibrils. The three types of muscles are

- Skeletal muscles are striated in appearance, voluntary in action and are closely attached to the skeletal bones.
- Smooth muscles are non-striated, involuntary muscles, found in the wall of internal organs such as blood vessels, stomach and intestine.
- Cardiac muscles are contractile tissues present only in the heart. The cell junctions of cardiac muscle cells fuse the plasma membrane and make them stick together. Intercalated discs act as the communication junctions allowing the cells to contract as a unit.

## **Nervous/Neural Tissue**

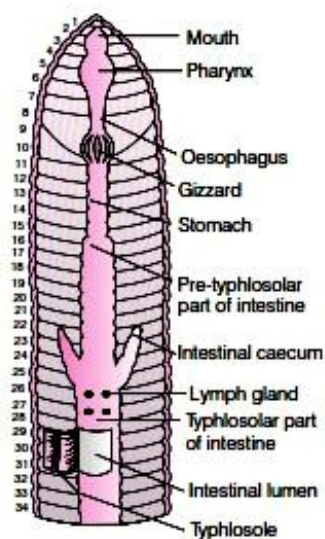
It exerts the greatest control over body's response to various stimuli. Neurons the basic unit of neural tissue, are excitable cells that show conductivity. There are also neuroglial cells that support the neurons structurally. Each neuron consists of cyton (cell body), dendrites and axon (processes of neuron)

## **Organ and Organ System**

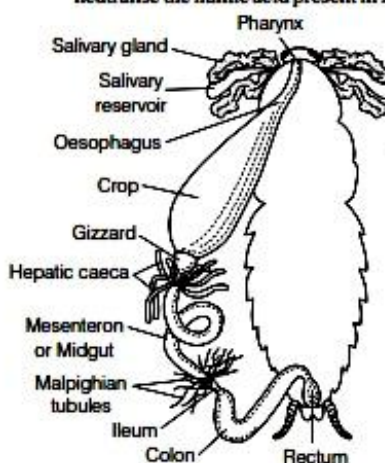
- The basic tissues organise to form organs which then associate to form organ system in multicellular organisms.
- Morphology (study of externally visible features) and anatomy (study of morphology of internal organs) of earthworm, cockroach and frog are discussed below in brief.

# Earthworm-Cockroach-Frog

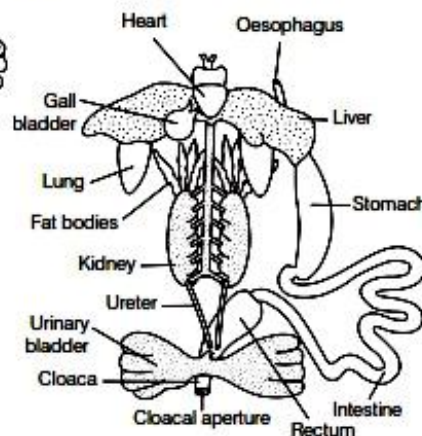
	<b>Earthworm (<i>Pheretima posthuma</i>)</b>	<b>Cockroach (<i>Periplaneta americana</i>)</b>	<b>Frog (<i>Rana tigrina</i>)</b>
<b>Colour</b>	Glistening reddish brown	Brown/Black	Olive green with dark irregular spots
<b>Body</b>	<ul style="list-style-type: none"> <li>Metamerically segmented, first body segment is peristomium and prostomium overhangs upon it dorsally.</li> <li>Clitellum (glandular tissue) present in 14th-16th segments, divides the body in 3 regions, i.e. preclitellar, clitellar and post-clitellar segments.</li> </ul>	<ul style="list-style-type: none"> <li>Externally segmented into head, thorax and abdomen.</li> <li>Mouth parts consist of labrum (upper lip), a pair of mandibles, a pair of maxillae, a labium (lower lip) and the hypopharynx.</li> <li>Thorax consists of prothorax, mesothorax and metathorax.</li> <li>Abdomen in both males and females consists of <b>10 segments</b> enclosed by four sclerites, i.e. one dorsal tergum, one ventral sternum and two lateral pleura.</li> <li>Chitinous exoskeleton covers the body.</li> </ul>	<ul style="list-style-type: none"> <li>Divisible into head and trunk (neck and tail are absent).</li> <li>Cold-blooded or Poikilothermous; become metabolically inactive during summer sleep (aestivation) and winter sleep (hibernation).</li> </ul>
<b>Body wall</b>	4-layered (i.e. cuticle, epidermis, muscle layer and parietal or coelomic layer).	3-layered (i.e. cuticle, hypodermis and basement membrane).	Smooth moist and scaleless, 2-layered (epidermis and dermis) skin.
<b>Locomotion</b>	Rows of S-shaped setae found in each segment except at first, last and clitellum, help in locomotion.	Two pairs of wings, mesothoracic and metathoracic, the latter help in flight.	Four digits in forelimbs and five digits in hindlimbs, help in swimming, walking, leaping and burrowing.
<b>Sexual dimorphism</b>	Hermaphrodite, protandrous animal with cross-fertilisation.	Dioecious, 7th sternum of female is boat-shaped and together with 8th and 9th sterna, forms a genital pouch, males possess anal styles and absent in females.	Dioecious, males possess vocal sacs, and copulatory pad on the first digit of forelimb.
<b>Digestive system</b>	<ul style="list-style-type: none"> <li>Alimentary canal is complete.</li> <li>Main grinding organ is the muscular gizzard (8th-9th segments).</li> <li>Typhlosole (a median fold of dorsal wall) in intestine increases absorptive surface (26th segment onwards).</li> </ul>	<ul style="list-style-type: none"> <li>Alimentary canal is subdivided into foregut, midgut and hindgut.</li> <li>Crop serves for food storage.</li> <li>Gizzard contains 6 chitinous plates called teeth, which enable grinding of food particle.</li> <li>Hepatic caeca secrete digestive enzyme and is present at the junction of foregut and midgut.</li> <li>Calciferous glands present in the stomach, neutralise the humic acid present in humus.</li> </ul>	<ul style="list-style-type: none"> <li>Complete alimentary canal opens into cloaca.</li> <li>The main digestive glands are liver and pancreas.</li> </ul>



Digestive system of earthworm



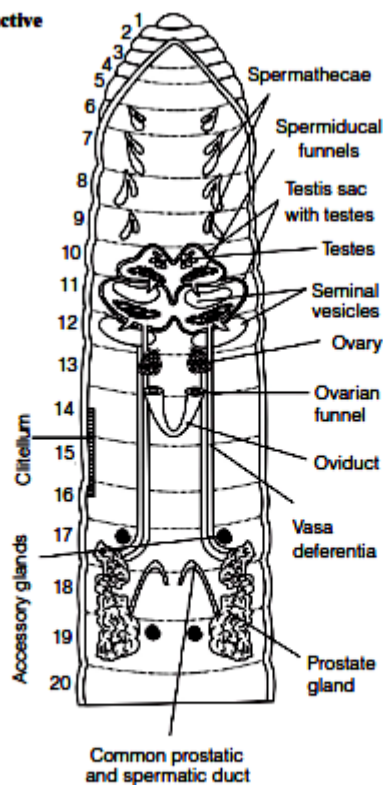
Digestive system of cockroach



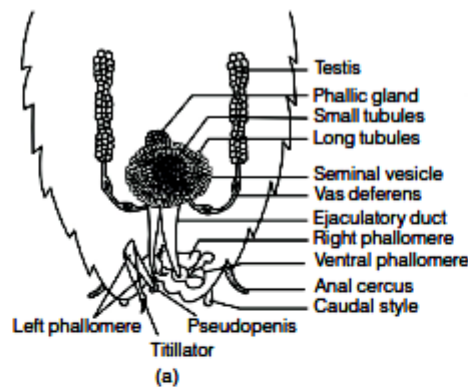
Digestive system of frog

	<b>Earthworm (<i>Pheretima posthuma</i>)</b>	<b>Cockroach (<i>Periplaneta americana</i>)</b>	<b>Frog (<i>Rana tigrina</i>)</b>
<b>Respiratory system</b>	<ul style="list-style-type: none"> <li>• Cutaneous (through moist skin)</li> </ul>	<ul style="list-style-type: none"> <li>• Tracheal (opening through 10 pairs of spiracles).</li> </ul>	<ul style="list-style-type: none"> <li>• Cutaneous (skin), buccopharyngeal and pulmonary (lungs).</li> </ul>
<b>Circulatory system</b>	<ul style="list-style-type: none"> <li>• Closed with heart and valves, blood glands present on the 4th-6th segments, phagocytic blood cells are present.</li> </ul>	<ul style="list-style-type: none"> <li>• Open, with an open space, haemocoel containing haemolymph; pumping of heart is assisted by alary muscles.</li> </ul>	<ul style="list-style-type: none"> <li>• Closed, with single circulation, well-developed hepatic and renal portal system.</li> </ul>
<b>Excretory system</b>	<ul style="list-style-type: none"> <li>• Through nephridia</li> <li>• Septal nephridia (15th to last segment), enteronephric</li> <li>• Integumentary nephridia (3rd to last segment).</li> <li>• Pharyngeal nephridia (4th to 6th segment), enteronephric</li> </ul>	<ul style="list-style-type: none"> <li>• Uricotelic, excretion through Malpighian tubules, fat body, nephrocytes and urecose glands.</li> </ul>	<ul style="list-style-type: none"> <li>• Through well-developed excretory system (kidneys, ureters, a urinary bladder and cloaca).</li> </ul>
<b>Nervous system</b>	<ul style="list-style-type: none"> <li>• Ganglia arranged segmentwise on ventral paired nerve cord.</li> <li>• Nerve cord bifurcates in the anterior region, laterally encircling the pharynx and joins the cerebral ganglia dorsally to form nerve ring.</li> </ul>	<ul style="list-style-type: none"> <li>• Fused, segmentally arranged ganglia; three lie in the thorax and six in the abdomen. Ganglia joined by paired longitudinal connectives on the ventral side.</li> </ul>	<ul style="list-style-type: none"> <li>• Well-defined CNS, PNS and ANS.</li> <li>• Ten pairs of cranial nerves arising from the brain; brain divided into forebrain, midbrain and hindbrain.</li> </ul>
<b>Sense organs</b>	<ul style="list-style-type: none"> <li>• Three sensory receptors, i.e.</li> <li>• Epidermal (touch)</li> <li>• Chemoreceptors (taste)</li> <li>• Photoreceptors (light).</li> </ul>	<ul style="list-style-type: none"> <li>• Photoreceptors (light) in compound eye containing ommatidia</li> <li>• Thigmoreceptors (touch) on antennae</li> <li>• Chemoreceptors (taste) in mouthparts</li> <li>• Auditory receptors (sound).</li> </ul>	<ul style="list-style-type: none"> <li>• Tangoreceptors (touch)</li> <li>• Gustatoreceptors</li> <li>• Olfactoreceptors</li> <li>• Organs of vision and hearing (tympanum).</li> </ul>

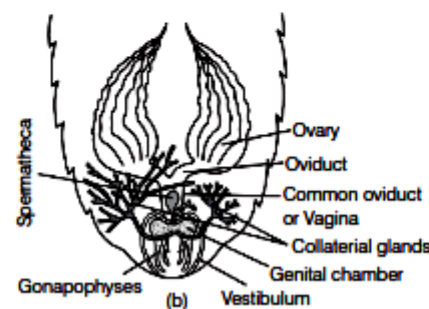
**Reproductive system**



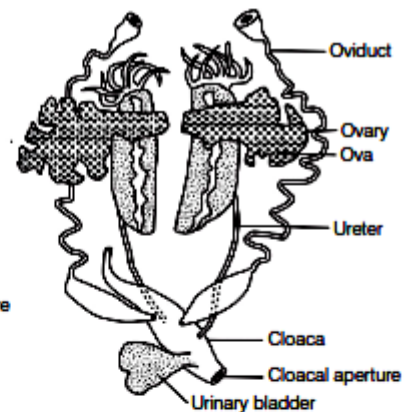
**Reproductive system of earthworm**



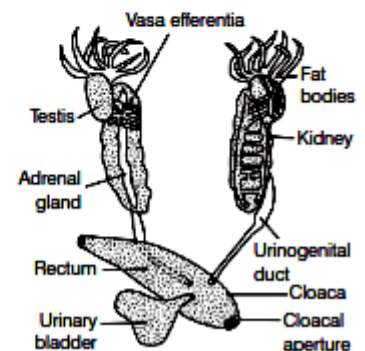
**Reproductive system of male cockroach**



**Reproductive system of female cockroach**



**Reproductive system of female frog**



**Reproductive system of male frog**

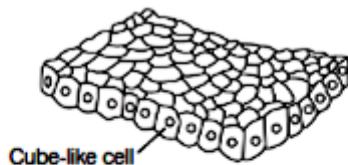
	<b>Earthworm (<i>Pheretima posthuma</i>)</b>	<b>Cockroach (<i>Periplaneta americana</i>)</b>	<b>Frog (<i>Rana tigrina</i>)</b>
<b>Testis and ovaries</b>	<ul style="list-style-type: none"> <li>Two pairs of testis present in the 10-11th segments; male genital pores on the ventro-lateral side of the 18th segment.</li> <li>One pair of ovaries at the inter-segmental septum of the 12th and 13th segments, female genital pore on 14th segment.</li> <li>Four pairs of spermathecae are located in 6-9th segments.</li> </ul>	<ul style="list-style-type: none"> <li>Paired testes on lateral sides in the 4th-6th abdominal segments.</li> <li>Ovaries lying laterally in the 2nd-6th segment.</li> <li>Accessory reproductive glands called mushroom glands in males in 6-7th abdominal segments.</li> </ul>	<ul style="list-style-type: none"> <li>Male reproductive system consists of a pair testes, vasa efferentia (which opens into Bidder's canal), urinogenital duct and cloaca.</li> <li>Female reproductive system consists of a pair of ovaries, oviduct and cloaca.</li> </ul>
<b>Fertilisation</b>	<ul style="list-style-type: none"> <li>External (in a cocoon)</li> </ul>	<ul style="list-style-type: none"> <li>Internal (within genital pouch)</li> </ul>	<ul style="list-style-type: none"> <li>External (in water)</li> </ul>
<b>Development</b>	<ul style="list-style-type: none"> <li>Direct, i.e. without any larval stage.</li> </ul>	<ul style="list-style-type: none"> <li>Paurometabolous, i.e. development through nymphal stage inside the ootheca (egg case).</li> </ul>	<ul style="list-style-type: none"> <li>Indirect (through metamorphosis of tadpole to adult frog).</li> </ul>
<b>Economic importance</b>	<ul style="list-style-type: none"> <li>Process of increasing fertility of soil by earthworms (vermicomposting) make the soil porous hence, earthworms are called 'Friends of Farmers'.</li> </ul>	<ul style="list-style-type: none"> <li>Considered as pests and transmit a variety of bacterial diseases.</li> </ul>	<ul style="list-style-type: none"> <li>Maintains ecological balance, i.e. serve as an important link of food chain and food web in the ecosystem.</li> </ul>

## **MULTIPLE CHOICE QUESTIONS**

- 1** Tissue is
  - (a) a group of similar cells together with their intercellular substances, which perform a specific function
  - (b) a single specialised cell with specified functions
  - (c) composed of a single layer of cuboidal cells
  - (d) Both (a) and (c)
- 2** In a tissue, the structure of cells varies according to their
  - (a) origin
  - (b) function
  - (c) gene content
  - (d) None of these
- 3** Which of the following tissues provide a covering layer for some of the body parts?
  - (a) Connective tissue
  - (b) Muscular tissue
  - (c) Epithelial tissue
  - (d) Neural tissue
- 4** Which one of the following options is associated with epithelium?
  - (a) Cells are compactly packed with little intercellular matrix
  - (b) Cells are loosely packed with large intercellular matrix
  - (c) It is highly vascularised
  - (d) It is a supporting tissue
- 5** Lining of body cavities, ducts and tubes are made up of
  - (a) compound epithelium
  - (b) simple epithelium
  - (c) cuboidal epithelium
  - (d) keratinised epithelium
- 6** Which of the following is not a function of epithelium?
  - (a) Protection
  - (b) Connection
  - (c) Secretion or Excretion
  - (d) Absorption
- 7** The cells of squamous epithelium are
  - (a) multilayered and thick
  - (b) flat and thick
  - (c) thin with rigid boundaries
  - (d) flat with irregular boundaries
- 8** The endothelium of blood vessels is made up of simple
  - (a) cuboidal epithelium
  - (b) squamous epithelium
  - (c) columnar epithelium
  - (d) non-ciliated columnar epithelium

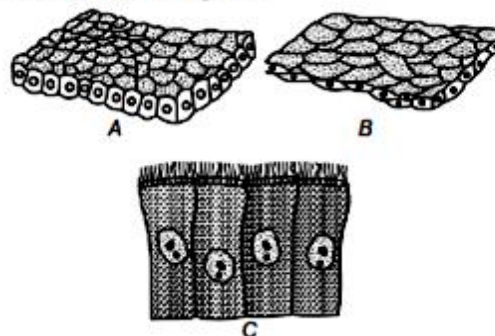


- 9** The cavities of alveoli of human lungs are lined by
- cuboidal epithelium
  - columnar epithelium
  - stratified cuboidal epithelium
  - squamous epithelium
- 10** Choose the correctly matched pair.
- Inner lining of salivary ducts–Ciliated epithelium
  - Moist surface of buccal cavity–Glandular epithelium
  - Tubular parts of nephrons–Cuboidal epithelium
  - Inner surface of bronchioles–Squamous epithelium
- 11** Identify the given diagram of tissue performing the functions like secretion and absorption.



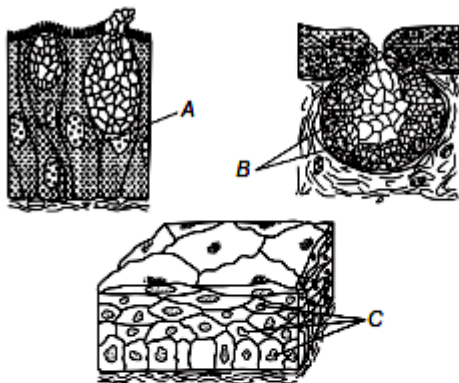
- Simple cuboidal epithelium
  - Simple columnar epithelium
  - Stratified cuboidal epithelium
  - Stratified columnar epithelium
- 12** The columnar epithelium in human body is found in
- stomach
  - lungs
  - kidney
  - Fallopian tube
- 13** Which of the following epithelium types helps in the secretion and absorption of nutrients?
- Cuboidal
  - Stratified squamous
  - Squamous
  - Columnar
- 14** The type of tissue lining in the nasal passage and the bronchioles is
- columnar ciliated epithelium
  - cuboidal epithelium
  - neurosensory epithelium
  - germinal epithelium
- 15** The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in
- Fallopian tubes and pancreatic duct
  - custachian tube and salivary duct
  - bronchioles and Fallopian tubes
  - bile duct and bronchioles
- 16** The tissue, which forms the glands in humans is
- muscular tissue
  - nervous tissue
  - epithelial tissue
  - connective tissue
- 17** Goblet cells of alimentary canal are a type of
- intercellular gland
  - multicellular gland
  - unicellular gland
  - None of these

- 18** Categorisation of secretory glands can be done on the basis of
- mode of pouring of their secretion
  - mode of breaking down of molecules
  - mode of segregation of products
  - None of the above
- 19** Which of the following secretions are released through ducts in human body ?
- Oil and milk
  - Mucus and ear wax
  - Digestive enzymes
  - All of these
- 20** In humans, compound squamous epithelium is found in
- stomach
  - intestine
  - trachea
  - pharynx
- 21** Compound epithelium
- plays major role in secretion and absorption
  - provides protection against chemical and mechanical stresses
  - covers only dry surface of skin
  - All of the above
- 22** Cell junctions are formed by
- epithelial tissue
  - connective tissue
  - Both (a) and (b)
  - muscular tissue
- 23** The function of adhering junction is to
- prevent leakage of substances across tissues
  - connect the cytoplasm of adjacent cells
  - diffuse small ions across tissues
  - cement the neighbouring cells together
- 24** The function of the gap junction is to
- perform cementing to keep neighbouring cells together
  - facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules
  - separate two cells from each other
  - stop substance from leaking across a tissue
- 25** A, B and C in given figures and choose the correct combination of option.



- A–Ciliated columnar, B–Squamous, C–Cuboidal
- A–Cuboidal, B–Squamous, C–Ciliated columnar
- A–Squamous, B–Ciliated columnar, C–Cuboidal
- A–Ciliated columnar, B–Cuboidal, C–Squamous

**26** Identify *A*, *B* and *C* in given figures and choose the correct combination of options.



- (a) A–Unicellular gland, B–Multicellular glands, C–Pseudocolumnar cells  
 (b) A–Multicellular gland, B–Unicellular glands, C–Squamous epithelium  
 (c) A–Unicellular gland, B–Multicellular glands, C–Multilayered cells  
 (d) A–Flattened cell, B–Multilayered cells, C–Transitional epithelium

**27** Which of the following tissues performs the function of linking and supporting other tissues of the body?

- (a) Epithelial tissue (b) Muscular tissue  
 (c) Connective tissue (d) Nervous tissue

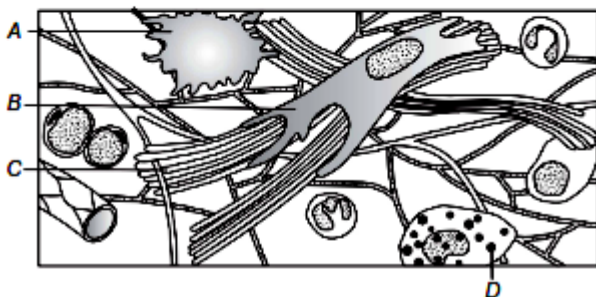
**28** Find the incorrect match between columns I and II.

- | Column I                                  | Column II                  |
|---|----------------------------|
| (a) Minimum regeneration power            | – Nervous tissue           |
| (b) Keratinised epithelial tissue         | – Pharynx, vagina, urethra |
| (c) Galea and lacinia are part of maxilla | – <i>Periplaneta</i>       |
| (d) Plasma cells                          | – Produce antibodies       |

**29** Choose the correctly matched pair. (a) Tendon–Specialised connective tissue

- (b) Adipose tissue–Dense connective tissue  
 (c) Areolar tissue–Loose connective tissue  
 (d) Cartilage–Loose connective tissue

**30** Given below is the diagrammatic sketch of a certain type of connective tissue. Identify the parts labelled *A*, *B*, *C* and *D* and select the right option about them.



Part A	Part B	Part C	Part D
(a) Macrophage	Fibroblast	Collagen fibres	Mast cell
(b) Mast cell	Macrophage	Fibroblast	Collagen fibres
(c) Macrophage	Collagen fibres	Fibroblast	Mast cell
(d) Mast cell	Collagen fibres	Fibroblast	Macrophage

**31** Most abundant and widely distributed tissue in animal body is

- (a) epithelium tissue (b) connective tissue  
 (c) skeletal muscle tissue (d) smooth muscle tissue

**32** Examples of specialised connective tissue is/are

- (a) bone (b) cartilage (c) blood (d) All of these

**33** Which of the following cells is/are contained in areolar connective tissue?

- (a) Mast cells (b) Fibroblasts  
 (c) Macrophages (d) All of these

**34** Cells of areolar tissues that produce or secrete fibres are called

- (a) fibroblasts (b) mast cells  
 (c) macrophages (d) adipocytes

**35** Adipose tissue is a type of

- (a) loose connective tissue  
 (b) dense connective tissue  
 (c) specialised connective tissue  
 (d) None of the above

**36** Adipose tissue performs which of the following functions?

- (a) Producing fat (b) Dissolving fat  
 (c) Storing fat (d) All of these

**37** Identify *A*, *B* and *C* in the given diagram of adipose tissue.

- (a) A–Cytoplasm, B–Nucleus, C–Cell wall  
 (b) A–Fat storage area, B–Mast cell, C–Plasma membrane  
 (c) A–Cell fluid, B–Collagen fibres, C–Plasmalemma  
 (d) A–Fat storage area, B–Nucleus, C–Plasma membrane



**38** Tendon is an example of which of the following connective tissue?

- (a) Loose connective tissue  
 (b) Dense connective tissue  
 (c) Specialised connective tissue  
 (d) All of the above

**39** Tendons help in connecting

- (a) muscles to bones (b) bone to bone  
 (c) bone to cartilage (d) cartilage to muscle

**40** Matrix secreting cells of cartilage are known as

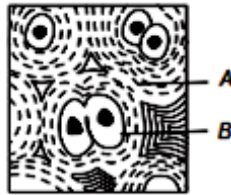
- (a) chondrocytes (b) osteoblasts  
(c) fibroblasts (d) mast cells

**41** Which of the following type of connective tissues is present at the tip of human nose?

- (a) Cartilage (b) Bone  
(c) Adipose tissue (d) None of these

**42** In the given diagram of TS of cartilage, identify *A* and *B*.

- (a) A-Collagen; B-Chondrocyte  
(b) A-Osteocyte; B-Collagen  
(c) A-Microtubule; B-Osteocyte  
(d) A-Chondrocyte; B-Collagen



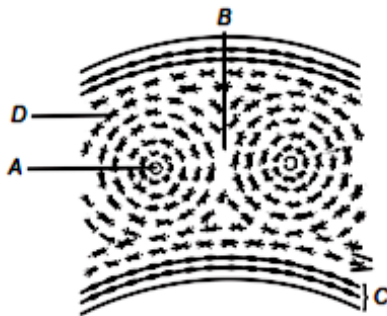
**43** In humans, the cartilage

- (a) contains solid and pliable intercellular material  
(b) in vertebrate embryo gets replaced by bones in adults  
(c) is found in between the bones of vertebral column  
(d) All of the above

**44** Cells, which help in the formation of bones are called

- (a) chondroblasts (b) osteoblasts  
(c) osteoclasts (d) chondroclasts

**45** In the given diagram of TS of bone, identify *A*, *B*, *C* and *D*.



- (a) A-Haversian canal, B-Interstitial lamella, C-Endosteum, D-Osteocytes  
(b) A-Interstitial lamella, B-Haversian canal, C-Osteocytes, D-Endosteum  
(c) A-Haversian canal, B-Canaliculi, C-Periosteum, D-Osteocytes  
(d) A-Interstitial lamella, B-Endosteum, C-Canaliculi, D-Osteocytes

**46** Bone marrow of long bones is the sites of

- (a) production of WBCs  
(b) production of RBCs  
(c) production of blood cells  
(d) breakdown of RBCs

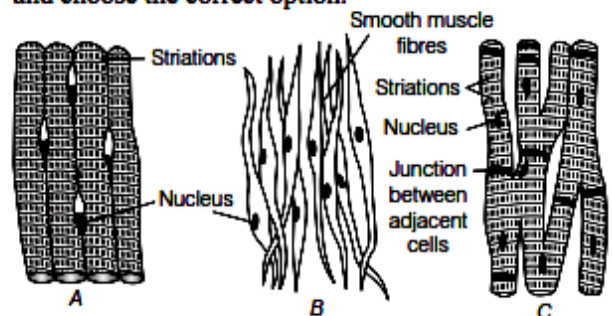
**47** Bones in human body perform all the listed functions except

- (a) weight-bearing function  
(b) destruction of worn-out blood cells  
(c) provide site for the attachment of skeletal muscles  
(d) protect soft tissues and organs

**48** Each muscle is made up of long, cylindrical fibres arranged in parallel arrays. These fibres are composed of numerous fine fibrils called

- (a) myofibrils (b) microfilament  
(c) fibroblast (d) None of these

**49** Examine the following figures, identify *A*, *B* and *C* and choose the correct option.



- (a) A-Skeletal muscle, B-Voluntary muscle, C-Cardiac muscle  
(b) A-Skeletal muscle, B-Smooth muscle, C-Cardiac muscle  
(c) A-Cardiac muscle, B-Skeletal muscle, C-Smooth muscle  
(d) A-Smooth muscle, B-Cardiac muscle, C-Skeletal muscle

**50** Skeletal muscles are found in

- (a) heart (b) blood vessels  
(c) biceps (d) intestine

**51** Smooth muscles are

- (a) involuntary, fusiform, non-striated  
(b) voluntary, multinucleate, cylindrical  
(c) involuntary, cylindrical, striated  
(d) voluntary, spindle-shaped, uninucleate

**52** Which type of tissue correctly matches with its location?

Tissue	Location
(a) Areolar tissue	Tendons
(b) Transitional epithelium	Tip of nose
(c) Cuboidal epithelium	Lining of stomach
(d) Smooth muscle	Wall of intestine

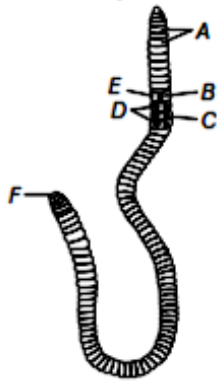
**53** In the cardiac muscles,

- (a) cell junctions fuse the plasma membrane of adjacent cells  
(b) contraction of one cell does not affect the other cells  
(c) intercalated discs prevent the communication among cardiac cells  
(d) All of the above

**54** What is the function of neuroglial cells ?

- (a) Formation of neurons  
(b) Destruction of neurons  
(c) Protection of neurons  
(d) Transmission of impulse along the neurons

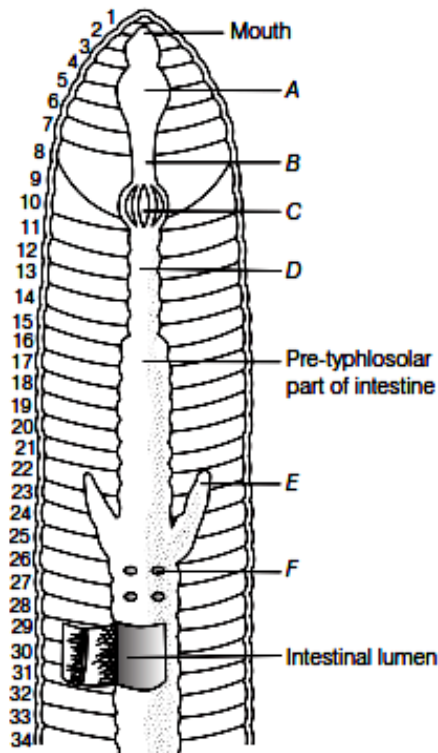
- 55** Earthworm lives in the burrows made by boring and swallowing the soil to/for  
 (a) uptake food (b) get moisture  
 (c) procreation (d) avoid opponents
- 56** Faecal deposits of earthworm are known as  
 (a) organic matter (b) castings  
 (c) dung (d) manure
- 57** The body of earthworm is divided into  
 (a) 100-120 metamers (b) 150-200 metamers  
 (c) 250-300 metamers (d) 300-350 metamers
- 58** The ventral surface of the body of earthworm is distinguished by  
 (a) blood vessels (b) mouth  
 (c) genital pores (d) segment size
- 59** The dorsal surface of the earthworm's body is marked by  
 (a) genital pores (b) mouth  
 (c) heart (d) blood vessel
- 60** The first segment of earthworm's body, which contains mouth is called  
 (a) prostomium (b) peristomium  
 (c) coelom (d) protractor
- 61** In earthworm *Pheretima*, a prominent dark band of glandular tissue (clitellum) is present in the segment numbers  
 (a) 10, 11 and 12 (b) 13, 14 and 15  
 (c) 14, 15 and 16 (d) 15, 16 and 17
- 62** Given below is the diagram of the ventral view of earthworm's body. Identify A-F and choose the correct combination of options.



- (a) A-Setae, B-Female genital aperture, C-Male genital aperture, D-Genital papillae, E-Clitellum, F-Anus  
 (b) A-Anus, B-Setae, C-Male genital aperture, D-Female genital aperture, E-Genital papillae, F-Clitellum  
 (c) A-Setae, B-Male genital aperture, C-Female genital aperture, D-Genital papillae, E-Clitellum, F-Anus  
 (d) A-Nephridiopores, B-Setae, C-Nuclei, D-Metamers, E-Prostomium, F-Anus

- 63** Which of the following intersegmental grooves contains four pairs of spermathecal apertures on the ventrolateral sides of the earthworm?  
 (a) 4th-8th (b) 5th-9th  
 (c) 6th-10th (d) 7th-11th
- 64** In earthworm, a single female genital pore is present in the midventral line of the segment number  
 (a) 14th (b) 16th  
 (c) 15th (d) 17th
- 65** In earthworm, a pair of male genital pores is present on the ventrolateral side of the segment  
 (a) 20th (b) 19th  
 (c) 18th (d) 17th
- 66** Numerous minute pores open on the surface of the body of earthworm are called  
 (a) setae (b) nephridiopores  
 (c) spermatopore (d) None of these
- 67** Which of the following segments in the earthworm's body have no setae?  
 (a) First (b) Last  
 (c) Clitellum (d) All of these
- 68** The principal role of setae in earthworm is  
 (a) respiration (b) excretion  
 (c) locomotion (d) assimilation
- 69** The body wall of the earthworm is covered by which of the following layers (externally-internally)?  
 (a) Epidermis, cuticle, coelomic epithelium, longitudinal muscle, circular muscles  
 (b) Cuticle, epidermis, circular muscles, coelomic epithelium, longitudinal muscles  
 (c) Non-cellular cuticle, epidermis, circular muscles, longitudinal muscles, coelomic epithelium  
 (d) Coelomic epithelium, epidermis, cuticle, circular muscles, longitudinal muscles
- 70** Which is the outermost layer in earthworm's body?  
 (a) Cuticle  
 (b) Epidermis  
 (c) Muscles  
 (d) Epithelium
- 71** Epidermis of the earthworm's body is made up of a single layer of  
 (a) cuboidal epithelium  
 (b) columnar epithelium  
 (c) squamous epithelium  
 (d) compound epithelium
- 72** In earthworms, secretory gland cells are present on  
 (a) epidermis (b) nephridiopores  
 (c) metamers (d) clitellum

**73** Observe the following figure of alimentary canal of earthworm and identify A, B, C, D, E and F.



The correct option is

- (a) A–Oesophagus, B–Pharynx, C–Stomach, D–Gizzard, E–Typhlosolae, F–Intestine
- (b) A–Pharynx, B–Oesophagus, C–Gizzard, D–Stomach, E–Intestinal caecum, F–Lymph gland
- (c) A–Gizzard, B–Pharynx, C–Oesophagus, D–Lymph gland, E–Stomach, F–Typhlosolae
- (d) A–Typhlosolae, B–Gizzard, C–Pharynx, D–Typhlosolae, E–Lymph gland, F–Stomach

**74** Earthworm feeds upon

- (a) small animals
- (b) small plants
- (c) organic matter and decaying leaves
- (d) All of the above

**75** Gizzard in earthworm helps in

- (a) emulsifying fat
- (b) releasing digestive juice
- (c) crushing or grinding food
- (d) excretion of waste material

**76** The main role of calciferous glands present in stomach of earthworm is

- (a) secreting mucus
- (b) breaking food particles
- (c) absorption of nutrients
- (d) neutralising the humic acid present in humus

**77** The function of typhlosolae in earthworm is

- (a) grinding soil particles
- (b) increasing absorptive area
- (c) purifying blood
- (d) storing fats

**78** On which segment of earthworm, a pair of short and conical caeca projects from the intestine?

- (a) 28th
- (b) 30th
- (c) 20th
- (d) 26th

**79** The blood vascular system of earthworm is

- (a) portal
- (b) closed
- (c) open
- (d) double circulatory

**80** Blood vascular system of *Pheretima* consists of

- (a) vessels, capillaries and heart
- (b) nerves, veins and heart
- (c) lymphs, heart and blood
- (d) visceral organ, lymph and blood

**81** Blood glands are present on which segments of the earthworm?

- (a) 4th, 5th and 6th
- (b) 3rd, 4th and 5th
- (c) 2nd, 3rd and 4th
- (d) 5th, 6th and 7th

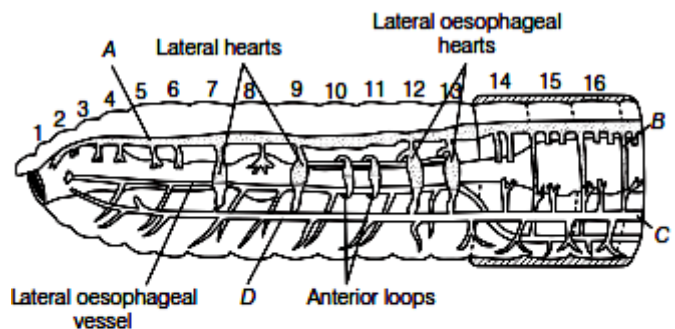
**82** Which of the following metalloproteins is found in the blood of earthworm?

- (a) Haemoglobin
- (b) Haemerythrin
- (c) Haemocyanin
- (d) Myoglobin

**83** Blood cells of the earthworm are ..... in nature.

- (a) exocytotic
- (b) endocytotic
- (c) phagocytotic
- (d) osmotic

**84** Observe the given figure of closed circulatory system of earthworm and identify A, B, C and D.



- (a) A–Ventral vessel, B–Subneural vessel, C–Commissural vessel, D–Dorsal vessel
- (b) A–Subneural vessel, B–Ventral vessel, C–Dorsal vessel, D–Commissural vessel
- (c) A–Dorsal vessel, B–Commissural vessel, C–Subneural vessel, D–Ventral vessel
- (d) A–Commissural vessel, B–Dorsal vessel, C–Ventral vessel, D–Subneural vessel

**85** Find out the pair in reference to the earthworm, which is not correctly matched.

- (a) Clitellum — Secretes cocoon
- (b) Blood plasma — Contains haemoglobin
- (c) Blood glands — Filter blood
- (d) Typhlosolae — Absorption

**86** In which of the following segments of earthworm, septal nephridia is present?

- (a) 15-last (b) 8-15 (c) 18-last (d) 15-17

**87** Septal nephridia of earthworm open into the

- (a) stomach (b) lining of body wall  
(c) intestine (d) coelomic chamber

**88** Which of the following nephridia in earthworm remains attached to the lining of the body wall of segment 3 to the last?

- (a) Integumentary (b) Pharyngeal  
(c) Septal (d) Dorsal

**89** In earthworm, pharyngeal nephridia are present as three paired tufts in the segments

- (a) 3rd, 4th and 5th (b) 4th, 5th and 6th  
(c) 5th, 6th and 7th (d) 6th, 7th and 8th

**90** Which of the following organs regulates the volume and composition of the body fluids of earthworm?

- (a) Stomach (b) Nephridia (c) Heart (d) Intestine

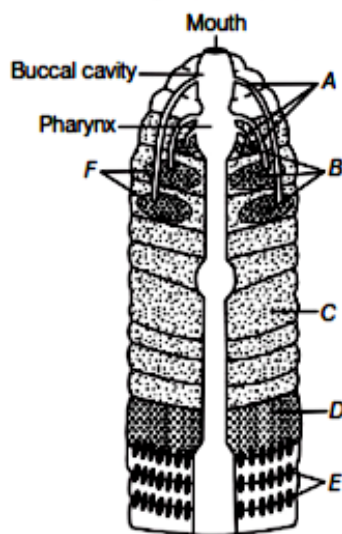
**91** In earthworm, nephridium collects the excess of fluid from the

- (a) septal chamber (b) nephridial chamber  
(c) coelomic chamber (d) gizzard chamber

**92** The waste collected by nephridium is poured into

- (a) anus (b) clitellum  
(c) digestive tube (d) pharynx

**93** Examine the given figure of nephridial system in earthworm and identify A, B, C, D, E and F.



(a) A–Tufts of pharyngeal nephridia, B–Forest of integumentary nephridia, C–Septal nephridia, D–Integumentary nephridia, E–Blood glands, F–Ducts of pharyngeal nephridia

(b) A–Forest of integumentary nephridia, B–Septal nephridia, C–Integumentary nephridia, D–Blood glands, E–Ducts of pharyngeal nephridia, F–Tufts of pharyngeal nephridia

(c) A–Ducts of pharyngeal nephridia, B–Tufts of pharyngeal nephridia, C–Integumentary nephridia, D–Forests of integumentary nephridia, E–Septal nephridia, F–Blood glands

(d) A–Blood vessels, B–Blood gland, C–Septal nephridia, D–Dorsal nephridia, E–Pharyngeal nephridia, F–Integumentary nephridia

**94** In earthworm, a nerve cord is

- (a) single, spongy and posterior  
(b) paired, solid and ventral  
(c) paired, hollow and dorsal  
(d) single, solid and ventral

**95** Which of the following segments in the body of earthworms is the cerebral ganglion present?

- (a) 7th (b) 5th (c) 6th (d) 3rd

**96** In which part of the earthworm, sense organs are most concentrated?

- (a) Posterior part (b) Anterior part  
(c) Middle part (d) None of these

**97** Earthworm can distinguish the light intensities and feel the vibration in the ground through

- (a) eyes (b) mechanical receptor  
(c) receptor cells (d) chemoreceptors

**98** How many pairs of testis are present in earthworm?

- (a) Five (b) Two (c) Three (d) Four

**99** In earthworm, the testes are present in the segments

- (a) 10th-11th (b) 11th-12th  
(c) 12th-13th (d) 13th-14th

**100** Up to which body segment, vasa deferentia run after being emerged from the testis of earthworm ?

- (a) 17th segment (b) 18th segment  
(c) 19th segment (d) 20th segment

**101** Which one of the following is the function of the spermathecae in the earthworm?

- (a) They receive eggs during copulation  
(b) They receive and store spermatozoa during copulation  
(c) They help in the formation of sperms  
(d) They receive spermatogonia for maturation

**102** In female earthworms,

- (a) one pair of ovary is present  
(b) ovary is attached at intersegmental septum of 8th-9th segment  
(c) ovarian funnels are present instead of ovary  
(d) Both (a) and (b)

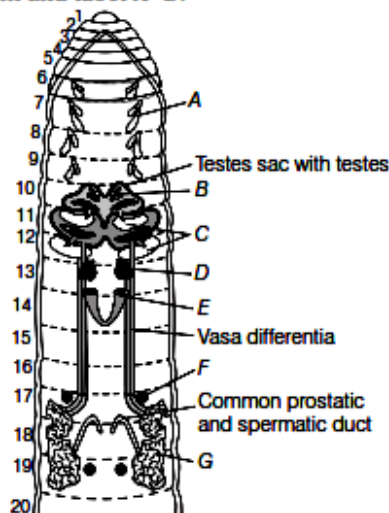
**103** In *Pheretima*, cocoon is produced by the gland cells of

- (a) stomach (b) clitellum  
(c) prostate gland (d) spermatophores

**104** Fertilisation and development in earthworms occur within the

- (a) spermathecae (b) cocoon  
(c) prostate gland (d) seminal vesicles

**105** Go through the given figure of reproductive system of earthworm and label A-G.



- (a) A–Ovary, B–Spermathecae, C–Spermiducal funnels, D–Prostate gland, E–Accessory gland, F– Ovarian funnel, G– Seminal vesicles
- (b) A–Spermathecae, B–Testes, C–Seminal vesicles, D–Ovary, E–Ovarian funnel, F–Accessory gland, G–Prostate gland
- (c) A–Ovarian funnel, B–Ovary, C–Spermathecae, D–Seminal vesicles, E–Prostate gland, F–Spermiducal funnel, G–Accessory gland
- (d) A–Seminal vesicles, B–Ovarian funnel, C–Ovaries, D–Accessory gland, E–Spermiducal funnel, F–Prostate gland, G–Spermathecae

**106** The process of increasing fertility of the soil by the earthworms is known as

- (a) composting
- (b) vermicomposting
- (c) manuring
- (d) green manuring

**107** Cockroaches are

- (a) diurnal and carnivores
- (b) nocturnal and herbivores
- (c) diurnal and herbivores
- (d) nocturnal and omnivores

**108** The body of the cockroach is segmented and divisible into

- (a) head and tail
- (b) head and thorax
- (c) head and abdomen
- (d) head, thorax and abdomen

**109** The entire body of the cockroach is covered by

- (a) skin
- (b) shell
- (c) hard chitinous exoskeleton
- (d) keratin

**110** In the exoskeleton of the cockroach, sclerites are joined to each other by

- (a) ossicles
- (b) arthroial membranc
- (c) amino acids
- (d) chitin

**111** The head of the cockroach shows great mobility in all the directions due to

- (a) flexible neck
- (b) absence of neck
- (c) small size of head
- (d) arthroial membranc

**112** The head capsule of the cockroach bears

- (a) no eyes
- (b) one eye
- (c) two eyes
- (d) many eyes

**113** The mouthparts of a cockroach are said to be

- (a) absorbing type
- (b) biting and absorbing type
- (c) biting and chewing type
- (d) biting and sucking type

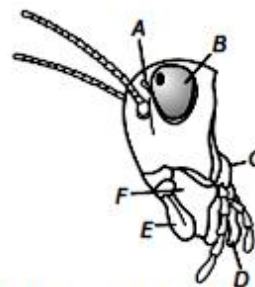
**114** A complete set of the mouthparts of the cockroach consists of

- (a) labrum and labium
- (b) labium, labrum and tongue
- (c) labrum, mandibles, maxillae and labium
- (d) labrum, maxillae and labium

**115** Hypopharynx of the cockroach acts as

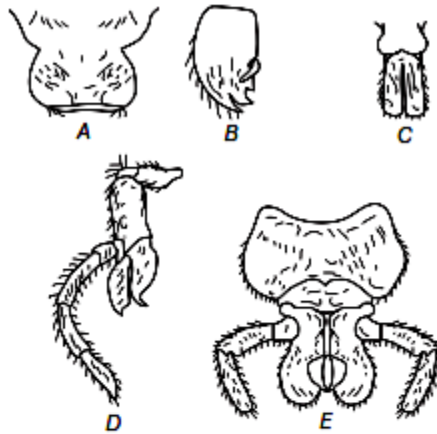
- (a) mouth
- (b) lips
- (c) tongue
- (d) jaws

**116** The given figure is related to the head region of cockroach. Identify A to F with the correct combination of options.



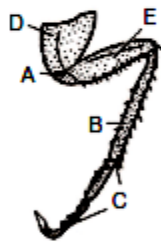
- (a) A–Maxilla, B–Compound eye, C–Ocellus, D–Labrum, E–Labium, F–Mandible
- (b) A–Ocellus, B–Compound eye, C–Maxilla, D–Labium, E–Labrum, F–Mandible
- (c) A–Ocellus, B–Compound eye, C–Maxilla, D–Labrum, E–Labium, F–Mandible
- (d) A–Mandible, B–Compound eye, C–Maxilla, D–Ocellus, E–Labrum, F–Labium

**117** Identify *A, B, C, D* and *E* in the given figure related with mouthparts of the cockroach.



- (a) A–Mandible, B–Labium, C–Labrum, D–Maxilla, E–Hypopharynx  
 (b) A–Labium, B–Labrum, C–Mandible, D–Hypopharynx, E–Maxilla  
 (c) A–Labrum, B–Mandible, C–Hypopharynx, D–Maxilla, E–Labium  
 (d) A–Hypopharynx, B–Maxilla, C–Labium, D–Labrum, E–Mandible

**118** Observe the following figure of leg of a cockroach and identify *A, B, C, D* and *E*.



- | A              | B     | C          | D      | E     |
|----------------|-------|------------|--------|-------|
| (a) Femur      | Tibia | Trochanter | Tarsus | Coxa  |
| (b) Coxa       | Femur | Trochanter | Tarsus | Tibia |
| (c) Trochanter | Tibia | Tarsus     | Coxa   | Femur |
| (d) Tibia      | Femur | Trochanter | Tarsus | Coxa  |

**119** The first and second pair of wings in cockroach arises from

- (a) prothorax and mesothorax, respectively  
 (b) mesothorax and metathorax, respectively  
 (c) metathorax and mesothorax, respectively  
 (d) mesothorax and prothorax, respectively

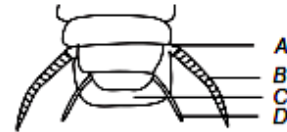
**120** Forewings of the cockroach are known as

- (a) tegmina (b) spiracles  
 (c) tergia (d) coxa

**121** The number of abdominal segments in male and female cockroach is

- (a) 9 and 10, respectively (b) 10 and 9, respectively  
 (c) 10 in both (d) 9 in both

**122** The given figure represents posterior region of male cockroach. Identify the parts labelled as *A, B, C* and *D*.



- | A               | B           | C           | D           |
|-----------------|-------------|-------------|-------------|
| (a) 9th sternum | Anal style  | 10th tergum | Anal cercus |
| (b) Anal style  | Anal cercus | 10th tergum | 9th sternum |
| (c) 9th sternum | Anal cercus | 10th tergum | Anal style  |
| (d) 9th sternum | Anal style  | 10th tergum | Anal cercus |

**123** In female cockroach, shape of the 7th sternum is

- (a) oval (b) circular  
 (c) boat-shaped (d) spiral

**124** In female cockroach, the 7th sternum together with the 8th and 9th sterna forms a

- (a) collateral gland (b) gonopore  
 (c) genital pouch (d) anal cerci

**125** In female cockroach, anterior part of the genital pouch contains

- (a) gonopore (b) spermathecal pores  
 (c) collateral glands (d) All of these

**126** In both the sexes of cockroaches, the 10th segment bears a pair of jointed filamentous structure called

- (a) anal style (b) anal cerci  
 (c) gonapophysis (d) spermathecal pores

**127** Which of the following features is used to identify a male cockroach from a female cockroach ?

- (a) Forewings with darker tegmina  
 (b) Presence of caudal styles  
 (c) Presence of a boat-shaped sternum on the 9th abdominal segment  
 (d) Presence of anal cerci

**128** Which of the following parts of the alimentary canal of cockroach is used for storing food?

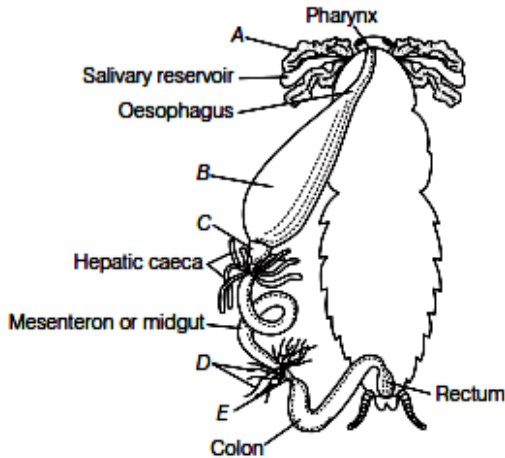
- (a) Crop (b) Gastric caeca  
 (c) Gizzard (d) Oesophagus

**129** In the digestive system of cockroach, gastric caeca is present at the junction of

- (a) midgut and hindgut  
 (b) hindgut and foregut  
 (c) foregut and mouth  
 (d) foregut and midgut

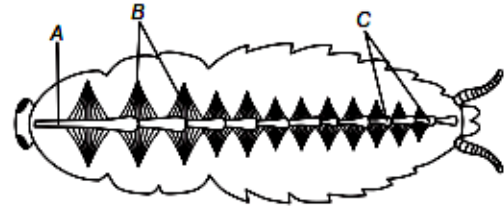


- 130** Given below is the figure of alimentary canal of cockroach. Identify *A* to *E* and choose the correct combination of *A* to *E*.



- (a) A–Salivary gland, B–Gizzard, C–Crop, D–Villi, E–Caecum  
 (b) A–Salivary gland, B–Crop, C–Gizzard, D–Malpighian tubules, E–Ileum  
 (c) A–Salivary gland, B–Gizzard, C–Malpighian tubule, D–Cilia, E–Ileum  
 (d) A–Salivary gland, B–Crop, C–Malpighian tubule, D–Gizzard, E–Ileum
- 131** Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth
- (a) Pharynx → Oesophagus → Gizzard → Crop → Ileum → Colon → Rectum  
 (b) Pharynx → Oesophagus → Gizzard → Ileum → Crop → Colon → Rectum  
 (c) Pharynx → Oesophagus → Ileum → Crop → Gizzard → Colon → Rectum  
 (d) Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum
- 132** Thin Malpighian tubules in cockroach are present at the junction of
- (a) foregut and midgut  
 (b) midgut and hindgut  
 (c) foregut and hindgut  
 (d) midgut and gizzard
- 133** Which of the following parts of the cockroach helps in the removal of excretory products from the haemolymph?
- (a) Rectum  
 (b) Malpighian tubules  
 (c) Ileum  
 (d) Cloaca

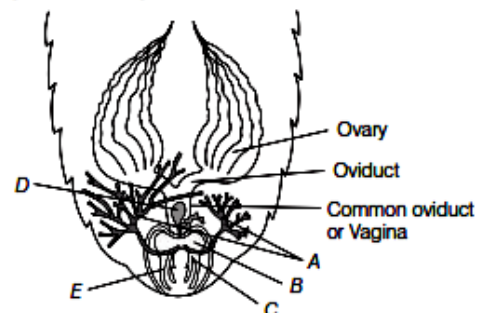
- 134** Given below is the figure of open circulatory system of cockroach. Identify *A*, *B*, *C* and choose the correct option.



- (a) A–Lateral aorta, B–Ciliary muscles, C–Chambers of heart  
 (b) A–Internal aorta, B–Alary muscles, C–Chambers of heart  
 (c) A–Anterior aorta, B–Alary muscles, C–Chambers of heart  
 (d) A–Posterior aorta, B–Fibrous muscles, C–Chambers of heart
- 135** Blood of a cockroach contains
- (a) plasma and haemocytes  
 (b) erythrocytes and plasma  
 (c) erythrocytes and platelets  
 (d) All of the above
- 136** The respiratory system of the cockroach consists of
- (a) a pair of lungs  
 (b) a pair of bronchioles  
 (c) a network of trachea  
 (d) a network of alveoli
- 137** The number of spiracles present in cockroaches are
- (a) 9 pairs  
 (b) 10 pairs  
 (c) 12 pairs  
 (d) 14 pairs
- 138** Exchange of gases takes place in cockroaches by the process of
- (a) diffusion  
 (b) osmosis  
 (c) expiration  
 (d) None of these
- 139** Malpighian tubules in the cockroach are lined by
- (a) glandular and ciliated cells  
 (b) cuboidal and ciliated cells  
 (c) columnar and glandular cells  
 (d) glandular and cuboidal cells
- 140** In addition to the Malpighian tubules, excretion of waste products in cockroach occurs by
- (a) fat bodies  
 (b) nephrocytes  
 (c) uricose glands  
 (d) All of these
- 141** The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of
- (a) ammonia  
 (b) potassium urate  
 (c) urea  
 (d) calcium carbonate

- 142** In the head region of the cockroach, brain is represented by  
 (a) supraoesophageal ganglion  
 (b) ganglia  
 (c) nerve cord  
 (d) sub-oesophageal ganglion
- 143** Which of the following is a sense organ pair in cockroach?  
 (a) Antennae and eyes  
 (b) Maxillary palp and labial palps  
 (c) Antennae and anal cerci  
 (d) All of the above
- 144** The position of compound eyes of cockroaches with respect to head is  
 (a) dorsal (b) ventral  
 (c) lateral (d) dorso-lateral
- 145** The compound eyes of cockroaches consist of about  
 (a) 200 hexagonal ommatidia  
 (b) 2000 hexagonal ommatidia  
 (c) 20 hexagonal ommatidia  
 (d) 20000 hexagonal ommatidia
- 146** The vision of cockroach is  
 (a) more sensitive with less resolution  
 (b) very poor during night  
 (c) less sensitive with high resolution  
 (d) high resolution during night
- 147** Mushroom glands are  
 (a) accessory glands in 6-7th abdominal segments of male cockroach  
 (b) helpful in storing sperms  
 (c) glands which secrete chemicals to make egg capsules, i.e. oothecae  
 (d) non-functional glands in 8-9th segments of female cockroach
- 148** The external genitalia of cockroach is  
 (a) gonapophysis  
 (b) pseudopenis  
 (c) spermatophore  
 (d) rudimentary penis
- 149** In male cockroaches, sperms are stored in which part of the reproductive system?  
 (a) Seminal vesicles (b) Mushroom glands  
 (c) Testes (d) Vas deferens
- 150** The female reproductive system of the cockroach consists of  
 (a) two large ovaries (b) three large ovaries  
 (c) one large ovary (d) four large ovaries
- 151** In the female reproductive system of cockroach, ovaries are located in which of the following abdominal segments?  
 (a) 2nd-6th (b) 4th-8th (c) 6th-12th (d) 1st-2nd

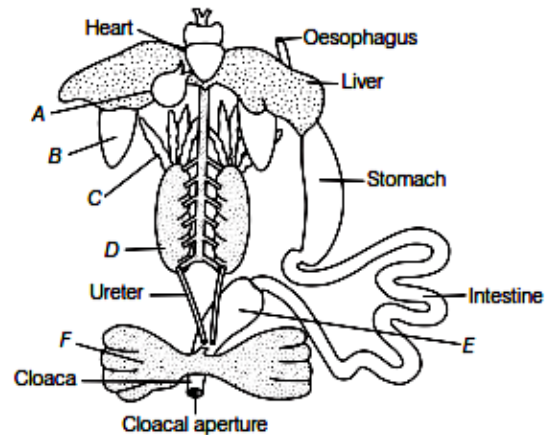
- 152** In a cockroach, spermatheca is present in the  
 (a) 7th segment (b) 6th segment  
 (c) 5th segment (d) 4th segment
- 153** Characteristic of female cockroach is  
 (a) presence of anal style  
 (b) each ovary is made up of '6' ovarioles  
 (c) one pair of spermatheca present in the 6th segment and open in genital chamber  
 (d) genital pouch is made up of 9th, 10th tergum and 9th sternum
- 154** In cockroach, fertilised eggs are stored in  
 (a) oothecae (b) cocoon  
 (c) genital pouch of female (d) gonapophysis
- 155** How many fertilised eggs are present in the oothecae of cockroach?  
 (a) 14 - 16 (b) 19 - 24  
 (c) 20 - 25 (d) 25 - 30
- 156** The development of *Periplaneta americana* is  
 (a) holometabolous  
 (b) paurometabolous  
 (c) ametabolous  
 (d) hemimetabolous
- 157** The number of moultings in which the nymphs of cockroaches reach the adult form is  
 (a) 6 (b) 8 (c) 10 (d) 13
- 158** What external changes are visible after the last moult of a cockroach nymph?  
 (a) Mandibles become harder  
 (b) Anal cerci develop  
 (c) Both forewings and hindwings develop  
 (d) Labium develops
- 159** Identify A to E in the given diagram of female reproductive system of cockroach.



- (a) A-Collateral glands, B-Vestibulum, C-Genital chamber D-Spermatheca, E-Gonapophysis  
 (b) A-Vestibulum, B-Collateral gland, C-Gonapophysis, D-Spermatheca, E-Genital chamber  
 (c) A-Collateral gland, B-Genital chamber, C-Vestibulum, D-Spermatheca E-Gonapophysis  
 (d) A-Genital chamber, B-Spermatheca, C-Collateral gland, D-Gonapophysis, E-Vestibulum

- 160** *Rana tigrina* displays all of the following habits except  
 (a) camouflage (b) aestivation  
 (c) hibernation (d) endothermy
- 161** The frogs have the ability to change its colour to hide them from their enemies. This protective colouration is called  
 (a) hibernation (b) aestivation  
 (c) mimicry (d) camouflage
- 162** The skin of frog is slippery and smooth due to the presence of  
 (a) mucus (b) gelatin  
 (c) waxy skin (d) mucilage
- 163** Body of a frog is divisible into  
 (a) head and trunk (b) head, neck and trunk  
 (c) trunk and tail (d) head, neck, trunk and tail
- 164** The forelimbs and hindlimbs of frogs are  
 (a) four digits  
 (b) five digits  
 (c) four and five digits, respectively  
 (d) five and four digits, respectively
- 165** Male frog can be distinguished from female frog by the presence of  
 (a) vocal sacs and copulatory pad on the first digit of the forelimb  
 (b) a neck and tail is absent  
 (c) the hindlimb ends in the five digits  
 (d) eyes are bulged and covered by the nictitating membrane
- 166** The alimentary canal of frog is short because frogs are  
 (a) herbivores (b) carnivores  
 (c) omnivores (d) heterotrophs
- 167** In frog, excess of the bile juice secreted by the liver is stored in  
 (a) intestine (b) pancreas  
 (c) gall bladder (d) rectum
- 168** In frog, for the digestion of food, walls of the stomach secrete  
 (a) pepsin and renin  
 (b) amylase and tryptophanase  
 (c) HCl and gastric juices  
 (d) HCl and pepsin
- 169** In frogs, digested food is absorbed by  
 (a) villi and microvilli in intestine  
 (b) villi in cloaca  
 (c) microvilli in cloaca  
 (d) villi and microvilli in stomach and intestine

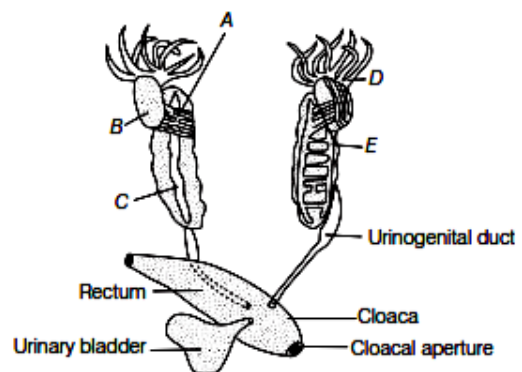
- 170** Given below is the diagram of internal organs of frog. Identify A to F.



- (a) A—Gall bladder, B—Lungs, C—Testis, D—Kidney, E—Urethra, F—Urinary bladder  
 (b) A—Gall bladder, B—Lungs, C—Fat bodies, D—Kidney, E—Rectum, F—Urinary bladder  
 (c) A—Gall bladder, B—Lungs, C—Ovary, D—Kidney, E—Ileum, F—Urinary bladder  
 (d) A—Gall bladder, B—Lungs, C—Fat bodies, D—Kidney, E—Colon, F—Urinary bladder
- 171** The respiration by lungs in frog is called  
 (a) pulmonary respiration (b) pericardial respiration  
 (c) alveolar respiration (d) None of these
- 172** During aestivation and hibernation in frogs, gaseous exchange takes place through  
 (a) skin (b) nose (c) lungs (d) scales
- 173** The vascular system of the frog is  
 (a) open type (b) closed type  
 (c) double circulatory (d) portal
- 174** The blood vascular system of the frog consists of  
 (a) heart, blood vessels and blood without haemoglobin  
 (b) blood vessels, capillaries and neurogenic heart  
 (c) haemolymph, blood vessels and heart  
 (d) arteries, veins, capillaries, heart and blood containing RBCs and WBCs
- 175** Three-chambered heart of the frog contains  
 (a) two ventricles and one atrium  
 (b) two atria and one ventricle  
 (c) one auricle and two ventricles  
 (d) one auricle, one ventricle and one atrium
- 176** Heart of the frog is covered by a membrane called  
 (a) pericardium (b) plasma membrane  
 (c) pleuromembrane (d) duramater

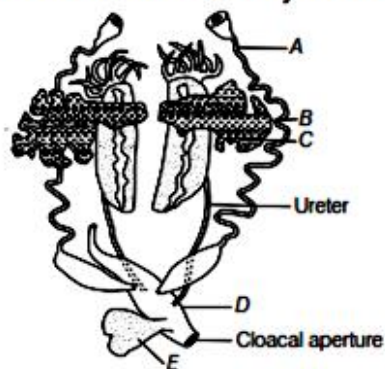
- 177** The lymph of frog lacks  
 (a) plasma proteins only (b) WBCs and RBCs  
 (c) RBCs and few proteins (d) RBCs, WBCs and proteins
- 178** In male frog, ureters act as  
 (a) urinogenital ducts (b) cloaca  
 (c) urinary bladder (d) genital ducts
- 179** Which of the following is the structural and functional unit of kidney in the frog?  
 (a) Ureters (b) Cloaca  
 (c) Nephrons (d) Bidder's canal
- 180** In frogs, cloaca is an opening of  
 (a) excretory ducts (b) reproductive ducts  
 (c) Both (a) and (b) (d) None of these
- 181** The frog is a/an  
 (a) urcotelic animal (b) ammonotelic animal  
 (c) uricotelic animal (d) None of these
- 182** Excretory system of the frog consists of  
 (a) pair of kidneys, ureters, urinary bladder, cloaca  
 (b) single kidney, urinary bladder and cloaca  
 (c) kidney and cloaca  
 (d) urethra and cloaca
- 183** The system for control and coordination in frogs comprises  
 (a) highly evolved neural system and endocrine glands  
 (b) highly evolved exocrine glands and least developed nervous system  
 (c) least developed endocrine system and nervous system  
 (d) endocrine and exocrine glands
- 184** The number of pairs of cranial nerves arising from the brain of frog is  
 (a) 10 (b) 9 (c) 8 (d) 7
- 185** The forebrain of frog consists of  
 (a) optic and olfactory lobes  
 (b) paired diencephalon  
 (c) olfactory lobes and unpaired diencephalon  
 (d) Both (a) and (b)
- 186** The midbrain of the frog is characterised by a pair of  
 (a) cerebral hemisphere (b) cerebellum  
 (c) optic lobes (d) olfactory lobes
- 187** Hindbrain of a frog consists of  
 (a) cerebellum and medulla oblongata  
 (b) olfactory lobes and cerebral hemispheres  
 (c) a pair of optic lobes  
 (d) cerebrum and cranium
- 188** Find out the pair in reference to the frog which is not correctly matched.  
 (a) Hearing – Tympanum with external ears  
 (b) Touch – Sensory papillae  
 (c) Smell – Nasal epithelium  
 (d) Vision – Simple eyes

- 189** In frogs, sensory papillae, taste buds and nasal epithelium are ....., while eyes and internal ears are well-organised structures.  
 (a) cellular aggregations around muscular tissue  
 (b) cellular aggregations around nerve endings  
 (c) cellular aggregations around fatty tissue  
 (d) cellular aggregations around heart
- 190** The number of vasa efferentia that arises from testes in frog's male reproductive system is  
 (a) 9 - 12  
 (b) 10 - 12  
 (c) 13 - 16  
 (d) 16 - 19
- 191** In male frogs, cloaca is a small median chamber that is used to pass  
 (a) sperms  
 (b) urine  
 (c) faecal matter  
 (d) All of the above
- 192** Select the correct route for the passage of sperms in male frogs.  
 (a) Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca  
 (b) Testes → Vasa efferentia → Kidney → Seminal vesicle → Urinogenital duct → Cloaca  
 (c) Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca  
 (d) Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca
- 193** Identify *A*, *B*, *C* and *D* in the given figure of male reproductive system of frog.



- (a) A–Fat bodies, B–Testis, C–Ureters, D–Vasa efferentia, E–Kidney  
 (b) A–Nephrons, B–Testis, C–Ureters, D–Villi, E–Kidney  
 (c) A–Vasa efferentia, B–Testis, C–Adrenal gland, D–Fat bodies, E–Kidney  
 (d) A–Mesorchium, B–Testis, C–Adrenal gland, D–Fat bodies, E–Kidney

194 Observe the following figure of female reproductive system of earthworm and identify A to D.



- (a) A–Urinary duct, B–Ova, C–Ovary, D–Cloaca, E–Urethra
- (b) A–Oviduct, B–Ovary, C–Ova, D–Cloaca, E–Urinary bladder
- (c) A–Oviduct, B–Ovary, C–Ova, D–Rectum, E–Adrenal gland
- (d) A–Urinogenital duct, B–Ovary, C–Ovum, D–Coelom, E–Urethra

195 In female frogs,

- (a) ovaries are absent
- (b) ovaries are functionally connected with kidneys
- (c) ovaries are not connected with kidney functionally
- (d) ovaries and oviducts are rudimentary

## SPECIAL FORMAT QUESTIONS

1. Which of the following statements is incorrect about squamous epithelium?

- (a) It consists of a single thin layer of flattened cells with irregular boundaries
- (b) It is present on secretory and absorptive surfaces
- (c) It is found on the walls of the kidney
- (d) It is involved in many functions like forming a diffusion boundary

2. Which of the following statements is incorrect with reference to the columnar epithelium?

- (a) It is composed of single layer of tall and slender cells
- (b) Nucleus of the cell is located at its base
- (c) Free surface may have microvilli
- (d) It is commonly found in kidneys of mammals

3. Which of the following statements is incorrect?

- (a) Cells are compactly packed in the epithelial tissues with little intercellular matrix
- (b) The cells secrete fibres of structural protein in all the connective tissues
- (c) Neuroglia is made up of more than one half the volume of neural tissue in our body
- (d) Muscles are made up of fibres

4. Which of the following statements is incorrect with reference to earthworm?

- (a) Nephridia are segmentally arranged coiled tubule
- (b) Nephridia regulate the volume and composition of the body fluids
- (c) There are three types of nephridia found in the earthworm
- (d) Pharyngeal nephridia are present as three paired tufts in the 3rd, 5th and 6th segments

5. Which of the following statements is incorrect regarding cockroach (*Periplaneta americana*)?

- (a) Cockroaches belong to the phylum– Arthropoda
- (b) Cockroaches are nocturnal animals
- (c) Cockroaches are carnivorous animals
- (d) Cockroaches have long antenna and legs

6. Select the correct statement from the given below with respect to *Periplaneta americana*.

- (a) Nervous system located dorsally, consists of segmentally arranged ganglia joined by a pair of longitudinal connectives
- (b) Males bear a pair of short thread-like anal styles
- (c) There are 16 very long Malpighian tubules present at the junctions of midgut and hindgut
- (d) Grinding of food is carried out only by the mouth parts

7. Which of the following statements is incorrect ?

- (a) Cockroaches exhibit mosaic vision with less sensitivity and more resolution
- (b) A mushroom-shaped glands is present in the 6th-7th abdominal segments of male cockroach
- (c) A pair of spermatheca is present in the 6th segments of female cockroach
- (d) Female cockroach possesses sixteen ovarioles in the ovaries

8. Which of the following statements is incorrect about *Periplaneta americana*?

- (a) They are nocturnal omnivores that live in the damp places
- (b) Its body is segmented and divisible in two regions, i.e. head and abdomen
- (c) Antennae have sensory receptor to monitor the environment
- (d) Head can move in all directions due to the presence of movable neck

9. Which of the following statements are incorrect regarding ciliated epithelium?

- I. Cells possess cilia on their free surface.
  - II. They bear microvilli at the free ends to increase surface area of the organ.
  - III. Mucus spreads over the epithelium as a thin layer.
  - IV. It is found only in the lining of the small intestine.
- (a) I and III (b) I and II (c) II and IV (d) III and IV

10. Choose the incorrect statements about skeletal muscles.

- I. Tissues are closely attached to bones.
  - II. A sheath of tough connective tissue encloses several bundles of muscle fibres.
  - III. These are involuntary in their action.
  - IV. These are present in the blood vessels.
- (a) I and II (b) II and III (c) III and IV (d) I and IV

- 11 Which of the following statements(s) is/are incorrect with reference to the blood vascular system of the earthworm?
- Blood vascular system is of open type.
  - Smaller blood vessels supply the gut, nerve cord and the body wall.
  - Blood glands are present on 6th, 7th and 8th segments.
  - Blood cells are phagocytotic in nature.
- (a) Only I (b) I and IV  
(c) I and III (d) II and III
- 12 Consider the following statements.
- The thorax of cockroach contains 6 ganglia, while abdomen contains 3 ganglia.
  - The next to last nymphal stage of cockroach possess wings.
- Select the correct option.
- (a) I is true, II is false (b) I is false, II is true  
(c) Both I and II are true (d) Both I and II are false
- 13 Consider the following statements.
- The RBCs, WBCs and platelets are nucleated in frogs.
  - In frogs, there is a special venous connection between liver and intestine called hepatic portal system.
- Select the correct option.
- (a) I is true, II is false (b) Both I and II are true  
(c) I is false, II is true (d) Both I and II are false
- 14 Given below are the statements depicting functions of different parts of the alimentary canal of cockroach. Correlate these functions with their respective organs.
- Grinding of food particles.
  - Secretion of digestive juices.
  - Clearing of haemolymph.
- The correct set of organs is
- (a) I. Malpighian tubule II. Proventriculus  
III. Hepatic caeca
- (b) I. Gizzard II. Gastric caeca  
III. Malpighian tubule
- (c) I. Gastric caeca II. Gizzard  
III. Malpighian tubule
- (d) I. Gizzard II. Crop  
III. Malpighian tubule
- 15 Consider the following statements.
- External ears are absent in frog, only tympanum with internal ears aids in hearing.
  - The eyes of frog possess single unit hence, are simple.
- Select the correct option.
- (a) Both I and II are true (b) I is true, II is false  
(c) Both I and II are false (d) I is false, II is true
- 16 Consider the following statements about the hind wings of cockroach.
- They are broad and thin.
  - They are not used in flying.
  - They are also known as mesothoracic wings.
  - They are transparent and delicate.
- Which of the statement(s) given above is/are incorrect?
- (a) Only I (b) II and III  
(c) I and IV (d) I, II, III and IV
- 17 Read the given statements in reference to the digestive system of cockroach.
- Except foregut entire alimentary canal is lined by cuticle.
  - Oesophagus opens into a sac-like structure called crop.
  - The hindgut is broader than midgut.
  - The gizzard possesses 6 cuticular teeth.
- Which of the statement(s) given above is/are incorrect?
- (a) I and IV (b) II and III  
(c) III and IV (d) Only I
- 18 Read the given statements about blood vascular system of cockroach.
- Circulatory system of cockroach is of closed type.
  - There are 12 pairs of alary muscles connected to heart.
  - Heart is 6-chambered, lies along mid-dorsal line of thorax and abdomen.
  - The haemolymph is composed of colourless plasma and haemocytes.
- Which of the statement(s) given above is/are incorrect?
- (a) Only I (b) I, II, and III  
(c) I and III (d) Only IV
- 19 Consider the following statements.
- Malpighian tubules help in the removal of excretory products from the haemolymph in cockroach.
  - Female cockroach bears mushroom glands, while male cockroach bears collateral glands.
- Select the correct option.
- (a) Both I and II are true  
(b) I is true, II is false  
(c) Both I and II are false  
(d) I is false, II is true
- 20 Which of the following statements are correct in reference with the frog?
- Eyes are bulged and covered by nictitating membrane.
  - Membranous tympanum receives the sound signals.
  - The frog never drinks water.
  - Heart possesses sinus venosus.
- (a) I and II (b) III and IV  
(c) I and IV (d) I, II, III and IV
- 21 Consider the following statements about frog.
- Skin acts as a respiratory organ only in water.
  - Development is indirect through tadpole larva.
  - Bidder canal is present in kidneys into which vasa efferentia opens in male frog.
  - They possess well-developed renal portal system.
- Which of the statements given above is/are incorrect?
- (a) Only I (b) I and III  
(c) I, II, and III (d) II and IV
- 22 Frog's heart when taken out of the body continues to beat for some time.
- Select the option containing the correct statements.
- Frog is not a poikilotherm.
  - Frog does not have any coronary circulation.
  - Heart is 'myogenic' in nature.
  - Heart is autoexcitable.
- (a) Only III (b) Only IV  
(c) I and II (d) III and IV

**23** Consider the following statements.

- I. All connective tissues except blood contain cells which secrete fibres of collagen or elastin.
- II. The matrix of connective tissues is formed by the modified polysaccharides.

Select the correct option.

- (a) I is true, II is false
- (b) I is false, II is true
- (c) Both I and II are true
- (d) Both I and II are false

**24** Consider the following statements.

- I. The prostomium is the first body segment in earthworm and it is sensory in function.
- II. Earthworm possesses two pairs of accessory glands, one pair each in 17th and 19th segments.

Select the correct option.

- (a) I is true, II is false
- (b) I is false, II is true
- (c) Both I and II are true
- (d) Both I and II are false

**25** Match the following columns.

Column I (Tissues)	Column II (Location)
A. Squamous epithelium	1. Presents in bronchioles
B. Cuboidal epithelium	2. Presents in lungs
C. Columnar epithelium	3. Presents in stomach
D. Ciliated epithelium	4. Presents in kidneys

**Codes**

- |       |   |   |   |
|-------|---|---|---|
| A     | B | C | D |
| (a) 2 | 4 | 3 | 1 |
| (b) 4 | 3 | 2 | 1 |
| (c) 3 | 2 | 1 | 4 |
| (d) 1 | 2 | 3 | 4 |

**26** Match the following columns.

Column I (Tissues)	Column II (Composition)
A. Areolar tissue	1. Fat cells
B. Adipose tissue	2. Osteocytes
C. Ligament	3. Loose connective tissue
D. Bone	4. Dense regular connective tissue

**Codes**

- |       |   |   |   |
|-------|---|---|---|
| A     | B | C | D |
| (a) 3 | 1 | 4 | 2 |
| (b) 1 | 2 | 3 | 4 |
| (c) 4 | 3 | 2 | 1 |
| (d) 2 | 1 | 4 | 3 |

**27** Match the following columns.

Column I (Connective tissues)	Column II (Location)
A. Smooth muscles	1. Biceps
B. Cardiac muscles	2. Gall bladder
C. Skeletal muscles	3. Osseous tissue
D. Bones	4. Myocardium

**Codes**

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 2 | 4 | 1 | 3 | (b) 3 | 4 | 2 | 1 |
| (c) 1 | 2 | 3 | 4 | (d) 4 | 3 | 2 | 1 |

**28** Match the following columns with reference to earthworm.

Column I (Body parts of earthworm)	Column II (Position in the body)
A. Buccal cavity	1. 9th-14th segments
B. Oesophagus	2. 8th-9th segments
C. Gizzard	3. 5th-7th segments
D. Stomach	4. 1st-3th segments

**Codes**

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 4 | 3 | 2 | 1 | (b) 1 | 2 | 3 | 4 |
| (c) 2 | 1 | 4 | 3 | (d) 1 | 3 | 2 | 4 |

**29** Match the following columns.

Column I (Body parts of earthworm)	Column II (Location)
A. Clitellar region	1. Intestine
B. Septal nephridia	2. Ectodermal
C. Origin of nephridia	3. 13 segments
D. Dorsal blood vessel	4. Forest of nephridia

**Codes**

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 4 | 1 | 2 | 3 | (b) 1 | 2 | 3 | 4 |
| (c) 4 | 3 | 2 | 1 | (d) 3 | 2 | 1 | 4 |

**30** Match the following columns.

Column I (Parts of reproductive system of earthworm)	Column II (Respective segments)
A. Testes	1. 10th-11th segments
B. Seminal vesicles	2. 11th-12th segments
C. Accessory gland	3. 17th-19th segments
D. Spermathecae	4. 6th-9th segments

**Codes**

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 2 | 3 | 4 | (b) 4 | 3 | 2 | 1 |
| (c) 3 | 1 | 4 | 2 | (d) 2 | 4 | 1 | 3 |

31 With reference to cockroach, match the following columns.

Column I (Body parts of cockroach)	Column II (Location in the body)
A. Anal cerci	1. 4th and 6th segments
B. Tegmina	2. 10th segment
C. Testes	3. Forewings
D. Ommatidia	4. Sclerites
E. Exoskeleton	5. Visual unit

Codes

	A	B	C	D	E
(a)	2	3	1	5	4
(b)	4	3	2	5	1
(c)	3	4	5	2	1
(d)	5	4	3	2	1

32 Match the following columns with reference to frog

Column I (Body parts in frog)	Column II (Location in the body)
A. Respiratory organ	1. Endocrine gland
B. Excretory system	2. Skin
C. Thymus	3. Cloaca
D. Brain box	4. Cranium
E. Nasal epithelium	5. Smell

Codes

	A	B	C	D	E
(a)	2	3	1	4	5
(b)	1	2	3	4	5
(c)	5	4	3	2	1
(d)	4	3	2	1	5

33 Match the following cell structures with their characteristic features.

Column I	Column II
A. Tight junctions	1. Cement neighbouring cells together to form sheet
B. Adhering junctions	2. Transmit information through chemical to another cells
C. Gap junctions	3. Establish a barrier to prevent leakage of fluid across epithelial cells
D. Synaptic junctions	4. Cytoplasmic channels to facilitate communication between adjacent cells

Codes

	A	B	C	D	A	B	C	D	
(a)	2	4	1	3	(b)	4	2	1	3
(c)	3	1	4	2	(d)	4	3	1	2

34 Match the following with reference to cockroach and choose the correct option.

Column I (Body parts of cockroach)	Column II (Position in the body)
A. Mushroom gland	1. 6 in number
B. Abdominal ganglion	2. 9th sternum
C. Phallomeres	3. 6th -7th segment
D. Total abdominal segments	4. 10th segments

Codes

	A	B	C	D	A	B	C	D	
(a)	4	3	2	1	(b)	3	1	2	4
(c)	4	2	1	3	(d)	1	2	3	4

## NCERT EXEMPLAR PROBLEMS

- Which one of the following types of cell is involved in making of the inner walls of blood vessels?
  - Cuboidal epithelium
  - Columnar epithelium
  - Squamous epithelium
  - Stratified epithelium
- To which one of the following categories does adipose tissue belong?
  - Epithelial
  - Connective
  - Muscular
  - Neural
- Which one of the following is not a connective tissue?
  - Bone
  - Cartilage
  - Blood
  - Muscles



4. Setae help in locomotion in earthworm but are not uniformly present in all the segments. They are present in
- 1<sup>st</sup> segment
  - Last segment
  - Clitellar segment
  - 20th - 22nd segment

5. Which one of the following statements is true for cockroach?
- The number of ovarioles in each ovary are ten.
  - The larval stage is called caterpillar
  - Anal styles are absent in females
  - They are ureotelic

6. Match the following and choose the correct option

Column I	Column II
A. Adipose tissue	i. Nose
B. Stratified epithelium	ii. Blood
C. Hyaline cartilage	iii. Skin
D. Fluid connective tissue	iv. Fat storage

Options:

- A-i, B-ii, C-iii, D-iv
- A-iv, B-iii, C-i, D-ii
- A-iii, B-i, C-iv, D-ii
- A-ii, B-i, C-iv, D-iii

7. Match the following and choose the correct option

Column I	Column II
A. Hermaphrodite	i. Produces blood cells and haemoglobin
B. Direct development	ii. Testis and ovary in the same animal
C. Chemoreceptor	iii. Larval form absent
D. Blood gland in earthworm	iv. Sense of chemical substances

Options:

- A-ii, B-iii, C-iv, D-i
- A-iii, B-ii, C-iv, D-i
- A-i, B-iii, C-ii, D-i
- A-ii, B-iv, C-iii, D-i

8. Match the following with reference to cockroach and choose the correct option

Column I	Column II
A. Phallomere	i. Chain of developing ova
B. Gonopore	ii. Bundles of sperm
C. Spermatophore	iii. Opening of the ejaculatory duct
D. Ovarioles	iv. The external genitalia

Options:

- A-iii, B-iv, C-ii, D-i
- A-iv, B-iii, C-ii, D-i
- A-iv, B-ii, C-iii, D-i
- A-ii, B-iv, C-iii, D-i

9. Match the following and choose the correct option

Column I	Column II
A. Touch	i. Nasal epithelium
B. Smell	ii. Foramen magnum
C. Cranial nerves	iii. Sensory papillae
D. Medulla oblongata	iv. Peripheral nervous system

Options:

- a. A-iii, B-i, C-ii, D-iv  
 b. A-ii, B-i, C-iv, D-iii  
 c. A-iii, B-iv, C-ii, D-i  
 d. A-iii, B-i, C-iv, D-ii

## NEET PREVIOUS QUESTIONS

1. Cuboidal epithelium with brush border of microvilli is found in

- (a) lining of intestine  
 (b) ducts of salivary glands  
 (c) proximal convoluted tubule of nephron  
 (d) Eustachian tube (NEET 2020)

2. Goblet cells of alimentary canal are modified from

- (a) squamous epithelial cells  
 (b) columnar epithelial cells  
 (c) chondrocytes  
 (d) compound epithelial cells. (NEET 2020)

3. The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in

- (a) bronchioles and Fallopien tubes  
 (b) bile duct and bronchioles  
 (c) Fallopien tubes and pancreatic duct  
 (d) Eustachian tube and salivary duct. (NEET 2019)

4. Match the following cell structure with its characteristic feature.

- |                        |   |
|------------------------|---|
| (A) Tight junctions    | (i) Cement neighbouring cells together to form sheet                          |
| (B) Adhering junctions | (ii) Transmit information through chemical to another cells                   |
| (C) Gap junctions      | (iii) Establish a barrier to prevent leakage of fluid across epithelial cells |
| (D) Synaptic junctions | (iv) Cytoplasmic channels to facilitate communication between adjacent cells  |

Select correct option from the following.

- (A) (B) (C) (D)  
 (a) (ii) (iv) (i) (iii)  
 (b) (iv) (ii) (i) (iii)  
 (c) (iii) (i) (iv) (ii)  
 (d) (iv) (iii) (i) (ii) (Odisha NEET 2019)

5. Smooth muscles are

- (a) involuntary, fusiform, non-striated  
 (b) voluntary, multinucleate, cylindrical

- (c) involuntary, cylindrical, striated  
 (d) voluntary, spindle-shaped, uninucleate.

(NEET-II 2016)

6. Which type of tissue correctly matches with its location?

Tissue	Location
(a) Transitional epithelium	Tip of nose
(b) Cuboidal epithelium	Lining of stomach
(c) Smooth muscle	Wall of intestine
(d) Areolar tissue	Tendons

(NEET-I 2016)

7. The function of the gap junction is to

- (a) separate two cells from each other  
 (b) stop substance from leaking across a tissue  
 (c) performing cementing to keep neighbouring cells together  
 (d) facilitate communication between adjoining cells by connecting the cytoplasm for rapid transfer of ions, small molecules and some large molecules. (2015)

8. Choose the correctly matched pair.

- (a) Tendon - Specialized connective tissue  
 (b) Adipose tissue - Dense connective tissue  
 (c) Areolar tissue - Loose connective tissue  
 (d) Cartilage - Loose connective tissue (2014)

9. Choose the correctly matched pair.

- (a) Inner lining of salivary ducts - Ciliated epithelium  
 (b) Moist surface of buccal cavity - Glandular epithelium  
 (c) Tubular parts of nephrons - Cuboidal epithelium  
 (d) Inner surface of bronchioles - Squamous epithelium (2014)

10. Identify the tissue shown in the diagram and match with its characteristics and its location.

- (a) Smooth muscles, show branching, found in the wall of the heart



- (b) Cardiac muscles, unbranched muscles, found in the walls of the heart
- (c) Striated muscles, tapering at both-ends, attached with the bones of the ribs
- (d) Skeletal muscles show striations and are closely attached with the bones of the limbs

(Karnataka NEET 2013)

11. *Pheretima* and its close relatives derive nourishment from

- (a) sugarcane roots
- (b) decaying fallen leaves and soil organic matter
- (c) soil insects
- (d) small pieces of fresh fallen leaves of maize, etc.

(2012)

12. One very special feature in the earthworm (*Pheretima*) is that

- (a) fertilization of eggs occurs inside the body
- (b) the typhlosole greatly increases the effective absorption area of the digested food in the intestine
- (c) the S-shaped setae embedded in the integument are the defensive weapons used against the enemies
- (d) it has a long dorsal tubular heart.

(2011)

13. Which one of the following structures in *Pheretima* is correctly matched with its function?

- (a) Clitellum - Secretes cocoon
- (b) Gizzard - Absorbs digested food
- (c) Setae - Defence against predators
- (d) Typhlosole - Storage of extra nutrients

(Mains 2011)

14. Consider the following four statements (A-D) related to the common frog *Rana tigrina*, and select the correct option stating which ones are true (T) and which ones are false (F).

Statements:

- A. On dry land it would die due to lack of O<sub>2</sub> if its mouth is forcibly kept closed for a few days.
- B. It has four-chambered heart.
- C. On dry land it turns uricotelic from ureotelic.
- D. Its life-history is carried out in pond water.

	A	B	C	D
(a)	T	F	F	T
(b)	T	T	F	F
(c)	F	F	T	T
(d)	F	T	T	F

(Mains 2011)

15. Which one of the following correctly describes the location of some body parts in the earthworm *Pheretima*?

- (a) Four pairs of spermathecae in 4<sup>th</sup>-7<sup>th</sup> segments
- (b) One pair of ovaries attached at intersegmental septum of 14<sup>th</sup> and 15<sup>th</sup> segments
- (c) Two pairs of testes in 10<sup>th</sup> and 11<sup>th</sup> segments
- (d) Two pairs of accessory glands in 16<sup>th</sup>-18<sup>th</sup> segments

(2009)

16. If the head of cockroach is removed, it may live for few days because

- (a) the supra-oesophageal ganglia of the cockroach are situated in ventral part of abdomen
- (b) the cockroach does not have nervous system
- (c) the head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body
- (d) the head holds a 1/3<sup>rd</sup> of a nervous system while the rest is situated along the dorsal part of its body.

(NEET 2020)

17. Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth.

- (a) Pharynx → Oesophagus → Ileum → Crop → Gizzard → Colon → Rectum
- (b) Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum
- (c) Pharynx → Oesophagus → Gizzard → Crop → Ileum → Colon → Rectum
- (d) Pharynx → Oesophagus → Gizzard → Ileum → Crop → Colon → Rectum

(NEET 2019)

18. Which of the following features is used to identify a male cockroach from a female cockroach?

- (a) Presence of a boat-shaped sternum on the 9<sup>th</sup> abdominal segment
- (b) Presence of caudal styles
- (c) Forewings with darker tegmina
- (d) Presence of anal cerci

(NEET 2018)

19. In male cockroaches, sperms are stored in which part of the reproductive system?

- (a) Seminal vesicles
- (b) Mushroom glands
- (c) Testes
- (d) Vas deferens

(NEET-II 2016)

20. Which of the following features is not present in *Periplaneta americana*?

- (a) Exoskeleton composed of N-acetylglucosamine
- (b) Metamerically segmented body
- (c) Schizocoelom as body cavity
- (d) Indeterminate and radial cleavage during embryonic development

(NEET-I 2016)

21. The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of

- (a) urea
- (b) calcium carbonate
- (c) ammonia
- (d) potassium urate.

(2015)

22. The terga, sterna and pleura of cockroach body are joined by

- (a) arthrodiol membrane
- (b) cartilage
- (c) cementing glue
- (d) muscular tissue.

(2015 Cancelled)

23. What external changes are visible after the last moult of a cockroach nymph?

- (a) Both forewings and hindwings develop
- (b) Labium develops
- (c) Mandibles become harder
- (d) Anal cerci develop

(NEET 2013)

24. Select the correct option with respect to cockroaches.
- Malpighian tubules convert nitrogenous wastes into urea.
  - Males bear short anal styles not present in females.
  - Nervous system comprises of a dorsal nerve cord and ten pairs of ganglia.
  - The forewings are tegmina which are used in flight. (Karnataka NEET 2013)
25. Which one of the following is one of the paths followed by air or O<sub>2</sub> during respiration in the adult male *Periplaneta americana* as it enters the animal body?
- Spiracle in metathorax, trachea, tracheoles, oxygen diffuses into cells
  - Mouth, bronchial tube, trachea, oxygen enters cells
  - Spiracles in prothorax, tracheoles, trachea, oxygen diffuses into cells
  - Hypopharynx, mouth, pharynx, trachea, tissues (Karnataka NEET 2013)
26. Select the correct statement from the ones given below with respect to *Periplaneta americana*.
- Nervous system located dorsally, consists of segmentally arranged ganglia joined by a pair of longitudinal connectives.
  - Males bear a pair of short thread like anal styles.
  - There are 16 very long Malpighian tubules present at the junctions of midgut and hindgut.
  - Grinding of food is carried out only by the mouth parts. (2012)
27. Select the correct route for the passage of sperms in male frogs.
- Testes → Vasa efferentia → Kidney → Seminal vesicle → Urinogenital duct → Cloaca
  - Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca
  - Testes → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca
  - Testes → Bidder's canal → Kidney → Vasa efferentia → Urinogenital duct → Cloaca (NEET 2017)
28. Frog's heart when taken out of the body continues to beat for sometime. Select the best option from the following statements.
- Frog is a poikilotherm.
  - Frog does not have any coronary circulation.
  - Heart is "myogenic" in nature.
  - Heart is autoexcitable.
- Only (4)
  - (1) and (2)
  - (3) and (4)
  - Only (3) (NEET 2017)
29. Compared to those of humans, the erythrocytes in frog are
- without nucleus but with haemoglobin
  - nucleated and with haemoglobin
  - very much smaller and fewer
  - nucleated and without haemoglobin. (2012)

## AIIMS PREVIOUS QUESTIONS

1. The type of epithelial cells which line the inner surface of fallopian tubes, bronchioles and small bronchi are known as [2006]
- squamous epithelium
  - columnar epithelium
  - ciliated epithelium
  - cubical epithelium
2. Tadpoles of frog can be made to grow as giant sized tadpoles, if they are [2006]
- administered antithyroid substance like thiourea.
  - administered large amounts of thyroxine.
  - reared on a diet rich in egg yolk.
  - reared on a diet rich in both egg yolk and glucose.
3. Which of the following type of cell junction is not found in animal tissues? [2013]
- Adhering junction
  - Tight junction
  - Gap junction
  - Plasmodesmata
4. Identify the figure with its correct function



- Areolar connective tissue – Serves as a support framework for epithelium
  - Adipose tissue – Store fats and act as heat insulators
  - Dense regular tissue – Provide flexibility
  - Dense irregular tissue – Provide strength and elasticity [2014]
5. Which of the following statement about cell junctions is false? [2015]
- All the cells of the epithelium are held together with little intercellular materials.
  - In almost all animal tissues specialized junction provide both structural and functional link between its individual cells.



## KEY

### MULTIPLE CHOICE QUESTIONS

1 (a)	2 (b)	3 (c)	4 (a)	5 (b)	6 (b)	7 (d)	8 (b)	9 (d)	10 (c)
11 (a)	12 (a)	13 (d)	14 (a)	15 (c)	16 (c)	17 (c)	18 (a)	19 (d)	20 (d)
21 (b)	22 (a)	23 (d)	24 (b)	25 (b)	26 (c)	27 (c)	28 (b)	29 (c)	30 (a)
31 (b)	32 (d)	33 (d)	34 (a)	35 (a)	36 (c)	37 (d)	38 (b)	39 (a)	40 (a)
41 (a)	42 (a)	43 (d)	44 (b)	45 (a)	46 (c)	47 (b)	48 (a)	49 (b)	50 (c)
51 (a)	52 (d)	53 (a)	54 (c)	55 (a)	56 (b)	57 (a)	58 (c)	59 (d)	60 (b)
61 (c)	62 (a)	63 (b)	64 (a)	65 (c)	66 (b)	67 (d)	68 (c)	69 (c)	70 (a)
71 (b)	72 (a)	73 (b)	74 (c)	75 (c)	76 (d)	77 (b)	78 (d)	79 (b)	80 (a)
81 (a)	82 (a)	83 (c)	84 (c)	85 (c)	86 (a)	87 (c)	88 (a)	89 (b)	90 (b)
91 (c)	92 (c)	93 (c)	94 (b)	95 (d)	96 (b)	97 (c)	98 (b)	99 (a)	100 (b)
101 (b)	102 (a)	103 (b)	104 (b)	105 (b)	106 (b)	107 (d)	108 (d)	109 (c)	110 (b)
111 (a)	112 (c)	113 (c)	114 (c)	115 (c)	116 (b)	117 (c)	118 (c)	119 (b)	120 (a)
121 (c)	122 (c)	123 (c)	124 (c)	125 (d)	126 (b)	127 (b)	128 (a)	129 (d)	130 (b)
131 (d)	132 (b)	133 (b)	134 (c)	135 (a)	136 (c)	137 (b)	138 (a)	139 (a)	140 (d)
141 (b)	142 (a)	143 (d)	144 (a)	145 (b)	146 (a)	147 (a)	148 (a)	149 (a)	150 (a)
151 (a)	152 (b)	153 (c)	154 (a)	155 (a)	156 (b)	157 (d)	158 (c)	159 (c)	160 (d)
161 (c)	162 (a)	163 (a)	164 (c)	165 (a)	166 (b)	167 (c)	168 (c)	169 (a)	170 (b)
171 (a)	172 (a)	173 (b)	174 (d)	175 (b)	176 (a)	177 (c)	178 (a)	179 (c)	180 (c)
181 (a)	182 (a)	183 (a)	184 (a)	185 (c)	186 (c)	187 (a)	188 (a)	189 (b)	190 (b)
191 (d)	192 (d)	193 (c)	194 (b)	195 (c)					

### SPECIAL FORMAT QUESTIONS

1	c	8	b	15	a	22	d	29	a
2	d	9	c	16	b	23	c	30	a
3	b	10	c	17	d	24	b	31	a
4	d	11	c	18	c	25	a	32	a
5	c	12	d	19	b	26	a	33	c
6	b	13	b	20	d	27	a	34	b
7	a	14	b	21	a	28	a		

### NCERT EXEMPLAR PROBLEMS

1	c
2	b
3	d
4	d
5	c
6	b
7	a
8	b
9	d

### NEET PREVIOUS QUESTIONS

1	c	6	c	11	b	16	c	21	d	26	b
2	b	7	d	12	b	17	b	22	a	27	b
3	a	8	c	13	a	18	b	23	a	28	c
4	c	9	c	14	c	19	a	24	b	29	b
5	a	10	d	15	c	20	d	25	a		

### AIIMS PREVIOUS QUESTIONS

1	c	5	d	9	d
2	b	6	a	10	a
3	d	7	b		
4	b	8	d		

**UNIT-III**  
**ANIMAL DIVERSITY-I**  
**(INVERTEBRATE PHYLA)**

# SYNOPSIS

## Basis of Classification

The fundamental features common to various individuals that are used as the basis of animal classification have been given below

- **Levels of Organisation** Though all the members of kingdom–Animalia are multicellular, yet all of them do not exhibit the same pattern of cellular organisation.
- Different levels of organisation are discussed below
  - **Cellular level** (cell aggregates) found in sponges.
  - **Tissue level** (cell performing same function are arranged into tissues) found in coelenterates and ctenophores.
  - **Organ level** (tissues grouped together to form organs) found in phylum–Platyhelminthes and other higher phyla.
  - **Organ system level** (association of organs to form functional systems) found in annelids to chordates.
- **Symmetry** On the basis of symmetry, animals can be **asymmetrical**, i.e. body cannot be divided into equal halves by any plane (e.g. sponges), **radially symmetrical**, i.e. body can be divided into equal halves by any plane passing through the central axis (e.g. coelenterates, ctenophores and echinoderms) and **bilaterally symmetrical**, i.e. body can be divided into two identical halves (left and right) only along one plane (e.g. annelids and arthropods).
- **Diploblastic and Triploblastic Organisation** On the basis of germ layers, animals are classified as
  - **Diploblastic** (cells arranged in two embryonic layers, i.e. external **ectoderm** and internal **endoderm**), e.g. coelenterates and **triploblastic** (cells arranged in three germ layers, i.e. ectoderm and endoderm and an undifferentiated layer **mesoderm** between them), e.g. phylum– Platyhelminthes to Chordata.
  - **Coelom** It is the body cavity (present between body wall and gut wall), which is lined by mesoderm. Animals are also classified on the basis of the presence or absence of coelom as given below
    - **Coelomates** Animals which possess coelom. They are further classified into schizocoelomates (e.g. annelids, molluscs and arthropods) and enterocoelomates (e.g. echinoderms and chordates).
    - **Acoelomates** The animal in which body cavity is absent are called acoelomates, e.g. Porifera to Platyhelminthes (true acoelomates).
    - **Pseudocoelomates** Mesoderm does not line the body cavity and is present between ectoderm and endoderm as scattered pouches, e.g. Aschelminthes.
  - **Segmentation** In some animals, the body is externally and internally divided into segments or somites with a serial repetition of at least some organs. In earthworm, this phenomenon is known as **metamerism**.
  - **Notochord** It is a mesodermally derived rod-like structure formed on the dorsal side during embryonic development in some animals. Animals with notochord are called **chordates** and without notochord are **non-chordates**, e.g. Porifera to Echinodermata

## I. Non-chordates

The non-chordates include the following phyla

1. **Phylum–Porifera** includes sponges, which are usually marine and mostly asymmetrical animals with canal system as most important features.



- Central cavity present in sponges is known as **spongocoel**, it is lined by collar cells or **choanocytes** and it opens to outside by osculum.
- Water enters the spongocoel through minute pores called **ostia** and moves out through osculum.
- The body is supported by **spicules** or **spongin** and protein fibres, which form skeletal system.
- They are **hermaphrodites**, i.e. both male and female gametes are produced within same individual. Fertilisation is internal and development is indirect.
- Sponges reproduce asexually by fragmentation and sexually by gamete formation. Larval forms are morphologically distinct from adults, e.g. *Sycon*, *Spongilla* and *Euspongia*.

2. **Phylum–Cnidaria** (Coelenterata) consists of aquatic marine, sessile, radially symmetrical animals.

- Tentacles are either present over the mouth or around their body edges. Cells called **cnidoblasts** or **cnidocytes** are present on the tentacles and the body. These cells are used for anchorage, defence and capture of prey.
- A central gastrovascular cavity (coelenteron) with a single opening, mouth on **hypostome** is present.
- Some cnidarians, e.g. **corals**, have skeleton composed of  $\text{CaCO}_3$ .
- They show polymorphism with two basic body plans, i.e. **polyps** are fixed, sessile, cylindrical, e.g. *Hydra*, *Adamsia*, etc., and **medusae** are umbrella-shaped and free-swimming, e.g. *Aurelia*.
- The cnidarians exist in both forms and exhibit alternation of generation (metagenesis), i.e. polyps produce medusae asexually and medusae produce polyps sexually (e.g. *Obelia*).

3. **Phylum–Ctenophora** (Comb jellies or Sea walnuts)

- These are exclusively marine, diploblastic, radially symmetrical, acoelomate organisms with tissue level of organisation.
- Body is soft, transparent and gelatinous with well-marked **bioluminescence** (the property of a living organism to emit light).
- Eight external rows or ciliated **comb plates** help in locomotion.
- Digestion is both extracellular and intracellular.
- These are sexually reproducing, monoecious organisms with external fertilisation and indirect development, e.g. *Ctenophora* and *Pleurobrachia*.

4. **Phylum–Platyhelminthes** (Flatworms)

- These are dorsoventrally flattened, bilaterally symmetrical, triploblastic and acoelomate animals. They are mostly endoparasites and show organ system level of organisation.
- They have specialised cells for excretion and osmoregulation called **flame cells**.
- They possess a high regeneration capacity. Fertilisation is internal and development is through many larval stages, e.g. *Planaria*, *Taenia* (tapeworm) and *Fasciola* (liver fluke).

5. **Phylum–Aschelminthes (Roundworms)**

- They are bilaterally symmetrical, triploblastic and pseudocoelomate animals with the body being circular in cross-section.
- They are free-living, aquatic, terrestrial or parasitic forms.
- They are **dioecious** (separate sexes) and show internal fertilisation with indirect development. Females are often longer than males.

- Alimentary canal is complete with a well-developed

### **muscular pharynx.**

- Excretion is through excretory pore. Fertilisation is internal and development may be direct or indirect. e.g. *Ascaris* (roundworm), *Wuchereria* (filaria worm) and *Ancylostoma* (hookworm).

### **6. Phylum–Annelida (Segmented worms)**

- They are triploblastic show organ level of body organisation and are bilaterally symmetrical.
- They show metameric segmentation, i.e. body surface is distinctly marked out into **segments** or **metameres**.
- Locomotion is aided by longitudinal and circular muscles. In *Nereis*, swimming is achieved by lateral appendages called **parapodia**.
- Respiration is through skin or gills, circulatory system is closed and digestive system is complete.
- Excretion is through **nephridia**. Both monoecious, e.g. *Nereis* and dioecious forms, e.g. *Pheretima* (earthworm) and *Hirudinaria* (leech) occur.
- Neural system consists of paired ganglia connected by lateral nerve to a double ventral nerve cord.
- They reproduce sexually

### **7. Phylum–Arthropoda Largest phylum** of kingdom– Animalia, includes insects.

- They are triploblastic, segmented, bilaterally symmetrical coelomate animals. Body is covered by chitinous exoskeleton.
- Body consists of **head, thorax** and **abdomen**.
- They possess **jointed appendages**.
- Circulatory system is open type, forming a haemocoel.
- Sensory organs like antennae, eyes, statocysts or balancing organs are present.
- Respiratory system shows diverse range, e.g. gills, trachea, book lungs, general body surface and book gills, e.g. *Apis*, *Culex*, *Limulus* (a living fossil), etc.
- Excretion takes place through **Malpighian tubules**.
- Fertilisation is internal with direct or indirect development. Mostly dioecious.

### **8. Phylum–Mollusca It is the second largest phylum.**

- These are terrestrial or aquatic, mostly marine and some are freshwater.
- These are bilaterally symmetrical, triploblastic and coelomate animals.
- Body is unsegmented and covered by a calcareous shell but consists of a distinct head, muscular foot and visceral hump. The space between hump and mantle is called mantle cavity in which feather like gills are present.
- They have respiratory and excretory functions. The anterior head region has sensory tentacles.
- Feeding is performed through radula. Circulation is open type, excretion through organ of Bojanus or metanephridia pair.
- Sexes are separate and are mostly oviparous, e.g. Octopus, Pila, Sepia.
- They are usually dioecious and oviparous with indirect development.

### **9. Phylum–Echinodermata have an endoskeleton of calcareous ossicles.**

- They are radially (pentamerous) symmetrical at adult stage and bilaterally symmetrical at larval stage.
- They are triploblastic and coelomate animals.

- Water vascular system is present, which helps in locomotion, capture and transport of food and respiration.
- Complete digestive system is present and an excretory system is absent.
- Sexes are separate and reproduction is sexual with indirect development and free-swimming larvae, e.g. Asterias (starfish), Echinus (sea urchin), Cucumaria (sea cucumber).

## 10. Phylum–Hemichordata (Half chordates)

- These are bilaterally symmetrical, triploblastic and coelomate worm-like marine animals.
- Body is cylindrical and divided into **proboscis**, **collar**
- and **trunk**. Notochord is absent.
- Excretion occurs through proboscis gland, circulation is open type and respiration occurs through gill slit pairs.
- Sexes are separate, fertilisation is external and development is indirect.
- Connecting link between echinoderms and chordates, e.g. *Balanoglossus*, etc.

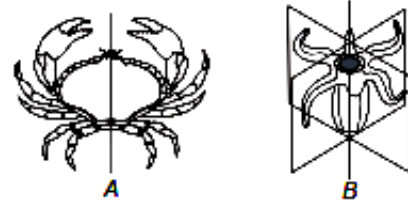
### SAILENT FEATUERS OF DIFFERENT PHYLA IN THE ANIMAL KINGDOM

Phylum	Level of Body Organisation	Symmetry	Coelom	Distinctive Features			Special Features
				Digestive System	Respiratory System	Circulatory System	
Porifera	Cellular	Asymmetrical	Acoelomate	Absent	Absent	Absent	<ul style="list-style-type: none"> <li>• Presence of choanocytes.</li> <li>• Presence of water transport or water canal system.</li> </ul>
Coelenterata (Cnidaria)	Tissues	Radial	Acoelomate	Incomplete	Absent	Absent	<ul style="list-style-type: none"> <li>• Presence of cnidoblasts.</li> <li>• Exhibition of two body forms, i.e. polyp and medusa.</li> </ul>
Ctenophora	Tissues	Radial	Acoelomate	Incomplete	Absent	Absent	<ul style="list-style-type: none"> <li>• Presence of comb plates for locomotion.</li> <li>• Bioluminescence.</li> </ul>
Platyhelminthes	Organ and organ system	Bilateral	Acoelomate	Incomplete	Absent	Absent	<ul style="list-style-type: none"> <li>• Dorsoventrally flattened body.</li> <li>• Presence of hooks and suckers.</li> </ul>
Aschelminthes	Organ system	Bilateral	Pseudocoelomate	Complete	Absent	Absent	<ul style="list-style-type: none"> <li>• Body is circular in cross-section.</li> </ul>
Annelida	Organ system	Bilateral	Schizocoelomate	Complete	Present	Absent	<ul style="list-style-type: none"> <li>• Show metamerism.</li> <li>• Presence of nephridia for excretion and osmoregulation.</li> </ul>
Arthropoda	Organ system	Bilateral	Schizocoelomate	Complete	Present	Present	<ul style="list-style-type: none"> <li>• Chitinous exoskeleton</li> <li>• Jointed appendages</li> <li>• Body divided into head, thorax and abdomen.</li> <li>• Presence of Malpighian tubules for excretion.</li> </ul>
Mollusca	Organ system	Bilateral	Schizocoelomate	Complete (mouth contains radula for feeding)	Present	Present	<ul style="list-style-type: none"> <li>• Body covered by calcareous shell.</li> <li>• Body is unsegmented with distinct head, muscular foot and visceral hump.</li> </ul>
Echinodermata	Organ system	Radial (pentamerous)	Enterocoelomate	Complete	Present	Present	<ul style="list-style-type: none"> <li>• Water vascular system for locomotion, capture and transport of food and respiration.</li> </ul>
Hemichordata	Organ system	Bilateral	Enterocoelomate	Complete	Present	Present	<ul style="list-style-type: none"> <li>• Worm like marine organisms.</li> <li>• Body consists of proboscis, collar and trunk.</li> </ul>
Chordata	Organ system	Bilateral	Enterocoelomate	Complete	Present	Present	<ul style="list-style-type: none"> <li>• Presence of notochord, dorsal hollow nerve chord and paired pharyngeal gill slits.</li> </ul>

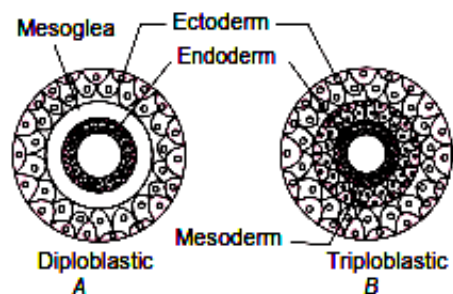
## MULTIPLE CHOICE QUESTIONS

- 1** Cellular level of organisation is
- seen in sponges
  - when cells shows division of labour
  - when cells are arranged in loose cell aggregates
  - All of the above
- 2** In tissue level of organisation the
- cells are arranged as loose cell aggregates
  - tissues are grouped to form organs
  - cells performing the same function are arranged into groups
  - tissues are grouped to form systems
- 3** Organ system level of organisation is observed in
- chordates
  - annelids
  - molluscs
  - All of these
- 4** Choose the incorrect option.
- Complete digestive system – Two openings, mouth and anus
  - Incomplete digestive system – Single opening
  - Open circulatory system – Blood is circulated through tube system
  - Closed circulatory system – Arteries, veins and capillaries are present
- 5** Phylum(s) that exhibit radial or radial-like symmetry is/are
- Coelenterata
  - Echinodermata
  - Ctenophora
  - All of these
- 6** The term 'bilateral symmetry' refers
- when the body can be divided into two unequal halves on passing central axis through it
  - to any plane passing through centre, which does not divide the body into equal halves
  - when the body can be divided into identical left and right halves only in one plane
  - any plane passing through the central axis of the body dividing the organism into two equal halves
- 7** The response to external stimulus is maximally quicker and more precise in which of the following symmetry?
- Radial
  - Bilateral
  - Spherical
  - Biradial

- 8** Choose the correct type of symmetry for the animals A and B.

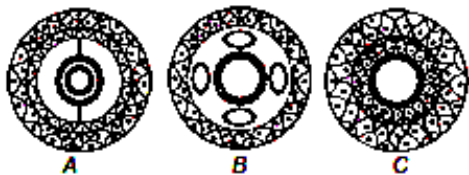


- Bilateral, Asymmetrical, respectively
  - Bilateral, Radial, respectively
  - Radial, Bilateral, respectively
  - Radial, Radial, respectively
- 9** The diagram below shows the diploblastic and triploblastic germ layers in the animals. Identify the correct option in which they are found.

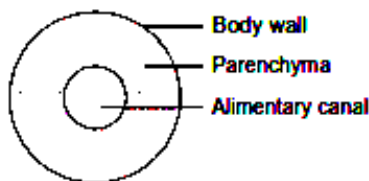


- A–Molluscs, B–Chordates
  - A–Annelida, B–Porifera
  - A–Coelenterates, B–Platyhelminthes
  - A–Porifera, B–Cnidaria
- 10** Diploblastic animals belong to the phylum
- Protista
  - Protozoa
  - Ctenophora
  - Platyhelminthes
- 11** Higher phylum like echinoderms include
- triploblastic animals
  - quadroblastic animals
  - diploblastic animals
  - uniblastic animals
- 12** Differentiated embryonic layers are called
- |               |              |
|---------------|--------------|
| I. ectoderm   | II. endoderm |
| III. mesoderm | IV. mesoglea |
- I, II and IV
  - I, II and III
  - II, III and IV
  - I, III and IV

- 13** A coelom is a  
 (a) cavity between body wall and gut wall  
 (b) body cavity lined by mesoderm  
 (c) body cavity not lined by mesoderm  
 (d) body cavity lined by endoderm
- 14** Which one of the following diagram shows coelomate condition?



- (a) A (b) B  
 (c) C (d) None of these
- 15** The pseudocoelomate animals are included in the phylum  
 (a) Porifera (b) Annelida  
 (c) Aschelminthes (d) Mollusca
- 16** The cross-section of the body of an invertebrate is given below. Identify the animal, which has this body plan.

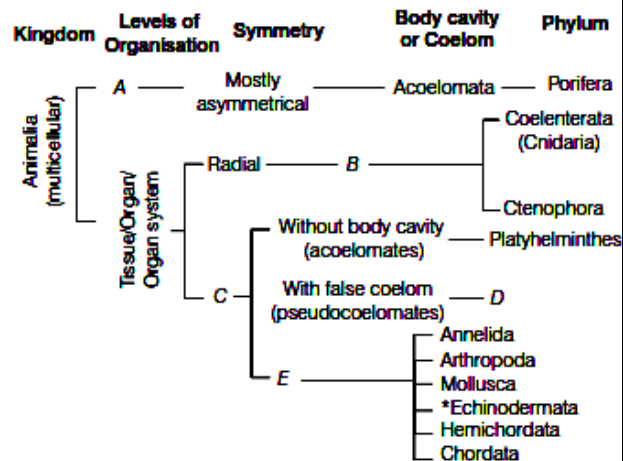


- (a) Cockroach (b) Roundworm  
 (c) Planaria (d) Earthworm
- 17** True segmentation is also called  
 (a) metagenesis (b) metamorphosis  
 (c) metamerism (d) metastasis
- 18** The notochord is derived from which of the following layers?  
 (a) Ectoderm (b) Mesoderm  
 (c) Endoderm (d) Placoderm
- 19** Which of the following is/are correct?  
 (a) Notochord is ectodermal in origin present in some animals  
 (b) Notochord is a mesodermally derived rod-like structure formed on the dorsal side during embryonic development in some animals  
 (c) Arthropods are non-chordates  
 (d) Both (b) and (c)
- 20** Tube-within-tube body plan is found in which animal?  
 (a) Euspongia (b) Fasciola  
 (c) Hydra (d) None of these

- 21** Fill in the blanks with the correct options.  
 I. ...A... have cellular level of organisation.  
 II. Coelom is not seen in ...B....  
 III. Radial symmetry is seen in phylum—Coelenterata, Ctenophora and ...C.....  
 IV. Notochord is lacking in ...D...  
 V. ...E... are bilaterally symmetrical.

Here A to E refers to

- (a) A—Platyhelminthes, B—Echinodermata, C—Arthropoda, D—Mollusca, E—Porifera  
 (b) A—Porifera, B—Platyhelminthes, C—Echinodermata, D—Mollusca, E—Arthropoda  
 (c) A—Porifera, B—Echinodermata, C—Mollusca, D—Arthropoda, E—Platyhelminthes  
 (d) A—Echinodermata, B—Arthropoda, C—Platyhelminthes, D—Mollusca, E—Porifera
- 22** Choose the false option.  
 (a) Amoeba – Asymmetrical  
 (b) Coelenterates – Diploblastic, radial symmetry, non-chordates  
 (c) Chordates – Petromyzon, Ornithorhynchus, Equus  
 (d) Annelid – Pseudocoelomate
- 23** Study the flow chart given below and identify the missing parts A, B, C, D, E.



A	B	C	D	E
(a) Cellular	Acoelomata	Bilateral	Aschelminthes	Coelomates
(b) Cellular	Coelomata	Radial	Aves	Pseudocoelomate
(c) Cellular	Acoelomata	Radial	Mammalia	Pseudocoelomate
(d) Cellular	Coelomata	Radial	Aschelminthes	Coelomates

- 24** Triploblastic, unsegmented, acoelomate exhibiting bilateral symmetry and reproducing both asexually and sexually, with some parasitic forms.  
 The above description is the characteristic of phylum  
 (a) Annelida (b) Ctenophora  
 (c) Cnidaria (d) Platyhelminthes
- 25** The animal with bilateral symmetry in young stage and radial pentamerous symmetry in the adult stage belongs to the phylum  
 (a) Annelida  
 (b) Mollusca  
 (c) Cnidaria  
 (d) Echinodermata

**26** Which one of the following option is incorrect about the occurrence of notochord?

- (a) It is present only in larval tail in ascidian
- (b) It is replaced by a vertebral column in adult frog
- (c) It is absent throughout life in humans from the very beginning
- (d) It is present throughout life in *Amphioxus*

**27** Examine the figures *A*, *B* and *C*. In which one of the four options all the animals (poriferans) are correct?



- (a) A–*Sycon*, B–*Euspongia*, C–*Spongilla*
- (b) A–*Euspongia*, B–*Spongilla*, C–*Sycon*
- (c) A–*Spongilla*, B–*Sycon*, C–*Euspongia*
- (d) A–*Euspongia*, B–*Sycon*, C–*Spongilla*

**28** In case of poriferans, the spongocoel is lined with flagellated cells called

- (a) ostia
- (b) oscula
- (c) choanocytes
- (d) mesenchymal cells

**29** In phylum–Porifera, opening through which water leaves the spongocoel is called

- (a) ostia
- (b) ommatidia
- (c) osculum
- (d) choanocytes

**30** The body wall of a common sponge consists of

- (a) pinacoderm
- (b) choanoderm
- (c) mesophyll layer
- (d) All of these

**31** In most simple type of canal system of Porifera, water flows through which one of the following ways?

- (a) Ostia → Spongocoel → Osculum → Exterior
- (b) Spongocoel → Ostia → Osculum → Exterior
- (c) Osculum → Spongocoel → Ostia → Exterior
- (d) Osculum → Ostia → Spongocoel → Exterior

**32** The skeleton of animals belonging to phylum–Porifera are made up of

- (a) spicules
- (b) spiracles
- (c) spines
- (d) spongocytes

**33** Asexual reproduction in sponges takes place by

- (a) binary fission
- (b) multiple fission
- (c) fragmentation
- (d) encystment

**34** Sponges are

- (a) with water canal system
- (b) sexually reproducing by formation of gametes
- (c) Both (a) and (b)
- (d) sessile or free-swimming

**35** Body having meshwork of cells, internal cavities lined with food filtering flagellated cells and indirect development are the characteristics of phylum

- (a) Coelenterata
- (b) Porifera
- (c) Mollusca
- (d) Protozoa

**36** Which one of the following is not a poriferan?

- (a) *Sycon*
- (b) *Spirulina*
- (c) *Euspongia*
- (d) *Spongilla*

**37** Which of the following is not true regarding phylum–Coelenterata?

- (a) They are diploblastic animals
- (b) They have cellular level of organisation
- (c) They have nematocyte cells present on the tentacles
- (d) The gastrovascular opening is called the hypostome

**38** Cnidarians are divided into the following classes.

- (a) Hydrozoa, Desmospongia and Scyphozoa
- (b) Actinozoa, Scyphozoa and Anthozoa
- (c) Scyphozoa, Anthozoa and Hydrozoa
- (d) None of the above

**39** The animal(s) that never perform(s) locomotion voluntarily is/are

- (a) *Ascaris*
- (b) *Leucosolenia*
- (c) Both (a) and (b)
- (d) *Hydra*

**40** Body forms present in cnidarians are

- (a) cylindrical and umbrella-shaped
- (b) corals and coral reefs
- (c) polyp and medusa
- (d) cnidoblasts and nematocysts

**41** Alternation of generations is also called

- (a) metamorphosis
- (b) metastasis
- (c) metazoan
- (d) metagenesis

**42** Here two basic body forms of cnidarians are given



- (a) A and B are free-swimming forms
- (b) A and B are sessile form
- (c) A produce B asexually and B form the 'A' sexually
- (d) B produce A asexually and A form the 'B' sexually

**43** Medusa is the sexually reproductive structure of

- (a) *Hydra*
- (b) *Obelia*
- (c) Sea anemone
- (d) None of these

**44** What is the symmetry of medusa?

- (a) Bilateral
- (b) Radial
- (c) Asymmetrical
- (d) Biradial

**45** Metagenesis is seen in

- (a) *Hydra*
- (b) *Aurelia*
- (c) *Obelia*
- (d) *Adamsia*

**46** The skeleton of corals is composed of

- (a) siliceous spicules
- (b) calcium sulphate
- (c) calcium carbonate
- (d) potassium sulphate

**47** The type of asexual reproduction found in *Hydra* is

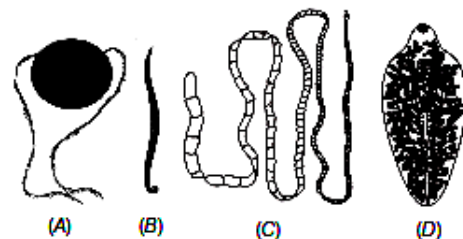
- (a) multiple fission
- (b) budding
- (c) sporulation
- (d) binary fission

**48** Choose the correct options for the following diagram.

- (a) It represents choanocyte in Porifera
- (b) It represent cnidoblasts in Platyhelminthes
- (c) It represent cnidoblast in Coelenterata
- (d) It represent choanocyte in Coelenterata

- 49 Select the taxon mentioned that represents both marine and freshwater species.  
 (a) Echinodermata (b) Ctenophora  
 (c) Cephalochordata (d) Cnidaria
- 50 Identifying feature of phylum–Ctenophora is  
 (a) the presence of comb plates and appearance like jellies  
 (b) the presence of comb plates only  
 (c) the presence of tentacles only  
 (d) alternation of generations only
- 51 Phylum–Ctenophora shows affinities with  
 (a) Cnidaria (b) Aschelminthes  
 (c) Cephalopoda (d) Turbellaria
- 52 Reproduction in *Ctenoplana* takes place by  
 (a) budding  
 (b) sexual reproduction  
 (c) binary fission  
 (d) multiple fission
- 53 Animal of which phylum have hooks and suckers and are endoparasite on other animals?  
 (a) Platyhelminthes (b) Annelida  
 (c) Aschelminthes (d) Arthropoda
- 54 Flame cells are present in  
 (a) Aschelminthes (b) Platyhelminthes  
 (c) Annelida (d) Cephalochordata
- 55 The cells that help in excretion in *Fasciola* are called  
 (a) choanocytes (b) nematocysts  
 (c) nephridia (d) flame cells
- 56 The level of organisation in Platyhelminthes is  
 (a) cellular level (b) tissue level  
 (c) organ level (d) organ system level
- 57 Which of the following does not belong to phylum–Platyhelminthes?  
 (a) *Fasciola* (b) *Taenia*  
 (c) *Ascaris* (d) *Planaria*
- 58 Which of the following is true about phylum–Platyhelminthes?  
 (a) Presence of sucking mouth  
 (b) Mostly free-living in nature  
 (c) Presence of complete digestive tract  
 (d) Polyembryony seen in some forms
- 59 If *Hydra* and *Planaria* are cut transversely in three equal parts, then  
 (a) all three parts will die  
 (b) regeneration will occur in all the three parts  
 (c) regeneration will occur only in anterior part  
 (d) regeneration occurs only in middle part
- 60 Trichocyst and nematocyst are meant for  
 (a) defence (b) nutrition  
 (c) respiration (d) excretion
- 61 The first phylum to have a complete alimentary canal is  
 (a) Platyhelminthes (b) *Ascaris*  
 (c) Aschelminthes (d) Annelida
- 62 Aschelminthes are usually  
 (a) dioecious (b) hermaphrodites  
 (c) metagenic (d) coelomates
- 63 Which one of the following endoparasites of humans does show viviparity?  
 (a) *Ancylostoma duodenale*  
 (b) *Enterobius spiralis*  
 (c) *Trichinella spiralis*  
 (d) *Ascaris lumbricoides*

- 64 *Wuchereria bancrofti* is a common filarial worm. It belongs to phylum  
 (a) Platyhelminthes (b) Aschelminthes  
 (c) Annelida (d) Coelenterata
- 65 A triploblastic pseudocoelomate, bilaterally symmetrical human parasite, which is oviparous and the transmission is by contaminated soil. It is  
 (a) filarial worm (b) hookworm  
 (c) Palaworm (d) tapeworm
- 66 *Ascaris* is characterised by  
 (a) the absence of true coelom, but presence of metamerism  
 (b) the presence of neither true coelom nor metamerism  
 (c) the presence of true coelom, but the absence of metamerism  
 (d) the presence of true coelom and metamerism
- 67 Identify the correct option specifying the names of the animals A, B, C and D.



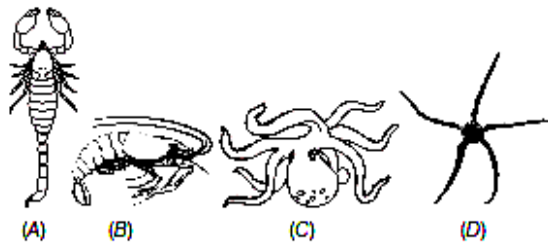
	A	B	C	D
(a)	<i>Pleurobrachia</i>	Tapeworm	<i>Taenia</i>	<i>Aurelia</i>
(b)	<i>Fasciola</i>	Tapeworm	Liver fluke	<i>Aurelia</i>
(c)	<i>Pleurobrachia</i>	Roundworm	<i>Taenia</i>	Liver fluke
(d)	<i>Fasciola</i>	Roundworm	Liver fluke	<i>Adamsia</i>

- 68 The phylum–Annelida is named so because of  
 (a) more organs are placed towards anterior part of the body  
 (b) the presence of antenna  
 (c) anteriorly placed neural system  
 (d) the presence of metameres
- 69 Which of the following animals are true coelomates with bilateral symmetry?  
 (a) Adult echinoderms (b) Aschelminthes  
 (c) Platyhelminthes (d) Annelids
- 70 The animals belonging to phylum–Annelida use the following in locomotion.  
 (a) Nephridia and nephridial pores  
 (b) Longitudinal and circular muscles  
 (c) Organs of bursa  
 (d) Spicules and ostia
- 71 Earliest occurrence of metamerism is witnessed in phylum  
 (a) Platyhelminthes (b) Coelenterata  
 (c) Arthropoda (d) Annelida
- 72 Members of phylum–Annelida have  
 (a) Nephridia – Excretion  
 (b) Parapodia – Swimming  
 (c) Double ventral nerve cord – Neural system  
 (d) All of the above
- 73 Which of the following groups is formed of only the hermaphrodite organisms?  
 (a) Earthworm, tapeworm, housefly, frog  
 (b) Earthworm, tapeworm, sea horse, housefly  
 (c) Earthworm, leech, sponge, roundworm  
 (d) Earthworm, tapeworm, leech, sponge

- 74** Which of the following contain all members of the phylum–Annelida?  
 (a) *Hirudinaria*, *Nereis* and *Wuchereria*  
 (b) Earthworms, *Aphrodite* and *Pila*  
 (c) *Pheretima*, *Tubifex* and *Nereis*  
 (d) *Aplysia*, *Nereis* and *Dentalium*
- 75** Bilateral symmetry, metameric segmentation, true coelom and open circulatory system are the features of  
 (a) Annelida (b) Arthropoda  
 (c) Mollusca (d) Echinodermata
- 76** Which one of the following features is not present in the phylum–Arthropoda?  
 (a) Metameric segmentation (b) Parapodia  
 (c) Jointed appendages (d) Chitinous exoskeleton
- 77** Which one of the following characteristics is mainly responsible for diversification of insects on land?  
 (a) Segmentation (b) Bilateral symmetry  
 (c) Exoskeleton (d) Eyes
- 78** The members of phylum–Arthropoda have balancing organ named as  
 (a) radula (b) statocysts  
 (c) choanocyte (d) comb plates
- 79** Choose the respiratory organs that are present in phylum–Arthropoda.  
 (a) Tracheal system or Book lungs  
 (b) Book gills  
 (c) Gills  
 (d) All of the above
- 80** Mark the incorrect option for the phylum–Arthropoda.  
 (a) Sensory organs like antennae present  
 (b) Only compound eyes present  
 (c) Body with head, thorax and abdomen  
 (d) The presence of Malpighian tubules for excretion
- 81** Which of the following groups includes only arthropods?  
 (a) Prawn, *Neopilina* and *Pila*  
 (b) Cockroach, scorpion and prawn  
 (c) Chiton, *Neopilina* and scorpion  
 (d) Chiton, prawn and cockroach
- 82** Which one of the following animals is called a living fossil?  
 (a) King locust (b) *Limulus*  
 (c) *Bombyx* (d) *Balanoglossus*
- 83** Which one of the following insects is not of any economic benefit?  
 (a) Silkworm (b) Lac insect  
 (c) Locust (d) Honeybee
- 84** The second largest number of species containing phylum after phylum–Arthropoda in the animal kingdom is  
 (a) Annelida (b) Cnidaria  
 (c) Mollusca (d) Chordata
- 85** What is true about Mollusca?  
 (a) The presence of metameric segmentation  
 (b) The presence of mantle cavity and coelom cavity  
 (c) The presence of tissue level of organisation  
 (d) The presence of chitinous exoskeleton
- 86** The animal's body belonging to phylum–Mollusca is divided into  
 (a) head, thorax and abdomen  
 (b) head, muscular foot and abdomen  
 (c) head, thorax and visceral hump  
 (d) head, muscular foot and visceral hump
- 87** The feeding organ in phylum–Mollusca is  
 (a) ctenedia (b) undulating membrane  
 (c) sucker (d) radula
- 88** Radula is a part of which animal?  
 (a) *Loligo* (b) *Merceneria*  
 (c) Oysters (d) *Angopecten*
- 89** Choose the incorrect option for phylum–Mollusca.  
 (a) Body is covered by a calcareous shell and unsegmented  
 (b) Feather-like gills present for excretion and respiration  
 (c) The anterior head region has sensory tentacles  
 (d) Mostly terrestrial, triploblastic and acoelomates
- 90** Which of the following is incorrect match?  
 (a) *Dentalium* – Tusk shell (b) *Sepia* – Cuttle fish  
 (c) Chiton – *Pila* (d) *Loligo* – Squid
- 91** Development of Mollusca is similar to annelids. This can be concluded as both have  
 (a) larvae named trochophore  
 (b) direct development without larval stages  
 (c) larval stage called glochidium only  
 (d) larval stage called wriggler
- 92** Most advanced invertebrates are  
 (a) arthropods (b) annelids  
 (c) molluscs (d) cephalopods
- 93** Which of the following phyla has no freshwater forms?  
 (a) Echinodermata (b) Mollusca  
 (c) Chordata (d) Porifera
- 94** Excretory organs in echinoderms is  
 (a) nephridia (b) green glands  
 (c) flame cells (d) None of these
- 95** Characteristic feature of phylum–Echinodermata is  
 (a) radial symmetry (b) water vascular system  
 (c) mantle cavity (d) All of these
- 96** Which of the following is/are function(s) of water vascular system in echinoderms?  
 (a) Locomotion  
 (b) Respiration  
 (c) Capture and transport of food  
 (d) All of the above
- 97** Scientific name of starfish is  
 (a) *Echinus* (b) *Limulus* (c) *Echidna* (d) *Asterias*
- 98** Choose the animals that belongs to phylum–Echinodermata from the options.  
 (a) Sea urchin, cuttlefish and sea lily  
 (b) *Echinus*, sea hare and sea cucumber  
 (c) *Antedon*, *Ophiura* and *Echinus*  
 (d) *Ophiura*, *Chaetopleura* and *Echinus*
- 99** Find the odd one.  
 (a) Sea lily (*Antedon*) (b) Sea hare (*Aplysia*)  
 (c) Sea cucumber (*Cucumaria*) (d) Sea urchin (*Echinus*)



100 Choose the correct names for the following.



- |     | A        | B         | C              | D               |
|-----|----------|-----------|----------------|-----------------|
| (a) | Scorpion | Prawn     | <i>Loligo</i>  | <i>Asterias</i> |
| (b) | Scorpion | Prawn     | <i>Octopus</i> | <i>Ophiura</i>  |
| (c) | Locust   | Butterfly | <i>Loligo</i>  | <i>Asterias</i> |
| (d) | Locust   | Prawn     | Squid          | <i>Ophiura</i>  |

101 Which one of the following animals does not undergo metamorphosis?

- (a) Moth                                      (b) Tunicate  
(c) Earthworm                                (d) Starfish

102 In which one of the following, the genus name, its two characters and its phylum are not correctly matched, whereas the remaining three are correct?

Genus Name	Two Characters	Phylum
(a) <i>Pila</i>	(i) Body segmented (ii) Mouth with radula	Mollusca
(b) <i>Asterias</i>	(i) Spiny skinned (ii) Water vascular system	Echinodermata
(c) <i>Sycon</i>	(i) Pore bearing (ii) Canal system	Porifera
(d) <i>Periplaneta</i>	(i) Jointed appendages (ii) Chitinous exoskeleton	Arthropoda

103 An important characteristic that hemichordates share with chordates is

- (a) absence of notochord    (b) ventral tubular nerve cord  
(c) pharynx with gill slits    (d) pharynx without gill slits

104 Excretory organ in phylum–Hemichordata is

- (a) proboscis gland                      (b) gills  
(c) collar cells                            (d) None of these

105 The correct classification of given animal is



- (a) Chordata – Vertebrata – Craniata  
(b) Chordata – Craniata  
(c) Chordata – Acraniata  
(d) Non-chordata – Hemichordata

106 The body of *Balanoglossus* is divisible into

- (a) proboscis, tunic and trunk  
(b) collar, trunk and tunic  
(c) proboscis, collar and trunk  
(d) proboscis, stomochord and trunk

107 Select the feature(s) which is/are present in hemichordates.

- (a) Stomochord                              (b) Worm-like body  
(c) Gills                                        (d) All of these

### SPECIAL FORMAT QUESTIONS

1 Which of the following statements is true?

- (a) Phylum–Porifera – Presence of choanocytes and nematocysts  
(b) Phylum–Coelenterata – *Meandrina* belongs to this phylum  
(c) Phylum–Ctenophora – All exhibit bilateral symmetry only  
(d) Phylum–Platyhelminthes – *Wuchereria* belongs to this phylum

2 Which statement is incorrect about *Pleurobrachia*?

- (a) They are diploblastic  
(b) They have tissue level organisation  
(c) They have comb plates  
(d) They show asexual and sexual reproduction

3 Which one of the following statements about certain given animals is correct?

- (a) Roundworms are pseudocoelomates  
(b) Molluscs are acoelomates  
(c) Insects are pseudocoelomates  
(d) Flatworms are coelomates

4 Mark the false statement for the phylum–Annelida.

- (a) They are bilaterally symmetrical coelomate animals  
(b) They have both monoecious and dioecious animal representatives  
(c) Excretory system consists of flame cells  
(d) They do not show asexual reproduction generally

5 Which of the following statements is false?

- (a) Male roundworm is smaller than female  
(b) Earthworms are hermaphrodites  
(c) Echinoderms are protostomous coelomates  
(d) Human teeth are anatomically comparable to scales of shark

- 6 Which of the following statements represents the incorrect feature of Echinodermata?
- They are triploblastic and coelomate animals
  - All are marine with cellular level of organisation
  - Endoskeleton of calcareous ossicle
  - None of the above

- 7 Choose the correct statement for the following animals.



(A)



(B)



(C)



(D)

- All these animals are aquatic, free-living
  - All are true coelomates
  - 'A' has radial symmetry, but remaining have bilateral symmetry
  - 'A' is monoecious, but remaining are dioecious
- 8 Consider the following features.
- Organ system level of organisation
  - Bilateral symmetry
  - True coelomates with segmentation of body
- Select the correct option of animal groups which possess all the above characteristics.
- Annelida, Arthropoda and Mollusca
  - Arthropoda, Mollusca and Chordata
  - Annelida, Mollusca and Chordata
  - Annelida, Arthropoda and Chordata
- 9 Which of the following statements are true/false?
- In higher phyla, cellular level of organisation is seen.
  - Phylum-Platyhelminthes have cellular level of organisation.
  - Cellular level of organisation is seen when the cells are not arranged as loose cell aggregates.
  - Molluscs exhibit tissue level of organisation.
- Choose the correct option from the following.
- I and II are true, but III and IV are false
  - All statements are false
  - All statements are true
  - III and IV are true, but I and II are false
- 10 Which of the following statements are true/false?
- Cell aggregate body plan is found in phylum-Platyhelminthes.
  - Radial symmetry is the most common symmetry found in animals.
  - Pseudocoelom is found only in phylum-Aschelminthes.
  - All triploblastic animals have a true coelom.

V. Haemocoel is sometimes observed in animals belong to phylum-Platyhelminthes.

- I and V are true and II, III and IV are false
  - II, III and V are true and I and IV are false
  - I, II and III are true and IV and V are false
  - I, II, IV and V are false, Only III is true
- 11 Some of the statements are given below.
- Porifera to Echinodermata lack a notochord.
  - Platyhelminthes display tissue level organisation.
  - Mesoglea is present in coelenterates during development.
  - Aschelminthes are coelomates (pseudocoelomates).
- Choose the option containing the correct statements.
- I, II, III and IV
  - I and II
  - I, III and IV
  - II and III
- 12 Which of the following is not a characteristic of phylum-Porifera?
- Development is indirect (larval stage is present).
  - Mostly asymmetrical and usually marine.
  - Primitive multicellular animals with cellular level of organisation.
  - Choanocytes lines the spongocoel and the canals.
  - Sexes are separate.
- I and IV
  - Only II
  - Only V
  - III and IV
- 13 Which of the option is correct for the statements given below?
- Commonly called sea walnuts or comb jellies.
  - Bioluminescence is well-marked.
  - Body bear eight external rows of ciliated comb plates.
  - Have flame cells for osmoregulation and excretion.
  - Alimentary canal is complete with a well-developed muscular pharynx.

	Ctenophores	Platyhelminthes	Aschelminthes
(a)	I, II, III	IV	V
(b)	IV	I, II	III, V
(c)	I, II	III, IV	V
(d)	IV, V	II, III	I

- 14 Consider the following statements.
- Triploblastic, bilateral symmetry.
  - Metamerically segmented and coelomate animals.
  - Dioecious
  - Closed circulatory system.
  - Lateral appendages.
  - Annelida

Which of the following information belongs to the given figure?

- I, II, IV and VI
- I, III, IV and V
- I, III, IV and V
- III, IV, V and VI



- 15** Choose the correct statement for starfish.
- I. Sexes are separate and reproduction is sexual.
  - II. Development is indirect with free-swimming larva.
  - III. Mouth is present on the upper (dorsal) side and anus on the lower (ventral) side.
  - IV. Their body bears jaw-like structure which are called oral arms.
- (a) I and III                      (b) I, II and IV  
(c) I, II and III                (d) III and IV

- 16** Choose the correct option for *Wuchereria*?
- I. Triploblastic with the presence of an excretory pore.
  - II. The presence of a muscular pharynx.
  - III. Males longer than females.
  - IV. Cellular level of organisation.
- (a) II and III                      (b) I and IV  
(c) I and II                        (d) III and IV

- 17** Which of the following statements are true?
- I. Molluscs possess cellular level of organisation.
  - II. Arthropods are true coelomates.
  - III. Platyhelminths are pseudocoelomates.
  - IV. Ctenophores have bilateral symmetry.
- Choose the correct option.
- (a) I and II                        (b) Only II  
(c) I and IV                       (d) II, III and IV

- 18** Consider the following statements about arthropods.
- I. Open circulatory system is found in most arthropods.
  - II. Arthropods contain haemolymph which directly bathes the internal tissues and organs.
- (a) I is true, but II is false  
(b) I is false, but II is true  
(c) Both I and II are true  
(d) Both I and II are false

- 19** Consider the following statements.
- I. Lancelets are jawless, primitive fish-like vertebrates.
  - II. In lancelets, notochord, tubular nerve cord and pharyngeal gill slits are present throughout their life.
- (a) I is true, but II is false  
(b) I is false, but II is true  
(c) Both I and II are true  
(d) Both I and II are false

**20.** Match the following columns.

Column I (Level of organisation)	Column II (Animal phyla)
A. Cellular level of organisation	1. Cnidarians
B. Organ level of organisation	2. Platyhelminthes
C. Organ system level of organisation	3. Chordates
D. Tissue level of organisation	4. Porifera

**Codes**

A	B	C	D	A	B	C	D
(a) 4	2	3	1	(b) 2	1	4	3
(c) 3	2	4	1	(d) 4	2	1	3

**21** Match the following organisms with their respective characteristics.

Column I	Column II
A. <i>Pila</i>	1. Flame cells
B. <i>Bombyx</i>	2. Comb plates
C. <i>Pleurobrachia</i>	3. Radula
D. <i>Taenia</i>	4. Malpighian tubules

**Codes**

A	B	C	D	A	B	C	D
(a) 3	4	2	1	(b) 2	4	3	1
(c) 3	2	4	1	(d) 3	2	1	4

**22** Match the following genera with their respective phylum

Column I	Column II
A. <i>Ophiura</i>	1. Mollusca
B. <i>Physalia</i>	2. Platyhelminthes
C. <i>Pinctada</i>	3. Echinodermata
D. <i>Planaria</i>	4. Coelenterata

**Codes**

A	B	C	D	A	B	C	D
(a) 4	1	3	2	(b) 3	4	1	2
(c) 1	3	4	2	(d) 3	4	2	1

**23** Match the items in Column I with those in Column II and choose the correct option from the codes given below.

Column I	Column II
A. Podocytes	1. Crystallised oxalates
B. Protonephridia	2. Annelids
C. Nephridia	3. <i>Amphioxus</i>
D. Renal calculi	4. Filtration slits

**Codes**

A	B	C	D	A	B	C	D
(a) 3	4	2	1	(b) 3	2	4	1
(c) 4	3	2	1	(d) 4	2	3	1

**24 Match the following columns.**

Column I (Specialised cell or part)	Column II (Animal phylum)
A. Choanocytes	1. Platyhelminthes
B. Cnidoblasts	2. Ctenophora
C. Flame cells	3. Porifera
D. Nephridia	4. Coelenterata
E. Comb plates	5. Annelida

**Codes**

	A	B	C	D	E
(a)	2	1	4	5	3
(b)	2	4	1	5	3
(c)	5	1	3	2	4
(d)	3	4	1	5	2

**25 Match the following columns.**

Column I (Cnidarian)	Column II (Common names)
A. <i>Pennatula</i>	1. Brain coral
B. <i>Meandrina</i>	2. Sea fan
C. <i>Gorgonia</i>	3. Sea pen
D. <i>Adamsia</i>	4. Sea anemone

**Codes**

	A	B	C	D	A	B	C	D
(a)	3	1	2	4	(b)	1	3	2
(c)	2	4	1	3	(d)	2	3	4

**26 Match the following columns.**

Column I (Scientific names)	Column II (Common names)
A. <i>Physalia</i>	1. Liver fluke
B. <i>Taenia</i>	2. <i>Scypha</i>
C. <i>Fasciola</i>	3. Tapeworm
D. <i>Sycon</i>	4. Portuguese man of war

**Codes**

	A	B	C	D	A	B	C	D
(a)	2	1	3	4	(b)	4	3	1
(c)	1	3	2	4	(d)	1	2	3

**27 Match the following columns.**

Column I (Common name of arthropodes)	Column II (Scientific names)
A. Honeybee	1. <i>Aedes</i>
B. Mosquito	2. <i>Apis</i>
C. Lac insect	3. <i>Laccifer</i>
D. Silkworm	4. <i>Bombyx</i>

**Codes**

	A	B	C	D	A	B	C	D
(a)	1	2	3	4	(b)	3	1	2
(c)	2	1	3	4	(d)	4	1	3

**28. Match the following columns.**

Column I (Scientific names)	Column II (Common names)
A. <i>Ancylostoma</i>	1. Hookworm
B. <i>Wuchereria</i>	2. Filaria worm
C. <i>Ascaris</i>	3. Roundworm
D. <i>Fasciola</i>	4. Liver fluke
	5. Flatworms

**Codes**

	A	B	C	D	A	B	C	D
(a)	1	4	3	5	(b)	2	5	1
(c)	4	1	5	3	(d)	1	2	3

**29 Match the following columns.**

Column I (Parts/organs)	Column II (Functions)
A. Statocysts	1. Radiating plates
B. Radula	2. Respiratory function
C. Gills	3. Organs of balance
D. Tentacles	4. Sensory organs
	5. Organs of feeding
	6. Organs of locomotion

**Codes**

	A	B	C	D	A	B	C	D
(a)	4	1	3	6	(b)	3	5	2
(c)	4	1	5	6	(d)	2	3	5

**30 Match the following columns.**

Column I (Animals)	Column II (Common names)
A. <i>Loligo</i>	1. Cuttlefish
B. <i>Aplysia</i>	2. Chiton
C. <i>Sepia</i>	3. Pearl oyster
D. <i>Chaetopleura</i>	4. Tusk shell
E. <i>Pinctada</i>	5. Squid
	6. Sea hare

**Codes**

	A	B	C	D	E
(a)	6	3	1	4	5
(b)	5	4	6	2	3
(c)	4	5	3	1	6
(d)	5	6	1	2	3

**31 Match the following columns.**

Column I (Parts/cells)	Column II (Features)
A. Thesocytes	1. Spongin fibres
B. Gemmules	2. Food storing cells
C. Osculum	3. Involved in reproduction
D. Spicules	4. Collar cells
	5. Water exits the spongocoel through this structure

**Codes**

	A	B	C	D	E
(a)	6	3	1	4	5
(b)	5	4	6	2	3
(c)	4	5	3	1	6
(d)	5	6	1	2	3

31 Match the following columns.

Column I (Parts/cells)	Column II (Features)
A. Thecoocytes	1. Spongin fibres
B. Gemmules	2. Food storing cells
C. Osculum	3. Involved in reproduction
D. Spicules	4. Collar cells
	5. Water exits the spongocoel through this structure

Codes

	A	B	C	D
(a)	1	2	3	4
(b)	3	1	4	5
(c)	2	3	4	1
(d)	2	3	5	1

32 Match the following columns.

Column I (Characteristics)	Column II (Animals)
A. Diploblastic, radial symmetry and tissue level organisation	1. <i>Wuchereria</i>
B. Triploblastic, pseudocoelomates and complete digestive system	2. <i>Dugesia</i>
C. Bilateral symmetry, incomplete digestive system, organ and organ system level of organisation	3. <i>Cucumaria</i>
D. Triploblastic, coelomate, radial symmetry	4. <i>Balanoglossus</i>
	5. <i>Hydra</i>

Codes

	A	B	C	D
(a)	2	1	4	5
(b)	3	2	1	5
(c)	4	3	2	5
(d)	5	1	2	3

33 Match the following columns.

Column I (Animal phyla)	Column II (Development)	Column II (Fertilisation)
A. Porifera	(i) Direct	(1) External
B. Ctenophora	(ii) Indirect	(2) Internal
C. Aschelminthes	(iii) Both direct and indirect	(3) Both external and internal
D. Arthropoda		
E. Echinodermata		
F. Hemichordata		

Codes

	A	B	C	D	E	F
(a)	ii, 2	ii, 1	iii, 2	iii, 2	ii, 1	ii, 1
(b)	i, 1	ii, 2	iii, 2	iii, 2	iii, 1	iii, 1
(c)	ii, 1	ii, 1	iii, 2	iii, 2	ii, 1	ii, 1
(d)	iii, 1	ii, 2	ii, 3	iii, 2	i, 2	i, 2

34 Match the following columns.

Column I (Parts)	Column II (Description)
A. Hypostome or manubrium	1. The oral tip surrounded by tentacles in <i>Hydra</i>
B. Muscular pharynx	2. Present in Aschelminthes to ingest food.
C. Radula	3. Rasping organ for feeding in <i>Pinetada</i>
D. Malpighian tubules	4. Excretory organ in cockroach

Codes

	A	B	C	D
(a)	1	2	3	4
(b)	4	3	2	1
(c)	2	1	4	3
(d)	3	4	2	1

## NCERT EXEMPLAR PROBLEMS

- In some animal groups, the body is found divided into compartments with serial repetition of at least some organs. This characteristic feature is called
  - Segmentation
  - Metamerism
  - Metagenesis
  - Metamorphosis
- Given below are types of cells present in some animals. Which of the following cells can differentiate to perform different functions?
  - Choanocytes
  - Interstitial cells
  - Gastrodermal cells
  - Nematocytes
- Which one of the following sets of animals belong to a single taxonomic group?
  - Cuttlefish, Jellyfish, Silverfish, Dogfish, Starfish
  - Bat, Pigeon, Butterfly
  - Monkey, Chimpanzee, Man
  - Silkworm, Tapeworm, Earthworm

4. Which one of the following statements is incorrect?
- Mesoglea is present in between ectoderm and endoderm in *Obelia*.
  - Exhibits radial symmetry *Asterias*
  - Fasciola* is a pseudocoelomate animal
  - Taenia* is a triploblastic animal

5. Which one of the following statements is incorrect?
- In cockroaches and prawns excretion of waste material occurs through malpighian tubules.
  - In ctenophores, locomotion is mediated by comb plates.
  - In *Fasciola*, flame cells help in excretion
  - Earthworms are hermaphrodites and yet cross fertilization take place among them.

6. Match the following list of animals with their level of organisation.

Division of Labour	Animal
Column I	Column II
A. Organ level	i. <i>Pheretima</i>
B. Cellular aggregate level	ii. <i>Fasciola</i>
C. Tissue level	iii. <i>Spongilla</i>
D. Organ system level	iv. <i>Obelia</i>

Choose the correct match showing division of labour with animal example.

- i-B, ii-C, iii-D, and iv-A
  - i-B, ii-D, iii-C, and iv-A
  - i-D, ii-A, iii-B, and iv-C
  - i-A, ii-D, iii-C, and iv-B
7. Body cavity is the cavity present between body wall and gut wall. In some animals the body cavity is not lined by mesoderm. Such animals are called
- Acoelomates
  - Pseudocoelomates
  - Coelomates
  - Haemocoelomates

8. Match the column A with column B and choose the correct option

Column I	Column II
A. Porifera	i. Canal system
B. Aschelminthes	ii. Water-vascular system
C. Annelida	iii. Muscular pharynx
D. Arthropoda	iv. Jointed appendages
E. Echinodermata	v. Metameres

- A-ii, B-iii, C-v, D-iv, E-i
- A-ii, B-v, C-iii, D-iv, E-i
- A-i, B-iii, C-v, D-iv, E-ii
- A-i, B-v, C-iii, D-iv, E-ii

## NEET PREVIOUS QUESTIONS

1. Bilaterally symmetrical and acoelomate animals are exemplified by  
 (a) ctenophora (b) platyhelminthes  
 (c) aschelminthes (d) annelida. (NEET 2020)

2. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	Gregarious, polyphagous pest	(i)	<i>Asterias</i>
(B)	Adult with radial symmetry and larva with bilateral symmetry	(ii)	Scorpion
(C)	Book lungs	(iii)	<i>Ctenoplana</i>
(D)	Bioluminescence	(iv)	<i>Locusta</i>

- (A) (B) (C) (D)  
 (a) (i) (iii) (ii) (iv)  
 (b) (iv) (i) (ii) (iii)  
 (c) (iii) (ii) (i) (iv)  
 (d) (ii) (i) (iii) (iv) (NEET 2020)

3. Consider following features.  
 (A) Organ system level of organisation  
 (B) Bilateral symmetry  
 (C) True coelomates with segmentation of body  
 Select the correct option of animal groups which possess all the above characteristics.  
 (a) Annelida, Mollusca and Chordata  
 (b) Annelida, Arthropoda and Chordata  
 (c) Annelida, Arthropoda and Mollusca  
 (d) Arthropoda, Mollusca and Chordata (NEET 2019)

4. Which of the following animals are true coelomates with bilateral symmetry?  
 (a) Adult Echinoderms  
 (b) Aschelminthes  
 (c) Platyhelminthes  
 (d) Annelids (Odisha NEET 2019)

5. Match the following organisms with respective characteristics.  
 (A) *Pila* (i) Flame cells  
 (B) *Bombyx* (ii) Comb plates  
 (C) *Pleurobrachia* (iii) Radula  
 (D) *Taenia* (iv) Malpighian tubules  
 Select the correct option from the following.

- (A) (B) (C) (D)  
 (a) (iii) (ii) (iv) (i)  
 (b) (iii) (ii) (i) (iv)  
 (c) (iii) (iv) (ii) (i)  
 (d) (ii) (iv) (iii) (i) (NEET 2019)

6. Match the following genera with their respective phylum.  
 (1) *Ophiura* (i) Mollusca  
 (2) *Physalia* (ii) Platyhelminthes  
 (3) *Pinctada* (iii) Echinodermata  
 (4) *Planaria* (iv) Coelenterata

- Select the correct option.  
 (a) (1)-(iv), (2)-(i), (3)-(iii), (4)-(ii)  
 (b) (1)-(iii), (2)-(iv), (3)-(i), (4)-(ii)  
 (c) (1)-(i), (2)-(iii), (3)-(iv), (4)-(ii)  
 (d) (1)-(iii), (2)-(iv), (3)-(ii), (4)-(i)

(Odisha NEET 2019)

7. Which of the following animals does not undergo metamorphosis?  
 (a) Earthworm (b) Tunicate  
 (c) Moth (d) Starfish (NEET 2018)
8. Important characteristic that hemichordates share with chordates is  
 (a) ventral tubular nerve cord  
 (b) pharynx with gill slits  
 (c) pharynx without gill slits  
 (d) absence of notochord. (NEET 2017)
9. In case of poriferans, the spongocoel is lined with flagellated cells called  
 (a) oscula (b) choanocytes  
 (c) mesenchymal cells (d) ostia. (NEET 2017)
10. Which of the following features is not present in the Phylum Arthropoda?  
 (a) Parapodia  
 (b) Jointed appendages  
 (c) Chitinous exoskeleton  
 (d) Metameric segmentation (NEET-I 2016)
11. Body having meshwork of cells, internal cavities lined with food filtering flagellated cells and indirect development are the characteristics of Phylum  
 (a) Mollusca (b) Protozoa  
 (c) Coelenterata (d) Porifera. (2015)
12. Metagenesis refers to  
 (a) occurrence of a drastic change in form during post-embryonic development  
 (b) presence of a segmented body and parthenogenetic mode of reproduction  
 (c) presence of different morphic forms  
 (d) alternation of generation between asexual and sexual phases of an organism. (2015)
13. Select the taxon mentioned that represents both marine and fresh water species.  
 (a) Echinoderms (b) Ctenophora  
 (c) Cephalochordata (d) Cnidaria (2014)
14. *Planaria* possesses high capacity of  
 (a) metamorphosis  
 (b) regeneration  
 (c) alternation of generation  
 (d) bioluminescence. (2014)
15. Which group of animals belong to the same phylum?  
 (a) Prawn, Scorpion, *Locusta*  
 (b) Sponge, Sea anemone, Starfish  
 (c) Malarial parasite, *Amoeba*, Mosquito  
 (d) Earthworm, Pinworm, Tapeworm (NEET 2013)

17. Match the name of the animal (column I), with one characteristic (column II) and the phylum/ class (column III) to which it belongs.

Column I	Column II	Column III
(a) <i>Limulus</i>	Body covered by chitinous exoskeleton	Pisces
(b) <i>Adamsia</i>	Radially symmetrical	Porifera
(c) <i>Petromyzon</i>	Ectoparasite	Cyclostomata
(d) <i>Ichthyophis</i>	Terrestrial	Reptilia

(NEET 2013)

### AIIMS PREVIOUS QUESTIONS

- Which of the following pairs of organisms, possess stinging cells (nematocytes)? [AIIMS 2013]
  - Sea fan and Sea pen
  - Cobra and Scorpion
  - Cockroach and Mosquito
  - Wasp and Honey bee
- Find out the correct option regarding following organisms; Fasci a: *Ascaris*: *Periplantea* [AIIMS 2014]
  - Except *Fasciola*, rest all have a complete digestive system
  - Ascaris* and *Nereis* have internal fertilisation
  - Except *Ascaris* all others show metamerism
  - Periplaneta* has compound eyes rest others have simple eyes
- Which of the following is correct match ? [AIIMS 2014]
  - Human and Frog – Nucleated RBC
  - Ascaris* and Liver fluke-Internal Fertilisation
  - Earthworm and cockroach -sexual dimorphism
  - Neres* and *Hydra*- Segmented body
- Which of the following is a correct match :- [AIIMS 2016]

	Animal	Phylum	Chracters
(1)	<i>Balanoglossus</i>	Hemichordata	Internal fertilisation, sexes are separate
(2)	<i>Aplysia</i>	Mollusca	Segmented body
(3)	<i>Pristis</i>	Porifera	Spicules skeleton
(4)	<i>Pleurobrachia</i>	Ctenophora	Tissue level organisation, Diploblastic

- Which one is incorrect ? [AIIMS 2016]



	<b>Animals</b>	<b>Habitat</b>
(1)	Cockroach	Drain and sewage
(2)	Sea urchin	Deep sea
(3)	Star fish	Sea rocks
(4)	Earthworm	Dry soil and leaves

6. Which of the following option is correct regarding animal kingdom? [AIIMS 2017]

<b>S. No.</b>	<b>Phylum</b>	<b>Symmetry</b>	<b>Example</b>	<b>Characteristic property</b>
(1)	Coelenterata	Bilateral	Hydra	Aquatic, Marine
(2)	Annelida	Bilateral	Ancylostoma	Hooks and Suckers present
(3)	Platyhelminthes	Bilateral	Planaria	High regeneration capacity
(4)	Mollusca	Radial	Pinctada	Aquatic

7. Which of the following is correctly matched with its characters? [AIIMS 2018]

	<b>Animal</b>	<b>Phylum</b>	<b>Character</b>
(1)	<i>Planaria</i>	Platyhelminthes	Regeneration
(2)	<i>Pleurobrachia</i>	Cnidaria	Comb plate
(3)	<i>Adamsia</i>	Annelida	Cnidoblast
(4)	<i>Pheretima</i>	Aschelminthes	Flame cell

8. Which of the following is correct ? [AIIMS 2018]

- (1) Mollusca - Pila, Radial symmetry
- (2) Fascia - Coelomate, Triploblastic
- (3) Adamsia - Metagenesis, Bilateral symmetry
- (4) Porifera - Sycon, Asymmetrical

9. Which of the following shows metamorphosis? [AIIMS 2013]

- (1) Nereis
- (2) Earthworm
- (3) Cockroach
- (4) Leech

10. Find the incorrect match :- [AIIMS 2018]

- (1) Platyhelminthes - Bilateral symmetry
- (2) Aschelminthes - Asymmetrical
- (3) Cnidaria - Radial symmetry
- (4) Annelida - Bilateral symmetry

## KEY

### MULTIPLE CHOICE QUESTIONS

1 (d)	2 (c)	3 (d)	4 (c)	5 (d)	6 (c)	7 (b)	8 (b)	9 (c)	10 (c)	11 (a)	12 (b)	13 (b)	14 (a)	15 (c)
16 (c)	17 (c)	18 (b)	19 (d)	20 (d)	21 (b)	22 (d)	23 (a)	24 (d)	25 (d)	26 (c)	27 (a)	28 (c)	29 (c)	30 (d)
31 (a)	32 (a)	33 (c)	34 (c)	35 (b)	36 (b)	37 (b)	38 (c)	39 (b)	40 (c)	41 (d)	42 (d)	43 (b)	44 (b)	45 (c)
46 (c)	47 (b)	48 (c)	49 (d)	50 (a)	51 (a)	52 (b)	53 (a)	54 (b)	55 (d)	56 (c)	57 (c)	58 (a)	59 (b)	60 (a)
61 (c)	62 (a)	63 (c)	64 (b)	65 (b)	66 (b)	67 (c)	68 (d)	69 (d)	70 (b)	71 (d)	72 (d)	73 (d)	74 (c)	75 (b)
76 (b)	77 (c)	78 (b)	79 (d)	80 (b)	81 (b)	82 (b)	83 (c)	84 (c)	85 (b)	86 (d)	87 (d)	88 (a)	89 (d)	90 (c)
91 (a)	92 (d)	93 (a)	94 (d)	95 (b)	96 (d)	97 (d)	98 (c)	99 (b)	100 (b)	101 (c)	102 (a)	103 (c)	104 (a)	105 (d)

106 (c) 107(d)

### SPECIAL FORMAT QUESTIONS

1	b	8	d	15	a	22	a	29	d
2	d	9	d	16	b	23	b	30	d
3	a	10	b	17	c	24	c	31	b
4	c	11	d	18	b	25	d	32	d
5	c	12	c	19	c	26	a	33	d
6	d	13	c	20	c	27	b	34	a
7	d	14	a	21	a	28	c	35	a

### NCERT EXEMPLAR PROBLEMS

1	b	4	a	7	b
2	b	5	a	8	c
3	c	6	c		

### NEET PREVIOUS QUESTIONS

1	b	5	c	9	b	13	d	17	c
2	b	6	b	10	a	14	b		
3	b	7	a	11	d	15	a		
4	d	8	b	12	d	16	a		

### AIIMS PREVIOUS QUESTIONS

1	a	4	d	7	a	10	b
2	a	5	d	8	a		
3	b	6	c	9	a		



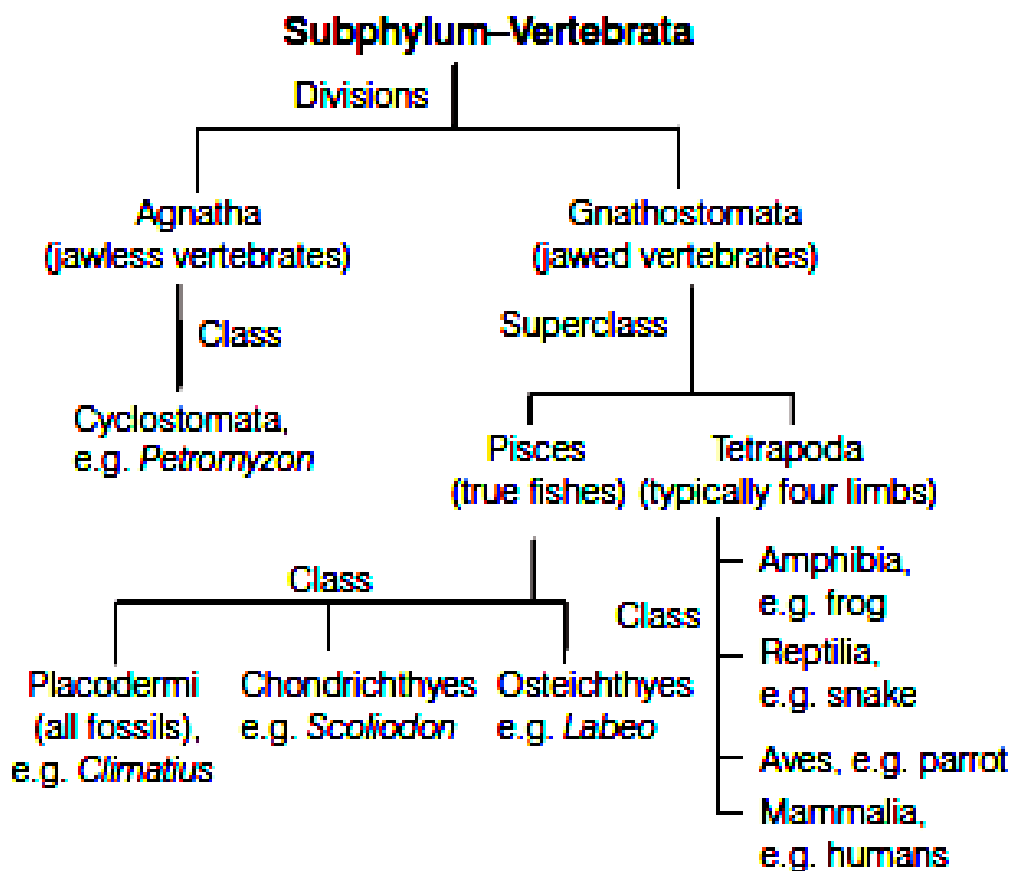
**UNIT-IV**  
**ANIMAL DIVERSITY-II**  
**(Chordata phylum)**

# SYNOPSIS

## I. Phylum–Chordata

These have **notochord, dorsal hollow nerve chord, paired pharyngeal gill slits** and post-anal tail at some stages of life. They are divided into following subphyla

- **Urochordata** (tunicates) Notochord is present only in larval tail, e.g. *Herdmania*.
- **Cephalochordata** (lancelets) Notochord persists throughout life and extends from head to tail, e.g. *Branchiostoma*.
- **Note** Urochordata and Cephalochordata are often referred to as **protochordata**.
- **Vertebrata** (vertebrates) Notochord replaced by vertebral column in adults.



✚ Some Major Classes of Vertebrates Characteristic features of some major classes of subphylum– Vertebrata are as follows

### 1. Class–Cyclostomata

- These are ectoparasites on some fishes, have 6-15 pairs of
- **gill slits**.
- Sucking and circular mouth without jaws. These possess sucktorial tongue that bears horny teeth.
- Cranium and vertebral column are cartilaginous.
- They die after spawning and their larvae return to ocean after metamorphosis, e.g. lamprey, hagfish.

## 2. Class–Chondrichthyes

- These are cartilaginous fishes.
- **Notochord** is well-developed and **persists** throughout life.
- Mouth is on the ventral side and teeth are modified
- **placoid scales**.
- Heart two-chambered, ureotelic animals, sexes are separate, males usually have claspers for copulation, e.g. sharks (*Carcharodon* and *Sphyrna*), sting rays (*Trygon*), etc.
- Some have **electric organs** (e.g. *Torpedo*) and others have **poison sting** (e.g. *Trygon*). They are poikilothermous (cold blooded, i.e. they lack the capacity to regulate their body temperature) animals. Possess uncovered gills and five pairs of gill slits and tough skin containing minute placoid scales.
- Some are predaceous (e.g. sharks).
- Sexes are separate and fertilisation is internal. Many are viviparous, e.g. *Carcharodon*, *Sphyrna*, etc.

## 3. Class–Osteichthyes

- These are marine as well as freshwater bony fishes.
- Four pairs of filamentous gills, covered by **operculum** (gill cover) are present. Exoskeleton with **cycloid** or **ctenoid** scales.
- They contain **air bladder** that regulates buoyancy.
- Heart is two-chambered and mostly of these are ammonotelic.
- Sexes are separate and development is direct. Mostly they are oviparous.
- Fertilisation external, e.g. *Labeo*, *Catla*, *Clarias*, etc.

## 4. Class–Amphibia

- These are the first terrestrial organisms and can live in both aquatic and terrestrial habitats. These are poikilothermic, ectothermic or cold-blooded.
- Body is divided into **head** and **trunk**. Tail may be present in some.
- Heart is three-chambered. These have mesonephric kidneys and mostly are ureotelic.
- Alimentary canal, urinary and reproductive tracts open into **cloaca**.
- Respiration occurs by gills, lungs, lining of buccopharyngeal cavity and moist skin, either, separately or in combination.
- **Tympanum** represents the ear.
- The eyes have eyelids and inner and middle ears represent the ear. Fertilisation is external. These are oviparous and the development is direct, e.g. *Salamandra*, *Rana* (Frog).

## 5. Class–Reptilia

- They show creeping or crawling movements and are mostly terrestrial.
- They are poikilothermic, exothermal or cold-blooded animals.
- Body covered by dry epidermal and cornified
- **scutes** or **scales** and their skin lacks glands.
- Kidney is metanephric. Crocodiles are ammonotelic, turtles and alligators are ureotelic and lizards and snakes are uricotelic.
- Bony endoskeleton, well-developed digestive system, respiration through lungs (in turtles through cloaca), heart is three-chambered (except in crocodiles that have four-chambered heart).
- Sexes are separate and fertilisation is internal. They are oviparous and show direct development, e.g. *Chameleon*, *Gavialis*.

## 6. Class–Aves

- These animals are characterised by the presence of feathers that act as insulator and help in flight. Body is streamlined.
- They possess beak and forelimbs that are modified into wings.
- They are endothermal and warm-blooded (homeothermous) animals.
- Bony endoskeleton, feathery exoskeleton metanephric kidneys and have pneumatic bones (with air cavities).
- Digestive tract contains crop and gizzard. Heart is four-chambered and respiration occurs through lungs. These are uricotelic and have a special voice producing organ called syrinx.
- Sexes are separate. Fertilisation is internal. They are oviparous and show direct development, e.g. crow, pigeon.

## 7. Class–Mammalia

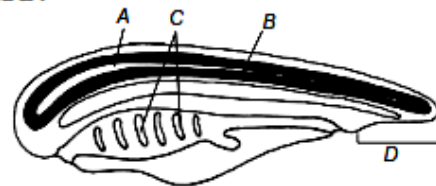
- These are characterised by the presence of milk producing mammary glands and give birth to young ones, i.e. show viviparity.
- They have two pairs of limbs and are adapted to fly (bat) or live in water (whale) or are terrestrial (horse, camel and human).
- They are homeothermal and the skin is covered with
- hairs and have external ears or pinnae.
- Body is divisible into head, neck, trunk and tail. The heart is four-chambered and respiration occurs through lungs.
- Sexes are separate, fertilisation is internal and development is direct, e.g. platypus, kangaroo, camel, etc.

## MULTIPLE CHOICE QUESTIONS

- 1 Which of the following is not found in the phylum–Chordata?  
(a) A dorsal hollow nerve cord  
(b) Lateral paired gill slits during development  
(c) A notochord at some stage of development  
(d) An external skeleton
- 2 All chordates have the following characteristics.  
(a) Bilaterally symmetrical, presence of coelom, triploblastic, open circulatory system  
(b) Bilaterally symmetrical, presence of coelom, diploblastic or triploblastic  
(c) Open circulatory system, diploblastic or triploblastic, coelom and bilaterally symmetrical  
(d) Bilaterally symmetrical, coelom present, triploblastic with closed circulatory system
- 3 Phylum–Chordata is divided into subphyla namely  
(a) Vertebrata, Protochordata and Urochordata  
(b) Urochordata, Gnathochordata and Vertebrata  
(c) Urochordata, Tunicata and Vertebrata  
(d) Tunicata, Cephalochordata and Vertebrata
- 4 The members of which of the following are often referred as protochordates?  
(a) Urochordata (b) Cephalochordata  
(c) Both (a) and (b) (d) None of these

- 5 Which animals belong to subphylum–Urochordata?  
(a) *Branchiostoma* and *Lancelet*  
(b) *Salpa* and *Lancelet*  
(c) *Ascidia* and *Doliolum*  
(d) *Salpa* and *Amphioxus*

- 6 Animals belonging to phylum–Chordata are fundamentally characterised by the presence of structure noted as *A*, *B*, *C* and *D*. Identify *A*, *B*, *C* and *D*.



- (a) A–Notochord, B–Nerve cord, C–Gill slits, D–Post-anal part  
(b) A–Nerve cord, B–Notochord, C–Gill slits, D–Post-anal part  
(c) A–Nerve cord, B–Notochord, C–Post-anal part, D–Gill slits  
(d) A–Nerve cord, B–Gill slits, C–Notochord, D–Post-anal part

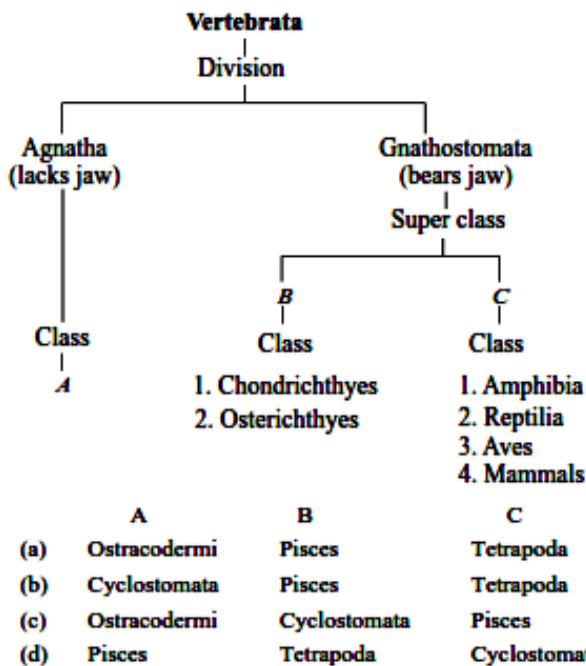
7 Select the correct difference between the notochord in the following.

- | Urochordata                                  | Cephalochordata                            |
|--|--|
| (a) Present only in larval tail              | – Extend from head to tail throughout life |
| (b) Present only in adult                    | – Present only in larval tail              |
| (c) Persistent throughout their life         | – Present only in adult                    |
| (d) Extend from head to tail throughout life | – Present only in larval tail              |

8 Choose the incorrect vertebrate character.

- (a) Ventral muscular heart  
 (b) Kidneys for excretion and osmoregulation  
 (c) Paired appendages which may be fins or limbs  
 (d) None of the above

9 The following is the flow chart depicting the divisions of the subphylum–Vertebrata. Fill in the parts *A*, *B*, *C* and *D* and choose the correct option.



10 Which of the following options about the class–Cyclostomata is incorrect?

- (a) Cranium and vertebral column are cartilaginous  
 (b) Elongated body bearing scales and paired fins  
 (c) Gill slits for respiration  
 (d) Sucking and circular mouth

11 *Myxine* (Hagfish) has  
 (a) 6-15 pairs of gill slits  
 (b) closed type circulation  
 (c) jaws  
 (d) Both (a) and (b)

12 A jawless fish, which lays eggs (spawning) in freshwater and whose ammocoetes larvae after metamorphosis return to the ocean is

- (a) *Eptatretus* (b) *Myxine*  
 (c) *Neomyxine* (d) *Petromyzon*

13 Match the name of the animal (Column I) with one characteristic (Column II) and the phylum/class (Column III) to which it belongs.

Column I	Column II	Column III
(a) <i>Petromyzon</i>	Ectoparasite	Cyclostomata
(b) <i>Ichthyophis</i>	Terrestrial	Reptilia
(c) <i>Limulus</i>	Body covered by chitinous exoskeleton	Pisces
(d) <i>Adamsia</i>	Radially symmetrical	Porifera

14 Chondrichthyes is characterised by tooth shaped

- (a) placoid scale with dorsal mouth  
 (b) ctenoid scale with dorsal mouth  
 (c) ctenoid scale with ventral mouth  
 (d) placoid scale with ventral mouth

15 Which one is not cartilaginous fish?

- (a) *Carcharodon* (Great white shark), *Trygon* (sting ray)  
 (b) *Exocoetus* (flying fish), *Catla* (katla), *Clarias* (magur)  
 (c) *Scoliodon* (dog fish)  
 (d) *Pristis* (saw fish)

16 Which of the following is not a characteristic feature of class–Chondrichthyes?

- (a) Gill slits are separate and without operculum  
 (b) Predaceous with powerful jaws  
 (c) Notochord is persistent throughout life  
 (d) Air bladder present

17 Choose the incorrect option for the given figure.



- (a) Operculum present (b) Bony fish  
 (c) Poisonous sting at tail (d) Sexes separate

18 Following are few examples of bony fishes. Choose the odd one out as marine bony fish.

- (a) Flying fish
- (b) *Hippocampus* (Sea horse)
- (c) Both (a) and (b)
- (d) *Labeo* (Rohu), *Catla*, *Clarias*

19 Bony fishes

- (a) have external fertilisation
- (b) are mostly oviparous
- (c) show direct development
- (d) All of the above

20 Bony fishes can stay at any particular depth in water without spending energy due to

- (a) operculum
- (b) neuromuscles
- (c) pneumatic bones
- (d) swim bladder

21 The number of gills present in Osteichthyes is

- (a) 2 pairs
- (b) 6 pairs
- (c) 5 pairs
- (d) 4 pairs

22 Air bladder occurs in

- (a) *Torpedo*
- (b) *Clarias*
- (c) *Scoliodon*
- (d) *Elasmobranch*

23 Choose the incorrect option for the following animal.

- (a) Cloaca present
- (b) Dioecious, external fertilisation, oviparous, indirect development
- (c) Body divisible into head and trunk
- (d) Eyes are without eyelids

24 Which features are common to the animals belonging to class–Amphibia and class–Reptilia?

- (a) The presence of scales with internal fertilisation and usually four-chambered heart
- (b) The presence of tympanum, poikilotherms and usually three-chambered heart
- (c) The presence of cloaca, oviparous and external fertilisation
- (d) Skin is moist

25 Reptiles are different from amphibians in

- (a) the skin
- (b) structure of the heart
- (c) development stages
- (d) All of these

26 The presence of which structure is common to frog and snake with respect to respiration?

- (a) Diaphragm
- (b) Skin
- (c) Buccal cavity
- (d) Lungs

27 Dry skin with scales or scutes without gland is a characteristic of

- (a) Fishes
- (b) Reptilia
- (c) Amphibia
- (d) Aves

28 The class name–Reptilia refers to

- (a) presence of scales or scutes on their body
- (b) presence of dry and cornified skin
- (c) their creeping or crawling mode of locomotion
- (d) None of the above

29 Syndactyly, prehensile tail and long protrusible tongue are the unique features of

- (a) rhesus monkey
- (b) *Archaeopteryx*
- (c) horsefish
- (d) *Chameleon*

30 In which of the following reptiles four-chambered heart is present?

- (a) Lizard
- (b) Snake
- (c) Scorpion
- (d) Crocodile

31 Which one of the following animals have both exoskeletal and endoskeletal structures?

- (a) Freshwater mussel
- (b) Tortoise
- (c) Frog
- (d) Jellyfish

32 Choose the correct option for the given figures.



(A)



(B)

- (a) Animal A is *Salamandra* and B is *Chameleon*
- (b) Both A and B belong to class–Reptilia
- (c) Fertilisation is external in both
- (d) Animal A has 2-chambered heart and B has 3-chambered heart

33 Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them?

- (a) *Pteropus* and *Ornithorhynchus* – viviparity
- (b) Garden lizard and crocodile – three-chambered heart
- (c) *Ascaris* and *Ancylostoma* – metameric segmentation
- (d) Sea horse and flying fish – cold-blooded (poikilothermal)

34 Which one of the following is incorrect for Aves?

- (a) Heart is four-chambered and animals are oviparous
- (b) The presence of air cavities in bones and the presence of feathers on the body
- (c) Digestive tract has additional chambers and animals are homeothermous
- (d) The forelimbs are not modified into wings

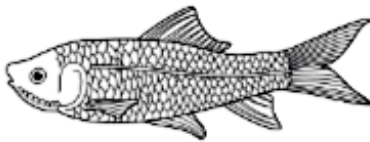


- 35 Which of the following sets of derivatives of integumentary structures characterise birds, as glorified reptiles?  
 (a) Scales and claws  
 (b) Syrinx and uropygial gland  
 (c) Claws and uropygial gland  
 (d) Syrinx and scales
- 36 Which of the following groups of animals shares similarly regarding maintenance of constant body temperature with mammals?  
 (a) Reptiles (b) Amphibians  
 (c) Aves (d) Fishes
- 37 Pneumatic bones are expected to be found in  
 (a) house lizard  
 (b) flying fish  
 (c) pigeon  
 (d) tadpole of frog
- 38 Which of the following is/are flightless bird?  
 (a) Ostrich (b) Emu  
 (c) Kiwi (d) All of these
39. The character of birds without exception is  
 (a) deuterostome development  
 (b) flying wings  
 (c) beak without teeth  
 (d) lay eggs with calcareous shell
- 40 Identify the vertebrate group of animals characterised by crop and gizzard in its digestive system.  
 (a) Aves  
 (b) Reptilia  
 (c) Amphibia  
 (d) Osteichthyes
- 41 Phenomenon seen in certain amphibians, but not in mammals is  
 (a) ability to undergo transformation  
 (b) ability to change according to season  
 (c) ability to change colour  
 (d) ability to stay still for long periods of time
- 42 Which of the following is a correct sequence of decreasing order of number of species?  
 (a) Aves, pisces, reptiles, amphibians, mammals  
 (b) Pisces, aves, reptiles, mammals, amphibians  
 (c) Pisces, mammals, reptiles, amphibians, aves  
 (d) Amphibians, aves, pisces, mammals, reptiles
- 43 The unique character of animals belonging to class-Mammalia is  
 (a) bipedal locomotion  
 (b) completely four-chambered heart  
 (c) the presence of mammary glands  
 (d) fertilisation is internal
- 44 Which of the following animals is not viviparous?  
 (a) Flying fox (bat) (b) Elephant  
 (c) Platypus (d) Whale
- 45 Select the correct set of animals of true mammals.  
 (a) Lion, *Hippopotamus*, penguin, bat  
 (b) Lion, bat, whale, ostrich  
 (c) *Hippopotamus*, penguin, whale, *Chelone*  
 (d) Whale, flying fox, kangaroo, *Hippopotamus*
- 46 Vivipary is characteristically found in  
 (a) Coelenterata (b) Protozoa  
 (c) Rabbit (d) Pisces
- 47 Which one of the following is an exclusive character of class-Mammalia?  
 (a) Homeothermy  
 (b) Internal fertilisation  
 (c) The presence of a four-chambered heart  
 (d) The presence of a muscular diaphragm
- 48 Which one of the following is not a mammalian character without exception?  
 (a) The presence of milk producing gland  
 (b) They have two pairs of limbs  
 (c) Skin is unique in possessing hairs  
 (d) Heterodont type of dentition
- 49 Which animals have well-developed echolocation system like that of bats?  
 (a) Wild cats (b) Beavers only  
 (c) Primates (d) Dolphins
- 50 Choose the odd pair amongst the following.  
 (a) *Ornithorhynchus*-Platypus  
 (b) *Pteropus*-Flying fox  
 (c) *Neophron*-Vulture  
 (d) *Delphinus*-Common dolphin
- 51 Which one of these animals is not a homeotherm?  
 (a) *Camelus* (b) *Chelone*  
 (c) *Macropus* (d) *Psittacula*
- 52 Which of the following represents order of 'Horse' ?  
 (a) Equidae (b) Perissodactyla  
 (c) Caballus (d) Ferus
- 53 Which among these is the correct combination of aquatic mammals?  
 (a) Seals, Dolphins, Sharks  
 (b) Dolphins, Seals, *Trygon*  
 (c) Whales, Dolphins, Seals  
 (d) *Trygon*, Whales, Seals

## SPECIAL FORMAT QUESTIONS

- 1 Choose the correct statement.  
 (a) All mammals are viviparous  
 (b) All cyclostomes do not possess jaw and paired fins  
 (c) All reptiles have a three-chambered heart  
 (d) All pisces have gills covered by an operculum
- 2 Which statement is incorrect for animals belonging to the class—Osteichthyes?  
 (a) The presence of cycloid/ctenoid scales  
 (b) Both marine and freshwater forms with bony endoskeleton  
 (c) Mouth terminal and gills covered by operculum  
 (d) Notochord is persistent only at larval stage, after that disappears
- 3 Choose the incorrect statement.  
 (a) Both cartilaginous and bony fishes are dioecious  
 (b) Cartilaginous fishes show sexual dimorphism  
 (c) Male cartilaginous fish have claspers  
 (d) Female cartilaginous fish have claspers

- 4 Choose the correct statement for the animals given in the figure below.




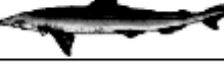


- (a) Its skin is tough, containing minute placoid scales  
 (b) It has four pairs of gills which are covered by air bladder  
 (c) Fertilisation is external and is oviparous  
 (d) Mouth is located ventrally and jaws are very powerful
- 5 Which one of the following statement for animals, is correctly described with no exception in it?  
 (a) All reptiles possess scales, have a three-chambered heart and are cold-blooded (poikilothermal)  
 (b) All bony fishes have four pairs of gills and an operculum on each side  
 (c) All sponges are marine and have collared cells  
 (d) All mammals are viviparous and possess diaphragm for breathing

6. Choose the correct option for the following statements.  
 I. All vertebrates are chordates.  
 II. Vertebrates possess notochord during embryonic period.  
 (a) I is true, but II is false  
 (b) II is true, but I is false  
 (c) Both I and II are true  
 (d) Both I and II are false

- 7 Which of the following statements are true/false?  
 I. In *Torpedo*, the electric organs are capable of generating strong electric shock to paralyse the prey.  
 II. Bony fishes use pectoral, pelvic, dorsal, anal and caudal fins in swimming.  
 III. Amphibian skin is moist and has thick scales.  
 IV. Birds are poikilothermous animals.  
 V. The most unique mammalian characteristic is the presence of milk producing mammary glands by which the young ones are nourished.  
 (a) I, II and III are true; IV and V are false  
 (b) I, II and V are true; III and IV are false  
 (c) I, II and III are false; IV and V are true  
 (d) I, II and IV are false; III, and V are true





- 8 Match the following columns.

Column I (Animals)	Column II (Scientific names)
A. 	1. <i>Scoliodon</i>
B. 	2. <i>Pristis</i>
C. 	3. <i>Myxine</i>
D. 	4. <i>Catla</i>
	5. <i>Petromyzon</i>

**Codes**

	A	B	C	D
(a)	4	2	5	1
(b)	4	2	3	1
(c)	1	3	5	2
(d)	1	4	5	3

- 9 Match the following columns.

Column I (Mammals)	Column II (Scientific names)
A. 	1. <i>Ornithorhynchus</i>
B. 	2. <i>Oryctolagus cuniculus</i>
C. 	3. <i>Pteropus</i>
D. 	4. <i>Macropus</i>
	5. <i>Balaenoptera</i>

**Codes**

	A	B	C	D
(a)	3	4	5	2
(b)	3	4	5	1
(c)	1	2	5	4
(d)	5	4	3	2

10 Match the following columns.

Column I (Scientific names)	Column II (Common names)
A. <i>Branchiostoma</i>	1. Hagfish
B. <i>Petromyzon</i>	2. Lamprey
C. <i>Trygon</i>	3. Sting ray
D. <i>Myxine</i>	4. Ascidia
	5. <i>Amphioxus</i>

**Codes**

A	B	C	D	A	B	C	D		
(a)	1	5	2	4	(b)	3	1	2	5
(c)	5	4	1	2	(d)	5	2	3	1

11 Match the following columns.

Column I (Features)	Column II (Animals)
A. These possess electric organs	1. <i>Trygon</i>
B. Animals of this class are poikilothermous	2. Cyclostomata
C. These possess poison sting	3. <i>Torpedo</i>
D. These migrate for spawning to freshwater	4. Chondrichthyes
	5. Lamprey
	6. <i>Exocoetus</i>

**Codes**

A	B	C	D	
(a)	6	1	3	2
(b)	1	4	6	5
(c)	3	4	1	5
(d)	3	4	6	2

12 Match the following columns.

Column I (Animals)	Column II (Common names)
A. <i>Chelone</i>	1. Wall lizard
B. <i>Bungarus</i>	2. Viper
C. <i>Calotes</i>	3. Krait
D. <i>Hemidactylus</i>	4. Garden lizard
	5. Turtle
	6. Tortoise

**Codes**

A	B	C	D	A	B	C	D		
(a)	3	2	1	6	(b)	5	3	4	1
(c)	5	4	1	6	(d)	2	5	1	6

13 Match the following columns.

Column I (Parts/cells)	Column II (Features)
A. Thesocytes	1. Spongin fibres
B. Gemmules	2. Food storing cells
C. Osculum	3. Involved in reproduction
D. Spicules	4. Collar cells
	5. Water exits the spongocoel through this structure

**Codes**

A	B	C	D	
(a)	1	2	3	4
(b)	3	1	4	5
(c)	2	3	4	1
(d)	2	3	5	1

## NCERT EXEMPLAR PROBLEMS

1. Which one of the following sets of animals share a four chambered heart?

- Amphibian, Reptiles, Birds
- Crocodiles, Birds, Mammals
- Crocodiles, Lizards, Turtles
- Lizards, Mammals, Birds

2. Which of the following pairs of animals has non glandular skin

- Snake and Frog
- Chameleon and Turtle
- Frog and Pigeon
- Crocodile and Tiger

3. Birds and mammals share one of the following characteristics as a common feature.

- a. Pigmented skin
- b. Pneumatic bones
- c. Viviparity
- d. Warm blooded

4. Which one of the following is oviparous?

- a. Platypus
- b. Flying fox (Bat)
- c. Elephant
- d. Whale

5. Which one of the following is a non-poisonous snake?

- a. Cobra
- b. Viper
- c. Python
- d. Krait

### NEET PREVIOUS QUESTIONS

1. Match the following columns and select the correct option.

Column-I		Column-II	
(A)	6-15 pairs of gill slits	(i)	<i>Trygon</i>
(B)	Heterocercal caudal fin	(ii)	Cyclostomes
(C)	Air bladder	(iii)	Chondrichthyes
(D)	Poison sting	(iv)	Osteichthyes

- (A) (B) (C) (D)  
(a) (ii) (iii) (iv) (i)  
(b) (iii) (iv) (i) (ii)  
(c) (iv) (ii) (iii) (i)  
(d) (i) (iv) (iii) (ii) (NEET 2020)

2. Which of the following statements are true for the Phylum Chordata?

- (A) In Urochordata, notochord extends from head to tail and it is present throughout their life.
  - (B) In Vertebrata, notochord is present during the embryonic period only.
  - (C) Central nervous system is dorsal and hollow.
  - (D) Chordata is divided into 3 subphyla : Hemichordata, Tunicata and Cephalochordata.
- (a) (D) and (C) (b) (C) and (A)  
(c) (A) and (B) (d) (B) and (C)

(NEET 2020)

3. Identify the vertebrate group of animals characterised by crop and gizzard in its digestive system.

- (a) Amphibia (b) Reptilia
- (c) Aves (d) Osteichthyes

(NEET 2018)

4. Which one of these animals is not a homeotherm?

- (a) *Macropus* (b) *Chelone*
- (c) *Camelus* (d) *Psittacula*

(NEET 2018)

5. Which among these is the correct combination of aquatic mammals?

- (a) Dolphins, Seals, *Trygon*
- (b) Whales, Dolphins, Seals
- (c) *Trygon*, Whales, Seals
- (d) Seals, Dolphins, Sharks

(NEET 2017)

6. Which of the following represents order of 'Horse'?

- (a) Perissodactyla (b) Caballus
- (c) Ferus (d) Equidae

(NEET 2017)

7. Choose the correct statement.

- (a) All mammals are viviparous.
- (b) All cyclostomes do not possess jaws and paired fins.
- (c) All reptiles have a three-chambered heart.
- (d) All pisces have gills covered by an operculum.

(NEET-II 2016)

8. Which one of the following characteristics is not shared by birds and mammals?  
 (a) Viviparity  
 (b) Warm blooded nature  
 (c) Ossified endoskeleton  
 (d) Breathing using lungs (NEET-I 2016)
9. Which of the following characteristic features always holds true for the corresponding group of animals?  
 (a) Possess a mouth with an upper and a lower jaw Chordata  
 (b) 3-chambered heart with one incompletely divided ventricle Reptilia  
 (c) Cartilaginous endoskeleton Chondrichthyes  
 (d) Viviparous Mammalia (NEET-I 2016)
10. A jawless fish, which lays eggs in fresh water and whose ammocoetes larvae after metamorphosis return to the ocean is  
 (a) *Neomyxine* (b) *Petromyzon*  
 (c) *Eptatretus* (d) *Myxine*. (2015)
11. A marine cartilaginous fish that can produce electric current is  
 (a) *Pristis* (b) *Torpedo*  
 (c) *Trygon* (d) *Scoliodon*. (201 )
12. One of the representatives of Phylum Arthropoda is  
 (a) puffer fish (b) flying fish  
 (c) cuttle fish (d) silver fish. (NEET 2013)

### AIIMS PREVIOUS QUESTIONS

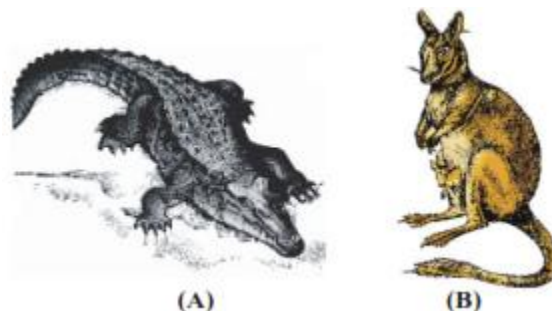
1. The most poisonous fish is :- [AIIMS 2012]

- (1) Clown fish (2) Eel (3) Tiga fish (4) Stone fish

2. Find out the correct Matching ? :- [AIIMS 2012]

- (1) Ostrich, peacock, Peteromyzon-Vertebrate Exception-Peteromyzon  
 (2) Ascaris, Leech, Earthworm-Eucoelomate Exception-Ascaris  
 (3) Scoli, Pristis, Exocoetus- Osteichthyes exception-Exocoetus  
 (4) Bufo, Rana, Chelone-Reptilia Exception- ChelOne

3. Select the correct option about the given diagram:- [AIIMS 2016]



- (1) A = Alligator = Dry cornified skin, 4 chambered heart  
 (2) B = Macropus = Oviparous, Uricotelic  
 (3) A = Crocodilus = Oviparous, 4 Chambered heart  
 (4) B = Opposum = Viviparous, Uricotelic

4. Which of the following is correct option? :- [AIIMS 2017]

- (1) Frog - External fertilisation (2) Scolodon - External fertilisation

(3) Exocoetus - Internal fertilisation      (4) Ophiura - Internal fertilisation

5. Find out the correct match :-[AIIMS 2017]

- (1) Chelone, Chameleon, Calotes - epidermal scales
- (2) Ornithorhynchus, Panthera leo, Macropus - Oviparous
- (3) Exocoetus, Pavo, Psittacula, Columba - Forelimbs are modified into wings
- (4) Scoliodon, Pristis, Pterophyllum-Placoid scales

6. Which of the following is the correct sequence of classification? :-[AIIMS 2017]

- (1) Human : Primata ; Mammalia, Chordata
- (2) Musca dorsota : Diptera, Insecta, Arthropoda
- (3) Panthera leo : Euthera, Chordata, Mammalia
- (4) Canis : Mammalia, Carnivora, Chordata

7. Which of the following have internal fertilization? :-[AIIMS 2017]

- (1) Sea urchin                              (2) Platypus                              (3) Frog                              (4) Labeo

8. Find out the correct match :- :-[AIIMS 2018]

- (1) Mammalia - Balaenoptera, Rattus, Felis, Delnus
- (2) Porifera - Gorgonia, sycon, Euspongia
- (3) Chondrichthyes - Hippocampus, Labeo, Scoliodon, Pristis
- (4) Aschelminthes - Hookworm, Lumbricus, Ancylostoma

9. Which one is correct for Osteichthyes? :-[AIIMS 2018]

- (1) 4-pairs of gills without operculum – Pristis
- (2) 4-pairs of gills without operculum – Clarias
- (3) 4-pairs of gills with operculum – Clarias
- (4) 6 to 15 pairs of gill slits with operculum -petromyzon

10. Find out the correct statement :-[AIIMS 2018]

- (1) Chelone - Skin is covered by dry cornified scales, external ear opening is present
- (2) Viper - Four chambered heart
- (3) Crocodile - External fertilisation, Oviparous
- (4) Testudo - Bony scutes, tympanum represent ear, four chambered heart

## KEY

### MULTIPLE CHOICE QUESTIONS

1	d	12	d	23	d	34	d	45	d
2	d	13	a	24	b	35	a	46	c
3	d	14	d	25	d	36	c	47	d
4	c	15	b	26	d	37	c	48	c
5	c	16	d	27	b	38	d	49	d
6	b	17	c	28	c	39	c	50	c
7	a	18	c	29	d	40	a	51	b
8	d	19	d	30	d	41	c	52	b
9	b	20	d	31	b	42	b	53	c
10	b	21	d	32	a	43	c		
11	d	22	b	33	d	44	c		

### SPECIAL FORMAT QUESTIONS

1	b	5	b	9	b	13	a
2	d	6	c	10	d		
3	d	7	b	11	c		
4	c	8	a	12	b		

### NCERT EXEMPLAR PROBLMES

- 1 b
- 2 c
- 3 d
- 4 a
- 5 c

### NEET PREVIOUS QUESTIONS

1	a	4	b	7	b	10	b
2	d	5	b	8	a	11	b
3	c	6	a	9	c	12	d

### AIIMS PREVIOUS QUESTIONS

1	d	3	c	5	a	7	b	9	c
2	b	4	a	6	a	8	a	10	a



# **UNIT-V**

## **LOCOMOTION AND REPRODUCTION**



# SYNOPSIS

## 5.1 LOCOMOTION IN PROTOZOA

- Locomotion influenced by **external and internal stimuli**.
- The movements exhibited by plants in response to stimuli of light and gravity are **tropic movements**.
- Voluntary movement of organisms from one place to another in search of food, shelter, mate or to escape from predators is called **locomotion**.
- **All locomotions are movements but all movements are not locomotions.**
- Locomotory organelles in protozoans **pseudopodia, flagella, cilia and myonemes**.

### 5.1.1 Pseudopodia :

- The temporary extensions of cytoplasm that develop in the direction of movement.
- Pseudopodia are found in **rhizopodeans**.
- Based on their form and structure pseudopodia are of 4 types such as **lobopodia, filopodia, reticulopodia and axopodia or heliopodia**.
- The pseudopodium is formed by the conversion of gel to sol and vice-versa.
- The most accepted theory for the formation of pseudopodia or amoeboid locomotion is the **sol-gel transformation theory**.
- The more appropriate theory is **Allen's theory of front contraction or Fountain zone theory**.
- However, the modern researchers bring in the role of actin and myosin protein molecules also.
- Amoeboid locomotion is also performed by amoeboid cells, macrophages, neutrophils, etc., of higher metazoans.

### Types of Pseudopodia

Pseudopodia	Structure	Examples
1. Lobopodia	Blunt, Finger like	<i>Amoeba</i> , <i>Entamoeba</i>
2. Filopodia	Fibre like	<i>Euglypha</i>
3. Reticulopodia	Net like	<i>Elphidium</i> ( <i>Polystomella</i> ), <i>Globigerina</i>
4. Axopodia (Heliopodia)	Sun ray like	<i>Actinophrys</i>

### 5.1.2 Flagella:

- Flagella are the long whip like locomotor organelles of the **mastigophoran protozoans**.
- Flagellum consists of central, longitudinal, microtubular structure is **axoneme**.
- Axoneme is surrounded by **plasma membrane**.
- Axoneme arises from **the basal granule(or) blepharoplast (or) basal body (or) kinetosome**.
- Blepharoplasts are derived from **the centrioles**.

### Ultrastructure of Flagellum/Cilium

- The central axial filament (or) axoneme of flagellum shows **(9 + 2) microtubular arrangement**.
- The two central longitudinal tubules( singlets) are enclosed by an **inner fibrous sheath**.
- The axoneme also contain **nine peripheral doublets** of micro tubules.
- Both singlet and doublet microtubules are formed by a protein **tubulin**.
- Each peripheral doublet consists of a microtubule **A** and a microtubule **B**.
- Microtubule **A** is outer, smaller but complete.
- Microtubule **B** is inner, larger but incomplete.

Microtubule-A	Microtubule-B
Outer	Inner
Smaller	Larger
Complete	Incomplete

- The doublets of the outer ring are connected by **radial spokes** to the inner fibrous sheath surrounding the central singlets.
- The adjacent peripheral doublets are interconnected by proteins called **nexins**.
- Microtubule **A** of each doublet has **a pair of dynein arms** all along its length.
- Dynein arms are made up of **a motor protein called dynein**.
- Peripheral doublets are surrounded by membranous outer sheath which is the extension of **plasma membrane / plasmalemma/pellicle**.
- Below the level of pellicle, the basal granule is formed by **9 peripheral triplets only**.
- Minute, hair-like structures present all along the length of some flagella are called **lateral appendages**.
- Lateral appendages arise from outer membranous sheath of axoneme of a flagellum. These appendages are absent for a cilium.

## Types of flagella

Types of flagella	Rows of lateral appendages	Terminal naked filament	Examples
I. Stichonematic	One row	Absent	<i>Euglena, Astasia</i>
II. Pantonematic	Two or more rows	Absent	<i>Peranema, Monas</i>
III. Acronematic	Absent	Present	<i>Chlamydomonas, Polytoxa</i>
IV. Pantacronematic	Two or more rows	Present	<i>Urceolous</i>
V. Anematic/simple	Absent	Absent	<i>Chilomonas, Cryptomonas</i>

## Number of flagella

Organism	Number of flagella
i) Trypanosoma	1 (Arise from rear/posteriorend)
ii) Euglena	2 (one long, one short)
iii) Trichomonas	4
iv) Giardia lamblia (grand old man of intestine)	8 (4 pairs)
v) Trichonympha	many

- Cilia are found in the **ciliate protozoans (on body surface)**, among the vertebrates in the **epithelial lining of respiratory tract, genital ducts, ventricles of brain, central canal of spinal cord etc.**
- Primitive ciliate that has cilia on the entire body. is **Eg: paramecium**.
- The advanced ciliates have cilia confined to peristomial region. **Eg: Vorticella**.
- Cilia are present only in juvenile stages but in the adults they are replaced by suckorial tentacles. **Eg: Acineta** (a suckorian).
- Cilia help in both **locomotion and food collection**.
- The central axoneme or axial filament of a cilium (like flagellum) is formed by **(9+2) microtubules**.
- Cilia arise from the **basal granule or kinetosome** situated in the **ectoplasm** below the pellicle.
- The structures connected to kinetosomes are called **kinetodesmal fibrils**.

- The kinetodesmal fibrils of the longitudinal row of kinetosomes are connected to longitudinal cords called **kinetodesmata** which are present on their right side.
- The longitudinal row of basal granules, their kinetodesmal fibrils, and kinetodesmata together constitute **kinety**.
- A network of all kineties present in the ectoplasm of *Paramecium* forms **infraciliary system**.
- **Infraciliary system** is connected to the **motorium**, a neuromotor centre near the cytopharynx in endoplasm.
- Motorium and infraciliary system together called as **neuromotor system**.
- The neuromotor system coordinates & controls the **ciliary movement**.
- If motorium is destroyed, the cilia **lose coordination**.
- Fastest locomotion in protozoans is **ciliary movement** because it is coordinated.
- Organelles that help both in locomotion and ingestion of food are **pseudopodia and cilia**.

#### 5.1.4 Myonemes.

Contractile fibrils present in the ectoplasm below the pellicle of **flagellates, ciliates, and sporozoans (apicomplexans)**.

## 5.2 Flagellar and Ciliary movement:

### 5.2.1 Swimming locomotion

- The type of locomotion performed by flagellum and cilia is **swimming locomotion**.
- Flagella and cilia are called **undulipodia** by **L.H. Hyman**.
- Bending movement of a flagellum / cilium is brought about by **the sliding of microtubules past each other**.
- Dynein arms of each peripheral doublet attach to an adjacent doublet and pull the neighbouring doublet and slide past each other in **opposite directions**.
- As the peripheral doublets are physically held in place by the radial spokes, they can not slide past much and cause **bending movement**.
- Dynein arms show complex cycles of movements using energy provided by **ATP**.
- Dynein arms are **sites of ATPase activity** in the cilia and flagella. They can also be considered as ATP breakdown sites in cilium/flagellum.
- The bending movements of flagellum and cilium play an important role **in swimming locomotion**.
- If nexins and radial spokes of an axoneme of flagellum or cilium are subjected to enzymatic action and exposed to ATP, then the doublets cannot slide past.

### 5.2.2 Flagellar Locomotion :

- Flagellum shows **undulations and side wise lash movements**.
- Undulations from the base to the tip causes pushing force (like propeller of a boat) due to which the organism is **pushed backwards**.
- Undulation from the tip to the base causes pulling force (like propeller of an aeroplane). Due to this, the organism is **pulled forward**.
- When the undulations are spiral, organism shows **rotatory movements/gyration** in its own axis.
- If the flagellum bends to one side and undulations from base to the tip, the organism moves **laterally in the opposite direction** to flagellar rotations.
- Each sidewise lash movement consists of 2 strokes **1) Effective stroke 2) Recovery stroke**.
- Flagellum becomes rigid and bends to one side, beats against the water during effective stroke.
- Beating of flagellum against water is at right angles to the body axis, and the organism moves forwards (the direction of movement of water is parallel to the surface line of attachment of flagellum and also to the longitudinal axis of the body).
- Flagellum becomes comparatively soft, so as to offer least resistance to water, and moves back to its original position by recovery stroke.
- A flagellum pushes the fluid medium/water at right angles to the surface of its attachment by its **bending movement**.

## Flagellar locomotion

Column – A	Column – B	Column – C
A) Undulations from base to tip	Pushing force	Propeller of an aeroplane
B) Undulation from Tip to base	Pulling force	Propeller of an aeroplane
C) Undulations from Base to tip	Pushing force	Propeller of a boat
D) Flagellum turns like a screw	Simple conical gyration	Propelling action

### 5.2.3 Ciliary locomotion :

- Ciliary movement is similar to **paddle/pendular movement**.
- Cilia show swift back and forth movements during locomotion. These are called effective stroke and recovery stroke.
- Cilium moves water parallelly to the surface of its attachment .
- The movement of water may also be described as perpendicular to the axis of cilium.
- The stroke in which cilia bend backwards and beats the water is called **effective stroke**.
- The effective stroke makes the **body moves forward while water moves backwards**.
- The cilia by its **recovery stroke** regains its original position.
- Beating of cilia of a longitudinal row (in a kineity), one after the other (sequentially) in one direction is called **metachronous movement**.
- The cilia of a transverse /horizontal row beat simultaneously (at a time) in one direction is called **synchronous movement**.

## Ciliary movement

Group -1	Group -2	Group -3
A) Synchronous movement	Cilia of transverse row	Beat simultaneously
B) Metachronous movement	Cilia of longitudinal row	Sequential movement
C) Effective stroke	Cilia becomes rigid	Propulsive stroke
D) Recovery stroke	Cilia comes to its original position	Without any resistance

- Small, zig-zag movements in the protozoans caused by the contraction and relaxation of myonemes present below the pellicle is called **gliding locomotion**.
- Gliding locomotion in the flagellates is called **euglenoid movement**.
- Gliding movements are seen in flagellates, sporozoans/apicomplexans, cnidosporans and ciliates.

## Types of movement

Type of movement	Shown by
Amoeboid movement	Rhizopods, Macrophages of Metazoans
Ciliary movement	Ciliates
Flagellar movement	Flagellates
Gliding movement	Ciliates, Flagellates, Apicomplexans
Undular movement	Flagella of flagellates
Pendular/paddle movement	Cilia of ciliates

## 5.2 Reproduction in protozoa :

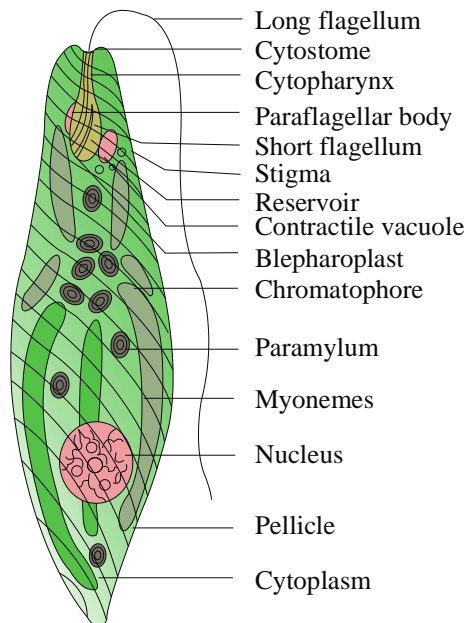
### 1) Asexual reproduction

- Production of progeny by a single parent without the involvement of gamete formation is asexual method.
- The progeny formed in this method are the exact copies of their parents. They show uniparental inheritance, without any genetic variations.
- Such morphologically and genetically similar members together called as **clone**.
- Members of Protista, Bacteria, Archaea and simple multicellular organisms show this method.
- Asexual reproduction includes binary fission and multiple fission.

### 1) Binary fission:

- Binary fission is most common asexual reproduction method in protozoans that occurs during favourable conditions.
- One parent divides into 2 daughter individuals by karyokinesis (division of nucleus) followed by cytokinesis (division of cytoplasm).
- Binary fission is classified into different types based on axis or plane of cytokinesis.

### A) Longitudinal binary fission:



## Euglena

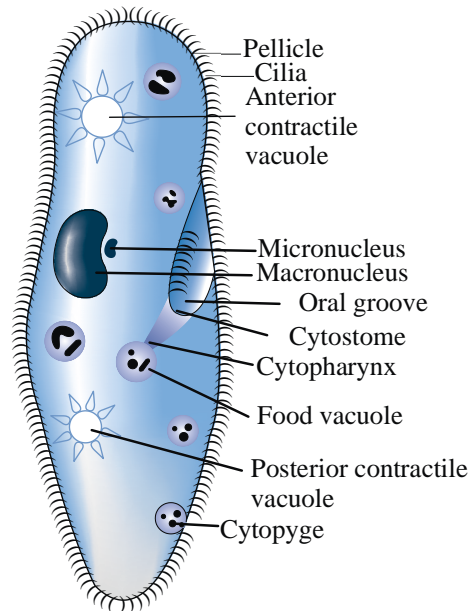
- Body of parent divides into two halves longitudinally. So, it is called longitudinal binary fission.
- Flagellates (mastigophorans) like *Euglena*, *Trypanosoma*, etc. exhibit this method.
- *Euglena* has two flagella i.e. one long and one short arising from two basal granules.
- Anteriorly it has one contractile vacuole, a stigma, a paraflagellar body, a cytopharynx and a reservoir.
- Paraflagellar body found near the base of longer flagellum acts as photoreceptor.
- Nucleus is at the centre, surrounded by chromatophores (chlorophyll containing structures)
- Pellicle is a proteinous layer. The contractile myonemes are found beneath the pellicle.

- Reserve food is present in the form of **paramylum**.

Nucleus undergoes mitotic division.

- Kinetosomes and chromatophores divide
- A longitudinal groove develops in the middle of anterior end of parent's body. It extends gradually towards the posterior end.
- One daughter retains parental flagella and other one develops new flagella.
- Stigma, contractile vacuole and paraflagellar body of parent disappear and hence they are newly formed in both the daughter *Euglenae*.
- As the daughter *Euglenae* are like mirror images, the division is known as **symmetrogenic** division.

## B) Transverse binary fission:



## Paramecium

- *Paramecium* is known as **slipper animalcule**.
- It has a slipper-like body with slightly concave oral surface having oral groove, cytostome and cytopharynx. Aboral surface is slightly convex.
- It shows nuclear dimorphism, i.e, presence of two types of nuclei.
- A polypoid bean - shaped macronucleus and a diploid spherical micronucleus are present in the cytoplasm.
- Two contractile vacuoles (1 anterior and 1 posterior), trichocysts (cell organelles analogous to cnidoblast cells of cnidarians), infraciliary system found in ectoplasm.
- A temporary cytopyge (=cell anus) is close to posterior end.
- It divides by transverse / horizontal binary fission during favourable conditions.

### Events during binary fission.

- During favourable conditions *Paramecium* stops feeding and attains maximum growth.
- Micronucleus divides by mitosis and macronucleus by amitosis simultaneously.
- Oral groove disappears.
- Constriction appears in the middle and divides the parent into anterior proter and posterior opisthe.
- Proter gets cytopharynx, cytostome and anterior contractile vacuole from parent and develops a posterior contractile vacuole and a oral groove newly.
- Opisthe gets 2 nuclei, a posterior contractile vacuole from parent and develops a new anterior contractile vacuole, new cytopharynx, new cytostome and a new oral groove.
- Binary fission is completed in 2 hrs and by repeated fissions, a parent can produce four generations of daughter *Paramecia* in a day.
- As the plane of binary fission (cytokinesis) is at right angle to the longitudinal axis of body, transverse binary fission is called **homothetogenic** fission.
- As the plane of binary fission is at right angles to the kineties, it is also called **perkinetal fission**.

## 2. Multiple fission :

- Multiple fission is the division of the parent into many smaller individuals and occur during **unfavourable** conditions.

- Repeated mitotic divisions are followed by the cytoplasmic divisions.
- Each bit of nucleus gets surrounded by a small bit of cytoplasm resulting in the formation of many daughter individuals.
- Methods like schizogony (in man), male gametogony and sporogony (in female anophelis mosquito) found in life cycle of *Plasmodium*.
- **Sporulation** method is found in *Amoeba*.

### Sexual reproduction :

- Male and female gametes produced by mature individuals fuse in sexual reproduction.
- Gamete formation normally involves meiosis.
- Gametes fuse to form **diploid zygote**.
- Zygote develops to form new organism.
- Sexual reproduction is relatively slow and complex process.
- The progeny are not identical to parents or among themselves.

### Sexual reproduction in Protozoans :

- Haploid nuclei known as **pronuclei** fuse in sexual reproduction.
- Specially gametes may be formed with gametic nuclei (pronuclei) or pronuclei are formed without the formation of gametes.
- It occurs in protozoans mainly by  
1) Syngamy 2) Conjugation

#### 1. Syngamy:

- Fusion of two gametes is **syngamy**.
- Union of pronuclei of gametes is called **amphimixis**, resulting in the formation of fused nucleus called **synkaryon**.
- Fusion of similar gametes is called **isogamy** e.g. *Monocystis*.
- Union of dissimilar gametes is known as **anisogamy**. e.g. *Plasmodium*.
- In **Hologamy**, two mature organisms behave as gametes. e.g. *Trichonympha*.

#### 2. Conjugation

- **Wichterman** defined conjugation as a temporary union between two senile ciliates that belong to **two different mating types** for exchange of nuclear material and reorganization (as observed in *Paramecium*).

Unfavourable conditions induce conjugation.

- Chromosomal imbalance is caused due to repeated amitotic divisions of macronucleus.
- Conjugation restores vigour and vitality. E.g. *Paramecium*, *Vorticella*.

## \*MULTIPLE CHOICE QUESTIONS\*

### 1. Flagellum with two or more lateral appendages is seen in

- 1) *Chilomonas*            2) *Polytoma*  
3) *Cryptomonas*        4) *Peranema*

### 2. Myonemes bring locomotion in

- 1) *Euglena*                2) sporozoans  
3) *Amoeba*                4) both 1 and 2

### 3. The total number of microtubules in the axoneme and in the kinetosome of a cilium /flagellum are respectively

- 1) 20 & 27                2) 20 & 29  
3) 12 & 27                4) 20 & 18

### 4. Sol-gel theory explains the formation of

- 1) pseudopodia          2) flagella  
3) myonemes              4) cilia

### 5. Temporary cytoplasmic extensions of cell which are formed on the surface of the body by the movement of cytoplasm.

- 1) Pseudopodia          2) Cilia                      3) Flagella                      4) Myonemes

### 6. Identify the locomotor organelles which are useful only for locomotion.

- 1) Undulipodia          2) Pseudopodia







- 4) Contractile vacuole, para flagellar body, chromatophores
- 42. In *Euglena*, during longitudinal binary fission, which cell organelles undergo division?**
- 1) Contractile vacuole, stigma                      2) Blepharoplast, chromatophore  
3) Contractile vacuole, blepharoplast  
4) Para flagellar body, chromatophores
- 43. The daughter *Euglenae* formed by binary fission are**
- 1) like mirror images    2) asymmetrical  
3) unequal                4) haploid
- 44. Vertical, antero-posterior division forming two individuals is**
- 1) cellular division  
2) anterior posterior fission  
3) longitudinal binary fission  
4) transverse binary fission
- 45. The longitudinal binary fission is seen in**
- 1) *Paramecium* and *Euglena*  
2) *Paramecium* and *Trypanosoma*  
3) *Trypanosoma* and *Euglena*  
4) *Amoeba* and *Plasmodium*
- 46. Sun ray - like pseudopodia are present in**
- 1) *Globigerina*            2) *Euglypha*                      3) *Actinophrys*            4) *Entamoeba*
- 47. Cells of higher metazoans exhibiting amoeboid locomotion are**
- 1) erythrocytes, plasma cells                      2) macrophages, neutrophils  
3) basophils, platelets  
4) fibroblasts, neutrophils
- 48. "Fountain zone theory" of amoeboid locomotion is proposed by**
- 1) Pantin    2) Mast    3) Hyman    4) Allen
- 49. Lobopodia : *Entamoeba*, Filopodia : ?**
- 1) *Amoeba*                      2) *Euglena*  
3) *Euglypha*                      4) *Elphidium*
- 50. Which of the following is correct based on the number of rows of lateral appendages ?**
- 1) Stichonematic < Pantonematic>Acronematic > Pantacronematic > Anematic  
2) Stichonematic < Pantonematic>Acronematic < Pantacronematic<Anematic  
3) Stichonematic > Pantonematic=Acronematic < Pantacronematic=Anematic  
4) Pantonematic=Pantacronematic> Stichonematic > Anematic = Acronematic
- 51. Inner sheath of flagellum is present around**
- 1) peripheral doublets    2) central singlets  
3) triplets of basal granule 4) outer to flagellum
- 52. Microtubules present in the peripheral doublets of a flagellum are**
- 1) 18            2) 9            3) 2                      4) 20
- 53. The arms of microtubules attached to outer doublets are made of a protein**
- 1) flagellin 2) tubulin 3) dynein    4) fibroin
- 54. One of the following is not related to flagellum.**
- 1) Inner sheath            2) Flimmers  
3) Outer sheath            4) Plasmagel tube
- 55. Triplets are related to**
- 1) basal granule of flagellum                      2) gel tube of pseudopodium  
3) inner sheath of cilium                              4) central microtubules of flagellum
- 56. Radial spokes of flagellum/cilium connect**
- 1) doublets of flagellum to inner sheath                      2) triplets of basal granule to inner sheath  
3) doublets of flagellum to outer sheath  
4) triplets of basal granule to outer sheath
- 57. Flagellum with one row of lateral appendages occur on the axoneme upto the tip is**

- 1) stichonematic      2) pantonematic
- 3) pantacronematic    4) anematic

58. **Stichonematic flagellum is present in**

- 1) *Urceolus*      2) *Polytoma*      3) *Monas*      4) *Astasia*

59. **Flagellum in which only lateral appendages are present on the axoneme in two or more rows without terminal naked filament is**

- 1) stichonematic      2) pantonematic
- 3) pantacronematic    4) anematic

60. **Pantonematic flagellum is present in**

- 1) *Euglena*      2) *Peranema*
- 3) *Polytoma*      4) *Urceolus*

61. **Flagellum in which lateral appendages are absent but axoneme ends as a terminal naked axial filament is**

- 1) stichonematic      2) acronematic      3) pantonematic      4) pantacronematic

62. **Acronematic flagellum is present in**

- 1) *Polytoma*      2) *Urceolus*
- 3) *Monas*      4) *Astasia*

63. **Flagellum provided with two or more rows of lateral appendages and axoneme ends in terminal naked filament is**

- 1) stichonematic      2) pantonematic      3) acronematic      4) pantacronematic

64. **Pantacronematic flagellum is present in**

- 1) *Monas*      2) *Astasia*
- 3) *Polytoma*      4) *Urceolus*

65. **Set of flagellates without 'mastigonemes' on their flagella are**

- 1. *Polytoma* and *Peranema*
- 2. *Monas* and *Chlamydomonas*
- 3. *Chilomonas* and *Polytoma*
- 4. *Polytoma* and *Astasia*

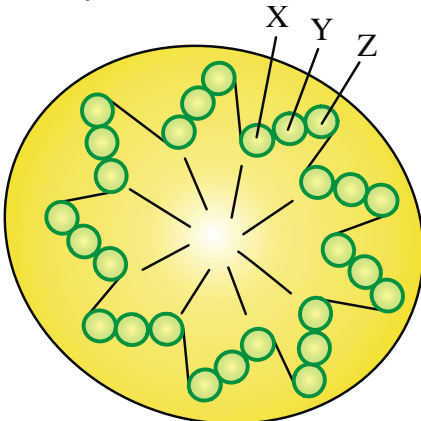
66. **Which of the following is correct based on number of flagella ?**

- 1) *Trypanosoma* > *Euglena* = *Trichomonas* < *Giardia* < *Trichonympha*
- 2) *Trypanosoma* < *Euglena* < *Trichomonas* < *Giardia* = *Trichonympha*
- 3) *Trypanosoma* < *Euglena* < *Trichomonas* < *Giardia* < *Trichonympha*
- 4) *Trypanosoma* < *Euglena* < *Trichomonas* = *Giardia* < *Trichonympha*

67. **Identify the set of flagellates from the following in which the flagellum has mastigonemes but no terminal naked filament, in both the cases.**

- 1) *Astasia*, *Chilomonas*
- 2) *Polytoma*, *Cryptomonas*
- 3) *Peranema*, *Euglena*
- 4) *Chlamydomonas*, *Polytoma*

68. **Identify the X, Y and Z in the following diagram.**



- 1) X = inner A tubule, Y = middle B tubule, Z = peripheral C tubule
- 2) X = inner C tubule, Y = middle B tubule, Z = peripheral A tubule
- 3) X = inner B tubule, Y = middle C tubule, Z = peripheral A tubule
- 4) X = inner B tubule, Y = middle A tubule, Z = peripheral C tubule

2) X = inner



- 3) all ciliates      4) sponges
- 85. The total number of microtubules in the axoneme and basal granule altogether of a flagellum/cilium is**  
 1) 27      2) 47      3) 29      4) 45
- 86. If the terminal naked axoneme of the flagellum of *Urceolus* is removed, then its flagellum resembles that of**  
 1) *Peranema*      2) *Polytoma*  
 3) *Cryptomonas*      4) *Astasia*
- 87. Within a flagellum, peripheral doublets are interconnected by linkers called**  
 1) dextrin      2) tubulin  
 3) nexins      4) dystrophin
- 88. Flagellum which is provided with two or more rows of lateral appendages and axoneme ends in terminal naked axial filament is**  
 1) stichonematic      2) pantonematic  
 3) acronematic      4) pantacronematic
- 89. Hypothetically speaking, what type of flagellum is formed if two or more rows of lateral appendages are added to the flagellum of *Chlamydomonas*?**  
 1) Acronematic      2) Pantacronematic      3) Pantonematic      4) Stichonematic
- 90. Flagellum of *Monas* differs from that of *Chlamydomonas* by the**  
 1) presence of naked terminal part and lateral appendages  
 2) absence of naked terminal part and lateral appendages  
 3) presence of naked terminal part and absence of lateral appendages  
 4) absence of naked terminal part and presence of lateral appendages
- 91. Identify the flagellate with many flagella.**  
 1) *Giardia*      2) *Trichonympha*  
 3) *Trypanosoma*      4) *Trichomonas*
- 92. Total number of triplets in the flagella of *Euglena* below the level of its pellicle is**  
 1) 9      2) 18      3) 11      4) 27
- 93. The locomotory organelle of which of the following protozoans is provided with terminal naked filament ?**  
 1) *Chlamydomonas*, *Chilomonas*  
 2) *Polytoma*, *Peranema*  
 3) *Urceolus*, *Chlamydomonas*  
 4) *Cryptomonas*, *Chlamydomonas*
- 94. Which one of the following mastigophoran protist will have maximum number of triplets?**  
 1) *Trypanosoma*      2) *Trichomonas*  
 3) *Trichonympha*      4) *Giardia*
- 95. Type of protein present in motor protein molecules is**  
 1) tubulin      2) globulin      3) dynein      4) actin
- 96. Number of dynein arms present in a flagellum/cilium is**  
 1) 9 pairs      2) 18 pairs      3) 20      4) many pairs
- 97. The flagellum without terminal filament and lateral appendages is present in**  
 1) *Urceolus*      2) *Peranema*      3) *Astasia*      4) *Chilomonas*
- 98. If the terminal filament of pantacronematic flagellum is removed, it resembles the flagellum of**  
 1) *Euglena*      2) *Cryptomonas*  
 3) *Monas*      4) *Polytoma*
- 99. Pantacronematic : *Urceolus* ; Acronematic ?**  
 1) *Peranema*      2) *Polytoma*      3) *Polystomella*      4) *Podophrys*
- 100. Number of flagella in 'grand old man of intestine' is**  
 1) 1 pair      2) 2 pairs      3) 4 pairs      4) many
- 101. Infraciliary system of *Paramecium* consists of**  
 1) kinetodesmata + motorium  
 2) kinetodesmata + kinetosomes  
 3) kinetia + neuromotor system

- 4) kinetodesmata only
- 102. Which one of the following is not a part of infraciliary system in *Paramecium*?**
- 1) Kinetosomes
  - 2) Motorium
  - 3) Kinetodesmal fibrils
  - 4) Kinetodesmata
- 103. Neuromotor system in *Paramecium* is formed of**
- 1) muscle fibers, nerve fibers
  - 2) kinetosomes, kinetodesmata only
  - 3) motorium, kinetosomes only
  - 4) motorium, infraciliary system
- 104. Infraciliary system together with motorium forms**
- 1) neuromotor junction
  - 2) kinety
  - 3) neuromotor system
  - 4) motor end plate
- 105. In which of the following protozoan, adult stage lacks or devoid of cilia ?**
- 1) *Amoeba*
  - 2) *Paramecium*
  - 3) *Acineta*
  - 4) *Acineta, Amoeba*
- 106. The type of flagellar movement in mastigophorans that makes the animal to rotate in its own axis is**
- 1) undulation
  - 2) pendular
  - 3) simple conical gyration
  - 4) sidewise lash
- 107. The contractile fibrils of certain protozoans which are similar to the myofibrils of higher organisms are**
- 1) myotomes
  - 2) myonemes
  - 3) myofilaments
  - 4) monotremes
- 108. ATPase enzyme activity is at ..... of cilia and flagella.**
- 1) Singlet microtubules
  - 2) Dynein arms
  - 3) Triplets of basal granule
  - 4) Radial spokes
- 109. Bending of flagellum/cilium is brought about by**
- 1) sliding of microtubules past each other by the functioning of 'dynein' arms
  - 2) sliding of microtubules past each other by the functioning of radial spokes
  - 3) movement of microtubules by central singlets
  - 4) immobility of microtubules
- 110. Excessive displacement of doublets in the bending movement of cilium /flagellum is prevented by**
- 1) dynein arms
  - 2) deficiency of ATP ase
  - 3) radial spokes
  - 4) protoplasmic sheath
- 111. If nexins and radial spokes of an axoneme in a flagellum/cilium are subjected to enzymatic digestion and then exposed to ATP, what happens to the peripheral doublets ?**
- 1) Slide past each other
  - 2) They can't physically held in place
  - 3) They will dissolve 'A' tubule
  - 4) Produce bending of Flagellum
- 112. Undulations of flagellum from base to tip causes pushing force which is like a**
- 1) propeller of a boat
  - 2) propeller of an aeroplane
  - 3) 1 and 2
  - 4) rudder of a boat
- 113. If undulations of flagellum passes from tip to the base, then the flagellate**
- 1) moves forwards
  - 2) moves backwards
  - 3) rotates on its own axis
  - 4) rotates in opposite direction to the flagellum
- 114. If the flagellum bends to the right side and shows undulations from base to the tip, then the organism shows**
- 1) lateral movement towards the left side
  - 2) lateral movement towards the right side
  - 3) rotating movement in clockwise direction
  - 4) rotating movement in anticlockwise direction
- 115. Flagellum turns like a screw exerting a propelling action during**

- 1) side wise lash movement
- 2) undulation movement
- 3) recovery stroke
- 4) simple conical gyration movement

**116. If the flagellum is bend towards right side and the undulations pass from tip to base, the movement of animal is**

- 1) towards right side
- 2) towards left side
- 3) anterior side
- 4) posterior side

**117. The sequential movement of cilia in a longitudinal row / kinety of *Paramecium* is called**

- 1) synchronous movement
- 2) metachronous movement
- 3) gliding movement
- 4) metaboly

**118. The centre to coordinate the ciliary locomotion in *Paramecium* is present near the**

- 1) macronucleus
- 2) contractile vacuole
- 3) cytopharynx
- 4) central fibrils of cilium

**119. The movement of *Paramecium* that resembles the movement of plants in paddy field (due to blow of wind) is called**

- 1) pendular
- 2) metachronous
- 3) synchronous
- 4) undular

**120. Small zigzag movements in the protozoans caused by the contraction and relaxation of myonemes is called**

- 1) gliding movement
- 2) gyration
- 3) amoeboid movement
- 4) metaboly

**121. The protozoans that exhibit slowest and fastest types of locomotion are respectively**

- 1) rhizopods and mastigophorans
- 2) rhizopods and ciliates
- 3) apicomplexans and mastigophorans
- 4) mastigophorans and ciliates

## REPRODUCTION IN PROTOZOANS

**122. The cell organelle that divides in binary fission of *Euglena* is**

- 1) cytopharynx
- 2) basal granules
- 3) contractile vacuole
- 4) stigma

**123. During longitudinal binary fission, which structure is retained by one daughter *Euglena* while the other daughter develops a new one?**

- 1) Reservoir
- 2) Nucleus
- 3) Chromatophore
- 4) Flagella

**124. Photoreceptor organelle of *Euglena* is**

- 1) cytophyge
- 2) paraflagellar body
- 3) tentacles
- 4) ocelli

**125. Homothetogenic binary fission is seen in**

- 1) *Euglena*
- 2) *Paramecium*
- 3) *Amoeba*
- 4) *Vorticella*

**126. *Trichocysts* are seen in**

- 1) *Paramecium*
- 2) *Euglena*
- 3) *Amoeba*
- 4) *Plasmodium*

**127. Which cell organelles are newly formed in *Opisthe*?**

- 1) Anterior contractile vacuole, cytopharynx and oral groove
- 2) Posterior contractile vacuole, cytopharynx
- 3) Posterior contractile vacuole, oral groove
- 4) All of the above

**128. Number of binary fissions that a *Paramecium* can undergo in a day is**

- 1) 5 times
- 2) 8 times
- 3) 9 times
- 4) 4 times

**129. A clone in *Paramecium* is**

- 1) a set of similar daughter cells formed by conjugation
- 2) a set of similar daughter cells formed by autogamy
- 3) a set of similar daughter cells formed due to repeated binary fission from a single parent
- 4) a set of similar daughter cells formed by endomixis

- 130. Number of generations of progeny formed from a *Paramecium* by repeated binary fissions in a day is**  
 1) 1      2) 2      3) 3      4) 4
- 131. A clone of *Paramecium* refers to**  
 1) morphologically similar but genetically different organisms  
 2) a colony of *Paramecia* living in one place  
 3) morphologically and genetically similar daughters from single parent  
 4) group of similar daughters individuals that have same number of cilia
- 132. The number of osmoregulatory structures in *Paramecium* is**  
 1) 2    2) 1    3) 4                      4) 8
- 133. In *Paramecium*, the first step during binary fission is that it**  
 1) stops excretion    2) stops respiration  
 3) stops osmoregulation  
 4) stops feeding
- 134. At the end of binary fission of a *Paramecium*, which daughter form contains the parental anterior contractile vacuole ?**  
 1) Opisthe    2) Proter    3) Both    4) None
- 135. Which is not true about 'Opisthe' ?**  
 1) New cytopharynx is formed by it  
 2) It receives posterior contractile vacuole from parent  
 3) Anterior contractile vacuole is formed afresh  
 4) Receives parental cytopharynx
- 136. In *Paramecium*, during binary fission, the micronucleus undergoes**  
 1) amitosis                      2) meiosis  
 3) mitosis                        4) endomixis
- 137. The fusion of similar gametes is called**  
 1) isogamy                        2) anisogamy  
 3) polygamy                      4) plasmotomy
- 138. Isogamy is seen in**  
 1) *Monocystis*                    2) *Vorticella*  
 3) *Plasmodium*                   4) *Amoeba*
- 139. Anisogamy is seen in**  
 1) *Monocystis*                    2) *Plasmodium*  
 3) *Amoeba*                        4) *Paramecium*
- 140. The fusion of pronuclei of two mature organisms which do not form gametes but behave themselves as gametes is called**  
 1) isogamy                        2) anisogamy  
 3) hologamy                      4) cytogamy



## **\*SPECIAL FORMAT QUESTIONS\***

### **1. Study the following statements.**

- I. The fastest locomotion is performed by flagellates.
- II. In protozoans, locomotion is influenced by food and other type of stimuli.
- III. Function of pseudopodia is not only locomotion but also food collection.

**Which of the above are correct ?**

- 1) I & II only            2) II & III only
- 3) I, II & III            4) I & III only

### **2. Study the following statements.**

- I. Blunt, finger- like pseudopodia are present in *Entamoeba*.
- II. Filopodia are fibre- like.
- III. Ray-like pseudopodia are present in *Actinophrys*.

**Which of the above are correct ?**

- 1) I & II only            2) II & III only
- 3) I & III only            4) I, II & III.

### **3. Study the following statements.**

- I. Flagella arise from blepharoplasts.
- II. Microtubular arrangement in flagella is 9+4
- III. Microtubular arrangement in basal granules is 9+2.
- IV. Many flagella are present in *Trichomonas*.

**Which of the above are correct ?**

- 1) Only I & II            2) I, II, III & IV
- 3) Only III                4) Only I

### **4. Study the following statements.**

- I. Many kineties are present in the ectoplasm of Paramecium as infraciliary system.
- II. Motorium and infraciliary system together called neuromotor system.
- III. Undular movement is produced by undulipodia.
- IV. Simple flagellum is stichonematic type

**Which of the above are correct ?**

- 1) I & III only            2) II & IV only
- 3) I, III & IV only      4) I & II only

### **5. If *Euglena* wants to move laterally to the left side, which one of the following would be correct ?**

- 1) Bending of flagellum to right side and show undulations from base to tip
- 2) Bending of flagellum to any side and show undulations from tip to base
- 3) Bending of flagellum to left side and shows undulations from base to tip
- 4) Bending of flagellum to right side and shows undulations from tip to base

### **6. During the effective stroke in sidewise lash movement, the flagellum becomes**

- 1) rigid, bends to one side, beats against water at right angle to longitudinal axis of body, and organism moves backwards
- 2) rigid, bends to one side, beats against water at right angle to longitudinal axis of body and the organism moves forwards
- 3) soft, bends to both sides, beats against water at right angle to longitudinal axis of body, organism moves backwards
- 4) rigid, bends to one side, beats against water at right angle to transverse axis of body, organism moves forwards

### **7. Find the correct statements.**

- A) All 'undulipodia' show undular movements.      B) Flagella unite to form cirri.
- C) Cilia perform 'pendular' movement.
- D) Neutrophils exhibit amoeboid movement.

- 1) A and C 2) A and D  
3) B and C 4) C and D

**8. Identify incorrect statements about ciliary movement .**

- I) Cilium moves like a wave.  
II) Cilium moves water perpendicular to the surface of its attachment.  
III) Cilium moves water perpendicular to its axis.  
IV) Cilium moves water parallel to the surface of its attachment.

- 1) I and II                      2) I and III  
3) III and IV                  4) I and IV

**9. Read the statements pertaining to Axoneme .**

- i) Axoneme is made up of 11 microtubules.  
ii) **A & B** tubules are present in the peripheral doublets.  
iii) Peripheral doublets are connected by nexins  
iv) Microtubule 'A' is large than the microtubule 'B'.  
1) All except i are correct                                      2) All except ii, iii correct  
3) All except i and iv are correct                              4) All are correct

**10. Identify the correct statement (s).**

- (a) All undulipodia show undular movements.  
(b) Some undulipodia do not show undular movements.  
(c) Some undulipodia show undular movements.  
1) a, b and c are correct    2) b and c are correct    3) a and c are correct    4) none are correct

**11. Read the following statements.**

- (i) A flagellum turns like a screw in conical gyration.  
(ii) Dynein arms of each doublet attach to an adjacent doublet & pull the neighbouring doublet.  
(iii) Doublets can't slide past much because they are attached to outer sheath by radial spokes.  
(iv) A flagellum pushes the fluid medium at right angles to the surface of its attachment, by its bending movement.

**The correct combinations are**

- 1) All except IV              2) All except I                      3) all except III 4) All except II

**12. Arrange the following individuals based on the number of flagella in a descending order.**

- A) *Trichomonas*              B) *Trichonympha*  
C) *Euglena*                      D) *Giardia*

- 1)  $B \rightarrow D \rightarrow A \rightarrow C$     2)  $B \rightarrow A \rightarrow C \rightarrow D$               3)  $B \rightarrow D \rightarrow C \rightarrow A$     4)  $A \rightarrow C \rightarrow D \rightarrow B$

**13. Arrange the following in correct sequence of action.**

- A. Sliding of doublets  
B. Pulling of doublets by dynein arms  
C. Swimming locomotion  
D. Bending of flagellum  
E. Attachment of the dynein arms to the neighbouring doublet

- 1) B - E - D - A - C    2) C - B - D - A - E  
3) E - B - A - D - C    4) E - B - D - A - C

**14. The following are the various parts in the flagellum / cilium. Arrange them in a correct sequence from outer to inner.**

- A) Singlets                      B) Protoplasmic sheath              C) Inner sheath D) Doublets E) Radial spokes  
1) C-D-B-D-E              2) B-D-C-A-E  
3) B-C-E-A-D              4) B-D-E-C-A

**15. Identify the components of neuromotor system in sequence.**

- A. Kinetodesmata              B. Kinety  
C. Kinetosomes              D. Infraciliary system  
E. Kinetodesmal fibrils F. Motorium

- 1) C - E - B - D - A - F  
2) B - C - A - D - E - F

3) C - A - E - B - D - F

4) C - E - A - B - D - F

**16. Identify the sequence of steps in bending movement of flagella.**

A. Pulling of neighbouring doublet.

B. Attachment of dynein arms to adjacent doublet.

C. Releasing of arms. D. Reattachment of arms.

E. Sliding

1) B - A - E - C - D    2) B - E - A - D - C

3) B - E - D - C - A    4) B - A - E - D - C

**17. Read the following statements.**

I. Heliopodia type of pseudopodium is present in sun ray-like animals.

II. Net-like pseudopodium is present in *Elphidium*.

III. Blunt finger-like pseudopodium is present in *Entamoeba* but not in *Amoeba*.

1) I & III are correct 2) I & II are correct

3) II & III are correct 4) All are correct

**18. Read the statements pertaining to Axoneme.**

I. Axoneme is made up of (9+2) set of microtubules.

II. A&B microtubules constitute the peripheral doublets.

III. Peripheral doublets are inter connected by nexins.

IV. Microtubule 'A' is smaller and complete bearing paired dynein arms all along its length.

1) All except I are correct

2) All except II, III are correct

3) All except IV are correct

4) All are correct

**19. Read the statements & choose the correct combinations.**

i) Central microtubules are absent in basal granules.

ii) The adult suctorians do not possess cilia.

iii) Flagella do not fuse/unite to form cirri.

1) Only i & ii            2) Only ii & iii

3) Only i & iii            4) All are correct

**20. Read the following statements.**

A) Flagella produce undular beat.

B) Cilia may form compound ciliary organelles.

C) Flagella help only in locomotion.

D) Cilia produce pendular beat.

**The correct statements are**

1) Only A & B            2) Only B, C & D

3) Only A & C            4) A, B, C & D

**21. Read the following statements.**

i) Ciliary locomotion is faster than flagellar locomotion.

ii) Myonemes are similar to the myofibrils of higher organisms.

iii) Ciliary locomotion is coordinated by the infraciliary system.

iv) Cilium moves the water parallel to the surface of its attachment.

**The correct statements are**

1) Only i & ii            2) Only ii & iii

3) Only i & iv            4) All the above

**22. Study the following statements.**

I. Undulipodia that shows pendular movement are flagella.

II. Cilia are the undulipodia that show pendular movement.

III. All undulipodia help in swimming locomotion.

**Which of the above are correct ?**

1) I, & II only            2) I & III only

3) II & III only            4) All

**23. Study the following statements and identify correct one**

- I. Union of pronuclei of gametes restores the diploid chromosomal number
  - II. The most common type of asexual reproduction in protozoa is binary fission
  - III. Photo receptor is present at the base of flagella of the *Euglena*
  - IV. Fusion of two similar gamete is called isogamy
- 1) I & II are correct    2) I, II & III are correct  
 3) I, II & IV are correct    4) All are correct

**24. Study the following statements and identify correct one**

- I. Longitudinal binary fission also called homothetogenic division
  - II. During transverse binary fission in *Paramecium* oral groove disappears
  - III. In *Euglena* the organellae present close to cytopharynx is chloroplast.
- 1) only II                      2) Only I & II  
 3) Only III                     4) Only I

**25. Study the following statements and identify correct one**

- I. Temporary pairing of two individuals for the exchange of pronuclei is called hologamy
  - II. Genetic recombination occur during sexual reproduction
  - III. Conjugation is induced only during unfavourable conditions
- 1) I & II only                2) II & III only  
 3) I, II & III                4) I & III only

**26. Study the following statements and identify correct one**

- I. Conjugation occurs between two senile individuals
  - II. Conjugation results in the production of rejuvenated individuals
  - III. Conjugation does not takes place during unfavourable conditions
- 1) I & II only                2) Only II  
 3) Only II & III             4) I, II & III

**27 Study the following statements which belongs to binaryfission of *Euglena***

- I. Blepharoplast & chromatophores divide
- II. Contractile vacuole, stigma, paraflagellar body disappear
- III. Flagella do not divide & disappear

**Which of the above are correct**

- 1) I, II & III                2) I, II only  
 3) I & III only              4) Only I

**28. Study the following statements and identify correct one**

- I. anterior daughter individual of *Paramecium* is called proter
  - II. Posterior daughter individual of *Euglena* is called opisthe
  - III. The process of transverse binaryfission in *Paramecium* is completed in about 4hrs
  - IV. Synchronous movement seen in the transverse row of cilia of *Paramecium*
- 1) I, II & IV only    2) I, III & IV only  
 3) I & II only        4) I, II, III & IV

**29. Match the following.**

**List –I**

- A) Flimmers
- B) Doublets
- C) Singlets
- D) Triplets

**List–II**

- I) Peripheral tubules of basal granule
- II) Lateral appendages of flagella
- III) Pairs of arms
- IV) Central tubules of axial filament
- V) Peripheral tubules of axial filament

- |    | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|----|----------|----------|----------|----------|
| 1) | III      | V        | IV       | I        |
| 2) | I        | IV       | V        | II       |

- 3) II V IV I  
4) I III IV V

**30. Match the following.**

**List –I**

**List –II**

- A) Two or more rows of mastigonemes  
B) Without flimmers  
C) Two or more rows of mastigonemes with axial filament  
D) Single row of lateral appendages upto the tip
- I) Anematic  
II) Pentacronematic  
III) Stichonematic  
IV) Pantonematic  
V) Acronematic

- |    | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|----|----------|----------|----------|----------|
| 1) | IV       | II       | III      | V        |
| 2) | IV       | III      | II       | V        |
| 3) | IV       | I        | II       | III      |
| 4) | IV       | I        | III      | II       |

**31. Match the following .**

**Pseudopodia**

**Nature**

- A) Lobopodia  
B) Filopodia  
C) Reticulopodia  
D) Axopodia
- I) Sun ray like pseudopodia  
II) Forms a network  
III) Blunt, finger like pseudopodia  
IV). Fiber like

- |    | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|----|----------|----------|----------|----------|
| 1) | III      | IV       | II       | I        |
| 2) | IV       | III      | I        | II       |
| 3) | III      | IV       | I        | II       |
| 4) | II       | I        | IV       | III      |

**32. Match the following.**

**Flagellate**

**No.of.flagella**

- A) *Euglena*  
B) *Trichomonas*  
C) *Trichonympha*  
D) *Giardia*
- I) 8  
II) 2  
III) 4  
IV) Many

- |    | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|----|----------|----------|----------|----------|
| 1) | III      | II       | IV       | I        |
| 2) | III      | IV       | II       | I        |
| 3) | II       | III      | IV       | I        |
| 4) | IV       | III      | II       | I        |

**33. Match the following.**

**List-A**

**List-B**

- 1) Filopodia  
2) Lobopodia  
3) Reticulopodia  
4) Axopodia
- A) *Elphidium*  
B) *Amoeba*  
C) *Euglypha*  
D) *Actinophrys*
- 1) 1A,2B,3C,4D  
2) 1C,2B,3A,4D  
3) 1C,2B,3D,4A  
4) 1C,2A,3B,4D

**34. List-A**

**List-B**

- 1) Pseudopodial  
2) Ciliary movement  
3) Flagellar movement  
4) Gliding movement
- A) Juvenile of movement *Acineta*  
B) Sporozoan  
C) *Polystomella*  
D) *Chlamydomonas*
- 1) 1A,2B,3C,4D  
2) 1C,2B,3A,4D

- 3) 1C,2B,3D,4A      4) 1C,2A,3D,4B

**35. Match the following.**

**List-A**

- I) Cellular extensions  
 II) Contractile fibrils  
 III) Short hair like organelles  
 IV) Whip like organelles

**List-B**

- A) Pseudopodia  
 B) Myonemes  
 C) Cilia  
 D) Flagella

- 1) I-A, II-B, III-C, IV-D  
 2) I-A, II-C, III-D, IV-B  
 3) I-D, II-C, III-A, IV-B  
 4) I-C, II-B, III-A, IV-D

**36. Match the following.**

**List-A**

- 1) Stichonematic  
 2) Acronematic  
 3) Anematic  
 4) Pentacronematic  
 5) Pantonematic

**List-B**

- A) *Polytoma*  
 B) *Astasia*  
 C) *Paranema*  
 D) *Chilomonas*  
 E) *Urceolus*

- 1) 1-A, 2-B, 3-C, 4-D, 5-E  
 2) 1-A, 2-C, 3-D, 4-E, 5-B  
 3) 1-D, 2-C, 3-E, 4-B, 5-A  
 4) 1-B, 2-A, 3-D, 4-E, 5-C

**37. Match the following.**

**List-A**

- 1) Single row of appendages  
 2) Two rows of appendages  
 3) Lateral appendages & Terminal filament are absent  
 4) Two rows of appendages & Terminal filament are present

**List-B**

- A) *Cryptomonas*  
 B) *Urceolus*  
 C) *Euglena*  
 D) *Monas*

- 1) 1-A, 2-B, 3-C, 4-D    2) 1-A, 2-C, 3-D, 4-B  
 3) 1-C, 2-D, 3-A, 4-B    4) 1-C, 2-B, 3-A, 4-D

**38. Match the following.**

**List-A**

- 1) Pushing force  
 2) Pulling force  
 3) Metachronous  
 4) Synchronous

**List-B**

- A) Propeller of an aeroplane  
 B) Longitudinal row of cilia  
 C) Propeller of a boat movement  
 D) Transverse row of cilia movement

- 1) 1-A, 2-B, 3-C, 4-D    2) 1-A, 2-C, 3-D, 4-B  
 3) 1-D, 2-C, 3-A, 4-B    4) 1-C, 2-A, 3-B, 4-D

**39. Match the following.**

**List-I**

- 1) Protoplasmic sheaths  
 2) Radial spokes in T.S. of axoneme  
 3) Singlets of axoneme  
 4) Singlets of kinetosome  
 5) Microtubules of all doublets

**List-II**

- a) 18  
 b) 1  
 c) 0  
 d) 2  
 e) 9

- 1) 1 = d; 2 = c; 3 = e; 4 = b; 5 = a  
 2) 1 = d; 2 = c; 3 = a; 4 = e; 5 = d

3) 1 = d; 2 = c; 3 = e; 4 = a; 5 = b

4) 1 = d; 2 = e; 3 = d; 4 = c; 5 = a

**40. Match the following.**

**List-I**

A) Number of doublets

B) Number of microtubules in axoneme

C) Number of dynein arms at a level

D) Number of microtubules in

**List-II**

1) 27

2) 9 pairs

3) 20

kinetosome

4) 9

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
1)	4	1	2	3
2)	1	4	2	3
3)	3	4	1	2
4)	2	3	4	1

**41. Match the following**

**List-I**

A) Schizogony

B) Male gamete-togony

C) Sporogony

D) Amitosis

**List-II**

I) Formation of sporozoites

II) Macronucleus of *Paramecium*

III) Asexual multiple fission

IV) Formation of male gametes

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
1)	III	IV	I	II
2)	II	IV	I	III
3)	IV	II	I	III
4)	III	I	IV	II

**42. Match the following**

**List-I**

A) Isogamy

B) Anisogamy

C) Hologamy

D) Syngamy

**List-II**

I) Zygote

II) Fusion of similar gametes

III) Fusion of dissimilar gametes

IV) Fusion of mature organisms

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
1)	III	IV	I	II
2)	IV	III	II	I
3)	I	II	III	IV
4)	II	III	IV	I

**43. Match the following**

**List-I**

A) Macronucleus of *Paramecium*

B) Micronucleus of *Paramecium*

C) Binary fission

D) Conjugation

**List-II**

I) Diploid

II) Polyploid

III) Unfavourable conditions

IV) Favourable conditions

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
1)	II	I	IV	III
2)	I	II	III	IV
3)	IV	III	I	II

**KEY :**  
**MULTIPLE CHOICE QUESTIONS**

1) 4    2) 4    3) 1    4) 1    5) 1    6) 4    7) 3    8) 4    9) 1    10) 3    11) 4    12) 1    13) 1  
14) 2    15) 1    16) 2    17) 1    18) 1    19) 3    20) 2    21) 2    22) 1    23) 2    24) 1    25) 2    26) 1  
27) 3    28) 2    29) 2    30) 4    31) 3    32) 2    33) 3    34) 4    35) 3    36) 2    37) 4    38) 3    39) 1  
40) 1    41) 1    42) 2    43) 1    44) 3    45) 3    46) 3    47) 2    48) 4    49) 3    50) 4    51) 2    52) 1  
53) 3    54) 4    55) 1    56) 1    57) 1    58) 4    59) 2    60) 2    61) 2    62) 1    63) 4    64) 4    65) 3  
66) 4    67) 3    68) 1    69) 1    70) 1    71) 1    72) 3    73) 2    74) 4    75) 4    76) 4    77) 1    78) 2  
79) 1    80) 2    81) 1    82) 1    83) 1    84) 2    85) 3    86) 1    87) 3    88) 4    89) 2    90) 4    91) 2  
92) 2    93) 3    94) 3    95) 3    96) 4    97) 4    98) 3    99) 2    100) 3    101) 2    102) 2    103) 4    104) 3  
105) 3    106) 3    107) 2    108) 2    109) 1    110) 3    111) 2    112) 1    113) 1    114) 1    115) 4    116) 1    117) 2  
118) 3    119) 2    120) 1    121) 2    122) 2    123) 4    124) 2    125) 2    126) 1    127) 1    128) 4    129) 3    130) 4  
131) 3    132) 2    133) 4    134) 2    135) 4    136) 1    137) 1    138) 1    139) 2    140) 3

**SPECIAL FORMAT QUESTIONS**

1) 2    2) 4    3) 4    4) 4    5) 1    6) 2    7) 4    8) 1    9) 3    10) 2    11) 3    12) 1    13) 3  
14) 4    15) 4    16) 1    17) 2    18) 4    19) 4    20) 4    21) 4    22) 3    23) 4    24) 1    25) 2    26) 4  
27) 1    28) 2    29) 3    30) 3    31) 1    32) 3    33) 2    34) 4    35) 1    36) 4    37) 3    38) 4    39) 4  
40) 4    41) 1    42) 4    43) 1    44) 2



**UNIT-VI**  
**BIOLOGY IN HUMAN**  
**WELFARE**  
**CHAPTER-8 HUMAN HEALTH AND**  
**DISEASE**

## SYNOPSIS

- **Health** is a state of complete physical, mental and social well-being rather than only physical fitness or the absence of disease.
  - Health is affected by genetic disorders, infections and life style.
  - Balanced diet, personal hygiene, regular exercise, rest and thinking are very important to maintain good physical and mental health.
- Awareness about diseases and their effect on different body functions, vaccination against infectious diseases, proper disposal of wastes, control of vectors, maintenance of hygienic food and water resources all are necessary for health.
- Disease is the condition of improper functioning or any condition which interferes with the normal functioning of one or more organs of the body and causes disorder of mind or body. It is characterised by various signs and symptoms. Diseases can be broadly classified into
  - **Congenital diseases** These diseases are present in human since birth (genetic disorders) or are caused due to mutation, e.g. Down's syndrome, sickle-cell anaemia, etc.
  - **Acquired diseases** These diseases develop after birth and are not transferred from parents to offspring. These diseases are further categorised into
    - **Infectious diseases or Communicable diseases** These diseases are easily transmitted from a diseased person to a healthy person. The infectious diseases are very common, e.g. AIDS, common cold, etc.
    - **Non-infectious diseases or Non-communicable diseases** These diseases cannot be transmitted from a diseased person to a healthy person. These diseases are caused by agents other than pathogens, e.g. cancer, diabetes, etc.

### Common Diseases in Humans

- **Pathogen** is an organism which can cause disease in human. These can belong to bacteria, viruses, fungi, protozoans, helminths, etc.
- Most parasites are therefore pathogens as these cause harm to the host by inhabiting them.
- The pathogens can enter our body by various means, multiply and interfere with normal vital activities and cause morphological and functional damage.
- Pathogens have to adapt to life within the environment of the host, e.g. the pathogens that enter the gut must know a way of surviving in the stomach at low pH and resisting the various digestive enzymes.
- **Vectors**, on the other hand, do not cause disease themselves, but act as carriers to transmit the pathogen from an infected person to a healthy person, i.e. spread the disease, e.g. female *Anopheles* mosquito.
- Some common diseases and their pathogenic members are discussed as follows

### Bacterial Diseases

Some common bacterial diseases are as follows

1. **Typhoid** is caused by a bacterium called *Salmonella typhi*.
  - *S. typhi* enters the small intestine through contaminated food and water and migrate to other organs through food and blood.
  - **Symptoms** are high fever (39-40°C), weakness, stomach pain, constipation, headache and loss of appetite. Intestinal perforation and in severe cases death may occur.
  - **Widal test** is the confirmatory test for diagnosis of typhoid.

2. **Pneumonia** is caused by *Streptococcus pneumoniae* and *Haemophilus influenzae*.
  - These bacteria infect alveoli of the lungs. The alveoli get filled with a fluid which causes decrease of respiratory efficiency of the lungs.
  - Pneumonia spreads by inhaling droplets/aerosol from infected individuals, sharing glasses and utensils with an infected person.
  - **Symptoms** of pneumonia are fever, chills, cough, headache, etc. In severe cases, the lips and finger nails may turn grey bluish in colour.
3. **Plague** is caused by *Pasteurella/Yersinia pestis* and is also called **black death**.
4. **Diphtheria** is caused by *Corynebacterium diphtheriae* and is characterised by difficulty in breathing due to infection in the mucous membrane of upper respiratory tract.

### Viral Diseases

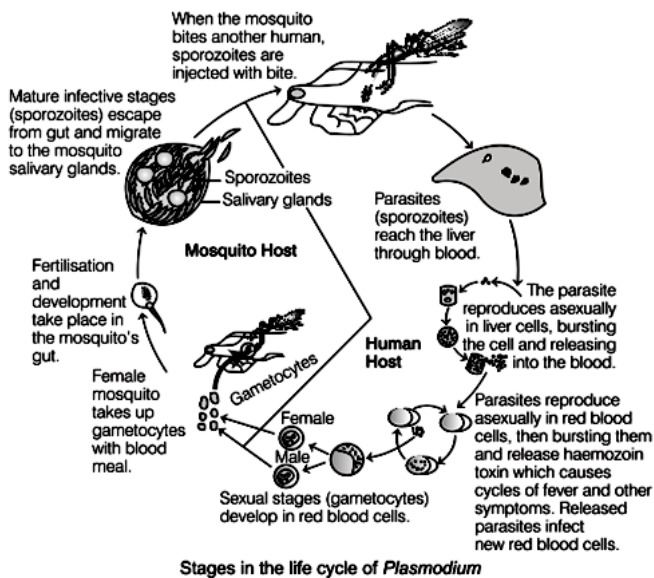
- **Common cold** occurs due to a group of viruses called **rhino viruses**.
- These viruses infect the nose and the respiratory passage, but not the lungs.
- **Symptoms** include nasal congestion and discharge, sore throat, hoarseness, cough, headache, tiredness, etc., which generally last for 3-7 days.
- The infection occurs when droplets from cough or sneeze of an infected person are either inhaled directly or transmitted through contaminated objects such as pen, books, cups, computer's keyboard or mouse, etc.

### Protozoan Diseases

Some common protozoan diseases are as follows

1. **Malaria** is caused by different species of the protozoan *Plasmodium (vivax, malariae and falciparum)*.
  - *P. falciparum* causes most serious kind of malaria which can be fatal.
  - Female *Anopheles* mosquito is the vector of *Plasmodium* which transfers the sporozoites (infectious form).

- Life cycle of *Plasmodium* is given in the figure below



- Thus, malarial parasite requires two hosts to complete its life cycle, i.e. human and mosquito.
- Amoebiasis (amoebic dysentery)** is caused by an intestinal endoparasite, *Entamoeba histolytica*, which is a protozoan parasite of the large intestine of humans.
    - Carrier of pathogens is housefly. It transmits the parasite from faeces of an infected person to the food.
    - Infection takes place through the contaminated food and water.
    - Symptoms** are abdominal pain, constipation, cramps, faeces with excess mucus and blood clots.

## Helminthic Diseases

Some common helminthic diseases are as follows

- Ascariasis** is caused by an intestinal endoparasite of human, *Ascaris lumbricoides* commonly called as **roundworm**.
  - Infection occurs as the eggs of parasite excreted along with faeces of infected person, contaminate water and soil.
  - Infection reaches human beings through contaminated vegetables, fruits and water.
  - Symptoms** of disease are abdominal pain, indigestion, muscular pain, fever, anaemia, nausea, headache and the blockage of intestinal passage.
- Filariasis/Elephantiasis** is caused by filarial worms *Wuchereria bancrofti* and *Wuchereria malayi*.
  - Culex* mosquito (female) is the vector.
  - Symptoms** are chronic inflammation of organs in which they live, blockage of lymph vessels of lower limbs resulting in swelling.
  - Genital organs also get affected leading to their deformation.

## Fungal Diseases

**Ringworm** is caused by fungi of the genera—*Microsporum*, *Trichophyton* and *Epidermophyton*.

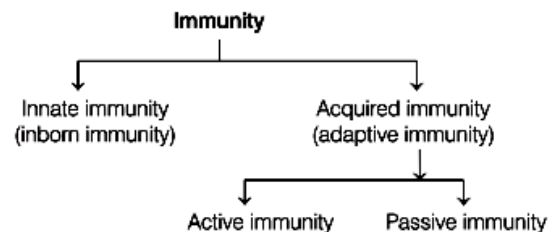
- Infection occurs through contact with an infected person or from soil, through the use of towels, clothes, combs, etc., of an infected person.
- Symptoms** of ringworm are appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp accompanied by intense itching.
- Heat and moisture help these fungi to grow in regions like folds as in groin or between the toes.

## Prevention and Control of Infectious Diseases

- Maintenance of personal and public hygiene is very important for prevention and control of many infectious diseases. **Personal hygiene** includes keeping the body clean, consumption of clean drinking water, food, etc. **Public hygiene** includes proper disposal of waste and excreta, periodic cleaning of water reservoirs, etc.
- Other preventive measures include
  - Eradication of vectors and destroying their breeding sites.
  - Use of mosquito nets and repellants.
  - Introducing fishes like *Gambusia* in pond that feed on mosquito larva.
  - Vaccination and immunisation programmes for diseases.
  - Use of antibiotics and other drugs can significantly and effectively treat infectious diseases.

## Immunity

It is the ability of the body (host) to fight against disease causing agents. Immunity is of two types.



### 1. Innate Immunity

It is present from birth and is inherited from the parents. It is non-specific and consists of following four types of barriers

- Physical barriers** prevent entry of microorganisms in the body. For example, skin, mucus coating of epithelium lining of respiratory, gastrointestinal and urogenital tracts.
- Physiological barriers** prevent microbial growth in the body. For example, acid in the stomach, saliva in the mouth, tears from eyes.
- Cellular barriers** phagocytose and destroy microbes. For example, some WBCs like Polymorpho-Nuclear Leucocytes (PMNL- neutrophils) and monocytes and natural killer cells (type of lymphocytes) in the blood as well as macrophages in tissues.
- Cytokine barriers** Virus-infected cells secrete proteins called **interferons**, which protect non-infected cells from further viral infection.

### 2. Acquired Immunity

- The immunity acquired after birth is called acquired immunity.
- Acquired immunity is pathogen specific.
- It is characterised by memory. This means when our body encounters a pathogen for the first time it produces a response called **primary response** which is of low intensity.
- Subsequent encounter with the same pathogen elicits a highly intensified **secondary** or **anamnestic response**. This is ascribed to the fact that our body appears to have memory of the first encounter.
- The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, i.e. **B-lymphocytes** and **T-lymphocytes**.

- The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them. These proteins are called **antibodies**.
- The T-cells themselves do not secrete antibodies but help the B-cells to produce them.
- The acquired immunity may be **active** or **passive**.
- **Active immunity** is generated by the body on exposure to antigen. Active immunity can also be achieved through vaccination, e.g. polio vaccine, tetanus vaccine, etc., (artificially acquired). On the basis of action of responding cell, active immunity is of two types
  - **Cell-mediated immunity** This immunity is due to T-lymphocytes, which mature in thymus. The graft rejection during organ transplantation is due to the ability of the T-cells to differentiate between self and non-self is cell-mediated immunity.
  - **Humoral immunity** This is due to B-lymphocytes, which secrete specific antibody when exposed to a particular antigen. These antibodies flow into the body fluids and neutralise the antigen.
- **Passive immunity** develops due to direct transfer of actively formed antibodies. For example, the yellowish fluid **colostrum** secreted by mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant. The foetus also receives some antibodies from their mother, through the placenta during pregnancy.

## Antibodies

- These are the proteins (immunoglobulin) produced within the body by the plasma cells against antigens.
- The basic structure of all antibody/ Immunoglobulin (Ig) molecule consists of four polypeptide chains linked by disulphide bonds. Two small chains called **light chain** and two longer chains called **heavy chain** are present.
- Five different types of immunoglobulins are known and these are as follows

Antibody	Description
<b>IgG</b>	Most prevalent class of antibody, 75-80% of total antibody. It can cross placenta from mother to child and confer immune protection to newborns.
<b>IgM</b>	They are the first to be produced in response to encounter with a pathogen. Responsible for blood transfusion reactions in ABO blood system.
<b>IgA</b>	Found in colostrum, i.e. breast milk for newborns to provide passive immune protection.
<b>IgE</b>	It is involved in allergic reactions.
<b>IgD</b>	It resembles IgG structurally and serves as a recognition receptor for antigen. It activates and suppresses lymphocyte activity.

## Vaccination and Immunisation

- The process of introduction of inactivated or weakened pathogen into the body to provide protection against a disease is called **vaccination**.
- **Immunisation** is the process by which the body produces antibodies against the vaccine (primary response) and develops the ability to neutralise pathogens during actual infection in the body (secondary response).
- Vaccine generates B and T-cells that recognise the pathogens on subsequent exposure and produce an intense immune response.
- In case of requirement of quick immune response like tetanus or snake bite infection, pre-formed antibodies or antitoxin (a preparation containing antibodies to the toxin) are injected into the patient. This is called **passive immunisation**.

- Recombinant DNA technology has produced antigenic polypeptides of pathogen in bacteria or yeast. This allowed large scale production of vaccines, e.g. hepatitis-B vaccine from yeast.

## Allergy

- It is the exaggerated response of the immune system to certain antigens present in the environment known as **allergens**.
- These can be pollen grains, animal dander, dust, feathers, penicillin drugs, etc.
  - IgE antibodies are produced in response to allergens.
  - **Causes of allergy** are histamine and serotonin released from the mast cells.
  - **Symptoms of allergy** are sneezing, watery eyes, running nose, difficulty in breathing.
  - **Treatment of allergy** include doses of antihistamine, adrenaline and steroids.

## Autoimmunity

- Higher vertebrates' immune system can distinguish foreign molecules as well as foreign organisms and mount a response to destroy them.
- But sometimes, due to genetic and other unknown reasons, the body attacks self cells. This results in damage to the body this is called **autoimmunity** and the disease is called **auto-immune disease**.
- Rheumatoid arthritis which affects many people in our society, myasthenia gravis, etc. are some examples of auto-immune diseases.

## Immune System in the Body

- The human immune system consists of lymphoid organs, tissues, cells and soluble molecules like antibodies.
- The immune system also plays an important role in allergic reactions, auto-immune diseases and organ transplantation.

## Lymphoid Organs

- These are the organs where origin and/or maturation and proliferation of lymphocytes occur. The **primary lymphoid organs** are **bone marrow** and **thymus** where immature lymphocytes differentiate into antigen-sensitive lymphocytes.
- After maturation, the lymphocytes migrate to **secondary lymphoid organs** like **spleen**, **lymph nodes**, **tonsils**, **Peyer's patches** of small intestine and appendix. The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become effector cells.
- The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.
- Both bone marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.
- The spleen is a large bean-shaped organ. It mainly contains lymphocytes and phagocytes. It acts as a filter of blood by trapping blood-borne microorganisms. It is also called the graveyard of RBCs.
- The lymph nodes are small solid structures located at different points along the lymphatic system. Lymph nodes serve to trap microorganisms or other antigens, which happen to get into the lymph and tissue fluid.
- A lymphoid tissue is also located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called **Mucosal Associated Lymphoid Tissue (MALT)**. It constitutes about 50 per cent of the lymphoid tissue in the human body.

## AIDS

- It refers to the deficiency of the immune system, acquired during the life-time of an individual, indicating that it is not a congenital disease. It was first reported in 1981 in USA.
- The causative agent is Human Immunodeficiency Virus (HIV). It belongs to the group of viruses called **retro virus**. It has single-stranded RNA genome enclosed in an envelope.
- HIV is transmitted by
  - Sexual contact with an infected person.
  - Transfusion of contaminated blood.
  - Sharing infected needles.
  - Infected mother to unborn child through placenta.
- Individuals who are susceptible to infection are
  - Drug addicts due to intravenous drug injections.
  - Involved with multiple sexual partners.
  - Require repeated blood transfusion.
  - Children born to HIV positive mother.
- HIV/AIDS spreads only through body fluids. There is always a time-lag between the infection and appearance of AIDS symptoms, i.e. it varies from a few months to many years (usually 5-10 years).

### Mode of HIV Infection

- Virus enters the macrophage after entering the body of a person.
- RNA gets replicated to form viral DNA by enzyme reverse transcriptase.
- Viral DNA gets incorporated into the host cell DNA and directs the infected cells to produce viruses.
- Macrophages continue to produce virus particles and act like HIV factory.
- These virus particles enter helper T-lymphocytes ( $T_H$  cells) in the blood, where they continue to replicate and produce viral progeny.
- The number of helper T-lymphocytes progressively decreases in the body of the infected people.
- As the number of T-cells decrease, immunity also decreases. As a result, the person cannot produce any immune response even against common bacteria like *Mycobacterium*, parasites like *Toxoplasma* viruses and fungi. During this period, person suffers from fever, diarrhoea and weight loss.

### Treatment and Diagnosis

- **Enzyme Linked Immuno-Sorbent Assay (ELISA)** is used as a diagnostic test for AIDS.
- Treatment of AIDS with anti-retroviral drugs is only partially effective. These can only prolong the life of the patient, but cannot prevent death.

### Prevention of AIDS

- As AIDS has no cure, prevention is the best option. Preventive measures for HIV infection are
  - National AIDS Control Organisation (NACO) (1991) and other NGOs educate peoples about AIDS.
  - Role of WHO to prevent HIV infection.
- Making blood (from blood banks) safe from HIV.
  - Ensure use of disposable syringes and needles.
  - Ensure keeping blood banks safe from HIV.
  - Free distribution of condoms.
  - Prevention of drug abuse.
- Discouraging unsafe sex and encouraging regular checkups.

## Cancer

- It is the major cause of death all over the globe. It is caused by the breakdown of normal regulatory mechanisms of cell growth.
- Normal cells show a property called **contact inhibition** by virtue of which contact with other cells inhibits their uncontrolled growth.
- Cancer cells, however lose this property and continue to divide giving rise to masses of cells called **tumours**.
- Tumours are of two types—**benign** and **malignant**.
  - **Benign tumours** normally remain confined to their original location and do not spread to other parts of the body and cause little damage.
  - **Malignant tumours** are a mass of proliferating cells called neoplastic or tumour cells. These cells grow very rapidly, invading and damaging the surrounding normal tissues.
  - As these cells actively divide and grow, these also starve the normal cells by competing for vital nutrients.
  - Cells sloughed from malignant tumours reach distant sites through blood and wherever they get lodged in the body, they start a new tumour there. This property is called **metastasis**.

### Causes of Cancer

**Carcinogens** are cancer-causing agents. These are

- **Chemicals** Cigarette smoke (cause lung cancer) benzopyrene, dyes, paints, etc.
- **Biological** Oncogenic viruses, some parasites, etc. Cancer causing viruses called **oncogenic viruses** have genes called **viral oncogenes**. Normal cells have genes called **cellular oncogenes (C-one)** or **proto-oncogenes** which are present in inactive state, but under certain conditions (like mutation) get transferred to cancer-causing oncogenes.
- **Physical** Ionizing radiation like X-rays and  $\gamma$ -rays, non-ionizing radiations like UV-rays (cause DNA damage leading to neoplastic transformation).

### Cancer Detection and Diagnosis

Cancer can be detected by the following methods

- Blood and bone marrow tests to know number of cell counts.
- **Biopsy** of a piece of suspected tissue done by cutting in thin sections, stained and examined under microscope.
- **Radiography** by X-rays to detect cancer of the internal organs.
- **Computed tomography** using X-rays to generate a 3D image of internal tissue.
- **Resonance imaging** involves use of non-ionizing radiation and strong magnetic field to detect pathological and physiological changes in living tissue.
- **Monoclonal antibodies** against cancer-specific antigens are also used for cancer detection.
- **Molecular biology** technique to detect genes in individual with inherited susceptibility to certain cancers.

### Treatment of Cancer

Treatment of cancer involves the following methods

- **Surgery** Tumours are removed by surgery to check further spread of cancer cells.

- **Radiation therapy** Tumour cells are irradiated by a lethal dose of radiation by protecting the surrounding normal cells.
- **Chemotherapy** Several chemotherapeutic drugs are used to kill cancer cells. But, their side effects like hair loss, anaemia is also reported.
- **Immunotherapy** biological modiniers like  $\alpha$ -interferons are used to activate the immune system and help in destroying the tumour.

## Drugs and Alcohol Abuse

The use of drugs and alcohol has risen especially among the youth. This is a cause of concern as it results in many harmful effects. The drugs which are commonly abused are as follows

- **Opioids** are the drugs which binds to specific opioid receptors present in our central nervous system and gastrointestinal tract.  
**Heroin** is a common opioid and is also called as **smack**. It is chemically diacetylmorphine, white, odourless, bitter crystalline compound.
  - Heroin is obtained from the acetylation of morphine, which is extracted from the latex of poppy plant, *Papaver somniferum*.
  - It is taken either by snorting or through injection.
  - Heroin is a depressant which slows down the body functions.
  - Morphine is an effective sedative, pain killer and very useful in patients who have undergone surgery.
- **Cannabinoids** are a group of chemicals which interact with cannabinoid receptors present mainly in brain.
  - Cannabinoids are obtained from the inflorescence of the plant *Cannabis sativa*.
  - Leaves, flower tops, resins of *C. sativa* in various combinations produce hashish, charas, marijuana and ganja.
  - These are inhaled or ingested orally.
  - These drugs affect cardiovascular system of the body.
- **Coca alkaloids** or **Cocaine** has a potent stimulating action on the central nervous system, producing a sense of euphoria and increased energy.
  - Cocaine is derived from the leaves and young branches of a South American plant called *Erythroxylum coca*.
  - Its mode of intake is either sniffing or snorting.
  - It is a strong stimulant and when taken in overdose causes headache, convulsions, hallucination and death due to cardiovascular or respiratory failure.
- **Hallucinogens** are psychedelic drugs because of their effect on the cerebrum and sense organs.
  - These are obtained from plants like *Atropa belladonna* and *Datura* species.
  - Lysergic acid diethyl amide (LSD) is derived from the fungus *Claviceps purpurea*.
  - Effect of these drugs occurs on thoughts, feelings and perceptions of an individual. Drugs like barbiturates, comphetamines, benzodiazepines, etc., normally used as medicines.
- **Tobacco** contains nicotine which stimulates the adrenal gland to release adrenaline and nor-adrenaline which in turn increases the blood pressure and heart rate.
  - It is obtained from tobacco plant.
  - Its mode of intake is smoking, chewing or can be used as a snuff.
  - Tobacco can induce lung cancer, bronchitis, emphysema, coronary heart disease, cancer of throat, oral cancer, urinary bladder cancer, etc.

## Adolescence and Drug/Alcohol Abuse

Adolescence is the period during which a child becomes mature in terms of his/her attitudes and beliefs for independent participation in the society.

- Age between 12-18 years is called **adolescent period**.
- Adolescence is accompanied by several biological and behavioural changes. It is a vulnerable phase of mental and psychological developemnt of an individual.
- In this age use of drugs or alcohol occurs out of curiosity or experimentation which later turns to addiction.

### Addiction and Dependence

- **Addiction** is the psychological attachment to certain effects-such as euphoria and a temporary feeling of well-being associated with drugs and alcohol.
- **Dependence** on drug/alcohol is the tendency of the body to manifest a characteristic and unpleasant **withdrawl syndrome**, if regular dose of drugs/alcohol is discontinued abruptly. Withdrawl symptoms are characterised by anxiety, shakiness, nausea and sweating.

### Effects of Drug/Alcohol Abuse

The common warning signals of drug/alcohol addiction are

- Drop in academic performance.
- Isolation from family and friends.
- Lack of interest in personal hygiene.
- Aggressive and rebellious behaviour.
- Reckless behaviour, vandalism and violence.

### Prevention and Control

The preventive measures are

- Avoid undue peer pressure.
- Accept failures and disappointments as part of life.
- Seek help from parents and peers.
- Seek professional and medical help for deaddiction.
- Look for danger signs.

## MULTIPLE CHOICE OF QUESTIONS

- 1** Which of the following adversely affects human health?  
(a) Change in lifestyle      (b) Genetic disorders  
(c) Rest and exercise      (d) Both (a) and (b)
- 2** Health is a combination of  
I. physical fitness  
II. presence of disease  
III. mental and social well-being  
Which of the options given above are correct?  
(a) I and II      (b) I and III  
(c) II and III      (d) I, II and III
- 3** Human health cannot be maintained by  
(a) maintaining personal hygiene  
(b) consuming a diet rich in carbohydrate only  
(c) regular physical exercise  
(d) None of the above
- 4** Necessary steps for achieving good health are  
I. awareness about diseases.  
II. vaccination.  
III. proper disposal of wastes.  
The correct combination having necessary steps are  
(a) I, II and III      (b) II, III and IV  
(c) I, III and IV      (d) II and IV
- 5** Measures for personal hygiene include.  
(a) Intake of clean drinking water  
(b) Keeping the body clean  
(c) Disinfection of water resources  
(d) Both (a) and (b)
- 6** A disease which can easily transmit from one person to another is called  
(a) non-infectious disease      (b) infectious disease  
(c) viral disease      (d) bacterial disease
- 7** Which one of the following disease is non-infectious as well as the major cause of death in humans?  
(a) Cancer      (b) AIDS  
(c) Asthma      (d) Typhoid
- 8** Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid. **NEET 2019**  
(a) *Streptococcus pneumoniae*/Widal test  
(b) *Salmonella typhi*/Anthrone test  
(c) *Salmonella typhi*/Widal test  
(d) *Plasmodium vivax*/UTI test
- 9** *Salmonella typhi* generally enters the small intestine through .....A..... and migrates to other body parts through .....B.....  
The most appropriate combination to fill the blanks is  
(a) A-contaminated food and water; B-blood  
(b) A-contaminated food; B-blood  
(c) A-skin; B-blood  
(d) A-air; B-blood
- 10** Common symptoms of typhoid are  
(a) high fever 39°C to 40°C and weakness  
(b) stomach pain and constipation  
(c) headache and loss of appetite  
(d) All of the above
- 11** The name of Mary Mallon is related with the disease  
(a) typhoid      (b) pneumonia  
(c) dengue      (d) AIDS
- 12** Pneumonia is an infection of the .....A..... . The most common cause of pneumonia is a type of bacteria known as .....B..... and .....C..... .  
Most suitable combination to fill the blanks is  
(a) A-liver, B-*Salmonella typhi*, C-*Streptococcus pneumoniae*  
(b) A-lungs, B-*Streptococcus pneumoniae*, C-*Haemophilus influenzae*  
(c) A-blood, B-*Streptococcus pneumoniae*, C-*Haemophilus influenzae*  
(d) A-heart, B-*Salmonella typhi*, C-*Haemophilus influenzae*
- 13** Which of the following health disorder includes symptoms of fever, chills, cough, headache, grey to bluish lips and fingers nails?  
(a) Filariasis      (b) Typhoid  
(c) Pneumonia      (d) Malaria
- 14** Infection of pneumonia occurs due to  
(a) droplets released from an infected person  
(b) released droplets/aerosols inhaled by healthy person  
(c) sharing contaminated objects such as glasses and utensils with an infected person  
(d) All of the above
- 15** Which of the following sets of diseases are caused by bacteria? **NEET 2016**  
(a) Cholera and tetanus      (b) Typhoid and smallpox  
(c) Tetanus and mumps      (d) Herpes and influenza
- 16** Rhinovirus causes  
(a) common cold      (b) malaria  
(c) AIDS      (d) pneumonia
- 17** Common cold differs from pneumonia in, that **CBSE-AIPMT 2012**  
(a) pneumonia is a communicable disease, whereas the common cold is a nutritional deficiency disease  
(b) pneumonia can be prevented by a live attenuated bacterial vaccine, whereas the common cold has no effective vaccine  
(c) pneumonia is caused by a virus, while the common cold is caused by the bacterium *Haemophilus influenzae*  
(d) pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs
- 18** Which of the following viruses is not transferred through semen of an infected male? **CBSE-AIPMT 2015**  
(a) Hepatitis-B virus  
(b) Human immunodeficiency virus  
(c) Chikungunya virus  
(d) Ebola virus

19 Female *Anopheles* mosquito is a vector of

- (a) filariasis (b) malaria  
(c) typhoid (d) AIDS

20 Malaria is caused by

- (a) *Plasmodium vivax*  
(b) *Plasmodium malariae*  
(c) *Plasmodium falciparum*  
(d) All of the above

21 Malignant malaria is caused by

- (a) *Plasmodium falciparum* (b) *Plasmodium ovale*  
(c) *Plasmodium vivax* (d) *Plasmodium malariae*

22 Where will you look for the sporozoites of the malarial parasite?

- (a) RBCs of humans suffering from malaria  
(b) Spleen of infected person  
(c) Salivary glands of freshly moulted female *Anopheles* mosquito  
(d) Saliva of infected female *Anopheles* mosquito

23 Infective stage of *Plasmodium* for man is

- (a) merozoites (b) ookinetes  
(c) sporozoites (d) None of these

24 Which of the following toxic substances is responsible for the high malarial fever?

- (a) Haemoglobin (b) Haemocyanin  
(c) Haemozoin (d) Haemoriden

25 *Plasmodium* completes its life cycle in two hosts. Asexual phase in ..... host and sexual phase in ..... host.

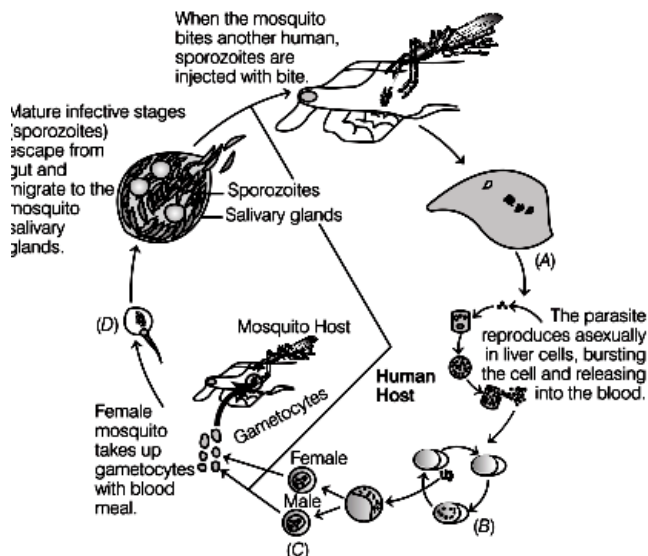
The correct option with words to fill the blanks is

- (a) human; *Culex* mosquito  
(b) human; female *Anopheles* mosquito  
(c) human; *Aedes* mosquito  
(d) human; male *Anopheles* mosquito

26 The primary host of *Plasmodium* is

- (a) man (b) male *Culex*  
(c) sheep (d) female *Anopheles*

27 Study the given diagram and name the labelled A, B, C and D.



- (a) A–Sporozoites in spleen, B–Sexual reproduction of *Plasmodium* in RBC, C–Gametocytes in RBC, D–Fertilisation of gametocytes in mosquito's intestine  
(b) A–Sporozoites in liver, B–Asexual reproduction of *Plasmodium* in RBC, C–Gametocytes in RBC, D–Fertilisation of gametocytes in mosquito's intestine (gut)  
(c) A–Sporozoites in liver, B–Asexual reproduction of *Plasmodium* in RBC, C–Gametocytes in RBC, D–Fertilisation of gametocytes in mosquito's salivary glands  
(d) A–Sporozoites in kidney, B–Sexual reproduction of *Plasmodium* in RBC, C–Gametocytes in RBC, D–Fertilisation of gametocytes in mosquito's intestine

28 Which one of the following diseases is spread by housefly?

- (a) Dengue fever  
(b) Encephalitis  
(c) Filariasis  
(d) Amoebiasis

29 Amoebiasis (amoebic dysentery) is caused by organism

- (a) *Plasmodium* (b) *Entamoeba histolytica*  
(c) houseflies (d) contaminated food and water

30 *Entamoeba histolytica* is a parasite of

- (a) large intestine (b) liver  
(c) lungs (d) kidney

31 Which one is not a symptom of disease caused by *E. histolytica* ?

- (a) Stools with excess mucus and blood clots  
(b) Constipation smacked  
(c) Abdominal pain and cramps  
(d) Nasal discharge

32 Which of the following is a protozoan disease?

- (a) Malaria (b) Amoebiasis  
(c) Sleeping sickness (d) All of these

33 Which of the following disease is caused by a protozoan?

- (a) Syphilis (b) Influenza  
(c) Babesiosis (d) Blastomycosis

34 Which of the following endoparasites of humans does show viviparity?

- (a) *Ancylostoma duodenale*  
(b) *Enterobius vermicularis*  
(c) *Trichinella spiralis*  
(d) *Ascaris lumbricoides*

35 Give the name of two helminths, which cause ascariasis and filariasis, respectively.

- (a) *Ascaris* and *Wuchereria*  
(b) *Wuchereria* and *Ascaris*  
(c) Roundworm and flatworm  
(d) *Plasmodium* and *Wuchereria*

36 Which of the following diseases causes internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage?

- (a) Ascariasis (b) Filariasis  
(c) Amoebiasis (d) Trypanosomiasis

37 Infection of *Ascaris* usually occurs by

- (a) drinking water containing egg of *Ascaris*  
(b) eating imperfectly cooked pork  
(c) tse-tse fly  
(d) mosquito bite



**38** Elephantiasis, a chronic inflammation that results in gross deformities is caused by

- (a) *Trichophyton* (b) *Wuchereria*  
(c) *E. coli* (d) *Ascaris*

**39** Elephantiasis causing organism belongs to

- (a) Aschelminthes (b) Platyhelminthes  
(c) Cnidaria (d) Porifera

**40** The filariasis pathogen is transmitted to a healthy person through the bite of

- (a) female *Anopheles* mosquito  
(b) female *Aedes* mosquito  
(c) female *Culex* mosquito  
(d) None of the above

**41** Adults of *Wuchereria bancrofti* attack **AIIMS 2018**

- (a) excretory system (b) digestive system  
(c) lymphatic system (d) nervous system

**42** In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels?

**NEET 2018**

- (a) Ringworm disease (b) Ascariasis  
(c) Elephantiasis (d) Amoebiasis

**43** Which one of the following pairs is not correctly matched?

- (a) Filariasis — *Wuchereria*  
(b) Syphilis — *Trichuris trichiura*  
(c) Plague — *Yersinia pestis*  
(d) Dengue fever — Flavi-ribo virus

**44** The group of diseases carried (transmitted) by insects are

- (a) typhoid, jaundice, tuberculosis  
(b) mumps, measles, smallpox  
(c) scabies, ringworm, swine flu  
(d) malaria, filaria, yellow fever

**45** The following table shows certain diseases, their causative organisms and symptoms.

Diseases	Causative organisms	Symptoms
I. Filariasis	A	Inflammation of lymphatic vessels
II. Typhoid	B	High fever, stomach pain
III. C	Rhinoviruses	Nasal congestion and discharge
IV. Ascariasis	<i>Ascaris</i>	D

The correct option regarding A, B, C and D is

- (a) A—*Wuchereria*, B—*Salmonella typhi*, C—Common cold, D—Internal bleeding, fever, anaemia  
(b) A—*Salmonella typhi*, B—*Ascaris*, C—Typhoid, D—Stomach pain, headache  
(c) A—*Ascaris*, B—*Entamoeba histolytica*, C—Pneumonia, D—Constipation, fever  
(d) A—*Entamoeba histolytica*, B—*Salmonella typhi*, C—Common cold, D—Nasal discharge, high fever

**46** Fungi belonging to genera—*Microsporum*, *Trichophyton* and *Epidermophyton* are responsible for

- (a) ringworm infection  
(b) skin allergy  
(c) amoebiasis  
(d) measles

**47** Ringworm is a/an

- (a) air borne disease (b) infectious disease  
(c) non-infectious disease (d) None of these

**48** Fill up the blanks.

I. Heat and moisture help ..... fungi to grow, which makes them thrive in skin folds.

II. Maintenance of ..... and ..... hygiene is important for the prevention of many infectious diseases.

III. .... gives the diseases its name, elephantiasis.

- (a) I. *Microsporum*, II. public; personal, III. Swelling of hand  
(b) I. *Trichophyton*, II. personal; public, III. Enlargement of eye  
(c) I. *Epidermophyton*, II. personal; public, III. Swelling of legs  
(d) I. *Wuchereria*, II. personal; public, III. Enlargement of tongue

**49** *Gambusia* is a fish which can control the mosquito borne disease like

- (a) dengue (b) malaria  
(c) chikungunya (d) All of these

**50** Ability of the body to fight against the disease causing organisms is called

- (a) vulnerability (b) susceptibility  
(c) irritability (d) immunity

**51** Innate immunity is also called

- (a) familiar immunity (b) inborn immunity  
(c) genetic immunity (d) All of these

**52** Non-specific host defence that exists prior to the exposure to an antigen is called

- (a) acquired immunity (b) passive immunity  
(c) innate immunity (d) active immunity

**53** Except skin, other physical barriers which also help to prevent the entry of the microorganisms are mucus coating of the epithelium lining of

I. the respiratory tract.

II. the gastrointestinal tract.

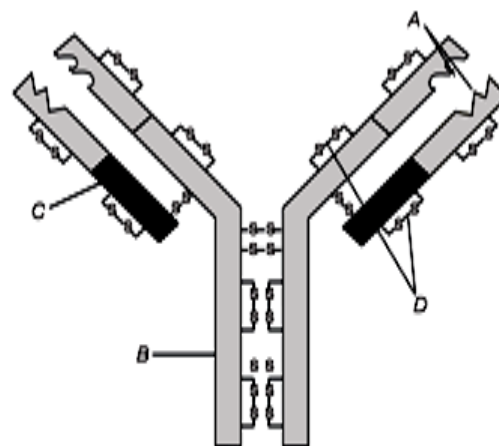
III. the urogenital tract.

Choose the correct option.

- (a) I and II  
(b) I and III  
(c) II and III  
(d) I, II and III

- 54** Which type of barriers do saliva in the mouth, tears from eyes and acid in the stomach belong?  
 (a) Cytokinin barriers (b) Cellular barriers  
 (c) Physiological barriers (d) Physical barriers
- 55** Full form of PMNL is  
 (a) Poly Morpho-Nuclear Leucocytes  
 (b) Para Morpho-Nuclear Lymphocytes  
 (c) Penta Morpho-Nuclear Leucocytes  
 (d) Poly Morpho-Nuclear Lymphocytes
- 56** The major phagocytic cells are  
 (a) antibody (b) antigen  
 (c) lymphocytes (d) macrophages
- 57** Which of the following are considered as cellular barrier of the body?  
 (a) Lymphocytes (b) Neutrophils  
 (c) Macrophages (d) All of these
- 58** Humans have acquired immune system that produces antibodies to neutralise pathogens. Still innate immune system is present at the time of birth because it  
**NEET (Odisha) 2019**  
 (a) is very specific and uses different macrophages  
 (b) produces memory cells for mounting fast secondary response  
 (c) has natural killer cells which can phagocytose and destroy microbes  
 (d) provides passive immunity
- 59** Which of the following is a suitable example of cytokine barrier?  
 (a) Interferons (b) T-lymphocytes  
 (c) B-lymphocytes (d) T<sub>H</sub> cells
- 60** The interferons can be used as  
 (a) antibacterial drugs (b) antiviral drugs  
 (c) antibiotic drugs (d) immunosuppressive
- 61** Interferon is a type of protein, which can be used to counter  
 (a) homeostatic disorder  
 (b) hepatitis caused by virus  
 (c) common cold caused by virus  
 (d) Both (b) and (c)
- 62** A person has developed interferons in his body. He seems to carry an infection of  
 (a) typhoid (b) filariasis (c) malaria (d) measles
- 63** Note the following words.  
 I. Skin II. Phagocytes  
 III. B-cells IV. Neutrophils  
 V. Antibodies VI. T-cells  
 VII. Macrophages VIII. NK-cells  
 Identify the factors involved in second line of defence.  
 (a) II, IV, VII and VIII (b) II, III, V and VI  
 (c) IV, VI, VIII and VIII (d) III, V, VII and VIII

- 64** Antibodies are  
 (a) proteins produced in response to pathogens in our body  
 (b) secreted by the action of both T-lymphocytes and B-lymphocytes  
 (c) molecules that specifically interacts with an antigen  
 (d) Both (a) and (b)
- 65** Each antibody has ...*A*... polypeptide chains, ...*B*... small chains called ...*C*... chains and ...*D*... longer chains called ...*E*... chains.  
 The antibody, therefore, is represented as ... *F*..  
 Here *A* to *F* refers to  
 (a) A-four, B-two, C-light, D-two, E-heavy, F-H<sub>2</sub>L<sub>2</sub>  
 (b) A-six, B-three, C-light, D-three, E-heavy, F-H<sub>3</sub>L<sub>2</sub>  
 (c) A-two, B-one, C-light, D-one, E-heavy, F-H<sub>1</sub>L<sub>1</sub>  
 (d) A-five, B-two, C-light, D-three, E-heavy, F-H<sub>2</sub>L<sub>2</sub>
- 66** Antigen binding site of immunoglobulin (antibody) is  
 (a) variable region of heavy chain  
 (b) variable region of light chain  
 (c) constant region of light chain  
 (d) variable region of both heavy and light chain
- 67** The figure given below shows an antibody molecule. Name the parts *A*, *B* and *C*.

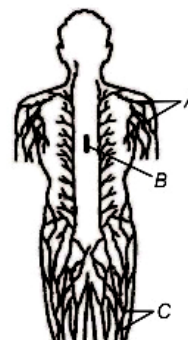


- (a) A-Antigen binding site, B-Heavy chain, C-Light chain, D-Disulphide bond  
 (b) A-Antibody binding site, B-Light chain, C-Heavy chain, D-Phosphoester bond  
 (c) A-Antigen binding site, B-Short chain, C-Long chain, D-Sulphur bond  
 (d) A-Antibody binding site, B-Long chain, C-Short chain, D-Disulphide bond
- 68** The most abundant class of Immunoglobulins (Igs) in the human body is  
 (a) IgA (b) IgM  
 (c) IgG (d) IgE

- 69** Humoral immunity is also called as  
 (a) antibody mediated immunity  
 (b) non-specific immune response  
 (c) antigen mediated immunity  
 (d) None of the above
- 70** Humoral immunity is mediated by  
 (a) B-cells (b) T-cells  
 (c) macrophages (d) monocytes
- 71** Humoral immune system defends against viruses and bacteria is present in  
 (a) blood (b) lymph  
 (c) Both (a) and (b) (d) None of these
- 72** The cell-mediated immunity inside the human body is carried out by **NEET 2013**  
 (a) T-lymphocytes (b) B-lymphocytes  
 (c) thrombocytes (d) erythrocytes
- 73** The process of removal and replacement of the damaged tissues or organs like heart, eye, liver, kidney with healthy ones from a donor is called as  
 (a) transplantation (b) repair and replacement  
 (c) replacement therapy (d) transformation
- 74** Which of the following immune responses is responsible for rejection of kidney graft? **NEET 2019, CBSE-AIPMT 2015**  
 (a) Humoral immune response  
 (b) Inflammatory immune response  
 (c) Cell-mediated immune response  
 (d) Auto-immune response
- 75** Active immunity is an immunity gained after  
 (a) natural infection (b) exposure to live pathogen  
 (c) immunisation (d) Both (a) and (b)
- 76** Active immunity development is related to  
 (a) natural killer cells (b) memory cells  
 (c) helper T-cells (d) suppressor T-cells
- 77** Passive immunisation includes  
 (a) transfer of lymphocyte directly  
 (b) transfer of maternal antibodies across placenta to the foetus  
 (c) introduction of antibodies directly in the body  
 (d) Both (b) and (c)
- 78** Colostrum, the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains **NEET 2019**  
 (a) monocytes (b) macrophages  
 (c) immunoglobulin-A (d) natural killer cells
- 79** Which of the following is involved in passive immunity? **JIPMER 2018**  
 (a) IgA (b) IgE  
 (c) IgM (d) IgD
- 80** Choose the correct option regarding antibodies. **JIPMER 2019**  
 (a) IgA - Helps in allergic reaction  
 (b) IgG - Cross placenta  
 (c) IgE - Found in secretions  
 (d) IgM - Exist as dimer
- 81** The principle of vaccination or immunisation depends on the property of ..... of the immune system. The most appropriate word to fill the blank is  
 (a) memory (b) antigen  
 (c) pathogen (d) plasma cells
- 82** Which form of pathogen is used in vaccination?  
 (a) Activated and strong pathogens  
 (b) Preformed antigens and antibody  
 (c) Inactivated and weakened pathogenic agents  
 (d) None of the above
- 83** If a quick immune response is needed as in tetanus infection, preformed antibodies or antitoxin is injected into the patient body. This type of immunisation is called .....  
 (a) active immunisation (b) passive immunisation  
 (c) innate immunity (d) humoral immunity
- 84** Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain **NEET 2016**  
 (a) harvested antibodies (b) gamma globulin  
 (c) attenuated pathogens (d) activated pathogens
- 85** Hepatitis-B vaccine is produced from  
 (a) yeast (b) bacteriophage  
 (c) bacteria (d) All of these
- 86** A substance that causes an allergic reaction is called  
 (a) allergen (b) pollen  
 (c) foreign substance (d) dander
- 87** Which of the following mediates allergic reaction? **JIPMER 2018**  
 (a) IgA (b) IgG (c) IgE (d) IgD
- 88** Common examples of allergens are  
 (a) dust (b) pollen grains  
 (c) animal dander (d) All of these
- 89** An allergic response appears at the site of infection causes sneezing, watery eyes, running nose, pain and heat due to the certain chemicals (allergens), they are  
 (a) histamine and serotonin (b) histamine and cerumen  
 (c) cerumen and serotonin (d) mucus and cerumen
- 90** What is injected into the patient's body for determining the cause of allergy?  
 (a) Allergen to which the patient is allergic  
 (b) IgG  
 (c) IgE  
 (d) Steroids

- 91** Which of the following drugs can be used to quickly reduce the symptoms of allergic reaction?  
 I. Anti-histamine  
 II. Adrenaline  
 III. Steroids  
 (a) I and II (b) I and III  
 (c) II and III (d) I, II and III
- 92** Asthma may be attributed to **NEET 2016**  
 (a) allergic reaction of the mast cells in the lungs  
 (b) inflammation of the trachea  
 (c) accumulation of fluid in the lungs  
 (d) bacterial infection of the lungs
- 93** In higher vertebrates, the immune system can distinguish self and non-self cells. If this property is lost due to the genetic abnormality and it attacks self-cells, then it leads to **NEET 2016**  
 (a) graft rejection  
 (b) autoimmune disease  
 (c) active immunity  
 (d) allergic response
- 94** Which of the following diseases is an autoimmune disorder? **NEET (Odisha) 2019**  
 (a) Myasthenia gravis (b) Arthritis  
 (c) Osteoporosis (d) Gout
- 95** Which of the following is not an autoimmune disease? **NEET 2018**  
 (a) Alzheimer's disease  
 (b) Rheumatoid arthritis  
 (c) Psoriasis  
 (d) Vitiligo
- 96** The site where immature lymphocytes differentiate into antigen sensitive lymphocytes are  
 (a) primary lymphoid organs  
 (b) secondary lymphoid organs  
 (c) lymph nodes  
 (d) tonsils
- 97** Which of the given sets include the primary lymphoid organs?  
 (a) Thymus, lymph nodes and spleen  
 (b) Bone marrow and thymus  
 (c) Bone marrow, Peyer's patches and thymus  
 (d) Thymus, liver and tonsils
- 98** Surgical removal of thymus of a newborn shall result in the failure to produce  
 (a) Allergens (b) Interferons  
 (c) B-lymphocyte (d) T-lymphocytes

- 99** Thymus is a lobed organ located near the..... *A* ..... and beneath the ....*B*.... . The most appropriate combination for *A* and *B* is  
 (a) *A*–heart; *B*–breast bone  
 (b) *A*–liver; *B*–ribs  
 (c) *A*–heart; *B*–ribs  
 (d) *A*–intestine; *B*–ribs
- 100** What is the main lymphoid organ where all blood cells including lymphocytes are produced?  
 (a) Bone marrow (b) Tonsils  
 (c) Liver (d) Spleen
- 101** T-lymphocytes mature in the ..... while B-lymphocyte mature in the ..... . Most appropriate combination of words to fill the blanks is  
 (a) thymus; bone marrow  
 (b) bone marrow; thymus  
 (c) thyroid; bone marrow  
 (d) yellow bone marrow; red bone marrow
- 102** Full form of MALT is  
 (a) Mucosal Associated Lymphoid Tissue  
 (b) Memory Associated Lymphoid Tissue  
 (c) Memory Associated Lymphocyte Tissue  
 (d) Mucosa Associated Lymphocyte Tissue
- 103** MALT constitutes about ..... per cent of the lymphoid tissue in human body. **NEET 2017**  
 (a) 50% (b) 20%  
 (c) 70% (d) 10%
- 104** Given below the diagrammatic representation of lymph nodes.



Label *A*, *B* and *C*.

- (a) *A*–Lymph nodes, *B*–Thymus, *C*–Lymphatic vessels  
 (b) *A*–Lymphatic vessels, *B*–Thyroid, *C*–Lymph nodes  
 (c) *A*–Tonsils, *B*–Peyer's patches, *C*–Lymphatic vessels  
 (d) *A*–Tonsils, *B*–Thymus, *C*–Peyer's patches

**105** Human immunodeficiency virus causes

- (a) Acquired Immuno Deficiency Syndrome
- (b) *Anthrax*
- (c) tuberculosis
- (d) polio

**106** Genetic material found in Human Immunodeficiency Virus (HIV) is

- (a) double-stranded RNA
- (b) single-stranded RNA
- (c) double-stranded DNA
- (d) single-stranded DNA

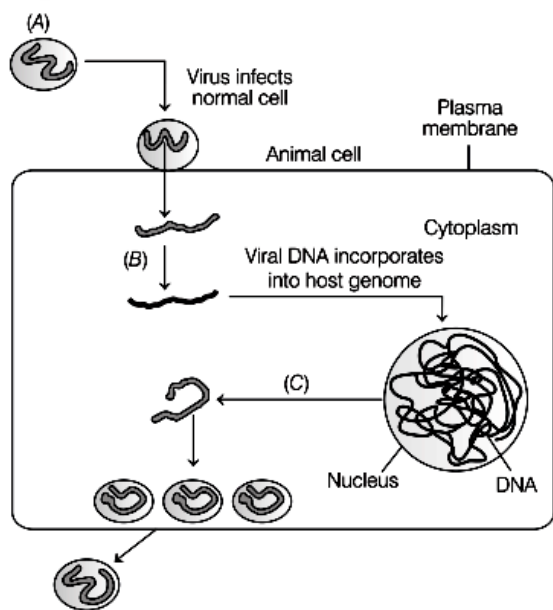
**107** AIDS virus contains

- (a) RNA with protein
- (b) DNA with protein
- (c) RNA without protein
- (d) Only DNA

**108** Transmission of HIV infection from infected mother to her child occurs through

- (a) liver
- (b) placenta
- (c) skin
- (d) None of these

**109** In the given flow chart, the replication of retrovirus in a host cell is shown. Observe it carefully and fill up the blank *A*, *B* and *C*.



(a) A–Bacteriophage, B–Viral DNA is produced, C–New viral RNA is produced

(b) A–Transcriptase, B–Bacterial RNA is produced, C–New viral DNA is produced by the infected cell

(c) A–Bacteriophage, B–Viral DNA is produced, C–New viral RNA is produced by the infected cell

(d) A–Retrovirus, B–Viral DNA is produced by reverse transcriptase, C–New viral RNA is produced by the infected cell

**110** HIV is a ....A..... and has genetic material composed of ...B...., HIV replicates inside the host cells. It is considered a retrovirus because it uses an enzyme, ....C...., to convert ..... D..... into .....E..... . Here *A* to *E* refers to

(a) A–retrovirus, B–RNA, C–reverse transcriptase, D–RNA, E–DNA

(b) A–retroviral, B–DNA, C–reverse transcriptase, D–DNA, E–RNA

(c) A–rhinovirus, B–DNA, C–reverse transcriptase, D–DNA, E–RNA

(d) A–adenovirus, B–RNA, C–reverse transcriptase, D–RNA, E–DNA

**111** In an infected human body the ‘HIV factory’ is

- (a) sperm
- (b) ova
- (c) macrophages
- (d) spleen cells

**112** At which stage of HIV infection does one usually show symptoms of AIDS? **CBSE-AIPMT 2014**

- (a) Within 15 days of sexual contact with an infected person
- (b) When the infected retrovirus enters host cells
- (c) When HIV damages large number of helper T-lymphocytes
- (d) When the viral DNA is produced by reverse transcriptase

**113** A patient is suspected to be suffering from Acquired Immuno Deficiency Syndrome (AIDS). Which diagnostic technique will you recommend for its detection?

- (a) ELISA
- (b) MRT
- (c) Ultrasound
- (d) WIDAL

**114** The word NACO stands for

- (a) National AIDS Control Organisation
- (b) Non-governmental AIDS Control Organisation
- (c) National Agrochemical Organistation
- (d) Both (b) and (c)

- 115** The property of normal cells by virtue of which contact with other cells inhibits their uncontrolled growth is called  
 (a) contact inhibition (b) metastasis  
 (c) benign tumour (d) metagenesis
- 116** Cell division or mitosis is a normal process in living cells but sudden and abnormal mitosis in an organ will frequently result in  
 (a) zygote (b) cancer  
 (c) new organ (d) gastrula
- 117** The uncontrolled proliferation of cancerous cells produces masses of cells, called  
 (a) tumours (b) neoplastic cells  
 (c) protooncomass (d) Both (a) and (b)
- 118** Which form of tumour remains confined to their original location and do not spread to other parts of the body?  
 (a) Malignant tumour (b) Benign tumour  
 (c) Both (a) and (b) (d) Leukaemia
- 119** Which of the following properties is possessed by malignant tumours?  
 (a) Metastasis  
 (b) Uncontrolled cell division  
 (c) Both (a) and (b)  
 (d) Controlled cell division
- 120** Which one of the following is not a property of cancerous cells, whereas the remaining three are?  
**CBSE-AIPMT 2012**  
 (a) They compete with normal cells for vital nutrients  
 (b) They do not remain confined in the area of formation  
 (c) They divide in an uncontrolled manner  
 (d) They show contact inhibition
- 121** Transformation of normal cell into cancerous cell is induced by  
 (a) carcinogens (b) lipids  
 (c) proteins (d) All of these
- 122** Physical carcinogens, e.g. UV-ray, X-ray and  $\gamma$ -rays cause  
 (a) DNA damage (b) RNA damage  
 (c) Both (a) and (b) (d) Protein damage
- 123** Chemical carcinogens present in tobacco smoke have been identified as a major cause of  
 (a) lung cancer (b) liver cancer  
 (c) oral cancer (d) None of these

- 124** Cancer causing viruses are called  
 (a) oncogenic viruses (b) retroviruses  
 (c) adenoviruses (d) poxviruses
- 125** The genes which can lead to the oncogenic transformation of the cells in which these are present, are called  
 (a) oncogenes (b) proto-oncogenes  
 (c) cellular oncogenes (d) Both (b) and (c)
- 126** Normal cell have genes called .....A..... which are present in inactivated state but under certain conditions like .....B... they get transformed to ...C.... Here A, B and C refers to  
 (a) A–cellular oncogenes, B–mutation, C–cancer causing oncogenes  
 (b) A–viral oncogenes, B–mutation, C–disease causing genes  
 (c) A–viral oncogenes, B–mutation, C–tumour causing genes  
 (d) None of the above
- 127** Characteristics of cancer are **AIIMS 2018**  
 (a) All viruses are oncogenic  
 (b) All tumours are cancers  
 (c) Cancerous cells show property of contact inhibition  
 (d) Cancer cells show metastasis
- 128** Which of the following techniques is used to detect the of cancer of internal organs?  
 (a) Magnetic Resonance Imaging (MRI)  
 (b) Radiography (X-ray)  
 (c) Computed Tomography (CT) scan  
 (d) All of the above
- 129** Cancer cells are more easily damaged by radiation than normal cells because they are  
 (a) starved of mutation  
 (b) undergoing rapid division  
 (c) different in structure  
 (d) non-dividing
- 130** Treatment and detection of cancer can be done by  
 (a) radiography (b) chemotherapy  
 (c) surgery (d) All of these
- 131** Alpha-interferons  
 (a) activate the immune system  
 (b) help in destroying the tumour  
 (c) Both (a) and (b)  
 (d) None of the above



- 148** Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown below?  
**CBSE-AIPMT 2014**



- (a) Hallucinogen (b) Depressant  
(c) Stimulant (d) Pain killer
- 149** Drugs, that are normally used as medicines to help the patients cope with mental illness are  
(a) barbiturates (b) amphetamines  
(c) benzodiazepines (d) All of these
- 150** LSD is derived from  
(a) *Claviceps purpurea* (b) *Pseudomonas putida*  
(c) *Cannabis indica* (d) *Cannabis sativa*
- 151** Which one of the following is a correct matching pair of a drug and its category?  
(a) Amphetamines — Stimulant  
(b) Lysergic acid diethylamide — Narcotic  
(c) Heroin — Psychotropic drug  
(d) Benzodiazepines — Pain killer
- 152** Which one of the following fungi contains hallucinogens?  
**CBSE-AIPMT 2014**  
(a) *Morchella esculenta* (b) *Amanita muscaria*  
(c) *Neurospora* sp. (d) *Ustilago* sp.
- 153** Nicotine is  
(a) an alkaloid (b) a steroid  
(c) a stimulant (d) Both (a) and (c)
- 154** Nicotine intake stimulates the ....A... to release ...B.... and ....C.... into blood circulation. This lead to increase in ...D... and an increase.... E ....  
Identify A to E.  
(a) A—adrenal gland, B—adrenaline, C—nor-adrenaline, D—blood pressure, E—heart rate  
(b) A—thyroid gland, B—thyroxine, C—parathyroxine, D—blood pressure, E—heart rate  
(c) A—adrenal gland, B—thyroxine, C—nor-adrenaline, D—blood pressure, E—heart rate  
(d) A—gonads B—adrenaline, C—nor-adrenaline, D—blood pressure, E—heart rate
- 155** Smoking addiction is harmful because smoke produces polycyclic aromatic hydrocarbons, which cause  
(a) reduction in oxygen transport  
(b) increase in blood pressure  
(c) cancer  
(d) retardation of growth of foetus

- 156** In heavy smokers, the alveoli of the lungs are enlarged and damaged, which reduces the surface area for the exchange of respiratory gases. This condition is called  
(a) asthma  
(b) silicosis  
(c) emphysema  
(d) insomnia
- 157** Carcinogen present in cigarette smoke is  
(a) benzopyrene (b) nicotine **JIPMER 2019**  
(c) carbon monoxide (d) All of these
- 158** Those who take drugs intravenously develop a risk of  
(a) AIDS (b) hepatitis-B  
(c) Both (a) and (b) (d) malaria
- 159** Cirrhosis of liver is caused by the chronic intake of  
**CBSE-AIPMT 2012**  
(a) opium (b) alcohol  
(c) tobacco (chewing) (d) cocaine
- 160** Fill up the blanks.  
I. The period between ....A.... years of age may be thought of as adolescence period.  
II. Adolescence is a bridge linking ....B .... and ....C....  
III. The chronic use of drug and alcohol damages ...D... and ...E...  
IV. Alcoholism during ....F.... adversely affects the foetus.  
(a) A-12-18, B-childhood, C-adulthood, D-nervous system, E-liver, F-pregnancy  
(b) A-10-15, B-adulthood, C-childhood, D-heart, E-stomach, F-adulthood  
(c) A-15-20, B-adulthood, C-childhood, D-liver, E-kidney, F-pregnancy  
(d) A-20-28, B-adulthood, C- childhood, D-liver, E-nervous system, F-pregnancy
- 161** Which part of the brain is involved in the loss of control over speech when a person consumes excessive alcohol?  
(a) Cerebellum  
(b) Medulla oblongata  
(c) Cerebrum  
(d) Pons varoli
- 162** Side effects of anabolic steroids in females include  
I. masculinisation.  
II. aggressiveness.  
III. mood swings, depression.  
IV. abnormal menstrual cycle.  
V. excessive facial and body hair.  
Choose the correct option.  
(a) I, II and III  
(b) I, II, III and IV  
(c) II, III, IV and V  
(d) I, II, III, IV and V



## SPECIAL FORMAT QUESTIONS

1. Which of the following statement(s) is/are correct regarding pathogens?

- I. A pathogen or an infectious agent is a microorganism, such as a virus, bacterium, fungus that causes disease in its host.
- II. Pathogens multiply in our body and interfere with the normal vital activities, resulting in morphological and functional damage.

- (a) Only I                      (b) Only II  
(c) I and II                    (d) None of these

2. Which one of the following statements is correct with respect to immunity?

- (a) Preformed antibodies need to be injected to treat the bite by a viper snake
- (b) The antibodies against smallpox pathogen are produced by T-lymphocytes
- (c) Antibodies are protein molecules, each of which has four light chains
- (d) Rejection of a kidney graft is the function of B-lymphocytes

3. Which of the following is correct regarding AIDS causative agent HIV?

- (a) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase
- (b) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase
- (c) HIV is unenveloped retrovirus
- (d) HIV does not escape but attacks the acquired immune response

4. Consider the following statements.

- I. Adolescence is a very vulnerable phase of mental and psychological developments of individual.
- II. Adolescence is marked by accelerated physical growth, development of reproductive organs and changes in functioning of the neuroendocrine system.

- (a) Both statements I and II are correct  
(b) Both statements I and II are incorrect  
(c) Statement I is correct, but II is incorrect  
(d) Statement I is incorrect, but II is correct

5. Choose the correct statements.

- I. Innate immunity is accomplished by providing different types of barriers.
- II. Acquired immunity is present from the birth and is inherited from parents.
- III. Acquired immunity can be divided into antibody mediated and cell-mediated immunity.
- IV. Innate immunity is also called specific immunity.
- V. Acquired immunity consists of specialised cells (T-cell and B-cell) and antibodies that circulate in the blood.

**Codes**

- (a) I, II and V                      (b) II, III, IV and V  
(c) I, III and V                    (d) I, II, III, IV and V

6. Consider the following statements.

- I. People should get vaccination to avoid infection.
- II. Vaccination is available against polio, cholera, typhoid, tuberculosis and many other diseases.
- III. Eradication of vectors are necessary in diseases like malaria and filariasis.
- IV. Dengue and chikungunya, both are spread by *Culex* mosquitoes.

Which of the statements given above are correct?

- (a) I, II and III                    (b) I, II and IV  
(c) I, III and IV                   (d) III and IV

7. Which of the following statements given below is/are correct?

- I. Secondary lymphoid organs includes lymph nodes, spleen and small masses of lymph tissue such as Peyer's patches, appendix and tonsils.
- II. The secondary lymphoid organs provide the site for interaction of lymphocyte with the antigens.

- (a) Only I                          (b) Only II  
(c) I and II                        (d) None of these

8. The lymph nodes

- I. are small solid structures along the lymphatic system.
- II. filter lymph fluid as it flows through them, trapping bacteria, viruses and other antigens, which are then destroyed by lymphocytes.

Which of the statements given above is/are correct?

- (a) Only I                          (b) Only II  
(c) I and II                        (d) None of these

9. Read the statements about a certain organ and choose the correct option.

- I. It is a large bean-shaped organ.
- II. It mainly contains lymphocytes and phagocytes.
- III. It acts as a filter of the blood by trapping blood-borne microorganisms.
- IV. It is a large reservoir of erythrocyte.
- V. It is a secondary lymphoid organ.

- (a) Thymus (b) Tonsils (c) Appendix (d) Spleen

10. Select the true statements.

- I. Cancer detection is based on biopsy and histopathological study of the suspected tissue.
- II. In biopsy, the suspected tissue is cut into thin sections, stained and examined under microscope.
- III. Certain chemotherapeutic drugs are used to kill the cancerous cells, but majority of the drugs have side effects like hair loss, anaemia, etc.
- IV. MRI uses strong magnetic fields and ionising radiations to accurately detect pathological and physiological changes in the living tissues.
- V. Techniques like radiography (use of X-rays), CT (Computed Tomography) scan and MRI are very useful to detect cancers of the internal organs.

- (a) I and II                          (b) I and III  
(c) II and III                        (d) All statements are true

11. Which of the following statements given below is/are correct?

- I. Growing number of people are taking LSD and other drugs like barbiturates and amphetamines to help themselves to cope with mental illness.

II. Several plants, fruits and seeds having hallucinogenic properties have been used in folk-medicine.

- (a) Statement I is true, but II is false
- (b) Statement I is false, but II is true
- (c) Both statements I and II are true
- (d) Both statements I and II are false

**12.** Warning signs of drug and alcohol abuse include

- I. drop in academic performance.
- II. absence from school/college.
- III. lack of interest in personal hygiene.
- IV. isolation, depression, fatigue, aggressive and rebellious behaviour.

Which of the statements given above are correct?

- (a) I, II and III
- (b) I, III and IV
- (c) II, III and IV
- (d) All of these

**13.** Reasons for alcohol abuse in adolescents are

- I. social pressure.
- II. curiosity and need for adventure, excitement and experiment.
- III. to escape from stress, depression and frustration.
- IV. to overcome hardships of daily life.

Which of the statements given above are correct?

- (a) I, II and III
- (b) I, III and IV
- (c) II, III and IV
- (d) All of these

**14.** Read the following statements and select the incorrect one.

- (a) When the functioning of one or more organs or systems of the body is adversely affected, characterised by appearance of various signs and symptoms, i.e. we have a disease
- (b) Some of the infectious diseases like AIDS are fatal
- (c) Pathogens cause harm to the host by living in (or on) them
- (d) None of the above

**15.** Read the following statements and select the correct statements.

- I. Subsequent encounter with the same pathogen for the second time elicits a highly intensified secondary immune response.
  - II. The vaccines generate B and T-cells that recognise the pathogen quickly on subsequent exposure and overwhelm the invaders with massive production of antibodies.
- (a) Both statements I and II are correct
  - (b) Statement I is correct, but II is incorrect
  - (c) Statement I is incorrect, but II is correct
  - (d) Both statements I and II are incorrect

**16.** Which of the following statements are correct?

- I. The exaggerated response of the immune system to certain antigens present in the environment is called allergy.
- II. The allergic tendency is genetically passed from the parents to the offspring and is characterised by the presence of large quantities of IgG antibodies in the blood.

III. Bone marrow and thymus are the organs where origin and/or maturation and proliferation of lymphocytes occur.

IV. Immunisation is the process by which the body produces antibodies against the vaccine preventable diseases through administration of specific vaccines.

- (a) I and II
- (b) II and IV
- (c) I, III and IV
- (d) All of these

**17.** Select the correct statements.

- I. The word AIDS stands for Acquired Immuno Deficiency Syndrome. This means deficiency of immune system, acquired during the lifetime of an individual.
- II. AIDS was first reported in 1981 and the word 'syndrome' in this, means a group of symptoms.
- III. There is always a time-lag between the infection and appearance of AIDS symptoms, i.e. vary from a few months to many years (usually 5-10 years).
- IV. During HIV infection, the macrophages cells of body continues produce virus and in this way acts like a HIV factory.

- (a) I, II and III
- (b) I, III and IV
- (c) I, and IV
- (d) All of these

**18.** Read the given statements carefully.

- I. In India, NACO and other NGOs are doing a lot to educate people about AIDS.
- II. To prevent HIV infections, use of disposable needles and syringes in hospitals, use of condoms during sex, control of drug abuse is necessary.
- III. 1st December is celebrated as World AIDS Day.
- IV. AIDS is characterised by decrease in the number of killer T-cells.

Which of the above statements are correct?

- (a) I, II and IV
- (b) I, II, III and IV
- (c) I and III
- (d) I and IV

**19.** Read the following statements and select the correct answer.

- I. Psychoactive drugs have the ability to alter the activity of the nervous system.
- II. Addiction is a psychological attachment to certain effects such as euphoria and temporary feeling of well-being associated with drugs and alcohol.
- III. When the drugs are taken for a purpose other than medicinal use or in amounts/frequency that impairs one's physical, physiological or psychological functions, it constitutes drug abuse.
- IV. Smoking increases carbon monoxide content in blood and reduces the concentration of oxygen. This causes oxygen deficiency in the body.

- (a) I and II
- (b) III and IV
- (c) I, II and IV
- (d) I, II, III and IV

20. Read the following statements and select the correct option.

- I. Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs/alcohol is abruptly discontinued
- II. Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral hemorrhage.
- III. Education about harmful effects of drugs and alcohol, counselling professional and medical help would relieve the individuals from the drug and alcohol abuse
- IV. Sports persons often misuse drugs to enhance their performance.

- (a) I and II                      (b) II and IV  
(c) I, II and III              (d) All of these

21. Match the following columns.

Column I (Diseases)	Column II (Causative organisms)
A. Dysentery	1. <i>Entamoeba histolytica</i>
B. Malignant malaria	2. <i>Plasmodium falciparum</i>
C. Common cold	3. Rhinovirus
D. Ringworm	4. <i>Trichophyton</i>

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 2 | 3 | 4 | (b) 2 | 3 | 4 | 1 |
| (c) 3 | 4 | 1 | 2 | (d) 4 | 1 | 2 | 3 |

22. Match the causative organisms with their diseases.

Column I	Column II
A. <i>Haemophilus influenzae</i>	1. Malignant malaria
B. <i>Entamoeba histolytica</i>	2. Elephantiasis
C. <i>Plasmodium falciparum</i>	3. Pneumonia
D. <i>Wuchereria bancrofti</i>	4. Typhoid
E. <i>Salmonella typhi</i>	5. Amoebiasis

Codes

- |       |   |   |   |   |
|-------|---|---|---|---|
| A     | B | C | D | E |
| (a) 1 | 5 | 3 | 2 | 4 |
| (b) 3 | 5 | 1 | 2 | 4 |
| (c) 5 | 1 | 3 | 4 | 2 |
| (d) 1 | 3 | 2 | 5 | 4 |

23. Match the diseases in Column I with the appropriate items (pathogen/prevention/treatment) in Column II.

Column I	Column II
A. Amoebiasis	1. <i>Treponema pallidum</i>
B. Diphtheria	2. Use only sterilised food and water
C. Cholera	3. DPT vaccine
D. Syphilis	4. Use of oral rehydration therapy

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 1 | 2 | 3 | 4 | (b) 2 | 4 | 1 | 3 |
| (c) 2 | 1 | 3 | 4 | (d) 2 | 3 | 4 | 1 |

24. Column I lists the components of body defence and Column II lists the corresponding descriptions. Match the two column, choose the correct option from those given.

Column I	Column II
A. Active natural immunity	1. Injection of gamma globulins
B. First line of defence	2. Complement proteins and interferons
C. Passive natural immunity	3. Direct contact with the pathogens that have entered inside the body
D. Second line of defence	4. Surface barriers
	5. Antibodies transferred through the placenta

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 4 | 3 | 5 | 2 | (b) 3 | 4 | 2 | 5 |
| (c) 3 | 4 | 5 | 2 | (d) 5 | 3 | 2 | 1 |

25. Match the following columns.

Column I (Cancer causing agents)	Column II (Examples)
A. Chemical agent	1. Benzopyrene in cigarette smoke
B. Physical agent	2. X-rays
C. Biological agent	3. Oncogenic viruses

Codes

- |       |   |   |       |   |   |
|-------|---|---|-------|---|---|
| A     | B | C | A     | B | C |
| (a) 1 | 2 | 3 | (b) 3 | 2 | 1 |
| (c) 3 | 1 | 2 | (d) 1 | 3 | 2 |

26. Match the following columns.

Column I (Biomedical techniques)	Column II (Features)
A. Biopsy	1. Uses X-rays to generate a three-dimensional image of the internals of an object
B. Radiography	2. Leukaemia
C. Blood or Bone marrow test	3. X-rays are used to detect cancer of the internal organs
D. Computed tomography	4. A piece of the suspected tissue cut into thin sections, stained and examined under microscope

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 4 | 2 | 1 | 3 | (b) 4 | 3 | 2 | 1 |
| (c) 3 | 2 | 1 | 4 | (d) 2 | 1 | 4 | 3 |

## NCERT EXEMPLAR PROBLEMS

1. The term 'Health' is defined in many ways. The most accurate definition of the health would be:
  - a. Health is the state of body and mind in a balanced condition
  - b. Health is the reflection of a smiling face
  - c. Health is a state of complete physical, mental and social well-being
  - d. Health is the symbol of economic prosperity.
2. The organisms which cause diseases in plants and animals are called:
  - a. Pathogens
  - b. Vectors
  - c. Insects
  - d. Worms
3. The clinical test that is used for diagnosis of typhoid is:
  - a. ELISA
  - b. ESR
  - c. PCR
  - d. Widal
4. Diseases are broadly grouped into infectious and non-infectious diseases. In the list given below, identify the infectious diseases.
  - i. Cancer
  - ii. Influenza
  - iii. Allergy
  - iv. Small pox

(a) i and ii      (b) ii and iii      (c) iii and iv      (d) ii and iv
5. The sporozoites that cause infection when a female *Anopheles* mosquito bites a person, are formed in:
  - a. liver of the person
  - b. RBCs of mosquito
  - c. salivary glands of mosquito
  - d. gut of mosquito
6. The disease *chikunguniya* is transmitted by:
  - a. house fly
  - b. *Aedes* mosquito
  - c. cockroach
  - d. female *Anopheles*
7. Many diseases can be diagnosed by observing the symptoms in the patient. Which group of symptoms are indicative of pneumonia?
  - a. Difficulty in respiration, fever, chills, cough, headache
  - b. Constipation, abdominal pain, cramps, blood clots
  - c. Nasal congestion and discharge, cough, constipation, headache
  - d. High fever, weakness, stomach pain, loss of appetite and constipation

8. Cancer causing genes are called:
- structural genes
  - expressor genes
  - oncogenes
  - regulatory genes
9. In malignant tumors, the cells proliferate, grow rapidly and move to other parts of the body to form new tumors. This stage of disease is called:
- metagenesis
  - metastasis
  - teratogenesis
  - mitosis
10. When an apparently healthy person is diagnosed as unhealthy by a psychiatrist, the reason could be that:
- the patient was not efficient at his work
  - the patient was not economically prosperous
  - the patient shows behavioural and social maladjustment
  - he does not take interest in sports
11. Which of the following are the reason(s) for Rheumatoid arthritis? Choose the correct option.
- The ability to differentiate pathogens or foreign molecules from self cells increases.
  - Body attacks self cells
  - More antibodies are produced in the body
  - The ability to differentiate pathogens or foreign molecules from self cells is lost
- (a) i and ii    (b) ii and iv    (c) iii and iv    (d) i and iii
12. AIDS is caused by HIV. Among the following, which one is not a mode of transmission of HIV?
- Transfusion of contaminated blood
  - Sharing the infected needles
  - Shaking hands with infected persons
  - Sexual contact with infected persons
13. 'Smack' is a drug obtained from the:
- latex of *Papaver somniferum*
  - leaves of *Cannabis sativa*
  - flowers of *Datura*
  - fruits of *Erythroxyl coca*
14. The substance produced by a cell in viral infection that can protect other cells from further infection is:
- serotonin
  - colostrum
  - interferon
  - histamine

15. Transplantation of tissues/organs to save certain patients often fails due to rejection of such tissues/organs by the patient. Which type of immune response is responsible for such rejections?
- auto-immune response
  - humoral immune response
  - physiological immune response
  - cell-mediated immune response
16. Antibodies present in colostrum which protect the new born from certain diseases is of
- Ig G type
  - Ig A type
  - Ig D type
  - Ig E type
17. Tobacco consumption is known to stimulate secretion of adrenaline and nor-adrenaline. The component causing this could be:
- Nicotine
  - Tannic acid
  - Curamin
  - Catechin
18. Antivenom against snake poison contains:
- Antigens
  - Antigen-antibody complexes
  - Antibodies
  - Enzymes
19. Which of the following is not a lymphoid tissue?
- Spleen
  - Tonsils
  - Pancreas
  - Thymus
20. Which of the following glands is large sized at birth but reduces in size with ageing?
- Pineal
  - Pituitary
  - Thymus
  - Thyroid
21. Haemozoin is a:
- precursor of hemoglobin
  - toxin released from *Streptococcus* infected cells
  - toxin released from *Plasmodium* infected cells
  - toxin released from *Haemophilus* infected cells

22. Which of the following is not the causal organism for ringworm?

- a. *Microsporum*
- b. *Trichophyton*
- c. *Epidermophyton*
- d. *Macrosporum*

23. A person with sickle cell anemia is

- a. more prone to malaria
- b. more prone to typhoid
- c. less prone to malaria
- d. less prone to typhoid

## NEET PREVIOUS QUESTIONS

1. The infectious stage of *Plasmodium* that enters the human body is  
(a) Trophozoites (b) Sporozoites  
(c) Female gametocytes (d) Male gametocytes  
(NEET 2020)
2. Match the following diseases with the causative organism and select the correct option.
- | Column-I      | Column-II               |
|---------------|-------------------------|
| A. Typhoid    | (i) <i>Wuchereria</i>   |
| B. Pneumonia  | (ii) <i>Plasmodium</i>  |
| C. Filariasis | (iii) <i>Salmonella</i> |
| D. Malaria    | (iv) <i>Haemophilus</i> |
- | A         | B     | C     | D     |
|-----------|-------|-------|-------|
| (a) (i)   | (iii) | (ii)  | (iv)  |
| (b) (iii) | (iv)  | (i)   | (ii)  |
| (c) (ii)  | (i)   | (iii) | (iv)  |
| (d) (iv)  | (i)   | (ii)  | (iii) |
- (NEET 2020)
3. Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid.  
(a) *Salmonella typhi* / Widal test  
(b) *Plasmodium vivax* / UTI test  
(c) *Streptococcus pneumoniae* / Widal test  
(d) *Salmonella typhi* / Anthrone test (NEET 2019)
4. In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels?  
(a) Elephantiasis (b) Ascariasis  
(c) Ringworm disease (d) Amoebiasis  
(NEET 2018)
5. Which of the following sets of diseases is caused by bacteria?  
(a) Cholera and tetanus  
(b) Typhoid and smallpox  
(c) Tetanus and mumps  
(d) Herpes and influenza (NEET-II 2016)
6. Which of the following diseases is caused by a protozoan?  
(a) Babesiosis (b) Blastomycosis  
(c) Syphilis (d) Influenza (2015)
7. Match each disease with its correct type of vaccine.
- | Column I          | Column II              |
|-------------------|------------------------|
| A. Tuberculosis   | (i) Harmless virus     |
| B. Whooping cough | (ii) Inactivated toxin |
| C. Diphtheria     | (iii) Killed bacteria  |
| D. Polio          | (iv) Harmless bacteria |
- (a) A-(iv), B-(iii), C-(ii), D-(i)  
(b) A-(i), B-(ii), C-(iv), D-(iii)  
(c) A-(ii), B-(i), C-(iii), D-(iv)  
(d) A-(iii), B-(ii), C-(iv), D-(i) (2015 Cancelled)
8. The active form of *Entamoeba histolytica* feeds upon  
(a) food in intestine (b) blood only  
(c) erythrocytes, mucosa and submucosa of colon  
(d) mucosa and submucosa of colon only.  
(2015 Cancelled)
9. Infection of *Ascaris* usually occurs by  
(a) Tse-tse fly  
(b) mosquito bite  
(c) drinking water containing eggs of *Ascaris*  
(d) eating imperfectly cooked pork. (NEET 2013)
10. Identify the site where *Wuchereria bancrofti* is normally found in human body.  
(a) Muscles of the legs  
(b) Blood vessels of the thigh region  
(c) Skin between the fingers  
(d) Lymphatic vessels of the lower limbs  
(Karnataka NEET 2013)
11. Motile zygote of *Plasmodium* occurs in  
(a) gut of female *Anopheles*  
(b) salivary glands of *Anopheles*  
(c) human RBCs  
(d) human liver. (2012)
12. Widal test is carried out to test  
(a) malaria (b) diabetes mellitus  
(c) HIV/AIDS (d) typhoid fever. (2012)
13. Common cold differs from pneumonia in that  
(a) pneumonia is a communicable disease whereas the common cold is a nutritional deficiency disease



- (b) pneumonia can be prevented by a live attenuated bacterial vaccine whereas the common cold has no effective vaccine
- (c) pneumonia is caused by a virus while the common cold is caused by the bacterium *Haemophilus influenzae*
- (d) pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs. (2012)

14. Where will you look for the sporozoites of the malarial parasite?

- (a) Saliva of infected female *Anopheles* mosquito
- (b) Red blood corpuscles of human suffering from malaria
- (c) Spleen of infected humans
- (d) Salivary glands of freshly moulted female *Anopheles* mosquito (2011)

15. Which one of the following options gives the correct match of a disease with its causative organism and mode of infection?

Disease	Causative organism	Mode of infection
(a) Typhoid	<i>Salmonella typhi</i>	With inspired air
(b) Pneumonia	<i>Streptococcus pneumoniae</i>	Droplet infection
(c) Elephantiasis	<i>Wuchereria bancrofti</i>	With infected water and food
(d) Malaria	<i>Plasmodium vivax</i>	Bite of male <i>Anopheles</i> mosquito (Mains 2011)

16. Common cold is not cured by antibiotics because it is

- (a) caused by a virus
- (b) caused by a Gram-positive bacterium
- (c) caused by a Gram-negative bacterium
- (d) not an infectious disease. (Mains 2011)

17. Ringworm in humans is caused by

- (a) bacteria (b) fungi
- (c) nematodes (d) viruses. (2010)

18. Widal test is used for the diagnosis of

- (a) malaria (b) pneumonia
- (c) tuberculosis (d) typhoid. (2010)

19. A person suffering from a disease caused by *Plasmodium*, experiences recurring chill and fever at the time when

- (a) the sporozoites released from RBCs are being rapidly killed and broken down inside spleen
- (b) the trophozoites reach maximum growth and give out certain toxins

- (c) the parasite after its rapid multiplication inside RBCs ruptures them, releasing the stage to enter fresh RBCs
- (d) the microgametocytes and megagametocytes are being destroyed by the WBCs. (Mains 2010)

20. Which of the following is a pair of viral diseases?

- (a) Common cold, AIDS
- (b) Dysentery, common cold
- (c) Typhoid, tuberculosis
- (d) Ringworm, AIDS (2009)

21. Match the disease in column I with the appropriate items (pathogen / prevention / treatment) in column II.

Column I	Column II
A. Amoebiasis	(i) <i>Treponema pallidum</i>
B. Diphtheria	(ii) Use only sterilised food and water
C. Cholera	(iii) DPT vaccine
D. Syphilis	(iv) Use oral rehydration therapy

(a) A – (ii), B – (i), C – (iii), D – (iv)

(b) A – (ii), B – (iii), C – (iv), D – (i)

(c) A – (i), B – (ii), C – (iii), D – (iv)

(d) A – (ii), B – (iv), C – (i), D – (iii) (2008)

22. Which one of the following is not correctly matched?

- (a) *Glossina palpalis* - Sleeping sickness
- (b) *Culex pipiens* - Filariasis
- (c) *Aedes aegypti* - Dengue fever
- (d) *Anopheles culicifacies* - Leishmaniasis (2004)

23. *Salmonella* is related with

- (a) typhoid (b) polio
- (c) T.B. (d) tetanus. (2001)

24. Which is the most infectious disease?

- (a) Hepatitis-B (b) AIDS
- (c) Amoebiasis (d) Malaria (2001)

25. Which is showing accurate pairing?

- (a) Syphilis - *Treponema pallidum*
- (b) AIDS - *Bacillus conjugalis*
- (c) Gonorrhoea - *Leishmania donovani*
- (d) Typhoid - *Mycobacterium leprae* (2000)

26. Saline solution is given to patients of cholera because

- (a)  $\text{Na}^+$  prevents water loss from body
- (b) NaCl function as regulatory material
- (c) NaCl produces energy
- (d) NaCl is antibacterial. (2000)

27. Botulism caused by *Clostridium botulinum* affects the

- (a) lymph gland
- (b) central nervous system
- (c) spleen
- (d) intestine. (1998)

28. Typhoid fever is caused by  
 (a) *Shigella* (b) *Escherichia*  
 (c) *Giardia* (d) *Salmonella*. (1998)
29. Diphtheria is caused by  
 (a) nematodes (b) bacteria  
 (c) virus (d) none of these. (1997)
30. Which of the following diseases is now considered completely eradicated from India?  
 (a) Small pox (b) Poliomyelitis  
 (c) Plague (d) Kala-azar (1997)
31. Which of the following symptoms indicate red sickness?  
 (a) Nausea and loss of hair  
 (b) Ulcerated skin, nausea and loss of hair  
 (c) Red and ulcerated skin  
 (d) Nausea and anaemia (1997)
32. Which of the following pair of diseases is caused by virus?  
 (a) Rabies, mumps (b) Cholera, tuberculosis  
 (c) Typhoid, tetanus (d) AIDS, syphilis (1996)
33. Which one of the following pairs is not correctly matched?  
 (a) Syphilis - *Trichuris trichiura*  
 (b) Sleeping sickness - *Trypanosoma gambiense*  
 (c) Dengue fever - Arbovirus  
 (d) Plague - *Yersinia pestis* (1995)
34. Which of the following causes plague?  
 (a) *Trichinella spiralis*  
 (b) *Salmonella typhimurium*  
 (c) *Yersinia pestis*  
 (d) *Leishmania donovani* (1995)
35. Which one of the following does correctly match a sexually transmitted disease with its pathogen?  
 (a) Syphilis-*Treponema pallidum*  
 (b) Gonorrhoea-*Entamoeba histolytica*  
 (c) Urethritis-*Bacillus anthracis*  
 (d) Softsore-*Bacillus brevis* (1994)
36. Schizont stage of *Plasmodium* occurs in human  
 (a) erythrocytes (b) liver cells  
 (c) erythrocytes and liver cells  
 (d) erythrocytes, liver cells and spleen cells. (1993)
37. If all ponds and puddles are destroyed, the organism likely to be destroyed is  
 (a) *Leishmania* (b) *Trypanosoma*  
 (c) *Ascaris* (d) *Plasmodium*. (1993)
38. Give the correct matching of causative agent/germ and disease.  
 (a) *Anopheles* - Malaria  
 (b) *Leishmania* - Sleeping sickness  
 (c) *Glossina* - Kala-azar  
 (d) *Wuchereria* - Filariasis (1993)
39. The part of life cycle of malarial parasite *Plasmodium vivax*, that is passed in female *Anopheles* is  
 (a) sexual cycle  
 (b) pre-erythrocytic schizogony  
 (c) exoerythrocytic schizogony  
 (d) post-erythrocytic schizogony. (1992)
40. African sleeping sickness is due to  
 (a) *Plasmodium vivax* transmitted by tse-tse fly  
 (b) *Trypanosoma lewisi* transmitted by bed bug  
 (c) *Trypanosoma gambiense* transmitted by *Glossina palpalis*  
 (d) *Entamoeba gingivalis* spread by housefly. (1991)
41. Malignant tertian malarial parasite, belongs to class  
 (a) *Plasmodium falciparum*  
 (b) *P. vivax*  
 (c) *P. ovale*  
 (d) *P. malariae*. (1991)
42. Who discovered *Plasmodium* in RBC of human beings?  
 (a) Ronald Ross (b) Mendel  
 (c) Laveran (d) Stephens (1991)
43. The infective stage of malarial parasite, *Plasmodium* that enters human body is  
 (a) merozoite (b) sporozoite  
 (c) trophozoite (d) minuta form. (1990)
44. A bite of tse-tse fly may pass to humans  
 (a) *Leishmania donovani*  
 (b) *Trypanosoma gambiense*  
 (c) *Entamoeba histolytica*  
 (d) *Plasmodium vivax*. (1989)
45. Malaria fever coincides with liberation of  
 (a) cryptomerzoties  
 (b) metacryptomerzoties  
 (c) merozoites  
 (d) trophozoites. (1989)
46. The vector for sleeping sickness is  
 (a) housefly (b) tse-tse fly  
 (c) sandfly (d) fruit fly. (1989)
47. The causal organism for African sleeping sickness is  
 (a) *Trypanosoma cruzi* (b) *T. rhodesiense*  
 (c) *T. tangela* (d) *T. gambiense*. (1989)

## 8.2 Immunity

48. Identify the wrong statement with reference to immunity.  
 (a) When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called "Active immunity".  
 (b) When ready-made antibodies are directly given, it is called "Passive immunity".

- (c) Active immunity is quick and gives full response.  
 (d) Fetus receives some antibodies from mother, it is an example for passive immunity.  
 (NEET 2020)
49. Which of the following immune responses is responsible for rejection of kidney graft?  
 (a) Cell-mediated immune response  
 (b) Auto-immune response  
 (c) Humoral immune response  
 (d) Inflammatory immune response (NEET 2019)
50. Colostrum, the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains  
 (a) immunoglobulin A (b) natural killer cells  
 (c) monocytes (d) macrophages.  
 (NEET 2019)
51. Which of the following is not an autoimmune disease?  
 (a) Psoriasis  
 (b) Rheumatoid arthritis  
 (c) Alzheimer's disease  
 (d) Vitiligo (NEET 2018)
52. Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of immune response is responsible for such rejections?  
 (a) Cell-mediated immune response  
 (b) Hormonal immune response  
 (c) Physiological immune response  
 (d) Autoimmune response (NEET 2017)
53. MALT constitutes about \_\_\_\_\_ percent of the lymphoid tissue in human body.  
 (a) 20% (b) 70% (c) 10% (d) 50%  
 (NEET 2017)
54. Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain  
 (a) gamma globulin (b) attenuated pathogens  
 (c) activated pathogens (d) harvested antibodies.  
 (NEET-I 2016)
55. In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to  
 (a) autoimmune disease (b) active immunity  
 (c) allergic response (d) graft rejection.  
 (NEET-I 2016)
56. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence?  
 (a) Haemocytes  
 (b) Serum globulins  
 (c) Fibrinogen in plasma  
 (d) Serum albumins (2015, 2007)
57. Which of the following immunoglobulins does constitute the largest percentage in human milk?  
 (a) IgA (b) IgG  
 (c) IgD (d) IgM (2015)
58. Grafted kidney may be rejected in a patient due to  
 (a) passive immune response  
 (b) innate immune response  
 (c) humoral immune response  
 (d) cell-mediated immune response. (2015)
59. Increased asthmatic attacks in certain seasons are related to  
 (a) eating fruits preserved in tin containers  
 (b) inhalation of seasonal pollen  
 (c) low temperature  
 (d) hot and humid environment. (2007)
60. Lysozyme that is present in perspiration, saliva and tears, destroys  
 (a) certain types of bacteria  
 (b) all viruses  
 (c) most virus-infected cells  
 (d) certain fungi. (2007)
61. Antibodies in our body are complex  
 (a) glycoproteins (b) lipoproteins  
 (c) steroids (d) prostaglandins. (2006)
62. Damage to thymus in a child may lead to  
 (a) a reduction in haemoglobin content of blood  
 (b) a reduction in stem cell production  
 (c) loss of antibody mediated immunity  
 (d) loss of cell mediated immunity. (2005)
63. Short-lived immunity acquired from mother to fetus across placenta or through mother's milk to the infant is categorised as  
 (a) active immunity  
 (b) passive immunity  
 (c) cellular immunity  
 (d) innate non-specific immunity. (2003)
64. Interferons are synthesized in response to  
 (a) mycoplasma (b) bacteria  
 (c) viruses (d) fungi. (2001)
65. The antibodies are  
 (a) proteins (b) carbohydrates  
 (c) lipids (d) germs. (1999)
66. The term 'active immunity' means  
 (a) increasing rate of heart beat  
 (b) increasing quantity of blood  
 (c) resistance developed after disease  
 (d) resistance developed before disease. (1999)
67. If a person shows production of interferons in his body, the chances are that he has got an infection of  
 (a) tetanus (b) malaria  
 (c) typhoid (d) measles. (1997)

68. Antibodies are produced by  
 (a) leucocytes (b) monocytes  
 (c) lymphocytes (d) spleen. (1996)
69. The interferons are  
 (a) antigen proteins (b) antiviral proteins  
 (c) antibiotic proteins (d) all of these. (1996)
70. Which one of the following diseases is due to an allergic reaction?  
 (a) Enteric fever (b) Skin cancer  
 (c) Goitre (d) Hay fever (1995)
71. Antigens are present  
 (a) inside the cytoplasm  
 (b) on nuclear membrane  
 (c) inside the nucleus  
 (d) on cell surface. (1995)
72. A cell-coded protein that is formed in response to infection, with most animal viruses, is called  
 (a) histone (b) antibody  
 (c) interferon (d) antigen. (1994)

### 8.3 AIDS

73. Which of the following is correct regarding AIDS causative agent HIV?  
 (a) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase.  
 (b) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase.  
 (c) HIV is unenveloped retrovirus.  
 (d) HIV does not escape but attacks the acquired immune response. (NEET-II 2016)
74. HIV that causes AIDS, first starts destroying  
 (a) helper T-lymphocytes  
 (b) thrombocytes  
 (c) B-lymphocytes  
 (d) leucocytes. (2015 Cancelled, 2006)
75. At which stage of HIV infection does one usually show symptoms of AIDS?  
 (a) Within 15 days of sexual contact with an infected person  
 (b) When the infected retro virus enters host cells  
 (c) When HIV damages large number of helper T - lymphocytes  
 (d) When the viral DNA is produced by reverse transcriptase (2014)
76. Which one of the following statements is correct with respect to AIDS?  
 (a) The HIV can be transmitted through eating food together with an infected person.  
 (b) Drug addicts are least susceptible to HIV infection.

- (c) AIDS patients are being fully cured cent per cent with proper care and nutrition.  
 (d) The causative HIV retrovirus enters helper T-lymphocytes thus reducing their numbers. (2010)
77. Human immuno deficiency virus (HIV) has a protein coat and a genetic material which is  
 (a) double stranded RNA  
 (b) double stranded DNA  
 (c) single stranded DNA  
 (d) single stranded RNA. (1998)

### 8.4 Cancer

78. Which of the following statements is not true for cancer cells in relation to mutations?  
 (a) Mutations inactivate the cell control.  
 (b) Mutations inhibit production of telomerase.  
 (c) Mutations in proto-oncogenes accelerate the cell cycle.  
 (d) Mutations destroy telomerase inhibitor. (NEET-I 2016)
79. Which one of the following is not a property of cancerous cells, whereas the remaining three are?  
 (a) They compete with normal cells for vital nutrients.  
 (b) They do not remain confined in the area of formation.  
 (c) They divide in an uncontrolled manner.  
 (d) They show contact inhibition. (2012)
80. Which one of the following techniques is safest for the detection of cancers?  
 (a) Magnetic resonance imaging (MRI)  
 (b) Radiography (X-ray)  
 (c) Computed tomography (CT)  
 (d) Histopathological studies (Mains 2010)
81. Carcinoma refers to  
 (a) malignant tumours of the connective tissue  
 (b) malignant tumours of the skin or mucous membrane  
 (c) malignant tumours of the colon  
 (d) benign tumours of the connective tissue. (2003)
82. Cancerous cells can easily be destroyed by radiations due to  
 (a) rapid cell division (b) lack of nutrition  
 (c) fast mutation (d) lack of oxygen. (2002)
83. Reason of lung cancer is  
 (a) coal mining (b) calcium fluoride  
 (c) cement factory (d) bauxite mining. (2001)
84. Which of the following will be curable in next two decades?  
 (a) Tuberculosis (b) Cancer  
 (c) Poliomyelitis (d) None of these (1997)

85. The blood cancer is known as  
(a) haemolysis (b) haemophilia  
(c) leukaemia (d) thrombosis. (1995)
86. A metastatic cancerous tumour is termed 'sarcoma' if the disorder is in  
(a) fibroblasts (b) circulatory system  
(c) immune system (d) epithelial cells. (1994)

87. Drug called 'Heroin' is synthesised by  
(a) nitration of morphine  
(b) methylation of morphine  
(c) acetylation of morphine  
(d) glycosylation of morphine. (NEET 2019)

88. Which part of poppy plant is used to obtain the drug "smack"?  
(a) Flowers (b) Latex  
(c) Roots (d) Leaves (NEET 2018)

89. Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown here?



- (a) Hallucinogen  
(b) Depressant  
(c) Stimulant  
(d) Pain killer

(2014)

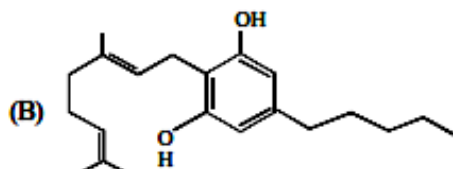
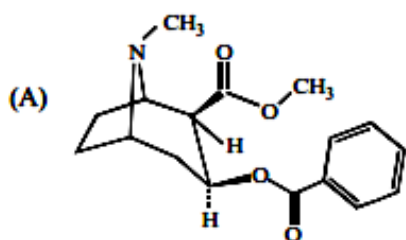
90. Which one of the following is a hallucinogenic drug?  
(a) Caffeine  
(b) Morphine  
(c) Lysergic acid diethylamide  
(d) Opium (Karnataka NEET 2013)

## AIIMS PREVIOUS QUESTIONS

1. *Gambusia* fish has been introduced in lakes and ponds of India to control a deadly disease. It feeds on larva of [1997]  
(a) *nepenthes* (b) *anopheles*  
(c) dragon fly (d) house-fly
2. Anti-viral substance is [1997]  
(a) antigen (b) antibody  
(c) interferon (d) antibiotic
3. Which malarial parasite has longest incubation period? [1997]  
(a) *Plasmodium vivax*  
(b) *Plasmodium falciparum*  
(c) *Plasmodium malariae*  
(d) *Plasmodium ovale*
4. The type of antibodies present in colostrum secreted from mammary gland is [1997]  
(a) IgM (b) IgD  
(c) IgE (d) IgA
5. Which of the following disease is due to an allergic reaction? [1998]  
(a) Goitre (b) Hay fever  
(c) Skin cancer (d) Rheumatic fever
6. Influenza is caused by [1998]  
(a) virus (b) bacteria  
(c) alga (d) fungus
7. Which type of cancer is found in lymph nodes and spleen? [1998]  
(a) Carcinoma (b) Sarcoma  
(c) Lymphoma (d) Leukemia
8. Amoebiasis is caused by [1999]  
(a) *Entamoeba histolytica*  
(b) *Taenia solium*  
(c) *Plasmodium vivax*  
(d) *E. coli*
9. Inflammatory response, in allergy is caused by the release of [1999]  
(a) antigen (b) histones  
(c) histamines (d) antibodies
10. Sporogony of malarial parasite occurs in [1999]  
(a) liver of man  
(b) RBCs of man  
(c) stomach wall of mosquito  
(d) salivary glands of mosquito
11. Malignant tertian malaria is caused by [2000]  
(a) *P. vivax* (b) *P. malariae*  
(c) *P. ovale* (d) *P. falciparum*
12. HIV has a protein coat and genetic material [2000]  
(a) ss RNA (b) ds RNA  
(c) ss DNA (d) ds DNA
13. Cyclosporine is used [2002]  
(a) For allergy  
(b) As immunodepressant  
(c) Prophylactic for virus  
(d) None of the above
14. Lysis of foreign cell is mediated through [2002]  
(a) IgM (b) IgA  
(c) IgE (d) IgM & IgG
15. The treatment of snake-bite by antivenom is an example of [2004]  
(a) artificially acquired active immunity  
(b) artificially acquired passive immunity  
(c) naturally acquired passive immunity  
(d) specific natural immunity
16. Electron beam therapy is a kind of radiation therapy to treat [2004]  
(a) enlarged prostate gland  
(b) gall bladder stones by breaking them  
(c) certain types of cancer  
(d) kidney stones
17. A young drug addict used to show symptoms of depressed brain activity, feeling of calmness, relaxation and drowsiness. Possibly he was taking [2005]  
(a) Amphetamine (b) Marijuana  
(c) Pethadine (d) Valium

18. When children play bare footed in pools of dirty water and flood water, they may suffer from diseases like [2006]  
 (a) leptospirosis and bilharzia  
 (b) malaria, amoebic dysentery and leptospirosis  
 (c) bilharzia, infective hepatitis and diarrhoea  
 (d) guinea worm infection, elephantiasis and amoebic dysentery
19. Which one of the following is not a matching pair of a drug and its category? [2004, 2008]  
 (a) Amphetamines - stimulant  
 (b) Lysergic acid - narcotic dimethyl amide  
 (c) Heroin - psychotropic  
 (d) Benzodiazepam - pain killer
20. An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as [2005, 2008]  
 (a) histamine and dopamine  
 (b) histamine and kinins  
 (c) interferons and opsonin  
 (d) interferons and histones
21. Antigen binding site in an antibody is found between [2005, 2008]  
 (a) two light chains  
 (b) two heavy chains  
 (c) one heavy and one light chain  
 (d) either between two light chains or between one heavy and one light chain depending upon the nature of antigen
22. The antigen-binding site are present where on the antibody molecule [2009]  
 (a) on light chain as well as on heavy chain.  
 (b) on light chain only.  
 (c) on variable region and constant region of light chain.  
 (d) on heavy chain only.
23. Which one of the following antimicrobial drugs is suitable for treatment of both tuberculosis and leprosy? [2010]  
 (a) Isoniazid  
 (b) R-aminosalicylic acid  
 (c) Streptomycin  
 (d) Rifampicin
24. Antigen is a substance which [2010]  
 (a) lowers body temperature  
 (b) destroys harmful bacteria  
 (c) triggers the immune system  
 (d) is used as an antidote to poison
25. Which of the following is a pentameric immunoglobulin and is produced first in a primary response to an antigen? [2010]  
 (a)  $I_gG$  (b)  $I_gM$   
 (c)  $I_gA$  (d)  $I_gE$
26. Cattle fed with spoiled hay to sweet clover which contains dicumarol [2011]  
 (a) are healthier due to a good diet  
 (b) catch infections easily  
 (c) may suffer vitamin K deficiency and prolonged bleeding  
 (d) may suffer from beri-beri due to deficiency of vitamin-B
27. Opium is obtained from [2011]  
 (a) *Oryza sativa*  
 (b) *Coffea arabica*  
 (c) *Thea sinensis*  
 (d) *Papaver somniferum*
28. Match the following bacteria with the diseases
- | Column-I                     | Column-II     |
|------------------------------|---------------|
| A. <i>Treponema pallidum</i> | I. Plague     |
| B. <i>Yersinia pestis</i>    | II. Anthrax   |
| C. <i>Bacillus anthracis</i> | III. Syphilis |
| D. <i>Vibrio</i>             | IV. Cholera   |
- [2012]  
 (a) A - III; B - I; C - II; D - IV  
 (b) A - IV; B - I; C - II; D - III  
 (c) A - III; B - II; C - I; D - IV  
 (d) A - I; B - III; C - II; D - IV
29. Which one of the following is a correct match? [2013]  
 (a) Bhang - Analgesic  
 (b) Cocaine - Opiate narcotics  
 (c) Morphine - Hallucinogen  
 (d) Barbiturate - Tranquiliser
30. Which of the following is an autoimmune disorder? [2013]  
 (a) Myasthenia gravis  
 (b) Osteoporosis  
 (c) Muscular dystrophy  
 (d) Gout
31. Which of the following is based upon the principle of antigen-antibody interaction? [2014]  
 (a) PCR  
 (b) ELISA  
 (c) r-DNA technology  
 (d) RNA

32. Identify the molecules (A) and (B) shown below and select the right option giving their source and use. [2014,2015]



	Molecule	Source	Uses
(a)	(A) Cocaine	<i>Erythroxylum coca</i>	Accelerates the transport of dopamine
(b)	(B) Heroin	<i>Cannabis sativa</i>	Depressant and slows down body functions
(c)	(B) Cannabinoid	<i>Atropa belladonna</i>	Produces hallucinations
(d)	(A) Morphine	<i>Papaver somniferum</i>	Sedative and pain killer

33. *Pasteurella/Yersinia pestis* (causal agent of Bubonic Plague) is transmitted by [2016]

- (a) *Cimex*                      (b) *Xenopsylla*  
 (c) *Pediculus*                (d) *Aedes*

34. Which of the following pairs is not correctly matched? [2016]

- (a) Cholera – *Vibrio cholerae*  
 (b) German measles – Rubella virus  
 (c) Whooping cough – *Bordetella pertussis*  
 (d) Tetanus – *Pasteurella pestis*

35. Human immuno deficiency virus (HIV) has a protein coat and a genetic material which is [2017]

- (a) Single stranded DNA.  
 (b) Single stranded RNA.  
 (c) Double stranded RNA.  
 (d) Double stranded DNA.

36. Which one of the following pairs of diseases is viral as well as transmitted by mosquitoes? [2017]

- (a) Elephantiasis and dengue  
 (b) Yellow fever and sleeping sickness  
 (c) Encephalitis and sleeping sickness  
 (d) Yellow fever and dengue





## KEY

### MULTIPLE CHOICE OF QUESTIONS

1 (d) 2 (b) 3 (b) 4 (a) 5 (d) 6 (b) 7 (a) 8 (c) 9 (a) 10 (d) 11 (a) 12 (b) 13 (c) 14 (d) 15 (a)  
16 (a) 17 (d) 18 (c) 19 (b) 20 (d) 21 (a) 22 (d) 23 (c) 24 (c) 25 (b) 26 (d) 27 (b) 28 (d) 29 (b) 30 (a)  
31 (d) 32 (d) 33 (c) 34 (c) 35 (a) 36 (a) 37 (a) 38 (b) 39 (c) 40 (c) 41 (c) 42 (c) 43 (b) 44 (d) 45 (a)  
46 (a) 47 (b) 48 (c) 49 (d) 50 (d) 51 (d) 52 (c) 53 (d) 54 (c) 55 (a) 56 (d) 57 (d) 58 (c) 59 (a) 60 (b)  
61 (d) 62 (d) 63 (a) 64 (d) 65 (a) 66 (d) 67 (a) 68 (c) 69 (a) 70 (a) 71 (c) 72 (a) 73 (a) 74 (c) 75 (d)  
76 (b) 77 (d) 78 (c) 79 (a) 80 (b) 81 (a) 82 (c) 83 (b) 84 (c) 85 (a) 86 (a) 87 (c) 88 (d) 89 (a) 90 (a)  
91 (d) 92 (a) 93 (b) 94 (a) 95 (a) 96 (a) 97 (b) 98 (d) 99 (a) 100 (a) 101 (a) 102 (a) 103 (a) 104 (a) 105 (a)  
106 (b) 107 (a) 108 (b) 109 (d) 110 (a) 111 (c) 112 (c) 113 (a) 114 (a) 115 (a) 116 (b) 117 (d) 118 (b) 119 (c) 120 (d)  
121 (a) 122 (a) 123 (a) 124 (a) 125 (d) 126 (a) 127 (d) 128 (d) 129 (b) 130 (d) 131 (c) 132 (c) 133 (a) 134 (a) 135 (b)  
136 (d) 137 (a) 138 (a) 139 (d) 140 (b) 141 (a) 142 (c) 143 (c) 144 (d) 145 (b) 146 (c) 147 (a) 148 (a) 149 (d) 150 (a)  
151 (a) 152 (b) 153 (d) 154 (a) 155 (c) 156 (c) 157 (a) 158 (c) 159 (b) 160 (a) 161 (c) 162 (d)

### SPECIAL FORMAT QUESTIONS

1	c	6	a	11	c	16	c	21	a	26	b
2	a	7	c	12	d	17	d	22	b		
3	b	8	c	13	d	18	b	23	d		
4	a	9	d	14	d	19	d	24	c		
5	c	10	d	15	a	20	d	25	a		

### NCERT EXEMPLAR QUESTIONS

1	c	6	b	11	b	16	b	21	c
2	a	7	a	12	c	17	a	22	d
3	d	8	c	13	a	18	c	23	c
4	d	9	b	14	c	19	c		
5	d	10	c	15	d	20	c		

### NEET PREVIOUS QUESTIONS

1. (b) 2. (b) 3. (a) 4. (a) 5. (a) 6. (a) 7. (a) 8. (c) 9. (c) 10. (d)  
11. (a) 12. (d) 13. (d) 14. (a) 15. (b) 16. (a) 17. (b) 18. (d) 19. (c) 20. (a)  
21. (b) 22. (d) 23. (a) 24. (a) 25. (a) 26. (a) 27. (b) 28. (d) 29. (b) 30. (a)  
31. (b) 32. (a) 33. (a) 34. (c) 35. (a) 36. (c) 37. (d) 38. (d) 39. (a) 40. (c)  
41. (a) 42. (c) 43. (b) 44. (b) 45. (b) 46. (b) 47. (d) 48. (c) 49. (a) 50. (a)  
51. (c) 52. (a) 53. (d) 54. (b) 55. (a) 56. (b) 57. (a) 58. (d) 59. (b) 60. (a)  
61. (a) 62. (d) 63. (b) 64. (c) 65. (a) 66. (c) 67. (d) 68. (c) 69. (b) 70. (d)  
71. (d) 72. (c) 73. (b,d) 74. (a) 75. (c) 76. (d) 77. (d) 78. (b) 79. (d) 80. (a)  
81. (b) 82. (a) 83. (a) 84. (b) 85. (c) 86. (a) 87. (c) 88. (b) 89. (a) 90. (c)

### AIIMS PREVIOUS QUESTIONS

1	b	9	c	17	a	25	b	33	b
2	c	10	d	18	a	26	c	34	d
3	c	11	d	19	d	27	d	35	b
4	d	12	a	20	b	28	a	36	d
5	b	13	b	21	c	29	d		
6	a	14	c	22	a	30	a		
7	c	15	b	23	d	31	b		
8	a	16	c	24	c	32	d		

**UNIT-VII**  
**PERIPLANATA AMERICANA**  
**(COCKROACH)**

## SYNOPSIS

- Phylum** : Arthropoda  
➤ **Subphylum** : Mandibulata  
➤ **Class** : Insecta / Hexapoda  
➤ **Order** : Orthoptera  
➤ **Family** : Blattidae
- Largest class of animals in the kingdom animalia is
  - Insects are distinguished from other arthropods in pairs of legs.
  - Study of Insects is called **Entomology**.
  - **William Kirby** is the **founder of Entomology**
  - Abundantly and easily available insect is cockroach.
  - A **common house hold pest** that **contaminates**
  - **Cockroach** is mostly the **inhabitant** of the **tropical**
  - The **two common species of cockroaches** found

### **Insecta.**

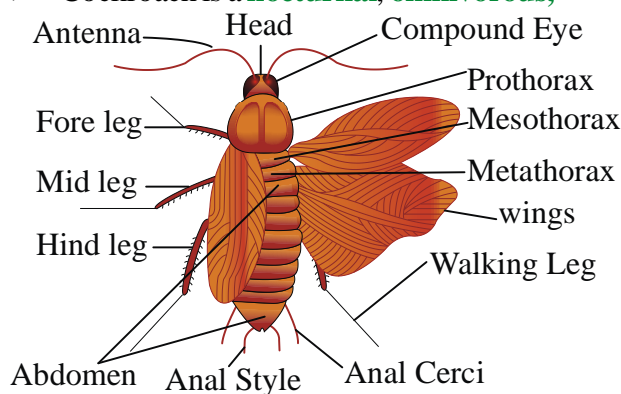
possessing - three **tagmata** in the body and three

our **food with excreta** is cockroach. **countries.**

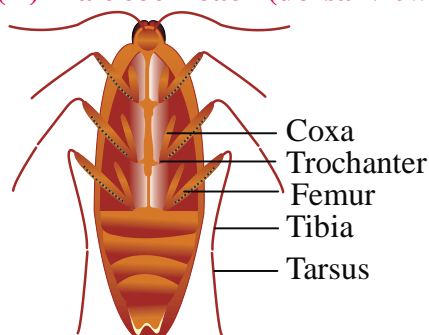
in **India** are i) *Blatta orientalis*  
ii) *Periplaneta americana* (**American cockroach-the largest and most common**).

## 7.1 HABITAT AND HABIT

- *Periplaneta americana* was a native of tropical America, it is currently worldwide in distribution.
- The generic name **Periplaneta** was **coined by Burmeister**.
- Cockroach is a **nocturnal, omnivorous, scavengerous and cursorial** insect.



(A) Male cockroach (dorsal view)



(B) Female cockroach (ventral view)

## 7.2 EXTERNAL FEATURES

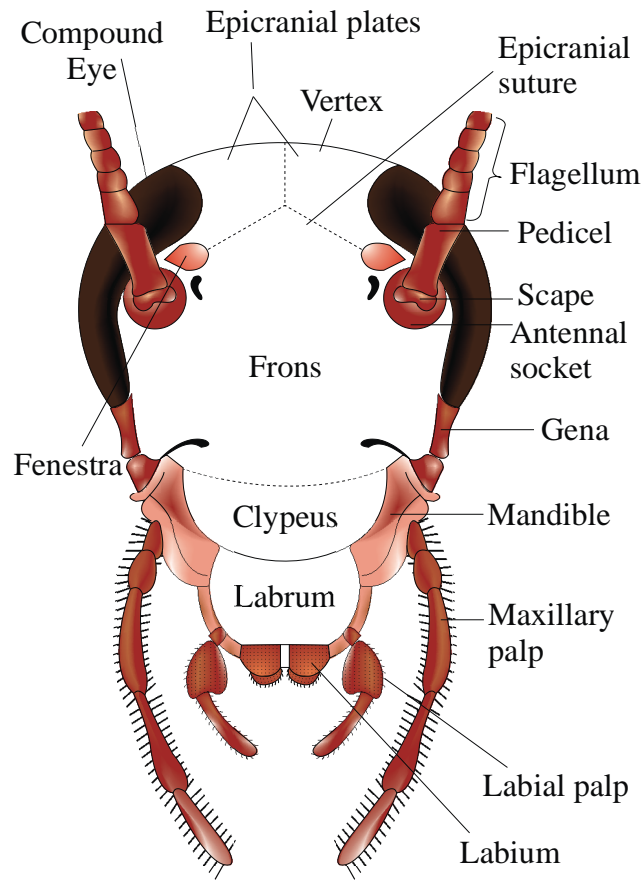
- Body of cockroach is elongated, narrow, elliptical, and dorso - ventrally depressed, flat and **bilaterally symmetrical**.
- Colour is reddish brown.
- **Exoskeleton** is the hard brown **chitinous cuticle**.
- **Cuticle** is **secreted by** the under lying cells of the **hypodermis / epidermis**.
- The functions of **cuticle** are attachment of muscles.
- i) Protection of the body ii) Prevention of loss of water iii) Provides rigidity and offers place for the membrane called **arthrodial membrane / intersegmental membrane**.
- **Chitinous plates** of the **cuticle** are called **sclerites**.
- Sclerites are joined by soft, thin and flexible

### **BODY**

- **Tagmata** of the body are head (first tagma) thorax (second tagma) and abdomen (third tagma).

- The body of cockroach is composed of 19 segments. They are
  - 6 in head
  - 3 in thorax
  - 10 in abdomen.

## HEAD



### Head of *Periplaneta* (Dorsal View)

Head lies hanging at right angles to the body axis with the posterior wider part upwards and the mandibles directed downwards, so it is called **hypognathous** head.

- **Head** of cockroach is **formed by the fusion of six embryonic segments**.
- Head is highly movable in all directions and movably attached to the thorax by a **neck** or **cervicum**.
- Exoskeleton formed by the fusion of six sclerites of head is called **head capsule**.
- The top of the head between the two compound eyes ( dorsolateral) is called **vertex**.
- Vertex has two sclerites called **epicranial plates**.
- Suture present between two epicranial plates is the **epicranial suture**. It is **inverted Y shaped**.
- The front part of the head is covered by
  - Frons** - unpaired and the largest head sclerite
  - Clypeus** - narrow, rectangular, unpaired sclerite attached to frons and labrum.
  - Genae** - paired lateral sclerites of head (cheek sclerites).
- Opening present at the back of the head capsule is the **occipital foramen**.
- Occipital foramen is bordered by a sclerite called **occiput**.
- Occipital foramen forms a passage for the oesophagus, aorta, trachea and nerve cord.
- A small whitish speck present at the base of each antenna is **fenestra** or ocellus or simple eye.

## APPENDAGES OF HEAD

- Segments of the head without appendages are first and third.
- Appendages of the second, fourth, fifth and sixth segments respectively are antennae, mandibles, maxillae and labium (second maxillae).
- Antennae are long, filamentous and lie in the sockets in front of eyes.
- The antenna has the scape, pedicel and flagellum (multi segmented) respectively.
- Antennae bear tactile and olfactory sensillae.

S.No.	Segment of head	Name of appendages
1.	First	absent

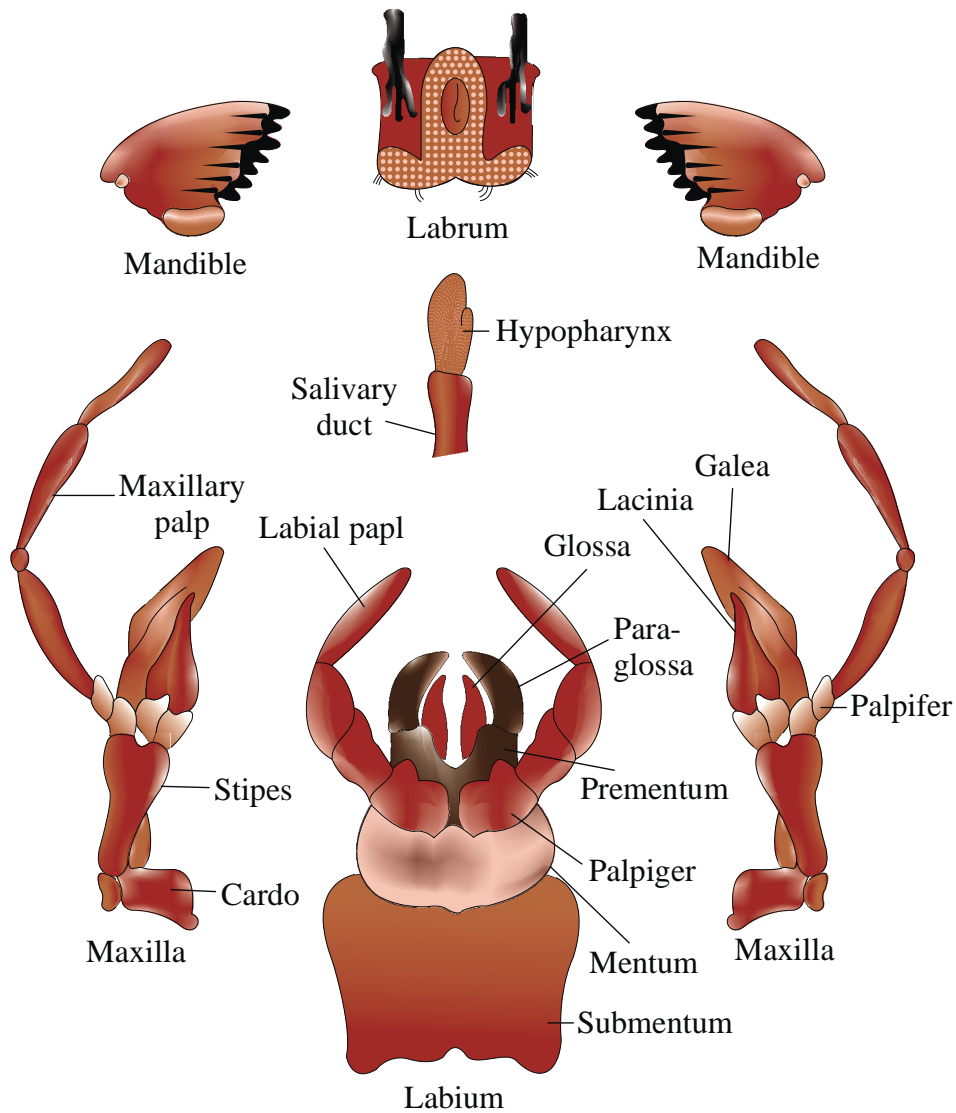
2.	Second	Pair of antennae	
3.	Third	absent	
4.	Fourth	Pair of mandibles	
5.	Fifth	First maxillae	
6.	Sixth	Second maxillae that form labium	(lower lip).

## MOUTH PARTS

- Type of mouth parts are **biting and chewing type** ( most primitive type).
- Biting and chewing type of mouth parts include labrum (upper lip, a head sclerite), mandibles (appendages of 4th head segment), first maxillae (appendages of 5th head segment), second maxillae (appendages of 6th head segment) that form labium (lower lip) and a hypopharynx.
- Space between the mouth parts is the **pre oral cavity**. It is the cavity surrounded by mouth parts.
- Anterior wall of the pre oral cavity is formed by **labrum** or **upper lip**. Posterior wall is formed by **labium**.
- Labrum**
- It is concerned with **holding and tasting the food**. It is movably articulated to the lower, inner edge of clypeus.
- Sensillae present on the inner surface of the labrum are **gustatory sensillae**.
- Mandibles**
- These are triangular, hard, unjointed, chitinised structures present on the sides of the mouth.
- Mouth parts connected to the genae are mandibles.
- Muscles that help in the movement of the mandibles are **adductor** and **abductor**.
- Inner margins of mandibles bear incising teeth [cutting or biting type] & grinding teeth (chewing type).

## First Maxillae

- **Biramous mouthparts** are 'first maxillae'.
- Parts of first maxillae are protopodite, exopodite and endopodite.
- **Protopodite** is formed of a Cardo and a Stipes.
- A **five - jointed maxillary palp** arises from a small sclerite called **palpifer** present at the outer edge of Stipes.
- Maxillary palp constitutes the exopodite.
- **Maxillary palps / exopodites** are the structures useful for cleaning the antennae and front pair of legs.
- From the distal end of the Stipes, internal to the maxillary palp arises the endopodite (galea & lacinia)
- **Endopodite** constitutes the outer, larger **galea** (hood-like) and inner, smaller **lacinia** (pincer-like).
- Mouth parts that serve to hold the food and bring it to the mandibles are first maxillae.



**Mouth parts of *Periplaneta***

### Labium or lower lip

- It is formed by the fusion of second pair of maxillae.
- Parts of the Labium are
  - i) proximal/ upper sub-mentum
  - ii) middle mentum
  - iii) distal/ lower prementum.
- Labial palp (three - segmented) arises from a sclerite called **palpiger** present on each side of the prementum.
- Mouth parts that prevent the food from falling, and pushes it in to the pre-oral cavity are labrum and labium (lips).
- **Paraglossa** (comparable to galea) and **glossa** (comparable to lacinia) arises from the distal end of the prementum.
- 2 Paraglossae and 2 glossae constitute the **Ligula**.
- **Hypopharynx** or **Tongue** or **Lingua**
- Rod - like, grooved, chitinous structure hanging in the pre-oral cavity in between the two first maxillae is the **Hypopharynx** or **Tongue** or **Lingua**.
- Efferent salivary duct opens at the base of the hypopharynx.

### NECK OR CERVICUM

- Slender, flexible tube that connects the head with thorax is neck or cervicum.
- Neck is supported by four cervical sclerites. (2 dorsal and 2 ventral).

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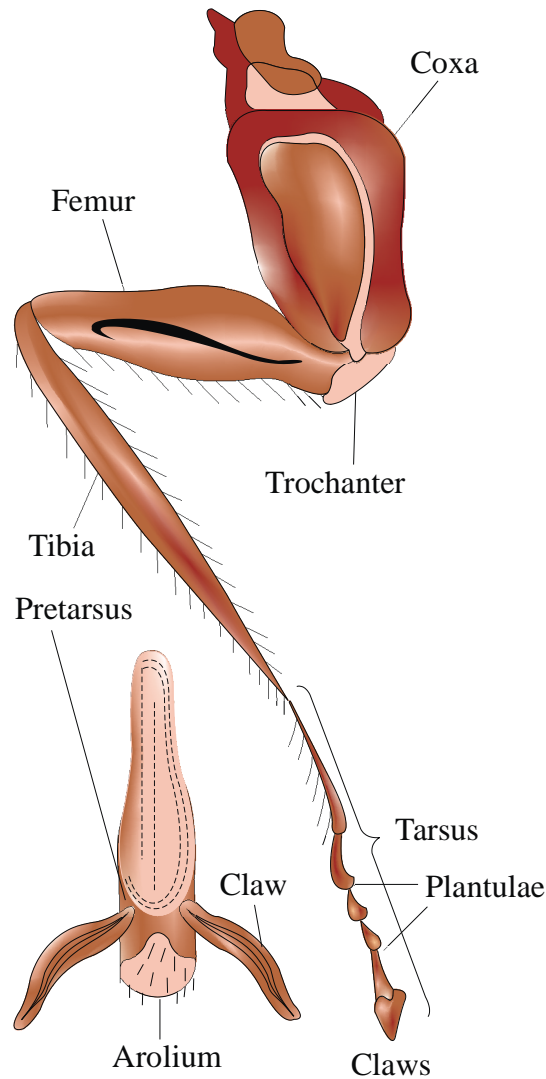
## NECK OR CERVICUM

- Slender, flexible tube that connects the head with thorax is neck or cervicum.
- Neck is supported by four cervical sclerites.  
(2 dorsal and 2 ventral).
- It is not a tagma of the body because it is the anterior extension of prothorax.

## Second tagma of the body is **Thorax**.

- Segments of the thorax are Prothorax, Mesothorax and Metathorax.
- Sclerites that cover each segment of the thorax are
  - i) Tergum or Notum (dorsal side)
  - ii) Sternum (on the ventral side)
  - iii) Pleura (on the lateral sides).
- Tergum of the prothorax is called **Pronotum**. It is triangular and the **largest sclerite** of the body.
- Terga on the mesothorax and metathorax are called **mesonotum** and **metanotum** respectively. They are **roughly rectangular**.

## LEGS



**Leg of *Periplaneta* and its pre tarsus**

- Number of jointed (walking) legs in cockroach are three pairs (6) (hexapod).
- Legs are connected with the pleura and sterna of the thoracic segments.
- Each leg (podos) is made up of five segments (5 joints) called **podomeres**.
- The 5 different podomeres serially from the base to the tip are Coxa, Trochanter, Femur, Tibia and Tarsus.
- Leg is connected to the thorax by its basal / proximal segment **coxa**.
- The podomere that is movably attached to the coxa, but fused with the femur is **Trochanter**.
- **Trochanter** is small and triangular podomere.
- The podomeres that bear spine-like chitinous bristles are Femur and Tibia.
- Femur and tibia are long cylindrical and spiny.
- Joints of tarsus are called **tarsomeres**. They are five in number.
- Soft pads that lie on the inner surface of the first four tarsomeres are called **plantulae**.
- The terminal joint of the tarsus is called **pretarsus**. It ends with a pair of claws.
- In between the claws, there is a soft, chitin, hairy pad called **arolium (pulvillus)**.
- **Plantulae** help the cockroach to move on smooth surfaces.
- **Arolium** as well as **claws** help the cockroach to move on rough surfaces.

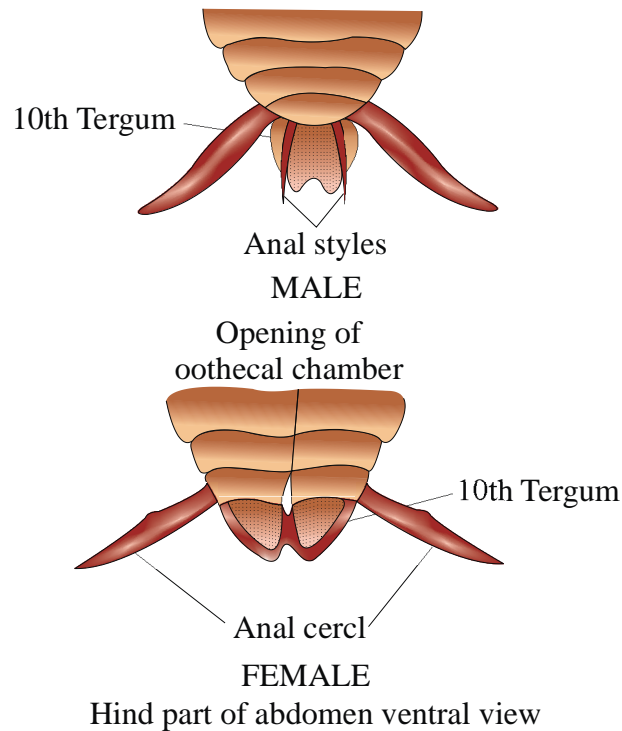
## **WINGS**

- Two pairs of wings in cockroach are, a pair of fore wings & a pair of hind wings.
- Wings that do not help in flight are fore wings (**Tegmina/Elytra**).



- Wings that help in flight are hind wings.
- Wings are strengthened by tubular, sclerotized structures called **veins** or **nervures**.
- Fore wings arise from dorso lateral sides of mesothorax.
- Fore wings are thick, leathery, opaque, dark and are used to cover the hind wings at rest.
- Hind wings are broad, transparent, thin, membranous and delicate. They help in flight and remain folded below the tegmina (fore wings) when not in use.

## ABDOMEN



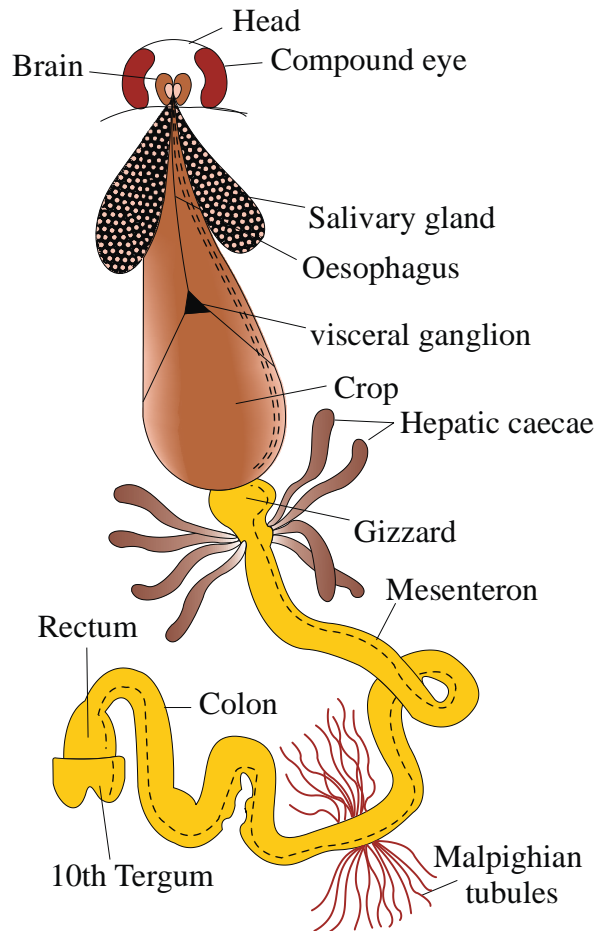
- Number of segments in the abdomen are ten in adult cockroach.
- Sclerites that cover each abdominal segment are a dorsal tergum, a ventral sternum and two lateral pleura or pleurites.
- Sternum is absent for the 10th abdominal segment.
- Number of abdominal terga and sterna are 10 (terga) & 9 (sterna) respectively.
- **In male**, seventh tergum overlaps only the eighth tergum and hence **eighth tergum is invisible**.
- **In female**, seventh tergum overlaps both eighth and ninth terga. Hence, **eighth and ninth terga are invisible**.
- **Anus** lies in the tenth abdominal segment just below 10th tergum.
- In female, genital pouch or brood pouch is formed by seventh, eighth and ninth abdominal sterna.
- **7th sternum** is boat-shaped and forms the floor (ventral wall) and side (lateral) walls of brood (genital) pouch.
- **8th sternum** forms anterior wall of brood pouch.
- **9th sternum** forms roof (dorsal wall) of brood pouch.
- The brood pouch has two functional parts. They are
  - i) an anterior **genital chamber** or **gynatrium** and
  - ii) a posterior **oothecal chamber** or **vestibulum**.
- **A pair of anal cerci** (each 15-jointed) arise from the lateral sides of the **10th tergum** in **both males & females**.
- **A pair of anal styles** (unjointed) arise from the 9th sternum **in males only**.
- Small, chitinous processes arising from the **ninth sternum in males** but from **eighth and ninth sterna in females** are called **gonapophyses** (external genital organs/external genitalia).
- **Male gonapophyses** are called **phallomeres**. **They are three in number**.
- **Female gonapophyses** are called **ovipositors**. **They are three pairs in number**.
- **Male genital aperture** is present on the **vental phallomere** (ninth abdominal sternum).
- **Female genital aperture** is present on the **eighth abdominal sternum**.

## 7.3 LOCOMOTION

- Cockroach can run on the ground with the help of its legs. So, it is a cursorial insect.
- Modes of locomotion in cockroach are

- i) Running or cursorial locomotion ii) Flying.
- During cursorial locomotion, cockroach moves by using its 6 legs as two tripods alternately.
- Each tripod is formed by 'foreleg (puller) and hind leg (pusher) of one side' and 'middle leg (pivot) of the other side'.
- Structures of legs that help in locomotion on rough surfaces are **claws and arolium**, and on smooth surfaces are **plantulae**.
- While flying, the first pair wings/fore wings are stretched out at right angles to the body.
- While flying, the second pair wings/hind wings are moved up (elevated) and down (depressed).
- Hind wings are elevated (moved up) by the contraction of dorsoventral (tergosternal) muscles and relaxation of dorsolongitudinal muscles.
- Wings are depressed (moved down) by the contraction of dorso longitudinal muscles and relaxation of dorsoventral muscles.

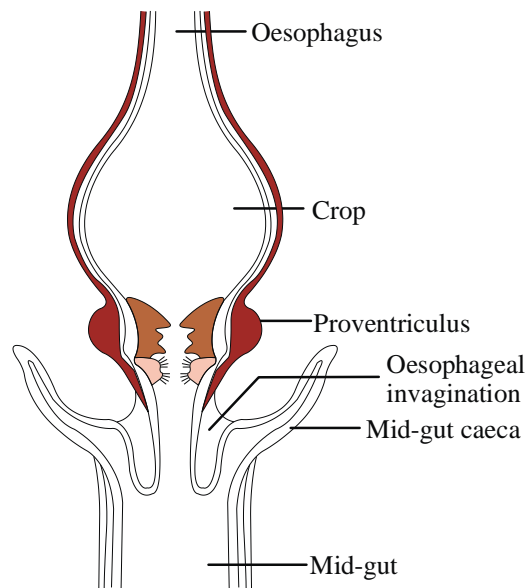
## 7.4 DIGESTIVE SYSTEM



**Alimentary canal of *Periplaneta***

- The digestive system of cockroach consists of alimentary canal & digestive glands.
  - Pre-oral cavity is present in front of the mouth.
  - The pre-oral cavity is divided into an anterior large **cibarium** and a posterior small **salivarium** by hypopharynx.
  - Three regions of the alimentary canal are
    - Foregut or Stomodaeum** - concerned with ingestion, storage and grinding of food.
    - Mid gut or Mesenteron** - concerned with digestion and absorption of food.
    - Hindgut or Proctodaeum** - concerned with absorption of salts, water and other materials, formation of faeces and its elimination.
  - Fore gut and hind gut are ectodermal and hence have an inner cuticular lining for protection.
  - The mid gut is endodermal and therefore lacks inner cuticular lining.
- I) Foregut or Stomodaeum**
- Fore gut includes pharynx, oesophagus, crop and gizzard (proventriculus).
  - **Mouth** is located at the base of cibarium. It leads in to a short tubular passage called **oesophagus**.

- Oesophagus passes through the nerve ring, neck and thorax and finally opens into a **sac-like crop**.
- **Crop** serves as a **reservoir for storing the food**.
- The part of the foregut that acts both as a '**grinding mill**' and a '**sieve**' is '**Gizzard**' or '**Proventriculus**'.
- The wall of gizzard has an outer thick layer of circular muscles. The thick inner cuticle forms six chitinous powerful teeth.



**Foregut of *Periplaneta***

- Cuticular lining of gizzard forms soft cushion like hairy pads behind the teeth with backwardly directed bristles act as filters on them.
- Bristles on the hairy pads allow only finer food particles to pass into mid gut.
- Membranous projection of the gizzard into the mesenteron or midgut or ventriculus in the form of a funnel is called **Stomodael valve**.
- The stomodael valve prevents the back flow of food (regurgitation) from the mesenteron into the gizzard.

## II) Midgut/Mesenteron/Ventriculus

- Ventriculus is a narrow tube of uniform diameter without inner lining of cuticle. It is functionally divided into an anterior secretory part and a posterior absorptive part.

A ring of 6 to 8 endodermal blind diverticulae called **hepatic caecae** arise from the anterior end of mesenteron. They help in the digestion and absorption of some food.

- Bolus of the food in the mesenteron is enveloped by a **peritrophic membrane**. It is a net work of chitin fibrils in a glycoprotein matrix.
- Peritrophic membrane is secreted by the anterior (proximal) part of ventriculus/midgut/mesenteron.
- The opening of the ventriculus into the hind gut is controlled by a **sphincter muscle** (prevents the entry of undigested food & uric acid from the ileum of hindgut into the mid gut).

## III) Hindgut or Proctodaeum

- Regions of the **hindgut** or **proctodaeum** are
  - i) Ileum
  - ii) Colon
  - iii) Rectum
- Hind gut parts are lined internally by chitinous cuticle
- At the junction between mid gut and hind gut, there are 6 to 8 bundles of about 100 to 150 thin, ectodermal, yellowish, filamentous **malpighian tubules** which open into the ileum. They help in removal of excretory wastes from haemolymph.
- **Rectum** bears six longitudinal chitinous folds called **rectal papillae** on its inner side. They help in reabsorption of water from the undigested food.
- Rectum opens out by anus just beneath the tenth abdominal tergum.
- The digestive glands associated with the alimentary canal of cockroach are a pair of salivary glands, hepatic caecae and glandular cells of the mesenteron.

## SALIVARY GLANDS

- A pair of salivary glands are present on the ventro lateral sides of the crop in the thorax.

- Number of lobes in each salivary gland is two.
- Each gland has two leaf-like lobes and a receptacle or reservoir in between them.
- Each lobe has many secreting lobules called acini.
- Each acinus is formed by a group of zymogen (acinar) cells and a ductule.
- Common salivary duct on each side is formed by ductules of both the lobes of a salivary gland.
- Median salivary duct is formed by the union of two common salivary ducts.
- Sac present between the two lobes of a salivary gland of each side is called salivary receptacle/reservoir.
- Receptacular/reservoir duct arises from each salivary receptacle.
- Receptacular ducts of both the sides unite to form common receptacular duct or common reservoir duct.
- Median salivary duct opens into the common receptacular duct.
- Efferent salivary duct is formed by median salivary duct & common receptacular duct. It passes anteriorly and finally opens into the salivarium of pre-oral cavity at the base of hypopharynx.
- Acinar or Zymogen cells secrete saliva.
- Saliva contains starch - digesting enzymes called amylases.
- **Hepatic caecae** or Midgut caecae contain secretory and absorptive cells.
- Enzymes secreted by glandular cells of the mesenteron are maltase, invertase or sucrase, proteases and lipases.

## Physiology of Digestion

- Cockroach feeds on all types of organic matter (omnivorous).

### Food collection

- Cockroach locates the food by olfactory sensillae of antennae, labial palps and maxillary palps.
- Food is seized with the help of forelegs, labrum and labium.
- For biting and chewing, the food is passed on to the mandibles.
- Food is held by laciniae/endopodites, galeae/exopodites of first maxillae, glossae+paraglossae (ligula) during chewing by mandibles.
- Food is prevented from falling down during chewing by labrum and labium (lips).

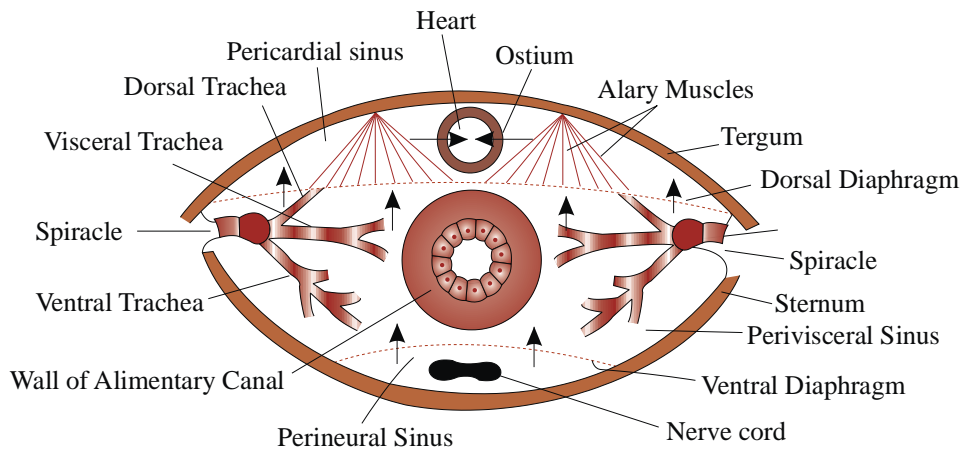
### Process of digestion

- During mastication, the food is mixed with saliva. Amylase of saliva digests carbohydrates into disaccharides. Labrum pushes the food into pharynx through mouth.
- Most of the food is digested in the crop, into which the enzymes of saliva (by forward flow) and mid gut (by reverse flow) will reach. Food moves through alimentary canal by peristalsis.
- Food is pulverised (grounded well) in the gizzard.
- Partly digested food after grinding is filtered by bristles of the gizzard.
- Anterior wall of mid gut secretes porous, chitinous, mesh - like membrane called **peritrophic membrane** around food bolus. This membrane protects the mid gut epithelium from the damage caused by hard food particles.
- Starches are converted into disaccharides by amylase (from salivary glands).
- Ventriculus secrete sucrase (invertase), maltase, lipase and proteases.
- Sucrase/invertase digests each sucrose into a glucose and a fructose.
- Maltase digest each maltose into 2 glucoses.
- Lipase digests lipids into fatty acids and glycerol.
- Proteases digest proteins into aminoacids.
- Chemical digestion gets completed in midgut. Digested food is absorbed in the midgut.
- Cellulose of the food is digested by the cellulase enzyme secreted by the microbes of hindgut (microbial digestion).
- Cellulose is converted into glucose which gets absorbed in hind gut
- Rectal papillae absorb water from the undigested wastes and convert them into solid faecal pellets.
- Faeces of cockroach is defaecated /egested through the anus as dry pellets. This is called egestion/defaecation.

## 7.5 CIRCULATORY SYSTEM

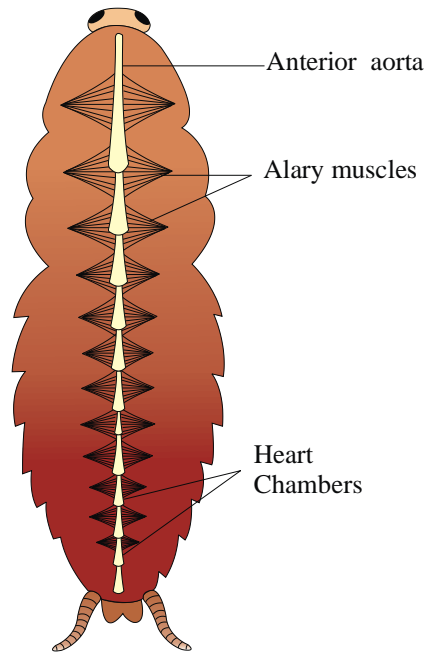
- Type of circulatory system is **open type**.
- Blood vessels are poorly developed and open into spaces/sinuses rather than capillaries.
- The three main parts associated with the circulatory system are haemocoel, heart and blood.
- **Haemocoel**
- Haemocoel is divided into three sinuses by two diaphragms/septa such as i) a dorsal diaphragm and ii) a ventral diaphragm.
- Both the diaphragms are provided with valvular pores (fenestrae).

- The dorsal diaphragm (pericardial septum) is attached laterally to the tergum.
- Ventral diaphragm is attached laterally to the sternum.
- A pair of fan - like , triangular 'alary muscles' in the pericardial sinus of each segment will connect the dorsal diaphragm by their broad bases, and by their pointed ends/ apices with the tergum of that segment.
- The sinuses of the haemocoel are
  - Pericardial haemocoel (Dorsal sinus):** It encloses heart, aorta, paired fan shaped (triangular) alary muscles one pair in each segment one on either side of heart.
  - Perivisceral haemocoel (Middle sinus):** It is the largest sinus. It encloses most of the internal organs including gut.
  - Sternal haemocoel (Ventral sinus or Perineural sinus):** It encloses double ventral nervecord.



**Diagrammatic TS of thorax of *Periplaneta***

- Largest sinus is the perivisceral sinus / middle sinus.
  - Muscles associated with the dorsal diaphragm are **alary muscles (12 pairs)**, 1 pair in each segment except the last (10th abdominal) segment.
- Heart**
- It is long, narrow, tubular, muscular, contractile with 13 chambers . It lies mid dorsally just beneath the terga of thorax and abdomen.
  - Posterior end of the heart (posterior end of 13th chamber) is closed while the anterior end (1st chamber) of heart is continued forward as narrow anterior aorta. It opens into head sinus.
  - All heart chambers, except the last/13th chamber, will open both anteriorly and posteriorly.
  - Each funnel - shaped chamber of heart communicates with its front chamber by a valvular opening.
  - Each heart chamber (except the last chamber), is provided with a pair of valvular small apertures called **ostia** postero-laterally.
  - The ostia are valvular and allow the flow of haemolymph from pericardial (dorsal) sinus into heart only but not in the opposite direction.



Circulatory system of *Periplaneta*

## Haemolymph

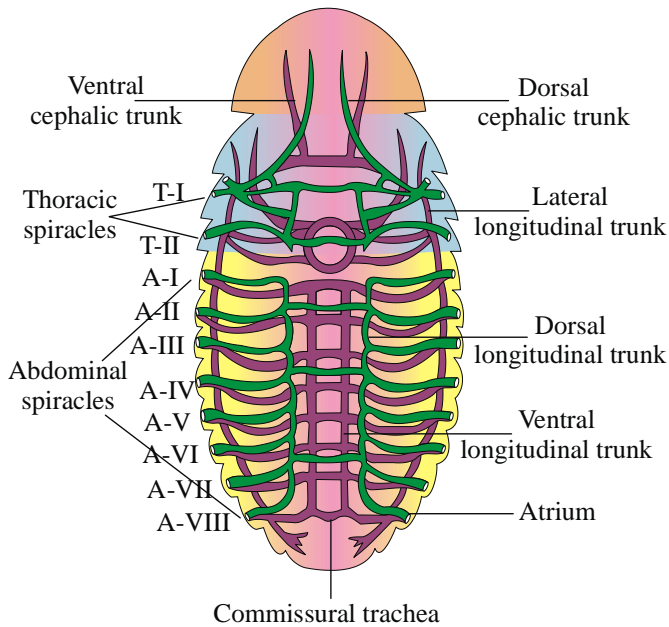
- Haemolymph consists of plasma and **colour less, nucleated haemocytes**.
- Haemolymph lacks a respiratory pigment and has no role in the transport of  $O_2$ .
- Haemocytes act as phagocytes and ingest bacteria etc
- **Important functions of the haemolymph are:**
  - i) absorbs digested food from the alimentary canal and distributes it to the rest of the body.
  - ii) brings nitrogenous wastes from all parts of the body to the excretory organs for excretion.
  - iii) carries defensive phagocytes to the places of infection.
  - iv) transports secretions of ductless/endocrine glands called hormones to their target organs.

## Circulation of blood

- Haemolymph circulates by the contraction and relaxation of heart, associated by paired alary muscles.
- Direction of flow of blood in the chambers of the heart is forward as contraction proceeds from 13th heart chamber towards the 1st chamber.
- At the anterior end of the heart, the blood flows into the head sinus through anterior aorta.
- From the head sinus, the blood flows into the perivisceral and sternal (perineural) sinuses.
- Contraction of alary muscles flattens the dorsal diaphragm due to which pericardial sinus enlarges.
- Haemolymph now enters pericardial sinus through the opened valvular fenestrae of dorsal diaphragm.
- When alary muscles relax, the dorsal diaphragm gets back to its normal position decreasing the volume of pericardial sinus. Then, pores on the dorsal diaphragm opens.
- Now, the blood under pressure, moves into the heart chambers through the opened valvular ostia and flows anteriorly towards head sinus.

## 7.6. RESPIRATORY SYSTEM

- Exchange of gases in insects occurs through a system of ectodermally originated internal tubules that constitute tracheal system.
- Tracheal system of cockroach extends to all the parts of body, thus oxygen is directly carried to its sites of utilization because its colourless blood is without respiratory pigment and not concerned with the transport of oxygen.



- Tracheal system of cockroach consists of spiracles (stigmata), tracheae & tracheoles.
- Tracheal system communicates with the exterior by ten pairs of openings called **stigmata** or **spiracles**.

### Spiracles

- Cockroach has **10 pairs** of spiracles, first pair lies on mesothorax, second pair lies on metathorax and remaining 8 pairs lie in the first 8 abdominal segments.
- Spiracles are located in the pleura of the respective segments.
- The respiratory system in insects is classified on the basis of number and nature of spiracles.
- Respiratory system of cockroach is **polypneustic** (as spiracles are more than 3 pairs in number) and **holopneustic** (as all spiracles are functional during respiration).
- Each spiracle is surrounded by a chitinous ring/annular sclerite called **peritreme**.
- Spiracles are **valvular** and can be closed or opened to regulate the flow of air. They bear small hair-like structures called **trichomes** on their inner margins.
- Each spiracle opens into a small chamber inside the body called **atrium** from which the tracheae arise.

### Trachea

- Several horizontal tracheae arise from the atrium of each thoracic spiracle. They unite to form cephalic trunks.
- Tracheal trunks that arise from the horizontal trachea are dorsal cephalic and ventral cephalic trunks and their branches.
- Tracheal tubes that arise from the atrium of each abdominal spiracle open into three separate **longitudinal tracheal trunks** (lateral, dorsal and ventral). There are **3 pairs** of longitudinal tracheal trunks in cockroach.
- **Longest tracheal trunk** is the **lateral longitudinal**.
- Longitudinal tracheal trunks of both sides are interconnected by **commissural tracheae**.
- All the tracheal branches that enter an organ will end in a special cell called **tracheole cell** or **tracheoblast**.
- The wall of trachea is made up of three layers
  - i) an outer basement membrane
  - ii) a middle, one celled thick epithelium
  - iii) an inner layer of cuticle called **intima**.
- At regular intervals, the **intima** forms **spiral thickenings** called **taenidia** which **prevent the tracheae from collapsing**.
- Tracheole cell has several intracellular tubular extensions towards tissue cells. They are called tracheoles.

### Tracheoles

- Tracheoles are devoid of intima and taenidia (as they are not the branches of trachea) but are made up of a protein called **trachein**.
- Tracheoles are filled with **tracheolar fluid** (nothing but ECF or tissue fluid that enters tracheoles).
- The level of tracheolar fluid varies with the metabolic activity of the insect.
- The level of the tracheolar fluid rises in the tracheoles, when the insect is inactive.
- The level of the tracheolar fluid falls, when the insect is active, as this fluid is reabsorbed back into the tissues.
- Tracheoles penetrate the cell and are intimately associated with mitochondria.

- Events in the processes of respiration are i) inspiration and ii) expiration.

### Mechanism of Respiration

- The muscles that help in respiration are dorso ventral muscles and ventral longitudinal muscles.
- Principal muscles of respiration are **dorsoventral muscles**(tergosternal muscles).
- Inspiration is a passive process, as it is effected by relaxation of dorsoventral muscles & ventral longitudinal muscles.
- Elevation of tergal plates and increase in the volume of the body cavity are due to the relaxation of dorsoventral muscles. This causes decrease in the air pressure in tracheae hence air enters the tracheoles via thoracic spiracles (2 pairs), atria and tracheae.
- Normal positioning of telescoped segments is due to the relaxation of ventral longitudinal muscles.
- The thoracic spiracles (2 pairs) are kept open and abdominal spiracles (8 pairs) are kept closed during inspiration.
- Expiration is an active process, as it is effected by the contraction of dorsoventral muscles and ventro-longitudinal muscles.
- Contraction of dorso-ventral muscles decreases the body volume due to which air pressure in trachea increases.
- The segments are telescoped and the volume of the body cavity decreases due to the contraction of ventral longitudinal muscles.
- Thoracic spiracles (2 pairs) are closed and abdominal spiracles (8 pairs) are kept open during expiration.

Inspiration	Expiration
Taking in of air with more oxygen	Sending out air with more CO <sub>2</sub> from the body
Thoracic spiracles are kept open	Thoracic spiracles are closed
Abdominal spiracles are kept closed	Abdominal spiracles are kept open
Caused by the relaxation of the dorsoventral and ventral longitudinal muscles	Caused by the contraction of the dorsoventral and ventral longitudinal muscles
Due to the relaxation of dorsoventral muscles terga are elevated and the volume of body cavity increases	When dorsoventral muscles contract, terga are depressed so body cavity decreased and pressure increases
Due to the relaxation of ventral longitudinal muscles, telescoped segments come to normal position and the volume of body cavity increases in the longitudinal axis	When ventral longitudinal muscles contract segments are telescoped so body cavity decreases in longitudinal axis and pressure increases further
Air is drawn into the body through the thoracic spiracles	CO <sub>2</sub> is expelled out through the abdominal spiracles
Passive Process (as relaxation of muscles occur)	Active process (as contraction of muscles occur)

- **Discontinuous ventilation** is exhibited by cockroaches, beetles and grass hoppers in which continuous exchange of gases is interrupted for prolonged periods during which spiracles remain closed.
- The exchange of gases depends on the metabolic rate and temperature.
- **Opening and closing of spiracles is influenced by CO<sub>2</sub> tension in haemolymph and O<sub>2</sub> tension in the trachea.**
- Cuticle is more permeable to CO<sub>2</sub> but impermeable to O<sub>2</sub> & H<sub>2</sub>O. CO<sub>2</sub> is carried more quickly in the haemolymph due to its greater solubility.
- As most of the CO<sub>2</sub> in cockroach is lost (sent out) through cuticle of body wall, the body wall is considered as 'the gateway of CO<sub>2</sub>'.

## 7.7.EXCRETORY SYSTEM

- Removal of metabolic wastes (nitrogenous compounds) from the body to maintain homeostasis is called **excretion**.
- Cockroach is a **uricotelic** animal (chief excretory waste is **uric acid** and some of its salts).



- **Uricotelism** is **advantageous to terrestrial insects**, as the loss of water is minimized (uric acid is relatively **non-toxic** and does not readily dissolve in water and is eliminated as **semi-solid waste**).
- The structures associated with excretory function are Malpighian tubules, fat bodies, uricose glands, nephrocytes and cuticle.

### Malpighian tubules

- Number of Malpighian tubules are **100 to 150** (arranged in **6-8 bundles; each bundle** having **15-25 tubules**)
- **Malpighian tubules** are **described** and **called as 'Vasa varicosa'** by **Marcello Malpighi**.
- Malpighian tubules arise as outgrowths of anterior end of ileum, hence are **ectodermal**.
- These are fine yellowish thread like blind end tubules, lying freely in the haemolymph.
- Malpighian tubule is lined **internally by** single layer of **glandular epithelium with brush border**.
- The glandular cells of **distal portion** of tubule are **secretory** and the **proximal part** are **absorptive**.
- Water, salts, CO<sub>2</sub> and nitrogenous wastes from the haemolymph are absorbed by glandular cells of the distal part of Malpighian tubules and form urine (uric acid).
- The urine flows towards the proximal absorptive part where water and certain inorganic salts are reabsorbed by the cells of that part, resulting in the precipitation of uric acid.
- Uric acid already present in the haemolymph combines with reabsorbed potassium bicarbonates and water to form the soluble potassium urate which is again actively transported from haemolymph into the distal portion of Malpighian tubules.
- Uric acid moves from Malpighian tubules into ileum by peristalsis. It is eliminated out of the body along with faeces through anus.
- Uricotelism is an adaptation for conservation of water.

### Urate cells

- Storage excretion is carried out by urate cells of fat body. These cells store uric acid throughout life.

### Nephrocytes

- These are the chains of cells found along the heart wall, associated with the fat bodies. They also store nitrogenous wastes which may later be removed by the blood.

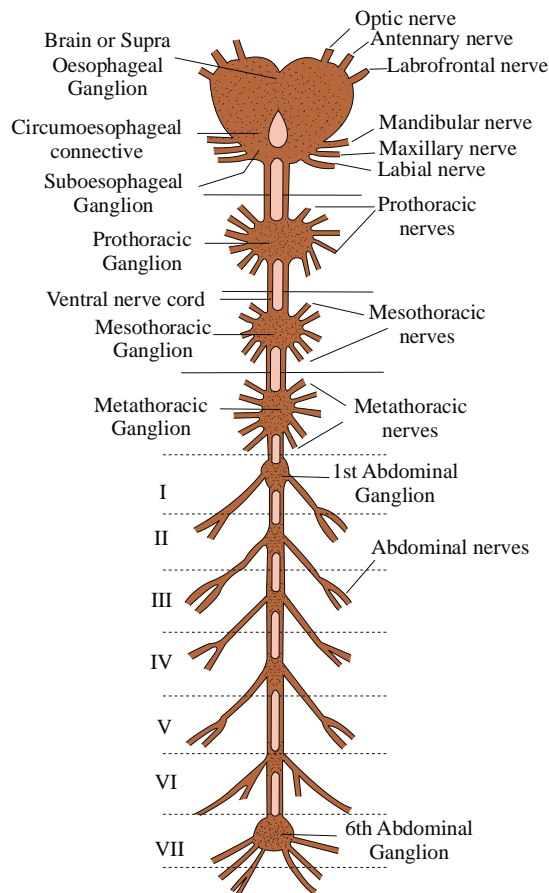
### Uricose glands

- Uric acid is stored in the Uricose glands or Utriculi majores of the mushroom gland in male cockroach. They discharge it over the spermatophore during copulation.

### Cuticle

- Cuticle eliminates nitrogenous wastes that get deposited on it, during moulting.

## 7.8. NERVOUS SYSTEM



Central and peripheral nervous system of *Periplaneta*

- Nervous system consists of Central, Peripheral & Autonomous systems.

### Central nervous system

- It consists of a nerve ring and a ganglionated double ventral nerve cord.
- **Nerve ring** is present **around the oesophagus**(circum oesophageal nerve ring). It is formed by brain (1 supra oesophageal ganglion), 1 sub-oesophageal ganglion and a pair of circum- oesophageal connectives.
- **Brain** is **sensory and endocrine center**. It lies above the oesophagus. It has three lobes such as
  - Protocerebrum** - receives sensory impulses from the compound eyes through optic nerves.
  - Deutocerebrum** - receives sensory impulses from antennae through antennal nerves.
  - Tritocerebrum** - receives sensory impulses from the labrum through labral nerve. It also sends a motor nerve called 'frontal nerve' to the frontal ganglion of ANS.

### Sub-oesophageal ganglion

- **It is the principal motor center** that controls the movements of mouth parts, legs and wings.
- Sub-oesophageal ganglion is formed by the fusion of paired ganglia of mandibular (4th) , maxillary(5th) and labial(6th) segments of the head.
- Tritocerebrum is connected to the sub-oesophageal ganglion by a pair of circum-oesophageal connectives.
- **Double ventral nerve cords** are solid and ganglionated. They **arise from the sub -oesophageal ganglion**, pass through neck and **extends upto only 7th abdominal segment** mid ventrally.
- The **number of ganglia** present on the **ventral nerve cords** is **nine** (3 thoracic ganglia @ one in each thoracic segment, 6 abdominal ganglia located in the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> abdominal segments respectively).
- **Segment without abdominal ganglion** on the ventral nerve cords is **5th abdominal segment**.
- **3 thoracic ganglia** are **larger than 6 abdominal ganglia**.
- **Largest** of all the **6 abdominal ganglia** is the **6th ganglion** located **in the 7th abdominal segment**.
- Sixth abdominal ganglion is formed by the fusion of the ganglia of 7th, 8th, 9th and 10th abdominal segments.

### Peripheral nervous system

- It includes
  - 1) **A pair of optic nerves** arise from the compound eyes and carry sensory impulses to the protocerebrum of brain.

2) A pair of antennal nerves arise from antennae and carry sensory impulses to deutocerebrum.

3) A pair of labral nerves arise from the labrum and carry sensory impulses to tritocerebrum.

➤ **Labro- frontal nerves** that are associated with the tritocerebrum are **mixed nerves**.

\* Labral nerve fibres start from labrum and carry sensory impulses to the tritocerebrum.

\* Frontal nerve fibres arise from tritocerebrum and carry motor impulses to the frontal ganglion of ANS.

## Autonomous nervous system

➤ Autonomous nervous system is connected to the central nervous system by labro-frontal nerves.

➤ **Sub-oesophageal ganglion** gives off three pairs of nerves such as i) a pair of mandibular nerves to mandibles, ii) a pair of maxillary nerves to maxillae and iii) a pair of labial nerves to labium.

➤ **Pro & Meso-thoracic ganglia** supply nerves to the parts (wings, legs and other parts) of their respective segments.

**Metathoracic ganglion** sends nerves to the parts of metathorax and also to the first abdominal segment.

➤ The first four abdominal ganglia supply nerves to the organs of abdominal segments nos. 2nd-5th serially.

➤ Nerves from the 5th abdominal ganglion (present in 6th segment) innervate the organs of 6th segment only.

➤ All the organs (reproductive organs, copulatory appendages and anal cerci) present in 7th to 10th abdominal segments will receive nerves from the last or 6th abdominal ganglion present in 7th abdominal segment.

➤ **Autonomous** nervous system is also called **stomatogastric** or **visceral** nervous system.

➤ Together, the nerves from the autonomic ganglia will innervate the muscles of gut and heart along with other viscera.

➤ Frontal ganglion is connected to the hypocerebral ganglion by a **recurrent nerve**.

➤ Hypocerebral ganglion is connected to inguival ganglion by **oesophageal nerve**.

The outer surface of each compound eye is divided into about 2000 **hexagonal areas** called **facets**. They **represent cornea** of corresponding ommatidia.

➤ Outer most part of an ommatidium is called **cornea** (acts as biconvex/converging lens).

➤ **Cornea** is the modified cuticle secreted by specialized cells of epidermis called **corneagen cells (lenticular cells)** lying below it.

➤ Four transparent cells called **vitellae** (semper/cone cells) lie below the corneagen cells. They secrete the **crystalline cone** at their center.

➤ **Refractive region** of ommatidium is **cornea**.

➤ **Focussing region or dioptrical region** of the ommatidium is **formed by the cornea and crystalline cone**.

➤ Focussing region is surrounded by iris/primary pigment sheath secreted by corneagen cells (primary pigment cells).

➤ Light rays are focussed on the rhabdome by crystalline cone.

➤ Elongated cells of the ommatidium are called **retinulae/ photoreceptor cells** (7 in number). They surround the rhabdome which is formed by the union of 7 rhabdomeres.

➤ Retinulae rest on the basement membrane.

➤ Photoreceptor pigments are present in retinulae on their inner edges with microvilli.

➤ The inner edges of retinulae are called rhabdomeres. The 7 rhabdomeres of 7 retinulae unite at the center to form rhabdome.

➤ **Rhabdome and retinulae (photoreceptor cells) constitute Photoreceptor region or Retinal region**, where image is formed.

➤ Receptor region is surrounded by retinal pigment sheath formed by seven secondary pigment cells (modified 7 retinulae).

➤ However, the ommatidium of cockroach (nocturnal insects) does not contain retinal pigment sheath as secondary pigment cells are absent (retinulae degenerate after they become inactive on ageing process).

## Ocelli or Fenestrae or Simple eyes

➤ They appear as whitish specks on head of cockroach near the bases of its antennae.

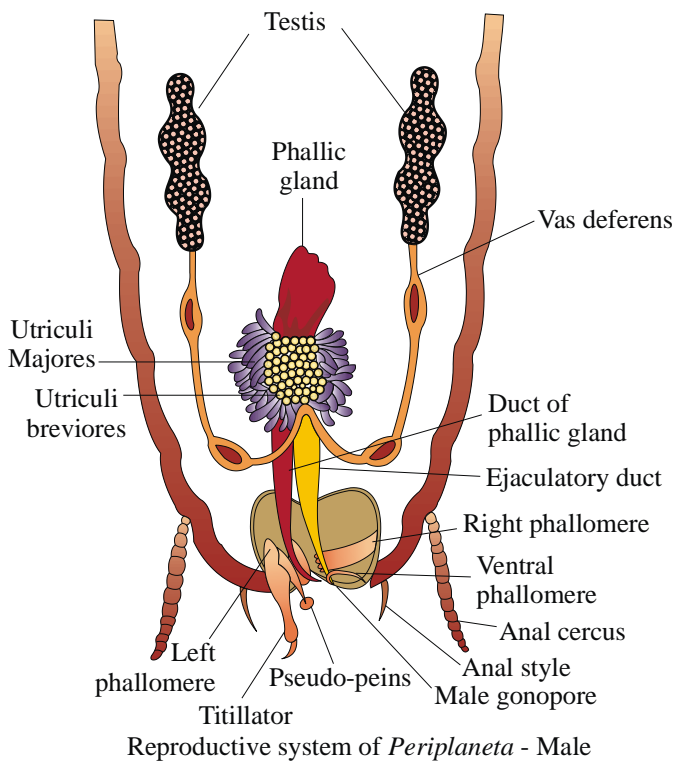
➤ Fenestrae are not involved in image formation but are very sensitive to changes in light intensity.

➤ Each ocellus consists of a single corneal facet.

## Male reproductive system

➤ It includes a pair of testes, a pair of vasa deferentia, ejaculatory duct, mushroom gland, seminal vesicles, phallic gland, genital pouch and external genitalia.

## Testes



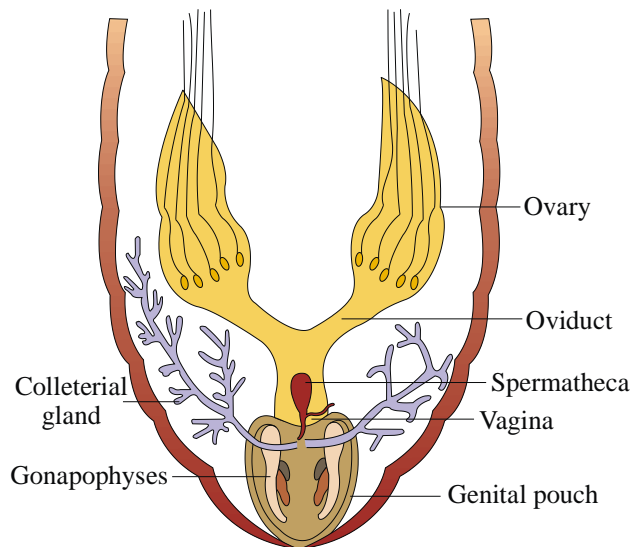
Reproductive system of *Periplaneta* - Male

- **Testes** lie one on each side in the **fourth to sixth abdominal segments**.
- Each testis is **lobed** and **elongated**.
- **Vasa deferentia** arise from testes, run backwards and inwards to open into a wide median duct called **ejaculatory duct /ductus ejaculatorius** ( in the 7th segment).
- **Ejaculatory duct** extends posteriorly and opens through the **male genital pore**, or male gonopore on the ventral phallomere.
- The wall of **ejaculatory duct** is glandular and its **secretions are believed to form second or the middle layer of spermatophore**.
- **Accessory reproductive gland** which is present in the **6th and 7th abdominal segments** is **mushroom shaped gland**.
- The **two types of tubules** in the **mushroom gland** are
  - 1) long slender tubules, the **utriculi majores** or peripheral tubules - secretes the **inner (first) layer of spermatophore**.
  - 2) Short tubules, the **utriculi breviores** (making up the major part of the gland) will **nourish the sperms**.
- All these tubules of mushroom-shaped gland will open into the anterior part of the ejaculatory duct.
- **A pair of seminal vesicles** are present on the ventral surface of the ejaculatory duct. They **store spermatophores** (bundles of sperms).
- **Phallic gland** or **conglobate gland** is a large **multilobed leaf-like** or **club-shaped** gland present below ejaculatory duct. It also opens near the male gonopore by phallic duct.
- **The secretions of Phallic gland** are believed to form the **outer (third) layer of spermatophore**.
- Male external genitalia are the phallic organs or gonapophyses or phallomeres (surround the male genital opening), and they help in copulation only.
- Male cockroach has three phallomeres formed from 9th abdominal sternum . They are 1 right, 1 left and 1 ventral.
- **Right phallomere** has a hook and a serrate lobe.
- **Left phallomere** is the largest and has a titillator, pseudopenis, asperate lobe and acculobolus lobe.
- **Ventral phallomere** has male gonopore.

### Female reproductive system :-

- The female reproductive system consists of a pair of ovaries, a pair of oviducts, vagina, spermathecae, spermathecal papilla and colleterial glands.
- Ovaries**
- Ovaries lie laterally in 2<sup>nd</sup> to 6<sup>th</sup> abdominal segments.

- Each **ovary** consists of **eight tubules** called **ovarian tubules** or **ovarioles**.
- **Each ovariole** consists of
  - i) a tapering anterior filament called **germarium** which consists of oogonia ( $2n$ ) and immature ova.
  - ii) a posterior wider **vitellarium** which consists of mature ova and yolk cells.



Reproductive system of *Periplaneta* -Female

### Oviduct

- The ovarioles, at their posterior ends unite to form a short wide duct called the oviduct.

### Vagina / Common oviduct

- It is formed by the union of two oviducts in the 7<sup>th</sup> segment.

### Genital opening / Vulva

- It is the vertical opening of vagina which lies on the 8<sup>th</sup> sternum (on anterior or front wall of genital/brood pouch).

### Spermatheca

- A **spermatheca** or **receptaculum seminis** is present in the 6<sup>th</sup> abdominal segment. It contains two parts, left part is **sac-like** and right one is **filamentous caecum**.
- Spermatheca opens by a median aperture on a small spermathecal papilla present on the dorsal wall/roof of the genital pouch (on the 9<sup>th</sup> sternum).
- In a fertile female, the spermatheca receives the sperms in the form of spermatophores during copulation from male cockroach and store them.

### Colleterial glands

- These are a pair of glands which lies behind and above the ovaries. Left gland is opaque and more developed and right gland is transparent and less developed.
- Two colleterial glands open on the roof into genital pouch through separate openings, just behind and above the spermathecal opening.
- **Secretion of colleterial glands forms** a hard egg case called **ootheca around the batch of 16 eggs**.

### Genital pouch/ Brood pouch

- Genital pouch in female is formed by 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> abdominal sterna.
- **7<sup>th</sup> sternum** is **boat-shaped** which forms the **floor (ventral wall)** and **lateral (side) walls** of the genital pouch.
- **8<sup>th</sup> sternum** forms **anterior (front) wall** of the genital pouch.
- **9<sup>th</sup> sternum** forms **roof/dorsal wall** of the genital pouch .
- The two chambers of genital pouch are
  - i) anterior **gynatrium** or genital chamber
  - ii) posterior **vestibulum** or **oothecal chamber**.
- The **site of fertilization** is **gynatrium** in genital pouch.

Secretions of colleterial glands forms hard egg case or ootheca around the fertilised eggs in vestibulum.

- Female external genitalia are called as gonapophyses (3 pairs) .They help in copulation and guide the ova into ootheca. Hence, they are called as ovipositors.
- Ovipositors are formed by 8<sup>th</sup> and 9<sup>th</sup> abdominal sterna.

## MULTIPLE CHOICE QUESTIONS

- Zoological name of cockroach is**
    - 1) *Glossina palpalis*
    - 2) *Periplaneta americana*
    - 3) *Musca nebula*
    - 4) *Apis indica*
  - Periplaneta americana* belongs to the family**
    - 1) hexapoda
    - 2) orthoptera
    - 3) arthropoda
    - 4) blattidae
  - Which are the two common Indian cockroaches?**
    - 1) *Periplaneta americana* and *Blatta orientalis*
    - 2) *Periplaneta indica* and *Blatta orientalis*
    - 3) *Periplaneta orientalis* and *Blatta americana*
    - 4) *Periplaneta americana* and *Blatta germanica*
  - Characteristic of group Insecta is the presence of**
    - 1) jointed appendages
    - 2) 3 pairs of jointed legs
    - 3) chitinous exoskeleton
    - 4) compound eyes
  - Scientist who coined the name '*Periplaneta*' is**
    - 1) Linnaeus
    - 2) K.N.Bahl
    - 3) Burmeister
    - 4) Lamarck
  - Which of the following is correct with regard to cockroach?**
    - 1) omnivorous, nocturnal, haemocoelomate.
    - 2) nocturnal, cursorial, monoecious.
    - 3) dioecious, detritivorous, enterocoelomate.
    - 4) omnivorous, diurnal, schizocoelomate.
  - The genus *Blatta* is changed as *Periplaneta* by**
    - 1) Linnaeus
    - 2) Lamarck
    - 3) Burmeister
    - 4) Darwin
  - Periplaneta americana* belongs to the class**
    - 1) Hexapoda
    - 2) Blattidae
    - 3) Pterygota
    - 4) Arthropoda
  - Total number of body segments found in adult cockroach is**
    - 1) 10
    - 2) 16
    - 3) 19
    - 4) 20
  - Total number of true tagmata in cockroach is**
    - 1) 2
    - 2) 5
    - 3) 3
    - 4) 4
  - Tagma with the highest number of segments in cockroach is**
    - 1) head
    - 2) thorax
    - 3) abdomen
    - 4) cervicum
- Head:**
- Head of cockroach according to its position is known as**
    - 1) hypopharynx
    - 2) hypocerebral
    - 3) hypognathus
    - 4) hypogynous
  - The chitin plates situated between the compound eyes on the top of the head of cockroach is called**
    - 1) Vertex
    - 2) Frons
    - 3) Epicranial plates
    - 4) Genae
  - Head segments without appendages are**
    - 1) 1<sup>st</sup> and 3<sup>rd</sup>
    - 2) 2<sup>nd</sup> and 3<sup>rd</sup>
    - 3) 1<sup>st</sup> and 4<sup>th</sup>
    - 4) 2<sup>nd</sup> and 4<sup>th</sup>
  - Unpaired sclerites of the head capsule of cockroach are**
    - 1) genae, epicrania
    - 2) frons, clypeus
    - 3) labrum, genae
    - 3) mandibles, maxillae
  - Antennae of cockroach consists of**
    - 1) scape, coxa and flagellum
    - 2) coxa, trochanter and tarsus
    - 3) scape, pedicel and flagellum
    - 4) cardo, stipes and flagellum
  - Mandibles of cockroach are the appendages of**
    - 1) IV segment of first tagma

- 2) IV segment of third tagma
- 3) V segment of first tagma
- 4) all body segments

**18. The structures that are used for cleaning the appendages of II head segment in *Periplaneta* belong to**

- 1) maxillae
- 2) hypopharynx
- 3) labium
- 4) labrum

**19. Which structure is known as 'lower lip' of cockroach?**

- 1) Labrum
- 2) Labium
- 3) Mentum
- 4) Submentum

**20. The postmentum of the labium of cockroach represents one of the following parts of second maxillae.**

- 1) Two fused stipes
- 2) Two fused cardos
- 3) Two fused laciniae
- 4) Two fused galeae

**21. Fundamentally similar structures of cockroach from the following are**

- 1) labium and anal cerci
- 2) maxillae and wings
- 3) anal styles and labrum
- 4) labium and maxillae

**22. Pincer - like structures that lie on the inner edge of stipes of maxillae are**

- 1) glossae
- 2) paraglossae
- 3) galeae
- 4) laciniae

**23. The structure that helps in handling and tasting the food in cockroach is**

- 1) labrum
- 2) mandibles
- 4) maxilla
- 4) clypeus

**24. Palpigers and palpifers are the parts of**

- 1) labrum & maxillae
- 2) labium & maxillae
- 3) maxillae & mandibles
- 4) labrum & labium

**25. Ligula is a part of**

- 1) labium
- 2) labrum
- 3) glossa
- 4) maxilla

**26. Hood-like structure of maxilla of cockroach is**

- 1) glossa
- 2) paraglossa
- 3) galea
- 4) lacinia

**27. Anterior part of preoral cavity of cockroach is**

- 1) salivarium
- 2) gynatrium
- 3) cibarium
- 4) vestibulum

## Thorax:

**28. The largest tergal plate of thorax is**

- 1) pronotum
- 2) mesonotum
- 3) metanotum
- 4) frons

**29. Thoracic segment without wings and spiracles is**

- 1) prothorax
- 2) mesothorax
- 3) metathorax
- 4) pronotum

**30. Thoracic segment with wings useful in flight is**

- 1) prothorax
- 2) mesothorax
- 3) metathorax
- 4) pronotum

**31. In cockroach, the wings that help in flying are**

- 1) elytra
- 2) fore wings
- 3) hind wings
- 4) mesothoracic wings

**32. Wings of cockroach are supported by sclerotised tubes called**

- 1) trachioles
- 2) arteries
- 3) nervures/veins
- 4) taenidia

**33. Identify the five- jointed structures of cockroach.**

- 1) Maxillary palps and Tarsus
- 2) Maxillary palps and Antennae
- 3) Labial palps and Maxillary palps
- 4) Tarsus and Labial palps

**34. The following structures are developmentally similar in cockroach.**

- 1) Labrum & labium
- 2) Lingua & ligula
- 3) Mandibles & maxillae
- 4) Labium & 1st pair of maxillae

**35. Number of segments in the leg of cockroach is**

- 1) 3
- 2) 5
- 3) 6
- 4) 9

**36. The longest segment of the leg of cockroach is**

- 1) tibia 2) trochanter 3) femur 4) tarsus

**37. Plantulae are found in cockroach on**

- 1) tarsomeres (first 4) 2) femur  
3) trochanter 4) coxa

**38. The broader segment in leg of cockroach is**

- 1) tarsus 2) coxa 3) femur 4) trochanter

**39. In cockroach, arolium/pulvillus is helpful in**

- 1) digestion 2) respiration  
3) locomotion 4) reproduction

**40. The adhesive pads in the legs that help the cockroach to walk on smooth surfaces are**

- 1) arolia 2) plantulae 3) claws 4) pulvilli

**41. Number of tarsomeres present in each tarsus is**

- 1) 3 2) 4 3) 5 4) 6

**42. Triangular podomere in the leg of cockroach is**

- 1) coxa 2) femur 3) trochanter 4) tibia

**Abdomen:**

**43. Main character for the distinction of male from female cockroach is**

- 1) antennae 2) mandibles  
3) anal cerci 4) anal styles

**44. In cockroach, anal styles are present on which segment ?**

- 1) 8<sup>th</sup> 2) 9<sup>th</sup> 3) 10<sup>th</sup> 4) 7<sup>th</sup>

**45. The dorsal plate of exoskeleton found on the abdomen of cockroach is called**

- 1) pleuron 2) sternum  
3) tergum 4) vertex

**46. Which of the following pair are similar ?**

- 1) Cardo & stipes 2) Glossae & Galeae  
3) Glossae & Lacineae 4) Palpifers & Pedipalps

**47. In cockroach sexual dimorphism is associated with which tagma ?**

- 1) Thorax 2) Abdomen  
3) Head 4) Cervicum

**48. Genital pouch in female cockroach is formed by the sterna of these abdominal segments.**

- 1) 5th, 6th and 7th 2) 6th, 7th and 8th  
3) 7th, 8th and 9th 4) 8th, 9th and 10th

**49. In cockroach, female gonopore is located on**

- 1) 9th abdominal sternum  
2) 8th abdominal sternum  
3) 9th abdominal tergum  
4) 8th abdominal tergum

**50. In male cockroach, the genital aperture is located on its**

- 1) dorsal phallomere 2) left phallomere 3) right phallomere 4) ventral phallomere

**51. The female cockroach is different from male in**

- 1) having short and broad abdomen  
2) number of gonapophyses  
3) both 1 & 2 4) having anal styles

**52. Number of segments and paired appendages in the head of adult cockroach are respectively**

- 1) 6 & 4 2) 6 & 6 3) 4 & 6 4) 6 & 3

**53. In female cockroach, gonapophyses arise from the**

- 1) ninth abdominal sternum only  
2) eighth and ninth abdominal sternum  
3) seventh, eighth and ninth abdominal sternum  
4) eighth abdominal sternum only

**54. Anal cerci are found in**

- 1) male cockroach only 2) both sexes



- 3) female cockroach only                      4) none

**55. Chitinous spongy pad present between the claws is called**

- 1) arolium/pulvillus                      2) arista  
3) plantula                                      4) pretarsus

**Body wall:**

**56. Which of the following are absent in the body wall of cockroach ?**

- 1) Cuticle                                      2) Muscles  
3) Epidermis                                  4) Basement membrane

**57. Cuticular layer without chitin is**

- 1) epicuticle                                  2) exocuticle  
3) endocuticle                                4) enterocuticle

**58. The waxy layer of cuticle is**

- 1) exocuticle                                  2) epicuticle  
3) endocuticle                                4) hypocuticle

**59. The articular membranes of cockroach contain**

- 1) epicuticle & endocuticle  
2) epicuticle & exocuticle  
3) exocuticle & endocuticle  
4) all the three layers of cuticle

**60. Exoskeleton of cockroach is made up of**

- 1) cartilage                                      2) calcium carbonate                      3) chitin    4) amino acids

**61. In the exoskeleton of cockroach, the inner and much thick layer is**

- 1) epicuticle                                  2) endocuticle  
3) epidermis                                  4) exocuticle

**62. In cockroach, arthrodial (inter segmental) membrane is devoid of**

- 1) epicuticle                                  2) exocuticle  
3) epidermis                                  4) endocuticle

**63. Chitin in the middle layer of cuticle is**

- 1) soft & multilaminar                      2) tough & pigmented                      3) soft & pigmented                      4) absent

**64. Non - pigmented region of the chitinous cuticle is**

- 1) epicuticle                                  2) endocuticle  
3) epidermis                                  4) exocuticle

**65. Cells of the epidermis of the body wall secrete**

- 1) cuticle                                        2) uric acid  
3) urea    4) ammonia

**66. The layer of the cuticle that gives rigidity to the exoskeleton of cockroach is**

- 1) epicuticle                                  2) exocuticle  
3) epidermis                                  4) endocuticle

**67. The origin of outer layer of the body wall of cockroach is**

- 1) ectodermal                                  2) endodermal  
3) mesodermal                                4) ectomesodermal

**68. The number of segments in anal cerci is**

- 1) 5    2) 15    3) 0    4) 3

**69. The type of cells present in the epidermis of body wall of cockroach is**

- 1) cuboidal                                      2) squamous  
3) columnar                                      4) square - like

**Body cavity & fat bodies:**

**70. The body sinus of cockroach surrounding the alimentary canal is**

- 1) dorsal sinus                                2) middle sinus  
3) ventral sinus                                4) anterior head sinus

**71. The largest sinus in the coelom of cockroach lies around**

- 1) heart    2) nerve cord                                      3) alimentary canal                                      4) brain

**72. The functional body cavity of cockroach is**



- 1) crop to gizzard 2) gizzard to mesenteron 3) mesenteron to gizzard 4) hind gut to mid gut
- 93. Number of hepatic caecae in cockroach is**  
 1) 3 - 5 2) 6 -8 3) 9 - 10 4) 6 - 8 bundles
- 94. Haepatic caecae of cockroach helps in**  
 1) storage of food  
 2) secretion of digestive enzymes  
 3) removal of wastes 4) absorption of uric acid
- 95. Peritropic membrane is secreted by**  
 1) anterior glandular part of ventriculus  
 2) hepatic caecae  
 3) stomodael valve 4) hindgut
- 96. Part of gut into which malpighian tubules open is**  
 1) mesenteron 2) colon  
 3) ileum 4) rectum
- 97. The structures which are associated with the absorption of water in the gut of cockroach is /are**  
 1) hepatic caecae 2) stomodaeal valve 3) rectal papillae 4) colon
- 98. What happens if peritrophic membrane is not formed in cockroach ?**  
 1) Digestion of food is impaired  
 2) Absorption of food is impaired  
 3) Peristalsis in the gut is affected  
 4) Mid gut may be injured
- 99. Structural adaptation of gut of cockroach for the conservation of water is**  
 1) hepatic caecae 2) rectal papillae 3) peritrophic membrane 4) colon
- 100. Saliva of cockroach contains**  
 1) amylase 2) pepsin 3) trypsin 4) lipase
- 101. Part of alimentary canal capable of digesting all the types of food (except cellulose) by the secretions of its own is**  
 1) crop 2) mid gut 3) fore gut 4) gizzard
- 102. The enzymes maltase, invertase and lipase are secreted from**  
 1) proventriculus 2) midgut  
 3) colon 4) rectum
- 103. Funnel - like membranous projection of proventriculus into the ventriculus is called**  
 1) peritrophic membrane  
 2) stomodaeal valve  
 3) hepatic caecae 4) rectal papillae
- 104. Number of teeth(denticles) present in the gizzard of cockroach is**  
 1) 5 2) 6 3) 9 4) 10
- 105. Cells of salivary glands that secrete saliva are**  
 1) peptic cells 2) chief cells  
 3) acinar cells 4) oenocytes
- 106. Part of salivary gland that stores saliva is**  
 1) lobules of salivary gland  
 2) salivary receptacle  
 3) median salivary duct 4) salivarium
- 107. Part of salivary gland that opens into salivarium to release saliva is**  
 1) common salivary duct 2) median salivary duct  
 3) common receptacular duct  
 4) efferent salivary duct
- 108. Digestive enzymes of saliva of cockroach digest**  
 1) proteins 2) fats  
 3) carbohydrates 4) nucleic acids
- 109. In the digestion of 56 sucrose molecules, what is the total number of fructose molecules produced ?**  
 1) 112 2) 56 3) many 4) zero

**110. In the digestion of 100 maltose molecules, what is the total number of glucose molecules produced ?**

- 1) 200    2) 100    3) 50    4) 0

### **7.6 Respiratory system:**

**111. Each spiracle opens into a small chamber called**

- 1) haemocoel                      2) occiput                      3) occipital foramen    4) atrium

**112. Opening and closing of spiracles is influenced by**

- 1) CO<sub>2</sub> tension in haemolymph  
2) O<sub>2</sub> tension in the trachea  
3) CO<sub>2</sub> tension in the trachea    4) both 1 & 2

**113. The telescoped segments come to the normal position due to**

- 1) relaxation of dorsoventral muscles  
2) relaxation of ventral longitudinal muscles  
3) contraction of dorsoventral muscles  
4) contraction of the ventral longitudinal muscles

**114. Tracheoles penetrate the cell and are intimately associated with**

- 1) nucleus                      2) mitochondria  
3) golgi complex              4) ribosomes

**115. The level of the tracheolar fluid varies with the**

- 1) temperature of the insect                      2) metabolic activity of the insect  
3) locomotory ability of the insect  
4) excretory activity of the insect

**116. Oxygen is carried to the tissues of cockroach by**

- 1) body wall                      2) tracheae  
3) haemolymph                  4) heart

**117. Respiratory organs of cockroach are**

- 1) tracheae                      2) gills  
3) book gills                      4) book lungs

**118. The longest tracheal trunks of the tracheal are system of cockroach**

- 1) dorsal longitudinal    2) ventral longitudinal    3) lateral longitudinal    4) cephalic

**119. Number of spiracles present in the abdomen of cockroach is**

- 1) 12 pairs    2) 10 pairs    3) 8 pairs    4) 2 pairs

**120. Total number of spiracles that help in inspiration of cockroach is**

- 1) 12 pairs    2) 10 pairs    3) 2 pairs    4) 8 pairs

**121. Circular sclerite present around the spiracle of cockroach is called**

- 1) peritreme                      2) intima  
3) taenidia                      4) trichome

**122. Tracheal system of cockroach is**

- 1) hemipneustic    2) apneustic  
3) polypneustic    4) mesodermally originated

**123. Respiratory pigment of cockroach is**

- 1) haemoglobin                  2) haemocyanin  
3) absent                      4) chlorocruorin

**124. Blood does not transport oxygen in**

- 1) cockroach                      2) earthworm  
3) rabbit                      4) man

**125. Discontinuous ventilation is seen in**

- 1) rabbit                      2) cockroach  
3) humans                      4) earthworm

**126. Reason for the development of tracheal respiratory system in cockroach is that**

- 1) the respiratory pigment is dissolved only in plasma but not in RBCs.  
2) it is easy to supply oxygen to different tissues directly  
3) the blood cannot carry oxygen to different tissues  
4) the tissues cannot take O<sub>2</sub> when it is bounded with respiratory pigment

**127. In cockroach, blood cannot transport oxygen because**

- 1) it has respiratory pigment dissolved in the blood plasma
- 2) it has respiratory pigment inside the RBCs
- 3) it lacks respiratory pigment in the blood plasma
- 4) it has haemocyanin in a dissolved state in the plasma of the blood

**128. In cockroach, the tracheal system communicates with the exterior by**

- 1) ostia
- 2) spiracles
- 3) atria
- 4) all the above

**129. The number of thoracic spiracles present in cockroach is**

- 1) two pairs
- 2) eight pairs
- 3) ten pairs
- 4) twelve pairs

**130. The tagmata of cockroach without spiracles is**

- 1) head
- 2) cervicum
- 3) thorax
- 4) abdomen

**131. The thoracic segment of cockroach without spiracles is**

- 1) prothorax
- 2) mesothorax
- 3) metathorax
- 4) all the above

**132. The abdominal segments of cockroach without spiracles are**

- 1) 1st and 2nd
- 2) 3rd and 4th
- 3) 6th and 7th
- 4) 9th and 10th

**133. 'Holopneustic tracheal system' means**

- 1) having 10 pairs of spiracles
- 2) having valvular spiracles
- 3) only thoracic spiracles are functional
- 4) participation of all spiracles in respiration

**134. The respiratory system of cockroach is 'polypneustic' as there are**

- 1) less than 3 pairs of spiracles
- 2) more than 3 pairs of spiracles
- 3) only three spiracles
- 4) only three pairs of spiracles

**135. Stigmata of cockroach bear small hair-like structures called**

- 1) cirri
- 2) cilia
- 3) trichomes
- 4) taenidia

**136. These spiracles open during expiration of cockroach.**

- 1) All thoracic and abdominal spiracles
- 2) 1st thoracic spiracles
- 3) 2nd thoracic spiracles
- 4) All abdominal spiracles

**137. These spiracles open during inspiration of cockroach.**

- 1) only 1st and 2nd pair of spiracles
- 2) all abdominal spiracles
- 3) all spiracles
- 4) only 1st and 2nd pair of abdominal spiracles

**138. Tracheae arise from**

- 1) spiracle
- 2) atrium
- 3) peritreme
- 4) stigmata

**139. From the atrium of each thoracic spiracle, how many horizontal tracheae run inside in cockroach ?**

- 1) One
- 2) Two
- 3) Three
- 4) Several

**140. In cockroach, from the atrium of each abdominal spiracle, how many tracheal tubes arise ?**

- 1) One
- 2) Two
- 3) Three
- 4) Many

**141. Tracheal trunks in the thorax of cockroach are**

- 1) dorsal cephalic trunks
- 2) ventral cephalic trunks
- 3) lateral longitudinal trunks

4) all these

**142. Longitudinal tracheal trunks in the abdomen of cockroach are**

- 1) lateral longitudinal trunks
- 2) dorsal longitudinal trunks
- 3) ventral longitudinal trunks
- 4) all these

**143. The total number of longitudinal tracheal trunks present in the abdomen of cockroach is**

- 1) one pair
- 2) two pairs
- 3) three pairs
- 4) four pairs

**144. Longitudinal tracheal trunks of cockroach are interconnected by**

- 1) lateral tracheae
- 2) commissural tracheae
- 3) dorsal cephalic tracheal trunks
- 4) ventral cephalic tracheal trunks

**145. Each tracheal branch entering into an organ ends in a special cell called**

- 1) nephrocyte
- 2) satellite cell
- 3) tracheoblast
- 4) trichogen cell

**146. The outer layer of trachea is**

- 1) epithelium
- 2) basement membrane
- 3) intima
- 4) trachein

**147. The middle one cell thick layer of the wall of trachea is**

- 1) epithelium
- 2) intima
- 3) basement membrane
- 4) muscle layer

**148. The inner cuticular layer of trachea is called**

- 1) intima
- 2) epithelium
- 3) basement membrane
- 4) trachein

**149. The intima of trachea is produced into spiral thickenings called**

- 1) ctenidia
- 2) taenidia
- 3) haustra
- 4) tapillae

**150. Which one of the following prevents the collapse of trachea in cockroach ?**

- 1) Epithelium
- 2) Ctenidia
- 3) Pseudotrachea
- 4) Taenidia

**151. The intracellular tubular extensions arising from tracheole cell/tracheoblast are called**

- 1) tracheoles
- 2) tracheae
- 3) pseudotracheae
- 4) tracheids

**152. Which one of the following are absent in tracheoles ?**

- 1) Trachein
- 2) Intima
- 3) Taenidia
- 4) 2 & 3

**153. Tracheoles are formed by a protein called**

- 1) trachein
- 2) intima
- 3) chitin
- 4) keratin

**154. Identify the correct statements on cockroach from the following.**

- 1) Tracheolar fluid is more in tracheoles when the insect is active
- 2) Tracheolar fluid is completely reabsorbed into the tissues, when the insect is more active
- 3) The level of the tracheolar fluid does not varies
- 4) The level of tracheolar fluid falls, when the insect is inactive

**155. The principal muscles of respiration in cockroach are**

- 1) intercostal
- 2) ventral longitudinal
- 3) dorsal longitudinal
- 4) dorsoventral

**156. Taking in air is called**

- 1) expiration
- 2) inspiration
- 3) asphyxiation
- 4) anorexia

**157. In cockroach, inspiration is a/an**

- 1) passive process
- 2) active process
- 3) diffusion process
- 4) eliminating process

**158. Sending out air from the body is called**

- 1) inspiration
- 2) expiration
- 3) anorexia
- 4) suffocation

**159. Expiration in cockroach is caused by the**

- 1) contraction of dorsoventral and ventral longitudinal muscles
- 2) relaxation of dorsoventral and ventral longitudinal muscles
- 3) contraction of alary muscles
- 4) relaxation of alary muscles

**160. In cockroach, inspiration is affected by**

- 1) contraction of the dorsoventral and ventral longitudinal muscles
- 2) relaxation of dorsoventral and ventral longitudinal muscles
- 3) contraction of alary muscles
- 4) relaxation of alary muscles

**161. Which of the following spiracles are closed during inspiration of cockroach ?**

- 1) 1st pair of abdominal spiracles
- 2) All abdominal spiracles
- 3) All thoracic spiracles
- 4) 2nd pair of abdominal spiracles

**162. Which of the following spiracles are closed during expiration in cockroach ?**

- 1) All abdominal spiracles
- 2) All thoracic spiracles
- 3) All spiracles
- 4) Some abdominal and some thoracic spiracles

**163. In cockroach, body cavity increases dorsoventrally due to**

- 1) the contraction of dorsoventral muscles
- 2) the relaxation of dorsoventral muscles
- 3) the contraction of ventral longitudinal muscles
- 4) the relaxation of ventral longitudinal muscles

**164. In a cockroach, body cavity decreases dorsoventrally due to**

- 1) the contraction of dorsoventral muscles
- 2) the relaxation of dorsoventral muscles
- 3) the contraction of ventral longitudinal muscles
- 4) the relaxation of ventral longitudinal muscles

**165. In cockroach, during inspiration, tergal plates are elevated due to the**

- 1) contraction of dorsoventral muscles
- 2) relaxation of dorsoventral muscles
- 3) contraction of ventral longitudinal muscles
- 4) relaxation of ventral longitudinal muscles

**166. In cockroach, during expiration, tergal plates are depressed due to the**

- 1) contraction of dorsoventral muscles
- 2) relaxation of dorsoventral muscles
- 3) contraction of ventral longitudinal muscles
- 4) relaxation of ventral longitudinal muscles

**167. Number of longitudinal tracheal trunks in cockroach is**

- 1) four
- 2) eight
- 3) six
- 4) two

**168. In cockroach, the exchange of gases depends on its**

- 1) metabolic rate
- 2) body temperature
- 3) blood flow
- 4) 1 & 2

**169. In cockroach, CO<sub>2</sub> from tissues is carried more quickly into the hemolymph due to its**

- 1) lesser solubility
- 2) greater solubility
- 3) high partial pressure
- 4) low partial pressure

**170. In cockroach, when air enters the tracheoles, O<sub>2</sub> diffuses faster into the tissues due to its**

- 1) greater solubility
- 2) lesser solubility
- 3) high partial pressure
- 4) low partial pressure

**171. In cockroach, opening and closing of spiracles is influenced by**

- 1) CO<sub>2</sub> tension in haemolymph and O<sub>2</sub> tension in tracheae
- 2) O<sub>2</sub> tension in haemolymph and CO<sub>2</sub> tension in the tracheae
- 3) high partial pressure of CO<sub>2</sub> in tracheae
- 4) greater solubility of O<sub>2</sub> in the haemolymph.

### Circulatory system:

**172. Number of chambers in the heart of cockroach is**

- 1)5
- 2)9
- 3)13
- 4)16

**173. Circulatory system in cockroach (insect)**

- 1) includes arteries and veins
- 2) is with red blood corpuscles
- 3) is of open type
- 4) is absent

**174. Heart of cockroach is**

- 1) four - chamberd
- 2) ventral and myogenic
- 3) three - chambered
- 4) 13 chambers, tubular

**175. Identify the false statement regarding the heart of cockroach.**

- 1) Heart is dorsal in position
- 2) Bidirectional flow of blood occurs
- 3) It lies in pericardial sinus
- 4) It has ostia

**176. Muscles associated with the heart of cockroach are**

- 1) 10 pairs of tergo-sternal muscles
- 2) 12 pairs of alary muscles
- 3) 13 pairs of cardiac muscles
- 4) 5 pairs of visceral muscles

**177. Heart of cockroach is**

- 1) myogenic
- 2) non - pulsatile
- 3) neurogenic
- 4) branchial heart

**178. Position of heart in cockroach is**

- 1) mid ventral
- 2) mid dorsal
- 3) dorsolateral
- 4) ventrolateral

**179. Direction of blood flow in the heart of cockroach is**

- 1) anterior to posterior
- 2) posterior to anterior
- 3) dorsal to ventral
- 4) ventral to dorsal

**180. The blood of cockroach contains no respiratory pigment so that the**

- 1) respiration is anaerobic
- 2) cockroach does not respire
- 3) oxygen goes into tissues by plasma
- 4) O<sub>2</sub> is directly carried to the tissues by trachea.

**181. Principal function of circulatory system in cockroach is**

- 1) transportation of heat
- 2) distribution of nutrients
- 3) transportation of oxygen
- 4) collection of wastes

**182. Absence of haemoglobin (any respiratory pigment) in the blood of cockroach is compensated by the presence of**

- 1) tracheal system
- 2) blood plasma
- 3) RBC in blood
- 4) haemocyanin

**183. Chief function of haemocytes of blood of cockroach is**

- 1) phagocytic
- 2) transportation of O<sub>2</sub>
- 3) transportation of CO<sub>2</sub>
- 4) excretion

### Excretory system:

**184. Cockroaches are**

- 1) ammonotelic
- 2) ureotelic
- 3) aminotelic
- 4) uricotelic

**185. The excretory organs in cockroach are**

- 1) green glands
- 2) hepatic caecae
- 3) metanephridia
- 4) malpighian tubules

**186. The malpighian tubules are called as vasa varicosa by**

- 1) Charles Darwin
- 2) Haeckel



- 3) Meckel                      4) Marcello Malpighi
- 187. The cells that store uric acid throughout the life in cockroach are**  
 1) urate cells                      2) mycetocytes                      3) oenocytes                      4) trophocytes
- 188. Number of tubules present in each bundle of malpighian tubules is**  
 1) 100-150                      2) 80 - 100                      3) 120 - 150                      4) 15 - 25
- 189. Malpighian tubule is lined internally by**  
 1) cuboidal epithelium 2) columnar epithelium  
 3) glandular epithelium 4) squamous epithelium
- 190. Secretory part of the malpighian tubule is**  
 1) distal portion                      2) proximal portion                      3) middle portion                      4) both 1 & 2
- 191. Malpighian tubules remove excretory products from**  
 1) haemolymph                      2) alimentary canal                      3) tracheae                      4) heart wall
- 192. Main excretory product in cockroach and other insects is**  
 1) urea    2) guanine 3) uric acid 4) ammonia
- 193. Osmoregulatory structures in cockroach are**  
 1) stigmata                      2) Malpighian tubules  
 3) hepatic caecae 4) contractile vacuoles
- 194. Malpighian tubules of cockroach are outgrowths of**  
 1) midgut 2) gizzard 3) ileum 4) anus
- 195. In cockroach, structure that stores but never removes uric acid from it is**  
 1) nephrocyte                      2) uricose gland                      3) Malpighian tubule                      4) fat body
- 196. Which of the following are the excretory organs of only male cockroach ?**  
 1) Corpora adiposa                      2) Cuticle  
 3) Uricose glands                      4) Malpighian tubules
- 197. Malpighian tubules of *Periplaneta* are attached at**  
 1) anterior end of hindgut  
 2) anterior end of midgut  
 3) posterior end of foregut  
 4) junction of foregut and midgut
- 198. The unbranched yellowish tubules of cockroach which are associated with gut but are excretory in function are**  
 1) Malpighian tubules                      2) hepatic caecae  
 3) rectal papillae                      4) nephrocytes
- 199. The number of bundles of Malpighian tubules in a cockroach is**  
 1) 100-150 2) 15-25                      3) 4-5 4) 6-8
- 200. The number of Malpighian tubules present in each bundle is around**  
 1) 15-25                      2) 100-150  
 3) 6-8                      4) 200-250
- 201. The unbranched yellowish tubules, involved in excretion of cockroach are described by**  
 1) Meckel                      2) Haeckel  
 3) Hymen                      4) Marcello Malpighi
- 202. Marcello Malpighi called Malpighian tubules as**  
 1) Vasa varicosa                      2) Vasa recta  
 3) Vasa vasorama                      4) Vasa differentia
- 203. Which of the following is true regarding Malpighian tubule ?**  
 1) Distal portion is secretory and proximal portion is absorptive  
 2) Proximal portion is secretory and distal portion is absorptive in nature  
 3) Anterior end is absorptive and posterior end is secretory in nature  
 4) Posterior end is absorptive and anterior end is secretory in nature
- 204. Pick out the function of cells of proximal part of the Malpighian tubules.**  
 1) absorption of salts, CO<sub>2</sub> and nitrogenous wastes  
 2) secretion of potassium urate into the lumen of tubules  
 3) reabsorption of water and certain inorganic salts

- 4) secretion of potassium bicarbonate into the lumen of alimentary canal
- 205. The glandular cells of Malpighian tubules absorb water, salts, CO<sub>2</sub> and nitrogenous wastes from the haemolymph and secrete them into**
- 1) lumen of ileum
  - 2) lumen of Malpighian tubules
  - 3) lumen of rectum
  - 4) all the three
- 206. Cockroach excretes uric acid along with**
- 1) saliva
  - 2) blood
  - 3) expired air
  - 4) faecal matter
- 207. Which of the following helps in complete reabsorption of water from the wastes and formation of dry uric acid in cockroach ?**
- 1) Rectum
  - 2) Malpighian tubules
  - 3) Hepatic caecae
  - 4) Fat bodies
- 208. The other name of fat bodies of cockroach is**
- 1) corpora adiposa
  - 2) corpora cardiaca
  - 3) corpora allata
  - 4) corpora striata
- 209. Cells of corpora adiposa which store nitrogenous excretory waste are**
- 1) trophocytes
  - 2) oenocytes
  - 3) urate cells
  - 4) mycetocytes
- 210. Elimination of nitrogenous waste materials occurs during moulting with the help of**
- 1) fat bodies
  - 2) cuticle
  - 3) mushroom gland
  - 4) Malpighian tubules
- 211. Uricose glands of cockroach are**
- 1) utriculi breviores of mushroom gland
  - 2) utriculi majores of phallic gland
  - 3) utriculi majores of mushroom gland
  - 4) utriculi breviores of phallic gland

### **Nervous system:**

- 212. Frontal ganglion is connected to the hypocerebral ganglion by**
- 1) optic nerve
  - 2) oesophageal nerve
  - 3) frontal nerve
  - 4) recurrent nerve
- 213. Largest of all the abdominal ganglia is**
- 1) 5th abdominal ganglion
  - 2) 4th abdominal ganglion
  - 3) 3rd abdominal ganglion
  - 4) 6th abdominal ganglion
- 214. Sub-oesophageal ganglion gives off motor nerves to**
- 1) mandibles
  - 2) maxillae
  - 3) labium
  - 4) all of these
- 215. The nervous system that controls the muscles of the alimentary canal and the heart is**
- 1) central nervous system
  - 2) peripheral nervous system
  - 3) somatic nervous system
  - 4) visceral nervous system
- 216. Choose the correct match from the following.**
- 1) Brain - motor centre
  - 2) Sub oesophageal ganglion - endocrine centre
  - 3) Proventricular ganglion - somata of the post ganglionic motor neurons
  - 4) Circum oesophageal connectives - tritocerebrum with protocerebrum
- 217. The total number of ganglia present on the ventral nerve cord of cockroach is**
- 1) 6
  - 2) 10
  - 3) 9
  - 4) 12
- 218. Number of thoracic and abdominal ganglia in cockroach respectively is**
- 1) 3,3
  - 2) 3,6
  - 3) 6,6
  - 4) 6,3
- 219. Ingluvial ganglion in cockroach is present above**

- 1) crop 2) gizzard 3) brain 4) none

**220. Cockroach and earthworm have common type of**

- 1) heart 2) nerve cord 3) nephridia 4) spermathecae

**221. In cockroach, nerve ring is formed around**

- 1) oesophagus inside the head  
2) oesophagus inside the neck  
3) pharynx inside the head  
4) pharynx inside the neck

**222. In cockroach, 5th abdominal ganglion is present in this segment.**

- 1) 4th abdominal segment  
2) 5th abdominal segment  
3) 6th abdominal segment  
4) 7th abdominal segment

**223. The nerves connected to the cerebral ganglion of cockroach are**

- 1) optic nerves 2) antennal nerves  
3) labrofrontal nerves 4) all the above

**224. Labro-frontal nerves are formed by**

- 1) sensory neurons of frontal and labral nerves  
2) motor neurons of frontal and labral nerves  
3) motor neurons of frontal and sensory neurons of labral nerves  
4) sensory neurons of frontal and motor neurons of labral nerves

**225. Mixed nerve among the following in cockroach is**

- 1) labral nerve 2) frontal nerve  
3) labro-frontal nerve 4) optic nerve

**226. Motor nerve among the following in cockroach is**

- 1) labral nerve 2) frontal nerve  
3) labro-frontal nerve 4) optic nerve

**227. Sensory nerve among the following in cockroach is**

- 1) labral nerve 2) frontal nerve  
3) labro frontal nerve 4) mandibular nerve

**228. 6th abdominal ganglion of cockroach supplies nerves to**

- 1) reproductive organs 2) anal cerci  
3) copulatory appendages 4) all these

**229. The number of ganglia present in the autonomous nervous system of cockroach is**

- 1) two 2) three 3) four 4) six

**230. In cockroach, frontal ganglion is present on**

- 1) the dorsal wall of pharynx in front of the brain  
2) the dorsal wall of oesophagus in front of brain  
3) the dorsal wall of oesophagus behind the brain  
4) the ventral wall of pharynx in front of brain

**231. In cockroach, hypocerebral ganglion is present**

- 1) below the oesophagus, behind the brain  
2) above the oesophagus, behind the brain  
3) above the pharynx, in front of the brain  
4) above the pharynx behind the brain

**232. Occipital ganglion of cockroach is also called**

- 1) hypocerebral ganglion  
2) proventricular ganglion  
3) ingluvial ganglion 4) frontal ganglion

**233. Visceral ganglion of cockroach is also called**

- 1) occipital ganglion 2) proventricular ganglion  
3) ingluvial ganglion 4) frontal ganglion

**234. In cockroach, proventricular ganglion is present on**

- 1) pharynx
- 2) oesophagus
- 3) crop
- 4) gizzard

**235. Occipital ganglion is connected to the ingluvial ganglion by**

- 1) frontal nerve
- 2) labro-frontal nerve
- 3) recurrent nerve
- 4) oesophageal nerve

**236. The abdominal segments of cockroach without ganglia are**

- 1) 5th only
- 2) 7th,8th,9th,10th
- 3) 8th,9th,10th only
- 4) 5th,8th,9th,10th

**Sense organs:**

**237. Sensilla present on the 1st, 2nd and 3rd segments of the tarsus (first three tarsomeres) of the legs are**

- 1) olfactory sensillae
- 2) gustatory sensillae
- 3) thermoreceptor sensillae
- 4) tactile sensillae

**238. Gustatory sensillae are a type of**

- 1) photoreceptors
- 2) chemoreceptors
- 3) taste receptors
- 4) thermoreceptors

**239. The mosaic / apposition image is formed in diurnal insects like house flies because**

- 1) the retinulae lie immediately below the vitellae and crystalline cone in each ommatidium
- 2) the retinulae are present deep below the vitellae and crystalline cone in each ommatidium
- 3) the retinal sheath is absent for each ommatidium
- 4) the rhabdome and retinulae of an ommatidium receive not only the light rays that enter through its own cornea but also the light rays entering through corneae of adjoining ommatidia

**240. Photoreceptor cells of ommatidium are**

- 1) cone cells
- 2) vitellae
- 3) semper cells
- 4) retinulae

**241. Focussing region of the ommatidium consists of**

- 1) cornea and semper cells
- 2) crystalline cone and cone cells
- 3) rhabdome and retinulae
- 4) cornea and crystalline cone

**242. Retinal pigment sheath around the receptor region is formed by**

- 1) six primary pigment cells
- 2) seven primary pigment cells
- 3) six secondary pigment cells
- 4) seven secondary pigment cells

**243. Refractory region of ommatidium is**

- 1) cornea
- 2) crystalline cone
- 3) rhabdome
- 4) retinulae

**244. The outer surface of the compound eye is divided into about 2,000 hexagonal areas called**

- 1) fenestrae
- 2) facets
- 3) femurs
- 4) faecal pellets

**245. Antennal pedicels and flagella have**

- 1) Johnston's organs
- 2) Jacobson's organs
- 3) sub-genual organs
- 4) tympanal organs

**246. Vision in nocturnal insects is called**

- 1) super position
- 2) mosaic
- 3) binocular
- 4) monocular

**247. Sensory units of subcuticular mechano receptors of chordotonal organs are**

- 1) sensillae
- 2) scolopidia
- 3) ommatidia
- 4) ocelli

**248. Tympanal organs of cockroach are located on**

- 1) anal cerci
- 2) anal styles
- 3) antennae
- 4) labial palps

**249. Superposition image formation takes place in cockroach when there is**

- 1) dim light
- 2) no light
- 3) bright light
- 4) sun light

**250. In cockroach, thermoreceptors are situated on**

- 1) legs
- 2) antennae
- 3) maxillary palps
- 4) anal cerci

**251. Chordotonal organs of cockroach are a kind of**

- 1) chemoreceptors
- 2) mechanoreceptors
- 3) thermoreceptors
- 4) photoreceptors

**252. Sensillae are the units of**

- 1) sub-cuticular receptors
- 2) cuticular receptors

- 3) thermoreceptors      4) both 2 and 3
253. Subcuticular units of mechanoreceptors are  
 1) scolopidia      2) ommatidia  
 3) sensillae      4) ocelli
254. Chordotonal organs of cockroach are  
 1) Johnston's organs      2) sub-genual organs  
 3) tympanal organs      4) All these
255. In cockroach, Johnston's organs are located in the antennal  
 1) scapes      2) pedicels  
 3) flagella      4) both 2 and 3
256. In cockroach, sub-genual organs are located on the proximal parts of  
 1) tibiae of all legs      2) femurs of all legs  
 3) tarsi of all legs      4) coxae of all legs
257. In cockroach tympanal organs are located on the  
 1) anal styles      2) anal cerci  
 3) antennae      4) palps
258. Johnston's organs are sensitive to  
 1) sound vibrations      2) ground vibrations  
 3) movement of flagella of antennae  
 4) temperature
259. Sub-genual organs are sensitive to  
 1) sound vibrations      2) ground vibrations  
 3) movement of flagella of antennae  
 4) temperature
260. Tympanal organs are sensitive to  
 1) sound vibrations      2) ground vibrations  
 3) movement of flagella of antennae  
 4) temperature
261. Thermoreceptor sensillae of cockroach are present on  
 1) anal cerci and pedicel of antennae  
 2) labrum, maxillary and labial palps  
 3) antennae, maxillary and labial palps  
 4) 1st, 2nd and 3rd segments of tarsi of legs
262. These are sensitive to smell in cockroach.  
 1) Olfactory sensillae      2) Gustatory sensillae  
 3) Thermoreceptor sensillae      4) Scolopidia
263. These are sensitive to taste in cockroach.  
 1) Olfactory sensillae      2) Gustatory sensillae  
 3) Thermoreceptor sensillae      4) Scolopidia
264. These are receptors of temperature in cockroach.  
 1) Olfactory sensillae      2) Gustatory sensillae  
 3) Thermoreceptor sensillae      4) Scolopidia
265. In cockroach, photoreceptors are present in  
 1) compound eyes and ocelli  
 2) 1st, 2nd and 3rd segments of tarsi of legs  
 3) antennae, maxillary and labial palps  
 4) labrum, maxillary and labial palps
266. The functional units of compound eye are  
 1) osphradia      2) ommatidia  
 3) odontophore      4) ocelli
267. The number of ommatidia present in each compound eye is about  
 1) 500      2) 1000      3) 1500      4) 2000
268. The compound eye of cockroach is

- 1) pyramidal                      2) spherical  
 3) mammalian kidney- shaped 4) pear- shaped
269. The biconvex lens of the ommatidium is  
 1) crystalline cone              2) rhabdome  
 3) cornea                          4) retinular cell
270. Which of the following is not applicable to the cornea of cockroach ?  
 1) It is the outermost part of the ommatidium  
 2) It is a transparent part of the cuticle  
 3) It is a refractive region of ommatidium  
 4) It focusses light on to the rhabdome
271. Corneagen cells of ommatidium are also called  
 1) vitellae                         2) cone cells  
 3) lenticular cells               4) retinulae
272. Lenticular cells of the ommatidium are the modified  
 1) vitellae                         2) retinulae  
 3) semper cells                  4) epidermal cells
273. Number of corneagen cells in a typical ommatidium is  
 1) 2            2) 4            3) 6    4) 8
274. Number of vitrillae or cone cells present in each typical ommatidium is  
 1) 2            2) 4            3) 6    4) 8
275. More or less conical cells in the ommatidium are  
 1) corneagen cells               2) semper cells  
 3) retinulae                       4) lenticular cells
276. Semper cells is the other name of  
 1) corneagen cells               2) cone cells  
 3) retinulae                       4) lenticular cells
277. Transparent conical structure secreted and surrounded by semper cells is  
 1) crystalline style               2) crystalline cone  
 3) rhabdome                       4) lens
278. Crystalline cone of the ommatidium is secreted by  
 1) corneagen cells               2) retinulae  
 3) vitrillae                         4) rhabdomeres
279. Number of retinulae in each ommatidium is  
 1) 2            2) 4            3) 6    4) 7
280. The number of units present in the rhabdome of an ommatidium is  
 1) 3            2) 5            3) 7    4) 9
281. The units of rhabdome are called  
 1) retinulae                       2) vitrillae  
 3) crystalline cone               4) rhabdomeres
282. The rhabdome of the ommatidium is formed by  
 1) vitrillae                         2) retinulae  
 3) cone cells                       4) lenticular cells
283. Rhabdome and retinulae of the ommatidium together form  
 1) receptor region or retinal region  
 2) focussing region  
 3) dioptrical region              4) frontal region
284. The region containing the cornea, and crystalline cone constitute  
 1) retinal region                  2) receptor region  
 3) focussing or dioptrical region  
 4) frontal region
285. In the ommatidium, image of object is are formed on  
 1) retinal region                  2) dioptrical region  
 3) focussing region              4) occipital region

286. Light absorbing dark iris pigment sheath is present around
- 1) rhabdomeres
  - 2) retinulae
  - 3) cornea
  - 4) vitellae
287. Receptor region of the typical ommatidium is surrounded by
- 1) iris pigment sheath
  - 2) retinal pigment sheath
  - 3) tendon sheath
  - 4) meninx
288. Retinal pigment sheath of ommatidium of diurnal insects is formed by
- 1) primary pigment cells
  - 2) secondary pigment cells
  - 3) vitellae
  - 4) retinulae
289. Innermost elongated cells of ommatidium are
- 1) cone cells
  - 2) vitellae
  - 3) retinulae
  - 4) corneagen cells
290. These cells of ommatidium contain microvilli.
- 1) Cone cells
  - 2) Retinulae
  - 3) Vitellae
  - 4) Corneagen cells
291. Nerve cells of ommatidium are
- 1) cone cells
  - 2) vitellae
  - 3) corneagen cells
  - 4) retinulae
292. Microvilli of each retinular cells
- 1) increase area of secretion
  - 2) increase area of absorption
  - 3) store light
  - 4) form a rhabdomere
293. These are absent in the ommatidium of nocturnal insects like cockroaches.
- 1) Primary pigment cells
  - 2) Secondary pigment cells
  - 3) Retinulae
  - 4) Vitellae
294. The type of vision in diurnal insects is
- 1) mosaic vision
  - 2) superposition vision
  - 3) telescopic vision
  - 4) stereoscopic vision
295. In cockroach, these are not involved in image formation but are very sensitive to changes in light intensity.
- 1) Ommatidia
  - 2) Compound eyes
  - 3) Fenestrae
  - 4) All these

### **Male reproductive system:**

296. Testes in cockroach are present
- 1) one on each lateral side in the fourth to sixth abdominal segments
  - 2) one on each lateral side in the fifth to eighth abdominal segment
  - 3) one on each lateral side in the 7th to 9th abdominal segments
  - 4) one on each lateral side in the 2nd to 6th abdominal segments
297. Ductus ejaculatorius starts in the
- 1) 6th segment
  - 2) 7th segment
  - 3) 8th segment
  - 4) 9th segment
298. Vas deferens opens into
- 1) testes
  - 2) mushroom-shaped gland
  - 3) ductus ejaculatorius
  - 4) seminal vesicle
299. The inner (first) layer of spermatophore is formed by the secretion of
- 1) utriculi majores (uricose glands)
  - 2) utriculi breviores
  - 3) ejaculatory duct
  - 4) phallic gland
300. Mushroom-shaped gland is present in the
- 1) 3rd & 4th thoracic segments
  - 2) 5th & 6th abdominal segments
  - 3) 4th & 5th abdominal segment
  - 4) 6th & 7th abdominal segments
301. The sperms are nourished by the
- 1) secretions of utriculi majories
  - 2) secretions of utriculi breviores







334. Floor and side walls of the genital pouch are formed by  
 1) 7th abdominal sternum  
 2) 8th abdominal sternum  
 3) 9th abdominal sternum  
 4) 6th abdominal sternum
335. The chemical substances produced by fertile female cockroach that are useful in chemocommunication are called  
 1) pheromones 2) enzymes 3) minerals 4) neurotransmitters
336. Fertilization in cockroach occurs in  
 1) gynatrium 2) vestibulum 3) germarium 4) vitellarium
337. Ootheca is formed by the secretion of  
 1) colleterial glands 2) mushroom-shaped gland 3) phallic gland 4) spermatheca
338. The ootheca are deposited on / in  
 1) moist place 2) warm and dark place 3) moist dark place 4) rocky area
339. Number of eggs in each ootheca is  
 1) 10 2) 8 3) 14 4) 16
340. Receptaculum seminis is located in this abdominal segment of cockroach.  
 1) 6<sup>th</sup> 2) 7<sup>th</sup> 3) 9<sup>th</sup> 4) 10<sup>th</sup>
341. Eggs of cockroach are fertilized in  
 1) cocoon 2) ootheca 3) fallopian tube 4) gynatrium
342. The structures of female cockroach that guide the ova into ootheca are  
 1) gonapophyses 2) receptaculum seminis  
 3) elaculatory duct 4) vas deferens
343. Ovipositors are formed by  
 1) gonapophyses of male from 9th sternum  
 2) phallomeres of female from 8th&9th sterna 3) gonapophysis of female from 8th&9th sterna  
 4) phallomeres of nymph
344. The eggs of cockroach are arranged in  
 1) 8 eggs in two rows 2) 16 eggs in two rows  
 3) 8 eggs in single row 4) 16 eggs in single row
345. The structure(s) that do not open directly into the genital pouch of female cockroach is/are  
 1) vagina 2) spermatheca  
 3) colleterial glands 4) oviducts
346. Sclerites that are found on the sides of head are  
 1) epicranial plates 2) frons  
 3) clypeus 4) genae
347. Vitellarium of female cockroach contains  
 1) spermatophores  
 2) various stages of developing ova  
 3) ova with seminal fluid  
 4) mature ova with yolk
348. In cockroach, the tapering ends of the ovarioles of each ovary unite to form a single thread which attaches to the  
 1) dorsal body wall 2) ventral body wall  
 3) lateral body wall 4) oviduct
349. Female genital pore of cockroach opens into  
 1) genital pouch on the eight sternum  
 2) oothecal chamber of seventh sternum  
 3) genital pouch on the eight tergum  
 4) brood pouch on the ninth sternum
350. Total number of spermathecae in a female cockroach is  
 1) two 2) three 3) one 4) four
351. Spermatheca of female cockroach is located in this segment of its abdomen.  
 1) Fifth 2) Ninth 3) Sixth 4) Eighth
352. Spermatheca of cockroach consists of



- 1) spermatheca of female
  - 2) spermathecal papilla of female
  - 3) ovipositors of female
  - 4) spermathecal papilla of male
370. Fertilization of cockroach occurs in
- 1) oothecal chamber      2) vestibulum
  - 3) gynatrium              4) vagina
371. In female cockroach, the egg case is formed around the fertilized eggs in
- 1) vestibulum              2) gynatrium
  - 3) spermatheca            4) genital chamber
372. Ootheca of cockroach contains
- 1) 8 eggs arranged in two rows
  - 2) 16 eggs arranged in two rows
  - 3) 10 eggs arranged in two rows
  - 4) 32 eggs arranged in two rows
373. In cockroach, the development of eggs occurs in
- 1) vagina                  2) oothecal chamber
  - 3) gynatrium               4) ootheca
374. The metamorphosis of cockroach is gradual through nymphal stages. So, cockroach is
- 1) holometabolous        2) paurometabolous
  - 3) ametabolous            4) heterometabolous
375. The young cockroach hatching from the ootheca is called
- 1) nymph                    2) caterpillar
  - 3) larva                     4) chrysalis

## SPECIAL FORMAT QUESTIONS

- The cuticle in cockroach serves the functions like
  - 1) protection of the body
  - 2) prevention of loss of water
  - 3) provides rigidity
  - 4) provides place for the attachment of muscles
  - 1) 1,2 and 3 are correct
  - 2) 1 and 2 are correct
  - 3) 2 and 4 are correct
  - 4) 1,2,3 and 4 are correct
- The occipital foramen forms the passage for
  - 1) oesophagus
  - 2) nerve cord
  - 3) crop
  - 4) ileum
  - 1) only 1 & 2 are correct
  - 2) only 2&3 are correct
  - 3) only 3&4 are correct
  - 4) only 1,2 & 3 are correct
- The labrum serves for
  - 1) holding the food
  - 2) tasting the food
  - 3) masticating the food
  - 4) preventing the food from falling down
  - 1) 1 & 2 are correct
  - 2) 2 & 3 are correct
  - 3) 3&4 are correct
  - 4) 1,2 and 4 are correct
- The posterior end of the abdomen of male cockroach has
  - 1) a pair of anal cerci
  - 2) a pair of anal styles
  - 3) gonapophyses
  - 4) genital pouch
  - 1) 1 & 2 are correct
  - 2) 2 & 3 are correct
  - 3) 3 & 4 are correct
  - 4) 1,2 and 3 are correct
- The hepatic caecae are also termed 'midgut caecae' as they contain
  - 1) secretory cells
  - 2) excretory cells
  - 3) absorptive cells
  - 4) urate cells
  - 1) 1 & 3 are correct
  - 2) 2 & 3 are correct
  - 3) 3 & 4 are correct
  - 4) 1,2 and 3 are correct
- The functions of the blood of cockroach are
  - 1) absorbs digested food from the alimentary canal and distributes it to all body parts
  - 2) brings nitrogenous wastes from all parts of the body to the excretory organs
  - 3) transports secretions of ductless glands to the target organs
  - 4) carries defensive phagocytes to the places of infection
  - 1) 1 & 2 are correct
  - 2) 2 & 3 are correct
  - 3) 3 & 4 are correct
  - 4) 1,2,3 & 4 are correct
- The mouth parts of cockroach that hold the food during chewing are
  - 1) laciniae
  - 2) galeae
  - 3) glossae
  - 4) paraglossae
  - 1) only 1 and 2
  - 2) only 2 and 3
  - 3) only 3 and 4
  - 4) all
- Efferent salivary duct is formed by the fusion of
  - 1) common salivary ducts
  - 2) median salivary duct
  - 3) common receptacular duct
  - 4) receptacular ducts
  - 1) 1 & 2 only are correct
  - 2) 2&3 only are correct
  - 3) 3&4 only are correct
  - 4) 1,2 & 3 only are correct
- The respiratory system in insects is classified on the basis of
  - 1) number of spiracles
  - 2) nature of spiracles

3) position of spiracles 4) structure of trachea

1) 1&2 only 2) 2&3 only

3) 1,2 & 3 only 4)1,2,3&4 only

10. Inspiration in cockroach is effected by

1) relaxation of dorsoventral muscles

2) relaxation of ventral longitudinal muscles

3) elevation of tergal plates

4) increase in the volume of body cavity

1) 1&2 only 2) 2&3 only

3) 3&4 only 4)1,2,3&4 only

11. Expiration in cockroach is effected by

1) contraction of dorsoventral muscles

2) decrease in size of the body cavity

3) contraction of ventral longitudinal muscles

4) segments are telescoped

1)1 & 2 only 2) 2&3 only

3) 3&4 only 4)1,2,3&4 only

12. The following are the statements about the legs of cockroach.

i) Each leg has five podomeres.

ii) Femur is articulated with the sternum of thoracic segments.

iii) The proximal podomere is called coxa.

**Which of the above statements are correct ?**

1) All are correct 2) Only i & ii are correct

3) Only ii & iii are correct

4) Only i & iii are correct

13. Study the following statements regarding the abdomen of cockroach.

i) 8th and 9th abdominal sterna are infolded to form the genital pouch in female.

ii) A pair of unsegmented anal styles is present attached to the 9th abdominal sterna one on either side, in male cockroach.

iii) Gonapophyses are helpful in copulation, formation of ootheca and oviposition in female.

iv) The sternum of seventh abdominal segment is boat - shaped in female.

**Which of the above statements are correct ?**

1) all 2) only i & ii 3) only ii&iii 4) only i & iii

14. The following are the statements about the anal cerci of cockroach.

i) Anal cerci occur only in males.

ii) Anal cerci occur in both males and females.

iii) Anal cerci are fifteen-segmented.

iv) Anal cerci are the chordotonal organs.

**Which of the above statements are correct ?**

1) all 2) only i & ii

3) only ii & iii 4) only ii, iii & iv

15. The following are the statements about the epidermis of cockroach.

i) It is single-layered containing columnar epithelial cells.

ii) Most of the cells are glandular which secrete digestive enzymes.

iii) It lies deep below the three layers of cuticle and hence called hypodermis.

iv) It secretes the cuticle.

1) ii, iii, & iv 2) only i & ii

3) only ii & iii 4) only i, iii & iv

16. The following are the statements about gizzard.

i) It has six denticulate plates.

ii) It stores the food.

iii) It acts as a grinding mill and sieve.

**Which of the above statements are correct ?**

- 1) All 2) only i & ii 3) only ii & iii 4) only i & iii
17. The following are the statements about the ganglia on the ventral nerve cord of *Periplaneta*.
- 6th abdominal ganglion is the largest of all the abdominal ganglia.
  - The fifth abdominal ganglion is present in the 6th abdominal segment.
  - the 6th abdominal ganglion is present in the 7th abdominal segment.
- Which of the above statements are correct ?**
- 1) All 2) only i & ii 3) only ii & iii 4) only i & iii
18. The following are the statements about the autonomous nervous system of cockroach.
- This system is also called stomatogastric nervous system or visceral nervous system.
  - It controls the visceral organs particularly the muscles of the alimentary canal and the heart.
  - In the head it has a frontal ganglion in front of the brain.
  - It has a visceral ganglion on the crop.
- Which of the above statements are true ?**
- 1) all 2) only i & ii 3) only ii & iii 4) only iii & iv
19. The following are the statements about the ommatidia of cockroach.
- Cornea is shed off during ecdysis of nymph.
  - The cornea, corneagen cells, the vitellae and crystalline cone together constitute the 'dioptrical region'.
  - Retinulae act as photoreceptors of the ommatidium.
- Which of the above statements are correct ?**
- 1) all 2) only i & ii 3) only ii & iii 4) only iii & iv
20. The following are the statements about the digestive system of cockroach.
- Principally, hind gut is useful in homeostasis.
  - The alimentary canal is highly regionalised in cockroach.
  - The fore gut is specialised for the mastication of food and storage of food.
  - The midgut is specialised for the mastication of food and storage of food.
- Which of the above statements are true ?**
- 1) i & ii only                      2) ii & iii only  
3) iii & iv only                    4) i, ii & iii only
21. The following are the statements about mechanism of respiration in cockroach.
- Dorsoventral muscles are the principal muscles of respiration.
  - Inspiration is an active process.
  - Expiration is a passive process.
  - Cockroaches and some other insects like grasshoppers and beetles exhibit the phenomenon of discontinuous ventilation.
- Which of the above statements are true ?**
- 1) i & ii only                      2) ii & iii only  
3) iii & iv only                    4) i & iv only
22. The following are the statements about the nervous system of cockroach.
- Brain is principally sensory in nature.
  - The 6th abdominal ganglion is present in the 7th segment.
  - 6th abdominal ganglion is the largest of all the abdominal ganglia.
  - Autonomous nervous system controls the visceral organs, particularly the muscles of the alimentary canal & heart.
- Which of the above statements are true ?**
- 1) i & ii only                      2) i, ii & iii only  
3) ii & iv only                    4) i, ii, iii & iv
23. The following are the statements about the sense organs of cockroach.
- Ommatidia are the units of photoreceptors.
  - Sensillae are the units of cuticular receptors and chemo receptors.
  - Scolopidia are the units of mechanoreceptors of chordo-tonal organs.
  - Mechano receptors are cuticular and sub-cuticular receptors.
- Which of the above statements are true ?**
- 1) i & ii only                      2) ii & iii only  
3) iii & iv only                    4) i, ii, iii & iv
24. Tick mark the false statement w.r.t cockroach.

- 1) Excretion is performed by Malpighian tubules which occur at the junction of midgut and hindgut.
  - 2) Cockroach is uricotelic.
  - 3) Blood vascular system of cockroach is closed type.
  - 4) Respiratory system consists of a network of tracheae that open out through 10 pairs of spiracles.
25. Tick mark the false statement w.r.t the reproductive system of female cockroach (*Periplaneta americana*).

- 1) Pair of spermatheca is present in the 6<sup>th</sup> segment.
- 2) Two large ovaries lie laterally in the 2<sup>nd</sup> – 6<sup>th</sup> abdominal segments.
- 3) Each ootheca contains 26 eggs.
- 4) The nymph grows by moulting about 13 times to reach the adult form.

26. Match the following and choose the correct combination

**List - I**

**List - II**

- |                           |                           |
|---------------------------|---------------------------|
| a) Vertex                 | i) Frons, clypeus, labrum |
| b) Front part of the head | ii) Genae                 |
| c) Sides of the head      | iii) Occipital foramen    |
| d) Back of the head       | iv) Epicranial plates     |
|                           | v) Oenocytes              |

- |    | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|----|----------|----------|----------|----------|
| 1) | iv       | i        | ii       | iii      |
| 2) | i        | ii       | iii      | iv       |
| 3) | iv       | iii      | ii       | i        |
| 4) | v        | iv       | iii      | ii       |

27. Match the following and choose the correct combination

**List - I**

**List - II**

- |                   |                               |
|-------------------|-------------------------------|
| a) Labrum         | i) Sub-mentum                 |
| b) Mandibles      | ii) Gustatory sensillae       |
| c) First maxillae | iii) Cervicum                 |
| d) Labium         | iv) Cardo                     |
|                   | v) Adductor, abductor muscles |

- |    | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|----|----------|----------|----------|----------|
| 1) | v        | iv       | ii       | iii      |
| 2) | iv       | iii      | ii       | i        |
| 3) | i        | ii       | iii      | iv       |
| 4) | ii       | v        | iv       | i        |

28. Match the following and choose the correct combination

**List - I**

**List - II**

- |                |                                |
|----------------|--------------------------------|
| a) Trophocytes | i) Secrete lipids              |
| b) Mycetocytes | ii) Store uric acid            |
| c) Oenocytes   | iii) Store food                |
| d) Uratecells  | iv) Contain symbiotic bacteria |
|                | v) Secrete digestive enzymes   |

- |    | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|----|----------|----------|----------|----------|
| 1) | ii       | iii      | iv       | v        |
| 2) | iii      | iv       | i        | ii       |
| 3) | i        | ii       | iii      | iv       |
| 4) | iv       | iii      | ii       | i        |

29. Match the following and choose the correct combination

**List - I**

**List - II**

- |                 |                               |
|-----------------|-------------------------------|
| a) Polypneustic | i) Ostia                      |
| b) Peritreme    | ii) Taenidia                  |
| c) Trichomes    | iii) Chitinous ring around    |
| d) Intima       | iv) More than three pairs of  |
|                 | v) Small hair-like structures |

- |  | <b>a</b> | <b>b</b> | <b>c</b> | <b>d</b> |
|--|----------|----------|----------|----------|
|--|----------|----------|----------|----------|

spiracle  
spiracles  
around spiracles



- |       |     |     |    |
|-------|-----|-----|----|
| 1) ii | iii | iv  | v  |
| 2) v  | iv  | iii | ii |
| 3) i  | ii  | iii | iv |
| 4) iv | iii | v   | ii |

30..Match the following and choose the correct combination.

**List - I**

**List - II**

- |                         |                        |
|-------------------------|------------------------|
| a) Grinding mill        | i) Pre-oral cavity     |
| b) Cibarium             | ii) Chitinous          |
| c) Peritrophic membrane | iii) Gizzard           |
| d) Hepatic caecae       | iv) Malpighian tubules |
|                         | v) Mesenteron          |

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
----------	----------	----------	----------

- |        |     |     |    |
|--------|-----|-----|----|
| 1) i   | ii  | iii | iv |
| 2) iii | i   | ii  | v  |
| 3) iv  | iii | ii  | i  |
| 4) v   | iv  | iii | ii |

31.Match the following and choose the correct combination.

**List - I**

**List - II**

- |                |                      |
|----------------|----------------------|
| a) Inspiration | i) Active process    |
| b) Expiration  | ii) Trachea          |
| c) Intima      | iii) Passive process |
| d) Peritreme   | iv) Atrium           |
|                | v) Spiracle          |

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
----------	----------	----------	----------

- |        |     |     |    |
|--------|-----|-----|----|
| 1) v   | iv  | iii | ii |
| 2) iv  | iii | ii  | i  |
| 3) iii | i   | ii  | v  |
| 4) i   | ii  | iii | iv |

32..Match the following and choose the correct combination.

**List - I**

**List - II**

- |               |                              |            |
|---------------|------------------------------|------------|
| a) Coxa       | i) Long and slender segment  | of the leg |
| b) Trochanter | ii) Stout bristles           |            |
| c) Femur      | iii) Large basal segment of  | the leg    |
| d) Tibia      | iv) Small segment of the leg |            |
|               | v) Claws                     |            |

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
----------	----------	----------	----------

- |        |     |     |    |
|--------|-----|-----|----|
| 1) v   | iv  | iii | ii |
| 2) iv  | iii | ii  | i  |
| 3) iii | iv  | ii  | i  |
| 4) i   | ii  | iii | iv |

33..Match the following and choose the correct combination.

**List - I**

**List - II**

- |                               |                          |
|-------------------------------|--------------------------|
| a) 7th sternum in female      | i) Gynatrium             |
| b) 8th & 9th sterna in female | ii) Anal styles          |
| c) 9th sternum in male        | iii) Gynovalvular plates |
| d) 10th tergum                | iv) Paraprocts           |
|                               | v) Anal cerci            |

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
----------	----------	----------	----------

- |        |     |     |    |
|--------|-----|-----|----|
| 1) iii | i   | ii  | v  |
| 2) i   | ii  | iii | iv |
| 3) iv  | iii | ii  | i  |
| 4) v   | iv  | iii | ii |

34..Match the following and choose the correct combination.

**List - I**

- a) Labrum
- b) Mandibles
- c) Maxilla
- d) Labium

**List - II**

- i) Toothed
- ii) Galea
- iii) Palpiger
- iv) Upper lip
- v) Occiput

**a****b****c****d**

- |       |     |     |     |
|-------|-----|-----|-----|
| 1) iv | i   | ii  | iii |
| 2) i  | ii  | iii | iv  |
| 3) iv | iii | ii  | i   |
| 4) v  | iv  | iii | ii  |

35. Match the following and choose the correct combination.

**List - I**

- a) Vertex
- b) Genae
- c) Fenestrae
- d) Scape

**List - II**

- i) Sides of the head capsule
- ii) Under developed ocelli
- iii) Basal segment of antenna
- iv) Middle segment of antenna
- v) Top of the head capsule

antenna

**a****b****c****d**

- |       |     |     |     |
|-------|-----|-----|-----|
| 1) v  | iv  | iii | ii  |
| 2) iv | iii | ii  | i   |
| 3) i  | ii  | iii | iv  |
| 4) v  | i   | ii  | iii |

36. Match the following and choose the correct combination.

**List - I**

- a) Inner layer of spermatophore
- b) Second layer of spermatophore
- c) Outer most layer of spermatophore
- d) Testes

**List - II**

- i) Wall of ejaculatory duct
- ii) Secretion of phallic gland
- iii) 4th to 6th abdominal segments
- iv) Utriculi majores

**a****b****c****d**

- |       |     |     |     |
|-------|-----|-----|-----|
| 1) ii | iii | iv  | v   |
| 2) iv | v   | ii  | iii |
| 3) iv | i   | ii  | iii |
| 4) i  | ii  | iii | iv  |

37. Match the following and choose the correct combination.

**List - I**

- a) Anal styles
- b) Boat-shaped plate
- c) Serrate lobe
- d) Pseudopenis

**List - II**

- i) 7th sternum
- ii) Right phallomere
- iii) 9th sternum
- iv) Ventral phallomere
- v) Left phallomere

**a****b****c****d**

- |        |     |     |    |
|--------|-----|-----|----|
| 1) iii | i   | ii  | v  |
| 2) i   | ii  | iii | iv |
| 3) v   | iv  | iii | ii |
| 4) ii  | iii | iv  | v  |

## NCERT EXEMPLAR PROBLEMS

1 Match the following and choose the correct option

Column I	Column II
A. Adipose tissue	i. Nose
B. Stratified epithelium	ii. Blood
C. Hyaline cartilage	iii. Skin
D. Fluid connective tissue	iv. Fat storage

Options:

- a. A-i, B-ii, C-iii, D-iv
- b. A-iv, B-iii, C-i, D-ii
- c. A-iii, B-i, C-iv, D-ii
- d. A-ii, B-i, C-iv, D-iii

2. Match the following with reference to cockroach and choose the correct option

Column I	Column II
A. Phallomere	i. Chain of developing ova
B. Gonopore	ii. Bundles of sperm
C. Spermatophore	iii. Opening of the ejaculatory duct
D. Ovarioles	iv. The external genitalia

Options:

- a. A-iii, B-iv, C-ii, D-i
- b. A-iv, B-iii, C-ii, D-1
- c. A-iv, B-ii, C-iii, D-1
- d. A-ii, B-iv, C-iii, D-1

3. Match the following and choose the correct option

Column I	Column II
A. Touch	i. Nasal epithelium
B. Smell	ii. Foramen magnum
C. Cranial nerves	iii. Sensory papillae
D. Medulla oblongata	iv. Peripheral nervous system

Options:

- a. A-iii, B-i, C-ii, D-iv
- b. A-ii, B-i, C-iv, D-iii
- c. A-iii, B-iv, C-ii, D-i
- d. A-iii, B-i, C-iv, D-ii

## NEET PREVIOUS QUESTIONS

1. In cockroach, the nerve cord is [CPMT'80]

- 1) single, ventral and hollow
- 2) Double, ventral and solid
- 3) Double, dorsal and hollow
- 4) Single, dorsal and solid

2. Cockroach and *Ascaris* are similar in one of the following cases [CBSE-2000]

- 1) Dorsal tubular nerve cord
- 2) Nephridia
- 3) Sexual dimorphism
- 4) Pseudocoel

3. Coelom in cockroach is [EAMCET-01]

- 1) Enterocoel
- 2) Schizocoel
- 3) Pseudocoel
- 4) None

4. Cockroach mainly excretes [CPMT'91]

- 1) Urea
- 2) Uric Acid
- 3) Ammonia
- 4) None

5. In female cockroach, ootheca is secreted by

- 1) Oothecal chamber
- 2) Oviduct
- 3) Collateral gland
- 4) Mushroom gland

[CPMT'90]

6. Egg of cockroach is

- 1) Telolecithal
- 2) Centrolcithal
- 3) Mesolecithal
- 4) Isolecithal

7. Most of the digestion in cockroach occurs in

[BHU'85]

- 1) Pharynx
- 2) Mid gut
- 3) Gizzard
- 4) Crop

8. The common feature of trachea of cockroach and rabbit is that both

[CPMT'90]

- 1) Have non-collapsible walls
- 2) Are ectodermal in origin
- 3) Are endodermal in origin
- 4) Have cartilaginous rings

9. In cockroach, the corpora allata are

- 1) sense organs
- 2) tactile organs
- 3) An endocrine organs
- 4) digestive glands

10. Arolium in cockroach helps in [CPMT'89]

- 1) Digestion
- 2) Locomotion
- 3) Reproduction
- 4) Paurometabolous

11. The labium in cockroach is formed by

[CPMT'80]

- 1) First maxillae
- 2) Second maxillae
- 3) Mentum

4) Submentum

12. Stomodaeal valve in cockroach is situated between

[CPMT'93]

- 1) Crop and gizzard
- 2) Rectum and anus
- 3) Gizzard and mesenteron
- 4) Mesenteron and ileum

13. Salivary duct of cockroach opens at

[Vellore'02]

- 1) Hypopharynx
- 2) Mandibular region
- 3) Labium

4) 1st maxilla

14. How the male cockroach can be distinguished from the female cockroach?

[MAHE'03]

- 1) Presence of anal cirri in female cockroach
- 2) Presence of anal styles in male cockroach
- 3) Absence of anal style in male cockroach
- 4) Absence of anal cirri in male cockroach

15. In cockroach alary muscles are associated with

[AMU'93;CPMT'94;HPMT'06]

- 1) Heart & blood circulation
- 2) Tracheae & spiracles
- 3) Wings and locomotion
- 4) Feeding and vision

16. Difference between *Blatta* and *Periplaneta* is

[CPMT'94]

- 1) *Blatta* has functional & *Periplaneta* has vestigial wings
- 2) *Periplaneta* has functional & *Blatta* has vestigial wings
- 3) *Blatta* and *Periplaneta* both have functional wings but *Blatta* is smaller.
- 4) *Blatta* and *Periplaneta* both have functional wings but *Blatta* is larger.

17. The part of cockroach having both exoskeleton and endoskeleton (tentorium and apodemes)

[RPMT'95]

- 1) Head
- 2) Thorax
- 3) Abdomen
- 4) All

18. Young one of the cockroach is called

[RPMT'95]

- 1) Naid
- 2) Grub
- 3) Nymph
- 4) Maggot

19. The functional units of compound eye of an insect are called

[MAHE'95]

- 1) Fenestrae                      2) Ocelli  
3) Radula                          4) Ommatidia

**20. Metamorphosis takes about is [RPMT'96]**

- 1) 10-12 months                  2) One month  
3) 5-13 Weeks                    4) Two years

**21. Number of chromosomes in *Blatta* is**

[CPMT'90]

- 1) 48 Chromosomes              2) 36 Chromosomes              3) 16 Chromosomes              4) 32 Chromosomes

**22. Mycetocytes (cells) of cockroach [CPMT'94]**

- 1) Have symbiotic bacteria      2) Secrete hormones  
3) Play role in metabolism      4) Help in ejaculation

**23. Generic name of *Periplaneta* was assigned to cockroach by**

- 1) Linnaeus                      2) Burmeister  
3) Beltham                        4) Huxley

**24. Saliva of cockroach is rich in the following enzymes**

[RPMT'97]

- 1) Amylase    2) Pytalin    3) Zymase    4) All above

**25. The heart of cockroach is [RPMT'97]**

- 1) Myogenic                      2) Neurogenic  
3) Neuro-myogenic              4) None of the above

**26. The wings are either rudimentary or vestigial in**

[CPMT'97]

- 1) Female cockroach of *Blatta orientalis*  
2) Male cockroach of *Blatta orientalis*  
3) Female cockroach of *Periplaneta americana*  
4) Male cockroach of *Periplaneta americana*

**27. Secretions of corpora allata in insects help is**

[RPMT'97]

- 1) Growth                        2) Metamorphosis  
3) Peristalsis                    4) Both (1) and (2)

**28. Which one of the following groups of structures/ organs have similar function ?**

[AIMS'05]

- 1) Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in Amoeba.  
2) Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubules in rat.  
3) Antennae of cockroach, tympanum of frog and clitellum of earthworm  
4) Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish

**29. The labrofrontal nerves in cockroach originates from:**

[EAMCET'05]

- 1) Sub oesophageal ganglia  
2) Supra oesophageal ganglia  
3) Antennary nerves              4) Frontal ganglia

**30. The mouth parts of cockroach are of [Manipur'05]**

- 1) piecing and sucking type  
2) chewing and lapping type  
3) biting and chewing type    4) siphoning type

**31. Which structure of man is similar to spiracle of cockroach?**

[Orissa'05]

- 1) nostril    2) bronchiole    3) lungs    4) alveoli

**32. Conglobate gland is present in [Orissa'05]**

- 1) male cockroach              2) female cockroach  
3) earthworm                      4) Hydra

**33. Which of the following can be absorbed by hepatic caeca?**

[GCET'06]

- 1) glucose and amino acid    2) glucose and lipid              3) lipid                              4) glucose

**34. In cockroach, larval and nymphal characters are maintained by**

[BHU'06]

- 1) ecdysone                      2) salivary glands              3) parotid gland                      4) juvenile hormone

**35. Which structure is absent in male cockroach?**

[AMU'06]

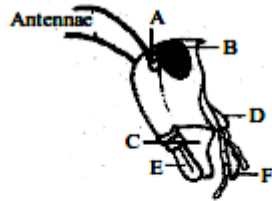
- 1) labium                        2) phallomeres                      3) spermatheca                      4) none of these

**36. The correct sequence of arrangement of segments in the leg of cockroach is [Kerala'06]**

- 1) tibia, trochanter, femur, tarsus and coxa              2) trochanter, coxa tibia, femur and tarsus  
3) coxa, femur, trochanter, tibia and tarsus              4) coxa, trochanter, femur, tibia and tarsus

**AIIMS PREVIOUS QUESTIONS**

1. The figure given below shows the head region of cockroach. Identify A to F.



**[2016]**

- (a) A- Compound eye, B-Ocellus, C-Maxilla, D-Mandible, E-Labrum, F-Labium
- (b) A- Ocellus, B-Compound eye, C-Mandible, D-Maxilla, E-Labrum, F-Labium
- (c) A- Ocellus, B-Compound eye, C-Mandible, D-Maxilla, E-Labium, F-Labrum
- (d) A- Ocellus, B-Compound eye, C-Maxilla, D-Mandible, E-Labrum, F-Labium

2. Male cockroach can be identified from the female by the presence of **[2017]**

- (a) long antennae
- (b) wingless body
- (c) elongated abdomen
- (d) anal styles

**KEY**  
**MULTIPLE CHOICE QUESTIONS**

- 1)2 2)2 3)1 4)2 5)3 6)1  
7)3 8)2 9)3 10)3 11)3 12) 3 13)1 14)1 15)2 16)3 17)3  
18) 2 19)2 20)2 21)4 22)4 23)2 24) 2 25)1 26)3 27)3 28)1  
29)1 30) 3  
31)3 32)3 33)1 34)4 35)2 36) 1 37)1 38)2 39)3 40)2 41)3  
42) 3 43)4 44)2 45)3 46)3 47)2 48) 3 49)2 50)4 51)1 52)4  
53)2 54) 2 55)1 56)2 57)1 58)2 59)1 60) 3  
61)2 62)2 63)2 64)2 65)1 66) 2 67)1 68)2 69)3 70)2 71)3  
72) 1 73)2 74)3 75)2 76)2 77)3 78) 1 79)4 80)2 81)2 82)1  
83)2 84) 2 85)4 86)2 87)1 88)1 89)3 90) 2  
91)3 92)3 93)2 94)2 95)1 96) 3 97)3 98)4 99)2 100)1 101)2  
102)1  
103)2 104)2 105)3 106)2 107)4 108)3 109)2 110)1 111)4 112)4 113)2 114)2  
115)2 116)2 117)1 118)3 119)3 120)3  
121)1 122)3 123)3 124)1 125)2 126)3 127)3 128)2 129)1 130)1 131)1 132)4  
133)4 134)2 135)3 136)4 137)1 138)2 139)4 140)3 141)4 142)4 143)3 144)2 145)3  
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176)2 177)3 178)2 179)2 180)4  
181)2 182)1 183)1 184)4 185)4 186)4 187)1 188)4 189)3 190)1 191)1 192)3  
193)2 194)3 195)4 196)3 197)1 198)1 199)4 200)1 201)4 202)1 203)1 204)3 205)2  
206)4 207)1 208)1 209)3 210)2  
211)3 212)4 213)4 214)4 215)4 216)3 217)3 218)2 219)1 220)2 221)1 222)3  
223)4 224)3 225)3 226)2 227)1 228)4 229)3 230)1 231)2 232)1 233)3 234)4 235)4  
236)4 237)3 238)2 239)1 240)4  
241)4 242)4 243)1 244)2 245)1 246)1 247)2 248)1 249)1 250)1 251)2 252)4  
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271)3 272)4 273)1 274)2 275)2 276)2 277)2 278)3 279)4 280)3 281)4 282)2  
283)1 284)3 285)1 286)4 287)2 288)2 289)3 290)2 291)4 292)4 293)2 294)1 295)3  
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326)4 327)2 328)1 329)2 330)1

331)1 332)3 333)1 334)1 335)1 336)1 337)1 338)2 339)4 340)1 341)4 342)1  
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361)2 362)2 363)4 364)2 365)4 366)3 367)2 368)1 369)2 370)3 371)1 372)2  
373)4 374)2 375)1

## SPECIAL FORMAT QUESTIONS

1) 4	11) 4	21) 4	31) 3
2) 1	12) 4	22) 4	32) 3
3) 4	13) 1	23) 4	33) 1
4) 4	14) 4	24) 3	34) 1
5) 1	15) 4	25) 1	35) 4
6) 4	16) 4	26) 1	36) 3
7) 4	17) 1	27) 4	37) 1
8) 2	18) 1	28) 2	
9) 1	19) 1	29) 4	
10) 4	20) 2	30) 2	

## NCERT EXEMPLAR PROBLEMS

1) 3  
2) 1  
3) 2

## NEET PREVIOUS QUESTIONS

1) 2	11) 2	21) 1	31) 1
2) 3	12) 3	22) 1	32) 1
3) 2	13) 1	23) 2	33) 1
4) 2	14) 2	24) 1	34) 4
5) 3	15) 1	25) 2	35) 3
6) 2	16) 2	26) 1	36) 4
7) 4	17) 4	27) 4	
8) 1	18) 3	28) 2	
9) 3	19) 4	29) 2	
10) 2	20) 3	30) 3	

## AIIMS PREVIOUS QUESTIONS

1) 2  
2) 4



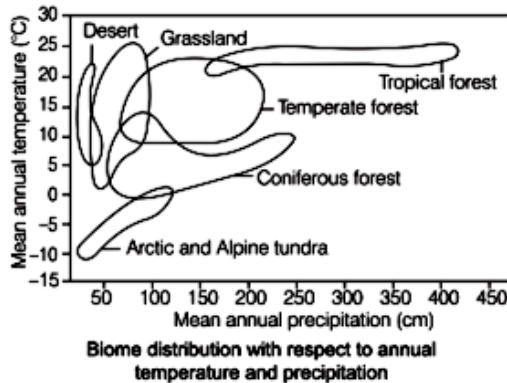
**UNIT-VIII**  
**ECOLOGY**  
**ORGANISMS AND**  
**POPULATION**  
**(CHAPTER -13)**

## SYNOPSIS

- Ecology is the branch of biology which studies the interactions among organisms and between organism and its physical, i.e. abiotic environment. The term 'ecology' was first described by **Ernst Haeckel**.
- Ecology is basically concerned with four levels of organisation. These are
  - **Organisms** are the basic and living unit of ecology.
  - **Population** refers to the sum total of all organisms having similar features and potential to interbreed among themselves and produce fertile offspring.
  - **Communities** refer to the assemblage of all the populations of different species in a specific geographical area.
  - **Biome** is a large unit which consists of a major vegetation type and its associated fauna in a particular climatic zone, e.g. tropical rainforest, deciduous forest, etc.

### Organism and its Environment

- Ecology at the organismic level is essentially physiological ecology, which studies the adaptations of organisms essential for survival and reproduction in any given environment.
- We know that the rotation of our planet around the sun and the tilt of its axis cause annual variations in the intensity and duration of temperature, resulting in distinct seasons.
- These variations together with annual variation in precipitation account for the formation of major biomes such as desert, rainforest and tundra.



- Regional and local variations within each biome lead to the formation of a wide variety of habitats.
- **Habitat** is a place, where an organism lives and represents a particular set of environmental conditions suitable for its successful growth.
- Each organism has an invariably defined range of conditions (evolved through natural selection) that it can tolerate, diversity in the resources it utilises and a distinct functional role in the ecological system all these together comprise its **niche**.
- Ecological equivalents are the organisms which occupy a part of the same niche, but have different habitats.

### Major Abiotic Factors

These are the non-living factors or components of the environment which influence the survival and reproductive functions of an organism.

Some important factors are

- **Temperature** It is the most ecologically relevant environmental factor. Organisms which can tolerate and thrive in wide range of temperature are called **eurythermal**, e.g. most mammals and birds, while organisms which can tolerate, a narrow range of temperature are called **stenothermal**, e.g. polar bear, amphibians.
- **Water** The life on earth is unsustainable without water. The productivity and distribution of plants are dependent on the availability of water.
  - Aquatic organisms survive in water and they are affected by pH, chemical composition, temperature and salinity of water.
  - Organisms which can tolerate a wide range of salinity are called **euryhaline**, e.g. salmon, while organisms which can be restricted to tolerate a narrow range of salinity are called **stenohaline**, e.g. shark.
- **Light** It is the source of energy used to prepare food by photosynthesis in plants to release oxygen.
  - It induces flowering in certain plants (photoperiodism), helps in transpiration, reproductive and migratory activities, etc.
  - The UV component of solar spectrum is harmful for living organisms, while visible spectrum (380-760 nm) is mainly utilised by plants. The availability of light on land is closely linked with that of temperature as the sun is source of both.
- **Soil** (edaphic factor) The nature and properties of soil is affected by climate, weathering process, whether soil is transported or sedimented and by soil development process.
  - Water holding capacity and percolation of the soil is determined by various characteristics, such as soil composition, grain size and aggregation.
  - Soil quality determines the vegetation in an area which inturn defines the type of fauna that can exist there.

### Responses to Abiotic Factors

- The abiotic factors are highly variable. An organism can achieve consistency by regulating optimum temperature and osmotic concentration of body fluids, in accordance to external environmental conditions.
- The following methods help organisms to cope up with stressful conditions

#### 1. Regulate

- Some organisms are able to maintain homeostasis by physiological and behavioural means to ensure a constant

- In higher plants, seeds and some other vegetative reproductive structures (propagules) help to pass over stress periods and dispersal. They do so by reducing their metabolic activity and entering into a state of dormancy. Under favourable moisture and temperature conditions, these germinate to form new plants.
- Some organisms are unable to migrate so they avoid stress by escaping in time. These organisms suspend their metabolic functions during the stressful period and resume their functions at the return of favourable conditions. For example, bear undergoes winter sleep called **hibernation** and certain animals like snails and fish undergo summer sleep known as **aestivation**. Under unfavourable conditions, many zooplanktons enter **diapause** (a stage of suspended development).

## Adaptation

Any attribute of an organism (morphological, physiological or behavioural) that enables it to survive and reproduce in its habitat can be referred to as **adaptation**. It is of following types

### Adaptations in Plants

- **Xerophytic plants** Roots grow very deep to explore any possibility of available underground water.
  - Many desert plants have a thick cuticle on their leaf surfaces and have their stomata arranged in deep pits to minimise water loss through transpiration. They also have a special photosynthetic pathway known as Crassulacean Acid Metabolism (CAM) that enables their stomata to remain closed during day time so as to minimise transpiration.
  - Some desert plants like *Opuntia*, have no leaves. Their leaves are reduced to spines and photosynthesis occurs in flattened stems.
- **Hydrophytic plants** Aquatic plants or hydrophytes have evolved aerenchyma for buoyancy and floating. They have covering of wax to avoid damage through water. Roots are generally absent in plants like *Hydrilla* and *Nymphaea*.
- **Halophytic plants** The plants of saline habitats or halophytes not only have the ability to tolerate high concentration of salts in their rooting medium but are also able to obtain their water supply from the same.
  - These are found in tidal marshes, coastal dunes, mangroves and saline soils. Certain green algae are also found in these areas, e.g. *Dunaliella*.
  - A number of plants possess small negatively geotropic vertical roots called **pneumatophores** (have lenticels for gaseous exchange), e.g. *Avicennia*, *Aegialitis*.

### Adaptations in Animals

- **Kangaroo rat** The kangaroo rat of the North American deserts is capable of meeting all its water requirement by internal oxidation of its body fat (water is a byproduct).

- It can also concentrate its urine, so that minimal volume of water is used to expel excretory products.
- **Desert lizards** They absorb heat from sun when the body temperature drops below the comfort zone and move into shade when the ambient temperature starts increasing. Some species burrow into the soil and escape from the above ground heat. These are behavioural responses.
- **Mammals** from colder climates generally have shorter ears and limbs to minimise heat loss. This is called **Allen's rule**. In polar regions, aquatic mammals like seals have a thick layer of fat (blubber) below their skin that acts as an insulator and reduces the loss of body heat.
- **At high altitudes in humans** At high altitude places like Rohtang Pass near Manali (> 3500 m) and Mansarovar (in China occupied Tibet) people suffer from **altitude sickness**.
  - The common symptoms include nausea, fatigue and heart palpitations. This is because at low atmospheric pressure of high altitudes, body does not get enough oxygen. The however gradually acclimatise.
  - The body copes up with this low oxygen stress by
    - increasing red blood cells production.
    - decreasing the binding affinity of haemoglobin.
    - increasing the breathing rate.
- **Antarctic fishes** Many fish thrive in Antarctic waters where the temperature is below zero as their body contains antifreeze glycoproteins to prevent the body fluid from freezing.
- A large variety of **marine invertebrates** and **fish** live at great depths of ocean where pressure is extremely high. These animals can survive only due to their small size, presence of more gelatin, less skeletal structures and absence of cavities which collapse under high pressure.

### Adaptations in Other Organisms

- **Microbes** like archaeobacteria flourish in deep sea hydrothermal vents and hot springs where temperature far exceeds 100°C. This is possible as their cell membrane possesses branched chain lipids to reduce membrane fluidity. They also bear impermeable cell wall.

## Population

A group of organisms living in a well-defined geographical area, sharing or competing for similar resources and can potentially interbreed, constitute a population.

### Population Attributes

A population has certain attributes whereas, an individual organism does not. Thus, population attributes refers to the describing characteristics of the population.

Main attributes of the population are as follows

- **Population density** The size of a population tells about its status in the habitat. The total number of individuals present in a unit area or volume at a specific time, is called its population density.

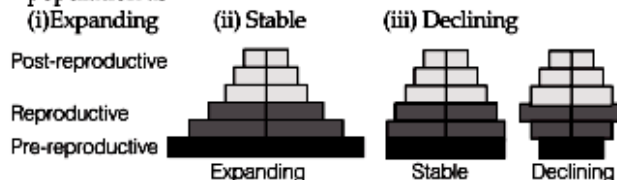
It can be calculated using the following formula,  $D = \frac{N}{S}$

Where,  $D$  = Density,  $N$  = Total number of individuals in a region and  $S$  = Size of unit area in the region

- **Birth rate or Natality** It is the production of new individuals in a population over fixed time period.
- **Death rate or Mortality** Number of individual dying in a population over fixed time period is called death rate.
- **Sex ratio** An individual is either male or female. The number of females and males per 1000 individuals in a given time is called as sex ratio.
- **Age pyramid** Population at any given time is composed of individuals of different ages. When the age distribution (per cent individuals of a given age or age group) is plotted for the population, this is called age pyramid.

- The age pyramids of human population generally show the age distribution of males and females.

- The shape of pyramid reflects the growth status of the population as



## Population Growth

- The size of a population for any species is not a static parameter as it keeps changing with time. It depends on factors such as food availability, predation pressure and adverse weather.
  - The population growth can fluctuate due to the following four processes
    - **Natality** which refers to the number of births during a given period that are added to the initial density.
    - **Mortality** which defines the number of deaths during a given period.
    - **Immigration** which is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.
    - **Emigration** which is the number of individuals of the population who left the habitat and moved somewhere else during the time period under consideration.
- So, if  $N$  is the population density at time  $t$ , then its density at time  $t + 1$  is

$$N_{t+1} = N_t + [(B + I) - (D + E)]$$

where,  $N$  = Population density,  $t$  = Time,

$B$  = Birth rate

$I$  = Immigration

$D$  = Death rate and

$E$  = Emigration

From the above equation we can see that population density will increase, if  $(B + I)$  is more than  $(D + E)$ .

## Growth Models

To study the behaviour and pattern of different populations, the following two models of population growth are used.

### 1. Exponential Growth

- Availability of resources (food and space) is essential for the growth of population. Unlimited availability of such resources results in exponential growth of population. The increase or decrease in population density during a unit time period ( $t$ ) is calculated as

$$\frac{dN}{dt} = (b - d)N$$

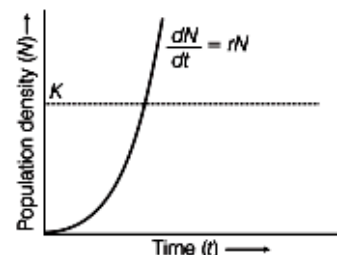
Let  $(b - d) = r$ , then,  $\frac{dN}{dt} = rN$

where,  $N$  is population size,  $b$  is birth per capita,

$d$  is death per capita,  $t$  is time period

and  $r$  is intrinsic rate of natural increase.

- $r$  is an important parameter that assesses the effects of biotic and abiotic factors on population growth. It is different for different organisms, e.g. its value is 0.015 for Norway rat and 0.12 for flour beetle. The above equation results in a J-shaped curve as shown in graph.



Population growth curve showing exponential growth

- Integral form of exponential growth equation is

$$N_t = N_0 e^{rt}$$

where,  $N_t$  = Population density after time  $t$

$N_0$  = Population density at time zero

$r$  = Intrinsic rate of natural increase

$e$  = Base of natural logarithms (2.71828).

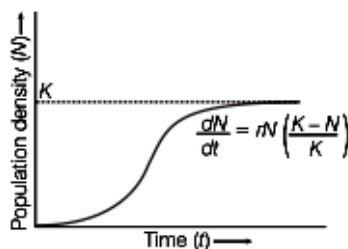
- Any species growing exponentially under unlimited resource conditions without any check, can reach enormous population densities in a short time.

## 2. Logistic Growth

- Practically, no population of any species in nature has unlimited resources at its disposal. This leads to competition among the individuals and the survival of the 'fittest'.
- Therefore, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible.
- This is called the **carrying capacity ( $K$ )** for that species in that habitat.
- When  $N$  is plotted in relation to time  $t$ , the logistic growth shows sigmoid curve and this type of growth is called **Verhulst-Pearl Logistic Growth**. It is calculated as

$$\frac{dN}{dt} = rN \left( \frac{K - N}{K} \right)$$

Where,  $N$  is population density at time  $t$ ,  $K$  is carrying capacity and  $r$  is intrinsic rate of natural increase.



Population growth curve showing logistic growth

- A population growing in a habitat with limited resources shows initially a **lag phase** followed by phases of **acceleration**, **deceleration** and finally an **asymptote phase**, when the population density reaches the carrying capacity ( $K$ ).
- The integral form of logistic growth equation is

$$N_t = \frac{K}{1 + \left[ \frac{K - N_0}{N_0} \right] e^{-rt}}$$

- This model is more **realistic** in nature because no population growth can sustain exponential growth indefinitely as there will be competition for the basic needs due to finite resources.

## Life History Variations

Populations evolve to maximise their reproductive fitness or Darwinian fitness (high  $r$  value) in the habitat where they live. Under a particular set of selection pressures, organisms evolve towards the most efficient reproductive strategy. Some organisms breed only once in their lifetime (e.g. pacific salmon fish, bamboo) while other breed many times during lifetime (most birds and mammals). Some produce a large number of small sized offsprings (oysters, pelagic fish), while others produce a small number of large sized offspring (birds, mammals). The rate of breeding varies from species to species.

## Population Interactions

- In nature, living organisms such as animals, plants and microbes, cannot live in isolation and therefore, interact in various ways to form a biological community.
- Interspecific interactions occur between populations of two different species. These interactions could be beneficial (+), detrimental (-) or neutral (0) as shown in table below

Population interactions and their effects are as follows

Names of Interaction	Effects on Species A	Effects on Species B
Mutualism	+	+
Competition	-	-
Predation	+	-
Parasitism	+	-
Commensalism	+	0
Amensalism	-	0

- Various population interactions are as follows

### 1. Predation

- It is the interspecific interaction, in which an animal (predator) kills and consumes other weaker animal(s) (prey). It is a biological control method, e.g. tiger (predator) and deer (prey). Role of predators is to
  - provide population stability.
  - maintain species diversity in a community.
- Defences developed in prey species to avoid predation are as follows
  - Preys are cryptically coloured, i.e. camouflaged, e.g. insects and frogs.
  - They produce poisonous toxins, e.g. monarch butterfly secretes chemical during caterpillar stage and *Calotropis* secretes cardiac glycosides.
  - 25% of insects are phytophagous, i.e. feed on plant sap and other parts of plants. Therefore, plants evolved by developing various defences against herbivores, e.g. thorns in *Acacia* and cactus are the most common morphological means of defence. Many plants produce and store chemicals which when ingested can make the herbivore sick or even kill it.

### 2. Competition

- It is the interaction in which closely related species compete for the same resources which are limited.
- Gause's competitive exclusion principle** states that two closely related species competing for the same resources cannot coexist indefinitely and the competitively inferior one will be eliminated eventually. This may hold true in case of limited resources.

- **Resource partitioning** is a mechanism evolved by competing species to ensure their coexistence. This refers to competitive coexistence.

### 3. Parasitism

- It is the mode of interaction between two species in which one species (parasite) depends on the other species (host) for food and shelter and damages it. In this process, one organism is benefitted (parasite), while the other is being harmed (host).
- **Types of parasites** Parasites are broadly divided into the following main types
  - **Ectoparasites** are present on the external surface of the host organism for the uptake of food and shelter, e.g. lice on humans, ticks on dogs, copepods in marine fishes, etc.
  - **Endoparasites** live inside the host's body at different sites like liver, kidney, lungs, etc., for food and shelter, e.g. tapeworm, liver fluke, *Plasmodium*, etc. The life cycles of endoparasites are more complex because of their extreme specialisation.
  - **Brood parasitism** in birds is a fascinating example of parasitism in which the parasitic bird lays its egg in the nest of its host and lets the host incubate the eggs.

### 4. Commensalism

- It is the interaction between two species, where one species is benefitted and the other is neither harmed nor benefitted.

- Some examples of commensalism are
  - An orchid growing as an epiphyte on a mango tree gets shelter and nutrition from the mango tree.
  - Barnacles growing on the back of whale are benefitted by getting to move to different locations for food as well as shelter.

### 5. Mutualism

- It is the interaction that confers benefit to both the interacting species. It is an obligate association where two organisms often live together and cannot live separately. Some examples of mutualism are
  - Lichens represent an intimate mutualistic relationship between a fungus and photosynthesising algae or cyanobacteria.
  - Mycorrhizae show close mutual association between fungi and the roots of higher plants, e.g. *Glomus* genus.
  - Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollinated by a species of bee.

### 6. Amensalism

- It is the interaction between different species, in which one species is harmed and the other is neither benefitted nor harmed. The organism which inhibits the growth of the other is called amensal, e.g. *Penicillium*, a mould, secretes penicillin which kills bacteria, but the mould remains unaffected.

## MULTIPLE CHOICE QUESTIONS

**1** The correct sequence of levels of biological organisation is

- (a) Macromolecules → Cells → Tissues → Organs → Individual organism → Population → Communities → Ecosystem → Biomes
- (b) Macromolecules → Tissues → Cells → Organs → Population → Ecosystem → Communities → Biomes
- (c) Micromolecules → Cells → Tissues → Organs → Individual organism → Communities → Population → Biomes → Ecosystem
- (d) Macromolecules → Cells → Tissues → Organs → Individual organism → Biomes → Ecosystem → Population → Communities

**2** The study of interactions among organisms and between the organism and its physical (abiotic) environment is

- (a) ecosystem study                      (b) environmental study  
(c) ecology                                      (d) population study

**3** Identify the basic levels of ecology.

- I. Organisms                      II. Populations  
III. Communities                IV. Biomes  
V. Human                          VI. Vertebrates

Choose the correct option.

- (a) I, II and III                      (b) II, III and VI  
(c) I, II, III and IV                (d) I, II, III and V

**4** Highest level of biological hierarchy in the given options is

- (a) biome                                      (b) ecosystem  
(c) individual                                (d) species

**5** An association of individuals of different species living in the same habitat and having functional interaction

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- (a) ecological niche  
(b) biotic community  
(c) ecosystem  
(d) population

**6** Different organisms are adapted to their environment in terms of not only survival but also reproduction. This statement belongs to

- (a) physiological ecology  
(b) species ecology  
(c) population ecology  
(d) All of these

**7** Major biomes of India include

- I. Tropical rainforest                      II. Alpine region  
III. Deciduous forest                      IV. Desert  
V. Himalayan region                      VI. Sea coast

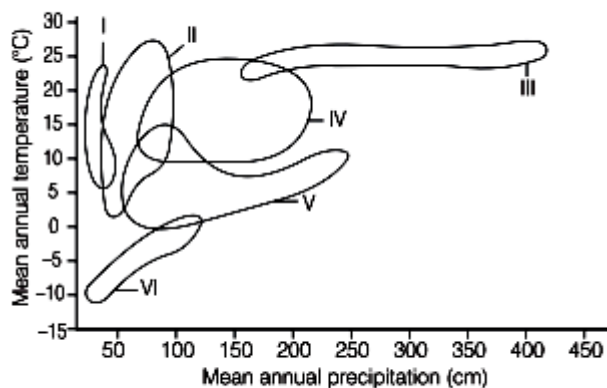
Choose the correct combination for given question.

- (a) I, III, IV and V                      (b) I, II, III and IV  
(c) II, III, IV and VI                      (d) I, III, IV and VI

**8** Formation of major biomes such as desert, rainforest takes place by

- (a) rotation of our planet around the sun  
(b) tilting of our planet to its axis  
(c) Both (a) and (b)  
(d) seasonal periodicity

- 9 In the given graph, identify Coniferous forest, Arctic and Alpine tundra and Tropical forest, respectively.



- (a) I, VI and III                      (b) V, VI and III  
(c) IV, III and I                      (d) I, II and III
- 10 Formation of wide variety of habitats takes place by  
(a) types of species inhabiting that area  
(b) types of predation  
(c) regional and local variation of environment conditions  
(d) All of the above
- 11 Environmental factor(s) that characterise the habitat of an organism is/are  
(a) abiotic components  
(b) biotic components  
(c) Both (a) and (b)  
(d) temperature only
- 12 Forest floors, tree canopies and edges of a pond are an example of  
(a) microhabitat                      (b) microclimate  
(c) ecological niche                      (d) local biome
- 13 The key elements that lead to large variations in the physical and chemical conditions of different habitats are  
(a) the physico-chemical (abiotic) components  
(b) the biotic components like pathogens, parasites, predators and competitors  
(c) Both (a) and (b)  
(d) None of the above
- 14 A defined range of conditions that an organism can tolerate, diversity in the resources it utilises and a distinct functional role in the ecological system, together comprise  
(a) habitat                      (b) niche  
(c) biome                      (d) biosphere
- 15 The most ecologically relevant environmental factor is  
(a) soil                      (b) water  
(c) temperature                      (d) light
- 16 Average temperature of thermal springs and deep sea hydrothermal vents exceeds  
(a) 50°C                      (b) 60°C  
(c) 70°C                      (d) 100°C
- 17 Temperature is very significant to the living beings because  
(a) kinetics of locomotion depend on temperature  
(b) kinetics of enzymes depend on temperature  
(c) high temperature facilitates digestion  
(d) low temperature facilitates digestion

- 19 Given below are some animals

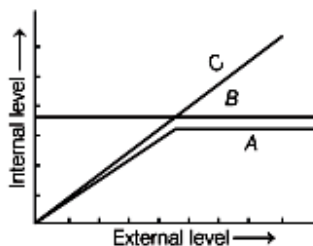
- I. Reptiles                      II. Snails  
III. Killer whales                      IV. Green crab  
V. Desert pupfish                      VI. Amphibians  
VII. Humans

Identify eurythermals from the given examples.

- (a) III, IV, V, and VII                      (b) II, III, IV and VI  
(c) I, II, III and IV                      (d) VII, VI, V and I
- 20 The organism which tolerates wide range of salinity called ...A...  
The organism which tolerates narrow range of salinity called ...B...  
Choose the correct option for A and B.  
(a) A–stenohaline, B–euryhaline  
(b) A–euryhaline, B–stenohaline  
(c) A–isohaline, B–euryhaline  
(d) A–heterohaline, B–isohaline
- 21 Consider the name of the fishes given below.  
I. Salmon                      II. Shark                      III. Sting ray  
Which of them is/are stenohaline and euryhaline?  

Stenohaline	Euryhaline
(a) I, III	II
(b) I, II	III
(c) II, III	I
(d) I	II, III
- 22 Many fishes of freshwater cannot live in sea water and *vice-versa* because of  
(a) nutrient                      (b) osmotic problems  
(c) breathing problems                      (d) excretion problems
- 23 Sunlight is available as a source of energy and is important in  
(a) chemosynthesis  
(b) photosynthesis  
(c) heterotrophic mode of nutrition  
(d) All of the above
- 24 In the oceans, the environment is perpetually dark at  
(a) more than 100 m                      (b) more than 500 m  
(c) less than 100 m                      (d) less than 500 m
- 25 Nature and properties of soil in different places vary due to  
(a) climate  
(b) weathering process  
(c) topography  
(d) All of the above
- 26 Which characteristics determine the percolation and water holding capacity of soils?  
(a) Soil composition                      (b) Grain size  
(c) Aggregation                      (d) All of these
- 27 Factor which does not determine the large extent vegetation of any area is  
(a) pH of soil  
(b) mineral composition of the soil  
(c) water holding capacity of soil  
(d) weather condition

- 28** In aquatic environment, the types of benthic animals are determined by
- type of water
  - type of sediment characteristics
  - light availability
  - nutrient availability
- 29** During the course of million of years of their existence most species should have evolved a relatively ...A... internal environment (within the body of organisms). This internal environment would permit all biochemical reactions and physiological functions to proceed with ...B... efficiency and therefore, increase the overall fitness of the species in terms of ...C... .  
Choose the correct option for A, B and C.
- A-constant, B-minimal, C-thermoregulation
  - A-constant, B-maximal, C-homeostasis
  - A-variable, B-minimal, C-osmoregulation
  - A-constant, B-versatile, C-homeostasis
- 30** Homeostasis is
- maintaining a constant internal environment
  - maintaining a constant external environment
  - Both (a) and (b)
  - maintaining circulation of blood
- 31** Identify the lines present in the given graph A, B and C.




- A-Partial regulators, B-Regulators, C-Endotherms
  - A-Partial regulators, B-Ectotherms, C-Endotherms
  - A-Partial regulators, B-Regulators, C-Conformers
  - A-Conformers, B-Ectotherms, C-Partial regulators
- 32** Regulators are the animals which
- does not maintain their body homeostasis
  - can maintain their body homeostasis
  - can regulate their heartbeat
  - can regulate their circulation
- 33** ...A... regulators are able to maintain homeostasis by means which ensure constant body temperature, constant osmotic concentration, etc. All ...B... and ...C... are a very few lower vertebrates and invertebrate species are indeed capable of such regulation (thermoregulation and osmoregulation). Evolutionary biologists believe that the 'success' of mammals is largely due to their ability to maintain a constant body ...D... and thrive whether they live in Antarctica or in the Sahara desert.  
Choose the correct option for A, B, C and D.
- A-Behavioural, B-vertebrates, C-invertebrates, D-temperature
  - A-Behavioural, B-bird, C-mammals, D-temperature
  - A-Physiological, B-bird, C-mammals, D-temperature
  - A-Behavioural, B-vertebrates, C-invertebrates, D-morphology

- 34** Regulators are also called
- endotherms
  - exotherms
  - ectotherms
  - Either (b) or (c)
- 35** What percentage of animals on this earth are regulators and conformers, respectively?
- 2%, 98%
  - 7%, 93%
  - 4%, 96%
  - 1%, 99%
- 36** Partial regulators are the organisms which
- can regulate body temperature to larger extent of environmental condition
  - can regulate body temperature to limited extent of environmental condition
  - can regulate body temperature only over a wide range of environmental condition
  - None of the above
- 37** An overwhelming majority ...A... of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature ...B... with the ambient temperature. In aquatic animals, the osmotic concentration of the body fluids ...C... with that of the ambient water osmotic concentration. These animals and plants are simply conformers.  
Choose the correct option for A, B and C.
- A-98%, B-changes, C-constant
  - A-97%, B-constant, C-changes
  - A-96%, B-changes, C-constant
  - A-99%, B-changes, C-changes
- 38** Conformers are inactive in adverse conditions due to
- inability to move
  - inability to digest properly
  - inability to maintain homeostasis
  - ability to maintain homeostasis
- 39** It can be said that some animals in their evolutionary development preferred to be conformers than regulators. Which of the following can be the best suited reason for it?
- The metabolic reactions of these organisms can occur at a very wide range of temperature
  - Maintaining homeostasis is an energetically expensive process
  - The enzymes of these organisms are functional at high temperatures
  - Both (b) and (c)
- 40** Conformers are also called
- endotherms
  - ectotherms
  - Both (a) and (b)
  - isotherms
- 41** Very small animals are rarely found in polar region because
- small animals have a larger surface area relative to their volume, so they lose body heat very fast when it is cold outside
  - small animals have a smaller surface area relative to their volume, so they lose body heat very fast when it is cold outside
  - small body volume makes internal heat production very difficult
  - None of the above



- 42** Every winter the famous ...A... (Bharatpur) in Rajasthan host thousands of migratory birds coming from ...B... and other extremely cold ...C... regions. Fill in the blanks A, B and C.
- (a) A—Keolado National Park, B—America, C—West  
 (b) A—Keolado National Park, B—Mexico, C—Eastern  
 (c) A—Keolado National Park, B—Siberia, C—Northern  
 (d) A—Keolado National Park, B—Siberia, C—Southern
- 43** In bacteria, fungi and lower plants, various of thick-walled ...A... are formed, which help them to survive ...B... conditions-these germinate on availability of suitable environment. In higher plants, ...C... and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal—they germinate to form new plants under favourable moisture and temperature conditions.
- Choose the correct option for A, B and C.
- (a) A—spores, B—unfavourable, C—seeds  
 (b) A—seeds, B—unfavourable, C—spores  
 (c) A—seeds, B—favourable, C—spores  
 (d) A—spores, B—favourable, C—seeds
- 44** Animals like snail and fish go into ..... to avoid summer related problem and animal like bear go into ..... to avoid winter related stress.
- (a) aestivation, migration (b) migration, hibernation  
 (c) aestivation, hibernation (d) hibernation, aestivation
- 45** Diapause is a
- (a) stage of development  
 (b) stage of suspended development  
 (c) stage of delayed morphology  
 (d) rapid developmental stage
- 46** Which of the following is an incorrect match?
- (a) Bacteria — Thick-walled resting spores  
 (b) Bear — Hibernation  
 (c) Lizard — Diapause  
 (d) Fish — Aestivation
- 47** Attribute of the organisms (morphological, physiological and behavioural) that enable organisms to survive and reproduce in its habitat are called
- (a) phenotypic plasticity (b) adaptations  
 (c) mimicry (d) surviving abilities
- 48** In the absence of an external source of water, Kangaroo rat in North American desert is capable of meeting all its water requirements through
- (a) internal fat oxidation (b) taking liquid food  
 (c) reducing his activities (d) hibernation
- 49** Which is the characteristic of desert plant adaptation?
- (a) Thick cuticle on their leaf surface  
 (b) Stomata arranged in deep pits  
 (c) Stomata remain closed during day (CAM)  
 (d) All of the above
- 50** An adaptation in *Opuntia* is that, it performs photosynthesis by
- (a) flower (b) stem  
 (c) roots (d) shoot
- 51** ..... rule states that mammals from colder climates generally have shorter ears and limbs to minimise heat loss.
- (a) Allen's rule  
 (b) Bergmann's rule  
 (c) Rensch's rule  
 (d) Jordan's rule
- 52** How seals can survive in polar climate where the temperature prevails below 0°C?
- (a) They have long hairs on their body surface  
 (b) They have thick layer of fat below their skin  
 (c) Both (a) and (b)  
 (d) They have genetic regulation for avoiding cold climate
- 53** Altitude sickness occurs at high mountains. This sickness have symptoms like
- (a) nausea (b) fatigue  
 (c) heart palpitations (d) All of these
- 54** At high altitude, we feel sick and nauseated. The reason for this sickness may be
- (a) low atmospheric pressure  
 (b) high atmospheric pressure  
 (c) high temperature  
 (d) low temperature
- 55** Body compensates for low oxygen availability at due to the altitudes sickness by
- (a) increasing RBC  
 (b) decreasing binding affinity of haemoglobin  
 (c) increasing breathing rate  
 (d) All of the above
- 56** In most animals, the metabolic reactions proceed in a ...A... temperature range (in humans, it is 37°C). But there are microbes (archaebacteria) that flourish in hot springs and deep sea hydrothermal vents where temperatures far exceed ...B... .
- Choose the correct option for A and B.
- (a) A—narrow, B—100°C  
 (b) A—broad, B—100°C  
 (c) A—median, B—100°C  
 (d) A—broad, B—40°C
- 57** Which of the following problems does the frequent deep sea diving organisms like whales may face?
- (a) Compression of tissues surrounding air-filled cavities  
 (b) High blood nitrogen levels  
 (c) Lack of oxygen  
 (d) All of the above
- 58** Whales can resist tissue compression during deep sea diving because they have
- (a) special proteins that prevent air absorption  
 (b) extensive blood vasculature which swells up to reduce the size of air-filled cavities  
 (c) thick coat of fat around body that works as an insulator  
 (d) None of the above
- 59** Desert lizards lack the ...A... ability that mammals have to deal with the ...B... temperatures of their habitat, but manage to keep their body temperature fairly constant by ...C... means.
- Choose the correct option for A, B and C.
- (a) A—morphological, B—high, C—behavioural  
 (b) A—physiological, B—high, C—behavioural  
 (c) A—behavioural, B—high, C—physiological  
 (d) A—physiological, B—high, C—morphological

- 60** Population is the total number of  
 (a) interbreeding individuals of a species found in a geographical area  
 (b) interbreeding individuals of a species found in different geographical area  
 (c) Both (a) and (b)  
 (d) None of the above
- 61** If in a pond, there are 20 lotus plants of last year and through reproduction 8 new plants are added. Then, the birth rate is  
 (a) 0.8 offspring per lotus per year  
 (b) 0.2 offspring per lotus per year  
 (c) 0.4 offspring per lotus per year  
 (d) 0.6 offspring per lotus per year
- 62** Individuals alive at the beginning of 1 year to 2 years age interval is 800. During this interval 200 individuals die. Then find out the death rate.  
 (a) 200 (b) 800  
 (c) 0.4 (d) 0.25
- 63** Sex ratio is the  
 (a) ratio of females to males  
 (b) ratio of males to females  
 (c) Both (a) and (b)  
 (d) ratio of infant girl to infant boy
- 64** If birth rate is 100, death rate is 10 and number of individuals in population group is 1000, then what will be the percentage of natural growth rate?  
 (a) 0.09% (b) 9.0%  
 (c) 0.9% (d) 90%
- 65** If the age distribution is plotted for a population, the resulting structure is called as  
 (a) age graph (b) age curve  
 (c) age pyramid (d) age diagram
- 66** Ecological age groups of populations are  
 I. Pre-reproductive  
 II. Reproductive  
 III. Post-reproductive  
 IV. Old-age group  
 V. Adolescent age group  
 VI. Infertile age group  
 Choose the correct combination.  
 (a) I, II and III (b) III, IV and V  
 (c) IV, V and VI (d) I, V and VI
- 67** The age structure of a population represents  
 (a) relative number of individuals at each age  
 (b) number of newborns each year  
 (c) number of individuals reaching puberty each year  
 (d) relative number of deaths at each age

- 68** Age structure of a population influences population growth because  
 (a) different age groups have different reproductive capabilities  
 (b) different age groups have same reproductive capabilities  
 (c) more young individuals indicate decreasing population  
 (d) All of the above
- 69** Under normal conditions positive growth or rapid increase in the population is indicated by  
 (a) less number of young individuals  
 (b) large number of young individuals  
 (c) large number of old individuals  
 (d) large number of childbirth
- 70** The age pyramid with broad base indicates  
 (a) high percentage of young individuals  
 (b) low percentage of young individuals  
 (c) high percentage of old individuals  
 (d) All of the above
- 71** Post-reproductive  
 Reproductive  
 Pre-reproductive
- 

Select the correct option with respect to age pyramids.

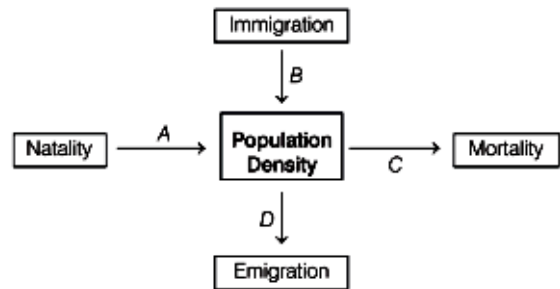
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- (a) A–Expanding, B–Stable, C–Declining  
 (b) A–Stable, B–Expanding, C–Declining  
 (c) A–Stable, B–Declining, C–Expanding  
 (d) A–Declining, B–Stable, C–Expanding

- 72** In a growing population of a country, **NEET 2018**  
 (a) reproductive and pre-reproductive individuals are equal in number  
 (b) reproductive individuals are less than the post-reproductive individuals  
 (c) pre-reproductive individuals are more than the reproductive individuals  
 (d) pre-reproductive individuals are less than the reproductive individuals
- 73** Bell-shaped age pyramid indicates that  
 (a) number of pre-reproductive and reproductive individual is almost equal  
 (b) post-reproductive individuals are comparatively fewer  
 (c) the population size remains stable  
 (d) All of the above
- 74** Zero growth of population is indicated by  
 (a) less number of childbirth  
 (b) less number of reproductive females  
 (c) reproductive individuals are equal to pre-reproductive individuals  
 (d) less number of males than females

- 75** When there is a large number of post-reproductive or older individuals and lesser number of pre-reproductive individuals then that population is  
 (a) growing (b) declining  
 (c) stable (d) None of these
- 76** Population size is more technically called  
 (a) population density (b) demography  
 (c) population growth (d) population dynamics
- 77** In some cases, population density is measured in terms of biomass rather than in terms of number because  
 (a) it is more meaningful measure when the considered organisms vary greatly in size  
 (b) it is more convenient when population is huge and counting is impossible or very time consuming  
 (c) it is relatively constant measure  
 (d) Both (a) and (b)
- 78** Which of the following is not an example of using relative density to measure population density in a certain area?  
 (a) Counting pugmarks of tigers to find population density of tigers in a forest  
 (b) Counting the number of fishes caught in a trap to find population density of fishes in a lake  
 (c) Measuring biomass of bacterial culture to find out population density of bacteria in a petri dish  
 (d) Both (a) and (c)
- 79** For which of the following cases, population density can be easily determined by utilising non-biological parameter?  
 (a) Fish density  
 (b) Density of bacteria in culture plate  
 (c) Siberian cranes in Bharatpur wetlands  
 (d) Tiger census
- 80** Population of any species is  
 (a) a static phenomena (b) a dynamic phenomena  
 (c) Neither (a) nor (b) (d) Both (a) and (b)
- 81** Population density of a population in a given habitat during a given period fluctuates due to the change in  
 (a) natality and mortality (b) immigration  
 (c) emigration (d) All of these
- 82** Natality refers to **NEET 2018**  
 (a) number of individuals leaving the habitat  
 (b) birth rate  
 (c) death rate  
 (d) number of individuals entering a habitat
- 83** A biologist studied the population of rats in a barn. He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is **NEET 2013**  
 (a) 10 (b) 15  
 (c) 05 (d) zero

- 84** Study the figure and identify A to D.



- (a) A-Increase, B-Decrease, C-Increase, D-Decrease  
 (b) A-Decrease, B-Increase, C-Decrease, D-Increase  
 (c) A-Increase, B-Increase, C-Decrease, D-Decrease  
 (d) A-Decrease, B-Decrease, C-Increase, D-Increase
- 85**  $A \xrightarrow{\oplus} \text{Population density} \xleftarrow{\ominus} B$ .  
 If A increases population density and B decreases it then choose the correct option of A and B.  
 (a) A can be mortality which brings positive change in population density  
 (b) B can be emigration which brings negative change in population density  
 (c) values of A and B can never be equal  
 (d) Both (b) and (c)
- 86** If natality is represented by  $-B$   
 If mortality is represented by  $-D$   
 If immigration is represented by  $-I$   
 If emigration is represented by  $-E$   
 If population density is represented by  $-N$   
 Then, population density at time  $t+1$  is represented by  
 (a)  $N_{t+1} = N_t - [(B+I) - (D+E)]$   
 (b)  $N_{t+1} = N_t + [(B+I) - (D+E)]$   
 (c)  $N_{t+1} = N_t + [(B+I) + (D+E)]$   
 (d)  $N_{t+1} = N_t - [(B+I) + (D+E)]$
- 87** Under normal condition, ...A... and ...B... are the most important factors influencing population density, ...C... and ...D... assuming importance only under special condition.  
 Choose the correct option for A, B, C and D.  
 (a) A-mortality, B-natality, C-emigration, D-immigration  
 (b) A-immigration, B-natality, C-emigration, D-mortality  
 (c) A-emigration, B-natality, C-mortality, D-immigration  
 (d) A-emigration, B-immigration, C-mortality, D-natality
- 88** Ratio between natality and mortality is called  
 (a) population ratio (b) vital index  
 (c) density co-efficient (d) census ratio
- 89** Who stated that human population grows geometrically?  
 (a) Malthus (b) Darwin  
 (c) Cannon (d) Lamarck

**90** Geometric representation of age structure is a characteristic of

- (a) biotic community (b) population  
(c) landscape (d) ecosystem

**91** Exponential growth occurs when

- (a) there is only sexual reproduction  
(b) there is only asexual reproduction  
(c) there is a fixed carrying capacity  
(d) no inhibition from crowding

**92** If  $b$  represents  $\rightarrow$  Birth rate

If  $d$  represents  $\rightarrow$  Death rate

If  $dN$  represents  $\rightarrow$  Increase or Decrease in population size

Then, exponential growth is represented by

- (a)  $dN/dt = (b + d) \times N$   
(b)  $dN/dt = (b - d) \times N$   
(c)  $dN/dt = (d - b) \times N$   
(d)  $dN/dt = (d - b)^N$

**93** In the exponential growth equation, if  $b - d$  is represented by  $r$ , then ' $r$ ' may be called as

- (a) intrinsic rate of natural increase  
(b) extrinsic rate of natural increase  
(c) morphological rate of natural increase  
(d) phenotypical rate of natural increase

**94** Population A—has the intrinsic rate of natural increase is 0.2.

Population B—has the intrinsic rate of natural increase is 0.3.

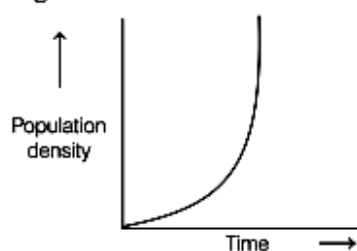
Population C—has the intrinsic rate of natural increase is 0.4.

Population D—has the intrinsic rate of natural increase is 0.5.

Which population will increase fastest among all of the given population?

- (a) D (b) C  
(c) B (d) A

**95** Below diagram indicates



- (a) exponential growth curve  
(b) logistic growth pattern  
(c) J-shaped curve  
(d) Both (a) and (c)

**96** No population of any species in nature has at its disposal ...A... resources to permit exponential growth. This leads to competition between individuals for ...B... resources. Eventually, the ...C... individual will survive and reproduce.

Choose the correct option for A, B and C.

- (a) A—limited, B—limited, C—fittest  
(b) A—limited, B—unlimited, C—fittest  
(c) A—unlimited, B—limited, C—fittest  
(d) A—unlimited, B—unlimited, C—fittest

**97** Carrying capacity is the capacity of

- (a) habitat that has resources to sustain certain number of individuals  
(b) population to reproduce and competitiveness  
(c) population to reproduce  
(d) individuals to fit among the natural environment

**98** Logistic growth is represented by which equation?

- (a)  $\frac{dN}{dt} = rN \left( \frac{K - N}{K} \right)$  (b)  $\frac{dN}{dt} = rN \left( \frac{K - N}{N} \right)$   
(c)  $\frac{dN}{dt} = rN \left( \frac{K + N}{K} \right)$  (d)  $\frac{dN}{dt} = rN \left( \frac{K}{K + N} \right)$

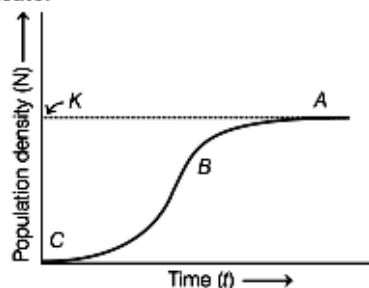
**99** Logistic growth occurs when there is

- (a) no resistance from increasing population  
(b) unlimited food  
(c) fixed carrying capacity  
(d) All of the above

**100** Which of the following is true regarding exponential growth?

- (a) No population can grow exponentially for long  
(b) Exponential growth slows down as the population nears its log phase  
(c) Bacterial colonies have been observed to maintain exponential growth always  
(d) Exponential growth is a commonly observed in large, slow-growing species such as humans and elephants

**101** Given population growth curve represents the logistic growth curve. In this curve, find out what do A, B and C indicate.



- (a) A—Lag phase, B—Log phase, C—Stationary phase  
(b) A—Log phase, B—Lag phase, C—Stationary phase  
(c) A—Stationary phase, B—Log phase, C—Lag phase  
(d) A—Stationary phase, B—Lag phase, C—Log phase

- 102** If  $b = 65$  and  $d$  is  $= 45$ ,  $N = 100$  then find out  $dN/dt$   
 (a) 2000 (b) 1000  
 (c) 200 (d) 100
- 103** When does the growth rate of a population following the logistic model equal zero? The logistic model is given as  $dN/dt = rN(1-N/K)$  **NEET 2016**  
 (a) when  $N$  nears the carrying capacity of the habitat  
 (b) when  $N/K$  equals zero  
 (c) when death rate is greater than birth rate  
 (d) when  $N/K$  is exactly one
- 104** Which model is considered a more realistic one?  
 (a) Logistic model  
 (b) Exponential model  
 (c) Geometric model  
 (d) J-shaped model
- 105** Asymptote in a logistic growth curve is obtained, when **NEET 2017**  
 (a) The value of ' $r$ ' approaches zero  
 (b)  $K = N$   
 (c)  $K > N$   
 (d)  $K < N$
- 106** Populations evolve to maximise their reproductive fitness are also called  
 (a) Mendel's fitness  
 (b) Darwinian fitness  
 (c) Lamarck's fitness  
 (d) Individual fitness
- 107** Life history traits of organisms have evolved in relation to the constraints imposed by which components of habitat?  
 (a) Organic components  
 (b) Abiotic components  
 (c) Biotic components  
 (d) Both (b) and (c)
- 108** Choose the incorrect match for life history variations in various organisms.  
 (a) Breeds only once in their life – Pacific salmon fish, bamboo  
 (b) Breeds many times during lifetime – Most birds, mammals  
 (c) Produces large number of small-sized offspring – Birds  
 (d) Produces large number of large-sized offspring – Mammals
- 109** Even a plant species, which makes its own food, cannot survive alone, it needs soil microbes to breakdown the ... $A$ ... matter in soil and return the ... $B$ ... nutrients for absorption. And then, how will the plant manage pollination without an animal agent? It is obvious that in nature, animals, plants and microbes cannot live in ... $C$ ... but interact in various ways to form a biological community.  
 Choose the correct option for  $A$ ,  $B$  and  $C$ .  
 (a)  $A$ -inorganic,  $B$ -organic,  $C$ -isolation  
 (b)  $A$ -organic,  $B$ -inorganic,  $C$ -isolation  
 (c)  $A$ -organic,  $B$ -inorganic,  $C$ -community  
 (d)  $A$ -inorganic,  $B$ -organic,  $C$ -community
- 110** Interspecific interactions arise from the interaction of  
 (a) population of two different species  
 (b) population of same species  
 (c) two individuals of same species  
 (d) two individuals of different area

- 111** Interspecific interaction could be  
 (a) beneficial (b) detrimental  
 (c) neutral (d) All of these
- 112** If '+' sign is assigned to beneficial interaction, '-' sign to detrimental and '0' sign to neutral interaction, then the population interaction represented by '+', '-', '0' refers to **NEET 2016**  
 (a) mutualism (b) amensalism  
 (c) commensalism (d) parasitism
- 113** Population interactions
- | Organisms A | Organisms B | Names of interaction |
|-------------|-------------|----------------------|
| +           | +           | Mutualism            |
| -           | -           | $A$                  |
| +           | -           | Predation            |
| +           | -           | $B$                  |
| +           | 0           | Commensalism         |
| -           | 0           | $C$                  |
- '+' sign for beneficial interaction.  
 '-' sign for harmful (detrimental) interaction.  
 '0' sign for neutral interaction.  
 Find out what could be  $A$ ,  $B$  and  $C$ .  
 (a)  $A$ -Amensalism,  $B$ -Parasitism,  $C$ -Competition  
 (b)  $A$ -Competition,  $B$ -Parasitism,  $C$ -Amensalism  
 (c)  $A$ -Competition,  $B$ -Amensalism,  $C$ -Parasitism  
 (d)  $A$ -Amensalism,  $B$ -Competition,  $C$ -Competition
- 114** The population interaction in which free-living organism that catches, kills and devours individuals of other species called prey is called  
 (a) parasitism (b) predation  
 (c) amensalism (d) commensalism
- 115** Predation is  
 (a) an unnatural way of transferring of energy to higher trophic level  
 (b) a natural way of transferring of energy to higher trophic level  
 (c) harmful to the natural balance  
 (d) All of the above
- 116** Animals eating plants are categorised separately as ... $A$ ..., they are in a broad ecological context, not very different from ... $B$ ...  
 Choose the correct option  $A$  and  $B$ .  
 (a)  $A$ -herbivores;  $B$ -predator  
 (b)  $A$ -herbivores;  $B$ -omnivores  
 (c)  $A$ -omnivores;  $B$ -herbivores  
 (d)  $A$ -omnivores;  $B$ -predator
- 117** Exotic species are also called  
 I. introduced species  
 II. alien species  
 III. non-indigenous species  
 IV. non-native species  
 Choose the correct combination.  
 (a) I, II and III (b) II, III and IV  
 (c) I, III and IV (d) I, II, III and IV
- 118** Exotic species sometimes become invasive and starts spreading fast because of  
 (a) natural predators  
 (b) abundant natural competitor  
 (c) invaded land not having its natural predators  
 (d) mutation in their genome

- 119** The prickly pear cactus becomes unusually abundant after its introduction in Australia because it  
 (a) does not have its predator  
 (b) formed new mycorrhizal association  
 (c) lost its thorns  
 (d) All of the above
- 120** Prickly pear cactus (an exotic species) can be brought under control (in Australia) by using  
 (a) babul eating predators (b) kikar eating predators  
 (c) cactus feeding predators (d) intensive herbicides
- 121** Predators also help in ...A... species diversity in a community, by ...B... the intensity of competition among competing prey species. Here, A and B can be  
 (a) A-exceeding; B-increasing  
 (b) A-maintaining; B-reducing  
 (c) A-reducing; B-maintaining  
 (d) A-maintaining; B-increasing
- 122** Starfish *pisaster* is the important predator in intertidal communities of  
 (a) American pacific coast (b) Indian pacific coast  
 (c) Middle pacific coast (d) East Indian lakes
- 123** 'Cryptically-coloured' (camouflaged) is a technique through which prey can  
 (a) feed abundantly  
 (b) lessen the impact of predator  
 (c) increase their number  
 (d) increase their reproductive fitness
- 124** Monarch butterflies are highly distasteful to predator due to  
 (a) its ugly look  
 (b) a special chemical present in his body  
 (c) Both (a) and (b)  
 (d) a poison secreted by their special glands
- 125** You never see any cattle or goat browsing on *Calotropis* due to  
 (a) its appearance  
 (b) production of foul odour  
 (c) production of cardiac glycosides  
 (d) distastefulness of its leaves
- 126** Which of the following is not an example of a defence used by plants against herbivores?  
 (a) Production of caffeine, tannins and quinine  
 (b) More production of non-woody tissues  
 (c) Production of hairs, thorns, spines  
 (d) Production of hormone-like chemicals that interfere with insect metamorphosis
- 127** Which of the following is not an example of prey-predator relationship?  
 (a) Tiger eating deer  
 (b) Plant *Nepenthes* trapping an insect  
 (c) Bacteria decomposing organic matter  
 (d) Crocodile killing a man
- 128** In which of the following interactions both partners are adversely affected? **CBSE-AIPMT 2015**  
 (a) Competition (b) Predation  
 (c) Parasitism (d) Mutualism
- 129** On the rocky sea coasts of Scotland, the larger and competitively superior barnacle *Balanus* dominates the intertidal areas and excludes the smaller barnacle *Chthamalus* from that zone. Which kind of interaction is being depicted by this example?  
 (a) Predator (b) Parasitism  
 (c) Commensalism (d) Competition
- 130** Level of competition between species depends on  
 (a) availability of resources  
 (b) population density  
 (c) group interaction of organism  
 (d) All of the above
- 131** When Darwin spoke of the struggle for the existence and survival of the fittest in the nature, he was convinced that  
 (a) intraspecific competition is a potent force in organic evolution  
 (b) interspecific competition is a potent force in organic evolution  
 (c) intensive reproduction is the potent force in organic evolution  
 (d) intensive predation is the potent force in organic evolution
- 132** Competition is best defined as a process in which the fitness of one species (measured in terms of its 'r' the intrinsic rate of increase) is significantly  
 (a) lower in the presence of another superior species  
 (b) higher in the presence of another superior species  
 (c) equal in the presence of another superior species  
 (d) equal in the presence of their own species
- 133** A species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species is found to expand its distributional range dramatically when the competing species is experimentally removed. This is called as  
 (a) competitive exclusion (b) competitive release  
 (c) predation (d) mutualism
- 134** The principle of competitive exclusion was stated by  
 (a) C Darwin (b) GF Gause **NEET 2016**  
 (c) MacArthur (d) Verhulst and Pearl
- 135** Gause's principle of competitive exclusion states that **NEET 2016**  
 (a) competition for the same resources excludes species having different food preferences  
 (b) no two species can occupy the same niche indefinitely for the same limiting resources  
 (c) larger organisms exclude smaller ones through competition  
 (d) more abundant species will exclude the less abundant species through competition
- 136** Species facing competition might evolve mechanism that promotes coexistence rather than exclusion. One such mechanism is  
 (a) competitive release  
 (b) resource partitioning  
 (c) coevolution  
 (d) None of the above

**137** Read the following reasons for the adaptation in parasites.

- I. loss of unnecessary organs.
- II. presence of adhesive organs.
- III. origin of suckers to cling to host.
- IV. loss of digestive system.
- V. high reproductive capacity.

Choose the correct option.

- (a) I, III and IV
- (b) II, IV and V
- (c) I, IV and V
- (d) I, II, III, IV and V

**138** Parasite that feed on the external surface of the host organism is called

- (a) endoparasite
- (b) ectoparasite
- (c) brood parasite
- (d) None of these

**139** ....A... parasite have simple life cycle and ....B.... parasite have complex life cycle.

- (a) A-Ecto, B-endo
- (b) A-Endo, B-brood
- (c) A-Brood, B-endo
- (d) A-Brood, B-ecto

**140** An interaction in which one organism is benefitted and other is unaffected **JIPMER 2019**

- (a) predation
- (b) commensalism
- (c) mutualism
- (d) parasitism

**141** Between which among the following, the relationship is not an example of commensalism? **NEET (Odisha) 2019**

- (a) Orchid and the tree on which it grows
- (b) Cattle egret and grazing cattle
- (c) Sea anemone and clown fish
- (d) Female wasp and fig species

**142** Which of the following is correct for *r*-selected species? **NEET 2016**

- (a) Large number of progeny with small size
- (b) Large number of progeny with large size
- (c) Small number of progeny with small size
- (d) Small number of progeny with large size

**143** Lichen is an example of

- (a) parasitism
- (b) predation
- (c) commensalism
- (d) mutualism

**144** Lichens represent an intimate mutualistic relationship between

- (a) fungus and bacteria
- (b) fungus and photosynthetic algae
- (c) fungus and archaebacteria
- (d) fungus and plants

**145** Mycorrhiza represents an intimate mutualistic relationship between

- (a) fungi and stem of higher plants
- (b) fungi and roots of higher plants
- (c) fungi and leaves of higher plants
- (d) fungi and leaflets of higher plants

**146** Which one of the following plants shows a very close relationship with a species of moth, where none of the two can complete its life cycle without the other? **NEET 2018**

- (a) Banana
- (b) *Yucca*
- (c) *Hydrilla*
- (d) *Viola*

**147** Pseudocopulation occurs in

- (a) maize
- (b) *Ophrys*
- (c) mango
- (d) papaya

**148** The plant-animal interaction often involve coevolution of the mutualists, so that

- (a) the mutually beneficial system could be safeguarded against cheaters
- (b) a given plant species can be pollinated only by its partner animal species and no other species
- (c) the animal utilises plant not only for oviposition but also to pollinate the plant
- (d) All of the above

**149** The interdependent evolution of the flowering plants and pollinating insects together is known as

- (a) mutualism
- (b) coevolution
- (c) commensalism
- (d) cooperation

**150** In ..... one species is harmed whereas the other is unaffected.

- (a) predation
- (b) amensalism
- (c) commensalism
- (d) parasitism

**151** Which one of the following population interactions is widely used in medical science for the production of antibiotics?

- (a) Parasitism
- (b) Mutualism
- (c) Commensalism
- (d) Amensalism

## SPECIAL FORMAT QUESTIONS

**1** Read the following statements.

- I. The levels of thermal tolerance of different species determinate a large extent their geographical distribution.
  - II. Life on earth originated in water and is unsustainable without water.
  - III. The salt concentrations (measured as salinity in parts per thousand) is less than 5 in inland waters, 30-35 in the sea and > 100 in some hypersaline lagoons.
  - IV. Many animals use the diurnal and seasonal variations in light intensity and duration as cues for timing their foraging, reproductive and migratory activities.
- Which of the given above statements are correct?

- (a) I, II and III                      (b) II, III and IV  
(c) I, III and IV                      (d) I, II, III and IV

**2.** Consider the following statements about regulation in humans.

- I. In summer, we sweat profusely causing evaporative cooling brings down the body temperature.
- II. In winters, we shiver which is an exercise that produces heat and raises the body temperature.

Choose the correct option.

- (a) Statement I is true, but II is false  
(b) Statement II is true, but I is false  
(c) Both statements are true  
(d) Both statements are false

**3.** Read the following statements and choose the correct statement.

- (a) Species ability to adapt is over a limited range of environment
- (b) If stressful external conditions are localised or remain only for a short duration the organism regulate for survival
- (c) Migration is moving away permanently from the stressful habitat to more hospitable area and return when stressful period is over
- (d) All of the above

- 4.**
- I. Desert lizard bask in the sun and absorbs heat when their body temperature drops below the comfort zone, but move into shade when the ambient temperature starts increasing.
  - II. Some species like rabbits and ground hog are capable of burrowing into the soil to hide and escape from the above ground heat.

Above statements are the examples of

- (a) cursorial adaptation      (b) behavioural adaptation  
(c) fossorial adaptation      (d) scansorial adaptation

- 5.**
- I. Many xerophytic plants have thick cuticle on leaf epidermis and sunken stomata.
  - II. Some xerophytic plants have special photosynthetic pathway (CAM) that enables their stomata close during day.
  - III. *Opuntia* has spines (modified leaves), photosynthetic phylloclade (stem).
  - IV. Adaptations are genetically fixed in organisms.

Choose the correct statements.

- (a) I, II, III and IV                      (b) II, III and IV  
(c) III, IV, and I                      (d) I, II and III

**6.** Consider the following statements.

- I. The number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration is called emigration.
- II. The number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration is called immigration.

Choose the correct option.

- (a) Statement I is true and II is false  
(b) Statement I is false and II is true  
(c) Both the statements are true  
(d) Both the statements are false

**7.** Read the following statements.

- I. Any species growing exponentially under unlimited resource condition can reach enormous population densities in short time.
- II. Darwin showed how even a slow growing animal like element could reach enormous numbers in the absence of check.
- III. If there are non-limiting or unlimited conditions are provided then natality and mortality decrease within a population.

Choose the correct option.

- (a) Statements I and II are correct  
(b) Statements I and III are correct  
(c) Statements II and III are incorrect  
(d) All statements are incorrect

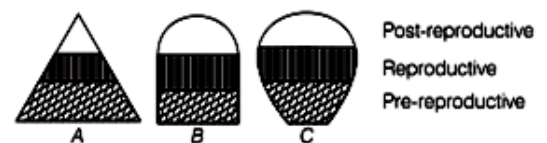
**8.** Read the following statements.

- I. In a population, birth rate and death rate refer to per capita births and deaths, respectively.
- II. In nature, we rarely find isolated single individuals of any species.
- III. The size of population for any species is stable phenomena.
- IV. Ecological effects of any factors on a population growth are generally reflected in its size/population density.

Choose the correct statements.

- (a) I and II                                      (b) II and III  
(c) I, II and III                              (d) I, II and IV

**9.** Read the following statements and choose the correct one.



- (a) A is a triangular age pyramid, where pre-reproductive stage is very large as compared to the reproductive and post-reproductive stages of the population. This type of age structure indicates that the population would increase rapidly
- (b) B is an inverted bell-shaped age pyramid where number of pre-reproductive and reproductive individuals is almost equal. This type of age structure indicates that the population is stable
- (c) C is an urn-shaped age pyramid where more number of reproductive individuals are present. This type of age structure indicates that the population is declining
- (d) All of the above



**10.** For a situation when food and space for a population are unlimited, which of the following statements given below represent incorrect features?

- I. Each species has the ability to realise fully its inherited potential to grow.
- II. Then, it is equal to  $dN/dt = rN$ .
- III. It is described by J-shaped curve.
- IV. It is described by S-shaped curve.
- V. That it has greater intrinsic rate for resources.
- VI. There are more competition among themselves.

- (a) I, II and III
- (b) II, III and IV
- (c) IV and VI
- (d) IV, V and VI

**11.** Which one is the correct statement for logistic model of population growth?

- I. Population growth rate increases as the size of population approaches the carrying capacity.
- II. All individuals have same effect on population growth.
- III. There are unlimited natural resources.
- IV. As population increases the competition goes on increasing.

- (a) I and II
- (b) Only IV
- (c) IV and III
- (d) I and III

**12.** In an area, there are 200 *Parthenium* and a single banyan tree. For the information given above which of the following conclusive statement(s) is/are correct?

- I. Population density of banyan is high.
- II. Population cover area of banyan is high.
- III. In above case, the percentage of cover area or biomass is more meaningful than population size.

- (a) Only I
- (b) I and II
- (c) II and III
- (d) I, II and III

**13.** I. Populations evolve to maximise their reproductive fitness, also called Darwinian fitness (higher  $r$  value), in the habitat in which they live.

- II. The population growth rate  $r$  is inversely related to generation time.
- III. The housefly, which has a short lifespan and produces a large number of eggs, could be considered as a 'K' selected species.
- IV. Under a particular set of selection pressures, organisms evolve towards the most efficient reproductive strategies.

V. Life history traits of organisms have evolved in relation to the constraints imposed by biotic and abiotic factors in their habitat.

Select the correct option from the statements given above.

- (a) I, II and III
- (b) I, III and IV
- (c) III, IV and V
- (d) All except III

**14.** Consider the following statements.

- I. Brood parasitism in birds is an example of parasitism in which the parasitic bird lays its eggs in the nest of its host and host incubates them.
- II. During the course of evolution, the eggs of the parasite bird have evolved to resemble the host's eggs in size and colour to reduce the chances of the host bird detecting the foreign eggs and removing them from the nest.

- (a) Statement I is true, but II is false
- (b) Statement I is false, but II is true
- (c) Both statements are true
- (d) Both statements are false

**15.** Read the following statements.

- I. Parasite that feed on the external surface of the host organism.
- II. Lice on humans and ticks on dogs.
- III. Marine fish infested with copepods.
- IV. *Cuscuta* growing on hedge plant.
- V. Parasite that lives inside the host body at different sites to derive benefit.
- VI. Liver fluke living inside the animal body.

Choose the correct option.

	Endoparasite	Ectoparasite
(a)	I, II, III	IV, V, VI
(b)	V, VI	I, II, III, IV
(c)	I, II, VI	III, IV, V
(d)	III, IV, V	I, II, VI

**16.** Read the following statements about 'recent studies supporting competition' as suggested in 'Gause's competitive exclusion principle'.

- I. Gause's hypothesis says if two species compete for same resources then one will be eliminated by another species.
- II. More recent studies point out that species facing competition might evolve mechanisms that promote coexistence rather than exclusion.
- III. Gause's competitive exclusion principle is effective when resources are in excess.
- IV. Unlimited resources give better opportunity for adaptation.

**17.** Choose the correct combination of statements.

- (a) I and II
- (b) I, II and IV
- (c) III and IV
- (d) I and IV

- I. The human liverfluke, a nematode parasite, depends on two intermediate hosts (snail and fish) to complete its life cycle.
- II. The malaria parasite needs a vector (mosquito) to spread to other hosts.
- III. The female mosquito is not considered parasite, however it needs our blood for reproduction.

- IV. In case of brood parasitism, the eggs of parasitic birds (e.g. cuckoo) are not detected and ejected from the nest because of parasite's eggs resemble the hosts eggs in morphology and colour.
- V. A population of frogs protected from all predators would increase indefinitely with unlimited food resources.

Which statements are correct?

- (a) I and II                      (b) II and III  
(c) III, IV and V                (d) I, II, III and IV
- 18.** Which of the following statements are incorrect?
- (a) Host is an organism which provides food and shelter to another organism  
(b) Amensalism is a relationship in which one species is benefitted, whereas the other is unaffected  
(c) Predator is an organism that catches and kills other organism for food  
(d) Parasite is an organism which always lives inside or on the body of other organism and may kill it
- 19.** Which of the following statements regarding species interdependence are true?
- (a) An association of two species where one is benefitted and other remains unaffected is called mutualism  
(b) An interspecific association where both partners derive benefit from each other is called commensalism  
(c) A direct food relation between two species of animals in which one animal kills and feeds on another is referred as parasitism  
(d) A relationship between two organisms of different species where both the organisms are benefitted from each other is called symbiosis
- 20.** Choose the incorrect statement.
- (a) Mutualistic relationships evolve when benefit of both species out weights the costs  
(b) Mutualistic relationship evolves when benefits of both species under weight the costs  
(c) Humans cause ecological imbalance by eradicating common parasites  
(d) Humans cause altering competition between species
- 21.** Choose the incorrect statement.
- (a) Parasite might render the host more vulnerable to predation by making it physically weak  
(b) Majority of the parasites harm the host and reduce the population density  
(c) Ideal parasite should be able to thrive within host without harming it  
(d) Malarial parasite does not need a vector (mosquito) to spread to other host

- 22.** Choose the incorrect statement.
- (a) Two closely related species may not live in same habitat  
(b) The more dissimilar the niches of two species the stronger is their competition  
(c) Two species cannot occupy the same niche in geographical area  
(d) Two species may occupy the same ecosystem
- 23.** Which one of the following is incorrect?
- (a) Eutrophic lakes are rich in nutrient and has high biological productivity  
(b) Animals do not respond to photoperiods, but plants do so  
(c) Oligotrophic lakes are poor in nutrients, clear and with low biological productivity  
(d) Mesotrophic lakes have properties in between eutrophic and oligotrophic lakes
- 24.** Which of the following is correct?
- (a) Antarctic fishes can survive below 0°C as these have antifreeze solutes in their body  
(b) Archaeobacteria can flourish in hot springs and deep sea hydrothermal vents where temperature is above 100°C  
(c) Desert lizard lacks the physiological ability to cope with extreme temperature, but manage the body temperature by behavioural means  
(d) All of the above
- 25.** Which of the following is correct?
- (a) Parasites do not tend to coevolve with the host  
(b) 'Brood parasitism' is absent in cuckoo  
(c) In general, herbivores and plants appear to be more adversely affected by competition than carnivores  
(d) The life cycle of parasites is often very simple involving one intermediate host or vector
- 26.** Choose the correct statement.
- (a) Among the red, green and brown algae, the red algae are found in the deepest ocean  
(b) Animals restricted to a narrow range of salinity are euryhaline  
(c) Every winter, the famous Keoladeo National Park (Odisha) hosts thousands of migratory birds  
(d) The mammals of colder climates generally have longer extremities to minimise heat loss
- 27.** Which of the following is correct?
- (a) Logistic growth model is more realistic than exponential growth model  
(b) *r*-selected species have low fecundity, large body size and late maturity  
(c) *K*-selected species have high fecundity, small body size and early maturity  
(d) Altruistic behaviour is common in dogs

28. Match the following columns.

Column I (Plants)	Column II (Habitats)
A. Hydrophytes	1. Dry habitat
B. Mesophytes	2. Wet habitat
C. Xerophytes	3. Moist habitat

Codes

A	B	C	A	B	C
(a) 2	3	1	(b) 1	2	3
(c) 3	2	1	(d) 2	1	3

29. Match the following columns.

Column I (Animals)	Column II (Habits)
A. Diurnal	1. Active during dusk
B. Nocturnal	2. Active at dawn
C. Arboreal	3. Active during night
D. Vespersal	4. Active during day time

Codes

A	B	C	D	A	B	C	D
(a) 4	3	2	1	(b) 4	3	1	2
(c) 4	2	1	3	(d) 1	2	3	4

30. Match the following columns.

Column I (Adaptations)	Column II (Animals)
A. Hibernation	1. Monarch butterfly
B. Aestivation	2. Leaf-like grasshopper
C. Cryptic appearance	3. Northern ground squirrel
D. Mimicry	4. Ground squirrel

Codes

A	B	C	D
(a) 4	3	2	1
(b) 3	4	1	2
(c) 4	3	1	2
(d) 3	4	2	1

31. Match the following columns.

Column I (Animals)	Column II (Adaptations)
A. Pink cotton bollworm	1. Diapause
B. Zooplankton	2. Hibernation
C. Snail	3. Aestivation
D. Polar bears	

Codes

A	B	C	D	A	B	C	D
(a) 1	3	1	2	(b) 1	1	3	2
(c) 3	2	1	1	(d) 2	3	1	2

32. Match the following columns.

Column I (Attributes of population growth)	Column II (Features)
A. Mortality	1. Individuals of same species going out from population.
B. Immigration	2. Individuals of same species coming in population.
C. Emigration	3. Numbers of deaths in population during given period.

Codes

A	B	C	A	B	C
(a) 1	3	2	(b) 2	3	1
(c) 3	2	1	(d) 2	1	3

33. Match the following columns.

Column I (Population growth models)	Column II (Features)
A. Logistic growth	1. Sigmoid growth
B. Exponential growth	2. Verhulst-Pearl logistic growth
	3. Geometric growth
	4. J-shaped growth

Codes

A	B	A	B
(a) 3, 4	1, 2	(b) 1, 2	3, 4
(c) 1, 3, 4	2	(d) 1,	2, 3, 4

34. Match the following columns.

Column I (Population interaction)	Column II (Examples)
A. Mutualism	1. Ticks on dogs
B. Commensalism	2. <i>Balanus</i> and <i>Chthamalus</i>
C. Parasitism	3. Sparrow and any seed
D. Competition	4. Epiphyte on a mango branch
E. Predation	5. Orchid, <i>Ophrys</i> and bee

Codes

A	B	C	D	E
(a) 1	5	4	3	2
(b) 2	1	5	4	3
(c) 3	2	1	5	4
(d) 5	4	1	2	3

35. Match the following columns.

Column I (Parasitism)	Column II (Examples)
A. Ectoparasite	1. Cuckoo
B. Endoparasite	2. Lice
C. Brood parasite	3. <i>Ascaris</i>

Codes

A	B	C	A	B	C
(a) 3	1	2	(b) 2	1	3
(c) 3	2	1	(d) 2	3	1

**36. Match the following columns.**

Column I	Column II
A. Epiphytes	1. Cattle egret
B. Grazing cattle	2. <i>Orchid</i> on mango tree
C. Sea anemone	3. Clown fish

**Codes**

	A	B	C
(a)	1	2	3
(b)	1	3	2
(c)	2	1	3
(d)	2	3	1

**37. Match the following columns.**

Column I (Examples)	Column II (Types of parasites)
A. <i>Rafflesia</i>	1. Endoparasite
B. Rat flea	2. Ectoparasite
C. Lice	3. Hyperparasite
D. <i>Taenia</i>	4. Phytoparasite

**Codes**

	A	B	C	D
(a)	4	3	2	1
(b)	4	2	3	1
(c)	4	1	2	3
(d)	1	2	3	4

**NCERT EXEMPLAR PROBLEMS**

- The term 'Health' is defined in many ways. The most accurate definition of the health would be:
  - Health is the state of body and mind in a balanced condition
  - Health is the reflection of a smiling face
  - Health is a state of complete physical, mental and social well-being
  - Health is the symbol of economic prosperity.
- The organisms which cause diseases in plants and animals are called:
  - Pathogens
  - Vectors
  - Insects
  - Worms
- The clinical test that is used for diagnosis of typhoid is:
  - ELISA
  - ESR
  - PCR
  - Widal
- Diseases are broadly grouped into infectious and non-infectious diseases. In the list given below, identify the infectious diseases.
  - Cancer
  - Influenza
  - Allergy
  - Small pox

(a) i and ii      (b) ii and iii      (c) iii and iv      (d) ii and iv
- The sporozoites that cause infection when a female *Anopheles* mosquito bites a person, are formed in:
  - liver of the person
  - RBCs of mosquito

- c. salivary glands of mosquito
  - d. gut of mosquito
6. The disease *chikunguniya* is transmitted by:
- a. house fly
  - b. *Aedes* mosquito
  - c. cockroach
  - d. female *Anopheles*
7. Many diseases can be diagnosed by observing the symptoms in the patient. Which group of symptoms are indicative of pneumonia?
- a. Difficulty in respiration, fever, chills, cough, headache
  - b. Constipation, abdominal pain, cramps, blood clots
  - c. Nasal congestion and discharge, cough, constipation, headache
  - d. High fever, weakness, stomach pain, loss of appetite and constipation
8. Cancer causing genes are called:
- a. structural genes
  - b. expressor genes
  - c. oncogenes
  - d. regulatory genes
9. In malignant tumors, the cells proliferate, grow rapidly and move to other parts of the body to form new tumors. This stage of disease is called:
- a. metagenesis
  - b. metastasis
  - c. teratogenesis
  - d. mitosis
10. When an apparently healthy person is diagnosed as unhealthy by a psychiatrist, the reason could be that:
- a. the patient was not efficient at his work
  - b. the patient was not economically prosperous
  - c. the patient shows behavioural and social maladjustment
  - d. he does not take interest in sports
11. Which of the following are the reason(s) for Rheumatoid arthritis? Choose the correct option.
- i. The ability to differentiate pathogens or foreign molecules from self cells increases.
  - ii. Body attacks self cells
  - iii. More antibodies are produced in the body
  - iv. The ability to differentiate pathogens or foreign molecules from self cells is lost
- (a) i and ii    (b) ii and iv    (c) iii and iv    (d) i and iii
-

12. AIDS is caused by HIV. Among the following, which one is not a mode of transmission of HIV?
- Transfusion of contaminated blood
  - Sharing the infected needles
  - Shaking hands with infected persons
  - Sexual contact with infected persons
13. 'Smack' is a drug obtained from the:
- latex of *Papaver somniferum*
  - leaves of *Cannabis sativa*
  - flowers of *Datura*
  - fruits of *Erythroxyl coca*
14. The substance produced by a cell in viral infection that can protect other cells from further infection is:
- serotonin
  - colostrum
  - interferon
  - histamine
15. Transplantation of tissues/organs to save certain patients often fails due to rejection of such tissues/organs by the patient. Which type of immune response is responsible for such rejections?
- auto-immune response
  - humoral immune response
  - physiological immune response
  - cell-mediated immune response
16. Antibodies present in colostrum which protect the new born from certain diseases is of
- Ig G type
  - Ig A type
  - Ig D type
  - Ig E type
17. Tobacco consumption is known to stimulate secretion of adrenaline and nor-adrenaline. The component causing this could be:
- Nicotine
  - Tannic acid
  - Curamin
  - Catechin
18. Antivenom against snake poison contains:
- Antigens
  - Antigen-antibody complexes
  - Antibodies
  - Enzymes

19. Which of the following is not a lymphoid tissue?
- Spleen
  - Tonsils
  - Pancreas
  - Thymus
20. Which of the following glands is large sized at birth but reduces in size with ageing?
- Pineal
  - Pituitary
  - Thymus
  - Thyroid
21. Haemozoin is a:
- precursor of hemoglobin
  - toxin released from *Streptococcus* infected cells
  - toxin released from *Plasmodium* infected cells
  - toxin released from *Haemophilus* infected cells
22. Which of the following is not the causal organism for ringworm?
- Microsporum*
  - Trichophyton*
  - Epidermophyton*
  - Macrosporum*
23. A person with sickle cell anemia is
- more prone to malaria
  - more prone to typhoid
  - less prone to malaria
  - less prone to typhoid

## NEET PREVIOUS QUESTIONS

1. The infectious stage of *Plasmodium* that enters the human body is  
(a) Trophozoites (b) Sporozoites  
(c) Female gametocytes (d) Male gametocytes  
(NEET 2020)
2. Match the following diseases with the causative organism and select the correct option.
- | Column-I      |  | Column-II               |  |
|---------------|--|-------------------------|--|
| A. Typhoid    |  | (i) <i>Wuchereria</i>   |  |
| B. Pneumonia  |  | (ii) <i>Plasmodium</i>  |  |
| C. Filariasis |  | (iii) <i>Salmonella</i> |  |
| D. Malaria    |  | (iv) <i>Haemophilus</i> |  |
- | A         | B     | C     | D     |             |
|-----------|-------|-------|-------|-------------|
| (a) (i)   | (iii) | (ii)  | (iv)  |             |
| (b) (iii) | (iv)  | (i)   | (ii)  |             |
| (c) (ii)  | (i)   | (iii) | (iv)  |             |
| (d) (iv)  | (i)   | (ii)  | (iii) | (NEET 2020) |
3. Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid.  
(a) *Salmonella typhi* / Widal test  
(b) *Plasmodium vivax* / UTI test  
(c) *Streptococcus pneumoniae* / Widal test  
(d) *Salmonella typhi* / Anthrone test (NEET 2019)
4. In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels?  
(a) Elephantiasis (b) Ascariasis  
(c) Ringworm disease (d) Amoebiasis  
(NEET 2018)
5. Which of the following sets of diseases is caused by bacteria?  
(a) Cholera and tetanus  
(b) Typhoid and smallpox  
(c) Tetanus and mumps  
(d) Herpes and influenza (NEET-II 2016)
6. Which of the following diseases is caused by a protozoan?  
(a) Babesiosis (b) Blastomycosis  
(c) Syphilis (d) Influenza (2015)
7. Match each disease with its correct type of vaccine.
- | Column I          | Column II              |
|-------------------|------------------------|
| A. Tuberculosis   | (i) Harmless virus     |
| B. Whooping cough | (ii) Inactivated toxin |
| C. Diphtheria     | (iii) Killed bacteria  |
| D. Polio          | (iv) Harmless bacteria |
- (a) A-(iv), B-(iii), C-(ii), D-(i)  
(b) A-(i), B-(ii), C-(iv), D-(iii)  
(c) A-(ii), B-(i), C-(iii), D-(iv)  
(d) A-(iii), B-(ii), C-(iv), D-(i) (2015 Cancelled)
8. The active form of *Entamoeba histolytica* feeds upon  
(a) food in intestine (b) blood only  
(c) erythrocytes, mucosa and submucosa of colon  
(d) mucosa and submucosa of colon only.  
(2015 Cancelled)
9. Infection of *Ascaris* usually occurs by  
(a) Tse-tse fly  
(b) mosquito bite  
(c) drinking water containing eggs of *Ascaris*  
(d) eating imperfectly cooked pork. (NEET 2013)
10. Identify the site where *Wuchereria bancrofti* is normally found in human body.  
(a) Muscles of the legs  
(b) Blood vessels of the thigh region  
(c) Skin between the fingers  
(d) Lymphatic vessels of the lower limbs  
(Karnataka NEET 2013)
11. Motile zygote of *Plasmodium* occurs in  
(a) gut of female *Anopheles*  
(b) salivary glands of *Anopheles*  
(c) human RBCs  
(d) human liver. (2012)
12. Widal test is carried out to test  
(a) malaria (b) diabetes mellitus  
(c) HIV/AIDS (d) typhoid fever. (2012)
13. Common cold differs from pneumonia in that  
(a) pneumonia is a communicable disease whereas the common cold is a nutritional deficiency disease  
(b) pneumonia can be prevented by a live attenuated bacterial vaccine whereas the common cold has no effective vaccine  
(c) pneumonia is caused by a virus while the common cold is caused by the bacterium *Haemophilus influenzae*  
(d) pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs. (2012)
14. Where will you look for the sporozoites of the malarial parasite?  
(a) Saliva of infected female *Anopheles* mosquito  
(b) Red blood corpuscles of human suffering from malaria  
(c) Spleen of infected humans  
(d) Salivary glands of freshly moulted female *Anopheles* mosquito (2011)
15. Which one of the following options gives the correct match of a disease with its causative organism and mode of infection?



Disease	Causative organism	Mode of infection
(a) Typhoid	<i>Salmonella typhi</i>	With inspired air
(b) Pneumonia	<i>Streptococcus pneumoniae</i>	Droplet infection
(c) Elephantiasis	<i>Wuchereria bancrofti</i>	With infected water and food
(d) Malaria	<i>Plasmodium vivax</i>	Bite of male <i>Anopheles</i> mosquito

(Mains 2011)

16. Malaria fever coincides with liberation of  
 (a) cryptomerozoites  
 (b) metacryptomerozoites  
 (c) merozoites  
 (d) trophozoites. (1989)
17. The vector for sleeping sickness is  
 (a) housefly (b) tse-tse fly  
 (c) sandfly (d) fruit fly. (1989)
18. The causal organism for African sleeping sickness is  
 (a) *Trypanosoma cruzi* (b) *T. rhodesiense*  
 (c) *T. tangela* (d) *T. gambiense*. (1989)
19. Identify the wrong statement with reference to immunity.  
 (a) When exposed to antigen (living or dead) antibodies are produced in the host's body. It is called "Active immunity".  
 (b) When ready-made antibodies are directly given, it is called "Passive immunity".

- (c) Active immunity is quick and gives full response.  
 (d) Fetus receives some antibodies from mother, it is an example for passive immunity. (NEET 2020)
20. Which of the following immune responses is responsible for rejection of kidney graft?  
 (a) Cell-mediated immune response  
 (b) Auto-immune response  
 (c) Humoral immune response  
 (d) Inflammatory immune response (NEET 2019)
21. Colostrum, the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains  
 (a) immunoglobulin A (b) natural killer cells  
 (c) monocytes (d) macrophages. (NEET 2019)
22. Which of the following is not an autoimmune disease?  
 (a) Psoriasis  
 (b) Rheumatoid arthritis  
 (c) Alzheimer's disease  
 (d) Vitiligo (NEET 2018)
23. Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of immune response is responsible for such rejections?  
 (a) Cell-mediated immune response  
 (b) Hormonal immune response  
 (c) Physiological immune response  
 (d) Autoimmune response (NEET 2017)
24. MALT constitutes about \_\_\_\_\_ percent of the lymphoid tissue in human body.  
 (a) 20% (b) 70% (c) 10% (d) 50% (NEET 2017)
25. Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain  
 (a) gamma globulin (b) attenuated pathogens  
 (c) activated pathogens (d) harvested antibodies. (NEET-I 2016)
26. In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to  
 (a) autoimmune disease (b) active immunity  
 (c) allergic response (d) graft rejection. (NEET-I 2016)
27. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence?  
 (a) Haemocytes  
 (b) Serum globulins  
 (c) Fibrinogen in plasma  
 (d) Serum albumins (2015, 2007)

28. Which of the following immunoglobulins does constitute the largest percentage in human milk?  
 (a) IgA (b) IgG  
 (c) IgD (d) IgM (2015)
29. Grafted kidney may be rejected in a patient due to  
 (a) passive immune response  
 (b) innate immune response  
 (c) humoral immune response  
 (d) cell-mediated immune response. (2015)
30. Increased asthmatic attacks in certain seasons are related to  
 (a) eating fruits preserved in tin containers  
 (b) inhalation of seasonal pollen  
 (c) low temperature  
 (d) hot and humid environment. (2007)
31. Lysozyme that is present in perspiration, saliva and tears, destroys  
 (a) certain types of bacteria  
 (b) all viruses  
 (c) most virus-infected cells  
 (d) certain fungi. (2007)
32. Antibodies in our body are complex  
 (a) glycoproteins (b) lipoproteins  
 (c) steroids (d) prostaglandins. (2006)
33. Damage to thymus in a child may lead to  
 (a) a reduction in haemoglobin content of blood  
 (b) a reduction in stem cell production  
 (c) loss of antibody mediated immunity  
 (d) loss of cell mediated immunity. (2005)
34. Short-lived immunity acquired from mother to fetus across placenta or through mother's milk to the infant is categorised as  
 (a) active immunity  
 (b) passive immunity  
 (c) cellular immunity  
 (d) innate non-specific immunity. (2003)
35. Interferons are synthesized in response to  
 (a) mycoplasma (b) bacteria  
 (c) viruses (d) fungi. (2001)
36. The antibodies are  
 (a) proteins (b) carbohydrates  
 (c) lipids (d) germs. (1999)
37. The term 'active immunity' means  
 (a) increasing rate of heart beat  
 (b) increasing quantity of blood  
 (c) resistance developed after disease  
 (d) resistance developed before disease. (1999)
38. If a person shows production of interferons in his body, the chances are that he has got an infection of  
 (a) tetanus (b) malaria  
 (c) typhoid (d) measles. (1997)
39. Antibodies are produced by  
 (a) leucocytes (b) monocytes  
 (c) lymphocytes (d) spleen. (1996)
40. The interferons are  
 (a) antigen proteins (b) antiviral proteins  
 (c) antibiotic proteins (d) all of these. (1996)
41. Which one of the following diseases is due to an allergic reaction?  
 (a) Enteric fever (b) Skin cancer  
 (c) Goitre (d) Hay fever (1995)

## AIIMS PREVIOUS QUESTIONS

1. Malignant tertian malaria is caused by [2000]  
(a) *P. vivax*                      (b) *P. malariae*  
(c) *P. ovale*                      (d) *P. falciparum*
2. HIV has a protein coat and genetic material [2000]  
(a) ss RNA                      (b) ds RNA  
(c) ss DNA                      (d) ds DNA
3. Cyclosporine is used [2002]  
(a) For allergy  
(b) As immunodepressant  
(c) Prophylactic for virus  
(d) None of the above
4. Lysis of foreign cell is mediated through [2002]  
(a) IgM                      (b) IgA  
(c) IgE                      (d) IgM & IgG
5. The treatment of snake-bite by antivenom is an example of [2004]  
(a) artificially acquired active immunity  
(b) artificially acquired passive immunity  
(c) naturally acquired passive immunity  
(d) specific natural immunity
6. Electron beam therapy is a kind of radiation therapy to treat [2004]  
(a) enlarged prostate gland  
(b) gall bladder stones by breaking them  
(c) certain types of cancer  
(d) kidney stones
7. A young drug addict used to show symptoms of depressed brain activity, feeling of calmness, relaxation and drowsiness. Possibly he was taking [2005]  
(a) Amphetamine              (b) Marijuana  
(c) Pethadine                      (d) Valium
8. When children play bare footed in pools of dirty water and flood water, they may suffer from diseases like [2006]  
(a) leptospirosis and bilharzia  
(b) malaria, amoebic dysentery and leptospirosis  
(c) bilharzia, infective hepatitis and diarrhoea  
(d) guinea worm infection, elephantiasis and amoebic dysentery
9. Which one of the following is not a matching pair of a drug and its category? [2004, 2008]  
(a) Amphetamines - stimulant  
(b) Lysergic acid - narcotic dimethyl amide  
(c) Heroin - psychotropic  
(d) Benzodiazepam - pain killer
10. An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as [2005, 2008]  
(a) histamine and dopamine  
(b) histamine and kinins  
(c) interferons and opsonin  
(d) interferons and histones
11. Antigen binding site in an antibody is found between [2005, 2008]  
(a) two light chains  
(b) two heavy chains  
(c) one heavy and one light chain  
(d) either between two light chains or between one heavy and one light chain depending upon the nature of antigen
12. The antigen-binding site are present where on the antibody molecule [2009]  
(a) on light chain as well as on heavy chain.  
(b) on light chain only.  
(c) on variable region and constant region of light chain.  
(d) on heavy chain only.

## KEY MULTIPLE CHOICE QUESTIONS

1 (a) 2 (c) 3 (c) 4 (a) 5 (b) 6 (a) 7 (d) 8 (c) 9 (b) 10 (c) 11 (c) 12 (a) 13 (c) 14 (b) 15 (c)  
 16 (d) 17 (b) 18 (b) 19 (a) 20 (b) 21 (c) 22 (b) 23 (b) 24 (b) 25 (d) 26 (d) 27 (d) 28 (b) 29 (b) 30 (a)  
 31 (c) 32 (b) 33 (c) 34 (a) 35 (d) 36 (b) 37 (d) 38 (c) 39 (c) 40 (b) 41 (a) 42 (c) 43 (a) 44 (c) 45 (b)  
 46 (c) 47 (b) 48 (a) 49 (d) 50 (b) 51 (a) 52 (b) 53 (d) 54 (a) 55 (d) 56 (a) 57 (d) 58 (b) 59 (b) 60 (a)  
 61 (c) 62 (d) 63 (b) 64 (b) 65 (c) 66 (a) 67 (a) 68 (a) 69 (b) 70 (a) 71 (a) 72 (c) 73 (d) 74 (c) 75 (b)  
 76 (a) 77 (d) 78 (d) 79 (d) 80 (b) 81 (d) 82 (b) 83 (d) 84 (c) 85 (d) 86 (b) 87 (a) 88 (b) 89 (a) 90 (b)  
 91 (d) 92 (b) 93 (a) 94 (a) 95 (d) 96 (c) 97 (a) 98 (a) 99 (c) 100 (a) 101 (c) 102 (a) 103 (d) 104 (a) 105 (b)  
 106 (b) 107 (d) 108 (c) 109 (b) 110 (a) 111 (d) 112 (d) 113 (b) 114 (b) 115 (b) 116 (a) 117 (d) 118 (c) 119 (a) 120 (c)  
 121 (b) 122 (a) 123 (b) 124 (b) 125 (c) 126 (b) 127 (c) 128 (a) 129 (d) 130 (d) 131 (b) 132 (a) 133 (a) 134 (b) 135 (b)  
 136 (b) 137 (d) 138 (b) 139 (a) 140 (b) 141 (d) 142 (a) 143 (d) 144 (b) 145 (b) 146 (b) 147 (b) 148 (d) 149 (b) 150 (b)  
 151 (d)

## SPECIAL FORMAT QUESTIONS

1	d	8	d	15	b	22	b	29	d	36	c
2	c	9	d	16	a	23	b	30	d	37	a
3	b	10	c	17	d	24	d	31	b		
4	b	11	b	18	b	25	c	32	c		
5	a	12	c	19	d	26	a	33	b		
6	d	13	d	20	b	27	a	34	d		
7	a	14	c	21	d	28	a	35	d		

## NCERT EXEMPLAR PROBLEMS

1	b	5	d	9	c	13	b	17	b
2	c	6	d	10	d	14	c	18	c
3	d	7	a	11	b	15	c	19	a
4	c	8	c	12	c	16	b	20	a

## NEET PREVIOUS QUESTIONS

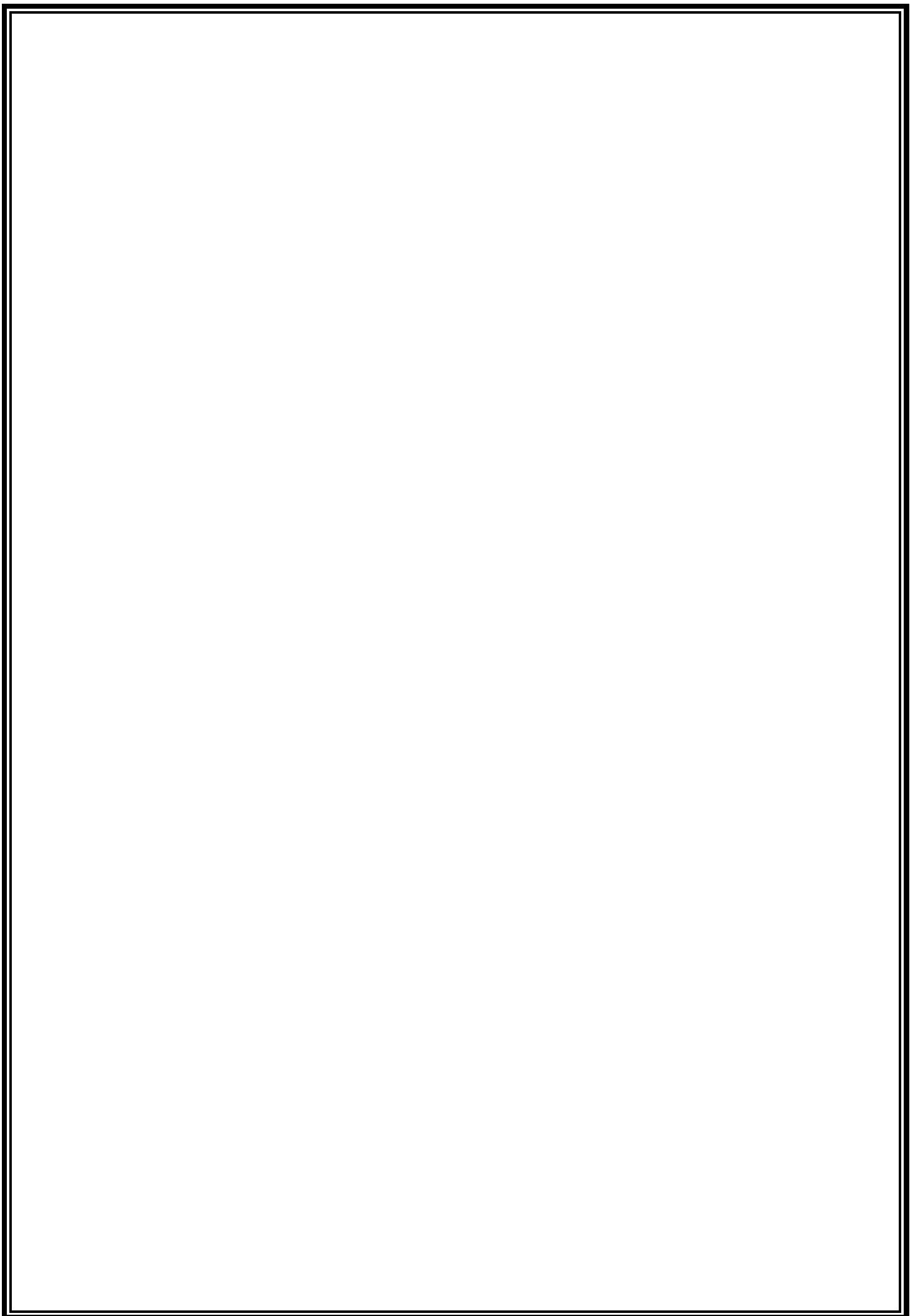
1	d	8	d	15	c	22	d	29	a	36	d
2	a	9	c	16	d	23	a	30	c	37	a
3	a	10	c	17	c	24	c	31	d	38	c
4	a	11	a	18	d	25	a	32	c	39	c
5	d	12	c	19	b	26	d	33	d	40	b
6	d	13	b	20	b	27	b	34	a	41	c
7	b	14	d	21	a	28	c	35	b		

## AIIMS PREVIOUS QUESTIONS

1	d	4	a	7	b	10	d
2	d	5	a	8	b	11	b
3	b	6	c	9	c	12	c



**UNIT-VIII**  
**ECOSYSTEM**  
**(CHAPTER 14)**



## SYNOPSIS

- Ecosystem is a functional unit of nature, where living organisms interact among themselves and also with their surrounding physical environment.
- The term ecosystem was coined by AG Tansley (1935). An ecosystem varies greatly in size from a small pond to a large forest or a sea.
- It is convenient to divide ecosystem into two categories
  - **Terrestrial**, e.g. forest, grassland and desert.
  - **Aquatic**, e.g. pond, lake, wetland, river and estuary ecosystems.  
Crop fields and an aquarium are the examples of man-made ecosystems.

### Components of an Ecosystem

The ecosystem consists of the following components

- **Biotic components** These are comprised of animals, plants and microorganisms and have the following main parts
  - **Producers** The green plants which make their own food by photosynthesis are called producers, e.g. all green plants and green algae.
  - **Consumers** All heterotrophic animals obtain their food from green plants directly or indirectly. These are divided into two categories **herbivores and carnivores**. For example, rabbit, rat, squirrel, goat, cattle, etc., are herbivore and birds, hawk, snake, fox, etc., are carnivore animals.
  - **Consumers** are of three types— primary, secondary and tertiary.  
**Omnivores** are eat both producers and consumers, e.g. pig, bear, etc.  
**Detritivores** are depend on dead and decaying organic matter for obtaining their food, e.g. vultures, earthworm.
  - **Decomposers** are obtain their food by decaying dead organic matter, e.g. bacteria and fungi. These are also called **saprobies or mineralisers**.
- **Abiotic components** These include temperature, water, light and soil.

### Ecosystem : Structure and Functions

- Interaction of biotic and abiotic components results in physical structure that is calculated by the characteristic of each type of ecosystem.
- The two important structural features of an ecosystem are
  - **Species composition** It is calculated by the identification and enumeration of plant and animal species of an ecosystem.
  - **Stratification** It is the vertical distribution of different species occupying different levels in an ecosystem, e.g. trees occupy top vertical strata or layer of a forest, shrubs the second and herbs and grasses occupy the bottom (third) layers.
- The important functional aspects of an ecosystem are
  - (i) Productivity      (ii) Decomposition
  - (iii) Energy flow      (iv) Nutrient cycling
- To understand the concept of an aquatic ecosystem, let us take a small pond ecosystem as an example.

### Pond Ecosystem

- A pond is fairly a self-sustainable unit, that explains even the complex interactions that exist in an aquatic ecosystem. It is a shallow water body in which all the above mentioned basic structural and functional components are present.

- The pond water (abiotic component) contains all the dissolved inorganic and organic materials and soil deposited at its bottom. The solar input, the cycle of temperature, day-length and other climatic conditions regulate the rate of function of the entire pond.
- **Autotrophic** components are phytoplanktons, some algae and the floating, submerged and marginal plants found at the edges.
- **Consumers** are zooplanktons, which are free swimming and bottom dwellers.
- **Decomposers** are the fungi, bacteria and flagellates found abundantly in the bottom of the pond.
- This pond system performs all the functions of an ecosystem and of the biosphere as a whole, i.e. **autotrophs** convert inorganic materials into organic material with the help of solar energy, **heterotrophs** consume autotrophs and **decomposers** decompose and mineralise dead organic materials to release them back for reuse by the autotrophs.
- These events are repeated over and over again, however energy flow is unidirectional towards the higher trophic levels. At each trophic level, a part of energy is dissipated and is lost as heat to the environment.

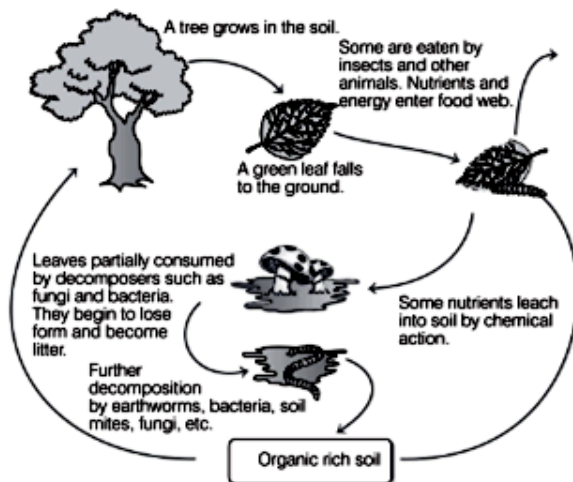
### Productivity

The rate of synthesis of biomass by any trophic level per unit area in unit time is called its **productivity**. It is expressed in terms of  $\text{gm}^{-2}\text{yr}^{-1}$  or  $(\text{Kcal m}^{-2})\text{yr}^{-1}$ .

- Productivity of an ecosystem can be categorised as **primary** and **secondary** productivity.
- **Primary production or productivity** It is the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight ( $\text{gm}^{-2}$ ) or energy ( $\text{Kcal m}^{-2}$ ).
  - The total sum of organic matter synthesised by primary producers *via* photosynthesis is called **Gross Primary Productivity (GPP)**.
  - The organic matter/energy stored by the primary producers after utilisation of some energy for respiration is called **Net Primary Productivity (NPP)**. It is a part of gross primary productivity.  
$$\text{Net Primary Productivity (NPP)} = \text{Gross Primary Productivity (GPP)} - \text{Respiratory loss by plants (R)}$$
- **Secondary productivity** It is the rate of new organic matter synthesised by the consumers. It is smaller than primary productivity and tends to decrease with an increase in trophic level.  
**Ecological efficiency** is the amount of energy received by one trophic level from the other in an ecosystem.

## Decomposition

- It is the process of breaking down of complex organic matter into inorganic substances like water, carbon dioxide and nutrients by decomposers.
- **Detritus** is the raw material for the decomposition process.
- Decomposition involves following steps during its process
  - **Fragmentation** It is a process of breakdown of detritus into small particles by **detritivores**, e.g. earthworm.
  - **Leaching** It is the process by which water soluble inorganic nutrients reach into soil horizon and get precipitated as unavailable salts.
  - **Catabolism** It is the process of degradation of detritus into simple organic material by the action of bacterial and fungal enzymes and then their further conversion into simpler inorganic compounds.
  - **Humification** It is a process that leads to accumulation of a dark coloured amorphous and colloidal substance called **humus**, which is highly resistant to microbial action and undergoes decomposition at a very slow rate.
  - **Mineralisation** It is the process of degradation of humus by microbial action and releases of inorganic nutrients.



Diagrammatic representation of decomposition cycle in a terrestrial ecosystem

- Factors affecting decomposition are as follows
  - **Chemical decomposition of detritus** Decomposition is slow, if detritus is rich in lignin and chitin, but it will quicker if detritus is composed of nitrogen and sugar.
  - **Climatic factors** Temperature and soil moisture are the most important climatic factors.

## Energy Flow

- Sun is the only source of energy for all the ecosystems on earth, except for deep sea hydrothermal ecosystem. Of all the total incident solar energy, less than 50% is **Photosynthetically Active Radiation (PAR)**. Plants utilise only 2-10% of PAR to sustain the entire living world.
- Plants as well as photosynthetic and chemosynthetic bacteria (autotrophs) fix sun's radiant energy to make food from simple inorganic molecules. Thus, all organisms are dependent on producers either directly or indirectly for their food.
- The flow of energy is unidirectional, i.e. it flows from the sun to producers and then to consumers and thus, maintains the **first law of thermodynamics**.
- Further, there is a constant need of supply of energy to synthesise the molecules, the ecosystem requires to counteract the universal tendency towards increasing disorderliness. This is in correlation with **second law of thermodynamics**.
- No energy that is trapped into an organism remains in it forever. The energy trapped by the producer, is either passed on to a consumer or the organism dies.
- The consumers may be of following types
  - **Primary consumers** The consumers that feed on plants directly, are called primary consumers or **herbivores**.
  - **Secondary consumers** Those animals, which eat other animals, who eat plants are called secondary consumers. These are also referred to as **primary carnivores**.
  - **Tertiary consumers** These are animals who feeds on secondary consumers for their nutrition. These are also referred to as **secondary carnivores**. Therefore, due to this interdependence of food/energy between organisms, the chains or webs are formed in the ecosystem.

## Food Chain

- The transfer of energy from green plants through a sequence of organisms, in which each eats the one below it in the chain and is eaten by the one above is called a **food chain**. It is actually a feeding chain of organisms in an ecosystem.
- The food chain present in nature is of two types
  - **Grazing Food Chain (GFC)** begins with producers which capture solar energy and pass on energy into food chain through photosynthesis, e.g.
 

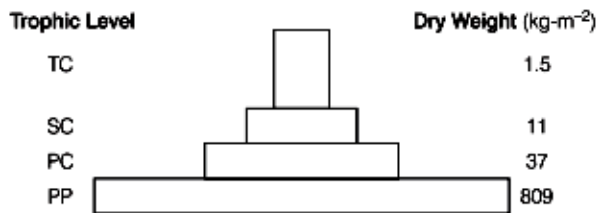
Grass → Goat → Man  
(Producer) (Primary consumer) (Secondary consumer)
  - **Detritus Food Chain (DFC)** begins with dead organic matter and consists of decomposers mainly **fungi** and **bacteria**, e.g.
 

Dead leaves → Wood louse → Black bird  
(Producer) (Primary consumer) (Secondary consumer)

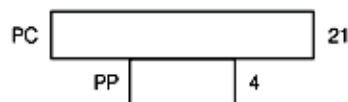


• **Pyramid of biomass** It shows relationship between producers and consumers in an ecosystem terms of biomass. It can be

- **Upright**, e.g. in case of grass land ecosystem.
- **Inverted**, e.g. in case of pond ecosystem.

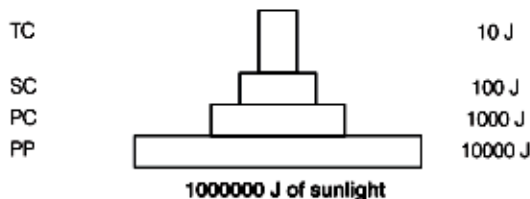


Upright pyramid of biomass shows a sharp decrease in biomass at higher trophic levels



Inverted pyramid of biomass. Small standing crop of phytoplankton supports large standing crop of zooplankton

• **Pyramid of energy** It is the relationship between producers and consumers in an ecosystem in terms of flow of energy. It is always upright because energy is always lost as heat at each step.



An ideal pyramid of energy. Observe that primary producers convert only 1% of the energy in the sunlight available to them into NPP.

• **Limitations of Ecological Pyramids**

- It includes a simple food chain which never exists in nature.
- It never keeps an account of the same species belonging to two or more trophic levels.
- In spite of the vital role played by saprophytes/ decomposers, they are not given any position in ecological pyramids.

## Ecological Succession

- It is a sequential, gradual and predictable change in the species composition of a given area.
- The entire sequence of communities that successively change in a given area are called **seres(s)**.
- The individual transitional communities are termed as **seral stages** or **seral communities**.
- In the successive seral stages, there is a change in the diversity of species of organisms, increase in the number

of species and organisms as well as an increase in the total biomass.

- These changes lead finally to a community that is near equilibrium with the environment and called a **climax community**. Ecological succession can be of two types
  - **Primary succession** begins in areas, where no living organisms ever existed, e.g. newly cooled lava, bare rock, newly created pond or reservoir. It starts with **pioneers species** (i.e. the first ones to invade a bare area) like lichens on rocks.
  - **Secondary succession** begins in areas, where natural biotic communities have been destroyed such as in abandoned farm lands, burned or cut forests, lands that have been flooded. Since, some soil or sediment is present, succession is faster than primary succession.

## Succession of Plants

- Based on the nature of the habitat, whether it is water (or very wet area) or it is on very dry area, there are two types of successions

### Hydrarch Succession

- It takes place in wetter areas and the successional series progress from hydric to the mesic conditions.
- During primary succession in water, pioneer species are the small phytoplanktons.
- These phytoplanktons are replaced with time by free-floating angiosperms, then by rooted hydrophytes, sedges, grasses and finally the establishment of trees occurs.
- At last, formation of stable climax forest takes place, i.e. with time the water body is converted into land.

### Xerarch Succession

- It takes place in dry areas and the series progress from xeric to mesic conditions.
- Lichens are the pioneer species in the primary succession on rocks as they secrete acids that dissolve rocks helping in weathering and soil formation.
- Later, small plants like bryophytes emerged which are able to take hold in the small amount of soil.
- These bryophytes, with time were succeeded by bigger plants. After several more stages of successions, ultimately a stable climax forest community tends to form.
- The climax community remains stable as long as the environment remains unchanged. In this way, xerophytic habitat gets completely converted into a mesophytic one.
- Both hydrarch and xerarch succession lead to medium water conditions (mesic), neither too dry (xeric) nor too wet (hydric). The important fact is that all successions whether taking place in water or on land, proceed to a similar **mesic climax community**.

## Nutrient Cycle

- The movement of nutrient elements through the various components of an ecosystem is called nutrient cycling or biogeochemical cycles.
- The amount of nutrients present in the soil at any given time, is referred to as the **standing state**. It varies in different kinds of ecosystems and also on a seasonal basis.
- Nutrient cycles are of two types
  - Gaseous
  - Sedimentary
- Atmosphere is the reservoir for **gaseous type of nutrient cycle** (e.g. nitrogen and carbon cycle).
- Earth's crust is the reservoir of **sedimentary cycle** (e.g. sulphur and phosphorus cycle).

## Ecosystem–Carbon Cycle

- It occurs through atmosphere, ocean and through living and dead organisms.
- A large amount of carbon returns to the atmosphere as CO<sub>2</sub> through respiratory activities of the producers and consumers; breakdown activities of decomposers, forest fire; combustion of organic matter, etc.

## Ecosystem–Phosphorus Cycle

- Phosphorus is a major constituent of biological membranes, nucleic acids, cellular energy transfer systems (ATP) and also of shells, bones and teeth.
- The natural reservoir of phosphorus is rock which contains phosphorus in the form of phosphates.
- The waste products and the dead organisms are decomposed by phosphate solubilising bacteria releasing phosphorus.

## Ecosystem Services

- The products of ecosystem processes are termed as **ecosystem services**.
- Forests are the major sources of ecological services. These are in purification of air and water, mitigating droughts and floods, cycling nutrients, generating fertile soils, providing wildlife habitat, maintenance of biodiversity, pollination of crops, providing storage site for carbon, providing aesthetic, cultural and spiritual values.
- **Robert Constanza** and his colleagues tried to put price tags on nature's life support services, i.e. about US \$ 33 trillion a year.

## MULTIPLE CHOICE QUESTIONS

- 1 A functional unit of nature, where living organisms interact among themselves and also with the surrounding physical environment is  
(a) biosphere (b) ecosystem  
(c) environment (d) None of these
- 2 The term ecosystem was coined by **NEET 2016**  
(a) AG Tansley (b) E Haeckel  
(c) E Warming (d) EP Odum
- 3 The basic categories of ecosystem are  
(a) aquatic (b) terrestrial  
(c) Both (a) and (b) (d) grassland and crop field
- 4 Which of the following is an example of man-made ecosystem?  
(a) An island (b) Aquarium  
(c) Desert (d) Forest
- 5 The two components of an ecosystem are  
(a) plants and animals  
(b) weeds, trees, animals and man  
(c) energy flow and mineral cycling  
(d) biotic and abiotic
- 6 Abiotic components refer to  
(a) non-living physico-chemical factors  
(b) living physico-chemical factors  
(c) gases produced by industries  
(d) living organisms
- 7 Biotic components refer to  
(a) gases produced by industries  
(b) nutrient-deficient soil  
(c) living organisms  
(d) fossil fuels
- 8 Vertical distribution of different species occupying different levels in a biotic community is known as **CBSE-AIPMT 2015**  
(a) divergence (b) stratification  
(c) zonation (d) pyramid
- 9 Stratification is more pronounced in  
(a) tropical rainforest  
(b) deciduous forest  
(c) temperate forest  
(d) tropical savannah

**10** Which one of the following is not a functional unit of an ecosystem? **CBSE-AIPMT 2012**

- (a) Energy flow (b) Decomposition  
(c) Productivity (d) Stratification

**11** Maximum primary productivity of pond is achieved by

- (a) phytoplankton (b) zooplankton  
(c) floating plants (d) red algae

**12** In a pond ecosystem, the autotrophic components are

- (a) phytoplanktons  
(b) algae  
(c) submerged and marginal plants  
(d) All of the above

**13** Primary production is

- (a) expressed in terms of weight ( $\text{gm}^{-2}$ ) or energy ( $\text{kcal m}^{-2}$ )  
(b) the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis  
(c) Both (a) and (b)  
(d) None of the above

**14** The rate of biomass production is

- (a) productivity  
(b) photosynthesis  
(c) respiration  
(d) decomposition

**15** In an ecosystem, the rate of production of organic matter during photosynthesis is termed as

- (a) net primary productivity **CBSE-AIPMT 2015**  
(b) gross primary productivity  
(c) secondary productivity  
(d) net productivity

**16** Net primary productivity is equal to

- (a) organic matter synthesised by photosynthesis plus utilisation in respiration and other losses  
(b) organic matter synthesised by photosynthesis minus utilisation in respiration and other losses  
(c) rate of increase in body weight of producers plus loss suffered through respiration and damages  
(d) rate of resynthesis of organic matter by the consumers

**17** Secondary productivity is rate of formation of new organic matter by **NEET 2013**

- (a) producer  
(b) parasite  
(c) consumer  
(d) decomposer

**18** Primary productivity depends upon

- (a) availability of nutrients  
(b) photosynthetic capacity of plants  
(c) Both (a) and (b)  
(d) None of the above

**19** Fill up the blanks.

- I. Productivity varies in different ecosystems. It is the highest in ...A... and lowest in ...B....  
II. Productivity varies in different seasons. Algal population is low in ...C... and high in ....D....  
III. ...E... is required for higher primary productivity. ...F... have the lowest primary productivity as the soil is deficient in moisture.

Choose the correct option for A, B, C, D, E and F.

- (a) A-agriculture field, B-forest, C-winter, D-spring, E-Heat, F-Forest  
(b) A-forest, B-pond, C-spring, D-summer, E-Rain, F-Forest  
(c) A-coral reef, B-desert, C-winter, D-summer, E-Rain, F-Desert  
(d) A-desert, B-coral reef, C-summer, D-winter, E-Forest, F-Desert

**20** The process of breaking down complex organic matter into inorganic substances like  $\text{CO}_2$ , water and nutrient is called

- (a) humification (b) mineralisation  
(c) decomposition (d) leaching

**21** Word detritus includes

- (a) dead plant parts (b) remains of animals  
(c) animal excretions (d) All of these

**22** A detritivore is

- (a) animal feeding on plant matter  
(b) animal feeding on dead and decaying organic matter  
(c) a plant feeding on an animal  
(d) animal feeding on another animal

**23** Which of the following is/are example(s) of detritivore?

- (a) Millipedes (b) Earthworm  
(c) Fiddler crabs (d) All of these

**24** Earthworms are called farmer's friends because

- (a) they help in fragmentation of detritus and loosening of soil  
(b) they help in immobilisation of nutrients inside the soil  
(c) they reduce the rate of decomposition  
(d) Both (b) and (c)

**25** The organisms which physically and chemically break the complex dead organic remains are known as

- (a) scavengers (b) decomposers  
(c) Both (a) and (b) (d) parasites

**26** In which layer of soil decomposition occurs at maximum rate?

- (a) Upper layer of soil (b) Middle layer of soil  
(c) Lower layer of soil (d) None of these

**27** The products of decomposition process are

- (a) humus (b) inorganic nutrients  
(c) organic nutrients (d) Both (a) and (b)

**28** Breakdown of detritus into smaller particles by detritivores is a process called

- (a) humification (b) fragmentation  
(c) mineralisation (d) catabolism

**29** The process by which water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts is called as

- (a) fragmentation  
(b) leaching  
(c) catabolism  
(d) mineralisation

**30** The enzymatic process by which degraded detritus is converted into simpler inorganic substances is called

- (a) catabolism (b) leaching  
(c) mineralisation (d) fragmentation

**31** The process of accumulation of a dark coloured amorphous substance that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate is called

- (a) mineralisation (b) humification  
(c) organisation (d) transformation

**32** Humus is

- (a) dark coloured amorphous organic matter rich in lignin  
(b) dark coloured organic matter rich in cellulose  
(c) Both (a) and (b)  
(d) red coloured substance rich in iron

**33** The process of mineralisation by microorganisms helps in the release of

- (a) inorganic nutrients from humus  
(b) both organic and inorganic nutrients from detritus  
(c) organic nutrients from humus  
(d) inorganic nutrients from detritus and the formation of humus

**34** The climatic factors that regulate soil microbe activities during decomposition are

- (a) temperature (b) soil moisture  
(c) Both (a) and (b) (d) wind

**35** The rate of decomposition is dependent on .....

- (a) chemical nature of detritus  
(b) temperature and pH  
(c) moisture and aeration  
(d) All of the above

**36** The organic substances, which decompose slowly are

- (a) chitin (b) lignin  
(c) cellulose (d) All of these

**37** The rate of decomposition is quicker when detritus is rich in

- (a) nitrogen and sugar (b) phosphorus and sugar  
(c) calcium and sugar (d) Both (b) and (c)

**38** Which one of the following processes can slow down the process of decomposition?

- (a) anaerobiosis (b) aerobiosis  
(c) photo-oxidation (d) photophosphorylation

**39** Which one of the following processes during decomposition is correctly matched? **NEET 2013**

(a) Fragmentation	Carried out by organisms such as earthworm
(b) Humification	Leads to the accumulation of a dark coloured substance humus, which is resistant to microbial action and undergoes decomposition at a very fast rate
(c) Catabolism	Last step in the decomposition under fully anaerobic condition
(d) Leaching	Water soluble inorganic nutrients rise to the top layers of soil

**40** PAR stands for

- (a) Photosynthesis Active Reaction  
(b) Photosynthesis Absorb Radiation  
(c) Photosynthetically Active Radiation  
(d) Photosynthetically Active Reaction

**41** Energy enters in any ecosystem through

- (a) herbivores (b) carnivores  
(c) producers (d) decomposers

**42** Energy flow in an ecosystem is

- (a) unidirectional (b) bidirectional  
(c) multidirectional (d) All of these

**43** The green plants in an ecosystem which can trap solar energy to convert it into chemical bond energy are called

- (a) producer  
(b) decomposer  
(c) consumer  
(d) predators

**44** Ecosystems need a constant supply of energy

- (a) to counteract increasing disorderliness  
(b) to counteract decreasing disorderliness  
(c) to synthesise molecules  
(d) Both (a) and (c)

**45** In a balanced ecosystem you would expect the biomass of the ..... to be greater than the biomass of any other groups of organisms. The most appropriate word to fill the blank is

- (a) producer (b) primary consumers  
(c) secondary consumers (d) top predators

**46** All the animals that depend on plants (directly or indirectly) for food are called

- (a) decomposers (b) root feeders  
(c) consumers (d) grazers

**47** Fill up the blanks.

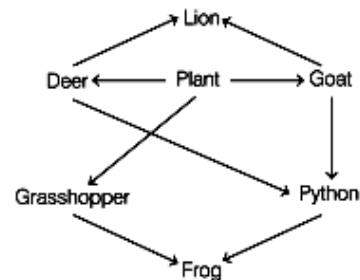
- I. Herbivores are also called ...A...  
II. Secondary consumers are eaten by larger ...B...  
III. ...C... consumer eat the secondary consumers.  
IV. A network of many food chains is called a ...D....

Choose the correct option for A, B, C and D.

- (a) A-secondary consumers, B-top predator, C-Quaternary, D-food web  
(b) A-primary consumer, B-predators, C-Tertiary consumer, D-food web  
(c) A-tertiary consumers, B-natural enemies, C-Primary consumer, D-food web  
(d) A-quaternary consumers, B-alligator, C-Top consumer, D-food web

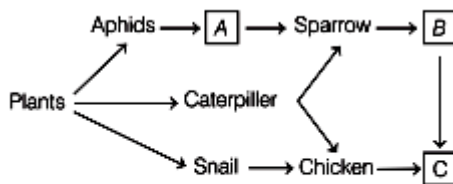
- 48** Frog that feeds on insects, is a  
 (a) primary consumer (b) secondary consumer  
 (c) tertiary consumer (d) decomposer
- 49** Which one of the following pairs belongs to the category of primary consumers?  
 (a) Insects and cattles (b) Eagle and snakes  
 (c) Insects and snakes (d) Snakes and frogs
- 50** Identify the food chain.  
 Dead animal → Blow fly maggots → Common frog → Snake  
 (a) Grazing food chain  
 (b) Detritus food chain  
 (c) Decomposer food chain  
 (d) Predator food chain
- 51** A lion that eats a zebra that ate grass is a  
 (a) primary producer (b) primary consumer  
 (c) secondary consumer (d) quaternary consumer
- 52** A bear that eats a fish that further ate bugs that ate algae is a  
 (a) primary producer (b) primary consumer  
 (c) secondary consumer (d) tertiary consumer
- 53** A person who eats a chicken that ate grain is a  
 (a) primary producer  
 (b) primary consumer  
 (c) secondary consumer  
 (d) quaternary consumer
- 54** Vegetable eating person acts as  
 (a) primary producer (b) primary consumer  
 (c) secondary consumer (d) tertiary consumer
- 55** What is common characteristic of earthworm, soil mites and dung beetle of an ecosystem?  
 (a) Primary producer (b) Primary consumer  
 (c) Secondary consumer (d) Tertiary consumer
- 56** Fill up the blanks.  
 I. Animals which feed directly on plants, are called ...A....  
 II. Consumers that feed on primary consumers are called ...B....  
 III. In an ecosystem two laws of thermodynamics govern the ...C....  
 Choose the correct option for A, B and C.  
 (a) A-herbivores, B-carnivores, C-flow of energy  
 (b) A-autotrophs, B-heterotrophs, C-trophic level  
 (c) A-photosynthesisers, B-higher levels predators, C-flow of energy  
 (d) A-predators, B-grazers, C-trophic level
- 57** Which of the following two organisms are producers?  
 (a) Plants and phytoplanktons  
 (b) Plants and consumers  
 (c) Zooplanktons and phytoplanktons  
 (d) Phytoplanktons and chlorophylls
- 58** A sequence of species or organism through which the food energy pass in a community is called  
 (a) pyramid of energy (b) food chain  
 (c) food web (d) nutrient cycle
- 59** Food chain refers to  
 (a) number of humans forming a chain for food  
 (b) animals gathered near a source of food  
 (c) transfer of energy from producers to consumers  
 (d) None of the above

- 60** Food chain starts with  
 (a) N<sub>2</sub>-fixation (b) osmosis  
 (c) respiration (d) photosynthesis
- 61** Food chain consists of  
 (a) plants (b) herbivores  
 (c) carnivores (d) All of these
- 62** In grazing food chain, energy comes from  
 (a) organic remain (b) sun  
 (c) water (d) All of these
- 63** ..... starts with green plants called producers as the first trophic level. The most appropriate choice for filling blank space is  
 (a) detritus food chain  
 (b) grazing food chain  
 (c) complex food chain  
 (d) normal food chain
- 64** A much larger fraction of energy flows in a terrestrial ecosystem through  
 (a) grazing food chain  
 (b) detritus food chain  
 (c) complex food chain  
 (d) food web aquatic ecosystem
- 65** Which food chain correctly describes the flow of energy in an ecosystem?  
 (a) Grass → cow → human  
 (b) Caterpillar → leaf → human  
 (c) Cow → grass → human  
 (d) Leaf → bird → caterpillar
- 66** A much large fraction of energy flows in an aquatic ecosystem through  
 (a) grazing food chain (b) detritus food chain  
 (c) complex food chain (d) food web
- 67** In what order do a hawk, grass and rabbit form a food chain in a meadow?  
 (a) Hawk → grass → rabbit  
 (b) Grass → hawk → rabbit  
 (c) Rabbit → grass → hawk  
 (d) Grass → rabbit → hawk
- 68** A food web  
 (a) is more real than food chain  
 (b) consists of a number of food chains interlinked at various trophic levels  
 (c) provides a number of alternate food to consumers  
 (d) All of the above
- 69** How many food chains are there in the food web shown below?



- (a) 2 (b) 3 (c) 5 (d) 7

**70** Identify *A*, *B* and *C* from the given flowchart.



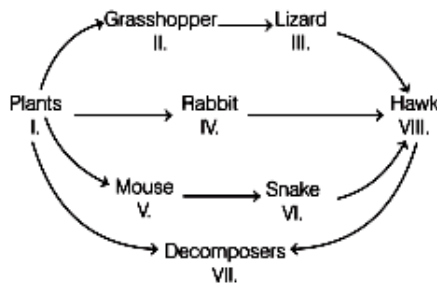
- (a) A–Bulbul, B–Snake, C–Monkey  
 (b) A–Beetle, B–Lizard, C–Praying mantis  
 (c) A–Ladybird, B–Snake, C–Hawk  
 (d) A–Lizard, B–Bird, C–Snake

**71** Select the options that correctly identifies *A*, *B* and *C* in the given table.

Organisms	Trophic level	Type of food chains
Eagle	<i>A</i>	Grazing
Earthworm	Primary consumer	<i>B</i>
<i>C</i>	Secondary consumer	Grazing

- (a) A–Secondary consumer, B–Grazing, C–Algae  
 (b) A–Top carnivore, B–Detritus, C–Frog  
 (c) A–Scavenger, B–Grazing, C–Hawk  
 (d) A–Decomposer, B–Detritus, C–Perch

**72** Which of the following organisms in the given food web act as a secondary consumers?



- (a) I and IV                      (b) V and VI  
 (c) III and VI                  (d) IV and VII

**73** Which of the following organisms in the given food web (fig of Q. 72) acts as a primary consumers?

- (a) II, IV and V                (b) I, II and III  
 (c) II, III and IV               (d) IV, VII and VIII

**74** Energy for the detritus food chain comes from

- (a) organic remain              (b) air  
 (c) radiation                    (d) water

**75** ..... begins with dead organic matter and saprophytes make the first trophic level. Most appropriate word for filling blank space is

- (a) Detritus food chain        (b) Grazing food chain  
 (c) Complex food chain        (d) Normal food chain

**76** Choose the incorrect option.

- (a) GFC (Grazing Food Chain) begins with producers at the first trophic level  
 (b) GFC binds up inorganic nutrients, while detritus chain helps in releasing inorganic nutrients to the cycling pool  
 (c) Both (a) and (b)  
 (d) Detritus chain account for less energy flow than grazing food chain

**77** In an ecosystem, organism occupies a specific place in a food chain is called

- (a) Branching lines              (b) Progressive straight line  
 (c) Trophic level                 (d) Standing crop

**78** Given flowchart represents grazing and detritus food chain.

Grazing food chain: Grass → Rabbit → Lion

Detritus food chain: Dead leaves → Wood louse → Black bird

The organisms which constitute the first trophic level of the grazing food chain and the detritus food chain are respectively,

- (a) grass and dead leaves  
 (b) grass and wood louse  
 (c) rabbit and wood louse  
 (d) rabbit and black bird

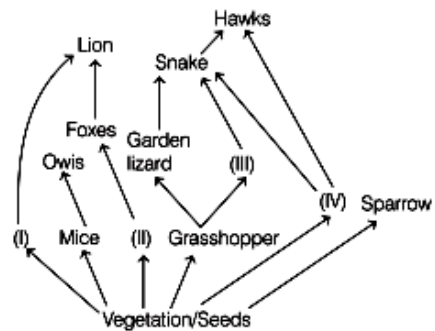
**79** The organisms, which attack dead animals are

- (a) first link of the food chain and are known as primary producers  
 (b) second link the food chain and are herbivorous  
 (c) third link of the food chain and are tertiary consumers  
 (d) present at the starting of food chain and are detritivores

**80** Select the incorrect food chain.

- (a) Grass → Frog → Vulture  
 (b) Grass → Grasshopper → Frog → Snake → Eagle  
 (c) Grass → Deer → Lion  
 (d) Phytoplankton → Zooplankton → Fish (perch) → Fish (bass) → Man

**81** Identify the likely organisms (I), (II) (III) and (IV) in the food web shown below. **CBSE-AIPMT 2012**



- | I            | II       | III      | IV     |
|--------------|----------|----------|--------|
| (a) Deer     | Rabbit   | Frog     | Rat    |
| (b) Dog      | Squirrel | Bat      | Deer   |
| (c) Rat      | Dog      | Tortoise | Crow   |
| (d) Squirrel | Cat      | Rat      | Pigeon |

**82** Identify the possible link '*A*' in the following food chain.

Plant → Insect → Frog → '*A*' → Eagle

**CBSE-AIPMT 2012**

- (a) Rabbit                              (b) Wolf  
 (c) Cobra                                (d) Parrot

**83** The mass of living material at a trophic level at a particular time is called **CBSE-AIPMT 2015**

- (a) gross primary productivity  
 (b) standing state  
 (c) net primary productivity  
 (d) standing crop

**84** The 10% law is related to

- (a) Mendelian genetics  
 (b) non-Mendelian genetics  
 (c) energy transfer from lower trophic level to higher trophic level  
 (d) energy consumption during photosynthesis in  $C_4$ -plants

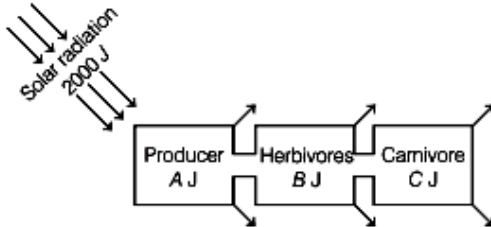
**85** The 10% law for energy transfer in food chains was given by

- (a) Stanley (b) Tansley  
(c) Lindemann (d) Weismann

**86** What percentage of herbivore's chemical energy is transferred to the chemical energy within the carnivore tissue?

- (a) 100% (b) 50%  
(c) 1% (d) 10%

**87** Suppose 2000 J of solar energy is incident on green vegetation. On the basis of 10% law of Lindemann. Identify A, B and C.



- (a) A – 20 J, B – 2 J, C – 0.2 J  
(b) A – 200 J, B – 20 J, C – 2 J  
(c) A – 400 J, B – 40 J, C – 4 J  
(d) A – 40 J, B – 4 J, C – 0.4 J

**88** The tiger is left with 10J of energy in a grass–deer–tiger food chain. The energy available at grass level is

- (a) 100 J (b) 2000 J  
(c) 1000 J (d) 10,000 J

**89** If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following food chain?  
Plant → Mice → Snake → Peacock

CBSE-AIPMT 2014

- (a) 0.02 J (b) 0.002 J  
(c) 0.2 J (d) 0.0002 J

**90** The relation between producers and consumers in an ecosystem can be graphically represented in the form of a pyramid called

- (a) ecological pyramid  
(b) trophic level  
(c) Pi chart  
(d) pyramid of biomass

**91** In ecological pyramid, the base always represents the ...A... and the apex represents ...B... Here, A and B represent.

- (a) A–producers, B–top level consumers  
(b) A–top level consumers, B–producers  
(c) A–producers, B–secondary consumers  
(d) A–producers, B–primary consumers

**92** To show how many organisms are present at each level of a food chain, ecologists use a model called

- (a) an energy flow pyramid  
(b) pyramid of numbers  
(c) pyramid of energy  
(d) food chain/food web pyramid

**93** How many trophic levels human beings function at in a food chain?

- (a) 1 (b) 2  
(c) 3 (d) 4

**94** The upright pyramid of number is absent in

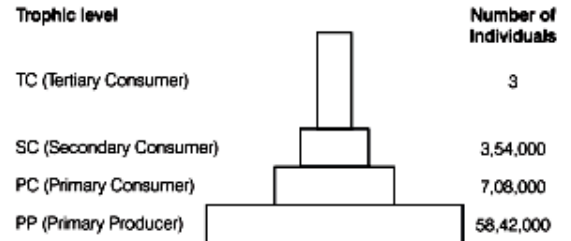
CBSE-AIPMT 2012

- (a) pond (b) forest  
(c) lake (d) grassland

**95** Which of the following ecological pyramid are always inverted?

- (a) Pyramid of number in parasitic food chain and pyramid of biomass in pond ecosystem  
(b) Pyramid of number in pond ecosystem and pyramid of biomass in pond ecosystem  
(c) Pyramid of number in pacific food chain and pyramid of number in pond ecosystem  
(d) All of the above

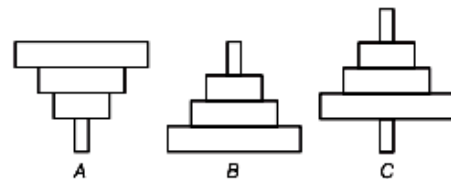
**96** Given below is one of the types of ecological pyramids.



This type represents

- (a) pyramid of number in a grassland ecosystem  
(b) pyramid of energy in forest ecosystem  
(c) pyramid of biomass in sea ecosystem  
(d) pyramid of biomass in terrestrial ecosystem

**97** Which of the following representations show both the pyramid of numbers and biomass in a grassland ecosystem?



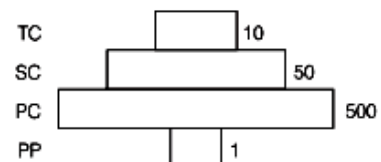
- (a) A (b) B (c) C (d) None of these

**98** Peacock eats a snake and snake eats frog and frog eats insects, while insects eat green plants. The position of peacock is

- (a) primary producer  
(b) secondary producer  
(c) decomposer  
(d) at the apex of food ecological pyramid

**99** Given below is an imaginary pyramid of number. What could be one of the possibilities about certain organisms at some of the different levels?

CBSE-AIPMT 2012



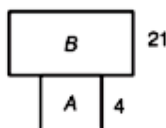
- (a) Level PC is insects and level SC is small insectivorous birds  
(b) Level PP is phytoplanktons in sea and whale on top level TC  
(c) Level one PP is peepal trees and the level SC is sheep  
(d) Level PC is rats and level SC is cats

**100** Which kind of pyramid is represented by the given diagram?



- (a) Pyramid of number in tree ecosystem
- (b) Pyramid of biomass in tree ecosystem
- (c) Pyramid of biomass in aquatic ecosystem
- (d) Pyramid of energy in tree ecosystem

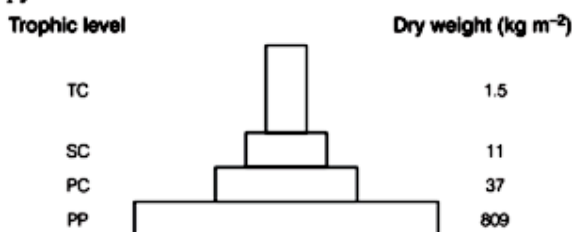
**101** Given diagram represents a pyramid of biomass in an aquatic system.



Identifies *A* of *B* and select correct options.

- (a) *A* is phytoplanktons and *B* is zooplanktons
- (b) *A* is zooplanktons and *B* is phytoplanktons
- (c) *A* is small body animals
- (d) *B* is small body animals

**102** Given below is one of the type of ecological pyramids.



This type represents

- (a) pyramid of energy in a grassland
- (b) pyramid of biomass
- (c) pyramid of number in a lake
- (d) pyramid of energy in a fallow land

**103** An inverted pyramid of ...*A*... may occasionally be observed in ...*B*... communities.

- (a) *A*–energy, *B*–grassland
- (b) *A*–energy, *B*–forest
- (c) *A*–biomass, *B*–marine
- (d) *A*–biomass, *B*–grassland

**104** Which of the following always has a pyramidal shape, that is, decreasing values at higher trophic levels?

- (a) Pyramid of number
- (b) Pyramid of biomass
- (c) Both (a) and (b)
- (d) Pyramid of energy

**105** Which is an example of true pyramid in an ecosystem?

- (a) Pyramid of biomass
- (b) Pyramid of number
- (c) Pyramid of energy
- (d) None of the above

**106** Pyramid of ..... is never inverted.

- (a) energy
- (b) mass
- (c) numbers
- (d) size

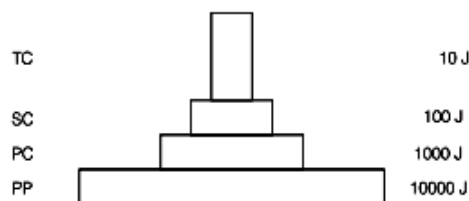
**107** Pyramid of biomass is more real than the pyramid of number

- (a) the pyramid of number does not take into consideration the size of the individual
- (b) maximum biomass occurs in top carnivores
- (c) it can be inverted in terrestrial ecosystem and upright in aquatic ecosystem
- (d) Both (a) and (b)

**108** The pyramid of energy is always upright for any ecosystems. This situation indicates the fact that

- (a) producers have the lowest energy conversion efficiency
- (b) carnivores have a better energy conversion efficiency than herbivores
- (c) energy conversion efficiency is the same in all trophic levels
- (d) herbivores have a better energy conversion efficiency than carnivores

**109** Given below is the diagram of the ecological pyramids.



This type represents

- (a) pyramid of number in a grassland
- (b) pyramid of biomass in a lake
- (c) pyramid of biomass in a land
- (d) pyramid of energy

**110** Which of the following ecological pyramids is generally inverted?

NEET 2019

- (a) Pyramid of energy
- (b) Pyramid of biomass in a forest
- (c) Pyramid of biomass in a sea
- (d) Pyramid of numbers in grassland

**111** Which ecosystem has the maximum biomass?

NEET 2017

- (a) Forest ecosystem
- (b) Grassland ecosystem
- (c) Pond ecosystem
- (d) Lake ecosystem

**112** What type of ecological pyramid would be obtained with the following data?

NEET 2018

Secondary consumer : 120 g

Primary consumer : 60 g

Primary producer : 10 g

- (a) Upright pyramid of numbers
- (b) Pyramid of energy
- (c) Inverted pyramid of biomass
- (d) Upright pyramid of biomass

**113** During ecological succession,

CBSE-AIPMT 2015

- (a) the gradual and predictable change in species composition occurs in a given area
- (b) the establishment of a new biotic community is very fast in its primary phase
- (c) the numbers and types of animals remain constant
- (d) the changes lead to a community that is in near equilibrium with the environment and is called pioneer community

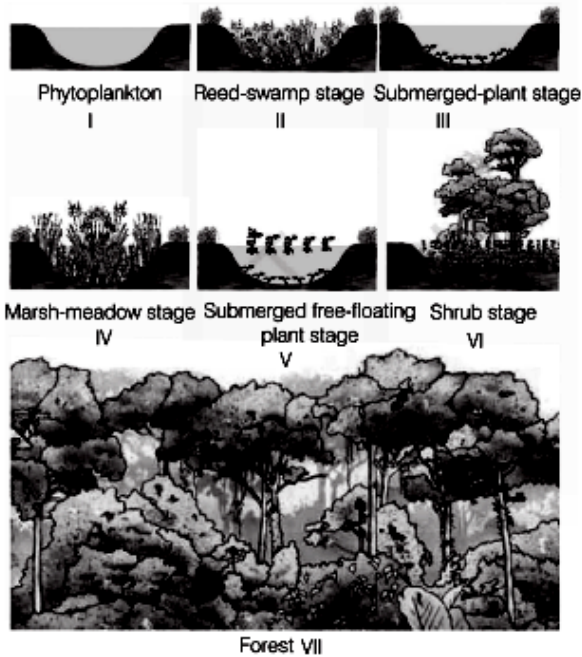
**114** Ecological succession is a sequence of series leading from barren land to the .....

- (a) seral community
- (b) climax community
- (c) pioneer species
- (d) benthos



- 115** Climax community is  
 (a) stable (b) self-perpetuating  
 (c) final biotic community (d) All of these
- 116** In ecological succession, the communities in near equilibrium with the environment, are called  
 (a) climax communities  
 (b) eco-friendly communities  
 (c) seral communities  
 (d) pioneer communities
- 117** In plant succession, when climax community is reached, the net productivity  
 (a) continues to increase (b) becomes zero  
 (c) becomes reduced (d) becomes stable
- 118** The nature of climax community in ecological succession is most dependent upon  
 (a) climate (b) water  
 (c) soil fertility (d) None of these
- 119** The entire sequence of communities that successively changes in a given area are called  
 (a) sere (b) climax  
 (c) pioneer (d) xerarch
- 120** An individual transitional communities in ecological succession are termed as  
 (a) climax community (d) pioneer community  
 (c) seral community (d) single community
- 121** In the successive seral stages, there is  
 (a) change in the diversity of species, of organisms  
 (b) Increase in the number of species and organisms  
 (c) increase in total biomass  
 (d) All of the above
- 122** The species that invade a bare area in ecological succession are called  
 (a) benthos (b) biological species  
 (c) seral species (d) pioneer species
- 123** Primary succession is the development of communities on  
 (a) cleared forest area  
 (b) previously unoccupied sites  
 (c) fresh harvested crop field  
 (d) pond filled after a day season
- 124** During ..... succession the establishment of new biotic community is generally low. The most appropriate word to fill the blank is  
 (a) primary (b) secondary  
 (c) tertiary (d) quaternary
- 125** Primary succession which occurs on a primary barren area  
 (a) is quite hostile to first life of pioneer community  
 (b) takes a very long time  
 (c) where pioneer community comes from outside  
 (d) All of the above
- 126** Primary succession on rocks starts with  
 (a) lichen (b) grass  
 (c) mosses (d) ferns
- 127** In lithosere, foliose lichens make the conditions favourable for the growth of  
 (a) crustose lichens (b) mosses  
 (c) annual grasses (d) perennial grasses
- 128** ..... succession begins in area where natural biotic communities have been destroyed. The most appropriate word to fill the blank is  
 (a) Primary (b) Secondary  
 (c) Tertiary (d) Quaternary
- 129** The second stage of hydrosere is occupied by plants like **CBSE-AIPMT 2012**  
 (a) *Azolla* (b) *Typha*  
 (c) *Salix* (d) *Vallisneria*
- 130** Secondary succession takes place on/in **CBSE-AIPMT 2015**  
 (a) bare rock (b) degraded forest  
 (c) newly created pond (d) newly cooled lava
- 131** Find out the correct order of succession levels in xerarch.  
 (a) Lichen → Moss stage → Annual herb stage → Perennial herb stage → Shrub stage → Forest  
 (b) Annual herb stage → Perennial herb stage → Lichen → Moss stage → Shrub stage → Forest  
 (c) Shrub stage → Forest → Annual herb stage → Perennial herb stage → Lichen → Moss stage  
 (d) Forest → Shrub stage → Annual herb stage → Perennial herb stage → Lichen → Moss stage
- 132** Primary succession in water, the pioneer species are  
 (a) free-floating angiosperm  
 (b) small phytoplanktons  
 (c) rooted hydrophytes  
 (d) lichens
- 133** Which one of the following is correct for xerarch succession?  
 (a) Successional series from xeric to mesic condition  
 (b) Successional series from hydric to mesic condition  
 (c) Both (a) and (b)  
 (d) None of the above
- 134** In secondary succession, the species that invade depend on  
 (a) the condition of soil  
 (b) availability of water  
 (c) seeds or other propagules  
 (d) All of the above
- 135** Fill in the missing stages (A to D) in the given primary hydrarch succession.  
 Phytoplankton → (A) → (B) → (C) → Marsh-meadow stage → (D) → Forest plant stage.  
 (a) A-Reed-swamp stage, B-Submerged plant stage, C-Submerged free-floating plant stage, D-Shrub stage  
 (b) A-Submerged plant stage, B-Submerged free-floating plant stage, C-Reed-swamp stage, D-Shrub stage  
 (c) A-Shrub stage, B-Submerged plant stage, C-Reed-swamp stage, D-Submerged free-floating plant stage  
 (d) A-Reed-swamp stage, B-Shrub stage, C-Submerged plant stage, D-Submerged free-floating plant stage

- 136** Following are the different stages in primary succession in water.



Which of the following is the logical sequence of primary succession in water?

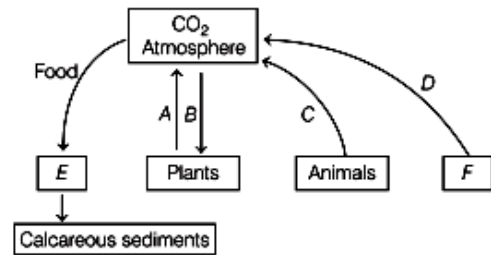
- (a) II → IV → V → VII → I → III → VI  
 (b) I → III → V → II → IV → VI → VII  
 (c) V → II → IV → VI → VII → III → I  
 (d) VI → VII → III → I → V → II → IV
- 137** The total amount of nutrients like carbon, phosphorus, calcium, etc., present in soil at any time is called
- (a) standing crop (b) standing state  
 (c) nutrient crops (d) sediment
- 138** In an ecosystem, the cycling of nutrient is known as
- (a) geological cycle (b) chemical cycle  
 (c) geochemical cycle (d) biogeochemical cycle
- 139** The reservoir for the gaseous type of biogeochemical cycle exists in
- (a) stratosphere (b) atmosphere  
 (c) ionosphere (d) lithosphere
- 140** Which of the following pair is a gaseous type of biogeochemical cycle?
- (a) Nitrogen and carbon cycle  
 (b) Phosphorus and carbon cycle  
 (c) Nitrogen and sulphur cycle  
 (d) Sulphur and carbon cycle
- 141** In a ..... cycle, the elements returns and is withdrawn from the atmosphere. Most appropriate word to fill the blank is
- (a) gaseous (b) sedimentary  
 (c) Both (a) and (b) (d) None of these
- 142** The reservoir for the sedimentary cycle exists in
- (a) earth's crust (b) organic sediments  
 (c) calcareous sediments (d) limestone
- 143** In sedimentary nutrient cycling,
- (a) the reservoir pool is lithosphere  
 (b) the sedimentary cycles are less perfect  
 (c) the withdrawal from reservoir pool is large  
 (d) All of the above

- 144** Which one of the following is not a gaseous biogeochemical cycle in ecosystem?

CBSE-AIPMT 2012

- (a) Oxygen cycle (b) Phosphorus cycle  
 (c) Nitrogen cycle (d) Carbon cycle

- 145** Complete the following model of carbon cycle filling A, B, C, D, E and F.



- (a) A–Osmosis, B–Photosynthesis, C–Respiration, D–Burning of fuel wood, E–Forest food chain, F–Limestone  
 (b) A–Photorespiration, B–Respiration, C–Respiration, D–Burning of organic debris, E–Pond food chain, F–Dolomite  
 (c) A–Respiration, B–Photosynthesis, C–Respiration, D–Combustion of fossil fuels, E–Aquatic food chain, F–Coal, oil  
 (d) A–Respiration, B–Photosynthesis, C–Respiration, D–Burning of forest, E–Terrestrial food chain, F–Forest
- 146** What is the reason behind deficit rising in nutrient reservoir?
- (a) Due to imbalance in the rate of influx  
 (b) Due to imbalance in the rate of efflux  
 (c) Due to imbalance in the rate of influx and efflux  
 (d) None of the above
- 147** Carbon constitutes ..... of dry weight of an organism. Most appropriate word to fill the blank is
- (a) 49% (b) 59%  
 (c) 69% (d) 39%
- 148** ..... of the carbon is found dissolved in oceans, which is responsible for its regulation in atmosphere. Most appropriate word to fill the blank is
- (a) 51% (b) 81%  
 (c) 61% (d) 71%
- 149** Which of the following regulates the amount of carbon dioxide in the atmosphere
- (a) respiration in animals  
 (b) respiration in plants  
 (c) photosynthesis activity of plants  
 (d) oceanic reservoir of carbon
- 150** What is the medium by which carbon cycle takes place?
- (a) Through atmosphere  
 (b) Through ocean  
 (c) Through living and dead organisms  
 (d) All of the above
- 151** What human activities are responsible to increase the amount of CO<sub>2</sub> in the atmosphere?
- (a) Deforestation  
 (b) Massive burning of fossil fuels  
 (c) Vehicle used for transport  
 (d) All of the above

**152** Which of the following factor is contributing to an overload of the carbon cycle?

- (a) Photosynthesis (b) Cellular respiration  
(c) Deforestation (d) Afforestation

**153** The exchange pool in the carbon cycle is

- (a) fossil fuels (b) sedimentary rock  
(c) water (d) atmosphere

**154** Which element is formed by the weathering of rocks and absorbed by plant from the soil?

- (a) Phosphorus (b) Carbon (c) Nitrogen (d) Oxygen

**155** Phosphorus is needed for the production of

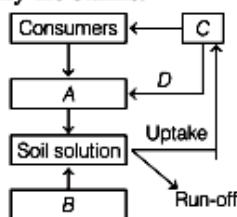
- (a) DNA and RNA (b) cellular membranes  
(c) bones and teeth (d) All of these

**156** In the phosphorus cycle, weathering makes phosphate available first to

- (a) producers (b) decomposers  
(c) consumers (d) None of these

**157** Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.

**CBSE-AIPMT 2014**



	A	B	C	D
(a)	Rock minerals	Detritus	Litter fall	Producers
(b)	Litter fall	Producers	Rock minerals	Detritus
(c)	Detritus	Rock minerals	Producer	Litter fall
(d)	Producers	Litter fall	Rock minerals	Detritus

**158** Select the incorrect match.

**AIIMS 2018**

- I. Sedimentary nutrient cycle–Nitrogen cycle  
II. Pioneer species–Lichens  
III. Secondary succession–Burned forests  
IV. Pyramid of biomass of aquatic ecosystem–Upright

**Codes**

- (a) I and IV (b) I, II and III (c) I and III (d) III and IV

**159** Fill up the blank.

- I. The products of ecosystem processes are called...A...  
II. ...B... are the major source of ecosystem services.  
III. ...C... and his colleagues tried to put price tags on nature's life support services, which came up to US ...D... a year.

Choose the correct option for A, B, C and D.

- (a) A–Ecosystem services, B–Plants, C–Robert Brown, D–31 trillion  
(b) A–Ecology services, B–Plants, C–Robert Constanza, D–32 trillion  
(c) A–Ecosystem services, B–Forests, C–Robert Constanza, D–33 trillion  
(d) A–Ecology services, B–Ponds, C–Robert Brown, D–34 trillion

## SPECIAL FORMAT QUESTIONS

1. Consider the following statements.

- I. Forest, grassland and desert are examples of terrestrial ecosystem.
  - II. Pond, lake, wetland, river and estuary are examples of aquatic ecosystem.
- (a) Statement I is true, but II is false  
(b) Statement I is false, but II is true  
(c) Both statements I and II are true  
(d) Both statements I and II are false

2. Consider the following statements.

- I. The components of ecosystem do not include decomposition.
- II. Decomposers are saprophytic organisms like fungi, bacteria and flagellates especially abundant in the bottom of the pond.

Choose the correct option.

- (a) I is true, but II is false    (b) I is false, but II is true  
(c) Both I and II are true    (d) Both I and II are false

3. Consider the following statements.

- I. Producers are also called as transducers because they are able to change radiant energy into chemical form.
- II. Consumers are animals, which feed on other organisms or their parts.
- III. Decomposers are saprotrophs, which feed on dead bodies of organisms.

Which of the statements given above are correct?

- (a) I, II and III    (b) I and II    (c) I and III    (d) II and III

4. Select the true statements.

- I. Productivity can be divided into gross primary productivity and net primary productivity.
- II. Net primary productivity is the available biomass for the consumption to heterotrophs.
- III. Net primary productivity is equal to gross primary productivity minus respiration.
- IV. There is unidirectional movement of energy towards higher trophic levels and its dissipation and loss as heat to the environment.

Choose the correct option.

- (a) I, II and III    (b) I and IV  
(c) II and III    (d) I, II, III and IV

5. Identify the incorrect statement.

- (a) The annual net primary productivity of the whole biosphere is approximately 170 billion tonnes of organic matter
- (b) The gaseous exchanges of phosphorus between organism and environment are negligible
- (c) In the successive seral stages, there is a change in the diversity of species of organisms, decrease in the number of species and organisms as well as decrease in the total biomass
- (d) In secondary succession, the species that invade depend on the condition of the soil, availability of water, the environment as also the seeds or other propagules present

6. Read the following statements.

- I. Identification and enumeration of plant and animal species of an ecosystem given its species composition.
- II. Despite occupying about 70% of the surface, the productivity of the oceans are only 55 billion tons.
- III. A constant input of solar energy is the basic requirement for any ecosystem to function and sustain.
- IV. Sugarcane have more efficiency to trap sunlight, so they accumulate more primary productivity.

Which of the statements given above are correct?

- (a) I and II    (b) I and IV  
(c) I, II, III and IV    (d) None of these

7. Choose the incorrect statement(s) for a pond ecosystem.

- I. Abiotic component is water with all inorganic and organic substances dissolved in it.
  - II. There is no means to regulate the rate of function of the entire pond.
  - III. Consumers are zooplankton and decomposers are fungi, bacteria and flagellates.
  - IV. Heterotrophs consumer autotrophs.
  - V. Autotrophs traps radiant energy of the sun.
- (a) I, II and III  
(b) II, III and IV  
(c) III, IV and V  
(d) Only II

8. Choose the true/false statements from the given set.

- I. Decomposition rate is higher when detritus is enriched with lignin and chitin.
- II. The humus formed during humification is further degraded by some microbes and release inorganic nutrients *via* mineralisation process.

Choose the correct option.

- (a) I is true, while II is false  
(b) I and II both are true  
(c) I is false, while II is true  
(d) I and II both are false

9. Which of the following statements is/are not true?

- I. Below ground detritus constitutes leaf litter, dried plant parts, remains of animals, their droppings and excretions.
- II. Above ground detritus mainly constitutes dead roots, underground dead animals, etc.
- III. Decomposition completely disposes off the whole detritus.
- IV. Humus is rich in chitin and lignin.

- (a) I, II and III                      (b) I, II and IV  
(c) I and II                              (d) II and III

10. Study the following statements.

- I. Decomposition is a carbon dioxide requiring process.
- II. Humus is colloidal in nature and serves as a reservoir of nutrients.
- III. Warm and moist environment slows down decomposition.
- IV. Humification and mineralisation occur during decomposition in the soil.

Which of the statements given above are correct?

- (a) II and IV                              (b) I and III  
(c) I and II                                (d) III and IV

Read the statements given below.

- I. A straight single pathway through which food travels in an ecosystem.
- II. Members of high trophic level feed on lower trophic level animals.
- III. No addition to the adaptability and competitiveness of the organism.
- IV. Links different organisms *via* their nutritional requirements.

11. The above statements correlate with

- (a) food web
- (b) detritus food chain
- (c) ecological pyramid of energy
- (d) food chain

12. Consider the following statements about food chain.

- I. The transfer of energy from producers to top consumers through a series of organisms is called food chain.
- II. A food chain is always straight and proceeds in a progressive straight line.
- III. In a food chain, there is unidirectional flow of energy from sun to producers and after that to series of different types of consumers.

Which of the statements given above are correct?

- (a) I and II                                (c) I and III  
(b) II and III                              (d) I, II and III

13. Consider the following statements.

- I. In a food chain, one organism holds only one position.
- II. In a food chain the flow of energy can be easily calculated.
- III. In food chain, competition is limited to the members of same trophic level.

Which of the statements given above are correct?

- (a) I, II and III                          (b) I and II  
(c) I and III                                (d) II and III

14. Consider the following statements.

- I. In a terrestrial ecosystem, major producers are herbaceous and woody plants.
- II. In an aquatic ecosystems, species like phytoplankton, algae and higher plants are producers.
- III. Primary consumers are herbivores.
- IV. Primary carnivores are secondary consumers.

Choose the option with correct statements.

- (a) I and II  
(b) III and IV  
(c) I and III  
(d) I, II, III and IV

15. Choose the correct option for the incorrect statements from the following.

- I. Plants form second trophic level.
- II. Herbivores eat grass and form first trophic level.
- III. The example of top carnivore is tertiary level consumers.
- IV. Detritivores are also a form of consumers.

- (a) I and II                                (b) II and III  
(c) III and IV                              (d) I and IV

16. Grazing food chain.

- I. It starts with green plant called producers as first trophic level.
- II. A much less fraction of energy flows through this type of food chain in terrestrial ecosystem.
- III. Energy for grazing food chain comes from organic remain or detritus.

Which of the statements given above are correct?

- (a) I and II                                (b) I and III  
(c) II and III                              (d) I, II and III

17. Regarding detritus food chain.

- I. It begins with dead organic matter and decomposers called saprophytes as first trophic level.
- II. A much large fraction of energy flows through this type of food chain in terrestrial ecosystem.
- III. Energy for detritus food chain comes from sun.

Which of the statements given above are correct?

- (a) I and II  
(b) I and III  
(c) II and III  
(d) I, II and III

**18.** Read the following statements.

- I. Decomposers are heterotrophs.
- II. Detritus food chain and decomposers are related with each other.
- III. The natural water connection of food levels forms food chain.
- IV. Decomposers are also called as consumers.

Which of the statements given above are correct?

- (a) I and II are true, III and IV are false
- (b) I and III are true, II and IV are false
- (c) III and IV are true, I and II are false
- (d) All statements are true

**19.** Consider the following statements about food web.

- I. One organism hold more than one position.
- II. The flow of energy is very difficult to calculate.
- III. Instead of straight line it is a series of branching lines.
- IV. Competition is amongst the members of same and different trophic levels.

Which of the statements given above are correct?

- (a) I, II and III
- (b) I, III and IV
- (c) II, III and IV
- (d) I, II, III and IV

**20.** Regarding 10% law.

- I. This law was put forward by Lindemann in 1942.
- II. According to this law, during the transfer of food energy from one trophic level to the other, only about 10% is stored at higher trophic level and the remaining 90% is lost in respiration, decomposition and waste in the form of heat.

Which of the statements given above is/are correct?

- (a) Only I
- (b) Only II
- (c) Both I and II
- (d) None of these

**21** Which one of the following statements for pyramid of energy is incorrect?

- (a) It is upright in shape
- (b) Its base is broad
- (c) It shows the energy content of organisms at different trophic level
- (d) It is sometimes inverted in shape

**22.** Consider the following statements about pyramid of biomass.

- I. When we plot the biomass (net dry weight) of producers, herbivores, carnivores and so on we have a pyramid of biomass.
- II. Two types of pyramid of biomass are found, i.e. upright and inverted.
- III. When larger weight of producers support a smaller of biomass weight of consumers an upright pyramid results.
- IV. When smaller weight of producers support larger weight of consumers an inverted pyramid of biomass is formed.

Which of the statements given above are correct?

- (a) I, II and III
- (b) I, III and IV
- (c) II, III and IV
- (d) I, II, III and IV

**23.** Consider the following statements about ecological pyramids.

- I. Charles Elton developed the concept of ecological pyramid.
- II. After his name, these pyramids are also called as Eltonian pyramids.
- III. It is a graphical representation or pyramid-shaped diagram which depicts the number of organisms, biomass and energy at each trophic level.

Which of the statements given above are correct?

- (a) I and II
- (b) I and III
- (c) II and III
- (d) I, II and III

**24.** Which of the following statements are correct about limitations of ecological pyramids?

- I. It does not take into account same species belonging to two or more trophic levels.
- II. It considers a simple straight food chain which almost never occurs in nature.
- III. Saprophytes are not placed in ecological pyramids however they play vital role.
- IV. It considers food web specific to an ecosystem.
- V. Only three types of pyramids are prevalent, while there can be more existing in nature.

Choose the correct option.

- (a) I, II and III
- (b) I, III and IV
- (c) III, IV and V
- (d) I, II and III

**25.** I. Pioneer community is the final biotic community that develops in an area.

- II. Growth is fast in pioneer community as compared to climax community.
- III. Pioneer community develops partly from the previous occupants and partly from migrants in primary succession.
- IV. Pioneer community is soon replaced by the next seral community during ongoing succession.

Identify the incorrect statements.

- (a) I and II
- (b) I, II and III
- (c) I and III
- (d) III and IV

**26.** Choose the incorrect statement.

- (a) Atmospheric inputs of phosphorus through rainfall are much smaller than carbon inputs
- (b) Gaseous exchanges of phosphorus between organism and environment are negligible
- (c) Phosphorus is released into the atmosphere by respiration
- (d) Herbivores and animals obtain phosphorus from plants

27. Choose the incorrect statement about nutrient cycling.

- I. The movement of nutrient elements through various components (abiotic and biotic) of an ecosystem is called biogeochemical cycle.
- II. Environmental factors like soil, moisture, pH, temperature, etc., regulate the rate of release of nutrients into the atmosphere.
- III. Atmosphere only contains about 10% of total global carbon.
- IV. Fossil fuel also represents a reservoir of carbon.

- (a) I and II                      (b) II and III  
(c) III and IV                    (d) Only III

28. Read the following statements about carbon cycle.

- I. About  $4 \times 10^{13}$  kg of carbon is fixed annually in the biosphere through photosynthesis.
- II. Carbon return to the atmosphere as  $\text{CO}_2$  through respiration by producers and consumers.
- III. Decomposers return  $\text{CO}_2$  to the atmosphere by processing of waste materials and dead organic matter of land or oceans.
- IV. Burning of wood, combustion of organic matter, volcanic activities, etc., release  $\text{CO}_2$  into the atmosphere.

Choose the correct option.

- (a) Both statements I and II are true, but III and IV are false  
(b) Both statements I and II are false, but III and IV are true  
(c) All statements are true  
(d) All statements are false

29. Consider the following statements about phosphorus cycle.

- I. Major reservoirs or phosphorus are phosphate rocks and fossil bone deposits laid down in the past geological ages.
- II. During weathering of rocks, minute amounts of these phosphates dissolve in soil solution and are absorbed by the roots of the plants.

- (a) Statement I is true, but II is false  
(b) Statement I is false, but II is true  
(c) Both statements I and II are true  
(d) Both statements I and II are false

30. Choose the correct statements about Ecosystem Services (ES).

- I. The value of the global gross national product GNP (Gross National Product) US and 18 trillion.
- II. The soil formation accounts for about 50% of ES.
- III. Recreation and nutrient cycling are less than 10% of ES.
- IV. The cost of climate regulation and habitat for wildlife are about 6% each.

- (a) I and II                      (b) III and IV  
(c) I and III                    (d) I, II, III and IV

31. Study the following columns and choose the correct option.

Column I (Ecological terms)	Column II (Characteristics)
A. Population	1. Part of the earth consisting of all the ecosystems of the world.
B. Community	2. Assemblage of all the individuals belonging to different species occurring in an area.
C. Ecosystem	3. Group of similar individuals belonging to the same species found in an area.
D. Biosphere	4. Interaction between the living organisms and their physical environment components.

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 3 | 2 | 1 | 4 | (b) 5 | 2 | 3 | 4 |
| (c) 2 | 3 | 5 | 1 | (d) 3 | 2 | 4 | 1 |

32. Match the following columns.

Column I (Components of ecosystem)	Column II (Feeding habits)
A. Scavengers	1. Autotrophs
B. Parasites	2. Heterotrophs
C. Producers	3. Consumers that feed on a small part of a living being
D. Phagotrophs	4. Consumers of dead bodies

Codes

- |       |   |   |   |       |   |   |   |
|-------|---|---|---|-------|---|---|---|
| A     | B | C | D | A     | B | C | D |
| (a) 4 | 3 | 1 | 2 | (b) 3 | 1 | 2 | 4 |
| (c) 1 | 2 | 4 | 3 | (d) 4 | 3 | 2 | 1 |

33. Match the following columns.

Column I (Categories)	Column II (Examples)
A. Inorganic substances	1. Light, temperature and humidity.
B. Organic compounds	2. Soil, pH and minerals.
C. Climatic factors	3. Proteins, carbohydrates, lipids and nucleic acid.
D. Edaphic factors	4. Carbon, nitrogen, oxygen and water.

Codes

- |       |   |   |   |
|-------|---|---|---|
| A     | B | C | D |
| (a) 3 | 1 | 2 | 4 |
| (b) 4 | 3 | 1 | 2 |
| (c) 1 | 2 | 3 | 4 |
| (d) 4 | 2 | 1 | 3 |

34. Match the following columns.

Column I	Column II
A. Natural ecosystem	1. Producer
B. Decomposer	2. Consumer
C. Primary productivity	3. Forest
D. Secondary productivity	4. Bacteria

Codes

A	B	C	D	A	B	C	D
(a) 1	2	3	4	(b) 2	3	4	1
(c) 3	4	1	2	(d) 3	4	2	1

35. Match the following columns.

Column I	Column II
A. Carbon fixed annually through photosynthesis	1. $4 \times 10^{13}$ kg
B. Net primary productivity of biosphere	2. 170 billion tons
C. Net primary productivity of oceans	3. 55 billion tons
D. Sunlight	4. 40,00,000 J

Codes

A	B	C	D	A	B	C	D
(a) 1	2	3	4	(b) 2	3	4	1
(c) 3	4	1	2	(d) 4	1	2	3

36. Match the following columns.

Column I (Types of consumers)	Column II (Feeding habits)
A. Primary consumers	1. A meat eater that eats primary consumers
B. Secondary consumers	2. A meat eater that eats tertiary consumers
C. Tertiary consumers	3. A vegetable eater that eats producers
D. Quaternary consumers	4. A meat eater that eats secondary consumers.

Codes

A	B	C	D	A	B	C	D
(a) 1	4	2	3	(b) 3	1	4	2
(c) 4	2	3	1	(d) 2	3	1	4

37. Match the following columns.

Column I (Terms)	Column II (Features)
A. Food chain	1. An organism that eats meat.
B. Food web	2. An organism that eats plants.
C. Heterotroph	3. An organism that makes its food from light or chemical energy without eating.
D. Autotroph	4. An organism that gets its energy by eating other organisms.
E. Carnivore	5. The sequence of organisms, as who eats whom in a biological community.
F. Herbivore	6. The network of all the inter-related food chains in a biological community

Codes

A	B	C	D	E	F
(a) 5	6	4	3	1	2
(b) 6	4	3	1	2	5
(c) 3	1	2	5	6	4
(d) 2	5	6	4	3	1

38. Match the following columns.

Column I	Column II
A. Primary succession	1. Ecosystem development
B. Climax community	2. Crustose lichens
C. Pioneer community on lithosphere	3. Community that has completed succession
D. Ecological succession	4. Colonisation of a new environment

Codes

A	B	C	D
(a) 3	2	1	4
(b) 4	3	2	1
(c) 1	2	3	4
(d) 4	3	1	2

39. Match the following columns.

Column I (Seres)	Column II (Features)
A. Xeroseres	1. Ecological succession starts on terrestrial habitat
B. Hydroseres	2. Succession begins from open water bodies
C. Lithoseres	3. Succession begins on sand
D. Psammoseres	4. Succession starts on a bare rock

Codes

A	B	C	D	A	B	C	D
(a) 3	1	2	4	(b) 4	3	1	2
(c) 1	2	4	3	(d) 2	4	3	1

40. Match the following columns.

Column I	Column II
A. Earthworm	1. Pioneer species
B. Succession	2. Detritivore
C. Ecosystem service	3. Natality
D. Population growth	4. Pollination

Codes

A	B	C	D	A	B	C	D
(a) 1	2	3	4	(b) 4	1	3	2
(c) 3	2	4	1	(d) 2	1	4	3

41. Match the following columns.

Column I	Column II
A. Standing state	1. Carbon cycle
B. Gaseous cycle	2. Sulphur cycle
C. Sedimentary cycles	3. Species that invade a bare area
D. Pioneer species	4. Amount of nutrients

Codes

A	B	C	D	A	B	C	D
(a) 1	2	3	4	(b) 4	1	2	3
(c) 4	1	3	2	(d) 3	4	1	2



## NCERT EXEMPLAR PROBLEMS

1. Decomposers like fungi and bacteria are:

- i. autotrophs
- ii. heterotrophs
- iii. saprotrophs
- iv. chemo-autotrophs.

Choose the correct answer:

- (a) i and iii, (b) i and iv (c) ii and iii, (d) i and ii

2. The process of mineralisation by micro organisms helps in the release of:

- a. inorganic nutrients from humus
- b. both organic and inorganic nutrients from detritus
- c. organic nutrients from humus
- d. inorganic nutrients from detritus and formation of humus.

3. Productivity is the rate of production of biomass expressed in terms of:

- i.  $(\text{kcal m}^{-3}) \text{ yr}^{-1}$
- ii.  $\text{g}^{-2} \text{ yr}^{-1}$
- iii.  $\text{g}^{-1} \text{ yr}^{-1}$
- iv.  $(\text{kcal m}^{-2}) \text{ yr}^{-1}$

- (a) ii, (b) iii, (c) ii and iv, (d) i and iii

4. An inverted pyramid of biomass can be found in which ecosystem?

- a. Forest
- b. Marine
- c. Grass land
- d. Tundra

5. Which of the following is not a producer?

- a. *Spirogyra*
- b. *Agaricus*
- c. *Volvox*
- d. *Nostoc*

6. Which of the following ecosystems is most productive in terms of net primary production?

- a. Deserts
- b. Tropical rain forests
- c. Oceans
- d. Estuaries

7. Pyramid of numbers is:

- a. Always upright
- b. Always inverted
- c. Either upright or inverted
- d. Neither upright nor inverted.

8. Approximately how much of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis?
- Less than 1%
  - 2-10%
  - 30%
  - 50%
9. Among the following, where do you think the process of decomposition would be the fastest?
- Tropical rain forest
  - Antarctic
  - Dry arid region
  - Alpine region
10. How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?
- 1%
  - 10%
  - 40%
  - 90%
11. During the process of ecological succession the changes that take place in communities are:
- Orderly and sequential
  - Random
  - Very quick
  - Not influenced by the physical environment.
12. Climax community is in a state of:
- non-equilibrium
  - equilibrium
  - disorder
  - constant change.
13. Among the following bio-geo-chemical cycles which one does not have losses due to respiration?
- Phosphorus
  - Nitrogen
  - Sulphur
  - All of the above
14. The sequence of communities of primary succession in water is:
- phytoplankton, sedges, free-floating hydrophytes, rooted hydrophytes, grasses and trees.
  - phytoplankton, free-floating hydrophytes, rooted hydrophytes, sedges, grasses and trees.
  - free-floating hydrophytes, sedges, phytoplankton, rooted hydrophytes, grasses and trees.
  - phytoplankton, rooted submerged hydrophytes, floating hydrophytes, reed swamp, sedges, meadow and trees.

15. The reservoir for the gaseous type of bio-geo chemical cycle exists in
- stratosphere
  - atmosphere
  - ionosphere
  - lithosphere
16. If the carbon atoms fixed by producers already have passed through three species, the trophic level of the last species would be.
- scavenger
  - tertiary producer
  - tertiary consumer
  - secondary consumer
17. Which of the following type of ecosystem is expected in an area where evaporation exceeds precipitation, and mean annual rainfall is below 100mm
- Grassland
  - Shrubby forest
  - Desert
  - Mangrove
18. The zone at the edge of a lake or ocean which is alternatively exposed to air and immersed in water is called:
- Pelagic zone
  - Benthic zone
  - Lentic one
  - Littoral zone
19. Edaphic factor refers to:
- Water
  - Soil
  - Relative humidity
  - Altitude
20. Which of the following is an ecosystem service provided by a natural ecosystem?
- Cycling of nutrients
  - Prevention of soil erosion
  - Pollutant absorption and reduction of the threat of global warming
  - All of the above

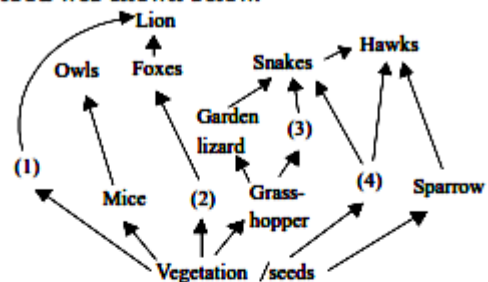
## NEET PREVIOUS QUESTIONS

- The term ecosystem was coined by  
(a) E. Haeckel (b) E. Warming  
(c) E.P. Odum (d) A. G. Tansley.  
(NEET-I 2016)
- Which one of the following is a characteristic feature of cropland ecosystem?  
(a) Absence of weeds  
(b) Ecological succession  
(c) Absence of soil organisms  
(d) Least genetic diversity (NEET-I 2016)
- Vertical distribution of different species occupying different levels in a biotic community is known as  
(a) zonation (b) pyramid  
(c) divergence (d) stratification.  
(2015 Cancelled)
- Which one of the following is not a functional unit of an ecosystem?  
(a) Energy flow (b) Decomposition  
(c) Productivity (d) Stratification (2012)
- Which one of the following is one of the characteristics of a biological community?  
(a) Stratification (b) Natality  
(c) Mortality (d) Sex-ratio (2010)
- Which of the following is the most stable ecosystem?  
(a) Mountain (b) Ocean  
(c) Forest (d) Desert (1995)
- In relation to Gross primary productivity and Net primary productivity of an ecosystem, which one of the following statements is correct?  
(a) Gross primary productivity is always less than Net primary productivity.  
(b) Gross primary productivity is always more than Net primary productivity.  
(c) Gross primary productivity and Net primary productivity are one and same.  
(d) There is no relationship between Gross primary productivity and Net primary productivity.  
(NEET 2020)
- The mass of living material at a trophic level at a particular time is called  
(a) net primary productivity  
(b) standing crop  
(c) gross primary productivity  
(d) standing state. (2015 Cancelled)
- In an ecosystem the rate of production of organic matter during photosynthesis is termed as  
(a) secondary productivity  
(b) net productivity  
(c) net primary productivity  
(d) gross primary productivity. (2015 Cancelled)
- Secondary productivity is rate of formation of new organic matter by  
(a) consumers (b) decomposers  
(c) producers (d) parasites.  
(NEET 2013)
- The rate of formation of new organic matter by rabbit in a grassland, is called  
(a) net productivity  
(b) secondary productivity  
(c) net primary productivity  
(d) gross primary productivity. (Mains 2012)
- Mass of living matter at a trophic level in an area at any time is called  
(a) standing crop (b) detritus  
(c) humus (d) standing state. (2011)
- The biomass available for consumption by the herbivores and the decomposers is called  
(a) net primary productivity  
(b) secondary productivity  
(c) standing crop  
(d) gross primary productivity. (2010)
- Which one of the following ecosystem types has the highest annual net primary productivity?  
(a) Tropical deciduous forest  
(b) Temperate evergreen forest  
(c) Temperate deciduous forest  
(d) Tropical rainforest (2007)
- Which of the following is expected to have the highest value ( $\text{gm/m}^2/\text{yr}$ ) in a grassland ecosystem?  
(a) Secondary production  
(b) Tertiary production  
(c) Gross production (GP)  
(d) Net production (NP) (2004)
- The rate at which light energy is converted into chemical energy of organic molecules is the ecosystem's  
(a) net secondary productivity  
(b) gross primary productivity  
(c) net primary productivity  
(d) gross secondary productivity. (1998)
- Which of the following ecosystem has the highest gross primary productivity?  
(a) Mangroves (b) Rainforest  
(c) Grassland (d) Coral reef (1997)
- Maximum solar energy is trapped by  
(a) planting trees  
(b) cultivating crops  
(c) growing algae in tanks  
(d) growing grasses. (1993)
- A very efficient converter of solar energy with net productivity of  $204 \text{ kg/m}^2$  or more is the crop  
(a) wheat (b) sugarcane  
(c) rice (d) bajra. (1989)

20. Which one of the following processes during decomposition is correctly described?  
 (a) Catabolism – Last step in the decomposition under fully anaerobic condition  
 (b) Leaching – Water soluble inorganic nutrients rise to the top layers of soil  
 (c) Fragmentation – Carried out by organisms such as earthworm  
 (d) Humification – Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate.  
 (NEET 2013)
21. The breakdown of detritus into smaller particles by earthworm is a process called  
 (a) humification (b) fragmentation  
 (c) mineralisation (d) catabolism.  
 (Mains 2011)
22. The slow rate of decomposition of fallen logs in nature is due to their  
 (a) anaerobic environment around them  
 (b) low cellulose content  
 (c) low moisture content  
 (d) poor nitrogen content. (2008)
23. Plant decomposers are  
 (a) monera and fungi  
 (b) fungi and plants  
 (c) protista and animalia  
 (d) animalia and monera. (2001)
24. Which of the following acts as "nature's scavengers"?  
 (a) Insects (b) Microorganisms  
 (c) Man (d) Animals (1997)
25. If we completely remove the decomposers from an ecosystem, its functioning will be adversely affected, because  
 (a) mineral movement will be blocked  
 (b) the rate of decomposition will be very high  
 (c) energy flow will be blocked  
 (d) herbivores will not receive solar energy. (1995)
26. The primary producers of the deep-sea hydrothermal vent ecosystem are  
 (a) green algae  
 (b) chemosynthetic bacteria  
 (c) blue-green algae  
 (d) coral reefs. (NEET-II 2016)
27. Most animals that live in deep oceanic waters are  
 (a) tertiary consumers  
 (b) detritivores  
 (c) primary consumers  
 (d) secondary consumers. (2015)
28. If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain?  
 Plant → Mice → Snake → Peacock  
 (a) 0.02 J (b) 0.002 J  
 (c) 0.2 J (d) 0.0002 J (2014)

29. Which of the following is a primary consumer in maize field ecosystem?  
 (a) Grasshopper (b) Wolf  
 (c) Phytoplankton (d) Lion  
 (Karnataka NEET 2013)
30. When man eats fish which feeds on zooplanktons which have eaten small plants, the producer in this chain is  
 (a) small plants (b) fish  
 (c) man (d) zooplankton.  
 (Karnataka NEET 2013)

31. Identify the possible link "A" in the following food chain.  
 Plant → Insect → Frog → "A" → Eagle  
 (a) Rabbit (b) Wolf  
 (c) Cobra (d) Parrot (2012)
32. Identify the likely organisms (1), (2), (3) and (4) in the food web shown below.



- |              |          |          |        |
|--------------|----------|----------|--------|
| (1)          | (2)      | (3)      | (4)    |
| (a) Deer     | Rabbit   | Frog     | Rat    |
| (b) Dog      | Squirrel | Bat      | Deer   |
| (c) Rat      | Dog      | Tortoise | Crow   |
| (d) Squirrel | Cat      | Rat      | Pigeon |

(Mains 2012)

33. Of the total incident solar radiation the proportion of PAR is  
 (a) about 70% (b) about 60%  
 (c) less than 50% (d) more than 80%.  
 (2011)
34. Which one of the following animals may occupy more than one trophic levels in the same ecosystem at the same time?  
 (a) Sparrow (b) Lion  
 (c) Goat (d) Frog (Mains 2011)
35. Which one of the following types of organisms occupy more than one trophic level in a pond ecosystem?  
 (a) Fish (b) Zooplankton  
 (c) Frog (d) Phytoplankton (2009)
36. Consider the following statements concerning food chains.  
 A. Removal of 80% tigers from an area resulted in greatly increased growth of vegetation.  
 B. Removal of most of the carnivores resulted in an increased population of deers.  
 C. The length of food chains is generally limited to

3-4 trophic levels due to energy loss.

D. The length of food chains may vary from 2 to 8 trophic levels.

Which two of the above statements are correct?

- (a) A, D (b) A, B  
(c) B, C (d) C, D (2008)

37. Bamboo plant is growing in a fir forest then what will be the trophic level of it?

- (a) First trophic level ( $T_1$ )  
(b) Second trophic level ( $T_2$ )  
(c) Third trophic level ( $T_3$ )  
(d) Fourth trophic level ( $T_4$ ) (2002)

38. Which is the reason for highest biomass in aquatic ecosystem?

- (a) Nano plankton, blue green algae and green algae  
(b) Sea grass and slime moulds  
(c) Benthic and brown algae  
(d) Diatoms (2000)

39. Energy transfer from one trophic level to other, in a food chain, is

- (a) 10% (b) 20% (c) 1% (d) 2%. (1999)

40. In a terrestrial ecosystem such as forest, maximum energy is in which trophic level?

- (a)  $T_3$  (b)  $T_4$  (c)  $T_1$  (d)  $T_2$  (1998)

41. The 10% energy transfer law of food chain was given by

- (a) Lindemann (b) Tansley  
(c) Stanley (d) Weismann. (1996)

42. In a biotic community, the primary consumers are

- (a) detritivores (b) herbivores  
(c) carnivores (d) omnivores. (1995)

43. The dominant second trophic level, in a lake ecosystem, is

- (a) phytoplankton (b) zooplankton  
(c) benthos (d) plankton. (1994)

44. Food chain in which microorganisms breakdown the food formed by primary producers is

- (a) parasitic food chain (b) detritus food chain  
(c) consumer food chain  
(d) predator food chain. (1991)

45. Pick up the correct food chain.

- (a) Grass → Chameleon → Insect → Bird  
(b) Grass → Fox → Rabbit → Bird  
(c) Phytoplankton → Zooplankton → Fish  
(d) Fallen leaves → Bacteria → Insect larvae (1991)

46. Upper part of sea/aquatic ecosystem contains

- (a) plankton  
(b) nekton  
(c) plankton and nekton  
(d) benthos. (1988)

47. What is true of ecosystem?

- (a) Primary consumers are least dependent upon producers.  
(b) Primary consumers out-number producers.  
(c) Producers are more than primary consumers.  
(d) Secondary consumers are the largest and most powerful. (1988)

48. In an ecosystem, which one shows one-way passage?

- (a) Free energy (b) Carbon  
(c) Nitrogen (d) Potassium (1988)

49. Match the trophic levels with their correct species examples in grassland ecosystem.

- (A) Fourth trophic level (i) Crow  
(B) Second trophic level (ii) Vulture  
(C) First trophic level (iii) Rabbit  
(D) Third trophic level (iv) Grass

Select the correct option.

- | (A)       | (B)   | (C)   | (D)  |
|-----------|-------|-------|------|
| (a) (ii)  | (iii) | (iv)  | (i)  |
| (b) (iii) | (ii)  | (i)   | (iv) |
| (c) (iv)  | (iii) | (ii)  | (i)  |
| (d) (i)   | (ii)  | (iii) | (iv) |
- (NEET 2020)

50. Which of the following ecological pyramids is generally inverted?

- (a) Pyramid of biomass in a sea  
(b) Pyramid of numbers in grassland  
(c) Pyramid of energy  
(d) Pyramid of biomass in a forest (NEET 2019)

51. What type of ecological pyramid would be obtained with the following data?

Secondary consumer : 120 g

Primary consumer : 60 g

Primary producer : 10 g

- (a) Inverted pyramid of biomass  
(b) Pyramid of energy  
(c) Upright pyramid of numbers  
(d) Upright pyramid of biomass (NEET 2018)

52. Which ecosystem has the maximum biomass?

- (a) Grassland ecosystem  
(b) Pond ecosystem  
(c) Lake ecosystem  
(d) Forest ecosystem (NEET 2017)

53. Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels?

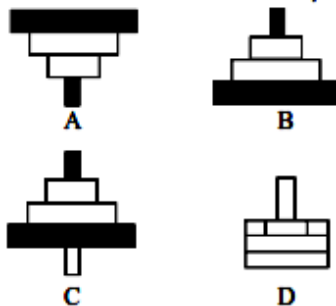


- (a) Level PC is "insects" and level SC is "small insectivorous birds".
- (b) Level PP is "phytoplanktons" in sea and "whale" on top level TC.
- (c) Level one PP is "pinal trees" and the level SC is "sheep".
- (d) Level PC is "rats" and level SC is "cats". (2012)

54. The upright pyramid of number is absent in  
 (a) pond (b) forest  
 (c) lake (d) grassland. (2012)

55. Which one of the following statements for the pyramid of energy is incorrect?  
 (a) Its base is broad.  
 (b) It shows energy content of different trophic level organisms.  
 (c) It is inverted in shape.  
 (d) It is upright in shape. (2011)

56. Which of the following representations shows the pyramid of numbers in a forest ecosystem?



- (a) D (b) A
- (c) B (d) C (Mains 2010)

57. Which one of the following is not used for construction of ecological pyramids?  
 (a) Fresh weight (b) Dry weight  
 (c) Number of individuals  
 (d) Rate of energy flow (2006)

58. Pyramid of numbers deals with number of  
 (a) species in an area  
 (b) individuals in a community  
 (c) individuals in a trophic level  
 (d) subspecies in a community. (1993)

59. Pyramid of numbers in a pond ecosystem is  
 (a) irregular (b) inverted  
 (c) upright (d) spindle shaped. (1993)

60. Which of the following would appear as the pioneer organisms on bare rocks?  
 (a) Mosses (b) Green algae  
 (c) Lichens (d) Liverworts (NEET-I 2016)

61. During ecological succession  
 (a) the numbers and types of animals remain constant  
 (b) the changes lead to a community that is in near equilibrium with the environment and is called pioneer community  
 (c) the gradual and predictable change in species composition occurs in a given area  
 (d) the establishment of a new biotic community is very fast in its primary phase. (2015)

62. Secondary succession takes place on/in  
 (a) newly created pond  
 (b) newly cooled lava  
 (c) bare rock  
 (d) degraded forest. (2015 Cancelled)

63. The second stage of hydrosere is occupied by plants like  
 (a) *Azolla* (b) *Typha*  
 (c) *Salix* (d) *Vallisneria*. (Mains 2012)

64. Which one of the following statements is correct for secondary succession?  
 (a) It begins on a bare rock.  
 (b) It occurs on a deforested site.  
 (c) It follows primary succession.  
 (d) It is similar to primary succession except that it has a relatively fast pace. (2011)

65. Both hydrarch and xerarch successions lead to  
 (a) medium water conditions  
 (b) xeric conditions  
 (c) highly dry conditions  
 (d) excessive wet conditions. (Mains 2011)

66. The correct sequence of plants in a hydrosere is  
 (a) *Volvox* → *Hydrilla* → *Pistia* → *Scirpus* → *Lantana* → *Oak*  
 (b) *Pistia* → *Volvox* → *Scirpus* → *Hydrilla* → *Oak* → *Lantana*  
 (c) *Oak* → *Lantana* → *Volvox* → *Hydrilla* → *Pistia* → *Scirpus*  
 (d) *Oak* → *Lantana* → *Scirpus* → *Pistia* → *Hydrilla* → *Volvox*. (2009)

67. An ecosystem which can be easily damaged but can recover after some time if damaging effect stops will be having  
 (a) low stability and high resilience  
 (b) high stability and low resilience  
 (c) low stability and low resilience  
 (d) high stability and high resilience. (2004)

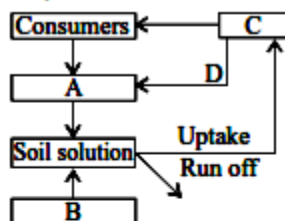
68. The primary succession refers to the development of communities on a
- forest clearing after devastating fire
  - newly-exposed habitat with no record of earlier vegetation
  - freshly cleared crop field
  - pond, freshly filled with water after a dry phase. (1995)

69. In which of the following both pairs have correct combination?

(a)	Gaseous nutrient cycle, Sedimentary nutrient cycle	Nitrogen and Sulphur, Carbon and Phosphorus
(b)	Gaseous nutrient cycle, Sedimentary nutrient cycle	Sulphur and Phosphorus, Carbon and Nitrogen
(c)	Gaseous nutrient cycle, Sedimentary nutrient cycle	Carbon and Nitrogen, Sulphur and Phosphorus
(d)	Gaseous nutrient cycle, Sedimentary nutrient cycle	Carbon and Sulphur, Nitrogen and Phosphorus

(2015)

70. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.



	A	B	C	D
(a)	Rock minerals	Detritus	Litter fall	Producers
(b)	Litter fall	Producers	Rock minerals	Detritus
(c)	Detritus	Rock minerals	Producers	Litter fall
(d)	Producers	Litter fall	Rock minerals	Detritus

(2014)

71. Natural reservoir of phosphorus is
- rock
  - fossils
  - sea water
  - animal bones.

(NEET 2013)

72. Which one of the following is not a gaseous biogeochemical cycle in ecosystem?
- Sulphur cycle
  - Phosphorus cycle
  - Nitrogen cycle
  - Carbon cycle (2012)

73. About 70% of total global carbon is found in
- oceans
  - forests
  - grasslands
  - agroecosystems. (2008)

74. Which of the following pairs is a sedimentary type of biogeochemical cycle?
- Phosphorus and nitrogen
  - Phosphorus and sulphur
  - Oxygen and nitrogen
  - Phosphorus and carbon dioxide (1995)

75. Match the following and select the correct option.

A. Earthworm	(i) Pioneer species
B. Succession	(ii) Detritivore
C. Ecosystem service	(iii) Natality
D. Population growth	(iv) Pollination

	A	B	C	D
(a)	(i)	(ii)	(iii)	(iv)
(b)	(iv)	(i)	(iii)	(ii)
(c)	(iii)	(ii)	(iv)	(i)
(d)	(ii)	(i)	(iv)	(iii)

(2014)



## AIIMS PREVIOUS QUESTIONS

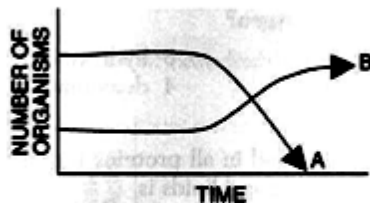
1 The function of leghaemoglobin during biological nitrogen fixation in root nodules of legumes is to [2006]

- (a) convert atmospheric  $N_2$  to  $NH_3$
- (b) convert ammonia to nitrite
- (c) transport oxygen for activity of nitrogenase
- (d) protect nitrogenase from oxygen

2 An ecosystem, such as an aquarium, is self-sustaining if it involves the interaction between organisms, a flow of energy, and the presence of [2009]

- (a) equal numbers of plants and animals
- (b) more animals than plants
- (c) materials cycles
- (d) pioneer organisms

3 The graph below shows the changes in two populations of herbivores in a grassy field. A possible reason for these changes is that [2009]



- (a) all of the plant populations in this habitat decreased.
- (b) population B competed more successfully for food than population A did.
- (c) population A produced more offspring than population B did.
- (d) population A consumed the members of population B.

4 A scorpion stalks, kills, and then eats a spider. Based on its behavior, which ecological terms describe the scorpion? [2009]

- (a) producer, herbivore, decomposer
- (b) producer, carnivore, heterotroph
- (c) predator, carnivore, consumer
- (d) predator, autotroph, herbivore

5 In the vast marine ecosystem, certain sea develop red colouration. This red colour is due to the presence of large population of which one of the following organisms? [2009]

- (a) *Trichodesmium erythrium*
- (b) *Physarium*
- (c) Dinoflagellates
- (d) Diatoms and members of red algae

6 The xerophytic plants conserve water by storing it in [2009]

- (a) intercellular spaces
- (b) normal parenchymatous cells
- (c) intercellular spaces and parenchymatous cells
- (d) parenchymatous cells specialized for this purpose

7 Most of the desert plants bloom during night time because [2010]

- (a) their blooming is controlled by low temperature.
- (b) they are sensitive to the phases of moon.
- (c) the desert insects eat away flowers during day time.
- (d) the desert insects are active during night time.

8 Whale is [2012]

- (a) Primary producer
- (b) Carnivorous, secondary consumer
- (c) A decomposer
- (d) Herbivorous

9 Which one of the following is not a function of an ecosystem? [2013]

- (a) Energy flow
- (b) Decomposition
- (c) Productivity
- (d) Stratification

10 How much portion of the Photosynthetically Active Radiation (PAR) is captured by the plants? [2016]

- (a) 5–10%
- (b) 7–10%
- (c) 8–10%
- (d) 2–10%

11 Arrange the following ecosystems in increasing order of mean NPP (Tonnes / ha / year)

- A. Tropical deciduous forest
  - B. Temperate coniferous forest
  - C. Tropical rain forest
  - D. Temperate deciduous forest [2017]
- (a)  $B < A < D < C$
  - (b)  $D < B < A < C$
  - (c)  $A < C < D < B$
  - (d)  $B < D < A < C$

## KEY

### MULTIPLE CHOICE QUESTIONS

1 (b) 2 (a) 3 (c) 4 (b) 5 (d) 6 (a) 7 (c) 8 (b) 9 (a) 10 (d) 11 (a) 12 (d) 13 (c) 14 (a) 15 (b)  
16 (b) 17 (c) 18 (c) 19 (c) 20 (c) 21 (d) 22 (b) 23 (d) 24 (a) 25 (b) 26 (a) 27 (d) 28 (b) 29 (b) 30 (a)  
31 (b) 32 (c) 33 (a) 34 (c) 35 (d) 36 (d) 37 (a) 38 (a) 39 (a) 40 (c) 41 (c) 42 (a) 43 (a) 44 (d) 45 (a)  
46 (c) 47 (b) 48 (b) 49 (a) 50 (b) 51 (c) 52 (d) 53 (c) 54 (b) 55 (b) 56 (a) 57 (a) 58 (b) 59 (c) 60 (d)  
61 (d) 62 (b) 63 (b) 64 (b) 65 (a) 66 (a) 67 (d) 68 (d) 69 (c) 70 (c) 71 (b) 72 (c) 73 (a) 74 (a) 75 (a)  
76 (d) 77 (c) 78 (b) 79 (d) 80 (a) 81 (a) 82 (c) 83 (d) 84 (c) 85 (c) 86 (d) 87 (a) 88 (c) 89 (a) 90 (a)  
91 (a) 92 (b) 93 (c) 94 (b) 95 (a) 96 (a) 97 (b) 98 (d) 99 (a) 100 (c) 101 (a) 102 (b) 103 (c) 104 (d) 105 (c)  
106 (a) 107 (a) 108 (d) 109 (d) 110 (c) 111 (a) 112 (c) 113 (a) 114 (b) 115 (d) 116 (a) 117 (d) 118 (a) 119 (a) 120 (c)  
121 (d) 122 (d) 123 (b) 124 (a) 125 (d) 126 (a) 127 (b) 128 (b) 129 (d) 130 (b) 131 (a) 132 (b) 133 (a) 134 (d) 135 (b)  
136 (b) 137 (b) 138 (d) 139 (b) 140 (a) 141 (a) 142 (a) 143 (d) 144 (b) 145 (c) 146 (c) 147 (a) 148 (d) 149 (d) 150 (d)  
151 (d) 152 (c) 153 (d) 154 (a) 155 (d) 156 (a) 157 (c) 158 (a) 159 (c)

### SPECIAL FORMAT QUESTIONS

1	c	8	c	15	a	22	d	29	c	36	b
2	b	9	b	16	a	23	d	30	d	37	a
3	a	10	a	17	a	24	d	31	d	38	b
4	d	11	d	18	a	25	c	32	a	39	c
5	c	12	d	19	d	26	c	33	b	40	d
6	c	13	a	20	c	27	d	34	c	41	b
7	d	14	d	21	d	28	c	35	a		

### NCERT EXEMPLAR PROBLEMS

1	c	5	b	9	a	13	d	17	c
2	a	6	b	10	b	14	d	18	d
3	c	7	c	11	a	15	b	19	b
4	b	8	b	12	b	16	c	20	d

### NEET PREVIOUS QUESTIONS

1. (d) 2. (d) 3. (d) 4. (d) 5. (a) 6. (b) 7. (b) 8. (b) 9. (d) 10. (a)  
11. (b) 12. (a) 13. (a) 14. (d) 15. (c) 16. (b) 17. (b) 18. (c) 19. (b) 20. (c)  
21. (b) 22. (d) 23. (a) 24. (b) 25. (a) 26. (b) 27. (b) 28. (a) 29. (a) 30. (a)  
31. (c) 32. (a) 33. (c) 34. (a) 35. (a) 36. (c) 37. (a) 38. (c) 39. (a) 40. (c)  
41. (a) 42. (b) 43. (b) 44. (b) 45. (c) 46. (a) 47. (c) 48. (a) 49. (a) 50. (a)  
51. (a) 52. (d) 53. (a) 54. (b) 55. (c) 56. (b,d) 57. (a) 58. (c) 59. (c) 60. (c)  
61. (c) 62. (d) 63. (d) 64. (b) 65. (a) 66. (a) 67. (a) 68. (b) 69. (c) 70. (c)  
71. (a) 72. (b) 73. (a) 74. (b) 75. (d)

### AIMS PREVIOUS QUESTIONS

1	d	4	c	7	d	10	d
2	c	5	a	8	b	11	d
3	b	6	d	9	d		



**UNIT-VIII**  
**BIODIVERSITY AND**  
**CONSERVATION**  
**(CHAPTER-15)**

## SYNOPSIS

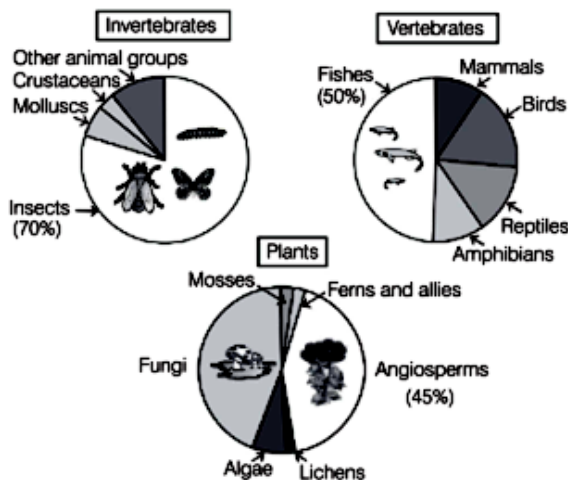
- Since life on earth evolved around 3.8 billion years ago, there have been diversification of all kinds of organisms in their effort to survive. Eventhough, there must be more than 7 million types of species, only 1.5 million have been recorded.

### Biodiversity

- Biodiversity is the term popularised by **Edward Wilson** to describe the sum total of the diversity of biological organisation at all the levels. The three most important levels of biodiversity are, genetic diversity, species diversity and ecological diversity.
- **Genetic diversity** shows high diversity at gene (and chromosomal) level.
  - The genetic variation (in terms of allelic forms of the same gene) expressed by the medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges is in terms of the potency and concentration of the active chemical (reserpine) that the plant produces.
  - India has more than 50000 genetically different strains of rice and 1000 varieties of mango.
- **Species diversity** is the measure of the varieties of species and their abundant presence within a region, e.g. Western Ghats have more amphibians than Eastern Ghats. **Species richness** and **species evenness** are the two important measures of species diversity.
- **Ecological diversity** refers to the diversity at ecosystem level. It makes communities more productive and stable, e.g. India has a greater ecosystem diversity (in terms of variety of habitats in deserts, rainforests, mangroves, coral reefs, wetlands, estuaries and alpine meadows) than a Scandinavian country like Norway.

### How Many Species are There on Earth and How Many in India?

- According to the IUCN 2004, more than 1.5 million species have been recorded in the world, but we have no idea of how many species are yet to be discovered and described. A sound estimate of global species diversity of about 7 million was given by **Robert May**.
- More than 70% of all the species recorded are animals, while plants comprise no more than 22%. Out of total animals recorded, 70% are insects (i.e. out of every 10 animals on this planet, 7 are insects).



Representing global biodiversity : proportionate number of species of major taxa of plants, invertebrates and vertebrates

- The number of fungi species is more than all the vertebrate species of fishes, amphibians, reptiles and mammals combined in the world and it is interesting to know that the diversity of microbial species alone might run into millions.
- **Indian biodiversity** India is one of the 12 megadiverse countries of the world. Though India has only 2.4% of the world's land area but it shares an impressive 8.1% of the world's species diversity.
- There are about 45,000 species of plants and twice as many of animals have been recorded in India.
- India probably has more than 1,00,000 species of plants and 3,00,000 species of animals yet to be discovered and described. If we apply Robert May's global estimate then only 22% of species of the world have been recorded.

### Patterns of Biodiversity

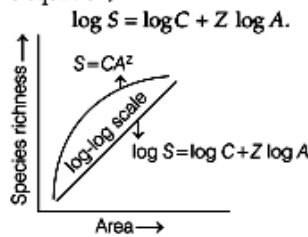
- The diversity of plants and animals, throughout the world, is not evenly distributed and shows some interesting patterns of distribution.
- The patterns of biodiversity are, latitudinal gradients and species-area relationships.

#### 1. Latitudinal Gradients

- It means that species diversity decreases as we move away from the equator and towards the poles (low to high latitude).
- Generally, tropics (latitudinal range of 23.5°N to 23.5°S) have more species than temperate or polar areas, e.g. Colombia near the equator has nearly 1,400 species of birds. India has more than 1,200 species, while New York at 91°N has 105 species and Greenland at 71°N has 56 species.
- The largely tropical Amazonian rainforest in South America has the greatest biodiversity on the earth using more than 40,000 species of plants, 3,000 of fishes, 1,300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and of more than 1,25,000 invertebrates.
- Some hypothesis proposed by scientists to explain the rich biodiversity in tropical regions are
  - The temperate regions were subjected to frequent glaciations in the past, whereas tropical latitudes have remained relatively undisturbed for millions of years.
  - Tropical environments are less seasonal, relatively more constant and predictable. This promotes niche specialisation and leads to a greater species diversity.
  - Availability of more solar energy in the tropics, contributes to higher productivity, this in turn might contribute indirectly to greater diversity.

## 2. Species-Area Relationships

- German naturalist and geographer Alexander von Humboldt observed that within a region, species richness increased with the increasing available area, but only up to a limit.
- The relation between species richness and area, for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.
- On a logarithmic scale, the relationship is a straight line described by the equation;



Where,  $S$  = Species richness,  $A$  = Area,  $Z$  = Slope of the line (regression coefficient) and  $C$  =  $y$ -Intercept.

- Ecologists have discovered that the value of  $Z$  lies in the range of 0.1 to 0.2, when analysis is done in small areas regardless of the taxonomic group or area. But the species-area relationships among very large areas (continents), will give a much steeper slope and  $Z$  values in the range of 0.6 to 1.2, e.g. for frugivorous birds and mammals in the tropical forests, the slope is found to be 1.15. Thus, it can be said that the larger the area, the steeper is the slope.

## Importance of Species Diversity to the Ecosystem

- **Stability** Communities with more species diversity, generally, tend to be more stable than those with less species. This is because such communities are more resistant or resilient to occasional disturbances (natural or man-made) and invasions by alien species.
- These communities do not show much variation in productivity from year to year.
- **David Tilman** discovered that increased diversity contributed to higher productivity and also proved that species richness is the key to the well-being of any ecosystem. It is also essential for the survival of man on this planet earth.
- **Ecosystem health** Ecologist Paul Ehrlich gave an analogy, **Rivet Popper hypothesis**, to help understand the effect of loss of species biodiversity. He compared each species with a rivet in the body of an airplane.
  - This hypothesis explain that ecosystem is an airplane and the species are the rivets joining all the parts together.
  - If every passenger travelling in the airplane starts taking rivets home (causing a species to become extinct), initially it may not affect flight safety but as more and more rivets are removed, over a period of time the plane becomes weak and poses threat to flight safety. However, if rivets on wings (keystone) species are removed, it would pose a more serious threat to flight safety.

## Loss of Biodiversity

- **International Union for Conservation of Nature (IUCN)** documents **Red List (2004)**, which lists **extinct and endangered species** of the earth in the Red Data Book.
- Red list has the following categories of species,
  - **Extinct** (no living member; extinct in the wild known to survive only in cultivation)
  - **Critically endangered** (extremely high risk)
  - **Endangered** (very high risk of extinction)
  - **Vulnerable** (high risk of extinction in medium term future)
  - **Threatened** (liable to become extinct in the absence of protective measures)
  - **Low Risk, Data deficient and not evaluated.**

- It documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in the last 500 years.
- Some examples of recent extinctions include Dodo (Mauritius), Quagga (Africa), Thylacine (Australia), Steller's Sea Cow (Russia) and three subspecies of tiger (Bali, Javan, Caspian). The last 20 years alone have witnessed the disappearance of 27 species.
- Presently, 12.1% of all birds species, 23% of all mammal species, 32% of all amphibian species and 31% of all gymnosperms (more than 15,500 species world-wide) are facing the threat of extinction.
- There have been five episodes of natural mass extinction (due to natural calamities) of species since the origin of life on the earth. The anthropogenic (man made) cause of mass extinction, i.e. sixth extinction is far more serious than the natural one. Ecologists warn that if present trends continue, nearly half of the species on earth might be wiped out within the next 100 years.
- The loss of biodiversity in a region may lead to
  - Decline in plant production.
  - Lowered resistance to environmental perturbations like drought, etc.
  - Negative impact on ecosystem processes such as plant productivity, water use pest and disease cycles.

## Causes of Biodiversity Loss

Habitat loss and fragmentation, overexploitation, alien species invasion, coextinction are the four (Evil Quartet) major causes of loss of biodiversity.

- **Habitat loss and fragmentation** occurs due to population explosion, that has destroyed forest land, which leads to the loss of habitat of several species, e.g. once covering more than 14 % of the earth's land surface, the Amazonian rainforests ('lungs of the planet') now cover less than 6 % as they are being cut and cleared for cultivation of soybeans or conversion into grasslands for raising beef cattle. This has caused loss of habitat for lots of species and has put tremendous pressure on the ecosystem.
- **Overexploitation** Uncontrolled or overuse of resources by humans leads to overexploitation of natural resources. Many species extinctions in the last 500 years such as that of Steller's sea cow, passenger pigeon, etc., were due to the overexploitation by humans. Currently, many marine fish populations are being over harvested, endangering the continued existence of some commercially important species.
- **Alien species invasions** When alien species are introduced unintentionally or deliberately in a habitat, some of them turn invasive and can cause decline or extinction of indigenous species, e.g. the Nile perch introduced into lake Victoria (East Africa) cause extinction of cichlid fishes, invasive weed species like carrot grass (*Parthenium*), *Lantana* and water hyacinth (*Eichhornia*) also can cause environment damage threaten the existence of native species. African catfish called, *Clarias gariepinus* is posing a threat to the indigenous catfishes in our rivers.
- **Coextinctions** When a species becomes extinct, the plant and animal species associated with it, in an obligatory way, also become extinct, e.g. when a host fish species becomes extinct, its parasites also vanish.

## Biodiversity Conservation

- Biodiversity needs to be conserved and maintained because humans derive lots of benefits from nature and are dependent on it for survival.
- They directly or indirectly derive economic benefits from nature like food products, firewood, fibre, construction material, industrial products and products of medicinal importance (about 2,500 plants used in traditional medicines).
- They also explore molecular, genetic and species level diversity (bioprospecting) for products of economic importance. These are called **narrowly utilitarian aspects of conserving biodiversity**.
- Ecosystem services (atmosphere's O<sub>2</sub>, pollination, water cycles, aesthetic pleasures) are **broadly utilitarian aspects of biodiversity conservation**.
- The Amazon forest is estimated to produce, through photosynthesis, 20% of the total oxygen in the earth's atmosphere.
- The **ethical aspect of conserving biodiversity** relates to our moral obligation to conserve the planet that we share with millions of plants, animals and microbial species.
  - We need to realise that every species has an **intrinsic value**, even if it may not be of current or any economic value to us.
  - We have a moral duty to care for their well-being and pass on our biological legacy in good order to future generations.

## How do We Conserve Biodiversity?

- Conservation of biodiversity means offering protection, implementing judicious and minimal use and rebuilding the damaged units. There are two basic approaches in the conservation of biodiversity, i.e. *in situ* conservation and *ex situ* conservation.

### *In Situ* (on-site) Conservation

- It involves protection of threatened or endangered species of animals or plants in their natural habitat.
- For maximum protection, certain regions like **hotspots**, have been identified. These are the regions of high levels of species richness and high degree of **endemism**, i.e. contain species are confined only to particular region and not found anywhere else.
- There are 34 hotspots in the world. Three of these hotspots are in India and are Western Ghats and Sri Lanka Indo-Burma and Eastern Himalaya cover our country's exceptionally high biodiversity regions.
- *In situ* method includes **biosphere reserves, national parks and sanctuaries**. India has 14 biosphere reserves, 90 national parks, 448 wildlife sanctuaries and many **sacred groves** (forest patches of religious importance).
- Sacred groves are found in Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghat regions of Karnataka, Maharashtra. The Sarguja, Chanda and Bastar areas of Madhya Pradesh.

### *Ex Situ* (off-site) Conservation

- It is the approach in which threatened animals and plants are taken out from their natural habitat and placed in special settings, where they can be protected and given special care. Zoological parks, botanical gardens and wildlife safari parks are used for *ex situ* conservation.
- Scientific technology has enabled advancement of *ex situ* conservation in following ways
  - **Cryopreservation** of gametes of threatened species involves preserving them in viable and fertile conditions for long periods at very low temperatures (-196°C in liquid nitrogen).
  - **In vitro fertilisation** to propagate endangered species. Offspring can be produced by using preserved sperm to fertilise the eggs in *in vitro* and then implanting in female animals.
  - **Tissue culture** can be used to propagate endangered plants species.
  - In **seed banks**, seeds of different genetic strains of commercially important plants can be kept for long periods, under specific conditions.
- The historic **Convention on Biological Diversity (The Earth Summit)** held in Rio de Janeiro in 1992, called upon **all the nations** to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.
- The **World Summit on Sustainable Development** held in 2002 in Johannesburg, South Africa, saw 190 countries pledge their commitment to achieve by 2010, a significant reduction in the current rate of biodiversity loss at global, regional and local levels.

## MULTIPLE CHOICE QUESTIONS

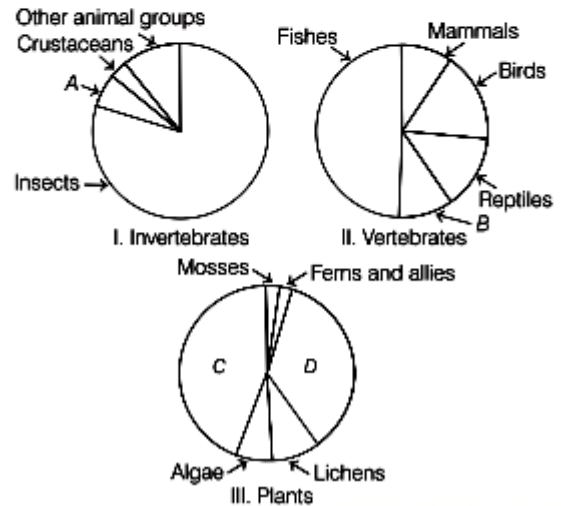
- 1** Three levels of biodiversity are
- genetic diversity, species diversity and ecological diversity
  - species diversity, ecological diversity and habitat diversity
  - geographical diversity, genetic diversity and habitat diversity
  - ecological diversity, species diversity and community diversity
- 2** Genetic diversity is the measure of
- varieties of the species and their relative abundance present within a region
  - variation in the genetic information contained in the organisms
  - diversity of the genes at community and ecosystem levels
  - All of the above
- 3** The medicinal plant, *Rauwolfia vomitoria*, growing in Himalayan ranges shows variation in terms of the potency and concentration of the chemical (reserpine), that it produces. It is an example of
- species diversity
  - ecological diversity
  - genetic diversity
  - None of the above
- 4** The Western Ghats have a greater amphibians diversity than the Eastern Ghats. It is an example of
- species diversity
  - genetic diversity
  - ecological diversity
  - None of the above
- 5** Ecological diversity exists at community level and is of three types. Select the correctly matched option for ecological diversity.
- Alpha diversity – Diversity between communities
  - Beta diversity – Diversity of organisms within same community
  - Gamma diversity – Diversity of organisms over the entire geographical area
  - None of the above
- 6** As estimated by Robert May, what is the total number of species present on earth?
- 3 million
  - 5 million
  - 7 million
  - 9 million
- 7** Which one of the following has the highest number of species in nature?
- Angiosperms
  - Fungi
  - Insects
  - Birds
- 8** Given below is the representation of the extent of global diversity of invertebrates. What groups the four portions (A-D) represent, respectively?

**CBSE-AIPMT 2014**



- |     | A           | B                   | C                   | D                   |
|-----|-------------|---------------------|---------------------|---------------------|
| (a) | Insects     | Crustaceans         | Other animal groups | Molluscs            |
| (b) | Crustaceans | Insects             | Molluscs            | Other animal groups |
| (c) | Molluscs    | Other animal groups | Crustaceans         | Insects             |
| (d) | Insects     | Molluscs            | Crustaceans         | Other animal groups |

- 9** Given below are pie diagrams I, II and III related to the proportionate number of species of major taxa of invertebrates, vertebrates and plants, respectively. Critically study and fill in the blanks A, B, C and D.



- A–Molluscs, B–Amphibians, C–Angiosperms, D–Gymnosperms
  - A–Molluscs, B–Amphibians, C–Fungi, D–Angiosperms
  - A–Turtles, B–Amphibians, C–Fungi, D–Angiosperms
  - A–Hexapoda, B–Amphibians, C–Fungi, D–Angiosperms
- 10** Which of the following represents maximum number of species among global biodiversity? **NEET 2013**
- Algae
  - Lichens
  - Fungi
  - Mosses and ferns
- 11** India is one of the 'twelve' megadiversity countries with ..... of genetic resources of the world.
- 12.1%
  - 18.1%
  - 38.1%
  - 8.1%
- 12** Biodiversity is affected by
- latitudinal gradients and species-area relationship
  - species-area relationship and longitudinal gradients
  - Both (a) and (b)
  - latitudinal and longitudinal gradients
- 13** From equator towards the poles biodiversity
- decreases
  - increases
  - remains same
  - first decreases then increases
- 14**
- Higher latitude (Poles)  $\xrightarrow{\text{Biodiversity increases}}$  Lower latitude (Equator)
  - Higher latitude (Poles)  $\xrightarrow{\text{Biodiversity decreases}}$  Lower latitude (Equator)
  - Higher altitude (Mountain top)  $\xrightarrow{\text{Biodiversity increases}}$  Lower altitude (Sea level)
  - Higher altitude (Mountain top)  $\xrightarrow{\text{Biodiversity decreases}}$  Lower altitude (Sea level)

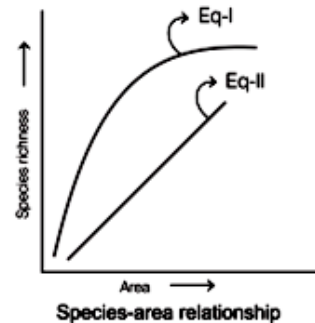
Which of the matches above is/are correct?

- (a) I and III (b) I and II  
(c) II and III (d) III and IV

- 15** Tropics (23.5°N to 23.5°S) have ..... species as compared to temperate or polar regions. The most appropriate word to fill the blank is  
(a) less (b) equal  
(c) more (d) None of these
- 16** Arrange the following places in increasing order of biodiversities of species of birds and select the right option.  
(a) Colombia → New York → Greenland → India  
(b) Greenland → New York → India → Colombia  
(c) New York → India → Colombia → Greenland  
(d) India → Colombia → Greenland → New York
- 17** How many times the tropical areas have vascular plants than the temperate areas have?  
(a) 10 (b) 50  
(c) 3 (d) 65
- 18** The country, whose tropical rainforests possess the greatest biodiversity on earth is  
(a) New York  
(b) South America  
(c) India  
(d) England
- 19** Given below are three statements (I-III) each with one or two blanks. Select the option, which correctly fill up to blanks.  
Ecologists and evolutionary biologists have proposed various hypotheses; some important ones are
- I. Speciation is generally a function of time, unlike ...A... regions subjected to frequent glaciations in the past. ...B... have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.
- II. ...C... environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity.
- III. There is more solar energy available in the ...D..., which contributes to higher productivity; this in turn might contribute indirectly to greater diversity.
- Choose the correct option for A, B, C and D.  
(a) A-tropics, B-Tropical latitudes, C-Temperate, D-Arctic tundra  
(b) A-temperate, B-Tropical latitudes, C-Tropics, D-chapparral  
(c) A-tropical, B-Tropical latitudes, C-Tropics, D-chapparral  
(d) A-temperate, B-Tropical latitudes, C-Tropical, D-tropics
- 20** Alexander von Humboldt described for the first time  
(a) ecological biodiversity (b) law of limiting factor  
(c) species-area relationships (d) population growth equation

NEET 2017

- 21** Alexander von Humboldt observed that, within a region species richness..... with increasing explored area. The most appropriate word to fill the blank is  
(a) increased  
(b) decreased  
(c) increased up to a limit  
(d) decreased up to a limit
- 22** The great German naturalist and geographer Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be rectangular hyperbola. Now find out correct equations shown in the graph.



- (a) I -  $S = CA^Z$ ; II -  $\log S = \log C + Z \log A$   
(b) I -  $\log S = \log C + Z \log A$ ; II -  $S = CA^Z$   
(c) I -  $S = CA^Z + \log C$ ; II -  $\log S = \log C + Z \log A$   
(d) I -  $S = CA^Z + \log A$ ; II -  $\log S = \log C + Z \log A$
- 23** The relationship between the species richness and the area for a wide variety of taxa appears as  
(a) straight line (b) sigmoid curve  
(c) rectangular hyperbola (d) None of these
- 24** On a logarithmic scale, the species-area relationship is a straight line described by the equation  
(a)  $\log S = \frac{\log C}{\log A}$  (b)  $Z \log A = \frac{\log C}{\log S}$   
(c)  $\log S = \log C + Z \log A$  (d)  $\log S = \log C - Z \log A$
- 25** In the species-area relationship, 'S' represents  
(a) species richness (b) slope of the line  
(c) specific area (d) special species
- 26** In the species-area relationship, 'Z' represents  
(a) regression coefficient  
(b) enzymatic coefficient  
(c) multiplication coefficient  
(d) None of the above
- 27** The value of 'Z' lies in the range of ..... regardless of the taxonomic group or the region. The most appropriate value to fill the blank is  
(a) 0.5 to 0.7 (b) 0.3 to 0.7  
(c) 0.2 to 0.3 (d) 0.1 to 0.2
- 28** For frugivorous birds and mammals in the tropical forests of different continents, Z(slope of the line/regression coefficient) is found to be  
(a) 1.15 (b) 0.1  
(c) 0.5 (d) 0
- 29** If  $\log A = 4$ ,  $Z = 0.3$  and  $\log C = 0.8$ , find the value of  $\log 'S'$ ?  
(a) 3.76 (b) 100  
(c) 4.24 (d) 2



- 30** Communities with more species tend to be more stable than those with less species. This was confirmed by  
 (a) Alexander von Humboldt  
 (b) David Tilman  
 (c) Paul Ehrlich  
 (d) Edward Wilson
- 31** Which of the following hypothesis suggests that ecosystems are like aeroplanes where flight safety (ecosystem functioning) may or may not be compromised, depending upon which species are being lost?  
 (a) Gaia hypothesis  
 (b) Gause-exclusion hypothesis  
 (c) Qudum's hypothesis  
 (d) Rivet popper hypothesis
- 32** The organisation, which publishes the Red List of species is **CBSE-AIPMT 2014**  
 (a) ICFRE (b) IUCN (c) UNEP (d) WWF
- 33** *Antelope cervicapra* (blackbuck) is categorised by IUCN as  
 (a) critically endangered (b) endangered  
 (c) vulnerable (d) extinct in the wild
- 34** A species facing extremely high risk of extinction in the immediate future is called **CBSE-AIPMT 2014**  
 (a) vulnerable (b) endemic  
 (c) critically endangered (d) extinct
- 35** In natural extinction of species  
 (a) gradual replacement of existing species takes place  
 (b) human activities play an active part  
 (c) catastrophes, earthquakes and other natural calamities are involved  
 (d) None of the above
- 36** Anthropogenic extinction is called  
 (a) fifth mass extinction (b) fourth mass extinction  
 (c) sixth mass extinction (d) seventh mass extinction
- 37** The term 'The Evil Quartet' is related with  
 (a) Four major causes of forest loss  
 (b) Four major causes of population explosion  
 (c) Four major causes of air pollution  
 (d) Four major causes of biodiversity losses
- 38** Which of the following is responsible for biodiversity loss?  
 (a) Habitat loss and fragmentation  
 (b) Alien species invasions  
 (c) Coextinctions  
 (d) All of the above
- 39** Which of the following is the most important cause for animals and plants being driven to extinction?  
 (a) Drought and floods **NEET 2019, 16**  
 (b) Economic exploitation  
 (c) Alien species invasion  
 (d) Habitat loss and fragmentation
- 40** Many species like Steller's sea cow and passenger pigeon have been driven to the brink of extinction. Which of the following describes this situation?  
 (a) Overexploitation by humans  
 (b) Pollution  
 (c) Habitat loss  
 (d) Competition from introduced species
- 41** Water hyacinth (*Eichhornia crassipes*) was introduced in Indian water to reduce pollution. It is an example of  
 (a) disturbance and degradation  
 (b) coextinctions  
 (c) alien species invasions  
 (d) overexploitation
- 42** Decline in the population of Indian native fishes due to introduction of *Clarias gariepinus* in river Yamuna can be categorised as **NEET (Odisha) 2019**  
 (a) coextinction  
 (b) habitat fragmentation  
 (c) overexploitation  
 (d) alien species invasion
- 43** If any extinction of a mutualistic pollinator takes place, what would be its effect on the plants where it pollinates?  
 (a) Decreased pollination  
 (b) No effect because substitute pollinator is available  
 (c) The plant would not be pollinated  
 (d) None of the above
- 44** The reasons behind conserving biodiversity can be grouped into categories, which include  
 I. broadly utilitarian  
 II. narrowly utilitarian  
 III. no utilitarian  
 IV. ethical utilitarian  
 Choose the correct option.  
 (a) I, II, III and IV (b) II, III and IV  
 (c) I, II and IV (d) I, III and IV
- 45** More than 25% of the drugs are derive from the plants. What benefit does this describe?  
 (a) Aesthetic value  
 (b) Ethical value  
 (c) Indirect economic value  
 (d) Direct economic value
- 46** Exploration of molecular, genetic and species level diversity for novel products of economic importance is known as **NEET (Odisha) 2019**  
 (a) biopiracy (b) bioenergetics  
 (c) bioremediation (d) bioprospecting
- 47** What is the sustainable use of resources?  
 (a) Protected strips of the land that allows organisms to migrate from one wilderness area to another  
 (b) A law that makes it illegal to do harm to the species that are listed as endangered or threatened  
 (c) The ability to use natural resources in a way that helps people to protect the ecosystem  
 (d) The study of the methods which help to protect biodiversity
- 48** Conservation in the natural habitat is  
 (a) *in situ* (b) *ex situ*  
 (c) zoo (d) botanical garden

- 49** Western Ghats have a large number of plant and animal species that are not found anywhere else. Which of the following terms will you use to notify such species? **NEET (Odisha) 2019**  
 (a) Endemic (b) Vulnerable  
 (c) Threatened (d) Keystone
- 50** How many hotspots of biodiversity in the world have been identified till date by Norman Myers? **NEET 2016**  
 (a) 17 (b) 25  
 (c) 34 (d) 43
- 51** Which one of the following areas in India, is a hotspot of biodiversity? **CBSE-AIPMT 2012**  
 (a) Eastern Ghats (b) Gangetic plain  
 (c) Sunderbans (d) Western Ghats
- 52** Conservation of hotspots are best described as  
 (a) conserving islands that are experiencing high rates of extinction  
 (b) conserving areas where native species are being replaced with introduced species  
 (c) conserving areas where the people are active supporters of the biological diversity  
 (d) conserving areas with the large members of endemic species that are disappearing rapidly
- 53** What is the approximate percentage of the earth covered by terrestrial hotspots?  
 (a) 1.5% (less than 2%) (b) 2.5%  
 (c) 3.5% (d) 4.5%
- 54** *In situ* strategies include  
 I. national parks II. wildlife sanctuaries  
 III. biosphere reserves IV. sacred groves  
 Choose the correct option.  
 (a) I and II (b) II, III and IV  
 (c) I, II and III (d) I, II, III and IV
- 55** The numbers of national parks, biosphere and wildlife sanctuaries of India, respectively are  
 (a) 90, 14, 448 (b) 158, 62, 10  
 (c) 58, 412, 10 (d) 96, 412, 10
- 56** Which one of the following is not a method of *in situ* conservation of biodiversity?  
 (a) Wildlife sanctuary  
 (b) Botanical garden  
 (c) Sacred grove  
 (d) Biosphere reserve
- 57** Which of the following national parks is home to the famous musk deer or hangul? **NEET 2016**  
 (a) Keibul Lamjao National Park, Manipur  
 (b) Bandhavgarh National Park, Madhya Pradesh  
 (c) Eaglenest Wildlife Sanctuary, Arunachal Pradesh  
 (d) Dachigam National Park, Jammu and Kashmir
- 58** Biosphere reserves differ from the national parks and wildlife sanctuaries because in the former  
 (a) human beings are not allowed to enter  
 (b) people are an integral part of the ecosystem  
 (c) plants are paid greater attention than the animals  
 (d) living organisms are brought from all over the world and preserved for posterity
- 59** In your opinion, which is the most effective way to conserve genetic diversity of the plant of an area?  
 (a) By tissue culture method  
 (b) By creating biosphere reserve  
 (c) By creating botanical garden  
 (d) By developing seed bank
- 60** Core zone, buffer zone and manipulation zone are found in  
 (a) national park (b) sanctuary  
 (c) tiger reserve (d) biosphere reserve
- 61** The region of biosphere reserve, which is legally protected and where no human activity is allowed is known as **NEET 2019**  
 (a) core zone (b) buffer zone  
 (c) transition zone (d) restoration zone
- 62** Sacred groves in India are related with  
 (a) aesthetic pleasure  
 (b) the place where threatened species are protected  
 (c) the place where only artificial plant breeding is allowed  
 (d) forest patches around the places of worship
- 63** Sacred groves in India are found in  
 (a) Jaintia hills of Karnataka  
 (b) Western Ghat regions of Tamil Nadu  
 (c) Aravalli hills of Meghalaya  
 (d) Bastar areas of Madhya Pradesh
- 64** *Ex situ* strategies include  
 I. zoological parks  
 II. seed/pollen banks  
 III. gene bank and tissue cultures  
 IV. botanical garden  
 Choose the correct option.  
 (a) II, III and IV (b) I, II and III  
 (c) I, II and IV (d) I, II, III and IV
- 65** Which one of the following is not used for *ex situ* plant conservation? **NEET 2013**  
 (a) Field gene banks  
 (b) Seed banks  
 (c) Shifting cultivation  
 (d) Botanical gardens
- 66** All of the following are included in *ex situ* conservation except **NEET 2019**  
 (a) botanical gardens  
 (b) sacred groves  
 (c) wildlife safari parks  
 (d) seed banks
- 67** Which one of the following is related to *ex situ* conservation of threatened animals and plants? **NEET 2019**  
 (a) Wildlife safari parks (b) Biodiversity hotspots  
 (c) Amazon rainforest (d) Himalayan region
- 68** One of the most important function of botanical gardens is that  
 (a) one can observe tropical plants there  
 (b) they allow *ex situ* conservation of the germplasm  
 (c) they provide the natural habitat for wildlife  
 (d) they provide a beautiful area for recreation

- 69** Cryopreservation of gametes of threatened species in viable and fertile condition can be referred to as  
**CBSE-AIPMT 2015**
- in situ* conservation of biodiversity
  - advanced *ex situ* conservation of biodiversity
  - in situ* conservation by sacred groves
  - in situ* cryopreservation of biodiversity
- 70** In which one of the following, both pairs have correct combination?  
**CBSE-AIPMT 2015**
- In situ* conservation/National park  
*Ex situ* conservation/Botanical garden
  - In situ* conservation/Cryopreservation  
*Ex situ* conservation/Wildlife sanctuary
  - In situ* conservation/Seed bank  
*Ex situ* conservation/National park
  - In situ* conservation/Tissue culture  
*Ex situ* conservation/Sacred groves

- 71** The Earth Summit held in Rio de Janeiro in 1992 was called  
**NEET 2019**
- for conservation of biodiversity and sustainable utilisation of its benefits
  - to assess threat posed to native species by invasive weed species
  - for immediate steps to discontinue the use of CFCs that were damaging the ozone layer
  - to reduce CO<sub>2</sub> emissions and global warming
- 72** Where was the World Summit on Sustainable development held ?
- |                  |         |
|------------------|---------|
| (a) South Africa | (b) USA |
| (c) South Korea  | (d) UK  |

## SPECIAL FORMAT QUESTIONS

- Select the correct statement about biodiversity.
  - The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals
  - Large scale planting of *Bt* cotton has no adverse effect on biodiversity
  - Western Ghats have a very high degree of species richness and endemism
  - Conservation of biodiversity is just a fad pursued by the developed countries
- Which of the following statements is false?
  - Species diversity provides stability to the ecosystem
  - Communities with more species tend to be more stable than those with less species
  - Ecosystems with higher biodiversity are more productive than the ecosystems with lower biodiversity
  - Biodiversity is not essential for the maintenance and health of ecosystems
- Which of the following statement is the incorrect explanations about higher diversity in tropical areas in comparison to the temperate areas?
  - There are less seasonal variations in tropics
  - Less solar energy is available in tropics
  - Rate of extinction is low in tropics
  - Resource availability is higher in tropics
- Which of the following statements shows an example of alien species invading a new ecosystem resulting in biodiversity losses?
  - Introduction of Nile perch into lake Victoria in East Africa
  - Introduction of water hyacinth into India
  - Introduction of African catfish into Indian rivers
  - All of the above
- Which of the following statements is true ?
  - The IUCN Red list (2004) documents the extinction of 784 species (including 338 vertebrates, 359 invertebrates and 87 plants) in last 500 years
  - There are more than 20,000 species of ants, 3,00,000 species of beetles, 28,000 species of fishes and nearly 20,000 species of orchids
  - More than 70% of all the species recorded are animals, while plants comprise no more than 22% of the total
  - All of the above
- Select the statement that is in support of ethical arguments for biodiversity conservation.
  - Every species has an intrinsic value even though economically it is not valuable
  - Several benefits are derived from biodiversity such as food, furniture, medicines, etc.
  - Pollination, photosynthesis, carbon cycle, etc., are the ecological processes which maintains the balance of nature
  - All of the above
- Identify the incorrect statement.
  - In wildlife sanctuaries protection is only given to animal life
  - National parks protects both the flora and fauna
  - MAB programme of UNESCO protects the sacred groves as a site of biodiversity conservation
  - Ramsar sites are integral part of watersheds are very rich in biodiversity and a component of *in situ* conservation
- Which of the following statements are correct?
  - Alpha diversity represents number of species in a given habitat.
  - Genetic diversity are the variation of the genes within species.
  - Beta diversity is the diversity of the habitat in the whole region.
  - Species diversity is the product of the species richness and evenness.

Choose the correct option.

(a) I, II and III	(b) I and II
(c) I, II, III and IV	(d) I, II and IV
- Which of the following statements are correct about Amazon rainforest?

- I. It is called lungs of the planet.
- II. It harbours probably millions of the species.
- III. It is the largest tropical rainforest in South America and has greatest biodiversity on earth.
- IV. They are being cut and cleared for cultivating soybeans or for the conversion to grasslands for raising beef cattle.

Choose the correct option.

- (a) II, III and IV
- (b) I, II and III
- (c) I and II
- (d) I, II, III and IV

10. The impacts of loss of biodiversity may lead to

- I. lowered resistance to environmental perturbation.
- II. decrease in plant production.
- III. increased variability in ecosystem processes like water use, pest/disease cycle, plants productivity.
- IV. increase in plant production.

Select the option containing correct statements.

- (a) I and II
- (b) I and IV
- (c) I and III
- (d) I, II and III

11. Which of the following statements are correct about narrowly utilitarian arguments for conserving biodiversity?

- I. Ecosystem services like photosynthesis.
- II. Industrial products like dyes and lubricants.
- III. Watching spring flowers in full bloom.
- IV. The aesthetic pleasure of walking through thick woods.
- V. Fibre, firewood and construction material.
- VI. Products of medicinal importance.

Choose the correct option.

- (a) I, II and III
- (b) II, V and VI
- (c) IV, V and VI
- (d) I, III and VI

12. Select the correct statement (s).

- I. India has more than 50,000 genetically different strains of rice.
  - II. India has 1000 varieties of mango.
  - III. At ecosystem level, India, with its deserts, rainforests mangroves, etc., has a greater diversity than a Scandinavian country like Norway.
  - IV. The tropical rainforest initially covered 14% of the land surface of earth, but now they cover only 6% of the land area.
- (a) I and II
  - (b) I, II and III
  - (c) II, III and IV
  - (d) I, II, III and IV

13. Wildlife conservation aims at

- I. maintaining the ecological process.
- II. to enrich the wildlife diversity with exotic species.
- III. preventing migration of the species.
- IV. maintaining the diversity of life.

Select the option containing correct statements.

- (a) I and II
- (b) II and III
- (c) III and IV
- (d) I and IV

14. Read the following statements.

- I. Species diversity increases as we move away from the equator towards the poles.
- II. Stellar's sea cow and passenger pigeon got extinct due to overexploitation by man.
- III. *Lantana* and *Eichhornia* are invasive weed in India.
- IV. The historic convention on biological diversity was held in 1992.

Choose the option containing correct statements.

- (a) I and II
- (b) I, II and IV
- (c) I, III and IV
- (d) II, III and IV

15. Match the following columns.

Column I	Column II
A. Species diversity	1. influences biotic interactions and stability of the community.
B. Genetic diversity	2. is the variety of forms in the ecosystem.
C. Ecological diversity	3. influences adaptability and distribution of a species in diverse habitats.
D. Biodiversity	4. is the occurrence of different types in different ecosystems, species of organism with the whole range of their variants and genes.

Codes

	A	B	C	D
(a)	1	3	2	4
(b)	2	1	4	3
(c)	4	2	3	1
(d)	3	4	2	1

16. Match the following columns.

Column I	Column II
A. Rivet popper hypothesis	1. Paul Ehrlich
B. Communities with more species	2. Edward Wilson
C. Communities with less species	3. Less stable
D. Term biodiversity	4. More stable

Codes

	A	B	C	D
(a)	2	4	3	1
(b)	1	4	3	2
(c)	1	3	4	2
(d)	1	4	2	3

17. Match the following columns.

Column I (Organisms)	Column II (Estimations)
A. Plants	1. 1,25,000
B. Fish	2. 427
C. Birds	3. 1,300
D. Mammals	4. 378
E. Reptiles	5. 40,000
F. Invertebrates	6. 3,000

Codes

	A	B	C	D	E	F
(a)	5	6	3	2	4	1
(b)	6	3	4	1	2	5
(c)	3	4	2	1	6	5
(d)	6	5	4	2	1	3

18. Match the following columns.

Column I	Column II
A. Dodo	1. <i>Rauwolfia</i>
B. Reserpine	2. Mauritius
C. Nile Perch in lake Victoria	3. Habitat destruction
D. Main cause for biodiversity loss	4. Alien species

Codes

	A	B	C	D
(a)	4	2	1	3
(b)	2	1	4	3
(c)	2	4	3	1
(d)	3	2	1	4

19. Match the following columns.

Column I	Column II
A. Hotspots	1. Areas maintained by government for the betterment of wildlife.
B. Protected areas	2. Areas of high endemism and high level of species richness.
C. National parks	3. Biogeographical areas where biological diversity along with natural and cultural resources is protected, maintained and managed.
D. Biosphere reserves	4. Multipurpose protected areas, which are meant for preserving genetic diversity in the ecosystem of various natural biomass and unique biological communities.

Codes

	A	B	C	D	A	B	C	D	
(a)	1	2	3	4	(b)	3	1	2	4
(c)	2	3	1	4	(d)	4	2	3	1

20. Match the following columns.

Column I	Column II
A. Rhinoceros	1. Bharatpur
B. Tiger project in Karnataka	2. Tropical evergreen forest
C. Assemblage protection	3. Kaziranga
D. Silent valley	4. National park
	5. Bandipur

Codes

	A	B	C	D
(a)	5	3	1	4
(b)	2	4	3	1
(c)	4	3	1	2
(d)	3	5	1	2

21. Match the Column I (terms of IUCN's Red list) and Column II (description).

Column I	Column II
A. Threatened species	1. Thinly scattered or localised population with less number of individuals, highly sensitive to pests/pathogens/alien invasion.
B. Endangered	2. Species facing very high risk of extinction in the wild
C. Extinct	3. Moving towards extinction if not allowed to realise their biotic potential and protection against human exploitation, alien species, scarcity of food, etc.
D. Rare	4. No living individual exists.

Codes

	A	B	C	D	A	B	C	D	
(a)	3	2	4	1	(b)	1	2	3	4
(c)	4	3	2	1	(d)	2	1	4	3

## NCERT EXEMPLAR PROBLEMS

1. Which of the following countries has the highest biodiversity?
  - a. South America
  - b. South Africa
  - c. Russia
  - d. India
  
2. Which of the following is not a cause for loss of biodiversity?
  - a. Destruction of habitat
  - b. Invasion by alien species
  - c. Keeping animals in zoological parks
  - d. Over-exploitation of natural resources
  
3. Which of the following is not an invasive alien species in the Indian context?
  - a. *Lantana*
  - b. *Cynodon*
  - c. *Parthenium*
  - d. *Eichhornia*
  
4. Where among the following will you find pitcher plant?
  - a. Rain forest of North-East India
  - b. Sunderbans
  - c. Thar Desert
  - d. Western Ghats
  
5. Which one of the following is not a major characteristic feature of biodiversity hot spots?
  - a. Large number of species
  - b. Abundance of endemic species
  - c. Mostly located in the tropics
  - d. Mostly located in the polar regions
  
6. Match the animals given in column I with their location in column II:

Column I	Column II
A. Dodo	i. Africa
B. Quagga	ii. Russia
C. Thylacine	iii. Mauritius
D. Stellar's sea cow	iv. Australia

Choose the correct match from the following:

  - a. A-i, B-iii, C-ii, D-iv
  - b. A-iv, B-iii, C-i, D-ii
  - c. A-iii, B-i, C-ii, D-iv
  - d. A-iii, B-i, C-iv, D-ii
  
7. What is common to the following plants: *Nepenthes*, *Psilotum*, *Rauwolfia* and *Aconitum*?
  - a. All are ornamental plants
  - b. All are phylogenetic link species
  - c. All are prone to over exploitation
  - d. All are exclusively present in the Eastern Himalayas.

8. The one-horned rhinoceros is specific to which of the following sanctuary
- Bhitarkanika
  - Bandipur
  - Kaziranga
  - Corbett park
9. Amongst the animal groups given below, which one appears to be more vulnerable to extinction?
- Insects
  - Mammals
  - Amphibians
  - Reptiles
10. Which one of the following is an endangered plant species of India?
- Rauwolfia serpentina*
  - Santalum album* (Sandal wood)
  - Cycas beddomei*
  - All of the
11. What is common to *Lantana*, *Eichhornia* and African catfish?
- All are endangered species of India.
  - All are keystone species.
  - All are mammals found in India.
  - All the species are neither threatened nor indigenous species of India.
12. The extinction of passenger pigeon was due to:
- Increased number of predatory birds.
  - Over exploitation by humans.
  - Non-availability of the food.
  - Bird flu virus infection.
13. Which of the following statements is correct?
- Parthenium* is an endemic species of our country.
  - African catfish is not a threat to indigenous catfishes.
  - Steller's sea cow is an extinct animal.
  - Lantana* is popularly known as carrot grass.
14. Among the ecosystem mentioned below, where can one find maximum biodiversity?
- Mangroves
  - Desert
  - Coral reefs
  - Alpine meadows
15. Which of the following forests is known as the 'lungs of the planet Earth'?
- Taiga forest
  - Tundra forest
  - Amazon rain forest
  - Rain forests of North East India

16. The active chemical drug reserpine is obtained from:
- Datura*
  - Rauwolfia*
  - Atropa*
  - Papaver*
17. Which of the following group exhibit more species diversity?
- Gymnosperms
  - Algae
  - Bryophytes
  - Fungi
18. Which of the below mentioned regions exhibit less seasonal variations?
- Tropics
  - Temperates
  - Alpines
  - Both (a) & (b)
19. The historic convention on Biological Diversity held in Rio de Janeiro in 1992 is known as:
- CITES Convention
  - The Earth Summit
  - G-16 Summit
  - MAB Programme
20. What is common to the techniques (i) *in vitro* fertilisation, (ii) Cryo preservation and (iii) tissue culture?
- All are *in situ* conservation methods.
  - All are *ex situ* conservation methods.
  - All require ultra modern equipment and large space.
  - All are methods of conservation of extinct organisms.



## NEET PREVIOUS QUESTIONS

1. Which of the following regions of the globe exhibits highest species diversity?  
 (a) Western Ghats of India  
 (b) Madagascar  
 (c) Himalayas  
 (d) Amazon forests (NEET 2020)
2. According to Robert May, the global species diversity is about  
 (a) 1.5 million (b) 20 million  
 (c) 50 million (d) 7 million. (NEET 2020)
3. Which of the following is the most important for animals and plants being driven to extinction?  
 (a) Alien species invasion  
 (b) Habitat loss and fragmentation  
 (c) Drought and floods  
 (d) Economic exploitation (NEET 2019)
4. Decline in the population of indian native fishes due to introduction of *Clarias gariepinus* in river Yamuna can be categorised as  
 (a) co-extinction  
 (b) habitat fragmentation  
 (c) over-exploitation  
 (d) alien species invasion. (Odisha NEET 2019)
5. Alexander von Humboldt described for the first time  
 (a) laws of limiting factor  
 (b) species area relationships  
 (c) population growth equation  
 (d) ecological biodiversity. (NEET 2017)
6. Which of the following is correctly matched?  
 (a) Aerenchyma – *Opuntia*  
 (b) Age pyramid – Biome  
 (c) *Parthenium* – Threat to *hysterophorus* biodiversity  
 (d) Stratification – Population (NEET-II 2016)
7. Red list contains data or information on  
 (a) all economically important plants  
 (b) plants whose products are in international trade

- (c) threatened species  
 (d) marine vertebrates only. (NEET-II 2016)
8. Which is the national aquatic animal of India?  
 (a) Blue whale (b) Sea-horse  
 (c) Gangetic shark (d) River dolphin (NEET-I 2016)
9. Which of the following is the most important cause of animals and plants being driven to extinction?  
 (a) Habitat loss and fragmentation  
 (b) Co-extinctions  
 (c) Over-exploitation  
 (d) Alien species invasion (NEET-I 2016)
10. A species facing extremely high risk of extinction in the immediate future is called  
 (a) vulnerable (b) endemic  
 (c) critically endangered (d) extinct. (2014)
11. The organization which publishes the Red list of species is  
 (a) ICFRE (b) IUCN  
 (c) UNEP (d) WWF. (2014)
12. Given below is the representation of the extent of global diversity of invertebrates. What groups the four portions (A-D) represent respectively?  

A	B	C	D
(a) Insects	Crustaceans	Other animal groups	Molluscs
(b) Crustaceans	Insects	Molluscs	Other animal groups
(c) Molluscs	Other animal groups	Crustaceans	Insects
(d) Insects	Molluscs	Crustaceans	Other animal groups

 (2014)
13. Which of the following represent maximum number of species among global biodiversity?  
 (a) Fungi (b) Mosses and Ferns  
 (c) Algae (d) Lichens (NEET 2013, 2012)
14. Which of the following has maximum genetic diversity in India?  
 (a) Mango (b) Wheat  
 (c) Groundnut (d) Rice (Karnataka NEET 2013, 2011)
15. Which organization publishes the 'Red Data Book'?  
 (a) IUCN (b) UNEP  
 (c) WWF (d) GEF (Karnataka NEET 2013)

17. Biodiversity of a geographical region represents  
 (a) endangered species found in the region  
 (b) the diversity in the organisms living in the region  
 (c) genetic diversity in the dominant species of the region  
 (d) species endemic to the region. (Mains 2011)

18. Study the four statements (i–iv) given below and select the two correct ones out of them.  
 (i) A lion eating a deer and a sparrow feeding on grains are ecologically similar in being consumers.  
 (ii) Predator star fish *Pisaster* helps in maintaining species diversity of some invertebrates.  
 (iii) Predators ultimately lead to the extinction of prey species.  
 (iv) Production of chemicals such as nicotine, strychnine by the plants are metabolic disorders.  
 The two correct statements are  
 (a) (ii) and (iii) (b) (iii) and (iv)  
 (c) (i) and (iv) (d) (i) and (ii). (2010)

19. The Indian rhinoceros is a natural inhabitant of which one of the Indian states?  
 (a) Uttarakhand (b) Uttar Pradesh  
 (c) Himachal Pradesh (d) Assam (Mains 2010)

20. Which one of the following has maximum genetic diversity in India?  
 (a) Mango (b) Wheat  
 (c) Tea (d) Teak (2009)

21. The table gives the populations (in thousands) of ten species (A–J) in four areas (p–s) consisting of the number of habitats given within brackets against each. Study the table and answer the question which follows.

Area and No. of habitats	Species, and their populations (in thousands) in the areas									
	A	B	C	D	E	F	G	H	I	J
p (11)	2.3	1.2	0.52	6.0	-	3.1	1.1	9.0	-	10.3
q (11)	10.2	-	0.62	-	1.5	3.0	-	8.2	1.1	11.2
r (13)	11.3	0.9	0.48	2.4	1.4	4.2	0.8	8.4	2.2	4.1
s (12)	3.2	10.2	11.1	4.8	0.4	3.3	0.8	7.3	11.3	2.1

Which area out of p – s shows maximum species diversity?

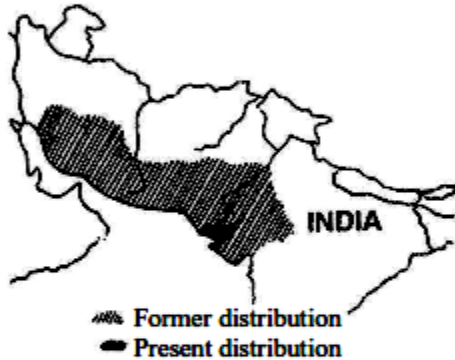
- (a) s (b) p (c) q (d) r (2008)
22. Which one of the following pairs of organisms are exotic species introduced in India?  
 (a) *Lantana camara*, water hyacinth  
 (b) Water hyacinth, *Prosopis cineraria*  
 (c) Nile perch, *Ficus religiosa*  
 (d) *Ficus religiosa*, *Lantana camara* (2007)
23. One of the endangered species of Indian medicinal plants is that of  
 (a) *Ocimum* (b) garlic  
 (c) *Nepenthes* (d) *Podophyllum*. (2007)

24. Which of the following pairs of an animal and a plant represents endangered organisms in India?  
 (a) Banyan and black duck  
 (b) *Bentinckia nicobarica* and red panda  
 (c) Tamarind and rhesus monkey  
 (d) *Cinchona* and leopard (2006)
25. According to IUCN Red List, what is the status of Red Panda (*Ailurus fulgens*)?  
 (a) Critically endangered species  
 (b) Vulnerable species  
 (c) Extinct species  
 (d) Endangered species (2005)
26. Which group of vertebrates comprises the highest number of endangered species?  
 (a) Mammals (b) Fishes  
 (c) Reptiles (d) Birds (2003)
27. Which endangered animal is the source of the world's finest, lightest, warmest and most expensive wool – the shahtoosh?  
 (a) Nilgai (b) Cheetal  
 (c) Kashmiri goat (d) Chiru (2003)
28. Wildlife is continuously decreasing. What is the main reason of this?  
 (a) Predation  
 (b) Cutting down of forest  
 (c) Destruction of habitat  
 (d) Hunting (2002)
29. Indri-indri lemur is found in  
 (a) Madagascar (b) Mauritius  
 (c) India (d) Sri Lanka. (2000)
30. Occurrence of endemic species in South America and Australia is due to  
 (a) these species has been extinct from other regions  
 (b) continental separation  
 (c) there is no terrestrial route to these places  
 (d) retrogressive evolution. (2001)
31. Which of the following is mainly responsible for the extinction of wildlife?  
 (a) Pollution of air and water  
 (b) Hunting of flesh  
 (c) Destruction of habitats  
 (d) All of these (1999)
32. What is the major cause of diminishing wildlife number?  
 (a) Felling of trees  
 (b) Paucity of drinking water  
 (c) Cannibalism  
 (d) Habitat destruction (1998)
33. The breeding place of Flamingo (Hansawar) in India is most likely  
 (a) Runn of Kutch (b) Ghana Vihar  
 (c) Sambhar lake (d) Chilka lake. (1996)
34. The abundance of a species population, within its habitat, is called  
 (a) relative density (b) regional density  
 (c) absolute density (d) niche density. (1995)

35. The most important human activity, leading to the extinction of wildlife, is  
 (a) pollution of air and water  
 (b) hunting for valuable wildlife products  
 (c) introduction of alien species  
 (d) alteration and destruction of the natural habitats. (1994)
36. The Earth Summit held in Rio de Janeiro in 1992 was called  
 (a) for immediate steps to discontinue use of CFCs that were damaging the ozone layer  
 (b) to reduce CO<sub>2</sub> emissions and global warming  
 (c) for conservation of biodiversity and sustainable utilisation of its benefits  
 (d) to assess threat posed to native species by invasive weed species. (NEET 2019)
37. Which one of the following is not a method of *in situ* conservation of biodiversity?  
 (a) Sacred grove (b) Biosphere reserve  
 (c) Wildlife sanctuary (d) Botanical garden (NEET 2019)
38. Western Ghats have a large number of plant and animal species that are not found anywhere else. Which of the following terms will you use to notify such species?  
 (a) Endemic (b) Vulnerable  
 (c) Threatened (d) Keystone (Odisha NEET 2019)
39. All of the following are included in 'ex-situ conservation' except  
 (a) wildlife safari parks (b) sacred groves  
 (c) botanical gardens (d) seed banks. (NEET 2018)
40. Which one of the following is related to *ex-situ* conservation of threatened animals and plants?  
 (a) Biodiversity hotspots  
 (b) Amazon rainforest  
 (c) Himalayan region  
 (d) Wildlife safari parks (NEET 2017)
41. The region of biosphere reserve which is legally protected and where no human activity is allowed is known as  
 (a) buffer zone (b) transition zone  
 (c) restoration zone (d) core zone. (NEET 2017)
42. How many hotspots of biodiversity in the world have been identified till date by Norman Myers?  
 (a) 17 (b) 25  
 (c) 34 (d) 43 (NEET-II 2016)
43. Which of the following national parks is home to the famous musk deer or hangul?  
 (a) Keibul Lamjao National Park, Manipur  
 (b) Bandhavgarh National Park, Madhya Pradesh  
 (c) Eaglenest Wildlife Sanctuary, Arunachal Pradesh  
 (d) Dachigam National Park, Jammu and Kashmir (NEET-II 2016)
44. The species confined to a particular region and not found elsewhere is termed as  
 (a) endemic (b) rare  
 (c) keystone (d) alien. (2015)
45. In which of the following, both pairs have correct combination?  
 (a) *In-situ* conservation : Seed Bank  
     *Ex-situ* conservation : National Park  
 (b) *In-situ* conservation : Tissue culture  
     *Ex-situ* conservation : Sacred groves  
 (c) *In-situ* conservation : National Park  
     *Ex-situ* conservation : Botanical Garden  
 (d) *In-situ* conservation : Cryopreservation  
     *Ex-situ* conservation : Wildlife Sanctuary (2015 Cancelled)
46. Cryopreservation of gametes of threatened species in viable and fertile condition can be referred to as  
 (a) *in situ* conservation by sacred groves  
 (b) *in situ* cryo-conservation of biodiversity  
 (c) *in situ* conservation of biodiversity  
 (d) advanced *ex situ* conservation of biodiversity. (2015 Cancelled)
47. An example of *ex-situ* conservation is  
 (a) national park (b) seed bank  
 (c) wildlife sanctuary (d) sacred grove. (2014)
48. Which one of the following is not used for *ex-situ* plant conservation?  
 (a) Shifting cultivation (b) Botanical gardens  
 (c) Field gene banks (d) Seed banks (NEET 2013)
49. The largest tiger reserve in India is  
 (a) Valmiki  
 (b) Nagarjunasagar-Srisailem  
 (c) Periyar  
 (d) Nagarhole. (Karnataka NEET 2013)
50. Which one of the following areas in India, is a hotspot of biodiversity?  
 (a) Eastern Ghats (b) Gangetic Plain  
 (c) Sunderbans (d) Western Ghats (2012)

## AIIMS PREVIOUS QUESTIONS

1. Heavy rainfall during summer produces [1998]  
(a) desert                      (b) grassland  
(c) forest                      (d) wetland
2. The trees occurring in two seasons is the characteristic feature of [1998]  
(a) temperate deciduous forest  
(b) tropical savannah  
(c) grassland  
(d) coniferous forest
3. The map given below indicates the former and the present distribution of an animal. [2003]



Which animal could it be?

- (a) Wild ass                      (b) Nilgai  
(c) Black buck                      (d) Lion
4. If the high altitude birds become rare or extinct, the plants which may disappear along with them are [2004]  
(a) pine                      (b) oak  
(c) orchids                      (d) *Rhododendrons*
5. Which one of the following is a pair of endangered species? [2004]  
(a) Garden lizard and Mexican poppy  
(b) Rhesus monkey and sal tree  
(c) Indian peacock and carrot grass  
(d) Hornbill and Indian aconite

6. Which one of the following is correct matching of a plant, its habit and forest type where it normally occurs? [2005]  
(a) *Prosopis*, tree, scrub  
(b) *Saccharum officinarum*, grass, forest  
(c) *Shorea robusta*, herb, tropical rain forest  
(d) *Acacia catechu*, tree, coniferous forest
7. One of the *ex-situ* conservation methods for endangered species is [2005]  
(a) wildlife sanctuaries  
(b) biosphere reserves  
(c) cryopreservation  
(d) national parks
8. Genetic diversity in agricultural crops is threatened by [2005]  
(a) introduction of high yielding varieties.  
(b) intensive use of fertilizers.  
(c) extensive intercropping.  
(d) intensive use of biopesticides.
9. The Montreal protocol refers to [2006]  
(a) persistent organic pollutants  
(b) global warming and climate change  
(c) substances that deplete the ozone layer  
(d) biosafety of genetically modified organisms
10. Biosphere reserves differ from National parks and Wildlife sanctuaries because in the former [2006]  
(a) human beings *are* not allowed to enter.  
(b) people are an integral part of the system.  
(c) plants are paid greater attention than the animals.  
(d) living organisms are brought from all over the world and preserved for posterity.
11. Which part of the world has a high density of organism? [2007]  
(a) Deciduous forests  
(b) Grasslands  
(c) Tropical rain forests  
(d) Savannahs

12. Beta diversity is diversity [2007]  
(a) in a community  
(b) between communities  
(c) in a mountain gradient  
(d) on a plain
13. Which one of the following pairs of geographical areas show maximum biodiversity in our country? [2008]  
(a) Sunderbans and Rann of Kutch  
(b) Eastern Ghats and West Bengal  
(c) Eastern Himalaya and Western Ghats  
(d) Kerala and Punjab.
14. A tree species in Mauritius failed to reproduce because of the extinction of a fruit-eating bird. Which one of the following was that bird?  
(a) Dove (b) *Dodo* [2010]  
(c) Condor (d) Skua
15. Tectonic is the study of [2011]  
(a) volcanos (b) earth's crust  
(c) sand dunes (d) Sun

16. If the Bengal tiger becomes extinct [2004, 2012]  
(a) Hyenas and wolves will become scare  
(b) The wild area will be safe for man and domestic animals  
(c) Its gene pool will be lost for ever  
(d) The population of beautiful animals like deers will be stabilized.
17. Which of the following is considered a hot-spot of biodiversity in India? [2013]  
(a) Indo-Gangetic Plain  
(b) Eastern Ghats  
(c) Aravalli Hills  
(d) Western Ghats
18. The largest Tiger reserve in India is [2014]  
(a) Nagarhole  
(b) Valmiki  
(c) Nagarjunsagar-Srisailam  
(d) Periyar

## **KEY**

### **MULTIPLE CHOICE QUESTIONS**

1 (a) 2 (b) 3 (c) 4 (a) 5 (c) 6 (c) 7 (c) 8 (d) 9 (b) 10 (c) 11 (d) 12 (a) 13 (a) 14 (a) 15 (c)  
16 (b) 17 (a) 18 (b) 19 (d) 20 (c) 21 (a) 22 (a) 23 (c) 24 (c) 25 (a) 26 (a) 27 (d) 28 (a) 29 (d) 30 (b)  
31 (d) 32 (b) 33 (c) 34 (c) 35 (a) 36 (c) 37 (d) 38 (d) 39 (d) 40 (a) 41 (c) 42 (d) 43 (c) 44 (c) 45 (c)  
46 (d) 47 (c) 48 (a) 49 (a) 50 (c) 51 (d) 52 (d) 53 (a) 54 (d) 55 (a) 56 (b) 57 (d) 58 (b) 59 (b) 60 (d)  
61 (a) 62 (d) 63 (d) 64 (d) 65 (c) 66 (b) 67 (a) 68 (b) 69 (b) 70 (a) 71 (a) 72 (a)

### **SPECIAL FORMAT QUESTIONS**

1 c	6 a	11 b	16 b	21 a
2 d	7 c	12 d	17 a	
3 b	8 d	13 d	18 b	
4 d	9 d	14 d	19 c	
5 d	10 d	15 d	20 d	

### **NCERT EXEMPLAR PROBLEMS**

1. (d) 2. (d) 3. (b) 4. (d) 5. (b) 6. (c) 7. (c) 8. (d) 9. (a) 10. (c)  
11. (b) 12. (d) 13. (a) 14. (d) 15. (a) 16. (b) 17. (b) 18. (d) 19. (d) 20. (a)  
21. (a) 22. (a) 23. (d) 24. (b) 25. (d) 26. (a) 27. (d) 28. (c) 29. (a) 30. (b)  
31. (c) 32. (d) 33. (d) 34. (d) 35. (d) 36. (c) 37. (d) 38. (a) 39. (b) 40. (d)  
41. (d) 42. (c) 43. (d) 44. (a) 45. (c) 46. (d) 47. (b) 48. (a) 49. (b) 50. (d)

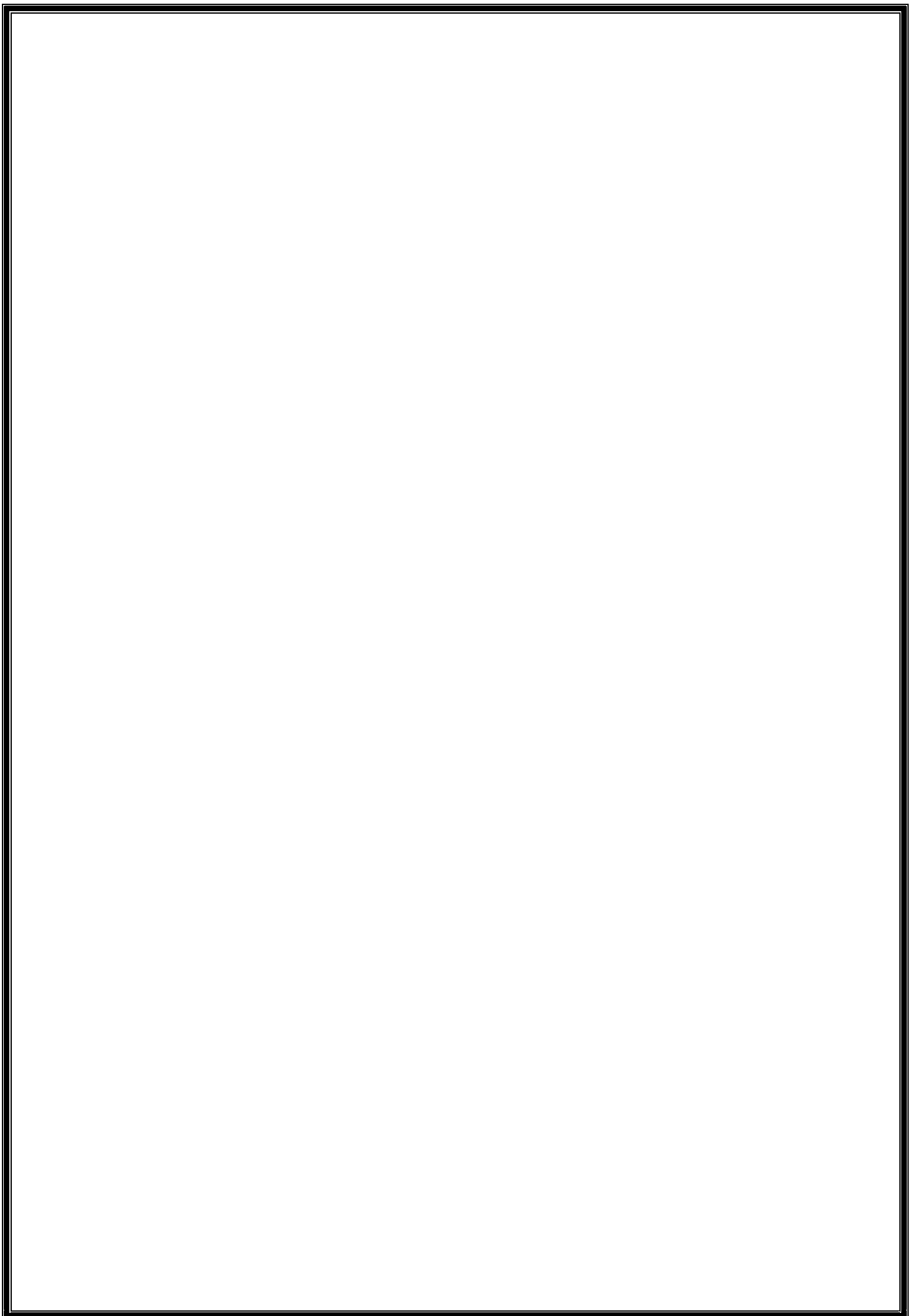
### **NEET PREVIOUS QUESTIONS**

1 a	5 d	9 c	13 c	17 d
2 c	6 d	10 d	14 c	18 a
3 b	7 c	11 d	15 c	19 b
4 a	8 c	12 b	16 b	20 b

### **AIIMS PREVIOUS QUESTIONS**

1 b	5 d	9 c	13 c	17 d
2 a	6 a	10 b	14 b	18 c
3 a	7 c	11 c	15 b	
4 b	8 d	12 b	16 c	





**UNIT-VIII**  
**ENVIRONMENTAL**  
**ISSUES**  
**(CHAPTER-16)**



## SYNOPSIS

- **Pollution** is undesirable change in physical, chemical and biological characteristics of environmental components (air, land, water and soil). Agents that brought about such an undesirable change are called as **pollutants**.
- Government of India has passed **Environment (Protection) Act, 1986** to protect and improve quality of environment (air, water and soil).

### Air Pollution

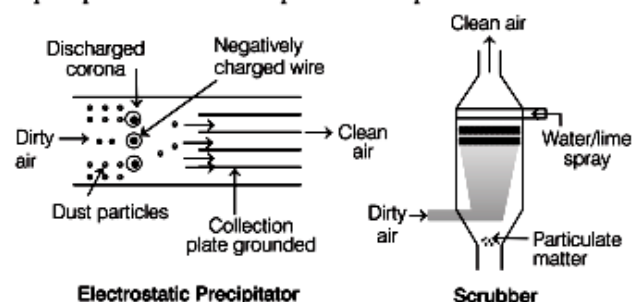
- It occurs due to undesirable changes in the physical, chemical and biological characteristics of air that exerts harmful effects on all living organisms including human beings.
- It results mainly from burning of fossil fuel, automobile exhaust, forest fires and industrial emissions.
- Air pollutants reduce growth and yield of crops and cause premature death of plants. It deteriorously affects the respiratory system of humans and animals.
- Harmful effects depend on the concentration of pollutants, duration of exposure and the organism.
- Thermal power plants, smelters and other industries releases particulate and gaseous air pollutants, i.e. carbon dioxide, sulphur and nitrogen oxides, together with harmless gases, such as nitrogen, oxygen, etc.
- Some devices used for controlling air pollution include

#### 1. Electrostatic Precipitator (ESP)

- It can remove over 99% particulate matter present in the exhaust from a thermal power plant. It has electrode wires that are maintained at several thousand volts, which produce a corona that releases electrons.
- These electrons attach to dust particles and give them a net negative charge.
- The collecting plates are grounded and attract these charged particles. The velocity of air between the plates are maintained low enough to allow the dust to fall.

#### 2. Scrubber

- It can remove gases like sulphur dioxide, when the exhaust is passed through a spray of water or lime. Water dissolved gases and lime reacts with sulphur dioxide to form a precipitate of calcium sulphate and sulphide.



- **Drawback** Recently, the dangers of particulate matter (very small particles that cannot be removed by these precipitators) has been found.
- According to **Central Pollution Control Board (CPCB)**, Suspended Particulate Matter (SPM) (size  $2.5 \mu\text{m}$  or less) if inhaled can cause breathing problems, irritation, inflammations and even premature deaths.

#### 3. Catalytic Converters

- It reduces the emission of poisonous gases from **automobiles**. Unleaded petrol is used in catalytic converter fitted automobiles, as lead inactivates platinum-palladium and rhodium catalysts used in the device.
- As the exhaust passes through the catalytic converter, it can cause  $\text{NO}_2$  to split into  $\text{N}_2$  and  $\text{O}_2$ , oxidation of  $\text{CO}$  into  $\text{CO}_2$  and complete burning of hydrocarbons into  $\text{CO}_2$  and  $\text{H}_2\text{O}$ .

### Government Steps to Reduce Air Pollution

- **Government steps** include switching of public transport buses, from diesel to Compressed Natural Gas (CNG) and a roadmap to cut down vehicular air pollution through new auto fuel policy.
- According to new auto fuel policy of Government of India, all automobiles must meet the Euro III norms which stipulate that sulphur be controlled at 350 parts per million (ppm) in diesel and 150 ppm in petrol. Aromatic hydrocarbons are to be contained at 42% of the concerned fuel. The goal is to reduce sulphur to 50 ppm in petrol and diesel and bring down the level to 35 per cent.
- **Mass Emission Standards (Bharat Stage II** which is equivalent to Euro-II norms) are no more applicable in any of the cities of India. Details of the latest Mass Emission Standards in India are provided below

Types of Vehicle	Norms	Cities of Implementation
4 Wheelers	Bharat Stage IV	Throughout the country since April 2017
3 Wheelers	Bharat Stage IV	Throughout the country since 1st April 2017
2 Wheelers	Bharat Stage IV	Throughout the country since April 2017

- Substantial fall in air pollution in Delhi is the result of **Euro norms** enforced by Delhi Government between 1997-2005.

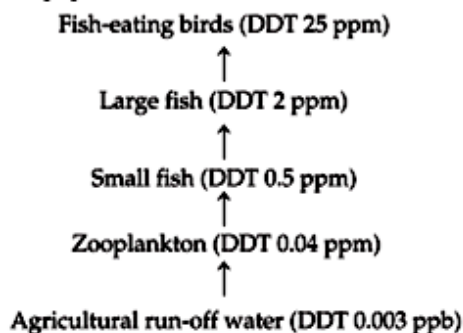
### Noise Pollution

- It is undesirable high level of sound.
- **Air (Prevention and Control of Pollution) Act, 1981** amended in 1987 to include noise as an air pollutant.
- Noise pollution is caused by loudspeakers, music systems used in functions and homes, rockets and jet planes, machines used in industries, etc.
- **Harmful effects** Brief exposure to extremely high sound level, 150 dB or more may cause sleeplessness, increased heart rate, breathing problem, feeling of stress and discomfort, permanent hearing loss and other psychological and physiological disorders.
- **Control measures** Noise pollution can be controlled by promoting use of sound absorbent materials or by sound muffling device by limiting the use of horns or marking horn-free zones around schools and hospitals and by not using loudspeakers for personal and religious functions.

### Water Pollution

- It is the contamination of water bodies due to the changes in physical, chemical and biological properties of water that can affect the living beings adversely.
- The main sources of water pollution are domestic sewage, industrial wastes and agricultural run-off.
- The government of India has passed the **Water (Prevention and Control of Pollution) Act** in 1974 to safeguard our water resources.
- Sources of water pollution are as follows
  - **Domestic sewage** constitutes wastewater from our homes and public sewage. A mere 0.1 per cent impurities make domestic sewage unfit for human use.
  - It contains suspended solids (sand, silt and clay) colloidal materials (bacteria, faecal matter, paper, etc.) and dissolved materials (nitrates, ammonia, phosphate, sodium, calcium salt). It also contains biodegradable organic matter that is readily decomposed by microbes.

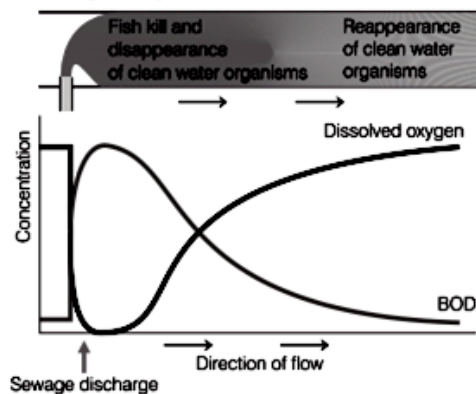
- It is easy to remove solids, but very difficult to remove dissolved salts such as nitrates, phosphates and toxic metal ions from wastewater.
- Industrial wastes** are released by petroleum, paper manufacturing, metal extraction and processing units. It contains heavy metals like mercury and many organic compounds.
- Effects of water pollution are as follows
  - Biomagnification** It refers to the increase in concentration of the toxic substance at successive trophic level, in the food chain.
  - The toxic substances accumulated by an organism cannot be metabolised or excreted. When this organism is eaten up by another animal of higher trophic level, it is passed on to this and then to the next higher trophic level and so on, e.g. biomagnification of DDT.
- Biomagnification** disturbs calcium metabolism in birds, which causes thinning of egg shell and their premature breaking, eventually causing decline in bird populations.



**Biomagnification of DDT in an aquatic food chain**

- Eutrophication** It is the natural ageing of a lake by biological enrichment of its water. In a young lake, the water is cold and clear, that supports little life. With time, streams draining into the lake bring nutrients such as nitrogen and phosphorus, which encourage the growth of aquatic organisms. As the lake's fertility increases, plant and animal life proliferate and organic matter remains begin to be deposited on the lake bottom.
- Over the centuries, the lake grows shallower and warmer. Eventually, the floating plants (bog), grow in the lake finally converting into land.
  - The accelerated ageing of lakes due to the sewage, agricultural and industrial wastes is called **cultural or accelerated eutrophication**.
  - Biochemical Oxygen Demand (BOD)** is the amount of oxygen required for microbial breakdown of biodegradable organic matter.

- It is higher in polluted water and lesser in clean water.



Effect of sewage discharge on some important characteristics of a river

- Algal bloom** is excessive growth of planktonic (free-floating) algae in aquatic bodies.
  - In domestic sewage, nutrients like nitrogen and phosphorus favours the growth of algal bloom.
  - It causes fish mortality and deterioration of water quality.
  - For example, excessive growth of **water hyacinth (*Eichhornia crassipes*)**. It is the most problematic aquatic weed, also called **Terror of Bengal**.
  - It grows abundantly in eutrophic water bodies and imbalances water ecosystem.
- Control measures of water pollution are as follows
  - Proper maintenance of water bodies and avoid disposal of waste into water.
  - Reduce use of pesticides and chemical fertilisers in agriculture.
  - Proper sewage treatment before disposal into large waterbodies.
  - EcoSan toilets** have been developed in areas of Kerala and Sri Lanka for ecological sanitation. This helps in recycling of human excreta into natural fertiliser to reduce need of chemical fertiliser. It is a practical, hygienic, efficient and cost effective method of disposal.
  - A citizen group called **Friends Of the Arcata Marsh (FOAM)** initiated the project of Integrated wastewater treatment, in Arcata (California) to treat wastewater in an integrated manner by utilising mixture of artificial and natural process.

## Solid Wastes

It refers to everything that goes out in trash and pollute land. It include various sources as follows

- Municipal solid wastes** consist of paper, leather, textile, rubber, glass, waste food materials from home, offices, etc.
- Industrial wastes** contain wastes like scraps, fly ash, etc., generated by industries.
- Hospital wastes** contain disinfectants and other harmful chemical generated by the hospitals.
- Fly ash** is formed in thermal power plants and mainly composed of oxides of iron, silica with aluminium with a low concentration of toxic heavy metals.
- Electronic wastes (e-wates)** These consist of the damaged electronic goods and irreparable computers.
- All wastes can categorised into three types
  - Biodegradable
  - Reusable/Recyclable
  - Non-biodegradable

- **Sanitary landfills** are areas, where wastes are dumped in a depression or trench after compaction and covered with dirt.
- **Rag-pickers and kabadiwala** collect and separate out wastes into reusable or recyclable categories.
- **Natural breakdown** by dumping biodegradable materials into deep pits for natural degradation.
- **Recycling of e-wastes** can be done to recover important metals.
- **Incineration** is a method of e-waste and hospital waste disposal. It is carried out at very high temperature, i.e. 900°C-1300°C.

- **Ahmed Khan**, a plastic sack manufacturer in Bengaluru gave a remedy for the plastic waste, i.e. polyblend, a fine powder of recycled modified plastic from any plastic film waste developed by his company.
- This mixture is mixed with bitumen and used to lay roads, enhanced the bitumen's water repellent properties and helped to increase road life by a factor of three.

## Soil Pollution

- It may be defined as the presence of materials in the soil, which are harmful to the living beings when they cross their threshold concentration level.
- It can be caused by
  - Chemical seepage from industries.
  - Excessive use of inorganic fertilisers, pesticides, herbicides, fungicides etc.
- **Harmful effects** of soil pollution are as follows
  - Soil becomes infertile.
  - Non-targeted organisms are killed in the soil due to harmful pesticides intake.
  - Pesticides can result in biomagnification as well as eutrophication.
- **Control measures** of soil pollution are as follows
  - Strict ways should be adopted by the industries and other sources for waste disposal.
  - Use of organic farming, i.e. a cyclic zero waste method, where waste products from one process are cycled in as nutrients for other processes, allowing maximum utilisation of resources and increasing the efficiency of production.

**Integrated organic farming** is done by Ramesh Chandra Dagar, a farmer in Sonapat (Haryana). It included bee-keeping, dairy management, water harvesting, composting and agriculture in a chain of processes. This chain supports each other and allow an extremely economical and sustainable venture.

## Radioactive Wastes

- These are wastes which release radioactivity (emission of  $\alpha$ -particles,  $\beta$ -particles or  $\gamma$  rays) from nucleotides of their elements.

- Traces of radioactive elements occur in a number of products, e.g. polonium in tobacco and several ores.
- Nuclear energy was once thought to be a non-polluting way of producing energy. Later, it was found that nuclear energy has two major drawbacks. These are
  - Accidental leakage of radioactive wastes as happened in Chernobyl and Three Mile Island.
  - Safe disposal of radioactive wastes.
- Radiation from nuclear material/waste is extremely harmful for the living organisms. It causes mutations at high rate and also increases the risk of cancer.
- At lower concentrations, it creates various disorders in the body, mainly cancer whereas at higher doses, it can be lethal.
- It has been recommended that nuclear waste before disposal should be pre-treated and then buried about 500 m deep below, within the rocks under the earth's crust, in suitably shielded containers. However, this method of disposal is also facing criticism.

## Greenhouse Effect and Global Warming

- The term, '**Greenhouse effect**' has been derived from a phenomenon, which occurs inside a greenhouse. In a greenhouse, the glass panel lets the light in, but does not allow heat to escape. This results in warming up of the greenhouse.
- The greenhouse effect is a naturally occurring phenomenon that is responsible for heating of Earth's surface and its atmosphere. Without greenhouse effect, the average temperature at surface of earth would have been chilly, i.e. approximately  $-18^{\circ}\text{C}$  rather than the present average of  $15^{\circ}\text{C}$ .
- To understand greenhouse effect it is necessary to know the fate of energy of sunlight that reaches the outermost atmosphere.
  - Clouds and gases reflect about one-fourth of the incoming solar radiation and absorb some of it.
  - Almost half of the incoming solar radiation falls on the surface of earth and heats it and a small proportion of the radiation is reflected back.
  - Earth's surface re-emits heat mostly in the form of infrared radiations. This re-emitted radiation is absorbed by the gases present in the upper atmosphere (e.g. carbon dioxide, methane, etc.). These gases are called **greenhouse gases** because they are responsible for the greenhouse effect.

## Global Warming

- The gradual and continuous increase in average temperature of surface of the earth has resulted in **global warming**.

- High levels of greenhouse gases (CO<sub>2</sub>, CFCs, etc.) in the atmosphere allow the heat waves to reach earth, but prevent their escape and the earth becomes warm.
- All living plants are capable of storing carbon, but as the number of plants on the planet declines, the amount of CO<sub>2</sub> in the atmosphere increases. Thus, deforestation is also a major cause of global warming.
- Increase in population also leads to deforestation and ultimately to global warming.
- The major effects of global warming include
  - Earth's temperature has increased by 0.6°C during past century, most of it in last three decades. This increased temperature cause changes in precipitation patterns.
  - Scientists have proposed that this rise in temperature causes deleterious changes in the environment, resulting in odd climatic changes (e.g. El Nino effect). Thus, leading to melting of the polar ice caps and Himalayan snow caps. This causes a rise in sea level that can submerge many coastal areas.

## Ozone Depletion in the Stratosphere

- Ozone is found in the upper part of the atmosphere (stratosphere) and acts as a shield absorbing ultraviolet radiation from the sun. This is known as 'good ozone' and the ozone formed in the lower atmosphere (troposphere) harms plants and animals and called as 'bad ozone'.
- The thickness of the ozone in a column of air from the ground to the top of the atmosphere is measured in terms of Dobson Units (DU).
- Ozone gas is continuously formed by the action of UV rays on molecular O<sub>2</sub> and also degrade into molecular O<sub>2</sub> in the stratosphere. There is a balance between production and degradation of ozone in the stratosphere, but it is disrupted due to enhancement of ozone degradation by chlorofluorocarbons (CFCs).
- In stratosphere, UV rays acts on CFCs and release Cl atoms. Cl degrades ozone releasing molecular O<sub>2</sub>, with these atoms acting as catalysts. UV-B damages DNA and cause mutation. It causes ageing of skin, i.e. skin cancer. In human eye, cornea absorbs UV-B radiations which causes inflammation of cornea, called snow-blindness, cataract, etc.
- Release of CFC (Chlorofluorocarbon) and aerosols is depleting ozone in stratosphere by reacting with O<sub>3</sub>. The depletion is particularly marked over the Antarctic region. This has resulted in the formation of a large area of thinned ozone layer called ozone hole.
- UV-A and UV-B rays reach on earth and affect life forms. An international treaty, known as the Montreal Protocol was signed at Montreal (Canada) in 1987 (effective in 1989) to control the emission of ozone depleting substances.

## Degradation due to Improper Resource Utilisation and Maintenance

- Degradation of natural resources can occur, not just by the action of pollutants, but also by improper resource utilisation practices.

### Soil Erosion and Desertification

- Top soil is the most fertile layer and it takes centuries to build. Improper human activities can remove it easily resulting in arid patches of land. Soil erosion is caused by human activities like over cultivation, unrestricted grazing, deforestation and poor irrigation practices.
- Desertification is also a major problem these days, that occurs mainly due to increased Urbanisation. When large barren patches extend and meet over time, a desert is created.

### Waterlogging and Soil Salinity

- Irrigation without proper drainage of water leads to waterlogging in the soil. It draws salt to the surface of the soil apart from affecting the crops.
- Deposited salt starts collecting at the roots of the plants or forms a thin crust on land surface. This affects the plant growth and productivity. It is extremely damaging to the agriculture.
- Waterlogging and soil salinity are some of the problems that have come in the wake of the green revolution.

## Deforestation

- It is the conversion of forested areas to non-forested areas by cutting down trees for timber, agriculture or grazing practices is called deforestation.
  - It can be caused by Urbanisation, overgrazing, forest fires, demand of forest products, etc.
  - **Jhum cultivation** is a technique in which tribal population slash and burn forests to make it agriculture land. It results in deforestation.
  - **Reforestation** is the process of restoring forest that once existed, but was removed at some point of time in the past.

## People Participation in Forest Conservation

- Amrita Devi Bishnoi in 1731 had shown exemplary courage by hugging a tree and daring king's people to cut her first. Government of India instituted **Amrita Devi Bishnoi Wildlife Protection Award** for individuals or communities, which protect and save forests.
- **Chipko movement** was launched by **Chandi Prasad Bhatt** and **Sundar Lal Bahuguna** against large scale falling of trees by timber contractor in Uttarakhand hills.
- These all protection movements led to introduction of **Joint Forest Management (JFM)** concept in 1980s for protecting and managing forests.

## MULTIPLE CHOICE OF QUESTIONS

- 1** Which of the following is a secondary pollutant?  
**NEET 2011**
- (a) SO<sub>2</sub> (b) CO<sub>2</sub>  
(c) CO (d) O<sub>3</sub>

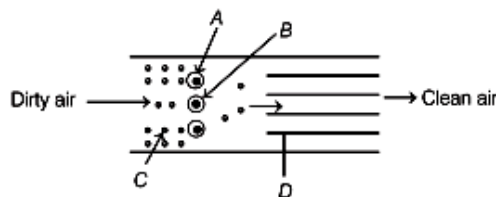
- 2** Fine organic or inorganic particles suspended in air is called
- (a) gaseous pollutant (b) particulate pollutant  
(c) aerosols (d) None of these

- 3** In plants, air pollution causes
- (a) reduce growth and yield  
(b) leads to premature death  
(c) Both (a) and (b)  
(d) None of the above

- 4** The harmful effects of the air pollution on organism depends on
- (a) size of pollutant particles present in air  
(b) concentration of air pollutants  
(c) duration of exposure and the organism  
(d) All of the above

- 5** Which method is used to remove particulate matter present in exhaust of thermal power plant?
- (a) Wet scrubbers  
(b) Absorption  
(c) Electrostatic precipitator  
(d) Gravitational method

- 6** The diagram given below shows electrostatic precipitator. Identify A, B, C, D and select the correct option.



- (a) A–Dust particle, B–Negatively charged wire, C–Discharge corona, D–Collection plate grounded  
(b) A–Discharge corona, B–Collection plate grounded, C–Dust particle, D–Negatively charged wire  
(c) A–Discharge corona, B–Negatively charged wire, C–Dust particle, D–Collection plate grounded  
(d) A–Discharge corona, B–Dust particle, C–Negatively charged wire, D–Collection plate grounded

- 7** ..... are used in electrostatic precipitator. Choose the most appropriate option to fill in the blank.

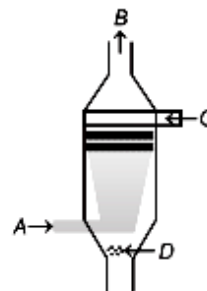
- (a) Catalysts  
(b) Absorbers  
(c) Electrodes  
(d) Chemicals

- 8** In electrostatic precipitator, electrode wires are provided with an electric current of several thousand volts, to produce a corona that release ...A... .

These particles attaches to dust particle and given them a ...B... charge within a very small fraction of a second. Here, A and B refer to

- (a) A–electron, B–positive  
(b) A–neutron, B–negative  
(c) A–electron, B–negative  
(d) A–proton, B–positive

- 9** The below diagram shows a scrubber. Identify A, B, C and D.



- (a) A–Particulate matter, B–Clean air, C–Dirty air, D–Dust particle  
(b) A–Dirty air, B–Clean air, C–Water/lime spray, D–Particulate matter  
(c) A–Clean air, B–Dirty air, C–Particulate matter, D–Water/lime spray  
(d) A–Dust particle, B–Clean air, C–Particulate matter, D–Collection plate grounded

- 10** A scrubber in the exhaust of a chemical industrial plant removes **CBSE-AIPMT 20**

- (a) gases like sulphur dioxide  
(b) particulate matter of the size 5 micrometer or above  
(c) gases like ozone and methane  
(d) particulate matter of the size 2.5 micrometer or less

- 11** Suspended particulate matter which remains in air for weeks is

- (a)  $\leq 10\mu\text{m}$  (b)  $\geq 10\mu\text{m}$  (c)  $\geq 20\mu\text{m}$  (d)  $\geq 25\mu\text{m}$

- 12** Which of the following health problems originate due to the inhalation of fine particulate matter?

- (a) Irritation  
(b) Inflammation of respiratory tract  
(c) Damage of lungs and premature deaths  
(d) All of the above

- 13** Which device is fitted in automobiles for reducing the emission of poisonous gases like NO and CO?

- (a) Catalytic converters  
(b) Electrostatic precipitator  
(c) Scrubber  
(d) Bag filter

- 14** Catalytic converters possess which one of the following metals as catalyst?

- (a) Platinum (b) Palladium  
(c) Rhodium (d) All of these

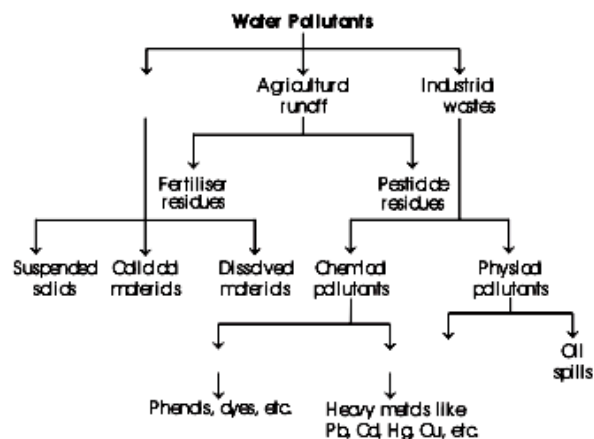
- 15** In catalytic converters, hydrocarbons which are unburnt and carbon monoxide and nitric oxide are changed into

- (a) CO<sub>2</sub> and N<sub>2</sub>; respectively  
(b) CO<sub>2</sub> and H<sub>2</sub>O; CO<sub>2</sub> and N<sub>2</sub>, respectively  
(c) O<sub>2</sub> and CO<sub>2</sub>; N<sub>2</sub>, respectively  
(d) H<sub>2</sub>O; CO<sub>2</sub> and N<sub>2</sub>, respectively

- 16** Identify the correctly matched pair.

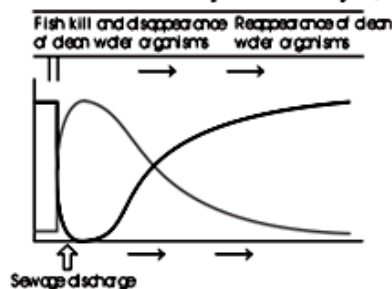
- (a) Particulate matter – Breathing and respiratory symptoms  
(b) Removal of particulate matter – Electrostatic precipitator  
(c) SO<sub>2</sub> – Catalytic converter  
(d) Both (a) and (b)

- 17** Motor vehicles equipped with catalytic converter should use unleaded petrol because lead
- in petrol inactivates the catalyst
  - increases the burning of petrol
  - decreases the efficiency of vehicles
  - is a heavy metal
- 18** Noise which is more than .....cause noise pollution.
- 70 dB
  - 80 dB
  - 120 dB
  - 180 dB
- 19** Which of the following problem(s) is/are created by a brief exposure to extremely high sound level, 150 dB or more generated by take off of a jet plane or rocket?
- Deafness
  - Damage eardrums
  - Both (a) and (b)
  - None of the above
- 20** Given below are the set of health problems.
- Lack of sleep
  - High blood pressure
  - Stress
  - Complete or partial hearing
  - Anxiety
- Which of the health problems given above are caused by noise pollution?
- I, II and III
  - II, III and IV
  - II, III, IV and V
  - I, II, III, IV and V
- 21** Steps taken by the Government of India to control air pollution includes
- compulsory mixing of 20% ethyl alcohol with petrol and 20% biodiesel with diesel
  - compulsory PUC (Pollution Under Control) certification of petrol driven vehicles, which tests for carbon monoxide and hydrocarbons
  - permission to use only pure diesel with a maximum of 500 ppm sulphur as fuel for vehicles
  - use of non-polluting Compressed Natural Gas (CNG) only as fuel by all buses
- 22** Euro III norms were stipulated to control
- carbon content
  - sulphur content
  - nitrogen content
  - phosphorus content
- 23** The air prevention and control of pollution act came into force in
- 1985
  - 1990
  - 1975
  - 1981
- 24** Water pollution due to faecal matter is indicated by
- Escherichia coli*
  - Rhizobium*
  - Bacillus*
  - Streptococcus*
- 25** The below chart shows the sources of water pollution.



Read the chart carefully and identify A, B, C and D.

- A–Domestic sewage, B–Thermal (hot) waste water, C–Organic compound, D–Inorganic compounds
  - A–Chemical sewage, B–Industrial waste water, C–Inorganic compound, D–Organic compounds
  - A–Industrial sewage, B–Domestic waste water, C–Phenol group, D–Heavy metallic group
  - A–Sewage, B–Chemical industry waste water, C–Organic compounds, D–Inorganic compounds
- 26** The amount of biodegradable organic matter in sewage water can be estimated by measuring
- biological oxygen demand
  - biochemical oxygen demand
  - the growth of microorganism in water
  - the growth of bacteria in water
- 27** Water having Dissolved Oxygen (DO) below ..... is considered polluted.
- 8 mg/L
  - 80 mg/L
  - 70 mg/L
  - 95 mg/L
- 28** Biochemical Oxygen Demand (BOD) may not be a good index for pollution in water bodies receiving effluents from
- domestic sewage
  - dairy industry
  - petroleum industry
  - sugar industry
- 29** Given below is a flow chart showing the effect of sewage discharge on some important characteristics of a river. Read carefully and identify A, B, C and D.



- A–BOD, B–Dissolved oxygen, C–Concentration, D–Direction of flow
- A–Dissolved oxygen, B–BOD, C–Direction of flow, D–Concentration
- A–Dissolved oxygen, B–BOD, C–Concentration, D–Direction of flow
- A–BOD, B–Dissolved oxygen, C–Direction of flow, D–Concentration

40 High value of BOD (Biochemical Oxygen Demand) indicates that **CBSE-AIPMT 2015**

- (a) water is pure
- (b) water is highly polluted
- (c) water is less polluted
- (d) consumption of organic matter in the water is higher by the microbes

31 A river with an inflow of domestic sewage rich in organic waste may result in **NEET 2016**

- (a) increased population of aquatic food web organisms
- (b) an increased production of fish due to biodegradable nutrients
- (c) death of fish due to lack of oxygen
- (d) drying of the river very soon due to algal bloom

52 Arrange the following options in ascending order of their BOD value.

I Sample of highly polluted pond water.

II Sample from unpolluted pond water.

III Distilled water.

- (a) III, I and II
- (b) II, III and I
- (c) III, II and I
- (d) I, III and II

53 Which of the following options is/are incorrect about algal bloom?

- (a) Formed by blue-green algae
- (b) Causes deterioration of water quality and fish mortality
- (c) Causes depletion of O<sub>2</sub> in water
- (d) Growth of *Eichhornia* causes discolouration of water

34 The term 'Terror of Bengal' is used for

- (a) *Eichhornia crassipes*
- (b) decreased biological oxygen demand
- (c) biomagnification
- (d) algal bloom

35 Hyacinth is termed as the terror of Bengal, how it causes death of fishes?

- (a) Covers the surface of the water that inhibits sunlight to pass through
- (b) Drains oxygen from the water that causes oxygen deficiency
- (c) Absorbs nutrients from the water that causes malnutrition
- (d) Releases carbon dioxide in a huge amount which is lethal to fishes

36 Increase in concentration of the toxicant at successive trophic levels is known as

**CBSE-AIPMT 2015, AIIMS 2018**

- (a) biomagnification
- (b) biodeterioration
- (c) biotransformation
- (d) biogeochemical cycling

37 DDT residues are rapidly passed through food chain causing biomagnification because DDT is

- (a) liposoluble
- (b) moderately toxic
- (c) non-toxic to aquatic animals
- (d) water soluble

38 If a pond food chain gets polluted by DDT, the tissue concentration of DDT would be the highest in

- (a) aquatic weed
- (b) herbivorous fish
- (c) carnivorous fish
- (d) None of these

39 The highest DDT concentration in aquatic food chain shall occur in **NEET 2016**

- (a) phytoplankton
- (b) seagull
- (c) crab
- (d) eel

40 In an area where DDT had been used extensively, the population of birds declined significantly because

- (a) birds stopped laying eggs **CBSE-AIPMT 2012**
- (b) earthworms in the area got eradicated

- (c) cobras were feeding exclusively on birds
- (d) many of the birds laid eggs that did not hatch

41 Eutrophication is caused due to

**JIPMER 2019**

- (a) accumulation of minerals
- (b) effect of UV - C
- (c) accumulation of metals
- (d) accumulation of zooplankton

42 Which of the following options pertain to eutrophication?

- (a) Occurs due to addition of artificial or natural nutrients
- (b) Results in algal bloom
- (c) More precisely called hypertrophication
- (d) All of the above

43 Advantage(s) of thermal waste water can be the

- (a) elimination of organisms sensitive to high temperature
- (b) enhancement in the growth of plants and fishes in extremely cold areas
- (c) Both (a) and (c)
- (d) None of the above

44 Choose the incorrect pair.

- (a) Eutrophication – Natural ageing of lake
- (b) Phosphorus – Decreases the growth of aquatic organisms
- (c) *Eichhornia crassipes* – Grow abundantly in eutrophic water bodies
- (d) Nitrates – Overstimulate the growth of algae

45 Cleaning of waste water in Arcata Marsh involves

- (a) only conventional method of sewage treatment
- (b) removal of dissolved heavy metals through biological process
- (c) filtration, chlorination like chemical processes
- (d) enhance the need for chemical fertilisers

46 Ecological sanitation is a sustainable system for handling human excreta, using dry composting toilets. Such 'EcoSan' toilets are working in

- (a) Assam and West Bengal
- (b) Andhra Pradesh and Maharashtra
- (c) Kerala and Sri Lanka
- (d) Karnataka and Andhra Pradesh

47 Sanitary landfills were adopted as the substitute for open-burning dumps, but it is not really much of a solution to manage solid waste in metro cities. Why?

- (a) The sites are getting filled due to increased garbage generation
- (b) There is a danger of seepage of chemicals, polluting the underground water
- (c) Both (a) and (b)
- (d) None of the above

48 E-waste are buried in ...A... or ...B... .

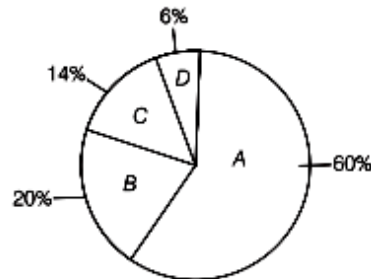
Complete the given statement by choosing appropriate option for A and B.

- (a) A–land fills, B–incinerated
- (b) A–open area, B–recycle
- (c) A–dumping zone, B–recycle
- (d) A–open area, B–incinerated

- 49 Which of the following is an innovative remedy for plastic waste? **NEET (Odisha) 2019**
- Burning in the absence of oxygen
  - Burying 500 m deep below soil surface
  - Polyblend
  - Electrostatic precipitator
- 50 Polyblend, a fine powder of recycled modified plastic, has proved to be a good material for **NEET 2019**
- use as a fertiliser
  - construction of roads
  - making tubes and pipes
  - making plastic sacks
- 51 A feature of integrated organic farming is that
- in this process, waste products from one process are recycled and used as nutrients for other processes
  - industrial wastes are utilised for manufacturing products like polyblend
  - chemical fertilisers are used to increase yield
  - Both (a) and (c)
- 52 High level radioactive waste can be managed in which of the following ways?
- Open dumping
  - Composting
  - Incineration
  - Dumping in sealed containers
- 53 Which of these following methods is the most suitable for disposal of nuclear waste? **NEET 2019**
- Bury the waste under Antarctic ice-cover
  - Dump the waste within rocks under deep ocean
  - Bury the waste within rocks deep below the earth's surface
  - Shoot the waste into space
- 54 What steps should be taken for the disposal of nuclear waste?
- Nuclear waste should be pre-treated
  - It should be stored in shielded containers
  - It should be buried about 500 m deep with in rock
  - All of the above
- 55 Why do you think burying radioactive waste deep is not agreeable to many people?
- Because it takes several decades to decay
  - Because it still have radioactive properties and can pose threat
  - Both (a) and (b)
  - None of the above
- 56 A naturally occurring phenomenon that is responsible for heating of earth's surface and atmosphere due to the presence of certain gases in the atmosphere is
- greenhouse effect
  - solar effect
  - ozone layer effect
  - None of the above
- 57 Which of the following pairs of gases is mainly responsible for greenhouse effect? **NEET 2019**
- Oxygen and nitrogen
  - Nitrogen and sulphur dioxide
  - Carbon dioxide and methane
  - Ozone and ammonia
- 58 What is the result of greenhouse effect?
- Melting of polar ice-caps
  - CO<sub>2</sub> fertilisation effect
  - Rising of sea level and global warming
  - All of the above

- 59 Carbon dioxide is called greenhouse gas because it is
- used in greenhouse to increase plant growth
  - transparent to heat but traps sunlight
  - transparent to sunlight but traps heat
  - transparent to both sunlight and heat

- 60 Study carefully the following pie diagram representing the relative contribution of various greenhouse gases to total global warming. Identify the gases A, B, C and D.



- A – N<sub>2</sub>O, B – CFCs, C – CO<sub>2</sub>, D – Methane
  - A – CO<sub>2</sub>, B – Methane, C – CFCs, D – N<sub>2</sub>O
  - A – CFCs, B – CO<sub>2</sub>, C – Methane, D – N<sub>2</sub>O
  - A – Methane; B – N<sub>2</sub>O, C – CFCs, D – CO<sub>2</sub>
- 61 Rise in temperature leads to deleterious changes in environment resulting in odd climatic changes called
- global warming
  - El Nino effect
  - La Nino effect
  - greenhouse effect
- 62 Global warming can be controlled by **NEET 2013**
- reducing deforestation, cutting down use of fossil fuel
  - reducing reforestation, increasing the use of fossil fuel
  - increasing deforestation, slowing down the growth of human population
  - increasing deforestation, reducing efficiency of energy usage
- 63 The zone of atmosphere in which ozone layer is present is called **CBSE-AIPMT 2014**
- ionosphere
  - mesosphere
  - stratosphere
  - troposphere
- 64 The thickness of ozone in a column of air from the ground to the top of the atmosphere is measured in terms of
- Decibel units
  - Pascal units
  - Svedberg units
  - Dobson units
- 65 Ozone gas is continuously formed by the action of ...A... on ...B... in the ...C....
- Fill in the blanks by selecting appropriate option.
- A – UV-A, B – oxygen, C – troposphere
  - A – Cl<sup>-</sup>, B – molecular oxygen, C – stratosphere
  - A – CFCs, B – UV-B rays, C – troposphere
  - A – UV rays, B – molecular oxygen, C – stratosphere
- 66 A balance should exist between production and degradation of ozone. By which factor this balance is being disrupted and causes reduction of ozone content of atmosphere? Choose the correct option.
- Greenhouse gases
  - Chlorofluorocarbons
  - Nitrous oxide
  - Aromatic compounds
- 67 In stratosphere, which one of the following elements acts as a catalyst in degradation of ozone and release of molecular oxygen? **NEET 2018**



(a) Fe (b) Cl (c) Carbon (d) Oxygen

**68** Fill up the blanks.

I ...A... used as refrigerants which reacts with UV in ...B... to release ...C... atoms.

II Chlorine atoms act as ...D... to degrade ozone and release molecular ...E....

III Bad ozone is formed in ...F... and is harmful to plant and animals.

IV Good ozone is formed in ...G... and absorbs harmful ...H... from the sun.

Complete the given set of statements by filling appropriate options in the blanks A-H.

(a) A-NO<sub>2</sub>, B-Troposphere, C-Fluoride, D-Catalyst, E-CO<sub>2</sub>, F-Stratosphere, G-Atmosphere, H-Infrared radiation

(b) A-CFCs, B-Stratosphere, C-Chlorine, D-Catalyst, E-Oxygen, F-Troposphere, G-Stratosphere, H-UV radiations

(c) A-CO<sub>2</sub>, B-Ionosphere, C-Calcium, D-Catalyst, E-Chlorine, F-Ionosphere, G-Troposphere, H-Infrared radiation

(d) A-CH<sub>4</sub>, B-Stratosphere, C-Sodium, D-Catalyst, E-Oxygen, F-Atmosphere, G-Ionosphere, H-UV radiation

**69** Identify the incorrect match.

(a) UV-B — Damages DNA and causes mutation

(b) UV-A — Passes through the ozone and reaches the earth's surface

(c) Ozone hole — A large area of thinned ozone layer

(d) None of the above

**70** Which of the following is not one of prime health risks associated with greater UV-radiation through the atmosphere due to depletion of stratospheric zone?

(a) Increased skin cancer **CBSE-AIPMT 2015**

(b) Reduced immune system

(c) Damage to eyes

(d) Increased liver cancer

**71** Which of the following protocols did aim for reducing emission of chlorofluorocarbons into the atmosphere? **NEET 2019**

(a) Kyoto protocol (b) Gothenburg protocol

(c) Geneva protocol (d) Montreal protocol

**72** World Ozone Day is celebrated on **NEET 2018**

(a) 16th September (b) 21st April

(c) 5th June (d) 22nd April

**73** The fertile top soil is removed by human activities like

(a) over-cultivation

(b) unrestricted grazing

(c) deforestation and poor irrigation practices

(d) All of the above

**74** Desertification has become a major problem due to

(a) decreased natural resources (b) increased urbanisation

(c) increased population (d) All of these

**75** One of the main reasons of soil erosion in India is

(a) farming (b) deforestation

(c) drought conditions (d) temperature

**76** If an agricultural field is liberally irrigated for a prolonged period of time, it is likely to face problem of

(a) metal toxicity **NEET (Odisha) 2019**

(b) alkalinity

(c) acidity

(d) salinity

**77** Fill up the blanks.

I ...A...in soil results from irrigation without proper drainage of water. This affects the plants and draws salts to the soil surface. The salt is either deposited as a layer on land surface or collects at ...B... of plants.

II A water logged soil has poor ...C....

III Removal of forest areas to fulfil the need of growing human population is called ...D....

IV ...E... of India has recommended 33% forest cover for the plains and 67% for the hills.

Here A-E refers to

(a) A—Soil erosion, B—stems, C—structure, D—reforestation, E—The National Forest Policy (1987)

(b) A—Water logging, B—roots, C—aeration, D—deforestation, E—The National Forest Policy (1988)

(c) A—Soil succession, B—leaves, C—nutrients, D—afforestation, E—The National Forest Policy (1989)

(d) A—Desertification, B—fruits, C—minerals, D—deforestation, E—The National Forest Policy (1986)

**78** Slash and burn agriculture in North-Eastern states of India is also called

(a) ley farming (b) commercial agriculture

(c) Jhum cultivation (d) All of these

**79** Jhum cultivation refers to

(a) cultivation of neem tress

(b) cultivation of medicinal plants

(c) tribal method of shifting cultivation

(d) cultivation of timber plants

**80** Read the following statements and select the correct option for filling the blanks.

I ..... occurs due to improper drainage of water.

II Cultivation practice that leads to deforestation particularly in North- Eastern region is .....

III The management of forests for the benefit of entire ecosystem is .....

(a) Water-logging, Jhum cultivation, Silviculture

(b) Soil erosion, Slash and burn culture, Joint forest movement

(c) Water-logging, Silviculture, Slash and burn culture

(d) Eutrophication, Silviculture, Jhum cultivation

**81** Identify the incorrect effect of deforestation.

(a) Soil erosion

(b) Altering the weather pattern by decreasing rainfall

(c) Accelerated nutrient recycling

(d) Destruction of natural habitats of wildlife

**82** Restoring a forest cover over an area where one existed earlier, but was removed at some point of time in the past is called

(a) reforestation

(b) afforestation

(c) deforestation

(d) None of these

**83** Indian government recently instituted 'Amrita Devi Bishnoi Award'. This is awarded to individuals and communities from rural areas involved in

(a) wildlife protection and conservation

(b) forest mangement

(c) environment protection

(d) tree plantation

**84** Joint Forest Management concept was introduced in India during **NEET 2016**

(a) 1970s (b) 1980s

(c) 1990s (d) 1960s

- 85** The concept of Joint Forest Management (JFM) involves
- work in close association with the local communities for protecting and managing forests on mutual benefits
  - conservation of forest and agricultural land by the NGOs
  - conservation of forest and agricultural land by the state government
  - conservation of forest and agricultural land by the local communities only

- 86** Increased soil fertility, decreased soil erosion and desertification, restore biodiversity, etc. All these can be achieved by
- joint forest management
  - reforestation
  - silviculture
  - All of the above

### SPECIAL FORMAT QUESTIONS

- Which of the statements given about pollution is incorrect?
  - Pollution is an undesirable change in physical, chemical or biological characteristics of air, land water or soil
  - The Air prevention and control of pollution act was amended in 1987 to include noise as an air pollutant
  - In order to control environmental pollution, the Government of India has passed the Environment Protection Act, 1976 to protect and improve the quality of our environment
  - All of the above
- Which of the statements regarding the sources of air pollution is correct?
  - Smoke from forest fires, volcanic eruptions do not cause air pollution
  - Decomposition of garbage does not result in the release of unwanted gases into the atmosphere
  - Burning of fossil fuels in automobiles and industries releases particulate and noise pollutants
  - Use of leaded petrol in automobiles emit various pollutants
- Which of the statements given about Electrostatic Precipitator (ESP) is/are correct?
  - is an electrical device to remove particulate matter present in the exhaust of thermal power plant
  - Over than 99% particulate matter can be removed by this method
  - ESP has electrode wires and a stage of collecting plates
  - All of the above
- Which one of the following is an incorrect statement?
  - Agents that bring about an undesirable change in characteristics of air, land, water or soil are called as pollutants
  - Automobiles are major cause of atmospheric pollution
  - Lead free petrol and diesel can reduce the atmospheric pollution *via* automobiles
  - Environment Protection Act (air, water and soil) was implemented in 1988
- Which of the statements given are correct about scrubber?
  - It is used to remove gases like nitrogen dioxide from industrial exhaust
  - In a scrubber, the exhaust is passed through a spray of water or lime
  - Water dissolves gases and lime reacts with nitrogen dioxide to form a precipitate of calcium nitrate and nitrite
  - All of the above

- Which one of the statement(s) given is/are correct about catalytic converters?
  - These are fit into automobiles for reducing emission of poisonous gases like NO<sub>2</sub> and CO
  - They have in expensive metals like lead, mercury and rhodium as catalysts
  - As the exhaust emission passes through catalytic converter, nitric oxide is changed to nitrogen gas, carbon monoxide is oxidised to carbon dioxide and unburnt hydrocarbons get completely burnt into O<sub>2</sub> and CO<sub>2</sub>
  - Motor vehicles fit with catalytic converter should use leaded petrol because lead in the petrol activates the catalyst
- Which one of the following statement (s) is/are correct?
  - CNG burns most efficiently without leaving any unburnt remnant behind
  - CNG is cheaper than petrol or diesel
  - CNG cannot be siphoned off by thieves and adulterated like petrol or diesel
  - All of the above
- Which one of the following statement(s) is/are incorrect?
  - Noise causes psychological disorder in humans
  - Noise causes physiological disorder in humans
  - Noise measurable unit is dB, but some times it is measured in Dobson unit
  - Sound level of 150 dB may damage eardrums
- Which statement is true about the Euro III norms?
  - It stipulates to control sulphur at 350 ppm in diesel and 150 ppm in petrol
  - It stipulates to reduce sulphur level to 20 ppm in petrol and diesel
  - It stipulates to reduce sulphur level to 200 ppm in diesel and petrol
  - It stipulates to reduce sulphur level to 200 ppm in diesel and 100 ppm in petrol
- Which of the following statement(s) is/are not correct regarding biomagnification?
  - Heavy metals and persistent pesticides pass into food chain and increases in amount per unit weight of organisms with the rise in trophic level due to their accumulation in fat
  - Accumulation of zinc can cause thinning of eggshell in birds
  - DDT accumulation is a major cause of killing of fish-eating birds
  - Biomagnification occurs in all aquatic food chain

11. Which of the statement(s) given about eutrophication is/are correct?
- Eutrophication is the unnatural ageing of a water body by nutrient enrichment
  - The accelerated ageing of lakes due to sewage and agricultural and industrial wastes is called cultural or accelerated eutrophication
  - The plant nutrients responsible for eutrophication are nitrates and sulphates
  - Phosphates and nitrates accelerate the growth of algae which reduce oxygen utilisation and may oxygenate the water, enough to allow the fishes and other aquatic animals to thrive
12. Which of the following statements is not valid for aerosols?
- They are harmful to human health
  - They alter rainfall and monsoon patterns
  - They cause increased agricultural productivity
  - They have negative impact on agricultural land
13. Identify the correct statement from below.
- A mere 0.1% impurities make domestic sewage unfit for human use
  - BOD of clean water is < 5 ppm and highly polluted water is 17 ppm
  - Both (a) and (b)
  - None of the above
14. Study the following statements regarding EcoSan toilets and select the incorrect ones.
- They are working in Sri Lanka and Kerala
  - Composting method for recycling of human excreta
  - Recycled materials forms natural fertilisers
  - Enhance the need for chemical fertilisers
15. Which of the following statements defines Integrated Organic Farming appropriately?
- It is cyclical and zero-waste procedure
  - Allows maximum utilisation of resources
  - Increases the efficiency of production
  - All of the above
16. Choose the correct statement for agrochemicals.
- Toxic to non-target organisms
  - Toxic to important components of soil ecosystem
  - Their usage enhance crop production
  - All of the above
17. Which statement correctly represents the harmful effects of depletion of earth's ozone layer?
- The average temperature of earth's surface will increase gradually
  - The oxygen content of the atmosphere will decrease
  - Increased amount of ultraviolet radiation will reach earth's surface
  - Sea levels will rise as the polar ice caps will gradually melt
18. Which one of the following is an incorrect statement?
- Most of the forests have been lost in tropical areas
  - Ozone in upper part of atmosphere is harmful to animals
  - Greenhouse effect is a natural phenomenon
  - Eutrophication is a natural phenomenon in freshwater bodies
19. Which of the following statements about ozone is correct?
- Tropospheric ozone protects us from UV- radiations
  - Stratospheric ozone is 'bad'
  - Tropospheric ozone is 'good'
  - Stratospheric ozone protects us from UV- radiations
20. Consider the following statements.
- Algal blooms are formed by free-floating algae.
  - Algal bloom causes fish mortality and deterioration of water quality.
  - Some bloom-forming algae are extremely toxic to human beings and animals.
- Which of the statements given above are correct?
- I and II
  - I and III
  - II and III
  - I, II and III
21. Consider the following statements about polyblend.
- In 1989, Ahmed Khan developed bitumen, a fine powder of recycled modified plastic.
  - Polyblend has been mixed with bitumen to lay roads in Bengaluru.
  - Polyblend and bitumen, when used to lay roads, enhanced bitumen's water repellent properties and helped to increase the life of road.
- Which of the statements given above are correct?
- I and II
  - I and III
  - II and III
  - I, II and III
22. Which of the given statements pertain correctly to solid wastes?
- Classification of waste into the categories like biodegradable, recyclable and non-biodegradable.
  - Reusable products can be recycled.
  - Dispose biodegradable waste into the pits in ground.
  - Reduce production of non-biodegradable waste as these are difficult to dispose.
  - Incineration is not advised.
- I and II
  - I, II, III and IV
  - I, II and III
  - I, II, III, IV and V
23. Consider the following statements about harmful effects of radioactive pollution.
- Radiations from nuclear wastes causes mutation at a very high rate.
  - At high doses, nuclear radiations are lethal.
  - At low doses, radiations cause various disorders like cancer.
- Which of the statements given above are correct?
- I and II
  - I and III
  - II and III
  - I, II and III
24. Which of the following statements are correct with regard to contribution of various factors to greenhouse effect?
- Relative contribution of various gases like  $\text{CO}_2$ ,  $\text{CH}_4$ , CFCs,  $\text{N}_2\text{O}$ , etc.
  - Biological magnification and eutrophication.
  - Deforestation to incorporate Urban needs.
  - Various activities like burning of fossil fuels.
  - Odd climatic changes such as El-Nino effect.
  - Use of refrigerants like chlorofluorocarbons.
- II, IV, V and VI
  - I, III and IV
  - IV, V and VI
  - II, III and I

25. Read the following statements carefully and select the correct option.

- I. UV-rays are essential for the production as well as degradation of ozone gas.
- II. Ozone present in ionosphere acts as a shield absorbing UV-radiations coming from the sun.
- III. One fourth of the incoming solar radiation is reflected by the atmospheric gases and clouds and only half of the incoming solar radiation falls on the earth's surface, heating it. Of this only a small proportion is reflected back.

- (a) I and II                      (b) I and III  
(c) II and III                    (d) I, II and III

26. Which of the following statements are correctly showing the harmful effects of global warming?

- I. The temperature of the earth has increased by  $0.6^{\circ}\text{C}$  in last three decades, which will lead to the change in precipitation patterns.
- II. This rise in temperature will lead to the increased melting of polar ice caps which will cause the rise in sea level and many coastal areas will be submerged.
- III. Increased temperature will lead to the decreased weed growth, eruption of diseases and pests. Thus, crop productivity will increase.

- (a) I and II                      (b) I and III  
(c) II and III                    (d) I, II and III

27. Which of the following statements correctly describe the consequence of deforestation?

- I. An increase in  $\text{O}_2$  concentration in atmosphere.
- II. Loss of biodiversity due to habitat destruction.
- III. Desertification, which leads to the formation of large barren patches of land.
- IV. Disturbed hydrological cycle.

- (a) I, II and III                (b) II, III and IV  
(c) I, III and IV                (d) I, II, III and IV

28. Which of the following statement(s) represents the advantages of ecological sanitation?

- I. It is a practical, hygienic and efficient method of waste disposal.
- II. It is cost effective method.
- III. Human excreta cannot be recycled into natural fertilisers to replace chemical fertilisers.

- (a) I and II                      (b) I and III  
(c) II and III                    (d) I, II and III

29. Jhum cultivation.

- I. Also called as slash and burn agriculture, is the farming practice in North-Eastern states of India.
- II. Farmers cut down the trees of forest and burn the plant remains.
- III. The ash is used as a fertiliser and the land is then used for farming or cattle grazing.
- IV. After cultivation, the land is left for several years, so as to allow its recovery.

Which of the statements given above are correct about Jhum cultivation?

- (a) I, II and III  
(b) II, III and IV  
(c) I, III and IV  
(d) I, II, III and IV

30. Consider the following statements.

- I. Reforestation is the process of restoring a forest that once existed but was removed at some point of time in the past.
- II. Reforestation may occur naturally in a deforested area.
- III. A tree plantation movement or Van Mahotsava is being carried out in India since 1982.

Which of the statements given above are correct?

- (a) I and III                      (b) I and II  
(c) II and III                    (d) I, II and III

31. Consider the following statements.

- I. Soil with a vegetation cover is easily eroded by both wind and water.
  - II. Excessive irrigation results in water logging of soil.
  - III. Increased salt concentration damages agriculture.
- Which of the statements given above are correct?

- (a) I and II                      (b) I and III  
(c) II and III                    (d) I, II and III

32. Which of the statements given about desertification are correct?

- I. Conversion of former moist and fertile land into arid desert area.
- II. It is a product of soil erosion.
- III. Desertified area can be put to any use.

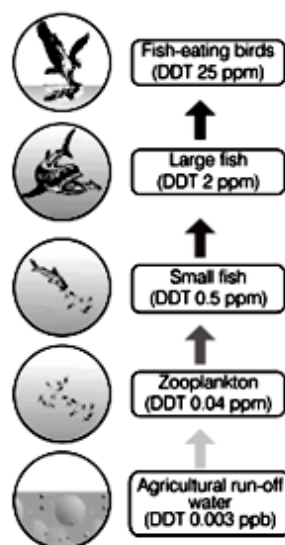
- (a) I and II                      (b) I and III  
(c) II and III                    (d) I, II and III

33. Which of the statements given are correct about Chipko movement?

- I. It was initially meant for protecting crops but now meant for preservation of environment including habitat and wildlife.
- II. Chipko movement was started in Garhwal, Himalayas in 1974 by Shri Sundar Lal Bahuguna to prevent cutting down of trees.
- III. Local women hugged trees to prevent them from being cut down by contractors.

- (a) I and II  
(b) I and III  
(c) II and III  
(d) I, II and III

34. Choose the correct statement regarding the process of biomagnification of DDT in an aquatic food chain as described by the figure given below.

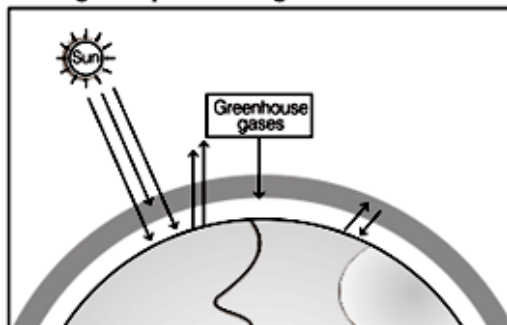


- I. Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
- II. High concentrations of DDT disturb calcium metabolism in birds, which cause thinning of eggshell and their premature breaking.
- III. River water may have a very low concentration of DDT, but the carnivorous fish in that river may contain high concentration of DDT, which is still suitable for consumption by human beings.

Which of the statements given above are correct?

- (a) I and II
- (b) I and III
- (c) II and III
- (d) I, II and III

35. Given diagram represents the greenhouse effect.



- I. Greenhouse gases are very small and are not removed by electrostatic precipitators.
  - II. Smokestacks of thermal power plants, smelters and other industries release particulate and gaseous air pollutants together with harmless gases like  $N_2$ ,  $O_2$ , etc.
  - III. In the 1990s, Delhi ranked first among the 41 most polluted cities of the world.
  - IV. Air pollution problems in Delhi became so serious that a Public Interest Litigation (PIL) was filed in the Supreme Court of India.
- Which of the above statements are correct?
- (a) I and IV
  - (b) I, II and III
  - (c) II and III
  - (d) I, II, III and IV

36. Go through the following statements.

- I. The dangers of particulate matter which are very small are not removed by electrostatic precipitators.
- II. Smokestacks of thermal power plants, smelters and other industries release particulate and gaseous air pollutants together with harmless gases like  $N_2$ ,  $O_2$ , etc.
- III. In the 1990s, Delhi ranked first among the 41 most polluted cities of the world.
- IV. Air pollution problems in Delhi became so serious that a Public Interest Litigation (PIL) was filed in the Supreme Court of India.

Which of the above statements are correct.

- (a) I, II and IV
- (b) I, II and III
- (c) II and III
- (d) I, II, III and IV

37. Which one of the following statement(s) is/are incorrect?

- I. Without greenhouse effect, the average temperature at surface of earth would have been a chilly  $-18^\circ\text{C}$  rather than the present average of  $15^\circ\text{C}$ .
- II. Ramesh Chandra Dagar, a farmer of Sonipat (Haryana) has created the Haryana kisan welfare club, with a current membership of 5000 farmers.
- III. Over half of the e-wastes generated in the developed world are exported to developing countries mainly to China, India and Pakistan.

IV. The use of incinerators is crucial to disposal of hospital waste, which includes disinfectants, harmful chemicals, pathogenic microbes, etc.

- (a) I and II
- (b) I, II and III
- (c) I, II, III and IV
- (d) None of these

38. Read the following statements given here below and select the right answer.

I. Solid wastes refer to everything that goes out in trash.

II. A citizen group called Friends of the Arcata Marsh (FOAM) are responsible for the upkeep and safeguarding of the integrated waste water treatment project.

III. Municipal solid wastes are wastes from homes, offices, schools, hospitals, etc., that are collected and disposed by the municipality.

IV. According to an estimate, a substantial rise in  $CO_2$  and  $SO_2$  level has been found in Delhi between 1997 and 2005.

- (a) I, II, III and IV
- (b) I, II and III
- (c) II, III and IV
- (d) I, II and IV

39. Match the following columns.

Column I (Pollutants)	Column II (Examples)
A. Particulate pollutants	1. Hydrogen sulphide
B. Gaseous pollutants	2. Metallic particles
C. Primary pollutants	3. $O_3$
D. Secondary pollutants	4. DDT

Codes

	A	B	C	D	A	B	C	D
(a)	2	1	4	3	4	3	2	1
(c)	3	2	4	1	2	3	1	4

40. Match the following columns.

Column I	Column II
A. Bhopal Gas Tragedy	1. Ramesh Chandra Dagar
B. Integrated organic farming	2. Reduction in emission of greenhouse gases (2005)
C. National forest policy	3. December 23, 1984
D. World Environment Day	4. 1988
E. Kyoto protocol	5. 5th June

Codes

	A	B	C	D	E
(a)	1	2	3	4	5
(b)	2	3	4	1	5
(c)	3	1	4	5	2
(d)	5	1	2	3	4

41. Match the following columns.

Column I	Column II
A. Suspended solids	1. Nitrates, ammonia, phosphate, sodium and calcium
B. Colloidal materials	2. Faecal matter, bacteria, paper and cloth fibres
C. Dissolved materials	3. Sand, silt and clay

Codes

A	B	C	A	B	C
(a) 1	2	3	(b) 2	3	1
(c) 3	1	2	(d) 3	2	1

42. Match the following columns.

Column I (Food chain)	Column II (Biomagnifications of DDT)
A. Fish eating birds	1. 2 ppm
B. Large fish	2. 0.5 ppm
C. Small fish	3. 0.04 ppm
D. Zooplankton	4. 25 ppm

Codes

A	B	C	D	A	B	C	D
(a) 3	2	4	1	(b) 4	1	2	3
(c) 2	3	4	1	(d) 3	4	1	2

43. Match the following columns.

Column I (Air pollution control measures)	Column II (Used for)
A. Catalytic converter	1. Particulate matter
B. Electrostatic precipitator	2. Carbon monoxide and nitrogen oxides
C. Scrubber	3. Sulphur dioxide

Codes

A	B	C	A	B	C
(a) 1	2	3	(b) 2	1	3
(c) 1	3	2	(d) 3	2	1

44. Match the following columns.

Column I	Column II
A. Polyblend	1. Mercury
B. EcoSan	2. Bitumen
C. Biomagnification	3. Kerala

Codes

A	B	C	A	B	C
(a) 1	2	3	(b) 2	3	1
(c) 3	2	1	(d) 2	1	3

45. Match the following columns.

Column I (Greenhouse gases)	Column II (Relative contributions)
A. CO <sub>2</sub>	1. 14%
B. CH <sub>4</sub>	2. 6%
C. N <sub>2</sub> O	3. 60%
D. CFC + HFC	4. 20%

Codes

A	B	C	D	A	B	C	D
(a) 3	4	2	1	(b) 4	3	2	1
(c) 2	3	4	1	(d) 1	4	2	3

46. Match the following columns.

Column I (Acts to reduce deforestation)	Column II (Years)
A. Bishnoi Community	1. 1988
B. Chipko Movement	2. 1980
C. Joint Forest Management	3. 1974
D. The National Forest Policy	4. 1731

Codes

A	B	C	D	A	B	C	D
(a) 1	4	3	2	(b) 4	3	2	1
(c) 3	2	1	4	(d) 4	1	2	3

47. Match the following columns.

Column I	Column II
A. Catalytic converter	1. Thermal power plant
B. Electrostatic precipitator	2. Platinum, palladium and rhodium
C. Ear muffs	3. High noise level
D. Landfills	4. Solid wastes

Codes

A	B	C	D	A	B	C	D
(a) 1	4	3	2	(b) 4	3	2	1
(c) 3	2	1	4	(d) 2	1	3	4

48. Match the following columns.

Column I	Column II
A. Eutrophication	1. UV-B radiation
B. Sanitary landfill	2. Deforestation
C. Snow blindness	3. Nutrient enrichment
D. Jhum cultivation	4. Waste disposal

Codes

A	B	C	D	A	B	C	D
(a) 3	4	1	2	(b) 1	3	4	2
(c) 2	1	3	4	(d) 1	2	4	3

## NCERT EXEMPLAR PROBLEMS

1. Non-biodegradable pollutants are created by:
  - a. nature
  - b. excessive use of resources
  - c. humans
  - d. natural disasters
  
2. According to the Central Pollution Control Board, the diameter of particles that are responsible for causing great harm to human health is:
  - a. 2.5 micrometer
  - b. 5.0 micrometer
  - c. 10.0 micrometer
  - d. 7.5 micrometer
  
3. The material generally used for sound proofing of rooms like a recording studio and auditorium is:
  - a. cotton
  - b. coir
  - c. wood
  - d. styrofoam
  
4. Compressed Natural Gas (CNG) is:
  - a. propane
  - b. methane
  - c. ethane
  - d. butane
  
5. World's most problematic aquatic weed is:
  - a. *Azolla*
  - b. *Wolffia*
  - c. *Eichhornia*
  - d. *Trapa*
  
6. Which of the following exhibits biomagnification?
  - a. SO<sub>2</sub>
  - b. Mercury
  - c. DDT
  - d. Both b & c
  
7. The expanded form of DDT is:
  - a. dichloro diphenyl trichloroethane
  - b. dichloro diethyl trichloroethane
  - c. dichloro dipyrydyl trichloroethane
  - d. dichloro diphenyl tetrachloroacetate
  
8. Which of the following material takes the longest time for biodegradation?
  - a. Cotton
  - b. Paper
  - c. Bone
  - d. Jute

9. Choose the incorrect statement.
- The Montreal protocol is associated with the control of emission of ozone depleting substances
  - Methane and carbon dioxide are green house gases
  - Dobson units are used to measure oxygen content of air
  - Use of incinerators is crucial to disposal of hospital wastes
10. Among the following which one causes maximum indoor chemical pollution?
- burning coal
  - burning cooking gas
  - burning mosquito coil
  - room spray
11. The green scum seen in the fresh water bodies is:
- blue green algae
  - red algae
  - green algae
  - both (a) and (c)
12. The loudness of a sound that a person can withstand without discomfort is about
- 150 dB.
  - 215 dB.
  - 30 dB.
  - 80 dB.
13. The major source of noise pollution world wide is due to:
- office equipment
  - transport system
  - sugar, textile and paper industries
  - oil refineries and thermal power plants.
14. Match the following and choose the correct option
- | Column I   | Column II |
|--|-----------|
| A. Environment Protection Act                                | i. 1974   |
| B. Air Prevention & Control of Pollution Act                 | ii. 1987  |
| C. Water Act   | iii. 1986 |
| D. Amendment of Air Act to include noise as an air pollutant | iv. 1981  |
- The correct matches is;
- A-iii, B-iv, C-i, D-ii
  - A-i, B-iii, C-ii, D-iv
  - A-iv, B-i, C-ii, D-iii
  - A-iii, B-iv, C-ii, D-i
15. Catalytic converters are fitted into automobiles to reduce emission of harmful gases. Catalytic converters change unburnt hydrocarbons into:
- carbon dioxide and water
  - carbon monoxide
  - methane
  - carbon dioxide and methane



16. Why is it necessary to remove sulphur from petroleum products?
- To reduce the emission of sulphur dioxide in exhaust fumes
  - To increase efficiency of automobiles engines
  - To use sulphur removed from petroleum for commercial purposes
  - To increase the life span of engine silencers
17. Which one of the following impurities is easiest to remove from wastewater?
- Bacteria
  - Colloids
  - Dissolved solids
  - Suspended solids
18. Which one of the following diseases is not caused due to contamination of water?
- Hepatitis-B
  - Jaundice
  - Cholera
  - Typhoid

## NEET PREVIOUS QUESTIONS

1. Which of the following is a secondary pollutant?  
(a) CO (b) CO<sub>2</sub>  
(c) SO<sub>2</sub> (d) O<sub>3</sub> (NEET 2018)
2. A renewable exhaustible natural resource is  
(a) coal (b) petroleum  
(c) minerals (d) forest. (2010)
3. Which is the cause of damage to relative biological effectiveness?  
(a) High temperature (b) Pollution  
(c) Radiation (d) Low temperature  
(2000)
4. Which of the following is a secondary pollutant?  
(a) PAN (b) Aerosol  
(c) CO (d) CO<sub>2</sub> (1999)
5. Petroleum is a  
(a) synthetic product  
(b) renewable resource  
(c) nonrenewable resource  
(d) inconvenient resource. (1992)
5. Minerals and metals are  
(a) biodegradable resources  
(b) renewable  
(c) non-renewable  
(d) renewable and non-renewable resources. (1992)
7. Domestic waste constitutes  
(a) non-biodegradable pollution  
(b) biodegradable pollution  
(c) effluents  
(d) air pollution. (1991)
8. Which one of the following statements is not valid for aerosols?  
(a) They alter rainfall and monsoon patterns.  
(b) They cause increased agricultural productivity.  
(c) They have negative impact on agricultural land.  
(d) They are harmful to human health.  
(NEET 2017)
9. Acid rain is caused by increase in the atmospheric concentration of  
(a) CO<sub>2</sub> and CO (b) O<sub>3</sub> and dust  
(c) SO<sub>2</sub> and NO<sub>2</sub> (d) SO<sub>3</sub> and CO. (2015)
10. Which of the following are most suitable indicators of SO<sub>2</sub> pollution in the environment?  
(a) Algae (b) Fungi  
(c) Lichens (d) Conifers (2015)
11. A location with luxuriant growth of lichens on the trees indicates that the  
(a) trees are very healthy  
(b) trees are heavily infested  
(c) location is highly polluted  
(d) location is not polluted. (2014)
12. A scrubber in the exhaust of a chemical industrial plant removes  
(a) gases like sulphur dioxide  
(b) particulate matter of the size 5 micrometer or above  
(c) gases like ozone and methane  
(d) particulate matter of the size 2.5 micrometer or less. (2014)
13. The Air Prevention and Control of Pollution Act came into force in  
(a) 1985 (b) 1990  
(c) 1975 (d) 1981 (NEET 2013)
14. Which one of the following is not correct with regard to the harmful effects of particulate matter of the size 2.5 micrometer or less?  
(a) It can cause respiratory problems.  
(b) It can directly enter into our circulatory system.  
(c) It can cause inflammation and damage to the lungs.  
(d) It can be inhaled into the lungs.  
(Karnataka NEET 2013)
15. dB is a standard abbreviation used for the quantitative expression of  
(a) the density of bacteria in a medium  
(b) a particular pollutant  
(c) the dominant *Bacillus* in a culture  
(d) a certain pesticide. (2010)

16. Steps taken by the Government of India to control air pollution include  
 (a) compulsory PUC (Pollution under control) certification of petrol driven vehicles which tests for carbon monoxide and hydrocarbons  
 (b) permission to use only pure diesel with a maximum of 500 ppm sulphur as fuel for vehicles  
 (c) use of non-polluting compressed natural gas (CNG) only as fuel by all buses and trucks  
 (d) compulsory mixing of 20% ethyl alcohol with petrol and 20% biodiesel with diesel. (2009)
17. According to Central Pollution Control Board (CPCB), which particulate size in diameter (in micrometers) of the air pollutants is responsible for greatest harm to human health?  
 (a) 1.0 or less (b) 5.2 - 2.5  
 (c) 2.5 or less (d) 1.5 or less (2008)
18. In a coal fired power plant electrostatic precipitators are installed to control emission of  
 (a)  $\text{NO}_x$  (b) SPM  
 (c) CO (d)  $\text{SO}_2$ . (2007)
19. Photochemical smog pollution does not contain  
 (a) PAN (peroxyacyl nitrate)  
 (b) ozone  
 (c) nitrogen dioxide  
 (d) carbon dioxide. (2006)
20. Lead concentration in blood is considered alarming if it is  
 (a) 20 mg / 100 mL (b) 30 mg / 100 mL  
 (c) 4 - 6 mg / 100 mL (d) 10 mg / 100 mL. (2004)
21. Fluoride pollution mainly affects  
 (a) brain (b) heart  
 (c) teeth (d) kidney. (2003)
22. What is the intensity of sound in normal conversation?  
 (a) 10-20 dB (b) 30-60 dB  
 (c) 70-90 dB (d) 120-150 dB (2001)
23. Which of the following is pollution related disorder?  
 (a) Silicosis (b) Pneumoniosis  
 (c) Fluorosis (d) Leprosis (1999)
24. Which of the following is the use of lichens in case of pollution?  
 (a) They promote pollution.  
 (b) Lichens are not related with pollution.  
 (c) They treat the polluted water.  
 (d) They act as bioindicators of pollutions. (1999)
25. The supersonic jets cause pollution by the thinning of  
 (a)  $\text{O}_2$  layer (b)  $\text{O}_3$  layer  
 (c)  $\text{CO}_2$  layer (d)  $\text{SO}_2$  layer. (1998)
26. Carbon monoxide is a pollutant because  
 (a) reacts with haemoglobin  
 (b) makes nervous system inactive  
 (c) it reacts with  $\text{O}_2$  (d) it inhibits glycolysis. (1998)
27. How carbon monoxide, emitted by automobiles, prevents transport of oxygen in the body tissues?  
 (a) By forming a stable compound with haemoglobin  
 (b) By obstructing the reaction of oxygen with haemoglobin  
 (c) By changing oxygen into carbon dioxide  
 (d) By destroying the haemoglobin (1998)
28. The Taj Mahal is threatened due to the effect of  
 (a) oxygen (b) hydrogen  
 (c) chlorine (d) sulphur dioxide. (1995)
29. The toxic effect of carbon monoxide is due to its greater affinity for haemoglobin as compared to oxygen approximately by  
 (a) 200 times (b) 1000 times  
 (c) 2 times (d) 20 times. (1995)
30. Sounds above what level are considered hazardous noise pollution?  
 (a) Above 80 dB (b) Above 30 dB  
 (c) Above 150 dB (d) Above 120 dB (1994)
31. Ultraviolet radiations from sunlight causes a reaction that produces  
 (a) fluorides (b) carbon monoxide  
 (c) sulphur dioxide (d) ozone. (1993)
32. Most hazardous metal pollutant of automobile exhausts is  
 (a) mercury (b) cadmium  
 (c) lead (d) copper. (1992)
33. Which one is not a pollutant normally?  
 (a) Hydrocarbon (b) Carbon dioxide  
 (c) Carbon monoxide (d) Sulphur dioxide (1992, 1988)
34. Acid rain is due to increase in atmospheric concentration of  
 (a) ozone and dust (b)  $\text{CO}_2$  and CO  
 (c)  $\text{SO}_3$  and CO (d)  $\text{SO}_2$  and  $\text{NO}_2$ . (1991)
35. Major aerosol pollutant in jet plane emission is  
 (a) sulphur dioxide (b) carbon monoxide  
 (c) methane (d) fluorocarbon. (1990)
36. Acid rains are produced by  
 (a) excess  $\text{NO}_2$  and  $\text{SO}_2$  from burning fossil fuels  
 (b) excess production of  $\text{NH}_3$  by industry and coal gas  
 (c) excess release of carbon monoxide by incomplete combustion  
 (d) excess formation of  $\text{CO}_2$  by combustion and animal respiration. (1989, 1988)

37. Biochemical Oxygen Demand (BOD) may not be a good index for pollution for water bodies receiving effluents from  
 (a) domestic sewage (b) dairy industry  
 (c) petroleum industry (d) sugar industry. (NEET-II 2016)
38. A lake which is rich in organic waste may result in  
 (a) increased population of aquatic organisms due to minerals  
 (b) drying of the lake due to algal bloom  
 (c) increased population of fish due to lots of nutrients  
 (d) mortality of fish due to lack of oxygen. (NEET-II 2016)
39. The highest DDT concentration in aquatic food chain shall occur in  
 (a) phytoplankton (b) seagull  
 (c) crab (d) eel. (NEET-II 2016)
40. A river with an inflow of domestic sewage rich in organic waste may result in  
 (a) an increased production of fish due to biodegradable nutrients  
 (b) death of fish due to lack of oxygen  
 (c) drying of the river very soon due to algal bloom  
 (d) increased population of aquatic food web organisms. (NEET-I 2016)
41. Eutrophication of water bodies leading to killing of fishes is mainly due to non-availability of  
 (a) essential minerals (b) oxygen  
 (c) food (d) light. (2015)
42. Increase in concentration of the toxicant at successive trophic levels is known as  
 (a) biotransformation  
 (b) biogeochemical cycling  
 (c) biomagnification  
 (d) biodeterioration. (2015)
43. High value of BOD (Biochemical Oxygen Demand) indicates that  
 (a) water is less polluted  
 (b) consumption of organic matter in the water is higher by the microbes  
 (c) water is pure  
 (d) water is highly polluted. (2015 Cancelled)
4. Rachel Carson's famous book "Silent Spring" is related to  
 (a) population explosion  
 (b) ecosystem management  
 (c) pesticide pollution  
 (d) noise pollution. (2015 Cancelled)
45. In an area where DDT had been used extensively, the population of birds declined significantly because  
 (a) birds stopped laying eggs  
 (b) earthworms in the area got eradicated  
 (c) cobras were feeding exclusively on birds  
 (d) many of the birds eggs laid, did not hatch. (2012)
46. Measuring Biochemical Oxygen Demand (BOD) is a method used for  
 (a) estimating the amount of organic matter in sewage water  
 (b) working out the efficiency of oil driven automobile engines  
 (c) measuring the activity of *Saccharomyces cerevisiae* in producing curd on a commercial scale  
 (d) working out the efficiency of RBCs about their capacity to carry oxygen. (2012)
47. Eutrophication is often seen in  
 (a) deserts (b) fresh water lakes  
 (c) ocean (d) mountains. (2011)
48. When domestic sewage mixes with river water  
 (a) small animals like rats will die after drinking river water  
 (b) the increased microbial activity releases micronutrients such as iron  
 (c) the increased microbial activity uses up dissolved oxygen  
 (d) the river water is still suitable for drinking as impurities are only about 0.1%. (Mains 2010)
49. Biochemical oxygen demand (BOD) in a river water  
 (a) has no relationship with concentration of oxygen in the water  
 (b) gives a measure of *Salmonella* in the water  
 (c) increases when sewage gets mixed with river water  
 (d) remains unchanged when algal bloom occurs. (2009)
50. DDT residues are rapidly passed through food chain causing biomagnification because DDT is  
 (a) moderately toxic  
 (b) non-toxic to aquatic animals  
 (c) water soluble  
 (d) lipo soluble. (2009)
51. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this.
- A. Lots of urea and phosphate fertilizer were used in the crops in the vicinity.  
 B. The area was sprayed with DDT by an aircraft.  
 C. The lake water turned green and stinky.  
 D. Phytoplankton populations in the lake declined initially there by greatly reducing photosynthesis.
- Which two of the above were the main causes of fish mortality in the lake?  
 (a) A, C (b) A, B  
 (c) B, C (d) C, D (2008)

52. In which one of the following the BOD (Biochemical Oxygen Demand) of sewage (S), distillery effluent (DE), paper mill effluent (PE) and sugar mill effluent (SE) have been arranged in ascending order?  
 (a)  $SE < PE < S < DE$  (b)  $PE < S < SE < DE$   
 (c)  $S < DE < PE < SE$  (d)  $SE < S < PE < DE$  (2007)
53. Which one of the following statements is correct?  
 (a) Both *Azotobacter* and *Rhizobium* fix atmospheric nitrogen in root nodules of plants.  
 (b) Cyanobacteria such as *Anabaena* and *Nostoc* are important mobilizers of phosphates and for plant nutrition in soil.  
 (c) At present it is not possible to grow maize without chemical fertilizers.  
 (d) Extensive use of chemical fertilizers may lead to eutrophication of nearby water bodies. (2007)
54. Which one of the following is not a bioindicator of water pollution?  
 (a) Blood-worms (b) Stone flies  
 (c) Sewage fungus (d) Sludge-worms (2007)
55. Limit of BOD prescribed by Central Pollution Control Board for the discharge of industrial and municipal waste waters into natural surface waters, is  
 (a)  $< 30$  ppm (b)  $< 3.0$  ppm  
 (c)  $< 10$  ppm (d)  $< 100$  ppm. (2006)
56. Which one of the following is not used for disinfection of drinking water?  
 (a) Chlorine (b) Ozone  
 (c) Chloramine (d) Phenyl (2005)
57. Common indicator organism of water pollution is  
 (a) *Lemna panicostata*  
 (b) *Eichhornia crassipes*  
 (c) *Escherichia coli*  
 (d) *Entamoeba histolytica*. (2004)
58. *Escherichia coli* is used as an indicator organism to determine pollution of water with  
 (a) heavy metals (b) faecal matter  
 (c) industrial effluents (d) pollen of aquatic plants. (2003)
59. Which of the following is absent in polluted water?  
 (a) *Hydrilla* (b) Water hyacinth  
 (c) Larva of stone fly (d) Blue green algae (2002)
60. What is B.O.D.?  
 (a) The amount of  $O_2$  utilised by organisms in water.  
 (b) The amount of  $O_2$  utilised by microorganisms for decomposition.  
 (c) The total amount of  $O_2$  present in water.  
 (d) All of the above (2001)
61. The Minamata disease in Japan was caused through the pollution of water by  
 (a) cyanide (b) methyl isocyanate  
 (c) lead (d) mercury. (1999)
62. D.D.T. is  
 (a) not a pollutant  
 (b) an antibiotic  
 (c) a non-degradable pollutant  
 (d) a biodegradable pollutant. (1999)
63. Which of the following organism is likely to have more concentration of D.D.T. in its body?  
 (a) Top carnivores (b) Primary producers  
 (c) Herbivores (d) Carnivores (1999)
64. The maximum biomagnification would be in which of the following in case of aquatic ecosystem?  
 (a) Zooplanktons (b) Phytoplanktons  
 (c) Fishes (d) Birds (1999)
65. Which one of the following organisms is used as indicator of water quality?  
 (a) *Azospirillum* (b) *Escherichia*  
 (c) *Biggiata* (d) *Chlorella* (1998)
66. The most common indicator organism that represents polluted water is  
 (a) *C.vibrio*  
 (b) *Entamoeba histolytica*  
 (c) *E.coli*  
 (d) *P.typhi*. (1997)
67. Phosphate pollution is caused by  
 (a) sewage and phosphate rock  
 (b) sewage and agricultural fertilizers  
 (c) phosphate rock only  
 (d) agricultural fertilizers only. (1997)
68. When huge amount of sewage is dumped into a river, its B.O.D. will  
 (a) slightly decrease (b) remain unchanged  
 (c) increase (d) decrease. (1995)
69. In Minamata Bay Japan the animals which remained free from minamata disease, are  
 (a) dogs (b) cats  
 (c) pigs (d) rabbits. (1995)
70. A dental disease characterized by mottling of teeth is due to the presence of certain chemical element in drinking water. Which of the following is that element?  
 (a) Fluorine (b) Boron  
 (c) Mercury (d) Chlorine (1995)
71. Which among the following is likely to have the highest levels of D.D.T. depositions in its body?  
 (a) Sea gull (b) Phytoplankton  
 (c) Eel (d) Crab (1994)
72. A disease caused by eating fish contaminated by industrial waste, containing mercury compounds, is called  
 (a) osteosclerosis (b) Hashimoto's oxidase  
 (c) Bright's disease (d) Minamata disease. (1994)
73. American water plant that has become a troublesome water weed in India is  
 (a) *Cyperus rotundus* (b) *Eichhornia crassipes*  
 (c) *Typha latifolia* (d) *Trapa bispinosa*. (1993)

74. Polyblend, a fine powder of recycled modified plastic, has proved to be a good material for  
 (a) making tubes and pipes  
 (b) making plastic sacks  
 (c) use as a fertiliser  
 (d) construction of roads. (NEET 2019)
75. Which of the following methods is the most suitable for disposal of nuclear waste?  
 (a) Bury the waste within rocks deep below earth's surface  
 (b) Shoot the waste into space  
 (c) Bury the waste under Antarctic ice-cover  
 (d) Dump the waste within rocks under ocean (NEET 2019)
76. Which one of the following statements is incorrect in case of Bhopal tragedy?  
 (a) Methyl isocyanate gas leakage took place.  
 (b) Thousands of human beings died.  
 (c) Radioactive fall out engulfed Bhopal.  
 (d) It took place in the night of December 2/3, 1984. (2011)
77. In 1984, the Bhopal gas tragedy took place because methyl isocyanate  
 (a) reacted with DDT  
 (b) reacted with ammonia  
 (c) reacted with CO<sub>2</sub>  
 (d) reacted with water. (2004)
78. In 1984, Bhopal gas tragedy was caused due to leakage of  
 (a) potassium isocyanate  
 (b) methyl isocyanate  
 (c) sodium monoxide  
 (d) none of these. (1999)
79. The two great industrial tragedies namely, MIC and Chernobyl tragedies respectively occurred where and at which time?  
 (a) Bhopal 1984, Ukraine 1986  
 (b) Bhopal 1986, Russia 1988  
 (c) Bhopal 1984, Ukraine 1990  
 (d) Bhopal 1984, Ukraine 1988 (1996)
80. Which of the following isotopes is most dangerous to *Homo sapiens*?  
 (a) Phosphorus-32 (b) Strontium-90  
 (c) Cesium-137 (d) Iodine-131 (1995)
81. Gas released during Bhopal tragedy was  
 (a) methyl isocyanate  
 (b) potassium isothiocyanate  
 (c) sodium isothiocyanate  
 (d) ethyl isothiocyanate. (1990)
82. Which of the following pairs of gases is mainly responsible for greenhouse effect?  
 (a) Carbon dioxide and methane  
 (b) Ozone and ammonia  
 (c) Oxygen and nitrogen  
 (d) Nitrogen and sulphur dioxide (NEET 2019)
83. The UN Conference of Parties on climate change in the year 2012 was held at  
 (a) Lima (b) Warsaw  
 (c) Durban (d) Doha. (2015)
84. The UN Conference of Parties on climate change in the year 2011 was held in  
 (a) Peru (b) Qatar  
 (c) Poland (d) South Africa. (2015 Cancelled)
85. Global warming can be controlled by  
 (a) increasing deforestation, slowing down the growth of human population  
 (b) increasing deforestation, reducing efficiency of energy usage  
 (c) reducing deforestation, cutting down use of fossil fuel  
 (d) reducing reforestation, increasing the use of fossil fuel. (NEET 2013)
86. Climate of the world is threatened by  
 (a) decreasing amount of atmospheric oxygen  
 (b) increasing amount of atmospheric carbon dioxide  
 (c) decreasing amount of atmospheric carbon dioxide  
 (d) increasing concentration of atmospheric oxygen. (Karnataka NEET 2013)
87. Which one of the following pairs of gases are the major cause of "greenhouse effect"?  
 (a) CO<sub>2</sub> and O<sub>3</sub> (b) CO<sub>2</sub> and CO  
 (c) CFCs and SO<sub>2</sub> (d) CO<sub>2</sub> and N<sub>2</sub>O (2011)
88. Which one of the following is correct expanded form of the acronym?  
 (a) IPCC = International Panel for Climate Change  
 (b) UNEP = United Nations Environmental Policy  
 (c) EPA = Environmental Pollution Agency  
 (d) IUCN = International Union for Conservation of Nature and Natural Resources (2011)
89. The two gases making highest relative contribution to the greenhouse gases are  
 (a) CO<sub>2</sub> and CH<sub>4</sub> (b) CH<sub>4</sub> and N<sub>2</sub>O  
 (c) CFCs and N<sub>2</sub>O (d) CO<sub>2</sub> and N<sub>2</sub>O. (2010)
90. Which one of the following is the correct percentage of the two (out of the total of 4) greenhouse gases that contribute to the total global warming?  
 (a) N<sub>2</sub>O 6%, CO<sub>2</sub> 86%  
 (b) Methane 20%, N<sub>2</sub>O 18%  
 (c) CFCs 14%, methane 20%  
 (d) CO<sub>2</sub> 40%, CFCs 30% (2008)

91. Which one of the following pairs is mismatched?  
 (a) Fossil fuel burning – release of CO<sub>2</sub>  
 (b) Nuclear power – radioactive wastes  
 (c) Solar energy – greenhouse effect  
 (d) Biomass burning – release of CO<sub>2</sub>  
 (2005)
92. Maximum greenhouse gas released by which of the following country?  
 (a) India (b) France  
 (c) USA (d) Britain (2002)
93. If there was no CO<sub>2</sub> in the earth's atmosphere, the temperature of earth's surface would be  
 (a) higher than the present  
 (b) dependent on the amount of oxygen in the atmosphere  
 (c) same as present  
 (d) less than the present. (1998)
94. The CO<sub>2</sub> content by volume, in the atmospheric air is about  
 (a) 3.34% (b) 4%  
 (c) 0.0314% (d) 0.34%. (1997)
95. The true statement about 'greenhouse effect' is that it is  
 (a) caused by combination of many gases  
 (b) caused only by CO<sub>2</sub>  
 (c) caused by CO<sub>2</sub>, CFC, CH<sub>4</sub> and NO<sub>2</sub> gases  
 (d) none of these. (1996)
96. Which one of the following gases contributes maximum to the 'greenhouse effect' on the earth?  
 (a) Carbon dioxide  
 (b) Chlorofluorocarbon  
 (c) Freon  
 (d) Methane (1994)
97. Greenhouse effect is warming due to  
 (a) infra-red rays reaching earth  
 (b) moisture layer in atmosphere  
 (c) increase in temperature due to increase in carbon dioxide concentration of atmosphere  
 (d) ozone layer of atmosphere. (1991, 1989)
98. Montreal protocol was signed in 1987 for control of  
 (a) transport of genetically modified organisms from one country to another  
 (b) emission of ozone depleting substances  
 (c) release of greenhouse gases  
 (d) disposal of e-wastes. (NEET 2020)
99. Snow-blindness in Antarctic region is due to  
 (a) freezing of fluids in the eye by low temperature  
 (b) inflammation of cornea due to high dose of UV-B radiation  
 (c) high reflection of light from snow  
 (d) damage to retina caused by infra-red rays. (NEET 2020)
100. Which of the following protocols did aim reducing emission of chlorofluorocarbons into atmosphere?  
 (a) Geneva Protocol (b) Montreal Protocol  
 (c) Kyoto Protocol (d) Gothenburg Protocol  
 (NEET 2019)
101. Which of the following statements about ozone is correct?  
 (a) Tropospheric ozone protects us from UV radiations.  
 (b) Stratospheric ozone is 'bad'.  
 (c) Tropospheric ozone is 'good'.  
 (d) Stratospheric ozone protects us from UV radiations. (Odisha NEET 2019)
102. In stratosphere, which of the following elements acts as a catalyst in degradation of ozone and release of molecular oxygen?  
 (a) Carbon (b) Cl  
 (c) Fe (d) Oxygen (NEET 2018)
103. World Ozone Day is celebrated on  
 (a) 5<sup>th</sup> June (b) 21<sup>st</sup> April  
 (c) 16<sup>th</sup> September (d) 22<sup>nd</sup> April.  
 (NEET 2018)
104. Depletion of which gas in the atmosphere can lead to an increased incidence of skin cancers?  
 (a) Ammonia (b) Methane  
 (c) Nitrous oxide (d) Ozone (NEET-I 2016)
105. Which of the following is not one of the prime health risks associated with greater UV radiations through the atmosphere due to depletion of stratospheric ozone?  
 (a) Damage to eyes (b) Increased liver cancer  
 (c) Increased skin cancer  
 (d) Reduced immune system (2015 Cancelled)
106. The zone of atmosphere in which the ozone layer is present is called  
 (a) ionosphere (b) mesosphere  
 (c) stratosphere (d) troposphere. (2014)
107. Kyoto protocol was endorsed at  
 (a) CoP - 6 (b) CoP - 4  
 (c) CoP - 3 (d) CoP - 5.  
 (NEET 2013)
108. The second commitment period for Kyoto Protocol was decided at  
 (a) Durban (b) Bali  
 (c) Doha (d) Cancun.  
 (Karnataka NEET 2013)
109. "Good ozone" is found in the  
 (a) mesosphere (b) troposphere  
 (c) stratosphere (d) ionosphere.  
 (Mains 2011)

110. Global agreement in specific control strategies to reduce the release of ozone depleting substances, was adopted by

- (a) Montreal Protocol (b) Kyoto Protocol  
(c) Vienna Convention  
(d) Rio de Janeiro Conference. (2009)

111. Montreal Protocol aims at

- (a) biodiversity conservation  
(b) control of water pollution  
(c) control of CO<sub>2</sub> emission  
(d) reduction of ozone depleting substances. (2009)

112. Montreal protocol which calls for appropriate action to protect the ozone layer from human activities was passed in the year

- (a) 1985 (b) 1986  
(c) 1987 (d) 1988. (2006)

113. Identify the correctly matched pair.

- (a) Basel convention – Biodiversity conservation  
(b) Kyoto protocol – Climatic change  
(c) Montreal protocol – Global warming  
(d) Ramsar convention – Ground water pollution (2005)

114. In coming years, skin related disorders will be more common due to

- (a) water pollution  
(b) depletion of ozone layer  
(c) pollutants in air  
(d) use of detergents. (1997)

115. Formation of ozone hole is maximum over

- (a) Europe (b) Africa  
(c) India (d) Antarctica. (1997)

116. Which country has the greatest contribution for the hole formation in ozone layer?

- (a) Russia (b) Japan  
(c) USA (d) Germany (1996)

117. Prolonged liberal irrigation of agricultural fields is likely to create the problem of

- (a) acidity (b) aridity  
(c) salinity (d) metal toxicity. (2005)

118. Match the items given in column I with those in column II and select the correct option given below.

Column I

Column II

- A. Eutrophication (i) UV-B radiation  
B. Sanitary landfill (ii) Deforestation  
C. Snow blindness (iii) Nutrient enrichment  
D. Jhum cultivation (iv) Waste disposal

- | A         | B     | C     | D     |
|-----------|-------|-------|-------|
| (a) (ii)  | (i)   | (iii) | (iv)  |
| (b) (i)   | (iii) | (iv)  | (ii)  |
| (c) (iii) | (iv)  | (i)   | (ii)  |
| (d) (i)   | (ii)  | (iv)  | (iii) |

(NEET 2018)

119. Joint Forest Management Concept was introduced in India during

- (a) 1980s (b) 1990s  
(c) 1960s (d) 1970s.

(NEET-I 2016)

120. Which one of the following is a wrong statement?

- (a) Most of the forests have been lost in tropical areas.  
(b) Ozone in upper part of atmosphere is harmful to animals.  
(c) Greenhouse effect is a natural phenomenon.  
(d) Eutrophication is a natural phenomenon in freshwater bodies. (2012)

121. Chipko movement was launched for the protection of

- (a) forests (b) livestock  
(c) wetlands (d) grasslands. (2009)

122. If we uncover half of the forest covering the earth, what crisis will be produced at most and at first?

- (a) Some species will be extinct.  
(b) Population and ecological imbalance will rise up.  
(c) Energy crisis will occur.  
(d) Rest half forests will maintain this imbalance. (1996)

123. Which of the following is the main factor of desertification?

- (a) Over-grazing (b) Tourism  
(c) Irrigated agriculture (d) All of these (1995)

124. Deforestation will decrease

- (a) soil erosion (b) land slides  
(c) soil fertility (d) rainfall. (1990)

125. Soil conservation is

- (a) conversion of sterile soil into fertile one  
(b) aeration of soil (c) erosion of soil  
(d) protection against loss. (1989)



## AIIMS PREVIOUS QUESTIONS

1. Ozone in stratosphere extends [2007]  
(a) 10-20km (b) 20-25km  
(c) 15-30km (d) 25-40km
2. Which one of the following organisms is likely to show the highest concentration of DDT, once it has been introduced into the ecosystem? [2010]  
(a) Grasshopper (b) Toad  
(c) Snake (d) Cattle
3. Which one of the following statement pertaining to pollutants is correct? [2011]  
(a) DDT is a non-biodegradable pollutant  
(b) Excess fluoride in drinking water causes osteoporosis hardening of bones, stiff joints  
(c) Excess cadmium in drinking water causes black foot disease  
(d) Methylmercury in water may cause "Itai Itai" disease
4. In the environment, ozone is known for its [2012]  
(a) Harmful effects  
(b) Useful effects  
(c) Both (a) and (b)  
(d) Inert nature
5. Which one of the following statement is true? [2013]  
(a) The greater the BOD of waste water, more is its polluting potential.  
(b) The greater the BOD of waste water, less is its polluting potential.  
(c) The lesser the BOD of waste water, more is its polluting potential.  
(d) The lesser the BOD of waste water, less is its polluting potential.
6. Which one of the following pairs is mismatched? [2013]  
(a) Fossil fuel burning - release of  $\text{CO}_2$   
(b) Nuclear power - radioactive wastes  
(c) Solar energy - green house effect  
(d) Biomass burning - release of  $\text{CO}_2$
7. The two gases making the highest relative contribution to the greenhouse gases are [2014]  
(a)  $\text{CO}_2$  and  $\text{CH}_4$  (b)  $\text{CH}_4$  and  $\text{N}_2\text{O}$   
(c) CFC and  $\text{N}_2\text{O}$  (d)  $\text{CO}_2$  and  $\text{N}_2\text{O}$
8. A lake near a village suffered heavy mortality of fishes within a few days. Consider the following reasons for this:  
1. Lots of urea and phosphate fertilizer were used in the crops in the vicinity  
2. The area was sprayed with DDT by an aircraft  
3. The lake water turned green and stinky
4. Phytoplankton populations in the lake declined initially thereby greatly reducing photosynthesis.  
Which two of the above were the main causes of fish mortality in the lake? [2015]  
(a) 2 and 3 (b) 3 and 4  
(c) 1 and 3 (d) 1 and 2
9. DDT residues are rapidly passed through food chain causing biomagnification because DDT is [2015]  
(a) moderately toxic  
(b) non-toxic to aquatic animals  
(c) water soluble  
(d) lipo soluble
10. Two lakes, A and B are identical in all aspects except that lake A has higher temperature. Which of the following is true? [2016]  
(a) A has higher rate of oxygen dissolution.  
(b) B has higher rate of oxygen dissolution.  
(c) Oxygen dissolution of both is the same.  
(d) Both the lakes have same BOD.
11. Euro II norms stipulate that sulphur be controlled at \_\_\_\_\_ ppm in diesel and \_\_\_\_\_ ppm in petrol. [2017]  
(a) 350; 150 (b) 150; 350  
(c) 350; 250 (d) 150; 250

**KEY**  
**MULTIPLE CHOICE QUESTIONS**

1 (d) 2 (b) 3 (c) 4 (d) 5 (c) 6 (c) 7 (c) 8 (c) 9 (b) 10 (a) 11 (a) 12 (d) 13 (a) 14 (d) 15 (b)  
 16 (d) 17 (a) 18 (b) 19 (c) 20 (d) 21 (d) 22 (b) 23 (d) 24 (a) 25 (a) 26 (b) 27 (a) 28 (c) 29 (b) 30 (b)  
 31 (c) 32 (c) 33 (d) 34 (a) 35 (b) 36 (a) 37 (a) 38 (c) 39 (b) 40 (a) 41 (a) 42 (d) 43 (b) 44 (b) 45 (b)  
 46 (c) 47 (c) 48 (a) 49 (c) 50 (b) 51 (a) 52 (d) 53 (c) 54 (d) 55 (c) 56 (a) 57 (c) 58 (d) 59 (c) 60 (b)  
 61 (b) 62 (a) 63 (c) 64 (d) 65 (d) 66 (b) 67 (b) 68 (b) 69 (d) 70 (d) 71 (d) 72 (a) 73 (d) 74 (d) 75 (b)  
 76 (d) 77 (b) 78 (c) 79 (c) 80 (a) 81 (c) 82 (a) 83 (a) 84 (b) 85 (a) 86 (d)

**SPECIAL FORMAT QUESTIONS**

1	c	9	a	17	c	25	a	33	a	41	b
2	d	10	b	18	b	26	b	34	a	42	b
3	d	11	b	19	d	27	a	35	a	43	b
4	d	12	c	20	d	28	d	36	d	44	a
5	b	13	c	21	c	29	b	37	b	45	b
6	a	14	d	22	b	30	c	38	a	46	d
7	d	15	d	23	d	31	a	39	c	47	a
8	c	16	d	24	b	32	c	40	d	48	d

**NCERT EXEMPLAR PROBLEMS**

1	c	5	c	9	c	13	b	17	d
2	a	6	d	10	a	14	a	18	a
3	d	7	a	11	d	15	a		
4	b	8	c	12	d	16	a		

**NEET PREVIOUS QUESTIONS**

1. (d) 2. (d) 3. (b) 4. (a) 5. (c) 6. (d) 7. (b) 8. (b) 9. (c) 10. (c)  
 11. (d) 12. (a) 13. (d) 14. (b) 15. (b) 16. (a) 17. (c) 18. (b) 19. (d) 20. (b)  
 21. (c) 22. (b) 23. (c) 24. (d) 25. (b) 26. (a) 27. (a) 28. (d) 29. (a) 30. (d)  
 31. (d) 32. (c) 33. (b) 34. (d) 35. (d) 36. (a) 37. (c) 38. (d) 39. (b) 40. (b)  
 41. (b) 42. (c) 43. (b,d) 44. (c) 45. (d) 46. (a) 47. (b) 48. (c) 49. (c) 50. (d)  
 51. (a) 52. (b) 53. (d) 54. (b) 55. (a) 56. (d) 57. (c) 58. (b) 59. (c) 60. (b)  
 61. (d) 62. (c) 63. (a) 64. (d) 65. (b) 66. (c) 67. (b) 68. (c) 69. (d) 70. (a)  
 71. (a) 72. (d) 73. (b) 74. (d) 75. (a) 76. (c) 77. (d) 78. (b) 79. (a) 80. (b)  
 81. (a) 82. (a) 83. (d) 84. (d) 85. (c) 86. (b) 87. (d) 88. (d) 89. (a) 90. (c)  
 91. (c) 92. (c) 93. (d) 94. (c) 95. (c) 96. (a) 97. (c) 98. (b) 99. (b) 100. (b)  
 101. (d) 102. (b) 103. (c) 104. (d) 105. (b) 106. (c) 107. (c) 108. (c) 109. (c) 110. (a)  
 111. (d) 112. (c) 113. (b) 114. (b) 115. (d) 116. (c) 117. (c) 118. (c) 119. (a) 120. (b)  
 121. (a) 122. (a) 123. (a) 124. (d) 125. (d)

**AIIMS PREVIOUS QUESTIONS**

1	b	4	c	7	a	10	b
2	c	5	a	8	c	11	a
3	a	6	c	9	d		

