BIOLOGY

Chapter 1

# The Living World

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Linnaeus system of classification is ***[1999]***
(a) Natural (b) Artificial
(c) Phylogenetic (d) Progressive

**2.** The basic unit of classification is ***[2000]***
(a) genus (b) species
(c) variety (d) subspecies

**3.** Binomial nomenclature was introduced by
(a) Linnaeus ***[2000]***
(b) Darwin
(c) Bentham and Hooker
(d) Aristotle

**4.** The usage of binomial names, for plant species was accepted by all after the publication of the work by ***[2001]***
(a) Hooker (b) Linnaeus
(c) Bentham (d) Darwin

**5.** Which one of the following is correctly matched regarding an Institute and its location? ***[2004]***
(a) National Institute of Virology - Pune
(b) National Institute of Communicable disease - Lucknow
(c) Central Drug Research Institute - Kasauli Institute
(d) National Institute of Nutrition - Mumbai

**6.** "*Ordines Anomali*" of Bentham and Hooker includes ***[2006]***
(a) seed plants showing abnormal forms of growth and development.
(b) plants represented only in fossil state.
(c) plants described in the literature but which Bentham and Hooker did not see in original.
(d) a few orders which could not be placed satisfactory in the classification.

**7.** The system of classification based on evolutionary and genetic relationships among organisms, ignoring the morphological similarities or differences, is called ***[2009]***
(a) cladistics
(b) phenetics
(c) classical systematics
(d) new systematics

**8.** Scientific name of Mango plant is *Mangifera indica* (Linn.) Santapau. In the above name Santapau refers to ***[2012]***
(a) Variety of Mango
(b) A taxonomist who proposed the present nomenclature in honour of Linnaeus
(c) A scientist who for the first time described Mango plant
(d) A scientist who changed the name proposed by Linnaeus and proposed present name

**9.** The classification of Linnaeus was mainly based on ***[2012]***
(a) Sepals (b) Carpels
(c) Petals (d) Stamens

**10.** Which of the following is less general in characters as compared to genus? ***[2013]***
(a) Species (b) Division
(c) Class (d) Family

**11.** Read the following statements
(i) Lower the taxon, more are the characteristics that the members within the taxon share.
(ii) Order is the assemblage of genera which exhibit a few similar characters.
(iii) 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)

**12.** Choose the correct one ***[2015]***

(i) Growth cannot be taken as a defining property of living organism.

(ii) Dead organism does not grow.

(iii) Reproduction cannot be an all inclusive defining characteristic of living organisms.

(iv) No non-living object is capable of replicating itself.

(v) Metabolism in a test tube is non-living.

(vi) 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

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

| | **Column-I** | | **Column-II** |
|---|---|---|---|
| A. | Family | I. | *tuberosum* |
| B. | Kingdom | II. | Polymoniales |
| C. | Order | III. | *Solanum* |
| 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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 14-15) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**14.** **Assertion:** Living organisms are regarded as closed systems.

**Reason:** Energy of living organisms can not be lost or gained from external environment. ***[2002]***

**15.** **Assertion:** Systematics is the branch of biology that deals with classification of living organisms.

**Reason:** The aim of classification is to group the organisms. ***[2002]***

**Directions for (Q. 16) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**16.** **Assertion :** Taxon and category are different things.

**Reason :** Category shows hierarchical classification. ***[2013, 14]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1.** **(b)** Carolus Linnaeus system of classification is artificial.

**2.** **(b)** The basic unit of classification is species which consists of a natural population of individuals having similar, morphological, anatomical, biochemical, cytological and reproductive characters so that they can interbreed freely and produce fertile offsprings.

**3.** **(a)** Carolus Linnaeus gave the binomial system of nomenclature.

**4.** **(b)** Carolus Von Linnaeus in his book *Genera Plantarum* made use of the artificial system of classification. He distinguished between the natural and artificial systems. He used the binomial nomenclature system and classified organisms into genus and species.

**5.** **(a)** National Institute of Virology is located in Pune.

The National Institute of Virology (NIV) is a premier virus research laboratory in India. It is one of the major Institutes of the Indian Council of Medical Research (ICMR). It was established at Pune,

**6.** **(d)** Bentham and Hooker system was published well before there were internationally accepted rules for botanical nomenclature. In this system, termination for families was not so as it is now.

**7.** **(a)** "Cladogram" emphasizes that the diagram represents a hypothesis about the actual evolutionary relationships of a group. This history is deduced on the basis of certain shares like homologous characters. that are thought to indicate common ancestry. While "phylogenies" represent true evolutionary history. To other biologists, "cladogram" suggests that the lengths of the branches in the diagram are arbitrary, while in a "phylogeny," the branch lengths indicate the amount of character change.

**8.** **(d)** Collection of rules regarding scientific nomenclature of plants is known as ICBN or International Code of Botanical Nomenclature. It was first accepted in 1961. According to ICBN, if any scientist has proposed wrong name then his name should be written in bracket and the scientist who corrected the name should be written after the bracket.

**9.** **(d)** Classification proposed by Linnaeus is artificial. Linnaeus classified plant kingdom on the basis of only two characters

(1) stamens (2) style

**10.** **(a)** Species is the lowest taxonomic category. Class is a category made of one or more related orders possessing similar correlated characters. Family is composed of one to many related genera. Division comprises of several related classes.

**11.** **(d)** Order being higher category is the assemblage of families which exhibit a few similar characteristics.

Dog (*Canis familaris*) and Cat (*Felis domesticus*) belong to two different families—Cancideae and Felidae respectively.

**12.** **(b)** Metabolism takes place only inside the body of a living organism.

**13.** **(b)** A - V; B - IV; C - II; D - I; E - III

## Type B : Assertion Reason Questions

**14.** **(d)** Living organisms are regarded as open system as energy flow is the key function of an ecosystem.

**15. (b)** Systematics is the science of identification, naming and classification of the organisms into groups.

**16. (a)** A category is a rank or level in the hierarchial classification of organisms. Taxon is a unit in classification which may represent any level of grouping of organisms based on certain common characteristics. There is some confusion in the use of taxon and category, for example Bryophyta is a taxon while division is a category.

Chapter 2

# Biological Classification

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The symbiotic relationship of algae and fungus is found in ***[1997]***
(a) lichen (b) mycorrhiza
(c) pneumatophore (d) bacteriophage

**2.** The virus that infects bacteria is called ***[1997]***
(a) cyanophage (b) mycophage
(c) bacteriophage (d) none of these

**3.** *Citrus canker* is caused by ***[1997]***
(a) bacterium (b) fungus
(c) alga (d) virus

**4.** Which of the following is a cyanobacterium ?
(a) *Nostoc* (b) *Chara* ***[1997]***
(c) *E. coli* (d) *Polysiphonia*

**5.** Virus has ***[1998]***
(a) DNA
(b) RNA
(c) both (a) and (b)
(d) either DNA or RNA

**6.** Hormogonia are vegetative reproductive structure of ***[1998]***
(a) *Spirogyra* (b) *Ulothrix*
(c) *Oscillatoria* (d) Yeast

**7.** Which is a unicellular fungus ? ***[1998]***
(a) Yeast (b) *E.coli*
(c) *Nostoc* (d) *Albugo*

**8.** Bacterial cell wall is made up of ***[1999]***
(a) xylan (b) chitin
(c) cellulose (d) murein

**9.** Cell wall is absent in ***[2000]***
(a) *Amoeba* (b) *Chara*
(c) yeast (d) *E. coli*

**10.** Which of the following is a fungus? ***[2000]***
(a) *Nostoc* (b) *E. coli*
(c) Yeast (d) *Chara*

**11.** Powdery mildews of crops are caused by ***[2001]***
(a) bacteria (b) ascomycetes
(c) basidiomycetes (d) phycomycetes

**12.** Pullorum disease of poultry is caused by ***[2001]***
(a) *Mycobacterium* (b) *Salmonella*
(c) *Clostridium* (d) *Haemophilus*

**13.** Viroids have ***[2003]***
(a) single stranded RNA not enclosed by protein coat.
(b) single stranded DNA not enclosed by protein coat.
(c) double stranded DNA enclosed by protein coat.
(d) double stranded RNA enclosed by protein coat.

**14.** Myxomycetes are ***[2006]***
(a) saprobes or parasites, having mycelia, asexual reproduction by fragmentation.
(b) slimy mass of multinucleate protoplasm, having pseudopodia like structures for engulfing food, reproduction through fragmentation or zoospores.
(c) prokaryotic organisms, cellular or acellular, saprobes or autotrophic, reproduce by binary fission.
(d) eukaryotic, single-celled or filamentous, saprobes or autotrophic, asexual reproduction by division of haploid individuals, sexual reproduction by fusion of two cells or their nuclei.

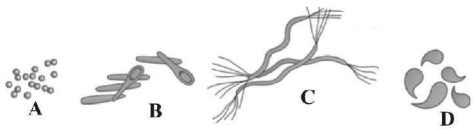
**15.** Among rust, smut and mushroom all the three ***[2006]***
(a) are pathogens (b) are saprobes
(c) bear ascocarps (d) bear basidiocarps

**16.** "Fairy rings" in lawns result from outward,spreading circles of mycelia of mushrooms producing, at their periphery, fruiting bodies called ***[2009]***
(a) ascocarps (b) basidiocarps
(c) sorocarps (d) pseudocarps

**17.** Which one of the following statements is correct? ***[2010]***
(a) Prions are the smallest free-living cells.
(b) The cell wall of *Mycoplasmas* is made up of amino sugars.
(c) Viroids consist of single-stranded RNA molecule.
(d) Rickettsiae lack cell wall.

**18.** Bacterial cell wall is composed of peptidoglycan, a complex of oligosaccharides and proteins. The oligosaccharide component consist of ***[2010]***
(a) linear chain of alternating NAG and NAM linked by $\alpha$ (1 – 4) linkage.
(b) linear chains of alternating NAG and NAM linked by $\beta$ (1 – 4) linkage.
(c) linear chain of glucose linked by $\beta$ (1 – 4) linkage.
(d) linear chain of glucose linked by $\alpha$ (1 – 4) likage.

**19.** Choose the correct names of the different bacteria according to their shapes. ***[2013]***




(a) A – Cocci, B – Bacilli, C – Spirilla, D – Vibrio
(b) A – Bacilli, B – Cocci, C – Spirilla, D – Vibrio
(c) A – Spirilla, B – Bacilli, C – Cocci, D – Vibrio
(d) A – Spirilla, B – Vibrio, C – Cocci, D – Bacilli

**20.** Which pair of the following belongs to Basidiomycetes? ***[2013]***
(a) Puffballs and *Claviceps*
(b) *Peziza* and *Alternaria*
(c) *Morchella* and mushrooms
(d) Birds nest fungi and puffballs

**21.** Match column-I with column-II and select the option . ***[2014]***

| **Column-I (Classes of fungi)** | **Column-II (Common name)** |
|---|---|
| A. Phycomycetes | I. Sac fungi |
| B. Ascomycetes | II. Algal fungi |
| C. Basidiomycetes | III. Fungi imperfecti |
| D. Deuteromycetes | IV. Club fungi |

The correct combination is –
(a) A – II; B – I; C – IV; D – III
(b) A – II; B – IV; C – I; D – III
(c) A – IV; B – I; C – II; D – III
(d) A – IV; B – III; C – II; D – I

**22.** Which of the following is correct about the slime mould ? ***[2015]***
(i) Its thalloid body, *Plasmodium* has pseudopodia for locomotion and engulfing organic matter.
(ii) During unfavourable conditions *Plasmodium* differentiates and produces fruiting bodies, sporangium.
(iii) Spores posses no true cell wall.
(iv) They are dispersed by air current.
(v) Being extremely resistant, spores survive for many years.
(vi) *Plasmodium* can grow upto several feet.
Choose the answer from the following options
(a) (i),(ii), (iv), (v) and (vi)
(b) (i),(ii) and (iii)
(c) (i),(ii), (iii) and (vi)
(d) (ii),(iii) and (vi)

**23.** (i) Green algae occur in fresh water, brackish water, salt water.
(ii) Habitat of Brown algae-fresh water (rare), brackish water, salt water
(iii) Some red algae are found in fresh water, mostly occur in salt water, some are in brackish water.
(iv) Most of the red algae are multicellular.
(v) Red alga may occur in both well lighted regions close to water-surface and also at great depths in oceans where light penetration is little.
(vi) Cell wall of red algae consists of cellulose + agar.
(vii) 2 – 8, equal and apical flagella in green algae ***[2015]***
(a) All are correct
(b) All are false
(c) (i) and (vi) are correct
(d) (ii), (iii) and (v) are correct

**24.** Fungi are filamentous with the exception of "X" which is unicellular. Identify X. ***[2017]***

(a) Yeast (b) Albugo
(c) Mucor (d) Lichen

**25.** Which of the following statements is not correct for viruses? ***[2017]***

(a) Viruses are obligate parasites.
(b) Viruses can multiply only when they are inside the living cells.
(c) Viruses cannot pass through bacterial filters.
(d) Viruses are made up of protein and DNA or RNA (never both DNA and RNA).

**26.** Which of the following statements regarding cyanobacteria is incorrect? ***[2017]***

(a) It is also called blue green algae.
(b) They are chemosynthetic heterotrophs.
(c) It forms blooms in polluted water bodies.
(d) It is unicellular, colonial or filamentous, marine or terrestrial bacteria.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 27-32) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**27.** **Assertion:** Viruses are not considered organism.
**Reason:** Viruses are nucleoproteins and lack cell organelle, *etc*. ***[1998]***

**28.** **Assertion :** Bacteria have three basic shapes, *i.e.*, round , rod, spiral.
**Reason :** *Cocci and Bacilli* may form clusters or chain of a definite length. ***[2000]***

**29.** **Assertion :** Aflatoxins are produced by *Aspergillus flavus*.
**Reason :** These toxins are useful to mankind. ***[2000]***

**30.** **Assertion :** *Escherichia coli*, *Shigella* sp. and *Salmonella* sp. are all responsible for diarrhoeal diseases. ***[2006]***
**Reason :** Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids and electrolytes should be ensured.

**31.** **Assertion :** Gram-negative bacteria do not retain the stain when washed with alcohol.
**Reason :** The outer face of the outer membrane of gram-negative bacteria contains lipopolysaccharides, a part of which is integrated into the membrane lipids. ***[2006]***

**32.** **Assertion :** *Neurospora* is commonly called water mould.
**Reason :** It belongs to basidomycetes fungi. ***[2007]***

**Directions for (Qs. 33-34) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**33.** **Assertion :** Chemosynthesis is an autotrophic nutrition.
**Reason :** Chemoautotrophs contain chlorophyll pigments. ***[2009]***

**34.** **Assertion :** TMV is a virus which causes mosaic disease.
**Reason :** TMV has RNA as genetic material. ***[2001, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (a)** Lichens are the symbiotic association between algae and fungi. Fungi provides the raw material and algae manufacture the food.

**2. (c)** The virus which attacks bacteria is called bacteriophage, *e.g.* T II phage, M13, $\phi$174 *etc.*

**3. (a)** *Citrus canker* is caused by bacterium, *Xanthomonas citri*. Bacterium is rod shaped, motile, flagellate and gram negative.

**4. (a)** *Nostoc* is a cyanobacterium. Cyanobacteria are gram (–) ve prokaryotes which perform oxygenic photosynthesis like plants. Cyanobacteria can be unicellular (*e.g. Spirulina*), colonial. (*e.g. Nostoc*) or filamentous (*e.g. Oscillatoria*)

**5. (d)** Virus are obligate intracellular parasite which can reproduce only by invading and taking over other cells as they lack the cellular machinery for self reproduction. Virus has either DNA or RNA and never both.

**6. (c)** Hormogonia is a part of a filament of a cyanobacterium that detaches and grows by cell division into a new filament. Cyanobacteria mostly multiply by asexual means like binary fission, small fragments (hormogones), hormospores, akinetes, endospores *etc*. Common cyanobacteria are-*Nostoc*, *Anabaena*, *Oscillatoria etc*.

**7. (a)** Yeast is the only member in kingdom fungi which is unicellular.

*Nostoc* : Blue green algae
*E. coli* : Bacterium
*Albugo* : Parasitic fungi

**8. (d)** Bacterial cell wall consists of peptidoglycan/murein/mucopeptide which contains polymers of modified sugars (N-acetyl glucosamine and N-acetylmuramic acid) cross linked by short peptides.

**9. (a)** Cell wall is a characteristic of bacteria, plants and fungi.

**10. (c)** Heterotrophs were the first to be evolved and fungi in the plant kingdom are heterotrophs. Yeast with its characteristic absence of chlorophyll and its vegetative propagation through budding and saprophytic nature shows it is a fungus.

**11. (b)** Powdery mildews are caused by fungi belonging to the family Erysiphaceae (class-Ascomycetes). Ascomycetes spores are harmful and it makes the crop vulnerable to its toxin. The stem becomes a powdery mass.

**12. (b)** Pullorum disease (Salmonellosis), a contagious disease of young birds, is caused by bacteria *Salmonella pullorum*. It is usually transmitted by infected hens through their eggs. Its symptoms are loss of appetite and thirst, diarrhoea with white faeces, drooping of wings *etc*.

**13. (a)** Viroids are the smallest known agents of infectious diseases comprising of small single stranded molecule of RNA. Viroids lack capsid and have no proteins associated with them.

**14. (b)** Myxomycetes are acellular plasmodial slime molds *i.e.* a group of 4 fungus which reproduces through fragmentation or zoospore.

**15. (d)** Rust, smut and mushroom bear short lived reproductive bodies called basidiocarps.

**16. (b)** Some basidiomycetes or club fungi (*e.g.*, *Agaricus campestris*) produce basidiocarps. These aerial structures also called mushrooms. They occur in rings called 'fairy rings'. Basidiocarps of some fungi are edible.

**17. (c)** **Viroid** is a small infective segment of nucleic acid, usually RNA.

**Prion** is an infectious pathogenic agent devoid of nucleic acid and composed mainly of proteins.

**Mycoplasmas** lack a cell wall while **Rickettsiae** possess a cell wall.

**18. (b)** The oligosaccharide component of bacterial cell wall consists of linear chains of alternating NAG and NAM linked by β (1 – 4) linkage.

**19. (a)** **20. (d)**

**21. (a)** A – II; B – I; C – IV; D – III

**22. (a)**

**23. (a)** All the given statements about algae are correct.

**24. (a)** Yeast being a unicellular fungus does not show filamentous nature. It is a microscopic fungus consisting of a single oval cell that reproduces by budding.

**25. (c)** Virus is a small infectious agent that replicates only inside the living cells of other organisms. Viruses can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea. Viruses can pass through bacterial proof filters as they are smaller than bacteria.

**26. (b)** Cyanobacteria are photosynthetic (containing a blue photosynthetic and chemosynthetic pigment) autotrophs. They are prokaryotic and represent the earliest known form of life on the Earth.

## Type B : Assertion Reason Questions

**27. (a)** Virus is a small infectious agent that can only replicate inside the cells of another organism. Viruses are not considered as organisms as they have no independent machinery.

**28. (e)** Bacteria are microscopic organisms whose single cells have neither a membrane enclosed nucleus nor other membrane enclosed orgnelles like mitochondria and chloroplast. Bacteria possess various forms and shapes like coccus (round), *bacillus* (rod shaped), *vibrio* (comma shaped) and *spirullum* (spiral like cork screw).

**29. (c)** Aflatoxin, produced by *Aspergillus flavus*, is a carcinogenic fungal toxin. The conidia not only causes allergies in human beings but also causes death of birds.

**30. (b)** *E. coli*, *Shigella sp.* and *Salmonella sp.* causes diarrhoea. It is due to intake of contaminated water.

**31. (a)** Gram negative bacteria contain lipopolysaccharide in its membrane.

**32. (d)** *Neurospora* belongs to class ascomycetes in which ascospores are produced in sac like asci . *Neurospora* is commonly called as pink or red bread mould. It can be grown easily in laboratory conditions so, used in genetics experiments.

**33. (b)** Chemoautotrophs developed the ability to synthesize organic molecules from inorganic raw materials. Chlorophyll pigments are present in photoautotrophs. The photo-autotrophs utilize the solar energy absorbed by them in synthesizing organic compounds. Certain chemo-autotrophs include green sulphur bacteria.

**34. (b)** In TMV, the chromosome consists of single stranded, linear RNA molecule coiled into a regular spiral. TMV causes mosaic disease in tobacco and some other plants.

Chapter 3

# Plant Kingdom

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Meiosis in *Dryopteris* takes place during ***[1997]***
(a) spore formation
(b) gametic formation
(c) spore germination
(d) zygote formation

**2.** Sometimes a ladder like structure in *Spirogyra* is formed due to ***[1998]***
(a) lateral conjugation
(b) asexual reproduction
(c) scalariform conjugation
(d) direct conjugation

**3.** In which group of the following would you place the plants having vascular tissue and lacking seeds? ***[1998]***
(a) Algae (b) Fungi
(c) Bryophytes (d) Pteridophytes

**4.** Largest ovule in plant kingdom are found in
(a) *Pinus* (b) *Cycas* ***[1998]***
(c) *Thuja* (d) *Gnetum*

**5.** Plant material, which is used in culture medium is obtained from ***[1998]***
(a) *Cycas* (b) coconut milk
(c) *Pinus* (d) mango

**6.** Which is a saprophytic angiosperm? ***[1998]***
(a) *Cuscuta* (b) *Neottia*
(c) *Agaricus* (d) Yeast

**7.** Bryophytes do not possess ***[1999]***
(a) vascular tissue
(b) gametophyte
(c) alternation of generation
(d) spores

**8.** The heart shaped fern prothallus is ***[1999]***
(a) gametophyte (b) sporophyte
(c) saprophyte (d) gamete

**9.** In *Dryopteris*, the opening mechanism of sporangium is effectively operated by ***[1999]***
(a) stalk (b) stomium
(c) annulus (d) peristome

**10.** 13 celled male gametophyte of *Selaginella* has ***[2000]***
(a) 12 cells of antheridium + 1 prothallial cell
(b) 10 cells of antheridium + 3 prothallial cell
(c) 9 cells of antheridium + 4 prothallial cell
(d) 8 cells of antheridium + 6 prothallial cell

**11.** Which of the following is found in algal zone of *Cycas* coralloid roots? ***[2000]***
(a) Blue green algae (b) Red algae
(c) Diatoms (d) Brown algae

**12.** Sex organs in *Funaria* develop ***[2001]***
(a) in protonema.
(b) outside capsule.
(c) in the axil of leaf.
(d) at the tip of gametophore.

**13.** In which portion of *Cycas* diploxylic vascular bundles are found ? ***[2001]***
(a) Root (b) Stem
(c) Leaflet (d) Rachis and leaflet

**14.** *Funaria* gametophyte is ***[2001]***
(a) dioecious
(b) heteroecious
(c) autoecious
(d) monoecious and autoecious

**15.** Sometimes, the fern plant arises from fern prothallus without fertilization. This is an example of ***[2001]***
(a) apospory (b) apogamy
(c) parthenocarpy (d) gametogenesis

**16.** Zygospore of *Spirogyra* at the time of meiosis is divided into 4 nuclei. How many nuclei degenerate out of these four ? ***[2001]***
(a) One (b) Two
(c) Three (d) Four

**17.** *Cycas* is **[2001]**
(a) monoecious (b) bisexual
(c) dioecious (d) hermaphrodite

**18.** The drug bellodona is obtained from **[2001]**
(a) *Atropa* (b) *Opium*
(c) *Rauwolfia* (d) *Solanum*

**19.** Algae are useful because they **[2002]**
(a) purify the atmosphere
(b) are large in number
(c) are used in fermentation
(d) are used to study respiration

**20.** The plant body of *Funaria* is **[2002]**
(a) sporophyte
(b) gametophyte
(c) predominantly sporophyte with independent gametophyte
(d) predominantly gametophyte with dependent sporophyte.

**21.** Elaters help in dispersal of spores of **[2002]**
(a) *Riccia* (b) *Marchantia*
(c) *Dryopteris* (d) *Funaria*

**22.** The nature of megasporophyll of *Cycas* is similar to **[2002]**
(a) stamen (b) carpel
(c) sepal (d) petal

**23.** Which of the following helps in respiration of lichens? **[2002]**
(a) Isidia (b) Soredia
(c) Cyphella (d) Cephalodia

**24.** In *Ulothrix*, meiosis takes place in **[2004]**
(a) cells of the filament
(b) holdfast
(c) zygote
(d) zoospores

**25.** Mosses and ferns are found in moist and shady places because both **[2004]**
(a) require presence of water for fertilization.
(b) do not need sunlight for photosynthesis.
(c) depend for their nutrition on micro-organisms which can survive only at low temperature.
(d) cannot compete with sun-loving plants.

**26.** In the following table identify the correct matching of the crop, its disease and the corresponding pathogen **[2006]**

| | Crop | Disease | Pathogen |
|---|---|---|---|
| (a) | *Citrus* | Canker | *Pseudomonas rubrilineans* |
| (b) | Potato | Late blight | *Fusarium udum* |
| (c) | Brinjal | Root-knot | *Meloidogyne incognita* |
| (d) | Pigeon pea | Seed gall | *Phytophthora infestans* |

**27.** Plants of which one of the following groups of genera are pollinated by the same agency?
(a) *Triticum, Cocos, Mangifera* **[2006]**
(b) *Ficus, Kigelia, Casuarina*
(c) *Salvia, Morus, Euphorbia*
(d) *Bombax, Butea, Bauhinia*

**28.** Which of the following match is correct? **[2007]**

| | Disease | Pathogen |
|---|---|---|
| (a) | Wilt disease | *Synchytrium* |
| (b) | Citrus canker | *Xanthomonas* |
| (c) | Red rot of sugarane | *Ustilago* |
| (d) | Powdery mildew | *Fusarium* |

**29.** People recovering from long illness are often advised to include the alga *Spirulina in* their diet because it **[2003, 2008]**
(a) makes the food easy to digest.
(b) is rich in proteins.
(c) has antibiotic properties.
(d) restores the intestinal microflora.

**30.** Botanical name of Sanjeevani is **[2009]**
(a) *Selaginella chrysocaulos*
(b) *Selaginella bryopteris*
(c) *Selaginella chrysorhizos*
(d) None of the above

**31.** In *Pinus*, the third tier of embryonal cells from below is known as **[2009]**
(a) rosette tier (b) suspensor tier
(c) embryonal tier (d) free-nuclear tier

**32.** Which of the following is found in algal zone of *Cycas* coralloid roots? **[2007, 2011]**
(a) Blue green algae (b) Red algae
(c) Diatoms (d) Brown algae

**33.** Which among the following is a rootless plant? ***[2007, 2011]***
(a) *Nymphaea* (b) *Sagittaria*
(c) *Ceratophyllum* (d) *Vallisneria*

**34.** Sporocarp is a reproductive structure of
(a) Some algae ***[2012]***
(b) Some aquatic ferns having sori
(c) Angiosperms having spores
(d) Bryophytes

**35.** Coralloid roots of *Cycas* is distinguished from angiosperm roots by ***[2013]***
(a) absence of pith
(b) having xylem tissue
(c) absence of algal zone
(d) presence of algal zone

**36.** If the cells of root in wheat plant have 42 chromosomes, then the no. of chromosome in the cell of pollen grain is ***[2014]***
(a) 14 (b) 21
(c) 28 (d) 42

**37.** Match the following

| | **Column-I (Classes)** | | **Column-II (Examples)** |
|---|---|---|---|
| A. | Psilotopsida | I. | *Dryopteris, Pteris, Adiantum* |
| B. | Lycopsida | II. | *Equisetum* |
| C. | Sphenopsida | III. | *Selaginella* |
| D. | Pteropsida | IV. | *Lycopodium* |
| | | V. | *Psilotum* |

***(2016)***
(a) A – V; B – III; C – II; D – I
(b) A – I; B – II; C – III; D – IV
(c) A – IV; B – III; C – II; D – I
(d) A – III; B – V; C – I; D – II

**38.** Consider the following statements regarding the major pigments and stored food in the different groups of algae and choose the correct option
(i) In chlorophyceae, the stored food material is starch and the major pigments are chlorophyll-*a* and *d*.
(ii) In phaeophyceae, laminarian is the stored food and major pigments are chlorophyll-*a* and *b*.
(iii) In rhodophyceae, floridean starch is the stored food and the major pigments are chlorophyll-*a*, *d* and phycoerythrin. ***[2017]***
(a) (i) is correct, but (ii) and (iii) are incorrect
(b) (i) and (ii) are correct, but (iii) is incorrect
(c) (i) and (iii) are correct, but (ii) is incorrect
(d) (iii) is correct, but (i) and (ii) are incorrect

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 39-43) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**39.** **Assertion :** Mosses are evolved from algae.
**Reason :** Protonema of mosses is similar to some green algae. ***[2001]***

**40.** **Assertion :** Coconut tree is distributed in coastal areas over a large part of the world.
**Reason :** Coconut fruit can float and get dispersed over thousands of kilometers before losing viability. ***[2004]***

**41.** **Assertion :** The fungi are widespread in distribution and they even live on or inside other plants and animals.
**Reason :** Fungi are able to grow anywhere on land, water or on other organisms because they have a variety of pigments, including chlorophyll, carotenoids, fucoxanthin and phycoerythrin. ***[2005]***

**42.** **Assertion :** Algae and fungi are classified as thallophytes.
**Reason :** They both are autotrophs. ***[2007]***

**43.** **Assertion :** Conifer trees produce a large quantity of wind borne pollen grains.

**Reason :** The pollen grains have wings. ***[2007]***

**Directions for (Qs. 44-46) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**44.** **Assertion :** Red algae contributes in producing coral reefs. ***[2004, 2011]***

**Reason :** Some red algae secrete and deposit calcium carbonate over their walls.

**45.** **Assertion:** The peristome is a fringe of teeth-like projections found at the mouth of the capsule. ***[2004, 2011]***

**Reason:** It may be of two types nematodontous and orthodontus.

**46.** **Assertion :** Members of phaeophyceae vary in colour from olive green to various shades of brown

**Reason :** Phaeophceae possess chlorophyll a, c, carotenoids and xanthophysis. ***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (a)** In sporangium,

Spore mother cell (2n) $\xrightarrow{\text{Meiosis}}$ spores (n) $\xrightarrow{\text{dispersed by}}$ germination $\longrightarrow$ Prothallus(n) $\longrightarrow$ gamete fusion $\longrightarrow$ zygote $\longrightarrow$ Main plant body (2n).

**2. (c)** **Conjugation** is exchange of genetic material *i.e.* mode of sexual reproduction in lower organisms. Conjugation occurs by two methods–

**(i) Scalariform conjugation**

It takes place during the night and between the recently divided cells of the conjugating participating filaments. Opposite cells of two filaments develop conjugation tube by lying side by side and parallel to each other. The conjugation tube between two filament looks like a ladder, through which gamete from one gametangia passes through to fuse with the passive gamete of another filament.

**(ii) Lateral conjugation**

Two adjacent cells of same filament function as male and female cells. It is commonly reported in *S. affinis* and *S. fenuissima*.

**3. (d)** Pteridophytes are seedless vascular plants. They are also called vascular cryptogams as they possess xylem and phloem.

**4. (b)** Largest ovule in plant kingdom is found in *Cycas*. Female cone consists of megasporophylls. Each megasporophyll bears 2-12 reddish ovules in the middle fertile part. Ovules of *Cycas* are the largest, 6-7 cm in diameter. The sperms of *Cycas* are also the largest (300 µm) in the biological world.

**5. (b)** Coconut milk is rich in compounds chemically similar to cytokinin and promote callus growth by inducing cell division.

**6. (b)** *Neottia* grows on soil rich humus. It has an underground stem with a cluster of roots. The roots are associated with endotrophic mycorrhiza. The fungus absorbs its food from humus and the cortical cells of the roots of *Neottia* absorb food from humus. *Neottia* is actually a parasite on fungus.

**7. (a)** Bryophytes are terrestrial plants found in moist places and shady localities .They are rightly called the amphibians of the plant kingdom .Since fertilization does not occur without water. Being in moist places, water and mineral salts are being absorbed by rhizoids that have the main function of fixing the plant. Absorption also occurs due to diffusion. Moreover, these plants are very small. Hence, Bryophytes do not possess the vascular tissue.

**8. (a)** The heart shaped prothallus is the characteristic feature of ferns and mainly belong to polypodiaceae.They show polarity and dorsoventrality. The prothallus contains both the antheridia and archegonia which are embedded in the prothallus. Since it forms the male and female gametes the prothallus is considered as the gametophyte.

**9. (b)** When the capsule of the sporangium in *Dryopteris* matures, about 4 lower median cells of the jacket stretch tangentially. The two median ones identify the place from where the capsule opens. This is called as stomium. The other cells of the jacket develop a thickening . At maturity, the indusium dries exposing the sorus. Due to loss of water in the annulus, the upper walls contract and inner ones straighten, the annulus coils. This feature exerts pressure

on the wall resulting in the breaking of the capsule, between the cells of the stomium, thereby, releasing the spores.

**10. (a)** The structure and development of male gametophyte was described by Slagg (1932). The 13 celled male gametophyte has 12 antheridial cells and one prothallial cell as a result of segmentation. This is to increase the number of biflagellate antherozoids.

**11. (a)** The algal zone consists of blue green algae in the coralloid roots. The relationship is a mutual relationship. The algae get the dwelling place, while *Cycas* can use the food produced by the algae.

**12. (d)** Sex organs in *Funaria* develop at the tip of gametophore since the plant itself constitutes the gametophytic phase. After fertilization develops the capsule from which protonema develops from the spores that dehisces from the capsule. The capsule constitutes the sporophytic phase. The plant shows an alternation of generation, between the sporophytic and gametophytic phase.

**13. (d)** The rachis and leaflet have diploxylic vascular bundles. At the region of the stem cortex, the leaf trace has only centrifugal xylem, hence, it is endarch. These traces enter the leaf as the rachis separates, the centripetal xylem appears and it is in the exarch condition. The leaflet has a single midrib bundle and is in the diploxylic condition.

**14. (d)** *Funaria* is both monoecious and autoecious. The antheridium (male sex organ) are born on different heads of the same plant. Hence, it is both autoecious and monoecious.

**15. (b)** Apogamy is the formation of sporophyte from a gametophytic cell other than egg without fertilization. The prothallus is only a part of gametophytic cell. Hence, the development is apogamy.

**16. (c)** The united protoplasmic mass of two gametes is called zygote or zygospore. Prior to germination, the diploid zygospore nucleus undergoes meiosis and forms four nuclei. Three of the four nuclei degenerate since they are smaller in size. The last cell is bigger and grows using the reserve food substances.

**17. (c)** *Cycas* is dioecious in nature since it produces micro and megaspores in the micro and megasporangia. The micro and megasporangia are born on microsporophyll and megasporophyll respectively.

**18. (a)** *Atropa bellandona* produces the drug belladona. It is an alkaloid which is atropine and hyoscyamine. The leaves and root contain the alkaloid. It is used to cure and relieve pain.

**19. (a)** Algae is a collective term for all those chlorophyll bearing organisms which are thalloid. So, during photosynthesis by taking in $CO_2$ and giving out $O_2$, they purify the atmosphere.

**20. (d)** In the life cycle of *Funaria*, two distinct individuals occur. One of these is haploid and is independent leafy plant. The other is diploid, leafless sporogonium. It is partially dependent on the leafy gametophyte for its nutrition.

**21. (b)** The diploid bispiral elaters are hygroscopic and they help in the dispersal of spores.

**22. (b)** Megasporophyll of *Cycas* bears ovules similar to carpel.

**23. (c)** Cyphella are aerating organs in the form of organised breaks, which occur in the lower cortex and appear as concave circular depression where white medulla is exposed.

**24. (c)** *Ulothrix* being an haploid organism, shows zygotic meiosis. Zygote is the only diploid structure which undergoes meiosis to form four cells. Each develops into *Ulothrix*.

**25. (a)** Mosses and ferns are called the amphibians of plants which are land plants but require a film of water for antherozoids to reach archegonium.

**26. (c)** Root knot/root gall in brinjal is caused by nematode *Meloidogyne incognita*.

**27. (c)** *Salvia*, *Morus*, *Euphorbia* are pollinated by insects (entomophily).

**28. (b)** Citrus canker is the disease caused by an aerobic, rod shaped bacterium, *Xanthomonas citri.*

**29. (b)** Some dieters say that blue green algae helps satisfy appetite and supplies good nutrition while dieting. Some dieters say that blue-green algae *Spirulina*, a well-known example, is a group of 1,500 species of microscopic aquatic plants. The two most common species used for human consumption are *Spirulina maxima* and *Spirulina platensis.* Spirulina is particularly rich in protein and also contains carotenoids, vitamins, minerals, and essential fatty acids. Blue-green algae (*Spirulina*) is a concentrated source of nutrients compared to most foods, but it is expensive compared to other supplemental sources of protein, vitamins, and minerals.

**30. (b)** *Selaginella bryopteris* (L.), popularly known as Sanjeevani, is a plant with medicinal properties. Sanjeevani grows on the hills of tropical areas, particularly the Arawali mountain terrains from east to west in India. Traditionally plants have been used to: (i) relief from heat stroke and the burning sensation during urination; (ii) restorating menstrual irregularities to normal and applied topically to pregnant women, aids easy delivery; and (iii) for treating jaundice.

**31. (a)** In *Pinus*, the third tier of embryonal cells from below is known as rosette tier. The four lower most cells which are far from the micropolar end are called the embryonal tier. These develop into an embryo. The cells above the embryonal tier called the suspensor tier and the third tier from below is called the rosette tier. The free nuclei tier are formed of 4 nuclei. It is the fourth upper most tier.

**32. (a)** The algal zone consists of blue green algae in the coralloid roots. The relationship is a mutual relationship. The algae get the dwelling place, while cycas can use the food produced by the algae.

**33. (c)** *Nymphaea*, *Sagittaria*, *Ceratophyllum* and *Vallisneria* are hydrophytes which grow in water. *Nymphaea*, *Sagittaria* and *Vallisnaria* are rooted hydrophytes while *Ceratophyllum* is a submerged floating hydrophyte. It remains completely under water but is not rooted in mud. *Ceratophyllum* lacks roots even in embryonic stage.

**34. (b)** Sporocarp is a reproductive structure of some aquatic ferns like *Marsilea*. Sporocarps are functionally and developmentally modified leaf which bears several sori. Each sori consists of sporangia of two types -megasporangia producing simple large female megaspore and microsporangia producing many small male microspore.

**35. (d)** In *Cycas*, coralloid roots are bluish green in colour and have blue-green algae in their cortex. This character distinguishes them from angiosperms.

**36. (b)** Number of chromosome in root cells of wheat plant is

$2n = 42$

$n = \frac{42}{2} = 21$

The number of chromosome in the cell of pollen grain is 21 because pollen grains are haploid (n) in nature.

**37. (a)**

**38. (d)** In chlorophyceae, the stored food material is starch and the major pigments are chlorophyll- *a* and *b*. In phaeophyceae, laminarian is the stored food and major pigments are chlorophyll *a*, *c* and *fucoxanthin.*

## Type B : Assertion Reason Questions

**39.** **(a)** Mosses that belong to the bryophytes have evolved from algae. The fact that protonema has a thallus like body shows that mosses have evolved from algae.

**40.** **(a)** Coconut tree is distributed in coastal areas since it floats on saline water because salt is more denser than freshwater, so it floats.

**41.** **(c)** Fungi lack pigments and are therefore, heterotrophic. The mode of nutrition is either parasitic/saprophytic.

**42.** **(c)** Thallophyte includes plants in which body is not differentiated into root, stem and leaves. Algae and fungi have thallose plant body. Algae are autotrophs *i.e.* they can prepare their own food by *photosynthesis*. while fungi are heterotrophs.

**43.** **(a)** In pinus, a conifer tree, the microspores are produced by microsporogenesis in microsporangium. Each microsporangium has an inner nourishing layer known as tapetum. A large number of dusty and two winged microspores are present. On maturity the microsporangium wall bursts and microspores are released in the air which is called "shower of sulphur."They are dispersed by wind due to presence of wings.

**44.** **(a)** Red algae generally grow attached to rocky stones. Some deep water red algae are calcareous and build up hard stony thalii responsible for the production of lime stones and coral reefs.

**45.** **(b)** The peristome teeth are present at the mouth of capsule. The teeth may be solid cellular tissue or composed only of the thickened portions of the cell walls of adjacent cells. When the teeth of peristome are solid structures composed of bundles of dead cells, it is termed *nematodontous* peristome are solid structures composed of bundles of dead cells, it is termed *nematodyntous* peristome. It is found in polytrichum, *Pogonatum* and *Tetraphis*. If peristome composed of thin, membranous, transversely barred teeth, each tooth is made up of the thickened portions of the cell walls of adjacent cells. Such a peristome is called orthodontous.

**46.** **(a)** Phaeophyceae possesses chlorophyll a, c, carotenoids and xanthophylls. Members of phaeophyceae show variations in colour from olive green to different shades of brown depending upon the amount of xanthophyll pigments.

Chapter

# 4 Animal Kingdom

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Pouched mammals are known as ***[1997]***
(a) prototherians (b) metatherians
(c) eutherians (d) therians

**2.** Sponges capture food with the help of ***[1997]***
(a) pinacocytes (b) choanocytes
(c) trophocytes (d) theocytes

**3.** Chloragogen cells of earthworm are similar to which organ of vertebrates ? ***[1997]***
(a) Liver (b) Lung
(c) Kidney (d) Spleen

**4.** Haemocoel is found in ***[1997]***
(a) *Hydra and Aurelia*
(b) *Taenia and Ascaris*
(c) Cockroach *and Pila*
(d) *Herdmania and Balanoglossus*

**5.** Aquatic reptiles are ***[1997]***
(a) ureotelic
(b) ureotelic on land
(c) ammonotelic
(d) uricotelic in water

**6.** Larva of house-fly lacks ***[1997]***
(a) eyes (b) wings
(c) spiracles (d) none of these

**7.** Single filament of *Nostoc* without mucilage sheath is called as ***[1998]***
(a) colony (b) mycelium
(c) trichome (d) hyphae

**8.** Organisms, attached to substratum generally possess ***[1998]***
(a) radial symmetry
(b) asymmetrical body
(c) single opening of digestive canal
(d) cilia to create water current

**9.** *Hydra* recognizes its prey by ***[1998]***
(a) nematocyst
(b) special organ
(c) chemical stimulus
(d) mechanical stimulus

**10.** The long bones are hollow and connected by air passage. They are characteristic of ***[1998]***
(a) aves (b) mammalia
(c) reptilia (d) sponges

**11.** Aristotle's lantern is found in ***[1998]***
(a) Asteroidea (b) Echinoidea
(c) Holothuroidea (d) Ophiuroidea

**12.** Sympathetic nerves in mammals arise from
(a) sacral region ***[1998]***
(b) cervical region
(c) 3rd, 7th, 9th, 10th cranial nerves
(d) thoracico-lumbar region

**13.** Which of the following statement is true regarding corals ? ***[1999]***
(a) Form branch colonies.
(b) Solitary or colonial.
(c) Grow as massive bodies.
(d) All of the above

**14.** Water current in *Leucosolenia* is produced by ***[1999]***
(a) pinacocytes (b) choanocytes
(c) archaeocytes (d) collencytes

**15.** Which is the example of platyhelminthes ? ***[1999]***
(a) *Entamoeba* (b) *Plasmodium*
(c) *Wuchereria* (d) *Schistosoma*

**16.** Paired spermathecae occur in *Pheretima* in which of the following segments ? ***[1999]***
(a) 4, 5, 6, 7 (b) 5, 6, 7, 8
(c) 6, 7, 8, 9 (d) 3, 4, 5, 6

**17.** Weberian ossicles are found in ***[1999]***
(a) frog (b) snakes
(c) fishes (d) birds

**18.** The vertebrae in birds are mostly ***[1999]***
(a) procoelous (b) heterocoelous
(c) amphicoelous (d) acoelous

**19.** Basket star belongs to class ***[1999]***
(a) Ophiuroidea (b) Echinoidea
(c) Crinoidea (d) Asteroidea

**20.** The egg case in female cockroach is formed by secretion of ***[2000]***
(a) collaterial gland (b) mushroom gland
(c) conglobate gland (d) prothoracic gland

**21.** Power of regeneration in sponges is due to ***[2000]***
(a) theocytes (b) archaeocytes
(c) amoebocytes (d) sclerocytes

**22.** The poisonous fluid present in nematocyst of *Hydra* is ***[2000]***
(a) toxin (b) venom
(c) hematin (d) hypnotoxin

**23.** Life cycle of *Taenia* is ***[2000]***
(a) monogenetic (b) digenetic
(c) polygenetic (d) hexogenetic

**24.** Pigment haemocyanin is found in ***[2000]***
(a) chordata (b) annelida
(c) porifera (d) mollusca

**25.** *Antedon* belongs to which of the following class? ***[2000]***
(a) Asteroidea (b) Ophiuroidea
(c) Crinoidea (d) Echinoidea

**26.** Scales in Chondrichthyes are ***[2000]***
(a) placoid (b) ctenoid
(c) cycloid (d) all of these

**27.** Which of the following snake is not poisonous?
(a) *Naja- Naja* (b) *Python* ***[2000]***
(c) *Hydrophis* (d) *Bungarus*

**28.** Birds are ***[2000]***
(a) cold blooded (b) homeothermal
(c) poikilothermal (d) homeopoiesis

**29.** Which of the following substances is at its lowest level in fish food ? ***[2000]***
(a) Actin (b) Myosin
(c) Cholesterol (d) Tissue fluid

**30.** How many ovaries are found in birds ? ***[2000]***
(a) One (b) Two
(c) Three (d) Many

**31.** Gemmule formation in sponges are useful in
(a) asexual reproduction ***[2001]***
(b) sexual reproduction
(c) parthenogenesis
(d) parthenocarpy

**32.** The places of first, second and third moulting of *Ascaris* larva are ***[2002]***
(a) soil, alveoli, lung
(b) liver, soil, stomach
(c) soil, lung, liver
(d) soil, intestine, lung

**33.** What is left, when bath sponges dries up?***[2002]***
(a) Spicules (b) Hold fast
(c) Spongin fibres (d) Tentacles

**34.** *Hydra* receives impulses and stimuli through ***[2002]***
(a) nerve cells (b) sensory cells
(c) neuron cell (d) nematocysts

**35.** Which of the following are uricotelic animals?
(a) Rohu, Frog ***[2002]***
(b) Camel, Frog
(c) Lizard, Crow
(d) Eagles, Earthworm

**36.** In *Entamoeba histolytica*, the presence of chromatid bodies is characteristic of ***[2002]***
(a) precystic stage
(b) trophozoite stage
(c) mature binucleate stage
(d) both (a) and (b)

**37.** Just as *Xenopsylla* is a *Yersenia pestis*, so is ***[2003]***
(a) *Glossina palpalis* to *Wuchereria bancrofti*
(b) *Culex* to *Plasmodium falciparum*
(c) *Homo sapiens* to *Taenia solium*
(d) *Phlebotomus* to *Leishmania donovani*

**38.** Which of the following feature is common to leech, cockroach and scorpion? ***[2004]***
(a) Nephridia (b) Ventral nerve cord
(c) Cephalization (d) Antennae

**39.** Which one of the following statements is correct with respect to salt water balance inside the body of living organisms? ***[2005]***
(a) When water is not available camels do not produce urine but store urea in tissues.
(b) Salmon fish excretes lot of stored salt through gill membrane in fresh water.
(c) *Paramecium* discharges concentrated salt solution by contractile vacuoles.
(d) The body fluids of fresh water animals are generally hypotonic to surrounding water.

**40.** Which one of the following groups of structures/organs have similar function? ***[2005]***
(a) Typhlosole in earthworm, intestinal villi in rat and contractile vacuole in *Amoeba*.
(b) Nephridia in earthworm, Malpighian tubules in cockroach and urinary tubules in rat.
(c) Antennae of cockroach, tympanum of frog and clitellum of earthworm.
(d) Incisors of rat, gizzard (proventriculus) of cockroach and tube feet of starfish.

**41.** Which one of the following features is common in silverfish, scorpion, dragonfly and prawn? ***[2005]***
(a) Three pairs of legs and segmented body.
(b) Chitinous cuticle and two pairs of antennae.
(c) Jointed appendages and chitinous exoskeleton.
(d) Cephalothorax and trachae.

**42.** Which one of the following animals is correctly matched with its one characteristic and the taxon? ***[2006]***

| | Animal | Characteristic | Taxon |
|---|---|---|---|
| (a) | Millipede | Ventral nerve cord | Arachnida |
| (b) | Duckbill platypus | Oviparous | Mammalia |
| (c) | Silverfish | Pectoral & Pelvic fins | Chordata |
| (d) | Sea anemone | Triploblastic | Cnidaria |

**43.** All mammals without any exception are characterized by ***[2006]***
(a) viviparity and biconcave red blood cells.
(b) extra-abdominal testes and a four-chambered heart.
(c) heterodont teeth and 12 pairs of cranial nerves.
(d) a muscular diaphragm and milk producing glands.

**44.** Which of the following does not come under the class mammals? ***[2007]***
(a) Flying fox (b) Hedgehog
(c) Manatee (d) Lamprey

**45.** Which one feature is common to leech, cockroach and scorpion? ***[2008]***
(a) Nephridia (b) Ventral nerve cord
(c) Cephalization (d) Antennae

**46.** Based on cellular mechanisms there are two major types of regeneration found in the animals. Which one of the following is the correct example of the type mentioned? ***[2008]***
(a) Morphallaxis - Regeneration of two transversely cut equal pieces of a *Hydra* into two small hydras
(b) Epimorphosis - Replacement of old and dead erythrocytes by the new ones.
(c) Morphallaxis - Healing up of a wound in the skin.
(d) Epimorphosis - Regeneration of crushed and filtered out pieces of a *Planaria* into as many new *Planarians.*

**47.** Which statement best explains why invertebrates regenerate lost tissue more readily than most vertebrates do? ***[2009]***
(a) Invertebrates contain specialized cells that produce the hormones necessary for this process.
(b) Invertebrate cells exhibit a higher degree of uncontrolled cell division than vertebrate cells do.
(c) Invertebrate animals reproduce asexually, but vertebrate animals reproduce sexually.
(d) Invertebrate animals have more undifferentiated cells than vertebrate animals have.

**48.** Which of the following is correctly matched?
(a) Human -Renal portal system ***[2009]***
(b) Earthworm - Closed circulatory system
(c) Cockroach - Nephridia
(d) None of the above

**49.** Which set of terms would most likely be used in a description of the nervous system of chordates? ***[2009]***
(a) Brain, dorsal nerve cord, highly developed receptors
(b) Brain, fused ganglia, ventral nerve cord
(c) No brain, fused ganglia, tympana
(d) No brain, nerve net, modified neurons

**50.** Which one of the following statements is **not** correct? ***[2010]***
(a) All echinoderms are viviparous.
(b) Roundworm has no circulatory system.
(c) In bony fishes, swim bladder is usually present.
(d) In cartilaginous fishes, fertilization is internal.

**51.** Ticks and mites are actually ***[2010]***
(a) arachnids (b) crustaceans
(c) insects (d) myriapods

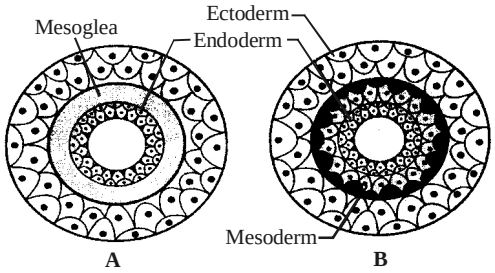
**52.** "Portuguese man of war" is *[2012]*
(a) Soldier of world war I
(b) Portuguese soldier
(c) A sponge
(d) A polymorphic, colonial, coelenterata

**53.** Which are exclusively viviparous ? *[2012]*
(a) Bony fishes
(b) Cartilagenous fishes
(c) Sharks
(d) Whales

**54.** Given are the four matches of phyla with their characteristic cells *[2013]*
A. Coelenterata - Nematocytes
B. Porifera - Choanocytes
C. Ctenophora - Solenocytes
D. Platyhelminthes - Nephrocytes
Mark the option that has both correct matches
(a) A and B (b) B and C
(c) C and D (d) B and D

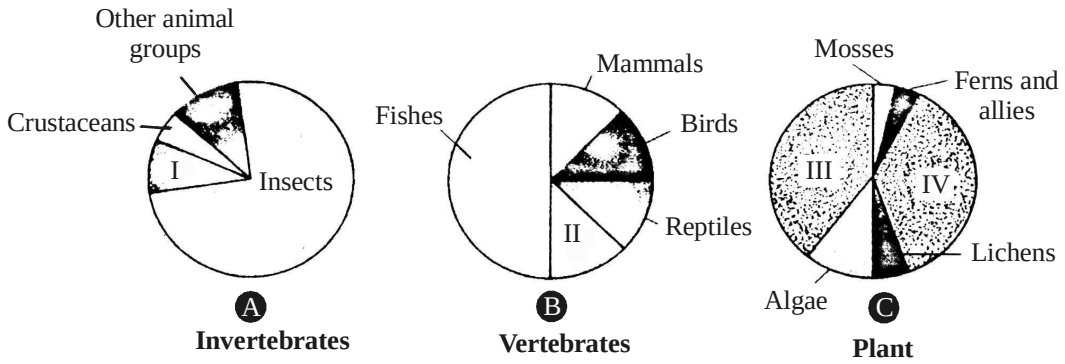
**55.** Cockroaches are brown or black bodied animals that are included in class _____ of phylum _____. *[2014]*
(a) Reptilia; Annelida
(b) Insecta; Arthropoda
(c) Insecta; Annelida
(d) Reptilia; Arthropoda

**56.**




The above diagram shows the germs layer. The animals having structures shown in the figures A and B are respectively called *[2014]*
(a) Diploblastic, Triploblastic
(b) Triploblastic, Diploblastic
(c) Diploblastic, Diploblastic
(d) Triploblastic, Triploblastic

**57.** Given below are pie diagrams A, B and C related to proportionate number of species of major taxa of invertebrates, vertebrates and plants respectively. Critically study and fill in the blanks I, II, III and IV




*[2015]*
(a) I- Molluscs, II-Amphibians, III-Fungi, IV-Angiosperms
(b) I- Molluscs, II-Amphibians, III-Angiosperms, IV-Fungi
(c) I- Hexapoda, II-Amphibians, III-Fungi, IV-Angiosperms
(d) I- Turtles, II-Amphibians, III-Fungi, IV-Angiosperms

**58.** Which of the following statements are true/false?
(i) In Torpedo, the electric organs are capable of generating strong electric shock to paralyze 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 poikilothermic animals.
(v) The most unique mammalian characteristic is the presence of milk producing mammary glands by which the young ones are nourished. ***[2015]***
(a) (i), (ii) and (iii) are true; (iv), (v) are false
(b) (i), (ii) and (v) are true; (iii) and (iv) are false
(c) (i), (iv) and (v) are true; (ii) and (iii) are false
(d) (i), (ii) and (iv) are false; (iii) and (v) are true

**59.** Column-I contains organisms and column-II contains their excretory structures. Choose the correct match form the options given below.

| | **Column- I (Organism)** | | **Column -II (Excretory structures)** |
|---|---|---|---|
| A. | Cockroach | I. | Nephridia |
| B. | Cat fish | II. | Malpighian tubules |
| C. | Earthworm | III. | Kidneys |
| D. | *Balanoglossus* | IV. | Flame cells |
| E. | Flatworm | V. | Proboscis gland |

***[2017]***
(a) A – I; B – III; C – II; D – IV; E – V
(b) A – III; B – I; C – II; D – V; E – IV
(c) A – II; B – I; C – III; D – V; E – IV
(d) A – II; B – III; C – I; D – V; E – IV

**60.** In which one of the following the genus name, its two characters and phylum are not correctly matched ?

| | **Genus name** | **Two characters** | **Phylum** |
|---|---|---|---|
| (a) | Pila | (i) Body segmented<br>Mouth with radula | Mollusca |
| (b) | Asterias | (ii) Spiny skinned<br>Water vascular system | Echinodermata |
| (c) | Sycon | (iii) Pore bearing<br>Canal system | Porifera |
| (d) | Periplaneta | (iv) Jointed appendages<br>Chitinous exoskeleton | Arthropoda |

***[2017]***

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 61-69) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**61.** **Assertion :** Cold blooded animals do not have fat layer.
**Reason :** Cold blooded animals use their fat for metabolic process during hibernation. ***[1997]***

**62.** **Assertion :** Birds have one ovary.
**Reason :** This reduces the body weight for flight. ***[1999]***

**63.** **Assertion:** Lateral line system is found in fishes and aquatic larval amphibians.
**Reason:** Lateral line system has receptor of sensory cells derived from ectoderm. ***[2002]***

**64.** **Assertion :** Bats and whales are classified as mammals.
**Reason :** Bats and whales have four-chambered heart. ***[2003]***

**65.** **Assertion :** Holoblastic cleavage with almost equal sized blastomeres is a characteristic of placental animals.
**Reason :** Eggs of most mammals, including humans, are of centrolecithal type. ***[2003]***

**66.** **Assertion :** All birds, except the ones like koel (cuckoo) build nests for retiring and taking rest during night time (day time for nocturnal).
**Reason :** Koel lays its eggs in the nests of tailor bird. ***[2003]***

**67.** **Assertion :** The honey bee queen copulates only ones in her life time.
**Reason :** The honey bee queen can lay fertilized as well as unfertilized eggs. ***[2004]***

**68.** **Assertion** : Torsion can be seen in ctendium.
**Reason** : Ctenidium acts as the respiratory organ. ***[2007]***

**69.** **Assertion :** Tapeworm, roundworm and pinworm are endoparasites of human intestine.
**Reason :** Improperly cooked food is the source of intestinal infections. ***[2004, 2008]***

**Directions for (Qs. 70-76) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**70.** **Assertion :** Sponges have body organization of "cellular level".
**Reason :** There is some physiological division of labour. ***[2009]***

**71.** **Assertion :** Acraniata is a group of organisms which do not have distinct cranium.
**Reason :** It includes small marine forms without head. ***[1997, 2012]***

**72.** **Assertion :** Sponges belong to Porifera.
**Reason :** Sponges have canal system. ***[1998, 2014]***

**73.** **Assertion :** The duck-billed Platypus and the spiny ant-eater, both are egg-laying animals yet they are grouped under mammals.
**Reason :** Both of them have seven cervical vertebrae and 12 pairs of cranial nerves. ***[2005, 2015]***

**74.** **Assertion :** Typhlosole increases the effective area of absorption in the intestine.
**Reason :** Typhlosole, present in the intestine, is the characteristic feature of cockroach. ***[2016]***

**75.** **Assertion :** Ambulacral system plays a major role in locomotion of echinoderm.
**Reason :** Hydraulic pressure of fluid and contraction of muscle of tube feet make possible movement of echinoderm. ***[2010, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Pouched mammals are metatherians or marsupials because their female has a pouch or marsupium containing the teats for rearing the young ones. *e.g.*, Kangaroo and Wallaby.

**2 (b)** Sponges capture food with the help of flagellated cells/collar cells/choanocytes. These cells maintain a flow of water through the body and improves both respiratory and digestive functions, pulling in oxygen and nutrients and allowing a rapid expulsion of $CO_2$ and other waste products.

**3. (a)** Chloragogen cells of earthworm are similar to the liver of vertebrates because of the connection with storage and synthesis of glycogen and fat, deamination and urea formation.

**4. (c)** Presence of haemocoel (a blood filled body cavity) is a characteristic of arthropods and molluscs, *e.g.* cockroach and *Pila*.

**5. (c)** Aquatic reptiles are ammonotelic. Their main excretory product is nitrogenous ammonia. Availability of water makes them ammonotelic.

**6. (b)** Larva of housefly is legless, headless and wingless maggot.

**7. (c)** *Nostoc* is a colonial cyanobacterium. It contains a number of interwined filaments on the periphery, a mucilage filled hollow interior and a dense mucilage covering on the outside.

**8. (a)** The organisms attached to substratum generally possess radial symmetry.

Radial animals are usually sessile, freely floating or weakly swimming.

**9. (c)** *Hydra* recognizes its prey by a chemical stimulus.

**10. (a)** Presence of air passages in the bones (pneumatic bones) is a characteristic of birds.

**11. (b)** Aristotle's lantern is a chewing toothed apparatus in class echinoidea of phylum echinodermata.

**12. (d)** Sympathetic nerves in mammals arise from thoracico–lumbar region. Sympathetic nervous system is represented by a chain of 21 sympathetic ganglion on either side of spinal cord. It receives preganglionic sympathetic fibres from the spinal cord which make these exit along with thoracic and lumbar region.

**13. (b)** Corals belong to class anthozoa which exist as solitary or colonial. Corals is the rock like external skeletons. Coral animals secrete external skeletons of calcium carbonate.

**14. (b)** Water current in *Leucosolenia* is produced by flagellated choanocytes.

**15. (d)** Platyhelminthes are flat worms, *e.g.* blood fluke, *Schistosoma*.

**16. (c)** Four pairs of small spermathecae are present on the intersegmental groove of 5 & 6, 6 & 7, 7 & 8 and 8 & 9 segments. They receive sperms from another worm during copulation.

**17. (c)** Weberian ossicles are the chain of 4 small bones that connect air bladder and internal ear of teleost fishes. They serve to enhance hearing by conducting pressure changes produced by externally originating sound waves from the swim bladder to the ear.

**18. (b)** The vertebrae in birds are of heterocoelous type.

**19. (a)** Basket star (*Astropecten*) belongs to class ophiuroidea of phylum echinoderm.

**20. (a)** A pair of unequal, branched collaterial glands (opening separately into genital chamber) form an egg case ootheca.

**21. (b)** In sponges, archaeocytes are totipotent cells which can transform into sclerocytes, spongocytes or collencytes. They also have a role in nutrient transport and sexual reproduction.

**22. (d)** Penetrant, the largest nematocysts in *Hydra* produce hypnotoxin.

**23. (b)** Life cycle of *Taenia* is digenetic. Their primary host is pig and secondary is man.

**24. (d)** Copper containing pigment, hemocyanin is found in molluscs.

**25. (c)** *Antedon* (sea lily/feather star) is found in the class crinoidea of phylum echinodermata.

**26. (a)** Chondrichthyes have placoid scales and teleosts have cycloid and ctenoid type of scales.

**27. (b)** *Python* is the largest non-poisonous snake.

**28. (b)** Birds are warm blooded/homeothermal animals. Their body temperature is independent of that of their external environment.

**29. (c)** Fish meal has good nutritive value because it contains easily digestive proteins (55 – 77%), minerals (10 – 20%) and moisture (6 – 12%).

**30. (a)** Birds have only one ovary (left) which reduces their body weight. It is an adaptation for flight.

**31. (a)** Gemmule is a type of internal bud formed in sponges to pass the unfavourable season. It is helpful in asexual reproduction.

**32. (a)** The rhabditoid larva moults within egg shell in soil to form second stage rhabditoid (capable of infection). Egg hatches in the intestine, bores through epithelium of intestine to enter the circulatory system and then it reaches alveoli where it moults for the second time. After its 3rd moult, it leaves the lungs through trachea.

**33. (c)** Spongin is an organic horny elastic substance. They are fibres insoluble, chemically inert and resistant to protein digesting enzymes.

**34. (b)** *Hydra* has diffused type of nervous system. It receives stimulus through sensory cells scattered in epitheliomuscular layer.

**35. (c)** Animals excreting uric acid are called uricotelic. It is least toxic and causes least loss of body water, *e.g.* land reptiles, birds *etc.*

**36. (a)** Chromatid bodies are present in the precystic stage in *Entamoeba histolytica.* These bodies disappear as the cyst mature.

**37. (d)** *Phlebotomus* (sand fly) transmits *Leishmania donovani* which causes dum dum fever/kala azar.

**38. (b)** In leech, cockroach and scorpion, double ventral nerve cord is present.

**39. (a)** When water is not available, the camels produce dry faeces and concentrated urine. One of the best sources of metabolic water in camels is oxidation of food in the hump.

**40. (b)** Nephridia in earthworm, malpighian tubules in cockroach and urinary tubules in the rat are excretory in function.

**41. (c)** Silverfish, scorpion, dragonfly and prawn are arthropods. They are characterised by jointed appendages and chitinous exoskeleton.

**42. (b)** Millipede is myriapod, silver fish is insecta and sea anemone is diploblastic.

Duck bill platypus is a small semiaquatic oviparous mammal.

*Ornithorhynchus anatinus*, the Duckbill platypus, is a unique mammal native to Queensland, New South Wales, Victoria, South Australia, and Tasmania. This animal is about the size of a house cat and is covered by thick waterproof hair. It has a beak like a duck, webbed forelimbs for swimming, clawed hind feet for aid in burrowing, a common opening for the reproductive, excretory and digestive systems, and a broad, flat tail. In addition, the males have a single spur on each hind ankle that contains venom, and the females lay eggs.

**43. (d)** Mammals are characterised by muscular diaphragm and milk producing glands.

**44. (d)** A lamprey (sometimes also called as lamprey eel) is a jawless fish that belongs to the class cyclostomata. Lampreys possess toothed funnel-like sucking mouth, having scaleless slimy skin with seven pairs of circular gill slits on each side. They are well known as those species which bore into the flesh of other fish to suck their blood.

**45. (a)** Nephridia are invertebrate organs which function similarly to kidneys. They remove metabolic wastes from an animal's body. They are of two basic types, metanephridia and protonephridia. A metanephridium is a type of excretory gland or nephridium found in annelids, arthropods and molluscs. A protonephridium is a network of dead-end tubules lacking internal openings. The ends are called *flame cells* or *solenocytes*; they functions in osmoregulation.

**46. (a)** Morphallaxis refers to the type of regeneration in which lost body parts are replaced by the remodeling of the remaining tissue. In this type of regeneration, little or no cellular proliferation takes place during the regeneration process. A classic example of an organism that regenerates using this mechanism is the *Hydra*. When a *Hydra* is cut into two pieces, two *Hydra* as will be regenerated, both smaller than the parental *Hydra*. Once regeneration is completed, the two *Hydra* can continue to grow and reach the size of their original parent. Growth requires cellular proliferation but during the regenerative process very little cellular proliferation takes place.

**47. (d)** Invertebrates, animals without a backbone such as an earthworm, are simpler than vertebrates such as a human. Therefore, their cells are not as complex and they may be able to regenerate or grow lost body parts easier than a more complex animal.

**48. (b)** Earthworm has closed circulatory system. The blood circulates in definite walled blood vessels. Renal portal system is characteristic of reptiles. In reptiles, renal portal system brings blood from internal organs to the kidneys because their digestive tract and urinary tract only have cloaca to eliminate wastes. Humans have hepatic portal system that brings all the venous flow from digestive system into the liver. In cockroach, the excretory organs are malpighian tubules not nephridia.

**49. (a)** Chordates are a group of animals such as fish, frogs, snakes, birds, dogs, monkeys and humans. We all have central nervous systems made up of a brain and a dorsal (back) nerve cord. We all have highly developed receptors to detect changes in the environment for us to respond to. Fused ganglia is a primitive brain found in earthworms, tympana are primitive ears found in grasshoppers, and nerve nets are branched nerves without direction found in the *Hydra.*

**50. (a)** The animals of phylum echinodermata are oviparous. They have the ability of regeneration.

**51. (a)** Scorpion, spider, tick and mites comes under class arachnida of phylum arthropoda.

**52. (d)** Portuguese man of war is a polymorphic, colonial coelenterate *Physalia physalis*. It is named so due to its appearance which resembles with portuguese vessels sailing in sea in 15th and 16th centuries

**53. (d)** Whales are exclusively viviparous.

In viviparous animals (majority of mammals including human beings), the zygote develops into a young one inside the body of the female organism. After attaining a certain stage of growth, the young ones are delivered out of the body of the female organism.

**54. (a)** **55. (b)**

**56. (a)** Diploblastic animals have two germinal layers, outer ectoderm and inner endoderm, *e.g.*, Porifera and Coelenterate. Triploblastic animals have three germinal layers – outer ectoderm, middle mesoderm and inner endoderm, *e.g.*, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Molluscs, Echinodermata and Chordata.

**57. (a)**

**58. (c)** The amphibian skin is moist.

**59. (d)**

**60. (a)** Molluscans are soft bodied animals. Their body is unsegmented with a distinct head, muscular foot and visceral hump. In *Pila*, the buccal cavity contains a rasping organ, the radula with transverse rows of teeth.

## Type B : Assertion Reason Questions

**61. (a)** Cold blooded organisms utilize their stored food at the time of hibernation and aestivation.

**62. (a)** Birds have only left ovary which is an adaptation to reduce the weight for flight.

**63. (b)** Lateral line system is made up of sensory cells of ectodermal origin. It is meant for balancing the body while swimming. So, is found in fishes and larval forms of amphibians.

**64. (b)** Bats and whales are classified as mammals. They have milk secreting mammary glands.

Whales and bats are mammals. Whales are warm blooded, breath air through lungs and give birth to live young that are suckled on milk secreted from the mother's mammary glands. Bats have hair, give birth to live young and feed these young on milk produced in mammary glands. They are the only true flying mammals and are so unique that they have been placed in an order of their own chiroptera. 4-chambered hearts in mammals and birds keep fully oxgenated.

**65. (c)** Cleavage in placental mammals is holoblastic because of microlecithal eggs.

**66. (c)** Koel (*Eudynemis*) lays eggs in crow's nest for incubation and rearing.

**67. (a)** Honey bee queen copulates only once in her life span (nupital flight) and stores all the sperms in her seminal receptacles. It depends on her whether she releases sperms while laying eggs or not, so there are both fertilized and unfertilized eggs.

**68. (b)** Ctenidium is a gill situated on the right side of the branchial chamber. It helps in respiration by beating cilia. During development, ctenidium shifts from left side to right side which is called "torison". It is characteristic feature of gastropods.

**69. (b)** Tapeworm, roundworm & pinworm are all endoparasites. The main cause of the intestinal infection is improperly cooked food. However, tapeworm infection occur by eating improperly cooked food, roundworm is transmitted by contaminated food & water and pinworm or ringworm is transmitted through food or improper sanitary condition.

**70. (b)** Sponges are multicellular but they have cellular level of body organization *i.e.*, true tissue, movable parts, or appendages are not formed. Although, there is some physiological division of labour, accompanied with structural differentiation amongst body cells. But here, similar cells are arranged neither in permanent layer nor masses to form tissues.

**71. (b)** Cephalochordates and urochordates are acraniates. These are marine animals without cranium, jaws, vertebral column and paired appendages. Notochord is present and they are less developed than crainates.

**72. (b)** Sponges belong to Porifera and they have characteristic canal system.

**73. (b)** Both duck billed platypus and spiny ant eaters are mammals because of their constant body temperature and presence of diaphragm.

**74. (d)** Typhlosole is the characteristic feature of earthworm. It can be defined as an extra flap of tissue or an infolding along the inner wall of intestine. The typhlosole in earthworm increases the surface area of the intestine for efficient secretion and absorption during digestion.

**75. (a)** The water vascular system is a unique organ system that functions in locomotion, feeding, respiration and excretion. Ambulacral canal is connected to outside through external tube feet. Hydraulic pressure of fluid and contraction of muscle of tube feet make possible movement of Echinoderm.

Chapter

# 5 Morphology of Flowering Plants

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Fern character of *Cycas* is ***[1997]***
(a) coralloid root
(b) tap root
(c) parallel venation
(d) circinate venation

**2.** The desert plants in order to tolerate water stress show ***[1997]***
(a) sunken stomata
(b) reduced leaves
(c) well developed root system
(d) all of these

**3.** Perisperm is ***[1997]***
(a) remnant of endosperm
(b) persistant nucellus
(c) remnant of embryo
(d) part of endosperm

**4.** In moss capsule, the number of peristome whorls are ***[1998]***
(a) 1 (b) 2
(c) 3 (d) 4

**5.** A mature ligule, having a prominent basal portion, is called ***[1998]***
(a) glossopodium (b) rhizophore
(c) trichome (d) None of these

**6.** Inflorescence of *Ficus* is ***[1999]***
(a) spike (b) hypanthodium
(c) raceme (d) verticillaster

**7.** The edible part of cauliflower is ***[2000]***
(a) inflorescence (b) leaf
(c) flower (d) stem

**8.** Most reduced form of stem is found in ***[2000]***
(a) bulb (b) rhizome
(c) tree (d) stem

**9.** In *Opuntia*, spines are modification of ***[2000]***
(a) stem (b) root
(c) leaf (d) flower

**10.** Clove is ***[2001]***
(a) flower bud (b) axillary bud
(c) thalamus (d) ovule

**11.** Pollinia are found in ***[2001]***
(a) wheat (b) madar
(c) mango (d) banana

**12.** Monocarpic plants flower ***[2001]***
(a) once (b) twice
(c) many times (d) never

**13.** Nodules with nitrogen fixing bacteria are found in ***[2001]***
(a) cotton (b) gram
(c) mustard (d) wheat

**14.** In which family (9) + 1 androecium condition is found ? ***[2001]***
(a) Malvaceae (b) Papilionaceae
(c) Solanaceae (d) Poaceae

**15.** Which of following type of anther is found in Malvaceae? ***[2002]***
(a) Monothecous (b) Dithecous
(c) Polythecous (d) Without thecous

**16.** Potato and sweet potato ***[2004]***
(a) have edible parts which are homologous organs.
(b) have edible parts which are analogous organs.
(c) have been introduced in India from the same place.
(d) are two species of the same genus.

**17.** The sugarcane plant has ***[2004]***
(a) dumb-bell shaped guard cells
(b) pentamerous flowers
(c) reticulate venation
(d) capsular fruits

**18.** The family containing mustard and its main characters are ***[2005]***
(a) Brassicaceae - Tetramerous flowers, six stamens, bicarpellary gynoecium, siliqua type fruit
(b) Brassicaceae - Pentamerous flowers, many stamens, pentacarpellary gynoecium, capsule type fruit
(c) Solanaceae - Pentamerous flowers, five stamens, bicarpellary gynoecium, berry type fruit
(d) Poaceae - Trimerous flowers, three stamens, monocarpellary gynoecium, caryopsis type of fruit

**19.** Velamen present in orchids help in ***[2007]***
(a) absorbing water from support
(b) respiration
(c) absorption of moisture from air
(d) synthesizing food

**20.** Composite fruit develops from ***[2007]***
(a) single ovary (b) inflorescence
(c) apocarpous ovary (d) pericarp

**21.** If the anthers are fused together forming a tubular structure while the filaments remain free, the condition is found in which one of the following family? ***[2009]***
(a) Malvaceae (b) Cucurbitaceae
(c) Solanaceae (d) Asteraceae

**22.** Floral diagram fails to indicate ***[2009]***
(a) epiphylly and epipetaly
(b) aestivation and placentation
(c) position of ovary on the thalamus
(d) cohesion of carpels and stamens

**23.** Aggregate fruit develops from ***[2009]***
(a) syncarpous ovary
(b) multicarpellary, syncarpous ovary
(c) unilocular ovary
(d) multicarpellary, apocarpous ovary

**24.** The presence of cilia, an oral groove, and food vacuoles, and the absence of chloroplasts in a unicellular organism indicate that the organism carries on ***[2009]***
(a) sexual reproduction
(b) autotrophic nutrition
(c) extracellular digestion
(d) heterotrophic nutrition

**25.** Of the following, which instrument is most commonly used to observe the external features of a grasshopper's abdomen? ***[2009]***
(a) Ultracentrifuge
(b) Microdissection instrument
(c) Dissecting microscope
(d) Electron microscope

**26.** In a bisexual flower, if androecium and gynoecium mature at different times, the phenomenon is known as a ***[2010]***
(a) dichogamy (b) herkogamy
(c) heterogamy (d) monogamy

**27.** Which of following type of anther is found in Malvaceae? ***[2011]***
(a) Monothecous (b) Dithecous
(c) Polythecous (d) Without thecous

**28.** Parachute type dispersal occurs in ***[2011]***
(a) tomato (b) mustard
(c) pea (d) cotton

**29.** Prickles of rose are ***[2012]***
(a) Modified leaves
(b) Modified stipules
(c) Exogenous in origin
(d) Endogenous in origin

**30.** Which of the following are not characteristic features of fabaceae? ***[2013]***
(a) Tap root system, compound leaves and raceme inflorescence.
(b) Flowers actinomorphic, twisted aestivation and gamopetalous.
(c) Stamens 10, introrse, basifixed, dithecous.
(d) Monocarpellary, ovary superior and bent stigma.

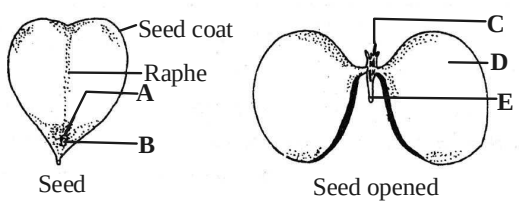
**31.** Which one of the following is correctly matched? ***[2014]***
(a) Onion – Bulb
(b) Ginger – Sucker
(c) *Chlamydomonas* – Conidia
(d) Yeast – Zoospores

**32.** Read the following statements.
(i) Gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level.

(ii) Ovary is half-inferior.
(iii) Examples are plum, rose and peach.
Which condition of flowers is being described by the above statements ? ***[2014]***

(a) Hypogyny (b) Perigyny
(c) Epigyny (d) None of these

**33.** Which one of the option is correct?




***[2015]***

(a) A - Hilum, B - Micropyle, C - Radicle, D - Cotyledon, E - Plumule
(b) A - Hilum, B - Micropyle, C - Plumule, D - Cotyledon, E - Radicle
(c) A - Micropyle, B - Hilum, C - Plumule, D - Cotyledon, E - Radicle
(d) A - Hilum, B - Micropyle, C - Plumule, D - Radicle, E - Cotyledon

**34.** Seeds are adaptively important because ***[2015]***

1. they maintain dormancy
2. they protect young plants during vulnerable stages
3. they store food for young plants, and facilitate dispersal

(a) 1 and 3 (b) 2 and 3
(c) 1 and 2 (d) All of these

**35.** Match the following-

| List-I | | List-II |
|---|---|---|
| A. Coleorhiza | I. | Development of sporophyte directly from gametophyte without intervention of gametes |
| B. Apogamy | II. | Development of gametophyte directly from sporophyte without the involvement of reduction division. |
| C. Indusium | III. | An unbranched columnar stem with a crown of leaves. |
| D. Caudex | IV. | Protective covering of radicle |
| | V. | Protective structure of a sorus. ***[2016]*** |

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

**36.** Which of the following is a modified stem for the protection of plants from browsing animals?

(a) Tendrils (b) Thorns
(c) Rhizome (d) Tuber

***[2017]***

**37.** Leaves of dicotyledonous plants possess _____ venation, while _____ venation is the characteristic of most monocotyledons. ***[2017]***

(a) reticulate and parallel
(b) parallel and reticulate
(c) reticulate and perpendicular
(d) obliquely and parallel

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 38-40) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**38.** **Assertion :** In hemianatropous ovule, the funicle lies parallel to body of ovule.

**Reason :** Here, body of ovule is rotated by 90°. ***[1999]***

**39.** **Assertion :** Many plants are propagated vegetatively even though they bear seeds.

**Reason :** Potatoes multiply by tubers, apple by cutting etc. ***[2001]***

**40.** **Assertion :** Ginger has a prostrate growing rhizome.

**Reason :** Shoot growth is not effected by gravity. ***[2004]***

**Directions for (Qs. 41-43) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**41.** **Assertion :** In fabaceae family monocarpellary, unilocular ovary is present. ***[2010]***

**Reason :** In fabaceae, placentation is parietal.

**42.** **Assertion :** Apical meristem of root is subterminal.

**Reason :** At the terminal end of root, root cap is present. ***[2014]***

**43.** **Assertion :** A simple leaf has undivided lamina.

**Reason :** Leaves showing pinnate and palmate venation have various types of incisions.

***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** In circinate venation, leaves are coiled when immature and gradually rolled with maturity. This coiling protects the growing point.

**2. (d)** Desert plants have well developed root system so that they can absorb water from the deeper layers of soil. They have sunken stomata and reduced leaves which reduce the rate of water loss through transpiration.

**3. (b)** The nucellus is generally used up during the development of embryo but in some cases it remains outside the endosperm in the form of a thin layer, called perisperm.

**4. (b)** In moss, peristome consists of 32 acellular teeth arranged in 2 whorls, outer hygroscopic and inner hygroscopic.

**5. (a)** Glossopodium is a mature ligule. It is generally present in grasses. The ligule is an outgrowth between leaf base and lamina. Leaves with ligule are called ligulates.

**6. (b)** *Ficus* has hypanthodium type of inflorescence *i.e.* cup shaped, fleshy receptacle bearing flowers on the inner wall of the cavity.

**7. (a)** Cauliflower is a crossbreed between 2 varieties of cabbage. It is evident that the edible part is the inflorescence due to the presence of small florets.

**8. (a)** Bulb has the most reduced form of stem since the stem is discoid in nature – a flattened disc. *e.g. Allium cepa, Allium sativum.*

**9. (c)** In *Opuntia*, the entire leaf is modified into the spine, to reduce water loss due to transpiration as *Opuntia* is a xerophyte.

**10. (a)** The structure of clove itself resembles the bud where we are, infact, able to see the calyx also. Clove that is used as a condiment and spice has more of the medicinal property at the bud stage.

**11. (b)** Pollinia is generally seen in fused anthers. Each anther has pollinia. Madar shows the characteristic feature of pollinia.

**12. (a)** Monocarpic flowers have a single carpel that can mature only once in their life time. Hence, they flower only once.

**13. (b)** Grams are leguminous plants. Nitrogen fixing bacteria is seen in leguminous plants. They convert atmospheric $N_2$ to nitrate that can easily be absorbed by plants.

**14. (b)** In papilionaceae- the androceium is seen in diadelphous condition. 10 stamens are seen in two bundles- 9 + 1. 9 together form one bundle whereas the single stamen forms another bundle.

**15. (a)** The filament of stamen bears one celled anther.

**16. (b)** Potato is the modified underground stem whereas sweet-potato is the modified root for storage of food. These are analogous organs which have different origin but serve the same functions.

**17. (a)** Sugarcane being a monocot plant is characterized by the presence of dumb-bell shaped guard cells. In dicots, guard cells are kidney shaped.

Stomata
Dicot

Stomata
Monocot

**18. (a)** Brassicaceae (cruciferae)

Other members are : Raddish, cabbage, cauliflower.

**Floral formula :**

Ebr, $\oplus$ $\male$, $K_{2+2}$, $C_4$ $A_{2+4}$, $G_{(2)}$

**19. (c)** Orchids are the epiphytes that posses aerial roots. These roots contain a spongy tissue called velamen whose main function is to absorb moisture from the air.

**20. (b)** Composite fruits develop from the complete inflorescence and are also known as multiple fruit. These are of 2 types- sorosis and syconus. Sorosis develops from spike, spadix or catkin inflorescence, *e.g. Ananas, Arto carpus*. Syconus develops from hypanthodium inflorescence, *e.g. Ficus*.

**21. (d)** This condition is called syngenesious. It is found in members of family asteraceae (or compositae), *e.g.*, disc florets of sunflower.

**22. (c)** Floral diagram illustrates the whorls and number of parts in each of the sets of organs comprising a flower. It shows the position of floral parts in relation to mother axis but although position of ovary on the thalamus is not shown by it.

**23. (d)** A muticarpellary ovary may be syncarpous (when carpels are fused) or apocarpous (when the carpels are free). A syncarpous ovary gives rise to a simple fruit while in an apocarpous ovary, each carpel changes into a fruitlet. The collection or aggregate of these fruitlets is known as etaerio.

**24. (d)** Cilia are hair-like bristles on a *Paramecium* used in locomotion and to find food. An oral groove is a mouth for a *Paramecium*, and food vacuoles store food in the cell body of the *Paramecium*. All of these are cell organelles used to ingest, digest, and egest preformed food, which is heterotrophic nutritrion. An autotroph can make its own food using chloroplasts.

**25. (c)** The dissecting microscope allows to view 3D images up to 50x magnification. It is commonly used in dissections. The ultracentrifuge spins liquids and separates the contents by their density, micro-dissection instruments are used to manipulate microscopic organelles (such as transferring nuclei), and electron micro-scopes can magnify an image up to 250,000x and are used to see microscopic details.

**26. (a)** In a bisexual flower, if androecium and gynoecium mature at different times, the phenomenon is known as dichogamy.

**27. (a)** The filament of stamen bears one celled anther.

**28. (b)** Dispersal is a universal biological need. For non-aquatic, terrestrial plants, the wind is an obvious supplier of energy for movement, and many plant adaptations exist that clearly take advantage of this fact. This type of seed dispersal is not efficient, but very effective. Appendages of some fruits & seeds act as parachute like seeds of cotton possess hair that help in dispersal of these seeds. Another well-known example is the dandelion.

**29. (c)** Prickles of rose develop only from cortex and epidermis and found at the nodes or internodes. It helps in climbing. It is exogenous in origin.

**30. (b)**

**31. (a)** Onion - Bulb - Undeground stem , Ginger - Rhizome, *Chlamydomonas* - Zoospore, Yeast - Ascospores

**32. (b)** **33. (b)**

**34. (d)** Seeds perform all the given functions.

**35. (b)**

**36. (b)** Thorn is a stiff, sharp-pointed woody projection on the stem or other part of a plant. Thorns are found in many plants such as *Citrus*, *Bougainvillea*. They protect plants from grazing animals.

**37. (a)** Leaves of dicotyledonous plants possess reticulate venation while parallel venation is the characteristics of most monocotyledonous. In reticulate venation, the main veins of leaf form numerous irregular branches and as a result a net like arrangements is formed. Reticulate

venation is the most common vein formation in leaves. It can be found in the leaves of maple trees, oak trees and rose bushes. In parallel venation, veins are arranged parallel to each other.

## Type B : Assertion Reason Questions

**38. (e)** In hemianatropus ovule, the funicle lies at right angles to the body of the ovule. The body of the ovule is rotated by 90°.

**39. (c)** Plants do propagate more by vegetative means since they multiply faster vegetatively.

**40. (b)** Ginger is an example of rhizome (*e.g.* prostrate stem creeping horizontally under soil surface). There is no effect of gravity. Rhizome of ginger contains nodes, internodes and scaly leaves. Buds are emerges from axils of scaly leaves. Response to light by plants is called phototropism. In this sense, shoot shows positive phototropism and root shows negative phototropism.

**41. (c)** In fabaceae, ovary is present. Placentation is marginal with many ovules.

**42. (a)**

**43. (b)** A leaf having a single or undivided lamina is called simple leaf, the lamina can have different types of incisions, which may reach upto half, more than half or near the base or midrib. Depending upon the pinnate or palmate venation, the incisions are known as pinnatifid, palmatifid, pinnatipartite, palmatipartite, pinnatisect and palmatisect, etc.

Chapter

# 6 Anatomy of Flowering Plants

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** *Cycas* stem shows ***[1997]***
(a) porous wood (b) manoxylic wood
(c) pycnoxylic wood (d) ring porous wood

**2.** Aerenchyma is found in ***[1997]***
(a) parenchyma (b) xylem
(c) phloem (d) sclerenchyma

**3.** Which of the following tissue is absent in vascular bundles of monocot stem ? ***[1997]***
(a) Xylem (b) Phloem
(c) Cambium (d) All of these

**4.** Cork cambium is a ***[1999]***
(a) lateral meristem
(b) apical meristem
(c) intercalary meristem
(d) primitive meristem

**5.** Endodermis is a part of ***[1999]***
(a) cortex (b) pericycle
(c) medulla (d) epidermis

**6.** Lateral root in higher plants arise from ***[1999]***
(a) cortex (b) pericycle
(c) epidermis (d) endodermis

**7.** Cambium of root is an example of ***[2000]***
(a) apical meristem
(b) intercalary meristem
(c) primary meristem
(d) secondary meristem

**8.** Which of the following is enucleate at maturity? ***[2000]***
(a) Companion cell (b) Meristematic cell
(c) Parenchyma (d) Sieve tube cell

**9.** Porous wood contains ***[2001]***
(a) vessels (b) tracheids
(c) fibres (d) parenchyma

**10.** Passage cells are found in ***[2002]***
(a) endodermis (b) pericycle
(c) cortex (d) epiblema

**11.** Fascicular cambium is the cambium of vascular bundle of ***[2002]***
(a) monocot stem (b) dicot stem
(c) monocot leaf (d) dicot leaf

**12.** Mesophyll is usually differentiated in ***[2002]***
(a) monocot leaf (b) isobilateral leaf
(c) dorsiventral leaf (d) both 'a' and 'b'

**13.** In a dicotyledonous stem, the sequence of tissues from the outside to the inside is ***[2003]***
(a) phellem-pericycle-endodermis-phloem
(b) phellem-phloem-endodermis-pericycle
(c) phellem-endodermis-pericycle-phloem
(d) pericycle-phellem-endodermis-phloem

**14.** The quiescent centre in root meristem serves as a
(a) site for storage of food which is utilized during maturation. ***[2003]***
(b) reservoir of growth hormones.
(c) reserve for replenishment of damaged cells of the meristem.
(d) region for absorption of water.

**15.** In a plant organ which is covered by periderm and in which the stomata are absent, some gaseous exchange still takes place through ***[2004]***
(a) aerenchyma (b) trichomes
(c) pneumatophores (d) lenticels

**16.** Companion cells in plants are associated with ***[2004]***
(a) vessels (b) sperms
(c) sieve elements (d) guard cells

**17.** Cork cambium results in the formation of cork which becomes impermeable to water due to the accumulation of ***[2004]***
(a) resins (b) suberin
(c) lignins (d) tannins

**18.** Which one of the following statements pertaining to plant structure is correct? ***[2005]***
(a) Cork lacks stomata but lenticels carry out transpiration.
(b) Passage cells help in transfer of food from cortex to phloem.
(c) Sieve tube elements possess cytoplasm but no nuclei.
(d) The shoot apical meristem has a quiescent centre.

**19.** In which one of the following would you expect to find glyoxysomes ? ***[2005]***
(a) Endosperm of wheat
(b) Endosperm of castor
(c) Palisade cells in leaf
(d) Root hairs

**20.** Grafting is successful in dicots but not in monocots because the dicots have ***[2006]***
(a) vascular bundles arranged in a ring
(b) cambium for secondary growth
(c) vessels with elements arranged end to end
(d) cork cambium

**21.** In the sieve elements, which one of the following is the most likely function of P-proteins? ***[2006]***
(a) Deposition of callose on sieve plates.
(b) Providing energy for active translocation.
(c) Autolytic enzymes.
(d) Sealing mechanism on wounding.

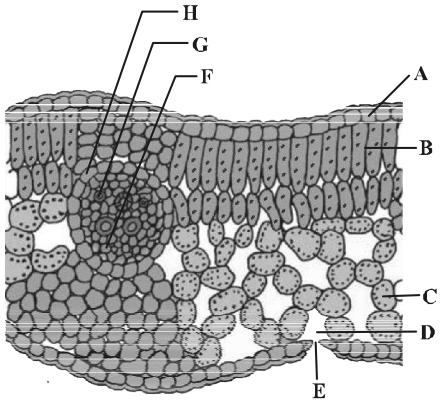
**22.** Two cross-sections of stem and root appear simple, when viewed by naked eye. But under microscope, they can be differentiated by ***[2009]***
(a) exarch condition of root and stem
(b) endarch condition of stem and root
(c) endarch condition of root and exarch condition of stem
(d) endarch condition of stem and exarch condition of root

**23.** If a stem is girdled ***[2012]***
(a) Root dies first
(b) Shoot dies first
(c) Both die together
(d) None of the above would die

**24.** Which of the following statement(s) is/are true?
(A) Uneven thickening of cell wall is characteristic of sclerenchyma. ***[2013]***
(B) Periblem forms cortex of the stem and the root.
(C) Tracheids are the chief water transporting elements in gymnosperms.
(D) Companion cell is devoid of nucleus at maturity.
(E) The Commercial cork is obtained from *Quercus suber*.
(a) A and D only (b) B and E only
(c) C and D only (d) B, C and E only

**25.** Sclerenchyma usually_____ and _____ protoplasts. ***[2014]***
(a) live, without (b) dead, with
(c) live, with (d) dead, without

**26.** T.S. of dicot leaf passing through the midrib is given below, certain parts have been indicated by alphabets. Choose the correct option.




***[2015]***
(a) A – Epidermis, B – Spongy parenchyma, C – Palisade parenchyma, D – Stomata, E – Guard cells, F – Phloem, G – Metaxylem, H – Protoxylem

(b) A – Epidermis, B – Palisade parenchyma, C – Spongy parenchyma, D – Sub-stomatal cavity, E – Stoma, F – Phloem, G – Metaxylem, H – Bundle sheath

(c) A – Epidermis, B – Palisade parenchyma, C – Spongy parenchyma, D – Stomata, E – Guard cells, F – Epidermis, G – Xylem, H – Phloem

(d) A – Epidermis, C – Palisade parenchyma, C – Spongy parenchyma, D – Stomata, E – Guard cells, F – Phloem, G – Metaxylem, H – Protoxylem

**27.** Contractile tissues have the following features

(i) Mesodermal in origin
(ii) They contain stretch receptors.
(iii) Rhythmic contractions are seen in them
(iv) They do not fatigue during the life of the animal

Which of the above are characteristics of sphincters? ***[2015]***

(a) All the four
(b) Only (i), (ii) and (iii)
(c) Only (i), (ii) and (iv)
(d) Only (i), (iii) and (iv)

**28.** Meristematic tissue responsible for increase in girth of tree trunk is ***[2016]***

(a) Apical meristem
(b) Intercalary meristem
(c) Lateral meristem
(d) Phellogen

**29.** In stems, the protoxylem lies towards the _____ and the metaxylem lies towards the _____ of the organ.

(a) centre; periphery
(b) periphery; centre
(c) periphery; periphery
(d) centre; centre ***[2017]***

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 30-38) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**30.** **Assertion :** Thick cuticle is mostly present in disease resistant plants.

**Reason :** Disease causing agents cannot grow on cuticle and cannot invade the cuticle. ***[1997]***

**31.** **Assertion:** Cambium is a lateral meristem and cause growth in width.

**Reason:** Cambium is made up of fusiform and ray initials in stem. ***[1998]***

**32.** **Assertion :** Higher plants have meristematic regions for indefinite growth.

**Reason :** Higher plants have root and shoot apices. ***[1999]***

**33.** **Assertion :** In collateral vascular bundles, phloem is situated towards inner side.

**Reason :** In monocot stem, cambium is present. ***[2000]***

**34.** **Assertion :** Collenchyma is thick walled dead tissue.

**Reason :** Collenchymatous cells show thickenings of pectin. ***[2002]***

**35.** **Assertion:** The two cotyledons in seed are embryonic leaves.

**Reason:** The embryo contains radicle and plumule. ***[2002]***

**36.** **Assertion :** In angiosperms, the conduction of water is more efficient because their xylem has vessels. ***[2006]***

**Reason :** Conduction of water by vessel elements is an active process with energy supplied by xylem parenchyma rich in mitochondria.

**37.** **Assertion :** In woody stems, the amount of heart wood continues to increase year after year.

**Reason :** The cambial activity continues uninterrupted. ***[2007]***

**38.** **Assertion :** Petroplants produce large amount of latex.

**Reason :** The latex contains long chain hydrocarbons. ***[2007]***

**Directions for (Qs. 39-41) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**39.** **Assertion :** Vessels are more efficient for water conduction as compared to tracheids. ***[2010]***

**Reason :** Vessels are dead lignified.

**40.** **Assertion:** Bulliform cells are useful in the unrolling of leaf.

**Reason:** Bulliform leaves store water. ***[2011]***

**41.** **Assertion :** In stem, pericycle take active part in secondary growth.

**Reason :** In dicots, pericycle has the capacity to produce lateral roots. ***[2013]***

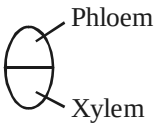
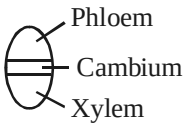
# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** *Cycas* stem shows monoxylic wood with broad parenchymatous rays and often contain abundant resinous cells and resin canals. Towards the periphery of the stem, cycads produce a 'leaf armour' consisting of the tightly packed, helically arranged leaf bases.

**2. (a)** Aerenchyma is the modification of parenchyma tissue in which cells are arranged in such a way that - large air filled spaces are formed. Aerenchyma is found in aquatic plants to produce buoyancy.

**3. (c)**

| **Monocot vascular bundle** | **Dicot vascular bundle** |
|---|---|
|   |   |
| No secondary growth, cambium absent *i.e.* V.B. is closed | secondary growth, V.B. is open. |

**4. (a)** Cork cambium (phellogen) is a secondary lateral meristem which develops from permanent tissues in the region of epidermis, hypodermis, cortex and even in outer layers of phloem.

**5. (a)** Endodermis is the inner most layer of cortex. The cells are characterized by the presence of casparian strips.

**6. (b)** The lateral roots arise from the cell of pericycle and hence, the root branches are said to be endogenous in origin (arising from a layer inner to endodermis). The lateral roots help in absorption of water and mineral salts from the soil. The meristematic cells of the lateral root push through the endodermis and cortex and then pierce through the epidermis to come out to form the lateral root.

**7. (d)** The cambium is secondary in its functional aspect since it forms secondary tissues like the secondary xylem and secondary phloem. It is, however, primary in origin.

**8. (d)** Sieve tube cell is enucleate at maturity due to the degeneration of its nucleus during its developmental process. The companion cell-that develops from the same initial as the sieve tube cell, possesses the nucleus throughout its life. The companion cell carries out the function of the sieve tube cell in the event of its degeneration.

**9. (a)** Porous wood contains vessels, with sieve cells, which contains passages for movement of substances.

**10. (a)** Passage cells are found in endodermis which allow a limited transfer of materials between the cortex and the vascular cylinder.

**11. (b)** In dicot stem, fascicular cambium and interfascicular cambium join to form a complete ring which helps in secondary growth.

**12. (c)** In a dorsiventral leaf, mesophyll is differentiated into two layers *i.e.* palisade parenchyma and spongy parenchyma.

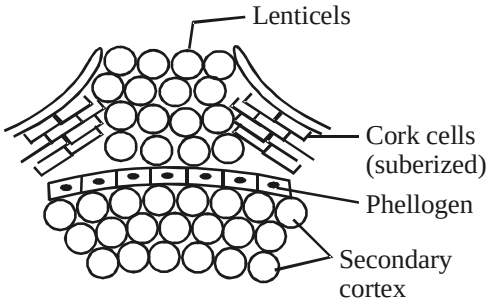
**13. (c)** In a dicotyledonous stem, the sequence of tissues from outside to the inside is phellem-endodermis-pericycle-phloem.

**14. (c)** The concept of Quiescent Centre was proposed by Clowes in 1961. On the basis of autoradiographic studies of DNA synthesis in the root tip of zea, he found a reservoir of cells having low DNA, RNA and protein concentration. He called it as Quiescent Centre. They may or may not divide. It is resistant to damages.

**15. (d)** During secondary growth, where epidermis is replaced by tough and hard periderm, the cracked/ruptured epidermis forms the small holes called lenticels which help in gaseous exchange.

**16.** **(c)** Companion cells are long elongated living cells, that lie on the sides of the sieve tubes in phloem. Companion cells control the activities of the sieve tube through plasmodesmata.

**17.** **(b)** Phellogen produces cork or phellem on the outer side. It consists of dead and compactly arranged rectangular cells that possess suberised cell walls.




**18.** **(c)** Sieve tube elements possess cytoplasm but lack nucleus at maturity. Its metabolic activities are regulated by the nucleus of a closely associated cell called companion cell.

**19.** **(b)** Glyoxysomes are found in the plant cells particularly in the cells of germinating fatty seeds, *e.g.* endosperm of castor.

**20.** **(b)** Grafting is a horticultural technique whereby tissues from one plants are inserted into those of another so that the sets of vascular tissues may join together. Grafting is successful in dicots because vascular bundles are arranged in a ring and have cambium for secondary growth.

**21.** **(a)** In the sieve elements, P-proteins deposit callose on sieve plates.

**22.** **(d)** The cross sections of stem and root appear simple, when viewed by naked eye but under microscope they can be differentiated as endarch condition in stem and exarch condition in root. In endarch, protoxylem is present towards the center of stem while metaxylem towards the pericycle. In the exarch condition, protoxylem is present towards pericycle and metaxylem towards the center of the root.

**23.** **(a)** If a stem is girdled, root dies first, as the food synthesized by leaves is not able to reach to the roots.

**24.** **(d)**

**25.** **(d)** Sclerenchyma consists of long, narrow cells with thick and lignified cell walls having a few or numerous pits. They are usually dead and without protoplasts.

**26.** **(b)** **27.** **(b)** **28.** **(c)**

**29.** **(a)** The first formed primary xylem elements are called protoxylem and the later formed primary xylem is called metaxylem. In stems, the protoxylem lies towards the centre (pith) and the metaxylem lies towards the periphery of the organ. This type of primary xylem is called endarch.

## Type B : Assertion Reason Questions

**30.** **(e)** Plant cuticles are a protective waxy covering produced only by the epidermal cells of leaves, young shoots and all other aerial plant organs. In addition to its function as a permeability barrier for water and other molecules, the micro and nano-structure of the cuticle confer specialized surface properties that prevent contamination of plant tissues with external water, dirt and micro-organisms. The waxy sheet of cuticle also functions in defence, forming a physical barrier that resists penetration by virus particles, bacterial cells, and the spores or growing filaments of fungi.

**31.** **(b)** Fusiform initials are vertically elongated cells that produce xylem and phloem elements. Ray initials are isodiametric and produce parenchymatous rays in secondary xylem and phloem.

**32.** **(a)** The root apex and shoot apex are meristematic in nature. These meristematic tissues are embryonic in origin. They are primary in origin because it develops from embryonic tissues and primary in function

because they form the primary structure of the plant cell, the root apex and shoot apex, that live till the death of the whole plant. Hence, plants have the feature of indefinite growth.

**33. (d)** Collateral vascular bundles have the xylem pointing towards the inner side of the phloem. In the same way in monocots, cambium is absent. Collateral vascular bundles are present in stems and leaves of angiosperms and gymnosperms.

**34. (e)** Collenchyma is made up of living cells with unevenly thickened cell wall. Their cell wall is made up of cellulose and pectin. Collenchyma are present beneath the epidermis of young stem, petioles and midrib of leaves *etc*. These are absent in underground tissues and leaves and stems of monocots.

**35. (b)** During epigeal germination, cotyledons come out of the soil. The green cotyledons function as leaves of the seedling. They manufacture food and sustain the young seedling till the plumule gives rise to new leaves.

**36. (d)** Xylem is the water conducting tissue. It consists of living cells like parenchyma and dead cells like tracheary elements.

**37. (a)** In woody trees, the central portion of stem is dark in colour. It is hard and tough due to deposition of resins, tannins, gums and formation of tyloses. This central hard portion is called heart wood. It is formed by secondary growth. Due to cambial activity secondary xylem becomes non-functional and forms heart wood or duramen. It is more durable and little susceptible to attack of pathogens. The cambial activity continues in this region.

**38. (a)** Petroplants are plants having large amount of latex with long chain hydrocarbons. Latex of these plants are a good substitute for liquid fuels or petroleum. Cultivation of petroplants is a part of energy- cropping. Dr. Calvin was the scientist who identified petrocrops. They have property of converting large amount of their photosynthates into latex along with hydrocarbons. Some important petrocrops are *Euphorbia antisyphilitica*, *E. lathyris* *Calotropis procera etc*.

**39. (b)** Vessels are more efficient for water conduction as compared to tracheids. Vessels resemble tracheids very much in structure and function. But unlike tracheids these are like long tubes arranged in vertical row formed of cylindrical cells arranged to end with their end walls completely dissolved. These are also dead and lignified.

**40. (b)** In isobilateral leaves, the upper epidermis contains specialized cells, *i.e.*, bulliform or motor cells. They are highly vacuolate and can store water, if available. However, in case of water deficiency, the bulliform cells lose water and become flaccid. As a result, the leaf gets rolled up to reduce the exposed surface. The bulliform cells are also useful in the unrolling of leaf during its development.

**41. (c)** Pericycle is the outermost layer of stele. In dicot stems, pericycle strengths the stem and provides protection to the vascular bundles. In angiosperms (dicots), pericycle gives rise to lateral roots and contribute to the vascular cambium often diverging into a work cambium.

Chapter

# 7 Structural Organisation in Animals

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** In frog, gastrulation process involves ***[1997]***
(a) epiboly (b) emboly
(c) invagination (d) all of these

**2.** Structure which remains unchanged during metamorphosis of frog's tadpole is ***[1997]***
(a) lung (b) heart
(c) nervous system (d) intestine

**3.** Which gland plays a key role in metamorphosis of frog ? ***[1999]***
(a) Adrenal (b) Thyroid
(c) Thymus (d) Pancreas

**4.** Major protein of connective tissue is ***[2001]***
(a) myosin (b) collagen
(c) melanin (d) keratin

**5.** Outer covering of cartilage is called ***[2001]***
(a) perichondrium (b) periosteum
(c) endosternum (d) peritoneum

**6.** The protoplasmic segment of a striated muscle fibre is termed as ***[2001]***
(a) sarcoplasm (b) sarcomere
(c) neuromere (d) metamere

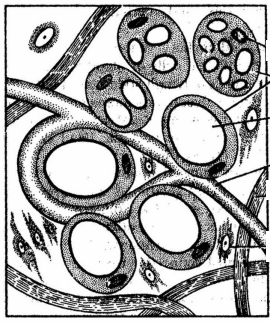
**7.** Sharpey's perforating fibres are related with
(a) heart contraction ***[2002]***
(b) muscle relaxation
(c) fixing of teeth
(d) none of these

**8.** The type of epithelial cells which line the inner surface of fallopian tubes, bronchioles and small bronchi are known as ***[2006]***
(a) squamous epithelium
(b) columnar epithelium
(c) ciliated epithelium
(d) cubical epithelium

**9.** Tadpoles of frog can be made to grow as giant sized tadpoles, if they are ***[2006]***
(a) administered antithyroid substance like thiourea.
(b) administered large amounts of thyroxine.
(c) reared on a diet rich in egg yolk.
(d) reared on a diet rich in both egg yolk and glucose.

**10.** Which of the following type of cell junction is not found in animal tissues ? ***[2013]***
(a) Adhering junction (b) Tight junction
(c) Gap junction (d) Plasmodesmata

**11.** Identify the figure with its correct function



(a) Areolar connective tissue – Serves as a support framework for epithelium
(b) Adipose tissue – Store fats and act as heat insulators
(c) Dense regular tissue – Provide flexibility
(d) Dense irregular tissue – Provide strength and elasticity ***[2014]***

**12.** Which of the following statement about cell junctions is false? ***[2015]***
(i) All the cells of the epithelium are held together with little intercellular materials.
(ii) In almost all animal tissues specialized junction provide both structural and functional link between its individual cells.
(iii) Tight junctions help to stop substances from leaking across a tissue.
(iv) Adhering junctions provide cementing to keep neighbouring cells together.

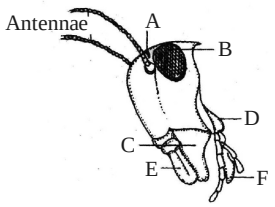
(v) Gap junctions provide cytoplasmic channels between cells for passage of ions, small molecules and sometimes big molecules.

(a) (ii) and (iii) (b) (i) and (ii)
(c) Only (v) (d) None of these

**13.** i. The shape of the cells may vary with the function they perform
ii. Human RBC is about 7.0 μm in diameter
iii. Cytoplasm is the main arena of cellular activities
iv. Various chemical reactions occur in cytoplasm to keep the cell in the living state ***[2015]***

(a) All are correct
(b) Only I and II are correct
(c) Only IV is correct
(d) All are wrong

**14.** 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

**15.** 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

**16.** The sensory papillae in frogs are associated with ***[2017]***

(a) smell (b) hearing
(c) respiration (d) touch

**17.** In earthworms, setae are present in all segments except ***[2017]***

(a) first and the last segments
(b) first segment and the clitellum
(c) first segment
(d) clitellum and last segments

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 18) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**18.** **Assertion :** Cartilage and bone are rigid connective tissues.
**Reason :** Blood is a connective tissue ***[2001]***

**Directions for (Q. 19) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**19.** **Assertion :** The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries.
**Reason :** They are found in walls of blood vessels and air sacs of wings. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** Gastrulation is the process of formation of three layers *i.e.* ectoderm, endoderm and mesoderm. In frog, these layers are formed by the processes of epiboly, emboly and invagination.

**2. (c)** Frog's nervous system once differentiated remains as such throughout life.

**3. (b)** Thyroxine hormone produced by thyroid gland plays a very important role in the metamorphosis of frog.

**4. (b)** Collagen is the major protein of connective tissue. Collagen, in the form of elongated fibrils is mostly found in fibrous tissues such as tendon, ligament and skin, and is also abundant in cornea cartilage, bone , blood vessels, the gut, and intervertebral disc. Collagen performs a very important role in ageing processes.

Myosin, commonest protein in muscle cells, is responsible for the elastic and contractile properties of muscle. It combines with actin to form actomyosin. Melanin is a black or dark brown pigment that is responsible for the dark colour of the skin, hair, scales, feathers and eyes of animals. Keratin is a fibrous scleroprotein that occurs in the outer layer of the skin and in horny tissues such as hair, feathers, nails and hooves.

**5. (a)** Cartilage is a type of connective tissue consisting of cells (called chondrocytes) and though flexible matrix made of collagen, protein, and sugar. The cartilage is covered on the outside by death of white fibrous connective tissue called perichondrium.

Periosteum is a membrane that lines the outer surface of all bones, except at the joints of long bones. It contains the blood vessels and nerves that provide nourishment and sensation.

Endosternum is a collective name for the apodemes or interior processes of the sternum in the thoracic of an insect. The peritoneum is thin membrane that lines the abdominal and pelvic cavities and covers most abdominal viscera.

**6. (b)** Sarcomere is the smallest contractile unit of striated muscle fibre. Sarcomere occurs as repeating units along the length of a myofibril, occupying the region between Z lines of the myofibril.

Sarcoplasm is the cytoplasm of a muscle fibre. It is a water solution containing ATP and phosphogens, as well as the enzymes of intermediate and product molecules involved in many metabolic reactions. Neuromeres is a metameric segment of CNS. Metamere is a linear series of primitively similar segments into which the body of higher invertebrate and vertebrate is divisible.

**7. (c)** Sharpey's fibres are collagenous fibres that pass from the periodontal membrane into the cementum and the jaw bones, fixing the teeth firmly in the sockets.

**8. (c)** Columnar ciliated epithelium posses fine hair like ongrowths, cilia on thier free surfaces. This epithelium lines the nasal passages, oviduct (fallopion tube), terminal bronchiole *etc*. Its major function is protection and movement of mucus, urine and egg in a particular direction.

Squamous epithelium forms the lining of cavities such as the mouth, blood vessels, heart and lungs and make up the outer layers of the skin. Columnar epithelium forms the lining of the stomach and intestines. Some columnar cells are specialized for sensory reception such as in the nose, ears and the taste buds of the

tongue. Cubical epithelium is found in glands and in the lining of the kidney tubules as well as in the ducts of the glands. They also constitute the germinal epithelium which produces the egg cells in the female ovary and the sperm cells in the male testes.

**9. (b)** Thyroxine helps in the metamorphosis of tadpole.

**10. (d)**

**11. (b)** Adipose tissue is another type of connective tissue located mainly beneath the skin. The cells of this tissue are specialised to store fats.

**12. (d)** All the given statements about cell functions are true.

**13. (a)** All the given statements are correct.

**14. (b)** A - Ocellus; B - Compound eye; C - Mandible; D - Maxilla; E - Labrum; F - Labium.

**15. (d)** Both the sexes of cockroach have anal cerci which are jointed structures. But in the male, in addition, there is a paired unjointed needle-like anal style, which serve to distinguish between the male and the female.

**16. (d)** Frog has different types of sense organs like organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears).

**17. (d)** Except the first, the last and clitellar segment in each segment bear a ring of tiny curved, chitinous structure known as setae. Setae helps in locomotion and copulation.

## Type B : Assertion Reason Questions

**18. (e)** Cartilage is a semi rigid connective tissue that is weaker than bone, but more flexible resilient. Cartilage serves to provide structure and support to the body's other tissues and also provide a cushioning effect in points. Bone is rigid connective tissue and forms the skeleton of the body. It is composed chiefly of calcium phosphate and calcium carbonate. It also serves as a storage area for calcium, playing a large role in calcium balance in the blood. Blood is a fluid connecting tissue. Blood delivers necessary substances, such as nutrients and oxygen, to the body's cells (in animals) and transports waste products away from those same cells.

**19. (b)**

Chapter

# 8 Cell : The Unit of Life

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** In many bacteria, cell membrane is invaginated and folded to form ***[1997]***
(a) pili (b) cristae
(c) flagella (d) mesosome

**2.** Cristae helps in ***[1998]***
(a) respiration (b) photosynthesis
(c) transpiration (d) guttation

**3.** In nucleoplasm, a spherical body attached to a particular chromosome on a definite position is called ***[1998]***
(a) nucleolus (b) karyolymph
(c) plasmid (d) reticulum

**4.** Which of the following is responsible for mechanical support and enzyme transport ? ***[1999]***
(a) Dictyosome (b) Cell membrane
(c) E.R. (d) Mitochondria

**5.** Which of the following is present between cell walls of the plant cells ? ***[1999]***
(a) Lomasome (b) Microsome
(c) Lysosome (d) Middle lamella

**6.** Rough E. R. differs from smooth E. R. due to the presence of ***[2000]***
(a) DNA (b) nucleus
(c) ribosome (d) enzyme

**7.** Electron microscope was invented by ***[2000]***
(a) Robert Hooke
(b) Knoll and Ruska
(c) Pasteur
(d) Schwann and Schleiden

**8.** Double membrane structure of cell are ***[2000]***
(a) nucleus (b) chloroplast
(c) mitochondria (d) all of these

**9.** Hydrolytic enzymes are found in ***[2000]***
(a) peroxisomes (b) lysosomes
(c) lepdosomes (d) lomasomes

**10.** Chromosomes with equal arms are called ***[2000]***
(a) metacentric (b) telocentric
(c) acentric (d) polycentric

**11.** A prokaryotic cell lacks ***[2001]***
(a) true nucleus
(b) nuclear membrane
(c) membrane bound organelles
(d) all of the above

**12.** Which of the following is a single membranous structure ? ***[2001]***
(a) Lysosome (b) Nucleus
(c) Mitochondria (d) Chloroplast

**13.** In bacteria, site of respiration is ***[2001]***
(a) mesosome (b) episome
(c) plasmid (d) cytoplasm

**14.** Which of the following organelle is related with photorespiration? ***[2002]***
(a) Peroxisome (b) Nucleus
(c) Cell wall (d) Lysosome

**15.** The phagocytosis was first of all seen by
(a) Huxley (b) Haeckel ***[2002]***
(c) Metchnikoff (d) Darwin

**16.** A chromosome with centromere at one end is called ***[2002]***
(a) telocentric (b) metacentric
(c) excentric (d) apocentric

**17.** Plasmodesmata connections help in ***[2003]***
(a) cytoplasmic streaming.
(b) synchronous mitotic divisions.
(c) locomotion of unicellular organisms.
(d) movement of substances between cells.

**18.** DNA is present in ***[2004]***
(a) chromosomes and dictyosomes
(b) chloroplasts and lysosomes
(c) mitochondria and chloroplasts
(d) mitochondria and endoplasmic reticulum

**19.** Three of the following statements regarding cell organelles are correct while one is wrong. Which one is wrong? ***[2005]***
(a) Lysosomes are double membraned vesicles budded off from Golgi apparatus and contain digestive enzymes.
(b) Endoplasmic reticulum consists of a network of membranous tubules and helps in transport, synthesis and secretion.
(c) Leucoplasts are bound by two membranes, lack pigment but contain their own DNA and protein synthesizing machinery.
(d) Sphaerosomes are single membrane bound and are associated with synthesis and storage of lipids.

**20.** What is common between chloroplasts, chromoplasts and leucoplasts? ***[2006]***
(a) Presence of pigments.
(b) Possession of thylakoids and grana.
(c) Storage of starch, proteins and lipids.
(d) Ability to multiply by a fission-like process.

**21.** In prokaryotes, chromatophores are ***[2006]***
(a) specialized granules responsible for colouration of cells.
(b) structures responsible for organizing the shape of the organism.
(c) inclusion bodies lying free inside the cells for carrying out various metabolic activities.
(d) internal membrane systems that may become extensive and complex in photosynthetic bacteria.

**22.** Which of the following is responsible for the mechanical support, protein synthesis and enzyme transport? ***[2007]***
(a) Cell membrane
(b) Mitochondria
(c) Dictyosome
(d) Endoplasmic reticulum

**23.** *"Omnis-cellula-e-cellula"* was given by***[2007]***
(a) Virchow (b) Hooke
(c) Leeuwenhoek (d) Brown

**24.** Genes present in the cytoplasm of eukaryotic cells, are found in ***[2005, 2008]***
(a) mitochondria and inherited v*ia* egg cytoplasm
(b) lysosomes and peroxisomes
(c) Golgi bodies and' smooth endoplasmic reticulum
(d) plastids and inherited *via* male gamete

**25.** What is common between chloroplasts, chromoplasts and leucoplasts ? ***[2008]***
(a) Presence of pigments.
(b) Possession of thylakoids and grana.
(c) Storage of starch, proteins and lipids.
(d) Ability to multiply by a fission-like process.

**26.** Molecules that are too large to pass through the pores of a cell membrane may enter the cell by a process known as ***[2009]***
(a) hydrolysis (b) pinocytosis
(c) cyclosis (d) synthesis

**27.** Three morphological forms of golgi complex are
(a) Lamellae, tubules and vesicles ***[2012]***
(b) Cisternae, tubules and vesicles
(c) Cisternae, tubules and lamellae
(d) Granum, thalykoids and vesicles

**28.** Which chromosome may lost during cell division? ***[2012]***
(a) Giant chromosome
(b) Acentric chromosome
(c) Polycentric chromosome
(d) Telocentric chromosome

**29.** Choose the incorrect match ***[2013]***
(a) Nucleus — RNA
(b) Lysosome — Protein synthesis
(c) Mitochondria — Respiration
(d) Cytoskeleton — Microtubules

**30.** Which of the following statements are correct ?
(i) In prokaryotic cells, a special membranous structure formed by the extension of the plasma membrane into the cell is known as polysome.
(ii) The smooth endoplasmic reticulum is the major site for synthesis of glycoproteins.
(iii) RuBisCO is the most abundant protein in the whole biosphere.
(iv) Mitochondria, chloroplasts and peroxisomes are not considered as part of endomembrane system. ***[2016]***
(a) (iii) and (iv) (b) (i) and (ii)
(c) (ii) and (iii) (d) (i) and (iv)

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 31-38) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**31.** **Assertion :** Power house of cell is mitochondria.
**Reason :** ATP is produced in mitochondria. ***[2001]***

**32.** **Assertion :** Cell wall is not found in animal cell.
**Reason :** Animal cells are covered by cell membrane. ***[2001]***

**33.** **Assertion:** Organisms are made up of cells.
**Reason:** Cells are structural unit of living organisms. A cell keeps its chemical composition steady within its boundary. ***[2002]***

**34.** **Assertion:** Specialization of cells is useful for organism.
**Reason:** It increases the operational efficiency of an organism. ***[2002]***

**35.** **Assertion:** The number of cells in a multicellular organism is inversely proportional to size of body.
**Reason:** All cells of biological world are alive. ***[2002]***

**36.** **Assertion :** Eukaryotic cells have the ability to adopt a variety of shapes and carry out directed movements.
**Reason :** There are three principal types of protein filaments-microfilaments, microtubules and intermediate filaments, which constitute the cytoskeleton. ***[2006]***

**Directions for (Qs. 37-40) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**37.** **Assertion :** Lipids present in the outer and inner side of the bilayer membrane are commonly different.
**Reason :** Oligosaccharides are attached to external surface as well as inner surface of a biomembrane. ***[2009]***

**38.** **Assertion :** Mitochondria and chloroplasts are semi autonomous organelles.
**Reason :** They are formed by division of pre-existing organelles as well as contain DNA but lack protein synthesizing machinery. ***[2005, 2014]***

**39.** **Assertion :** A cell membrane shows fluid behaviour.
**Reason :** A membrane is a mosaic or composite of diverse lipids and proteins. ***[2003, 2008, 2015]***

**40.** **Assertion :** Centrosomes and centrioles are related to each other.
**Reason :** Centrosome usually contains two cylindrical structures called centrioles. ***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** In prokaryotic cell, cell membrane invaginate to form mesosomes. They have enzymes, which are useful for respiration.

**2. (a)** Cristae form a part of mitochondria which helps in cellular respiration.

**3. (a)** A small spherical body attached to the particular chromosome (nucleolar chromosome) in the nucleoplasm is nucleolus. Nucleolus is the principal or active site for the development of ribosomal RNAs & it is essential for spindle formation of ribosomes.

**4. (c)** ER provides mechanical support and enzyme transport in a cell.

**5. (d)** Adjacent cells in a plant tissue are held together by a thin, sticky, amorphous layer of cementing tissue called middle lamella. It is made up of Ca and Mg pectate.

**6. (c)** Rough endoplasmic reticulum is rough due to the presence of ribosomes at its surface. Their attachment to the ER is by means of protein ribophorin I and II.

**7. (b)** Electron microscope was invented by Knoll and Ruska in 1932.

**8. (d)** Double membrane organelles of the cell are mitochondria, chloroplast and nucleus.

**9. (b)** Lysosomes are spherical, single membrane limited vesicles, containing hydrolytic enzymes working at acidic pH. Lysosome is also known as suicidal bag/sac as they contain hydrolytic enzymes.

**10. (a)** Metacentric chromosomes have equal sized chromatids *i.e.* they have centromere in the centre.

**11. (d)** Prokaryotic cells, among the tiniest of all cells, has one envelope system with no membrane lined internal organelles except thylakoid if present. A prokaryotic cell lacks membrane bound organelles, nuclear membrane and histone proteins.

**12. (a)** Lysosome consists of hydrolytic enzymes, enclosed in a unit membrane.

**13. (a)** In bacteria, mesosome helps in cell respiration.

**14. (a)** Leaf peroxisomes are associated with endoplasmic reticulum, chloroplast and mitochondria and are involved in photorespiration. Photorespiration is light induced $CO_2$ liberation from a $C_2$ compound (glycolic acid) of dark phase of photosynthesis.

**15. (c)** The phagocytosis was first of all seen by Metchnikoff in 1893. Phagocytosis is a process whereby certain cells & unicellular organisms are capable of ingesting and digesting solid material.

**16. (a)** When centromere is located at the tip of the chromosome, it is said to be telocentric.

**17. (d)** Plasmodesmata are small fuses that connect plant cells to each other, providing living bridges between cells. Plasmodesmata brings the exchange of substances between cells.

**18. (c)** DNA is present in mitochondria and chloroplasts (extranuclear DNA). So these organelles are self replicating.

**19. (a)** Lysosomes are single membrane bound organelles rich in hydrolytic enzymes.

**20. (a)** $C_4$ pathway/Hatch and Slack pathway ensures the Calvin cycle to be operated only in bundle sheath cell. It is an adaptation to photorespiratory loss. Therefore, $C_4$ plants are adapted to photorespiratory loss.

**21. (d)** In prokaryotes, chromatophores are internal membrane system that may become extensive and complex in photosynthetic bacteria. It is structurally and functionally similar to eukaryotic chloroplast.

**22. (d)** Endoplasmic reticulum (ER) is a system of flattened membranes running through the cytoplasm. Rough ER containing ribosomes is mainly concerned with protein synthesis and transport of enzymes. It also functions as cytoskeleton by giving mechanical support to the cytoplasm.

**23. (a)** The cell is the basic structural and functional unit of living organisms. In 1855, Rudolf Virchow showed that all cells arise from the pre-existing cells by cell division or *Omnis-cellula-e-cellula*. Robert Hooke was the first one to find out the basic units of life and termed them as cells. Anton van Leeuwenhoek was the one who observed unicellular organisms including bacteria. Robert Brown described the nucleus as a characteristic spherical body in plant cells.

**24. (a)** Genes present in the cytoplasm of eukaryotic cells are found in mitochondria and inherited *via* egg cytoplasm.

**25. (c)** Chromoplasts are plastids responsible for pigment synthesis and storage. They, like all other plastids (including chloroplasts and leucoplasts), are organelles found in specific photosynthetic eukaryotic species. Chloroplasts conduct photosynthesis. Chloroplasts absorb light and use it in conjunction with water and carbon dioxide to produce sugars. Leucoplasts are non-pigmented, in contrast to other plastids such as the chloroplast. Lacking pigments, leucoplasts are not green, so they are predictably located in roots and non-photosynthetic tissues of plants. They may become specialized for bulk storage of starch, lipid or protein and are then known as amyloplasts, elaioplasts, or proteinoplasts respectively.

**26. (b)** Pinocytosis, or pinching in of the cell membrane, allows cells, such as the *Paramecium*, to capture larger food molecules. Hydrolysis, is the process of using water to split molecules apart. Cyclosis is a mechanism for transporting materials within a cell, by the cytoplasm swirling. Synthesis is the process of building up molecules within the cell.

**27. (b)** Three morphological forms of golgi complex are cisternae, tubules and vesicles. Varied number of cisternae are present in a Golgi complex.

The Golgi cisternae are concentrically arranged near the nucleus with distinct convex cis or the forming face and concave trans or the maturing face.

Tubules are long flattened structure while vesicles are round or oval structure.

**28. (b)** Acentric chromosome may be lost during cell division as centromere is absent in them. During metaphase and anaphase, spindle fibres are not attached with them and so they are not able to reach to the poles.

**29. (b)** Protein synthesis takes place in ribosomes, which are attached to surface of endoplasmic reticulum by ribophorin-I and ribophorin-II. About 50 hydrolytic enzymes are found in the lysosome. They include proteases, nucleases, glycosidases, lipases, phospholipases, phosphatases and sulphatases. All lysosomal enzymes are acid hydrolases and optimally active at pH-5.0

**30. (a)** The special membranous structure formed by the extension of prokaryotic plasma membrane is known as mesosome while polysome is structure formed by combination of many ribosomes.

SER is the major site of synthesis of lipids. The site of protein synthesis is RER.

## Type B : Assertion Reason Questions

**31. (b)** Mitochondria are called power house of a cell because they produce large amount of energy in the form of ATP.

**32. (a)** Animal cells are covered by semipermeable plasma membrane. Cell wall is absent in animal because cell wall is incompatible with the way in which an animal moves and grows.

**33. (a)** Cells are the basic structural and functional unit of organism.

**34. (a)** Specialization of the cell increases the efficiency of the cell for a particular function.

**35. (d)** The size and shape of the cell in multicellular organism depends upon the location and function performed by them.

**36. (b)** Eukaryotic cells contain three types of filaments as microtubules, microfilament and intermediate filament which give definite shape to the cell and also helps in directional movement.

**37. (c)** Lipids present in the outer and inner side of the bilayer are commonly different, *e.g.*, lecithin on the outer side and cephalin on the inner side of erythrocyte membrane. Oligosaccoharides are attached to external surface of lipids and proteins of a bio-membrane. They are absent on the inner side.

**38. (c)**

**39. (a)** The cell membrane also called the plasma membrane, plasmalemma, or "phospholipid bilayer" is a selectively permeable lipid bilayer found in all cells. It contains a wide variety of biological molecules, primarily proteins and lipids, which are involved in a vast array of cellular processes such as cell adhesion, ion channel conductance and cell signaling. The plasma membrane also serves as the attachment point for both the intracellular cytoskeleton and, if present, the extracellular cell wall.

**40. (a)** The centrosome is the main place where cell microtubules get organized. Centrosome usually contains two cylindrical structure called centrioles. Centrioles are composed of grouping of microtubules arranged in 9 + 3 pattern. The pattern is so named because a ring of 9 microtubule "triplets" are arranged at right angles to one another. Centrioles, found in animal cells, help to organize the assembly of microtubules during cell division. Centrioles replicate during the interphase stage of mitosis and meiosis.

Chapter

# 9 Biomolecules

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Which is the derivative of amino acid ? ***[1999]***
(a) Epinephrine (b) Estrogen
(c) Progesterone (d) All of these

**2.** High energy bond of ATP are present in between ***[1999]***
(a) C – C (b) C – O
(c) C – N (d) O – P

**3.** Who coined the term zymase? ***[1999]***
(a) Pasteur (b) Buchner
(c) Kuhne (d) Sumner

**4.** Apoenzyme is ***[2000]***
(a) protein (b) lipid
(c) sugar (d) vitamin

**5.** Gamma globulins are synthesized inside
(a) liver ***[2000]***
(b) kidney
(c) bone marrow
(d) lymph and lymphoid tissues

**6.** Proteins are ***[2002]***
(a) polysaccharides (b) polyamides
(c) polynucleotides (d) polyglycol

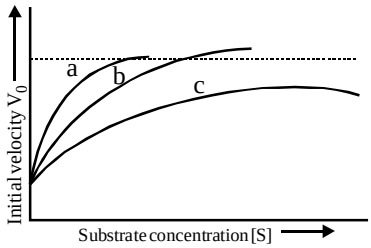
**7.** Which of the following gives Fehling's test?
(a) Pectin (b) Sucrose ***[2002]***
(c) Cellulose (d) Glucose

**8.** The nicotinamide is synthesized in our body from ***[2002]***
(a) tryptophan (b) tryosine
(c) valine (d) alanine

**9.** An example of competitive inhibition of an enzyme is the inhibition of ***[2003]***
(a) succinic dehydrogenase by malonic acid
(b) cytochrome oxidase by cyanide
(c) hexokinase by glucose-6-phosphate
(d) carbonic anhydrase by carbon dioxide

**10.** Which of the following set of three items are not true as each set belongs to the category mentioned against them ***[2005]***
(a) Lysine, glycine, thiamine - Amino acids
(b) Myosin, oxytocin and gastrin - Hormones
(c) Rennin, helicase and hyaluronidase - Enzyme
(d) Optic nerve, occulomotor, vagus - Sensory nerves

**11.** The figure given below show three velocity-substrate concentration curves for an enzyme reaction. What do the curves a, b and c depict respectively? ***[2006]***




(a) a - normal enzyme reaction,
b - competitive inhibition,
c - non-competitive inhibition.
(b) a - enzyme with an allosteric modulator added,
b - normal enzyme activity,
c - competitive inhibition.
(c) a - enyzme with an allosteric stimulator,
b - competitive inhibitor added,
c - normal enzyme reaction.
(d) a - normal enzyme reaction,
b - non-competitive inhibitor added,
c - allosteric inhibitor added.

**12.** Which of the following contain β-l, 4 linkage?
(a) Maltose (b) Sucrose ***[2007]***
(c) Lactose (d) Fructose

**13.** Which statement is true? ***[2007]***
(a) Adenine has 4 nitrogen atoms.
(b) Cytosine has 3 nitrogen atoms.
(c) Guanosine has 3 nitrogen atoms.
(d) Uracil has 5 nitrogen atoms.

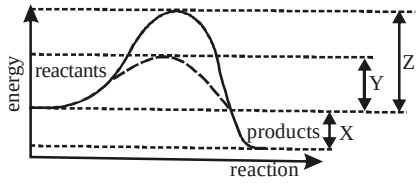
**14.** Michaelis constant $K_m$ is equal to ***[2010]***
(a) $\frac{K_1}{K_2 - K_3}$ (b) $\frac{K_2 + K_3}{K_1}$
(c) $\frac{K_2 - K_3}{K_1}$ (d) $\frac{K_1 \times K_2}{K_3}$

**15.** Alpha-keratin is a protein present in ***[2010]***
(a) blood (b) skin
(c) lymph (d) eggs

**16.** Which one of the following statements regarding starch and cellulose is not correct? ***[2010]***
(a) Both of them are of plant origin.
(b) Both of them are polymers.
(c) Both of them give colour with iodine.
(d) Both of them are made up of glucose molecules.

**17.** Which of the following type of enzyme is not matched correctly with the molecule that it breaks down? ***[2013]***
(a) Amylase–starch
(b) Lipase–starch
(c) Protease–proteins
(d) Disaccharidase–sugars

**18.** The diagram illustrates energy changes in an enzyme controlled reaction. ***[2013]***

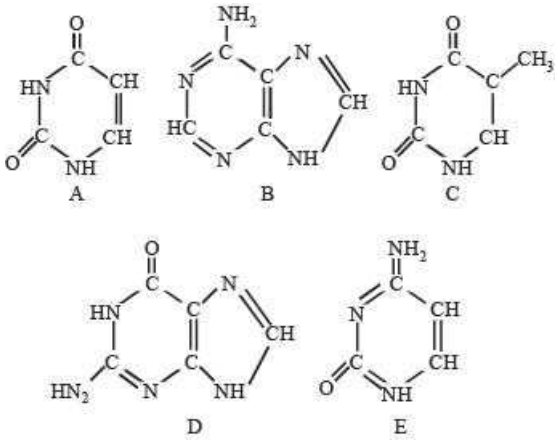



Which of the following represents the lowering of the activation energy?
(a) X (b) Y
(c) Z (d) Z – Y

**19.** Which one of the following is a non - reducing carbohydrate? ***[2014]***
(a) Maltose
(b) Sucrose
(c) Lactose
(d) Ribose 5 - phosphate

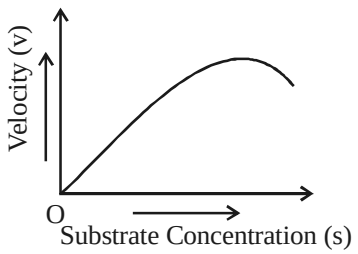
**20.** The Km value of the enzyme is the value of the substrate concentration at which the reaction reaches to ***[2014]***
(a) Zero (b) 2Vmax
(c) ½Vmax (d) ¼Vmax

**21.** The following diagrams represent the nitrogenous bases of nucleic acid molecules. Identify the correct combination




***[2015]***
(a) A-uracil, B-adenine, C-thymine, D-guanine, E- cytosine
(b) A - uracil, B-guanine, C-cytosine, D-adenine, E-thymine
(c) A-uracil, B - guanine, C-thymine, D-adenine, E-cytosine
(d) A-thymine, B-guanine, C-uracil, D-adenine, E-cytosine.

**22.** The given graph shows the effect of substrate concentration on the rate of reaction of the enzyme green -gram -phosphatase. What does the graph indicate ?

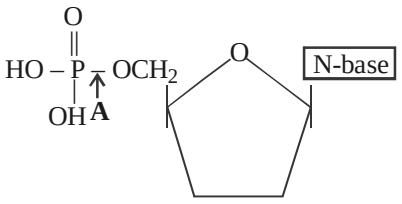



***[2015]***

(a) The rate of enzyme reaction is directly proportional to the substrate concentration
(b) Presence of an enzyme inhibitor in the reaction mixture
(c) Formation of an enzyme-substrate complex
(d) At higher substrate-concentration the pH increases.

**23.** Inorganic catalyst work efficiently at _____temperature and _____ pressure. ***[2016]***
(a) high, low (b) low, low
(c) low, high (d) high, high

**24.** Refer the given structure of adenylic acid. In this identify A.




***[2016]***
(a) Glycosidic bond (b) Phosphate bond
(c) Ester bond (d) Ionic bond

**25.** Nucleotides are building blocks of nucleic acids. Each nucleotide is a composite molecule formed by ***[2017]***
(a) base-sugar-phosphate.
(b) base-sugar-OH.
(c) $(\text{base-sugar-phosphate})_n$.
(d) sugar-phosphate.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 26-27) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**26.** **Assertion :** Enzymes have active sites and substrates have reactive sites on their surface respectively.
**Reason :** Active and reactive sites push the enzyme and substrate molecules away from each other. ***[1999]***

**27.** **Assertion :** Vegetable oils are fats which are present in plant cells in soluble form.
**Reason :** Vegetable oils occur only in cells of embryo. ***[2007]***

**Directions for (Qs. 28-37) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.
(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**28.** **Assertion :** Human diet should compulsorily contain glycine, serine and tyrosine. ***[2010]***
**Reason :** Essential amino acids can not be synthesized in the human body.

**29.** **Assertion :** Unsaturated fats are more reactive compared with the saturated fats. ***[2010]***
**Reason :** Unsaturated fats have only single bonds in their structure.

**30.** **Assertion :** The amino acid glycine comes under the category of nonessential amino acids.
**Reason :** This is due to the fact that it can not be synthesised in the body. ***[2011]***

**31.** **Assertion :** Allosteric enzymes show feed back inhibition.
**Reason :** The inhibitor is competitive. ***[2012]***

**32.** **Assertion :** Coenzymes serve as co-factors in a number of different enzyme catalyzed reactions.
**Reason :** Coenzymes and prosthetic groups are cofactors. ***[2013]***

**33.** **Assertion :** Enzymes lower the activation energy.
**Reason :** A substrate molecule can be acted upon by a particular enzyme. ***[2014]***

**34.** **Assertion :** Comparative biochemistry provides a strong evidence in favour of common ancestory of living beings.
**Reason :** Genetic code is universal. ***[2015]***

**35.** **Assertion :** A co-enzymes or metal ions that is very tightly bound to enzyme protein is called prosthetic group.
**Reason :** A complete, catalytically active enzyme together with its bound prosthetic group is called apoenzyme. ***[2016]***

**36.** **Assertion :** Glycosidic bonds are formed by dehydration.
**Reason :** In polysaccharides, individual monosaccharide is linked by glycosidic bond. ***[2016]***

**37.** **Assertion :** In a DNA molecule, A–T rich parts melt before G–C rich parts.
**Reason:** In between A and T there are three H–bond, whereas in between G and C there are two H-bonds. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (a)** Epinephrine is derived from tyrosine amino acid.

**2. (d)** High energy bonds of ATP are between O~P.

**3. (b)** Buchner coined the term zymase for the complex of biocatalysts extracted from yeast and taking part in alcoholic fermentation.

**4. (a)** Apoenzyme is the protein part of holoenzyme.

**5. (a)** Gamma globulins ($\gamma$) are synthesized by B-lymphocytes and stem cells found in the liver during foetal stage and bone marrow cells in the adult stage.

**6. (b)** Proteins are the polymers of basic units amino acids and hence are polyamides.

**7. (d)** Glucose is an aldehydic sugar and their free –CHO part converts $Cu^{+2}$ to $Cu^{+1}$ (Fehling's reagent).

**8. (a)** The enzyme nicotinamide can be synthesized in small quantities from amino acid, tryptophan.

**9. (a)** Enzyme inhibition caused by a substance resembling substrate molecule through blocking its active site is competitive inhibition. Malonate closely resembles succinate in structure that inhibits the action of succinic dehydrogenase.

**10. (c)** Thiamine is a nitrogen base; myosin is a muscle protein; occulomotor nerve is motor and vagus is mixed type.

**11. (a)** The effect of a competitive inhibitor is reversed by increasing substrate concentration. At a sufficiently high substrate concentration, the reaction velocity reaches the $v_{max}$ observed in the absence of inhibitor whereas non-competitive inhibitor decreases the $v_{max}$ of the reaction *i.e.* it can not be overcome by increase in substrate concentration.

**12. (c)** Lactose or milk sugar, found exclusively in milk, contain $\beta$-1,4 linkage. It is a disaccharide formed by combination of galactose and glucose by means of a chemical reaction called as condensation reaction.

**13. (a)** Nucleotides contain carbon, hydrogen, oxygen, nitrogen and phosphorous. Nucleotides are either purines or pyrimidines. Adenine and guanine are the two purines which are the 9-membered double ringed compound where each ring possesses four nitrogen atoms. Thymine, uracil, and cytosine are the pyrimidines which are single ringed nitrogenous compounds.

**14. (b)** Michaels constant $K_m$ is equal to $\frac{K_2 + K_3}{K_1}$.

**15. (b)** Alpha-keratin is present in high quantity in skin and epidermal appendages like hair and nail.

**16. (c)** Starch is the reserve substance in plant cells whereas cellulose is the most important structural component of the cell wall of plants. Both starch and cellulose are polymers of glucose. Starch is a branched polymers of $\alpha$-D glucose units which are linked by $\alpha$–1, 4 glycosidic bonds (but at branching, by $\alpha$–1, 6 glycosidic bonds). Cellulose is a linear polymer of $\beta$–D–glucose units connected through $\beta$-1, 4 glycosidic bonds. In contrast to starch and glycogen, cellulose is insoluble in ordinary solvents and is not hydrolysed by boiling dilute acids. It gives no colour with iodine.

**17. (b)** Lipases are enzymes found in the small intestine of humans that help in the breakdown of fats.

**18. (d)** The energy required to initiate a reaction is known as the activation energy, Ea. The bold curve shows the uncatalysed reaction with Ea = Z, whilst Y represents the Ea of the catalysed reaction (dotted curve). The Ea is thus lowered by (Z – Y).

**19. (b)** Sucrose is classified under non-reducing sugar because it does not have any free aldehyde or keto group.

**20. (c)** The concentration of substrate at which velocity of enzymatic action reaches half of its maximum value, is called **Km** value or **Michaelis constant**.

**21. (a)**

**22. (b)** Even though the substrate concentration increases the velocity is decreasing there by showing a presence of inhibitor.

**23. (d)** Inorganic catalyst work efficiently at high temperature and high pressure. Inorganic catalysts speed up reactions, but they do not have carbon-hydrogen atoms. An example of this is magnesium sulphate, which is a compound used to speed up some reactions in the chemistry lab.

**24. (c)** Phosphate is bound to pentose sugar by ester bond.

**25. (a)** Nucleotides are the building blocks of nucleic acid. Each nucleotide consists of three parts: a sugar (ribose for RNA and deoxyribose for DNA), a phosphate, and a nitrogenous base.

## Type B : Assertion Reason Questions

**26. (d)** Enzymes are biocatalyst that increases the speed of a chemical reaction without themselves undergoing any permanent chemical change. Enzymes have active sites to bind the substrate during catalyzed reaction.

**27. (d)** Vegetable oils and fats are present in plants in insoluble form. They are extracted mostly from seeds. In several cereals, they are obtained from embryo. Olive and palm oils are obtained from flesly pericarp of the fruit. Sometimes oils are also extracted from roots, stem and leaves.

**28. (d)** Essential amino acids are those which are taken from food and not synthesized in the body whereas non-essential amino acids need not be supplied in the diet and are synthesized in the body. Glycine, serine and tyrosine are non-essential amino acids.

**29. (c)** Compound having double bond in their structure are more unstable compound in comparison to single bond holder compounds. Unsaturated fats those have double bonds in their structures are more reactive than saturated fats.

**30. (c)** Non-essential amino acids are those amino acids which need not be supplied in the diet because they can be synthesised by the body, particularly from carbohydrate metabolites, Glycine is one such non essential amino acid. On the contrary, essential amino acids are those amino acids which can not be synthesised in the animal body and must be supplied with food in adequate amounts. Out of twenty amino acids, eight are considered essential in human diet.

**31. (c)** Feed back inhibition is a type of reversible inhibition found in allosteric enzymes. The inhibitor is noncompetitive and is usually a low molecular intermediate or product of metabolic pathway having a chain of reactions involving a number of enzymes.

**32. (b)** Cofactor may be inorganic or organic in nature. Organic cofactors are of two types, coenzymes and prosthetic groups. Coenzymes are easily separable nonprotein organic cofactors. Prosthetic groups are

non-protein organic cofactors firmly attached to apoenzymes (protein part of enzyme).

**33. (b)** Activation energy is an external supply of energy which is needed for the initiation of the chemical reaction. Activation energy required for such a large number of reactions cannot be provided by living systems. Enzymes lower the activation energy required for a reaction. Enzymes are generally specific for their substrates.

**34. (b)** Comparative biochemistry provides a strong evidence for common ancestors of living beings (*e.g.* proteins lymph, enzymes, hormones, blood groups *etc.*)

**35. (c)** Prosthetic group is an organic substance which is thermostable and firmly attached to the protein or apoenzyme portion during the complete catalytic cycle. Apoenzyme is a protein that forms an active enzyme system by combination with a coenzyme and determines the specificity of this system for a substrate.

**36. (b)** In polysaccharides, individual monosaccharide is linked by glycosidic bond. This bond is formed between two carbon atoms of two adjacent monosaccharides. A glycosidic bond is a type of covalent bond that joins a carbohydrate molecule to another group, which may or may not be another carbohydrate. Glycosidic bonds are formed by dehydration.

**37. (c)** In a DNA molecule, A-T rich parts melt before G-C rich parts because there are two H-bond between A and T whereas in between G and C, there are three H-bond.

Chapter 10

# Cell Cycle and Cell Division

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The correct sequence in cell cycle is *[1999]*
(a) S - $G_1$ - $G_2$ - M (b) S - M - $G_1$ - $G_2$
(c) $G_1$ - S - $G_2$ - M (d) $M_1$ - $G_1$ - $G_2$ - S

**2.** Colchicine prevents the mitosis of cells at which of the following stage? *[2000]*
(a) Anaphase (b) Metaphase
(c) Prophase (d) Interphase

**3.** Spindle fibres of mitotic cells are made up of
(a) tubulin (b) actin *[2001]*
(c) myosin (d) collagen

**4.** When synapsis is complete all along the chromosome, the cell is said to have entered a stage called *[2005]*
(a) zygotene (b) pachytene
(c) diplotene (d) diakinesis

**5.** Which one of the following precedes re-formation of the nuclear envelope during M-phase of the cell cycle? *[2008]*
(a) Decondensation from chromosomes and reassembly of the nuclear lamina.
(b) Transcription from chromosomes and reassembly of the nuclear lamina.
(c) Formation of the contractile ring and formation of the phragmoplast.
(d) Formation of the contractile ring and transcription from chromosomes.

**6.** During which stages (or prophase I substages) of meiosis do you expect to find the bivalents and DNA replication respectively? *[2009]*
(a) Pachytene and interphase (between two meiotic divisions)
(b) Pachytene and interphase (just prior to prophase I)
(c) Pachytene and S phase (of interphase just prior to prophase I)
(d) Zygotene and S phase (of interphase prior to prophase I)

**7.** Many cells function properly and divide mitotically even though they do not have *[2011]*
(a) plasma membrane
(b) cytoskeleton
(c) mitochondria
(d) plastids

**8.** The stage of meiosis where centromere separate *[2013]*
(a) metaphase I (b) metaphase II
(c) anaphase I (d) anaphase II

**9.** During meiosis I, the chromosomes start pairing at *[2014]*
(a) Leptotene (b) Zygotene
(c) Pachytene (d) Diplotene

**10.** How many mitotic divisions are needed for a single cell to make 128 cells? *[2016]*
(a) 7 (b) 14
(c) 28 (d) 64

**11.** Match the description (given in column I) with correct stage of prophase I (given column II) and choose the correct option. *[2017]*

| | Column I | | Column II |
|---|---|---|---|
| A. | Chromosomes are moved to spindle equator | I. | Pachytene |
| B. | Centromere splits and chromatids move apart | II. | Zygotene |
| C. | Pairing between homologous chromosomes takes place | III. | Anaphase |
| D. | Crossing between homologous chromosomes | IV. | Metaphase |

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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 12) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**12.** **Assertion:** Meiosis results in production of haploid cells.
**Reason:** Synapses occurs during leptotene. ***[1998]***

**Directions for (Qs. 13-17) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**13.** **Assertion :** Meiosis II is known as equational or homotypic division. ***[2010]***
**Reason :**Meiosis II produces same number of chromosome in cell.

**14.** **Assertion :** Interphase is resting stage.
**Reason :** The interphase cell is metabolically inactive. ***[2012]***

**15.** **Assertion :** During zygotene, chromosomes show bivalent stage.
**Reason :** Bivalent is half the number of chromosomes. ***[2013]***

**16.** **Assertion :** The stage between two mitotic divisions is called interkinesis.
**Reason :** Interkinesis is generally short lived. ***[2016]***

**17.** **Assertion :** Diplotene is characterized by the presence of chiasmata.
**Reason :** Diplotene can last for months and years in oocytes of some vertebrates. ***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** The correct sequence of cell cycle is $G_1$, S, $G_2$ and M.

**2. (c)** Colchicine is an alkaloid derived from (*colchicum autumnale*) arrests the spindle formation at the end of prophase. Hence, it is also called 'Mitotic Poison'.

**3. (a)** Spindle fibres of mitotic cells are made up of microtubules. It consists of protein tubulin that maintain cell shape, serve a tracks for organelle movement & help in cell division by getting attached to the centromeres of bivalents. They are arranged on equator due to congression movements. The movement of bivalents or chromosomes occur towards the poles as a result of spindle fibres contraction.

**4. (b)** Synapse stabilizes the paired condition of chromosomes in zygotene stage. After this the cell enters the pachytene stage.

**5. (a)** In most eukaryotes, the nuclear envelope that separates the DNA from the cytoplasm disassembles. The chromosomes align themselves in a line spanning the cell. Microtubules, essentially miniature strings, pulls out from opposite ends of the cell and shorten, pulling apart the sister chromatids of each chromosome. As a matter of convention, each sister chromatid is now considered a chromosome, so they are renamed to sister chromosomes. As the cell elongates, corresponding sister chromosomes are pulled toward opposite ends. A new nuclear envelope forms around the separated sister chromosomes.

**6. (d)** In bivalent formation of chromosomes during meiosis, the homologous chromosomes are arranged in pairs. The phenomenon is called synapsis and it occurs during zygotene stage. DNA replication occurs during S phase or synthetic phase which is the second phase of interphase.

**7. (d)** Many cells function properly and divide mitotically even in the absence of plastids.

**8. (d)**

**9. (b)** During zygotene, a substage of Prophase I of meiosis I, where chromosomes start pairing together is called synapsis. Such paired chromosomes are called as homologous chromosomes. A complex structure *i.e.*, synaptonemal complex is formed by a pair of synapsed homologous chromosomes called a bivalent or a tetrad.

**10. (a)** In mitosis, a single cell divides to form two daughter cells. So, the number of mitotic divisions can be calculated by $2^n$.

*where*, n is the number of division of cell.

$2^n = 128$

$2^n = 2^7$

$n = 7$

Thus, 7 mitotic divisions are needed for a single cell to make 128 cells.

**11. (c)** A – IV; B – III; C – II; D – I

Metaphase – Chromosomes are moved to spindle fibre.

Anaphase – Centromere splits and chromatids move apart.

Zygotene – Pairing between homologous chromosomes takes place.

Pachytene – Crossing between homologous chromosomes occurs.

## Type B : Assertion Reason Questions

**12. (c)** Synapsis occurs during zygotene stage. Synapsis is the pairing of homologous chromosomes which leads to formation of bivalents.

**13. (a)** Meiosis II is known as equational or homotypic division like mitosis. It ensures the maintenance of constant number of chromosomes from generation to generation on a species.

**14. (c)** Previously interphase is called resting stage because there is no apparent activity related to cell division. The interphase cell is metabolically quite active. Interphase consist of three subphases ($G_1$ , $G_2$ and S). Synthesis of DNA occurs in S phase. $G_1$ is the period between the end of mitosis and the start of S phase. $G_2$ is the phase between S phase and the next mitosis. As the synthesis of DNA and proteins occurs in interphase so, it is considered as metabolically active phase.

**15. (b)** During zygotene, because of the pairing of the homologues, the nucleus contains half the number of chromosomes. Each unit is a bivalent composed of two homologous chromosomes.

**16. (d)** Interkinesis or interphase II is a period of rest that cells of some species enter during meiosis, between meiosis I and meiosis II. No DNA replication occurs during interkinesis however it does occur during the interphase I stage of meiosis. Interkinesis is generally short lived.

**17. (b)** Diplotene is the longest and most active subphase of prophase I of meiosis. The beginning of diplotene is recognized by the dissolution of synaptonemal complex and the tendency of the recombined homologous chromosomes of the bivalents to separate from each other except at the sites of crossovers. These X-shaped structures are called chiasmata. Diplotene can last for months and years in oocytes of some vertebrate.

Chapter

# 11 Transport in Plants

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Translocation of organic materials in plants is explained by *[1997]*
(a) active transport
(b) transpiration pull
(c) inhibition theory
(d) mass flow hypothesis

**2.** The main function of phloem is translocation of
(a) food (b) water *[1998]*
(c) mineral (d) air

**3.** In rainy season, door gets swelled due to *[2001]*
(a) imbibition (b) diffusion
(c) transpiration (d) respiration

**4.** Which of the following helps in ascent of sap? *[2007]*
(a) Root pressure (b) Transpiration
(c) Capillarity (d) All of these

**5.** Hydroponics is *[2007]*
(a) nutrient less culture
(b) water less culture
(c) soilless culture
(d) none of these

**6.** During $Na^+ - K^+$ pump *[2010]*
(a) $3Na^+$ and $2K^+$ are transported
(b) $1Na^+$ and $2K^+$ are transported
(c) $3\ Na^+$ and $3K^+$ are transported
(d) Depends on requirement of cell

**7.** Excessive loss of water causes wilting of leaves, it can be prevented by : *[2012]*
(a) Keeping the plant in bright light
(b) Spraying the plant with alcohol
(c) Applying vaseline on the leaf surface
(d) Adding high amounts of fertilizers to the soil

**8.** Water potential of pure water and its solution are *[2013]*
(a) 0 and 1
(b) 0 and 0
(c) 0 and more than one
(d) 0 and less than 1.

**9.** In which method of transport in plasma membrane does not require carrier molecule? *[2014]*
(a) Active transport
(b) Facilitated diffusion
(c) Simple diffusion
(d) $Na^+ - K^+$ pump

**10.** Seed increase in its volume by the adsorption of water through *[2014]*
(a) Osmosis (b) Plasmolysis
(c) Imbibition (d) Diffusion

**11.** Minerals are known to enter the plant root by means of a number of mechanisms, including all except one of the following. Which one of the following is NOT a mechanism for moving minerals into roots? *[2015]*
(a) Foliar feeding (b) Active transport
(c) Proton ($H^+$) pump (d) Cation exchange

**12.** A botanist discovered a mutant plant that was unable to produce materials that form casparian strip. This plant would be *[2015]*
(a) unable to transport water or solutes to the leaves.
(b) unable to use its sugar as a sugar sink.
(c) able to exert greater root pressure than the normal plant.
(d) unable to control amounts of water and solutes it absorbs.

**13.** If a cell A with D.P.D. 4 bars is connected to cell B, C, D whose O.P. and T.P. are respectively 4 and 4, 10 and 5 and 7 and 3 bars, the flow of water will be *[2015]*
(a) A and D to B and C
(b) A to B, C and D
(c) B to A, C and D
(d) C to A, B and D

**14.** A boy is studying transport of a certain type of molecules into cell. He finds that transport slows down when the cells are poisoned with a chemical that inhibits energy production. Under normal circumstances, the molecules studied by the boy is probably transported by ***[2016]***
(a) simple diffusion
(b) osmosis
(c) active transport
(d) facilitated diffusion

**15.** Which of the following statements is/are not incorrect? ***[2017]***
(i) Water and minerals, and food are generally moved by a mass or bulk flow system.
(ii) Bulk flow can be achieved either through a positive hydrostatic pressure gradient or a negative hydrostatic pressure gradient.
(iii) The bulk movement of substances through the conducting tissues of plants is called translocation.
(iv) Xylem translocates organic and inorganic solutes, mainly from roots to the aerial parts of the plants.
(v) Phloem translocates water, mineral salts, some organic nitrogen and hormones, from the leaves to other parts of the plants.
(a) (ii), (iii) and (v)
(b) (ii), (iii) and (iv)
(c) (iv) and (v)
(d) (ii) and (v)

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 16-18) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**16.** **Assertion :** Waxy and cutin coating on plant parts reduce the transpiration.
**Reason :** These adaptation are found in xerophytes. ***[1999]***

**17.** **Assertion :** Water and mineral uptake by root hairs from the soil occurs through apoplast until it reaches endodermis.
**Reason :** Casparian strips in endodermis are suberized. ***[2003]***

**18.** **Assertion :**When the ambient temperature is high and soil contains excess of water, the plants tend to lose water in the form of droplets from lenticels.
**Reason :** Root pressure regulates the rate of loss of water form lenticels. ***[2006]***

**Directions for (Qs.19-21) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.
(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**19.** **Assertion :** Upward movement of water is called ascent of sap.
**Reason :** Upward movement of water occurs through xylem and phloem. ***[2013]***

**20.** **Assertion :** Long distance flow of photo assimilates in plants occurs through sieve tubes.
**Reason :** Mature sieve tubes have parietal cytoplasm and perforated sieve plates. ***[2012, 2015]***

**21.** **Assertion :** Light is very important factor in transpiration.
**Reason :** Light induces stomatal opening and darkness closing of stomata. Therefore, transpiration increases in light and decreases in dark. ***[1999, 2015]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (a)** Active transport is the mediated transport of biochemicals, and other atomic/ molecular substances, across membranes. Unlike passive transport, this process requires chemical energy in the form of adenosine triphosphate(ATP). In this form of transport, molecules move against either an electrical or concentration gradient (collectively termed an electrochemical gradient).

**2. (a)** Phloem is the chief food conducting tissue of vascular plants responsible for translocation of organic solutes.

**3. (a)** In rainy season, door gets swelled due to the phenomenon of imbibition. It is the process of absorption of water without forming a solution.

**4. (d)** Upward movement of water (sap) through xylem against the force of gravity is called ascent of sap. All three help in ascent of sap.

**5. (c)** Cultivation of plants by placing the roots in the nutrient solution without any soil is called hydroponics. It is also known as soilless culture/ water culture/ solution culture. It is used to determine which elements are essential for plant growth and what symptoms are produced by the absence or deficiency of essential elements.

**6. (a)** During sodium-potassium pump, the concentration of sodium ions will be about 14 times more in extra cellular fluid (outside) and concentration of potassium ions will be about 28-30 times more in axoplasm (inside). Thus, $3Na^+$ and $2K^+$ are transported during the process.

**7. (c)** Excessive loss of water from the leaves can be prevented by applying vaseline on leaf surface. It will close the stomata and check transpiration.

**8. (d)**

**9. (c)**

**10. (c)** Imbibition is the process of adsorption of water by hydrophilic surfaces of a substance without forming a solution. It is a type of diffusion by which movement of water takes place along a diffusion gradient. The solid particles which adsorb water or any other liquid are called Imbibants. The liquid which is imbibed is known as Imbibate. Examples are absorption of water by seeds and dry wood.

**11. (a)** Potassium is accumulated by passive transport. Some solutes are pumped across membranes using active transport. The role of proton pumps in the transport process of plant cells is a specific application of chemiosmosis, a transmembrane proton gradient that links energy-releasing processes to energy-consuming ones like active transport.

**12. (d)** The casparian strips function in regulation of the flow of water between outer tissues and the vascular cylinder.

**13. (c)** DPD = OP – TP.
DPD (A) = 4 bar.
DPD (B) = 0 bar.
DPD (C) = 10 – 5 = 5 bars.
DPD (D) = 7 – 3 = 4 bars.
Water always flows from lower DPD (Diffusion Pressure Deficit) to higher DPD. Since the DPD of cell B is the lowest (O) the water will flow from B to A and then to C.

**14. (c)** Active transport uses energy (ATP) to pump molecules against a concentration gradient. Cells undergoing active transport bear abundant mitochondria to provide ATP, needed to power active transport. So, the production of ATP is blocked or decreased and active transport is blocked or slow down.

**15. (c)** Statements (iv) and (v) are not correct.

(iv) Xylem is associated with the translocation of mainly water, mineral salts, some organic nitrogen and hormones from roots to the aerial parts of the plants.

(v) Phloem translocates a variety of organic and inorganic solutes mainly from the leaves to other parts of the plants.

## Type B : Assertion Reason Questions

**16. (a)** Waxy and cutin coating does reduce transpiration. This adaptive feature is seen in xerophytic and in plants of semi-arid region. This adaptive feature is seen to reduce water loss by transpiration.

**17. (a)** The radial and the inner walls of the cells of the endodermis are greatly thickened. These are called as casparian strips and these are impervious to water. Apart from the casparian strips, and suberization also does not allow the water to reach the endodermis. Hence, water moves through the apoplast which are passage cells.

**18. (d)** Root pressure is a pressure produced in the roots of plants, causing exudation of sap from cut stems and guttation of water from leaves. The pressure is generated by the concentration of solutes in the xylem of the root and stem which is then causes water to move into the xylem by osmosis.

**19. (c)** Sap is water with dissolved ingredients. The upward movement of water from roots towards the tips of stem branches and their leaves is called ascent of sap. It occurs through the tracheary elements of xylem.

**20. (a)** The parietal cytoplasm and perforated sieve plates help in the transport of photoassimilates that are required for photosynthesis. The parietal cytoplasm is the streaming of cytoplasm. The streaming cytoplasm moves throughout the cell, thus, helping in the transport of photoassimilates from one cell to another through the sieve plates.

**21. (a)** Light is an important factor in transpiration. The stomata opens well on days when light is brighter. It is also evident on cloudy days that the stomata does not open well. Hence, light induces stomatal opening and darkness closing.

Chapter 12

# Mineral Nutrition

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Leghaemoglobin helps in ***[2007]***
(a) nitrogen fixation
(b) protecting nitrogenase from $O_2$
(c) destroys bacteria
(d) transport of food in plants

**2.** Which of the following is correct set of micronutrient for plants? ***[2007, 2011]***
(a) Mg, Si, Fe, Cu, Ca
(b) Cu, Fe, Zn, B, Mn
(c) Mg, Fe, Zn, B, Mn
(d) Mo, Zn, Cl, Mg, Ca

**3.** In glycolysis, glucose molecule is converted into: ***[2011]***
(a) PEP (b) RuBP
(c) Acetyl CoA (d) Pyruvic acid

**4.** Which one of the following elements is not an essential micronutrient for plant growth? ***[2012]***
(a) Ca (b) Mn
(c) Zn (d) Cu

**5.** Which element plays an important role in nitrogen fixation? ***[2012]***
(a) Mn (b) Mo
(c) Zn (d) Cu

**6.** Match column-I and Column-II and choose the correct option given below the columns. ***[2013]***

| | **Column-I (Element)** | | **Column-II (Function)** |
|---|---|---|---|
| A. | Calcium | I. | Required for ionic- balance. |
| B. | Boron | II. | Essential for constitution of nucleic acid |
| C. | Phosphorus | III. | Required for absorption of calcium. |
| D. | Chlorine | IV. | Required to activate respiratory enzyme. |
| E. | Manganese | V. | Required for synthesis of mitotic spindle. |

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

**7.** Which of the following is an **INCORRECT** match of essential element and function? ***[2014]***
(a) Manganese - structural component of chlorophyll.
(b) Calcium - component of the middle lamella.
(c) Zinc - enzyme activator.
(d) Iron - component of ferredoxin.

**8.** Which of the following is the mismatched pair?

| | **Mineral elements** | **Form that is absorbed by plant** |
|---|---|---|
| (a) | Nitrogen | $NO_3^-$ |
| (b) | Phosphorus | $H_2PO_4^-$ |
| (c) | Sulphur | $H_2SO_4$ |
| (d) | Iron | $Fe^{3+}$ |

***[2016]***

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 9-10) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**9.** **Assertion :** Plants lack excretory organs.
**Reason :** Plant usually absorb essential nutrients and lead a passive life. ***[1997]***

**10.** **Assertion :** Plants absorb sulphur in the form of sulphate ions.
**Reason :** Sulphur bacteria are required for the formation of sulphate. ***[2007]***

**Directions for (Q.11) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**11.** **Assertion :** Deficiency of sulphur causes chlorosis in plants.
**Reason :** Sulphur is a constituent of chlorophyll, protein and nucleic acids. ***[2004, 2014]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** The root nodules of leguminous plants contain a symbiotic nitrogen fixing bacteria *Rhizobium*. Root nodules are small irregular outgrowth of the roots which are pinkish internally due to presence of a pigment called leghaemoglobin. It is related to blood pigment haemoglobin. The cells of root nodules are tetraploid and contain polyhedral bacteria called bacteroids. Leghaemoglobin is an oxygen scavenger and protects the nitrogen fixing enzyme nitrogenase of bacteroids.

**2. (b)** The essential elements are divided into macroelements and microelements based on the quantity in which they are required by the plants. Mn, Cu, Mo, Zn, B, and Cl are the micronutrients needed in very small quantities by the plants. C, H, O, N, P, S, K, Ca, Mg, Fe are the macronutrients required in more quantity.

**3. (d)** In this process, one molecule of glucose undergoes partial oxidation to form 2 molecules of pyruvic acid.

**4. (a)** Micronutrient elements are those element which is required in less quantity. These are Cu, Zn, Mn, B, Cl, Mo and Ni. Some physiologist consider Fe as micronutrient.

**5. (b)** Molybdenum (Mo) is required for symbiotic nitrogen fixation by legumes. Plants requires molybdenum 0.1 to 2.5 ppm in their tissue for normal growth. Molybdenum availability varies with soil type, being highest in organic soil, less in clay, least in sandy soil.

**6. (d)**

**7. (a)** Magnesium is a constituent of the ring structure of chlorophyll. Function of manganese is to activate many enzymes involved in photosynthesis, respiration and nitrogen metabolism. The best defined function of manganese is in the splitting of water to liberate oxygen during photosynthesis.

**8. (c)** Plants obtain sulphur in the form of sulphate ($SO_4^{2-}$).

## Type B : Assertion Reason Questions

**9. (b)** Plants do lack excretory organs, but it is not due to absorption pattern or passive life. The carbon dioxide during respiration passes out through the stomata. The other waste materials comes out in the form of alkaloids, gums and resins.

**10. (a)** Sulphur is a constituent of amino acids (cystein and cystine and methionine). Sulphur is present in the soil in the form of oxides. Sulphur bacteria convert them into sulphate ions.The plants absorb sulphur in the form of sulphate ions.

**11. (c)** Due to deficiency of sulphur plant shows chlorosis (*i.e.*, yellowing due to degradation of chlorophyll) followed by anthocyanin development. The younger leaves show chlorosis before older ones. Sulphur is not the constituent of chlorophyll. The main constituent of chlorophyll is magnesium.

Chapter

# 13 Photosynthesis in Higher Plants

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** In $C_4$ plants, the first carbon dioxide acceptor is
(a) pyruvate *[1997]*
(b) phosphoenol pyruvate
(c) ribulose biphosphate
(d) ribulose 5, phosphate

**2.** In photosynthesis, splitting of water and release of oxygen occurs during *[1998]*
(a) photolysis (b) red drop
(c) Pasteur effect (d) Calvin cycle

**3.** Blackman's law of limiting factor is applied to *[2001]*
(a) respiration (b) transpiration
(c) photorespiration (d) photosynthesis

4. Hill reaction occurs in *[2003]*
(a) high altitude plants
(b) total darkness
(c) absence of water
(d) presence of ferricyanide

**5.** Which one of the following categories of organisms do not evolve oxygen during photosynthesis? *[2004]*
(a) Red algae
(b) Photosynthetic bacteria
(c) $C_4$ plants with Kranz anatomy
(d) Blue green algae

**6.** What is PAR range? *[2007]*
(a) 200 nm - 800 nm (b) 400 nm - 700 nm
(c) 350 nm - 550 nm (d) 600 nm - 100 nm

**7.** Through the use of oxygen-18 (heavy oxygen), scientists have found that the oxygen released during photosynthesis comes from molecules of *[2009]*
(a) carbon dioxide (b) water
(c) glucose (d) chlorophyll

**8.** Select the incorrect statement *[2011]*
(a) $C_4$ pathway for $CO_2$ fixation were discovered by Hatch and Slack
(b) $CO_2$ is essential for photosynthesis
(c) Addition of sodium carbonate in water retards photosynthetic rate in vallisneria
(d) Phloem is the principal pathway for translocation of solutes

**9.** The family in which many plants are $C_4$ type *[2012]*
(a) Malvaceae (b) Solanaceae
(c) Crucifereae (d) Graminae

**10.** In the electron transport chain during terminal oxidation, the cytochrome, which donates electrons to $O_2$ is *[2012]*
(a) Cytochrome-b (b) Cyto-C
(c) Cyto-$a_3$ (d) Cyto-f

**11.** Which one does not differ between a $C_3$ and a $C_4$ plant? *[2013]*
I. Initial $CO_2$ acceptor.
II. Extent of photorespiration.
III. Enzyme catalyzing reaction that fixes $CO_2$.
IV. Presence of Calvin cycle.
V. Leaf anatomy.
(a) I and V (b) IV
(c) II and III (d) II

**12.** The total requirement of ATP & NADPH for each molecule of $CO_2$ fixed & reduced in photosynthesis in the Calvin cycle is *[2014]*
(a) 2 ATP & 2 NADPH
(b) 2 ATP & 3 NADPH
(c) 3 ATP & 2 NADPH
(d) 4 ATP & 3 NADPH

**13.** Consider the following statements regarding photosynthesis. *[2015]*
(A) ATP formation during photosynthesis is termed as photophosphorylation.

(B) Kranz anatomy pertains to leaf.
(C) Reduction of $NADP^+$ to NADPH occurs during Calvin cycle.
(D) In a chlorophyll molecule, magnesium is present in phytol tail. Of the above statements *[2015]*
(a) A and B are correct
(b) C and D are correct
(c) A and C are correct
(d) A and D are correct

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 14-23) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**14.** **Assertion:** $C_4$ pathway of $CO_2$ fixation is found in some tropical plants.
**Reason:** In this pathway, $CO_2$ is fixed by 3C compound. *[1998]*

**15.** **Assertion :** Mitochondria helps in photosynthesis
**Reason :** Mitochondria have enzymes for dark reaction. *[1999]*

**16.** **Assertion:** Bacterial photosynthesis occurs by utilizing wavelength longer than 700 nm.
**Reason:** Here reaction centre is B-890. *[2002]*

**17.** **Assertion :** *Rhoeo* leaves contain anthocyanin pigments in epidermal cells.
**Reason :** Anthocyanins are accessory photosynthetic pigments. *[2003]*

**18.** **Assertion :** Cyclic pathway of photosynthesis first appeared in some eubacterial species.
**Reason :** Oxygen started accumulating in the atmosphere after the non-cyclic pathway of photosynthesis evolved. *[2004]*

**19.** **Assertion :** $C_4$ photosynthetic pathway is more efficient than the $C_3$ pathway.
**Reason :** Photorespiration is suppressed in $C_4$ plants. *[2005]*

**20.** **Assertion :** The atmospheric concentration of $CO_2$ at which photosynthesis just compensates for respiration is referred to as $CO_2$ compensation point.
**Reason :** The $CO_2$ compensation point is reached when the amount of $CO_2$ uptake is less than that generated through respiration because the level of $CO_2$ in the atmosphere is more than that required for achieving $CO_2$ compensation point. *[2005]*

**21.** **Assertion :** Under conditions of high light intensity and limited $CO_2$ supply, photorespiration has a useful role in protecting the plants from photo-oxidative damage.
**Reason :** If enough $CO_2$ is not available to utilize light energy for carboxylation to proceed, the excess energy may not cause damage to plants. *[2006]*

**22.** **Assertion :** Photosynthetically $C_4$ plants are less efficient than $C_3$ plants. *[2006]*
**Reason :** The operation of $C_4$ pathway requires the involvement of only bundle-sheath cells.

**23.** **Assertion :** Dark reaction is purely enzymatic reaction. *[2007]*
**Reason :** It occurs only in absence of light.

**Directions for (Qs.24-30) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**24.** **Assertion :** Dark reaction occurs only at night in the stroma of chloroplast.
**Reason :** $CO_2$ fixation occurs only during $C_3$ cycle. *[2009]*

**25.** **Assertion :** *Amaranthus* and sugarcane are called as Hatch & Slack plants.
**Reason :** One glucose is formed by fixation of 6 $CO_2$ in the plants. ***[2010]***

**26.** **Assertion :** D.C.M.U. is a photosynthetic inhibitor. ***[2010]***
**Reason :** D.C.M.U. inhibits a photolysis of water.

**27.** **Assertion:** The stromal thylakoids are rich in both PS I and PS II.
**Reason:** The stroma membranes are rich in ATP synthetase. ***[2011]***

**28.** **Assertion :** Cyclic pathway of photosynthesis first appeared in some eubacterial species.
**Reason :** Oxygen started accumulating in the atmosphere after the non-cyclic pathway of photosynthesis evolved. ***[2012]***

**29.** **Assertion :** Each molecule of ribulose-1, 5-bisphosphate fixes one molecule of $CO_2$.
**Reason :** Three molecules of NADPH and two ATP are required for fixation of one molecule of $CO_2$. ***[2013]***

**30.** **Assertion:** Six molecules of $CO_2$ and twelve molecules of $NADPH^+ + H^+$ and 18 ATP are used to form one hexose molecule.
**Reason:** Light reaction results in formation of ATP and $NADPH_2$. ***[2002, 2015]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** In $C_4$ plants, the first $CO_2$ acceptor is 3C compound, phosphoenol pyruvate.

**2. (a)** In photosynthesis, release of oxygen occurs during photolysis of water in light reaction.

**3. (d)** Blackman's law is applicable to photosynthesis. It states that when a process is conditioned as to its rapidity by number of factors, its rate is limited to the pace of slowest factor. Taking temperature into consideration, rate of photosynthesis is maximum at optimum temperature.

**4. (a)** Hill reaction or light reaction depends upon light. It involves photolysis of water and production of assimilatory power in the form of NADPH and ATP.

**5. (b)** Photosynthetic bacteria do not use $H_2O$ as electron donor but some other compound like $Fe^{2+}$, $H_2S$.
In photosynthesis, splitting of water and liberation of $O_2$ by chlorophyll in presence of light and hydrogen acceptor is called photolysis of water.

$$H_2O \rightleftharpoons 2H^+ + 2e^- + \frac{1}{2}O_2$$

[Photolysis of water]

**6. (b)** PAR (Photosynthetically active radiations) ranges between the wavelength 400-700nm.

**7. (b)** Oxygen which is liberated during photosynthesis comes form water.In photosynthesis, the light energy is captured by chlorophyll in the chloroplasts in plant leaves. This energy is used to split water apart in a process called photolysis.

$$4H_2O \rightleftharpoons 4H^+ + 4OH^-$$

$$4OH^- \xrightarrow{Mg^{++}, Cl^-} 2H_2O + O_2 + 4e^-$$

**8. (c)** $C_4$ pathway for $CO_2$ fixation were discovered by Hatch and Slack. This pathway has more effective method of $CO_2$ fixation and is seen in plants like sugarcane. $CO_2$ is essential for photosynthesis. It is the source of carbon. The phloem or leptome is the pathway for movement of solutes.

**9. (d)** $C_4$ cycle occurs in 1500 species of 19 angiospermic families but most of the plants are monocots which belong to graminae and cyperaceae family.

**10. (c)** In ETS or respiratory chain, there are five cytochromes cyto-b, cyto-$c_1$, cyto-c, cyto-a, cyto-$a_3$. Cytochrome $a_3$ is last cytochrome of ETS which denotes electrons to $O_2$ due to this metabolic water is formed.

**11. (b)**

**12. (c)** For every $CO_2$ molecule entering the Calvin cycle, 3 molecules of ATP and 2 molecules of NADPH are required.

**13. (a)** During Calvin cycle, NADPH is oxidised to NADP. In a chlorophyll molecule, magnesium is present in the porphyrin ring.

## Type B : Assertion Reason Questions

**14. (b)** $C_4$ pathway is an adaptation of tropical plants to reduce/avoid the photorespiratory loss. In $C_4$ pathway, first acceptor of $CO_2$ is a 3 carbon compound - phosphoenol pyruvate.

**15. (d)** Mitochondria helps in cellular respiration by transferring energy from organic compounds to ATP. Chloroplast helps in photosynthesis. Dark reaction takes part in the stroma of the chloroplast.

**16. (b)** In bacteria, photosynthesis utilizes light wavelength more than 700 nm and their reaction centre is B-890.

**17. (c)** Anthocyanin pigments only give colouration since the epidermal cells mainly have potential colouring pigments. It is responsible of blue, red, pink and purple colours, observed in different parts of plants such as petals, stamens and fruits etc.
Anthocyanin are also important for attracting insects for pollination and seed dispersal. Hence, Anthocyanin pigments are not accessory photosynthetic pigments.

**18. (b)** Photosynthetic bacteria have a substance called bacteriochlorophyll. The bacterio-chlorophyll pigment absorbs light in the extreme UV and infra-red parts of the

spectrum which is outside the range used by normal chlorophyll, seen in plants.

**19. (a)** $C_4$ pathway/Hatch and Slack pathway ensures the Calvin cycle to be operated only in bundle sheath cell. It is an adaptation to photorespiratory loss. Therefore, $C_4$ plants are adapted to photorespiratory loss.

**20. (c)** Compensation point is that value or point in the light intensity and atmospheric $CO_2$ concentration when the rate of photosynthesis is just equivalent to the rate of respiration in the photosynthetic organ. So that there is not net gaseous exchange.

**21. (c)** Photorespiration is the uptake of $O_2$ and release of $CO_2$ in light and results from the biosynthesis of glycolate in chloroplasts and subsequent metabolism of glycolate acid in the same leaf cell. During photorespiration loss of carbon takes place in the form of $CO_2$.

**22. (d)** $C_4$ plants are more efficient in picking up $CO_2$ even when it is found in low concentration because of its high affinity for PEP. They show kranz anatomy *i.e.* vascular bundle is surrounded by bundle sheath and mesopyll cells.

**23. (e)** During photosynthesis, assimilatory power ATP and $NADPH_2$ are produced which require light. This reaction is called light reactions or Hill's reaction. Assimilatory powers are required for the reduction of $CO_2$. This reaction is enzymatic and independent of light. It is called dark reaction which takes place in stroma of chloroplast. So, dark reaction is independent of presence or absence of light.

**24. (d)** Dark reaction is also known as light-independent phase. Unlike, light reaction, it does not require light as an essential factor. Thus, can take place both in the presence or absence of light. The term dark reaction does not mean that it takes place only in dark period or at night. $CO_2$ fixation occurs in both $C_3$ and $C_4$ cycle. In $C_3$ cycle, $CO_2$ is added by the enzyme, RuBisco to a 5 carbon compound RuBP that is converted to 2 molecules of 3-carbon PGA. In $C_4$ cycle, the first product of $CO_2$ fixation (takes place in mesophyll) is a 4-carbon compound, oxaloacetic acid. It is seen in some tropical plants.

**25. (b)** *Amaranthus* sp and sugarcane are known as Hatch and Slack plants. In Hatch and Slack pathway, one glucose molecule is formed by fixation of $6CO_2$ in the plants.

**26. (a)** DCMU (Dichlorophenyl dimethyl urea) is a herbicide that can prevent non cyclic photophosphorylation and oxygen production. It inhibits photolysis of water.

**27. (d)** The grana stacks of membranes are enriched in PS II and LHC (Light harvesting centre), while there is little ATP synthetase. On the other hand, a fraction of stroma thylakoids is rich in PS I and ATPase and poor in PS II and LHC.

**28. (b)** Cyclic pathway of photosynthesis is appeared first in some eubacterial species. It is supposed to be the first evidence of production of ATP in the presence of light. During non-cyclic photophosphorylation photolysis of water takes place. Under the influence of light energy and the catalytic action of chlorophyll, water is split up into oxygen and hydrogen. Non-cyclic photophosphorylation is the only natural process which adds molecular oxygen to the atmosphere.

**29. (c)** Each molecule of ribulose-1, 5-biphosphate fixes one molecule of carbon dioxide with the addition of water, thereby resulting in the formation of two molecules of 3-phosphoglyceric acid (3-PGA). The fixation and reduction of one molecule of $CO_2$ requires three molecules of ATP and two of NADPH, coming from the photochemical reactions.

**30. (b)** Light reaction or Hill reaction results in the formation of ATP and $NADPH_2$, $6CO_2$, $6H_2O$, ATP and $NADPH_2$ are utilised to produce one molecule of glucose.

Chapter

# 14 Respiration in Plants

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Glycolysis occurs in *[2000]*
(a) mitochondria (b) chloroplast
(c) cytoplasm (d) peroxisome

**2.** Anaerobic respiration, after glycolysis is also called as *[2002]*
(a) fermentation (b) fragmentation
(c) restoration (d) multiplication

**3.** In glycolysis, glucose molecule is converted into *[2002]*
(a) PEP (b) RuBP
(c) acetyl CoA (d) pyruvic acid

**4.** Photorespiration in $C_3$ plants starts from *[2003]*
(a) phosphoglycerate
(b) phosphoglycolate
(c) glycerate
(d) glycine

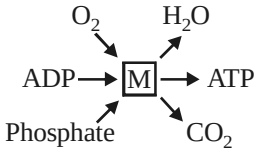
**5.** Which of the following is the connecting link between glycolysis and Krebs cycle? *[2007]*
(a) Acetyl CoA
(b) Oxalosuccinic acid
(c) Pyruvic acid
(d) Citric acid

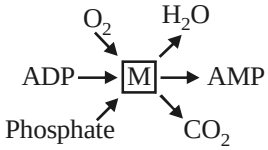
**6.** Pyruvate kinase enzyme catalyses *[2010]*
(a) first irreversible step of glycolysis
(b) second irreversible step of glycolysis
(c) third irreversible step of glycolysis
(d) fourth irreversible step of glycolysis

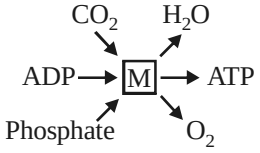
**7.** An enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in inner mitochondrial membrane in eukaryotes and in cytosol in prokaryotes. This enzyme is *[2012]*
(a) Succinate dehydrogenase
(b) Lactate dehydrogenase
(c) Isocitrate dehydrogenase
(d) Malate dehydrogenase

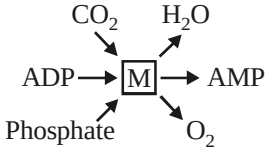
**8.** Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins? *[2014]*
(a) Fructose 1, 6 - bisphosphate
(b) Pyruvic acid
(c) Acetyl CoA
(d) Glucose - 6 - phosphate

**9.** Which of the following representation correctly explain the function of mitochondrion? *[2015]*

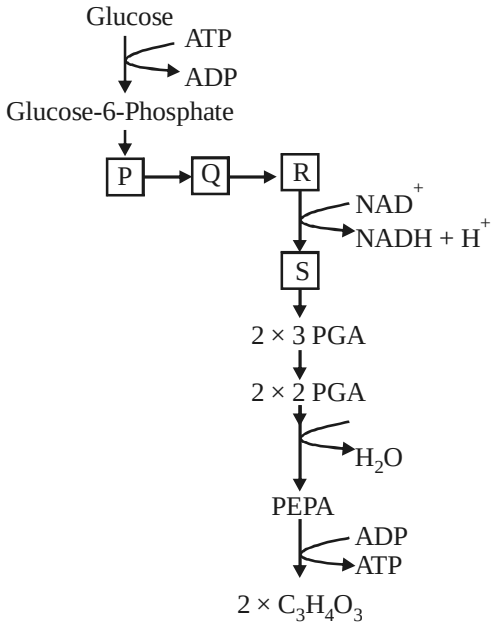
(a)



(b)



(c)



(d)


**10.** Refer the figure and answer the question.




Choose the correct names of P, Q, R, and S. ***[2015]***

| | P | Q | R | S |
|---|---|---|---|---|
| (a) | 1,3 di PGA | 3 PGA ld | Fr.1,6 di P | Fr. 6 P |
| (b) | 3 PGA 1d | 1,3 di PGA | Fr. 1,6 di P | Fr.6 P |
| (c) | Fr. 1,6 di P | Fr. 6 P | 3 PGA ld | 1,3 di PGA |
| (d) | Fr.6 P | Fr. 1,6 di P | 3 PGA ld | 1,3 di PGA |

**11.** By which of the following complex, proton is pumped to reach ATP synthase to participate in ATP synthesis?

(a) Cytochrome $b_6f$
(b) Cytochrome *c* oxidase
(c) Cytochrome $a$ - $a_3$
(d) Cytochrome *bc*

***[2016]***

**12.** Which of the following statements (i to v) regarding glycolysis are correct.

(i) It is ten enzymatic reactions that convert a six-carbon molecule to a three carbon pyruvate and result in a net gain of 2 ATP molecules.
(ii) Glucose undergoes partial oxidation to form one molecule of pyruvic acid.
(iii) Glucose is phosphorylated to give rise to glucose - 6 - phosphate by the activity of the enzyme phosphofructokinase.
(iv) The scheme of glycolysis was given by Gustav Embden, Otto Morrison, and J. Parnas and is often referred to as the EMP pathway.
(v) ATP is utilized at two steps: first in the conversion of glucose into glucose 6-phosphate & second in the conversion of fructose - 6- phosphate to fructose 1, 6-disphosphate. ***[2016]***

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

**13.** Refer the given equation and answer the question.

$$2(C_{51}H_{98}O_6) + 145O_2 \longrightarrow 102CO_2 + 98H_2O + \text{Energy}$$

The R.Q of above reaction is ***[2017]***

(a) 1 (b) 0.7
(c) 1.45 (d) 1.62

**14.** In alcoholic fermentation, $NAD^+$ is produced during the ***[2017]***

(a) reduction of acetyldehyde to ethanol.
(b) oxidation of glucose.
(c) oxidation of pyruvate to acetyl coA.
(d) hydrolysis of ATP to ADP.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 15) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**15.** **Assertion :** Stomata are absent in submerged hydrophytes.
**Reason :** Respiration occurs by means of air chambers in submerged plants. ***[1997]***

**Directions for (Qs.16-18) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**16.** **Assertion :** Glycolysis is the first step of respiration in which glucose completely breaks into $CO_2$ and $H_2O$.
**Reason :** In this process, there is net gain of twenty four molecules of ATP. ***[2009]***

**17.** **Assertion :** The inner membrane of mitochondria contains systems involving electron transport.
**Reason :** The mitochondrial matrix contains enzymes of Kreb's cycle. ***[2013]***

**18.** **Assertion :** Glycolysis occurs in cytoplasm.
**Reason :** Enzymes for glycolysis are found in cytoplasm. It is common in aerobic/anaerobic respiration. ***[2002, 2014]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** All the enzymes required for the different steps of glycolysis (Ist step in cellular respiration) are present in the cytoplasm.

**2. (a)** Glycolysis is a common step for both aerobic and anaerobic respiration. Next step after glycolysis is fermentation in anaerobic respiration which leads to the formation of ethanol or lactic acid.

**3. (d)** In glycolysis, one molecule of glucose undergoes partial oxidation to form 2 molecules of pyruvic acid.

**4. (a)** In $C_3$ plants, photorespiration starts from 3-phosphoglycerate. Photorespiration is also called glycolate pathway.

**5. (a)** Acetyl CoA is the connecting link between glycolysis and Krebs cycle. Acetyl CoA combines with oxalo acetic acid to form citric acid during Krebs cycle.

**6. (c)** Pyruvate kinase enzyme catalyses third irreversible step of glycolysis.

2 Phosphoenol pyruvic acid + 2ADP

$$\xrightarrow[Mg^{2+}, K^{+}]{\text{Pyruvate kinase}}$$ Pyruvic acid + ATP.

**7. (a)** All the oxidative enzymes of TCA are located in matrix except succinic dehydrogenase. This enzyme catalysed the conversion of succinic acid into fumaric acid. The enzyme is an integral protein complex that is tightly bound to the inner mitochondrial membrane. Infact this enzyme is the preferred marker enzyme for inner membranes when doing mitochondrial fractionations.

**8. (c)** Acetyl CoA is common to respiration mediated breakdown of fats, carbohydrates and proteins. Fats are broken down to fatty acid and glycerol and again fatty acid degraded to acetyl CoA . Protein first degraded by proteases to indiviual amino acids which deaminated to pyruric acid and further decarboxylised to acetyl CoA.

**9. (a)** The main function of mitochondrion is the generation of ATP from ADP and inorganic phosphate during cellular respiration.

**10. (d)**

**11. (a)** With the help of cytochrome $b_6f$, proton is pumped to reach ATP synthetase to participate in ATP synthesis.

**12. (a)** Glucose undergoes partial oxidation to form two molecules of pyruvic acid, Glucose is phosphorylated to give rise to glucose-6-phosphate by the activity of the enzyme hexokinase. The scheme of glycolysis was given by Gustav Embden, Otto Meyerhof, and J. Parnas, and is often referred to as the EMP pathway.

**13. (b)** The ratio of the volume of $CO_2$ liberated to the volume of oxygen absorbed per molecule during respiration is called Respiratory Quotient (RQ). The value of RQ indicates the types of respiratory substrate.

$$RQ = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ consumed}}$$

$$RQ = \frac{102}{145} = 0.7$$

**14. (a)** Alcoholic fermentation is a process in which molecules such as glucose etc. are converted into cellular energy and thereby produce ethanol and carbon dioxide as metabolic waste products. During alcoholic fermentation, $NAD^+$ is produced when acetaldehyde is reduced to ethanol.

## Type B : Assertion Reason Questions

**15. (b)** Stomata are absent since gaseous exchange takes place through diffusion in submerged plants.

**16. (d)** Glycolysis is the process of breakdown of glucose or similar hexose sugar into two molecules of pyruvic acid through a series of enzyme mediated reactions, releasing

energy (ATP) and reducing power ($NADH_2$). It is the first step of respiration, which occurs inside the cytoplasm and is independent of $O_2$. In glycolysis, two molecules of ATP are consumed during double phosphorylation of glucose to form fructose 1, 6 diphosphate. Four molecules of ATP are produced in the conversion of 1, 3-diphosphoglycerate to 3-phospho-glycerate and phosphenol pyruvate to pyruvate whereas, two molecules of $NADH_2$ are formed during oxidation of glyceraldehyde 3-phosphate to 1,3-diphosphoglycerate. Since, each NADH is equivalent to 3 ATP, so net gain in glycolysis is 8 ATP.

**17. (b)** Electron transport system is a series of co-enzymes and cytochromes that takes part in the passage of electrons from a chemical to its ultimate receptor. The mitochondrial matrix contains all the soluble enzymes of the citric acid or Kreb's cycle and those involved in the oxidation of fatty acids.

**18. (a)** Glycolysis occurs in cytoplasm as all necessary enzymes are found in it. This process is common in aerobic/anaerobic respiration. In this process, one glucose molecule is converted into 2 molecules of pyruvic acid.

Chapter

# 15 Plant Growth and Development

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** In plant, auxin synthesis occurs in *[1997]*
(a) cortex
(b) xylem
(c) phloem
(d) root and shoot tips

**2.** Which of the following hormone induces cell division ? *[1997]*
(a) Auxin (b) Gibberellin
(c) Cytokinin (d) Trypsin

**3.** Which is a weedicide ? *[1998]*
(a) IAA (b) 2,4-D
(c) IBA (d) NAA

**4.** Which of the following is gaseous hormone ?
(a) Auxin (b) Ethylene *[1998]*
(c) Cytokinin (d) GA

**5.** A plant cell has potential to develop into a full plant. This is called *[1998]*
(a) totipotency (b) gene cloning
(c) tissue culture (d) regeneration

**6.** Which of the following induces dormancy ?
(a) Auxin (b) Cytokinin *[1999]*
(c) Both (a) and (b) (d) Abscisic acid

**7.** The plant hormone controlling fruit ripening is
(a) IAA (b) GA *[1999]*
(c) ABA (d) Ethylene

**8.** Induction of cell division and delay in senescence is done by *[2001]*
(a) cytokinins (b) auxins
(c) GA (d) CoA

**9.** Curling of tendrils is due to *[2001]*
(a) thigmotropism (b) phototropism
(c) chemotropism (d) nyctinasty

**10.** Bud dormancy can be induced by *[2002]*
(a) IAA (b) GA
(c) ABA (d) ethylene

**11.** *Avena* curvature test is a bioassay for examining the activity of *[2006]*
(a) auxins (b) gibberellins
(c) cytokinins (d) ethylene

**12.** Induction of cell division and delay in senescence is done by *[2011]*
(a) Cytokinins (b) Auxins
(c) GA (d) CoA

**13.** Gibberellins can promote seed germination because of their influence on *[2005, 2012]*
(a) Rate of cell division
(b) Production of hydrolyzing enzymes
(c) Synthesis of abscisic acid
(d) Absorption of water through hard seed coat.

**14.** Study the following statements. *[2013]*
I. "X" hormone promotes root growth and root hair formation thus helping the plants to increase their absorption surface.
II. "Y" hormone induces flowering in mango and also promotes rapid internode/petiole elongation in deep plants and hence helping leaves or upper parts of shoot above water.
III. "Z" hormone inhibits the seed germination, increase the tolerance of plant to various stresses, play import in seed development, maturation and dormancy.

Identify the correct names of hormones marked as 'X', 'Y' & 'Z'.
(a) Y = ABA; X = Auxin; Z = GA
(b) Z = GA; X = Auxin; Y = $C_2H_4$
(c) Y = Auxin; X = $C_2H_4$; Z = GA
(d) Y = $C_2H_4$; X = $C_2H_4$; Z = ABA

**15.** Identify the correct and incorrect statements from the following.
(i) 17,500 new cells are produced per hour by a single maize root apical meristem.
(ii) With the help of length, growth of pollen tube is measured.
(iii) The growth of the leaf is measured in term of volume.
(iv) Cells in a watermelon may increase in size by upto 3,50,000 times. *[2016]*

(a) (i), (ii), (iii) are correct and (iv) is incorrect.
(b) (i), (ii), (iv) are correct and (iii) is incorrect.
(c) (ii), (iii) are correct and (i), (iv) are incorrect.
(d) (i), (iv) are correct and (ii), (iii) are incorrect.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 16-19) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**16.** **Assertion :** Dark period plays more important part in flowering than light period.
**Reason :** Flowering occurs in short-day plant if the dark period is interrupted by light break.
***[2013]***

**17.** **Assertion :** Photomodulation of flowering is a phytochrome regulated process.
**Reason :** Active form of phytochrome ($P_{FR}$) directly induces floral induction in shoot buds.
***[2015]***

**18.** **Assertion (A) :** Vernalization is acceleration of subsequent flowering by low temperature treatment.
**Reason (R) :** Site of vernalization is apical meristem.
***[2015]***

**19.** **Assertion** : Auxins help to prevent fruit and leaf drop at early stages.
**Reason** : Auxins promote the abscission of older mature leaves and fruits.
***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** Auxin is a plant hormone which promote and regulate its growth and development. Auxin are produced in the meristem of shoot tips and move down the plant causing various effects.

**2. (c)** Cytokinins are substances which act primarily on cell division and have little or no effect on extension/growth. It delays the senescence of leaves.

**3. (b)** 2, 4-D (dichlorophenoxyacetic acid) is a common systemic pesticide/herbicide. It is a synthetic auxin (plant hormone) and is used for killing broad leaved weeds (generally dicot).

**4. (b)** Ethylene is the only gaseous natural plant growth regulator produced by all plant organs but its maximum production occurs in ripening fruits and during senescence.

**5. (a)** Any cell which has an ability to develop into a complete organism is totipotent.

**6. (d)** Abscisic acid (ABA) induces dormancy. Robinson and Warming (1964), isolated a substance responsible for dormancy in *Acer pseudoplatanus*, and named it as dormin. This hormone was similar to absicissin. It is a naturally occurring hormone that is present in all vascular plants and some mosses but is not present in bacteria, algae, fungi and liverworts. This hormone is responsible for dormancy.

**7. (d)** Fruit ripening is controlled by hormone, ethylene. Ethylene is a gaseous hormone. It affects the growth, development, ripening and senescence (aging) of all plants.

**8. (a)** Cytokinins promote cell division and inhibit the degradative reactions in detached leaves and slow down senescence in intact leaves. The effect of cytokinin in retarding ageing is called the Richmond Lang Effect.

**9. (a)** The curling of tendrils is a growth movement induced due to contact or touch. Such a movement is called thigmotropic movement. When the tip of the tendril comes in contact with an uneven surface, it coils around the support. This is due to the differential growth in the tendril.

**10. (c)** Abscisic acid (ABA) is a plant hormone which promotes dormancy in seeds and buds.

**11. (a)** Went (1928) performed *Avena* curvature test for auxins.

**12. (a)** Cytokinins promote cell division and inhibit the degradative reactions in detached leaves and slow down senescence in intact leaves. The effect of cytokinin in retarding ageing is called the Richmond Lang Effect.

**13. (b)** Gibberellins can promote seed germination in cereals due to production of hydrolyzing enzymes like $\alpha$ amylase and proteases.

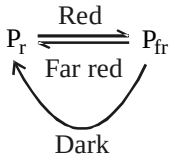
**14. (d)** Gibberellins stimulate the production of some mRNAs and then hydrolytic enzymes like amylase, lipase ribonuclease and proteases. The enzymes solubilise the reserve food of the seeds and the same is transferred to embryo axis for its growth.

**15. (b)** The growth of the leaf is measured in term of surface area.

## Type B : Assertion Reason Questions

**16. (c)** It has been demonstrated that flowering in plant is more of a response to the dark period than to the light period. In short day plants, the plants can flower in complete darkness if supplied with exogenous nutrients. Flowering is prevented in them if dark period below the critical level is interrupted by a flash of light. Interruption of light by dark inhibits flowering under normal photoperiods.

**17. (a)** Active form of PFR is responsible for inducing flowering. Phytochrome, protein pigment, exists in two inter convertible forms.



**18. (b)** The physiological mechanism of flowering in plants is controlled by two factors— light period and low temperature. The cold treatment of plants to induce flowering is called vernalization. Term vernalization was first given by T.D.Lysenko(1928). As a result of vernalization a flowering hormone called vernaline is formed. Site of vernalization is apical meristem.

**19. (b)** Auxin delays abscission of young leaves and fruits. Its effect is through non-formation of abscission zone below a leaf or fruit. Abscission zone cuts off nutrients and water supply. However, auxin promotes the abscission of mature or older leaves and fruits.

Chapter

# 16 Digestion and Absorption

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Tocopherol stands for *[1997]*
(a) Vitamin A (b) Vitamin E
(c) Vitamin C (d) Vitamin K

**2.** Scurvy is caused due to deficiency of vitamin
(a) A (b) B *[1997]*
(c) E (d) C

**3.** The contraction of gall bladder is due to *[1998]*
(a) gastrin (b) secretin
(c) cholecystokinin (d) enterokinase

**4.** The function of rennin is *[1999]*
(a) vasodilation
(b) reduce blood pressure
(c) degradation of angiotensinogen
(d) none of the above

**5.** Liver in our body stores *[1999]*
(a) Vitamin A (b) Vitamin D
(c) Vitamin $B_{12}$ (d) All of these

**6.** Vitamin C is also called as *[2000]*
(a) ascorbic acid (b) glutamic acid
(c) aspartic acid (d) enolic acid

**7.** Brunner's glands are present in *[2001]*
(a) duodenum (b) oesophagus
(c) ileum (d) stomach

**8.** Curdling of milk in small intestine takes place due to *[2002]*
(a) rennin (b) trypsin
(c) chymotrypsin (d) ptyalin

**9.** Which of the following has minimum pH? *[2002]*
(a) Bile (b) Saliva
(c) Gastric juice (d) Pancreatic juice

**10.** Which of following teeth are lophodont? *[2002]*
(a) Incisor and canine
(b) Premolar and molar
(c) Canine and premolar
(d) Premolar and incisor

**11.** Wharton's duct is the duct of *[2002]*
(a) Parotid gland
(b) Sublingual gland
(c) Submaxillary gland
(d) Pancreatic gland

**12.** Continued consumption of a diet rich in butter, red meat and eggs for a long period may lead to
(a) vitamin A toxicity *[2003]*
(b) kidney stones
(c) hypercholesterolemia
(d) urine laden with ketone bodies

**13.** Which one of the following pairs of the cells with their secretion is **correctly** matched? *[2006]*
(a) Oxyntic cells - A secretion with pH between 2.0 and 3.0
(b) Alpha cells of Islets of Langerhans - Secretion that decreases blood sugar level.
(c) Kupffer cells - A digestive enzyme that hydrolysis nucleic acids.
(d) Sebaceous glands - A digestive enzyme that hydrolysis nucleic acids

**14.** Which match is true? *[2007]*

| | Vitamin deficiency disease | Vitamin | Source |
|---|---|---|---|
| (a) | Severe bleeding | Tocopherol | Milk, egg |
| (b) | Anaemia | Ascorbic acid | Lemon, orange |
| (c) | Night blindness | Retinol | Carrot, milk |
| (d) | Sterility | Calciferol | Milk, butter |

**15.** A child took sugar cane and sucked its juice. Regarding this which of the following match is correct? *[2007]*

| | Substrate of enzyme | Enzyme secretion | Site of formed | Products |
|---|---|---|---|---|
| (a) | Proteins | Pepsin | Duodenum | Polypeptides |
| (b) | Starch | Amyase glands | Salivary | Glucose |
| (c) | Lipids | Lipase globules | Pancreas | Fat |
| (d) | Sucrose | Invertase | Duodenum | Glucose + Fructose |

**16.** Which one of the following pairs of the kind of cells and their secretion are correctly matched? ***[2008]***

(a) Oxyntic cells – A secretion with pH between 2.0 and 3.0

(b) Alpha cells of (Nutrition) islets – Secretion of Langerhans that decreases blood sugar level

(c) Kupffer cells – A digestive enzyme that hydrolyses nucleic acids

(d) Sebaceous glands – A secretion that evaporates for cooling

**17.** Fat present below the skin surface in our body, acts as a barrier against ***[2010]***

(a) loss of heat from the body
(b) loss of essential body fluids
(c) loss of salts from the body
(d) entry of harmful micro-organisms from the environment

**18.** The nutritional deficiency condition that needs to be given top priority for remedial action in India today is ***[2010]***

(a) scurvy (b) rickets
(c) xerophthalmia (d) pellagra

**19.** What is the average fat content of buffalo milk? ***[2010]***

(a) 7.2% (b) 4.5%
(c) 9.0% (d) 10.9%

**20.** Consumption of fish is considered to be healthy when compared to flesh of other animals because when compared to flesh of other animals, fish contains ***[2010]***

(a) polyunsaturated fatty acids
(b) saturated fatty acids
(c) essential vitamins
(d) more carbohydrates and proteins

**21.** Endoscopy, a technique used to explore the stomach or other inner parts of the body, is based on the phenomenon of ***[2010]***

(a) total internal reflection
(b) interference
(c) diffraction
(d) polarization

**22.** Lathyrism is caused by excessive consumption of ***[2010]***

(a) khesari dal (b) mustard oil
(c) polished rice (d) mushrooms

**23.** The normal temperature of human body on the Kelvin scale is ***[2010]***

(a) 280 (b) 290
(c) 300 (d) 310

**24.** Parotid salivary glands are present ***[2012]***

(a) Below the tongue
(b) Below the cheeks
(c) In the angle between two jaws
(d) Below the eye orbits

**25.** If for some reason the parietal cells of the gut epithelium become partially non-funcitonal, what is likely to happen? ***[2015]***

(a) The pancreatic enzymes and specially the trypsin and lipase will not work efficiently
(b) The pH of stomach will fall abruptly
(c) Steapsin will be more effective
(d) Proteins will not be adequately hydrolysed by pepsin into proteoses and peptones

**26.** A healthy person eats the following diet - 5 gm raw sugar, 4 gm albumin, 10 gm pure buffalo ghee adultrated with 2 gm vegetable ghee (hydrogenated vegetable oil) and 5 gm lignin. How many calories he is likely to get? ***[2014, 2016]***

(a) 144 (b) 126
(c) 164 (d) 112

**27.** Which of the following statement is true ? ***[2017]***

(a) Pepsin cannot digest casein.
(b) Trypsin can digest collagen.
(c) Pepsin cannot digest collagen.
(d) Chymotrypsin can digest casein.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 28) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**28.** **Assertion :** Scurvy is caused by deficiency of vitamin.

**Reason :** Deficiency of ascorbic acid causes scurvy. ***[2001]***

**Directions for (Qs.29-35) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**29.** **Assertion :** In the condition of obstructive jaundice, large amounts of unabsorbed fats are eliminated out of the body.

**Reason :** Entry of bile into the small intestine is prevented during obstructive jaundice. ***[2009]***

**30.** **Assertion :** Pancreatic amylase digest starch to maltose. ***[2010]***

**Reason :** Pancreatic amylase breaks the peptide bond of protein.

**31.** **Assertion :** Trypsin helps in blood digestion of predator animals.

**Reason :** Trypsin hydrolyzes fibrinogen. ***[2011]***

**32.** **Assertion :** Lipases of bile help in the emulsification of fats.

**Reason :** Lipases can break large fat droplets into smaller ones. ***[2011]***

**33.** **Assertion :** In the condition of obstructive jaundice, large amounts of unabsorbed fats are eliminated out of the body.

**Reason :** Entry of bile into the small intestine is prevented during obstructive jaundice. ***[2015]***

**34.** **Assertion :** Starch is hydrolysed by ptyalin to maltose.

**Reason :** Sucrase hydrolyses sucrose to lactose. ***[2016]***

**35.** **Assertion** : Water and electrolytes are almost fully absorbed in the large intestine.

**Reason** : In large intestine, haustral contractions (slow segmenting movements) roll the forming faeces over and over, causing absorption of water and electrolytes. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Tocopherol or vitamin E is fat soluble vitamin. It is antisterility factor and antioxidant for membrane lipids, skin, and hair *etc*. It reduces atherosclerosis and inhibits oxidation of vitamin A and unsaturated fatty acid. Retinol, ascorbic acid and phylloquinone stands for vitamin A, C and K respectively.

**2. (d)** Deficiency of vitamin C (which is necessary for collagen production and iron absorption) causes scurvy. It is characterised by bleeding of gums, disturbance of protein metabolism and increased susceptibility to infections.

Scurvy is most frequently seen in order, malnourished adults. Scurvy commonly is associated with sailors in the 16th to 18th centuries who navigated long voyages without enough vitamin C frequently perished from the condition.

Deficiency of vitamin A, B and E results in xeropthalmia, beri-beri and miscarriage respectively.

**3. (c)** The contraction of gall bladder occurs due to hormone, cholecystokinin.

Cholecystokinin is a gastrointestinal hormone that is secreted by cells in the duodenum. Its release is stimulated by the presence of fatty acids and amino acids in the small intestine. It stimulates the release of bile into the intestine by contracting gall bladder and the secretion of pancreatic enzymes. Gastrin and secretin are polypeptide hormones. Gastrin, secreted by certain cells of the pyloric glands, stimulates secretion of gastric juice into the bloodstream and churning movement of stomach. Secretin is secreted by the mucosa of the duodenum and jejunum. It stimulates secretion of water and bicarbonates in bile and activates pancreas to secrete pancreatic juice. Enterokinase of enteropeptidase is an enzyme, secreted from dudonum's glands, called the crypts of Lieberkuhn, it converts inactive trypsinogen into active trypsin.

**4. (d)** Rennin (also called rennet or chymosin) is an coagulating enzyme produced from stomach of human body. It catalyzes the coagulation of milk by converting milk with soluble protein caesin into insoluble semi fluid calcium paracaesinate. This is called curdling of milk. Rennin produced in the infants immediately after birth. As the child grows, rennin production goes down and is replaced by pepsin digestive enzymes.

Renin is an enzyme which acts as hormone secreted by juxtaglomerular cells. It converts angiotensinogen into angiotensin.

**5. (d)** Liver is the largest organ in the body. It helps in digestion and removes waste products and worn-out cells from the blood. Liver performs many functions, like it forms and secretes bile that contains bile acids to aid in the intestinal absorption (taking in ) of fats and the fat-soluble vitamins as A, D, E, K and $B_{12}$. Hence, it stores vitamins as A, D, E, K and $B_{12}$.

**6. (a)** Vitamin C (also called as ascorbic acid) is a water soluble vitamin. It helps the body to make collagen, an important protein used to make skin, cartilage, tendons, ligaments and blood vessels. Vitamin C is essential for healing wounds, and for repairing and maintaining bones and teeth.

**7. (a)** Brunner's glands are compound tubular glands found only in the sub-mucosa of duodenum. They produce mucoid fluid which protects the duodenal mucosa from acidic chyme coming from the stomach.

**8. (a)** Trypsin changes chymotrypsinogen to chymotrypsin and procarboxypeptidase to carboxypeptidase. Chymotrypsin changes caesin of milk into paracaesin. Ptyalin or salivary amylase converts starch and glycogen into limit dextrins, maltose and isomaltose.

**9. (c)** pH of bile is 8; pH of saliva is 6.7, pH of pancreatic juice is 8.8 and that of stomach is 2.

**10. (b)** Premolar and molar are lophodont teeths. Lophodont teeth with the cusps elongated to form narrow ridges. The molars in elephants and horses have cusps fused by means of intermediate masses of dentine to form ridges or lophs.

**11. (c)** Wharton's duct is the duct of the submaxillary or submandibular gland that occurs in the mouth on a papilla at the side of the frenulum of the tongue. The purpose of this duct is to drain the saliva.

**12. (c)** Continued consumption of fat rich diet causes hypercholesterolemia. Hypercholesterolemia is the presence of high levels of cholesterol in the blood. High cholesterol raises your risk for heart disease, heart attack, and stroke. Kidney stones are solid mass made up of tiny crystals. There are different types of kidney stones. The exact cause depends on the type of stone like, calcium stones, uric acid stone *etc*. Vitamin A toxicity or hypervitaminosis A is having too much of vitamin A in the body. Ketonuria is condition in which ketone bodies are present in urine. Body productes excess ketone bodies as an alternate source of energy during starvation or diabetes mellitus (type 1).

**13. (a)** Oxyntic cells or Parietal cells, are the stomach epithelium cells that secrete gastric acid intrinsic factor. These cells secrete hydrochloric acid (HCl) which makes the gastric juice acidic.(pH = 2.0-3.0).

Alpha cells of islets of Langerhans secretes glucagon hormone which increase the glucose level in the blood by converting glycogen to glucose in liver cells. Kupffer's cells are specialized cells in the liver that destroy bacteria, foreign proteins, and worn-out blood cells. Sebaceous glands and microscopic glands in the skin that secrete an oily/waxy matter (called sebum) to lubricate the skin and hair of mammals.

**14. (c)** Retinol is the chemical name of the vitamin A, which is mostly found in carrots, milk, cheese, fish etc. Retinol is well adapted for light absorption in animals where it is converted into the light-absorbing molecule called retinal. Deficiency of vitamin A mostly affects the rods containing retinal and leads to a disease called as night blindness or poor night vision. Tocopherol is the chemical name of vitamin E, found mostly in wheat germ oil, brown flour etc. Its deficiency causes sterility in rats. Vitamin C, also called as ascorbic acid, is found mostly in citrus fruits, potatoes, tomatoes etc. Its deficiency causes painful disease of the joints and gums called scurvy.

**15. (d)** Sugarcane and sugarbeet are the richest sources of sucrose, a disaccharide. It is most commonly found in plants, where it is transported in large quantity by phloem tissue. In humans, enzyme invertase (sucrase) present in duodenum of the small intestine hydrolyses sucrose into one molecule of glucose and one molecule of fructose. Pepsin is proteolytic enzyme that hydrolyses many proteins into smaller molecules of peptones. Saliva of humans contains salivary amylase (ptyalin) that hydrolyses starch into maltose, isomaltose and small dextrins. Lipases hydrolyse triglyceride fat into diglycerides, and then into monoglycerides alongwith fatty acids at each step.

**16. (a)** Parietal cells also called oxyntic cells are the stomach epithelium cells that secrete gastric acid and intrinsic factor. A cell of the gastric glands that secretes hydrochloric acid.

**17. (a)** Fats present below the skin surface in our body, is called subcutaneous fat deposition. It acts as insulator of body and prevent loss of heat from the body.

**18. (c)** Xerophthalmia is caused by vitamin A deficiency. This generally occurs in poorer section of the society because often they do not have adequate amount of fruits in diet.

**19. (a)** The average fat content in buffalo milk is 7.2% which is higher than human milk. Lactose is higher in human milk than cow and buffalo's milk.

**20. (a)** Fish has more polyunsaturated fatty acids which act as natural antioxidant.

**21. (a)** Endoscopy, a technique used to explore the stomach or other inner parts of the body, is based on total internal reflection.

**22. (a)** Lathyrism is caused by excessive consumption of khesari dal.

**23. (d)** Normal body temperature is 37 degree centigrade but in Kelvin scale 0ºC = 0ºC + 273 = 273ºK. When we convert 37ºC into Kelvin, it becomes 37 + 273 = 310ºK.

**24. (b)** There are three pairs of salivary glands. These are parotids (below the cheeks), sub maxillary/ or sub mandibular (lower jaw) and the sublinguals (below the tongue)

**25. (d)**

**26. (a)** Physiological value of carbohydrates is 4.0 kcal/g, proteins 4.0 kcal/g and of fats is 9.0 kcal/g. Hence,

5 g raw sugar will yield

5 × 4.0 = 20.0 kcal

4 g albumin (protein) will yield

4 × 4.0 = 16.0 kcal

10 + 2 g of fat will yield

12 × 9.0 = 108.0 kcal

Total yield = 144 kcal.

**27. (d)** Milk protein can be digested by pepsin and chymotrypsin

## Type B : Assertion Reason Questions

**28. (a)** Deficiency of ascorbic acid/vitamin C causes scurvy.

**29. (a)** In the condition of obstructive jaundice the entry of bile into the small intestine is prevented due to an obstruction in the bile duct. As we know that bile salts helps in the digestion of fats by emulsification and also in their absorption by the formation of water soluble droplets called micelles from whom fatty acids, glycerides, sterols and fat soluble vitamins are absorbed into the intestinal cells. Therefore, in the absence of bile, the fats remain unabsorbed and consequently are eliminated out of the body in the faeces.

**30. (c)** Pancreatic amylase is a starch splitting enzymes similar to ptyalin by hydrolysing starch and glycogen to maltose, isomaltose and limit dixtrins.

**31. (a)** Trypsin is protein digesting enzyme present in the intestine of animals. Though it cannot digest casein (a milk protein), in predator animals drinking the blood of their prey, trypsin hydrolyses fibriongen of blood into fibrin, leading to blood coagulation thus help in blood digestion. It also activates other pancreatic proteases.

**32. (d)** It is not lipases but the bile salts which are responsible for the emulsification of fats. Bile salts are steroids secreted by the liver in the bile. In the intestinal lumen, they reduce the surface tension of fat dropletes, causing their breakdown into many smaller ones. A stable fine emulsion of fat is thereby formed. On the other hand, lipases are the enzymes which hydrolyse fats and oils. Lipases can digest fat in significant amounts only when large fat droplets are broken into tiny droplets to form a fine emulsion. Emulsificaion of fats by bile salts thus, increases the lipase action on fats.

**33. (a)** In the condition of obstructive jaundice the entry of bile into the small intestine is prevented due to an obstruction in the bile duct. As we know that bile salts help in the digestion of fats by emulsification and also in their absorption by the formation of water soluble droplets called micelles from whom fatty acids, glycerides, sterols and fat soluble vitamins are absorbed into the intestinal cells. Therefore, in the absence of bile, the fats remain unabsorbed and consequently are eliminated out of the body in the faeces.

**34. (c)** Sucrase hydrolyses sucrose to glucose and fructose.

**35. (a)**

Chapter

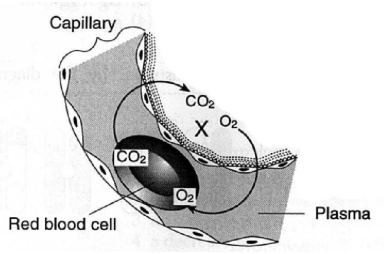
# 17 Breathing and Exchange of Gases

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Oxidative breakdown of respiratory substrates with the help of $O_2$ is called as ***[1997]***
(a) fermentation
(b) anaerobic respiration
(c) R.Q.
(d) aerobic respiration

**2.** Severe Acute Respiratory Syndrome (SARS)
(a) is caused by a variant of *Pneumococcus pneumoniae*. ***[2004]***
(b) is caused by a variant of the common cold virus (corona virus).
(c) is an acute form of asthma.
(d) affects non-vegetarians much faster than the vegetarians.

**3.** The diagram below represents part of a capillary in a specific region of the human body. The region labeled X represents part of ***[2009]***




(a) a glomerulus (b) an alveolus
(c) a villus (d) the liver

**4.** In humans, the concentration of carbon dioxide in the plasma ***[2009]***
(a) causes increased production of hydrochloric acid.
(b) regulates gastric acid production by forming carbonic acid.
(c) regulates breathing rate by its effect on the medulla.
(d) causes inflammation of the tissues of the bronchial tubes.

**5.** If the respiratory rate of 'A' is 35 breaths/min and tidal volume 185 cc/breath and of 'B' is 25 breaths/min and tidal volume 259 cc/breath then ***[2009]***
(a) Pulmonary ventilation of 'A' and 'B' is same.
(b) Alveolar ventilation of 'A' and 'B' is same.
(c) Pulmonary ventilation of 'A' is greater than 'B'.
(d) Alveolar ventilation of 'A' is greater than 'B'.

**6.** Oxyhaemoglobin can transport ***[2010]***
(a) 8 ml of $CO_2$/100 ml blood
(b) 5 ml of $CO_2$/100 ml blood
(c) 3 ml of $CO_2$/100 ml blood
(d) 2 ml of $CO_2$/100 ml blood

**7.** Which of the following match is correct? ***[2011]***
(a) Emphysema: reduction of surface area of alveoli and bronchi
(b) Pneumonia: occupational disease with asbestos
(c) Silicosis: inflammation of alveoli
(d) Asthma: excessive secretion of bronchial mucus

**8.** Volume of air breathed in and out during normal breathing is called ***[2012]***
(a) Vital capacity (b) IRV
(c) ERV (d) Tidal volume

**9.** Much developed larynx of human male is called
(a) Aristole's lanttern (b) Syrinx ***[2012]***
(c) Adam's apple (d) Muller's organ

**10.** The presence of $CO_2$ in blood will lower pH because $CO_2$ combines with____, with the rate of reaction increased by_____ . ***[2013]***
(a) $H_2O$ to form $H^+$ and $HCO_3^-$, carbonic anhydrase
(b) $H_2O$ to form only $HCO_3^-$, carbonic anhydrase
(c) $H_2O$ to form only $H^+$, carbonic ions
(d) $H^+$ to form $HCO_3^-$, oxyhaemoglobin

**11.** Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs ***[2014]***
(a) as bicarbonate ions
(b) in the form of dissolved gas molecules
(c) by binding to RBC
(d) as carbamino - haemoglobin

**12.** During oxygen transport the oxyhaemoglobin at the tissue level liberates oxygen to the cells because in tissue ***[2016]***
(a) $O_2$ concentration is high and $CO_2$ is low
(b) $O_2$ concentration is low and $CO_2$ is high
(c) $O_2$ tension is high and $CO_2$ tension is low
(d) $O_2$ tension is low and $CO_2$ tension is high

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 13-14) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**13.** **Assertion :** Many visitors to the hills suffer from skin and respiratory allergy problems.
**Reason :** Conifer trees produce a large quantity of wind-borne pollen grains. ***[2003]***

**14.** **Assertion :** Severe Acute Respiratory Syndrome (SARS) is originated in China.
**Reason :** China is the most populated country of the world. ***[2003]***

**Directions for (Qs.15-17) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**15.** **Assertion :** Oxyhaemoglobin dissociates near the organ tissue due to Bohr effect and oxygen is released. ***[2010]***
**Reason :**Increased $CO_2$ concentration reduces the affinity of haemoglobin for oxygen.

**16.** **Assertion:** In mammals, complex respiratory system has developed. ***[2011]***
**Reason:** Mammalian skin is impermeable to gases

**17.** **Assertion :** Inspiration occurs due to muscular relaxation.
**Reason :** During inspiration, the diaphragm and external intercostal muscle contract simultaneously. ***[2012]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** The oxidative breakdown of respiratory substrates (like carbohydrates, fats, proteins) into $CO_2$ and water, occurs in the presence of oxygen. It is called aerobic respiration.

**2. (b)** Severe acute respiratory syndrome (SARS) is caused by mutant of Influenza/common cold virus (*Corona* virus).

**3. (b)** An alveolus is a tiny air sac in the lung. It is the actual part of the lung that exchanges atmospheric oxygen with carbon dioxide from the blood. A glomerulus is a ball of capillaries found in the nephrons of the kidneys (to filter nitrogenous wastes), a villus is a tiny projection of a capillary in the small intestine (to absorb digested food), and the liver is the site of bile production and breakdown of amino acids.

**4. (c)** The medulla oblongata at the base of the brain increases breathing rate if the amount of carbon dioxide increases. It does not regulate breathing rate by checking oxygen content.

**5. (c)** The process by which a continuous exchange of gases is maintained across respiratory surface is often called external respiration. The ventilation rate of an animal is the volume of air breathed per minute *i.e* tidal volume x number of breathes per minute. It can be measured with the aid of a respirometer.

**6. (c)** Oxyhaemoglobin can transport about 3ml of carbon dioxide per 100 ml of blood.

**7. (a)** Cigarette smoking leads to the disease emphysema. In this disease, terminal bronchioles get obstructed. This reduces the ventilation of the alveoli connected to them. Many alveoli coalesce together to form large chambers due to destruction of their walls. This change of smaller alveoli to large chambers reducing the area of alveolar surface across which gases are exchanged. All these changes reduce both oxygen uptake and carbon dioxide elimination.

**8. (d)** Volume of air breathed in and out during normal breathing is called tidal volume. It is approximately 500 ml i.e., a healthy person can expire or inspire approximately 6000 to 8000 ml of air per minute as breathing rate is 12-16 times/minute.

**9. (c)** Larynx is a cartilaginous box which helps in sound production and hence is called the sound box. Much developed larynx of human male is called Adam's apple.

**10. (a)** Carbon dioxide combines with $H_2O$ in the plasma to form $H^+$ and $HCO_3^-$. The enzyme carbonic anhydrase catalyzes the reaction.

**11. (a)** $CO_2$ from the respiratory tissues to the lungs is transported by the blood in 3 ways:

**(i) In dissolved state or as a physical solution:** Very small amount is physically dissolved in plasma (7% *i.e.* 0.3 ml of $CO_2$ by each 100 ml of blood).

**(ii) Bicarbonate ions:** About 70% (*i.e.* @ 2.5 ml per 100 ml of blood) $CO_2$ diffuses in plasma & then into RBCs where it (in the presence of carbonic anhydrase) combines with $H_2O$ to form carbonic acid which is almost spontaneously dissociated into hydrogen ion and bicarbonate ions.

**(iii) Carbaminohaemoglobin :** 23% (*i.e.* 1 ml of $CO_2$ per 100 ml of blood) combines with haemoglobin forming an unstable compound.

**12. (d)**

## Type B : Assertion Reason Questions

**13. (b)** The skin problem could be due to pollen allergy and respiratory problem could be due to the decrease in oxygen content, since the atmosphere becomes thin as one goes up the hill.

**14. (b)** The first patient of SARS was reported in February 2003 in China. Its causing agent is human corona virus (type of Influenza virus) which spreads through contact, respiratory secretions and cockroaches.

**15. (a)** Bohr's effect is the effect of $CO_2$ on oxyhaemoglobin. Body tissues obtain oxygen from oxyhaemoglobin because of its dissociation caused by low $O_2$ and high $CO_2$ concentration. The increased $CO_2$ concentration reduces the affinity of haemoglobin for oxygen.

**16. (b)** Mammalian skin is impermeable so that water loss through it is minimised. But mammals need far more oxygen to maintain their high metabolic rates than lower animals; so they need a more extensive respiratory surface. Thus, a complex mammalian respiratory system consists of the nasal cavity, nasopharynx, larynx, trachea, bronchi, bronchiole and lungs.

**17. (c)** Inspiration is the result of muscular contraction. The diaphragm and external intercostal muscles contract simultaneously. The lateral thoracic wall moves outward and upward.

Chapter

# 18 Body Fluids and Circulation

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Anti-serum contains *[1997]*
(a) antigens (b) antibodies
(c) leucocytes (d) RBCs

**2.** Which enzyme induces lysis of fibrinogen to fibrin during fibrinolysis ? *[1997]*
(a) Plasmin (b) Thrombin
(c) Fibrin (d) Trypsin

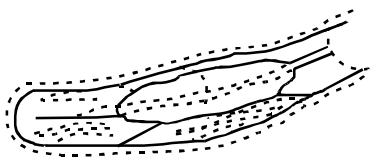
**3.** Which of the following blood group can be given to any patient ? *[1999]*
(a) A (b) B
(c) O (d) AB

**4.** Which of the following chamber of heart has the thickest muscular wall ? *[1999]*
(a) Left auricle (b) Left ventricle
(c) Right ventricle (d) Right auricle

**5.** In which of the following pairs the two items mean one and the same thing? *[2004]*
(a) Malleus - Anvil
(b) SA node - Pace maker
(c) Leucocytes - Lymphocytes
(d) Haemophilia - Blood cancer

**6.** An artificial pace maker is implanted subcutaneously and connected to the heart in patients *[2004]*
(a) having 90% blockage of the three main coronary arteries.
(b) having a very high blood pressure.
(c) with irregularity in the heart rhythm.
(d) suffering from arteriosclerosis.

**7.** The figure below shows an angioplasty of the coronary blood vessel. Which one of the following statements correctly describes, what is being done? *[2006]*



(a) It is coronary artery which has a cancerous growth that is being removed.
(b) It is coronary artery which is blocked by a plaque and the same is being cracked.
(c) It is coronary vein in which the defective valves are being opened.
(d) It is coronary vein blocked by a parasite (blood fluke) that is being removed.

**8.** Hirudin is *[2006]*
(a) A protein produced by *Hordeum vulgare*, which is rich in lysine.
(b) A toxic molecule isolated from *Gossypium hirusutum*, which reduces human fertility.
(c) A protein produced from transgenic *Brassica napus*, which prevents blood clotting.
(d) An antibiotic produced by a genetically engineered bacterium, *Escherichia coli*.

**9.** The component of blood which prevents its coagulation in the blood vessels is *[2007]*
(a) haemoglobin (b) plasma
(c) thrombin (d) heparin

**10.** Thickening of arteries due to cholesterol deposition is *[2007]*
(a) arteriosclerosis (b) rheumatic heart
(c) blood pressure (d) cardiac arrest.

**11.** Which one of the following is a matching pair? *[2003, 2008]*
(a) Lubb - Sharp closure of AV valves at the beginning of ventricular systole.
(b) Dup - Sudden opening of semilunar valves at the beginning of ventricular diastole.
(c) Pulsation of the radial artery valves in the blood vessels.
(d) Purkinje fibres-Initiation of the heart beat.

**12.** A malfunction of the lymph nodes would most likely interfere with the *[2009]*
(a) release of carbon dioxide into the lymph
(b) filtering of glucose from the lymph
(c) release of oxygen into the lymph
(d) filtering of bacteria from the lymph

**13.** Arteries supplying blood to the heart are called *[2010]*
(a) carotid arteries (b) hepatic arteries
(c) coronary arteries (d) pulmonary arteries

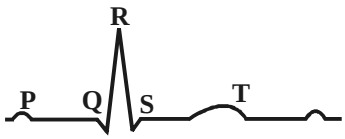
**14.** A man whose blood group is not known meets with a serious accident and needs blood transfusion immediately, which one of the blood groups readily available in the hospital will be safe for transfusion? ***[2010]***
(a) O, $Rh^-$ (b) O, $Rh^+$
(c) AB, $Rh^-$ (d) AB, $Rh^+$

**15.** With reference to the blood in a normal person, which one of the following statements is correct? ***[2010]***
(a) Compared to arteries, veins are less numerous and hold less of the body's blood at any given time.
(b) Blood cells constitute about 70 percent of the total volume of the blood.
(c) White blood cells (WBC) are made by lymph nodes only.
(d) The blood has more platelets than WBC.

**16.** Which of the following organs is the blood bank? ***[2011]***
(a) Heart (b) Lungs
(c) Spleen (d) Liver

**17.** Which one of the following is a matching pair of a certain body feature and its value/count in a normal human adult? ***[2003, 2008, 2011]***
(a) Urea 5-10 mg / 100 ml of blood
(b) Blood sugar (fasting) - 70-100 mg/100 ml
(c) Total blood volume - 5-6
(d) ESR in Wintrobe method - 9-15 mm in males and 20-34 mm in females

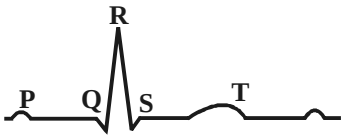
**18.** Given below is the ECG of a normal human. Which one of its components is correctly interpreted below? ***[2013]***




(a) Peak P and Peak R together - systolic and diastolic blood pressures
(b) Peak P - Initiation of left atrial contraction only
(c) Complex QRS - One complete pulse
(d) Peak T - Initiation of total cardiac contraction

**19.** Which of the following statements are wrong? ***[2013]***
(i) Leucocytes disintegrate in the spleen and liver.
(ii) RBC, WBC and blood platelets are produced by bone marrow.
(iii) Neutrophils bring about destruction and detoxification of toxins of protein origin.
(iv) The important function of lymphocytes is to produce antibodies.
(a) (i) and (ii) only (b) (i) and (iv) only
(c) (i) and (iii) only (d) (ii) and (iii) only

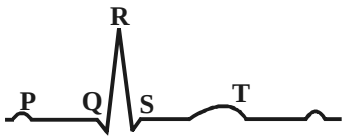
**20.** The diagram given here is the standard ECG of a normal person, the P-wave represents the :




(a) Initiation of the ventricular contraction
(b) Beginning of the systole
(c) End of systole
(d) Contraction of both the atria ***[2014]***

**21.** Bulk of carbon dioxide ($CO_2$) released from body tissues into the blood is present as ***[2015]***
(a) 70% carbamino-haemoglobin and 30% as bicarbonate
(b) carbamino-haemoglobin in RBCs
(c) bicarbonate in blood plasma and RBCs
(d) free $CO_2$ in blood plasma

**22.** Given below is the ECG of a normal human. Which one of its components is correctly interpreted below?




***[2015]***

(a) Peak P and Peak R together - systolic and diastolic blood pressures
(b) Peak P - Initiation of left atrial contraction only
(c) Complex QRS - One complete pulse
(d) Peak T - Initiation of total cardiac contraction

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 23-29) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are

required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**23.** **Assertion :** Muscle fibres of SA node possess the lowest rhythmicity among all cardiac muscles.
**Reason :** Due to this fact, it can initiate excitatory waves at the highest rate. ***[1999]***

**24.** **Assertion :** Saline water is not given to patients of hypertension.
**Reason :** Saline water can cause vomiting and may drop blood pressure suddenly causing cardiac arrest. ***[2000]***

**25.** **Assertion :** Blood pressure is arterial blood pressure.
**Reason :** Blood pressure is measured by sphygmomanometer. ***[2000]***

**26.** **Assertion:** WBCs accumulate at site of wounds by diapedesis.
**Reason:** It is squeezing of leucocytes from endothelium. ***[2002]***

**27.** **Assertion :** Persons suffering from haemophilia fail to produce blood clotting factor VIII.
**Reason :** Prothrombin producing platelets in such persons are found in very low concentration. ***[2005]***

**28.** **Assertion (A)** : Blood coagulates in uninjured blood vessels.
**Reason (R)** : Uninjured blood vessels release an anticoagulant heparin. ***[2007]***

**29.** **Assertion** : Smaller the organism higher is the rate of metabolism per gram weight.
**Reason** : The heart rate of a six month old baby is much higher than that of an old person. ***[2007]***

**Directions for (Qs.30-34) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**30.** **Assertion :** Prothrombinase enzyme act as antiheparin. ***[2010]***
**Reason :** Heparin prevent coagulation of blood in blood vessels.

**31.** **Assertion :** Blood is coloured in the insects.
**Reason :** Insect blood has no role in $O_2$ transport. ***[2012, 2013]***

**32.** **Assertion :** When there is a fall in the blood pressure due to loss of blood volume, this is compensated by vasoconstriction of veins.
**Reason :** Veins hold the extra amount of blood which can be shifted to the arteries as required. ***[2010, 2015]***

**33.** **Assertion :** Lub is a heart sound which is produced during each cardiac cycle.
**Reason :** It is associated with the closure of the tricusp and bicuspid valves. ***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Anti-serum is a blood serum that contains antibodies.

**2. (b)** During blood clotting, lysis of fibrinogen to fibrin occurs by plasma thrombin. Later on fibrin entangles corpuscles to form a clot. Thrombin is not mormally found in circulating blood, but instead it is repressed by its inactive precursor prothrombin. The conversion of prothrombin to thrombin requires blood platelets, calcium ions and thromboplastin.

**3. (c)** Blood group 'O' is universal donor. Group 'O' blood, with no antigens, can be given to anyone.

**4. (b)** Left ventricle of the heart has the thickest wall because it has to pump the blood to the farthest end of the body.

**5. (b)** Malleus is hammer shaped; lymphocytes are type of leucocytes and hemophilia is bleeder's disease (genetic) disorder). SA node acts as pacemaker because it functions as originator of cardiac impulse.

**6. (c)** Artificial pace maker is implanted to the patients where heart beat level drops abnormally low (30-40) due to disease or operations.

**7. (b)** In this figure, coronary angioplasty is being done where atherosclerotic plaque, which builds up and clogs the coronary arteries, is compressed against the vessel wall by expanding a balloon like device inserted through a catheter that has been threaded through the artery.

**8. (c)** Hirudin is an anticlotting agent produced by transgenic *Brassica napus*.

**9. (d)** Blood contains an anticoagulant called heparin, which prevents the activation of prothrombin. The latter is an inactive globulin which is required during blood coagulation. Heparin is released from the mast-cell granules.

**10. (a)** High proportion of cholesterol in blood leads to deposition of cholesterol on the walls of blood vessels. This causes the arteries to lose their elasticity and get stiffened. This is called arteriosclerosis or hardening of arteries.

**11. (a)** Lubb sound is caused partly by the closure of the bicuspid and tricuspid valves and partly by the contraction of the muscles in the ventricles. Lubb is the first heart sound.

**12. (d)** The lymphatic system not only regulates fluid amounts in the blood but also helps to fight infection. The lymph nodes produce white blood cells and filter harmful bacteria, that is why they tend to enlarge when we have an infection.

**13. (c)** Coronary arteries supply the blood to the heart. Carotid arteries supply the blood to head region. Hepatic arteries supply the blood to liver while the pulmonary artery supplies blood to the lungs.

**14. (b)** According to ABO system of blood grouping, O type blood can be given to person of all types of blood, *i.e.*, O, A, B and AB. Hence, a person with O type blood is called universal donor.

According to Rh system of blood grouping, most of the people have blood in which there is a substance called Rh factor. Rh stands for rhesus. This type of blood can be donated only in rarest of rare chances. In India, about 97% of people are $Rh^+$. So, if an $Rh^+$ person is transfused with $Rh^+$ blood, then it is safe. But if an Rh negative ($Rh^-$) person is transfused with $Rh^+$ blood then he/she will develop anti-Rh factor *i.e.*, antibodies in his/her blood, and there might beno harm is, but may kill the recipient if a second $Rh^+$ transfusion is done.

**15. (d)** The number of blood platelets per cubic mm in human blood is 3 lacs while the number of WBCs are 5000/cubic mm of blood. Veins are as complex as the arteries. Veins and arteries both are types of blood vessels. Arteries carry blood from heart to different organs while vein carries blood from different organs to heart. At any given

time in a healthy human, the blood amount is same in both, as the circulation of blood never stops.

Blood consists of two parts:

The **plasma** (water, proteins, inorganic salts and other elements) constitutes 55-60% of blood while **cellular** part constitutes 40-45% of total blood. WBCs are produced in red bone marrow, lymph nodes and sometimes even in liver and spleen.

**16. (c)** Spleen is referred to as a blood bank of the body because it is the organ having the function of making and storing lymphocytes and red corpuscles. These are squeezed out into the blood-stream when the body needs more in circulation, as for instance in haemorrhage or shock.

**17. (b)** Fasting glucose level is 70-110 mg/decilitre. Total blood volume in normal adult human is 5-6 litres. Blood is a fluid connective tissues. Its cells consists of corpuscles. Plasma represents matrix of blood. Blood is mesodermal in origin and salty in taste. Its pH is 7.3 – 7.4.

**18. (c)** **19. (c)**

**20. (d)** The P-wave represents the electrical excitation (or depolarisation) of the atria, which leads to the contraction of both the atria. The QRS complex represents the depolarisation of the ventricles, which initiates the ventricular contraction. The contraction starts shortly after Q and marks the beginning of the systole.

**21. (c)**

**22. (c)**

## Type B : Assertion Reason Questions

**23. (e)** The sinoatrial or sinoauricular node determines the rate of heart beat by determining the rate of discharge of cardiac impulse. It is called the pace maker. It is formed of specialized cardiac muscles and is located in the right atrial wall near the opening of superior venacava. These muscles are self excitable. Since it is self excitable, it can produce waves at highest rate. Hence, the assertion is incorrect.

**24. (c)** Saline water increases the blood pressure due to the presence of NaCl in it. Hence, the reason for the assertion is false.

**25. (b)** Blood pressure is the arterial pressure of blood exerted on the wall of arteries with each heart beat. It is measured form the brachial artery in the elbow pit. It is expressed as

$$= \frac{\text{systolic pressure (mm/Hg)}}{\text{diastolic pressure (mm/Hg)}}$$

Arterial (superficial; arteries) blood pressure is measured by sphygmomanometer.

**26. (b)** WBC's are wandering cells capable of coming out of blood capillaries by amoeboid movement called diapedesis.

**27. (a)** Haemophilia is caused by lack of activity of blood clotting factor VIII or IX and they show platelet function disorder.

**28. (d)** When an injury is caused to a blood vessel, bleeding starts which is stopped by blood clotting. At the site of injury blood platelets release platelet factor - 3 and injured tissues release thromboplastin. The two combine to form prothrombinase enzyme which converts prothrombin to thrombin. The latter stimulates formation of fibrin thread or clot. Blood contains an anticoagutant heparin which prevents blood clotting in uninjured vessels.

**29. (b)** The basal metabatic rate is defined as the energy requirement of human body at rest. BMR of smallest animals are generally higher then larger animals. Peoples with higher metabolism means that they have higher heart rate. Heart rate of baby is 70-190 times/minute, whereas adults (including serious) is 60-100 times/ minute.

**30. (b)** Prothrombinase enzyme is necessary for blood clotting. It acts as antiheparin. Coagulation of blood in vessels is prevented by heparin, a quick acting anticoagulant. It inhibits conversion of prothrombin to thrombin and is used in open-heart surgery.

**31. (b)** Insect blood is colourless and does not play any role in transport of oxygen. Insects have tracheal respiration.

**32. (a)** When the blood pressure of an individual decreases due to loss of blood volume, then vasoconstriction of veins occurs. This shifts the little amount of blood from veins to arteries.

**33. (b)** Lub and dub are two heart sounds, which occurs due to the closure of cuspid valves and semilunar valves respectively. Lub is the first heart sound which is formed due to closure of atrioventricular valves at the beginning of ventricular systole. It is low pitched of long duration (0.15 sec).

Chapter 19

# Excretory Products and their Elimination

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Podocytes occur in *[1998]*
(a) large intestine
(b) glomerulus of kidney
(c) wall of capillaries
(d) neck region

**2.** The end product of ornithine cycle is *[1999]*
(a) urea (b) uric acid
(b) $NH_3$ (d) $CO_2$

**3.** Reabsorption in tubules of nephrons occurs by *[2000]*
(a) osmosis (b) diffusion
(c) active transport (d) both (b) & (c)

**4.** Toxic substances are detoxified in human body in *[2001]*
(a) kidney (b) lungs
(c) liver (d) stomach

**5.** In which of the following minimum content of urea is present ? *[2012]*
(a) Hepatic portal vein
(b) Portal vein
(c) Renal vein
(d) Vena cava

**6.** Duct of Bellini is concerned with *[2012]*
(a) Filtration of urine
(b) Purification of urine
(c) Conduction of urine
(d) All the above

**7.** Which one of the following statements in regard to the excretion by the human kidneys is *correct*? *[2013]*
(a) Ascending limb of Loop of Henle is impermeable to electrolytes
(b) Descending limb of Loop of Henle is impermeable to water
(c) Distal convoluted tubule is incapable of reabsorbing $HCO_3^-$
(d) Nearly 99 per cent of the glomerular filtrate is reabsorbed by the renal tubules

**8.** If Henle's loop were absent from mammalian nephron which of the following is to be expected *[2015]*
(a) there will be no urine formation
(b) there will be hardly any change in the quality and quantity of urine formed
(c) the urine will be more concentrated
(d) the urine will be more dilute.

**9.** Which blood vessel in mammals would normally carry the largest amount of urea? *[2016]*
(a) Dorsal aorta (b) Hepatic vein
(c) Hepatic portal vein (d) Renal vein

**10.** In ornithine cycle, enzyme arginase breaks down arginine into *[2016]*
(a) Citrulline and ammonia
(b) Ornithine and ammonia
(c) Ornithine and urea
(d) Citrulline and urea.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 11-13) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**11.** **Assertion :** During physiology of excretion, deamination does not take place in liver.
**Reason :** Deamination is a process to make use of excess of amino acids which cannot be incorporated into protoplasm. *[2001]*

**12.** **Assertion :** Secreting hypotonic urine is effective in reducing urinary loss of water.
**Reason :** Hypotonic urine is more concentrated and higher in osmotic pressure than the blood. ***[2007]***

**13.** **Assertion :** Aldosterone is a steroid hormone and is important in the control of sodium and potassium ion concentration in mammals.
**Reason :** It upgrades sodium ion concentration in the ECF by promoting reabsorption of sodium ions from renal tubules and excretion of potassium ions in urine. ***[2007]***

**Directions for (Qs.14-18) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**14.** **Assertion :** Ultrafiltration takes place in presence of effective filtration pressure.
**Reason :** In ultrafiltration process, blood is filtered in Bowman's capsule, filtered fluid contain protein & blood corpuscles also. ***[2010]***

**15.** **Assertion :** In vertebrates, the liver is also referred as an accessory excretory organ.
**Reason :** Liver helps kidneys in the secretion of urine. ***[2012]***

**16.** **Assertion :** Main constituent of human urine is ammonia.
**Reason :** If human urine is allowed to stand for some time, it smells strongly of ammonia. ***[2013]***

**17.** **Assertion :** Hemodialysis can save and prolong the life of uremic patients.
**Reason :** Waste products like urea can be removed from the blood by the process of hemodialysis. ***[2014]***

**18.** **Assertion :** In the descending limb of loop of Henle, the urine is hypertonic, whereas in ascending limb of loop of Henle, the urine is hypotonic.
**Reason :** Descending limb is impermeable to sodium, while ascending limb is impermeable to water. ***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Podocytes are specialized visceral epithelial cell in the Bowman's capsule in the kidneys that wraps around the capillaries of the glomerulus. It helps filter blood in the glomerulus of the kidney.

**2. (a)** The ornithine cycle occurs in the mitochondria of liver cells. It is meant for urea formation.

**3. (d)** Tubular reabsorption is the second process in urine formation through filtrate. In this, most of the filtrate passes out of rephron tubule and returns to the blood through peritubular capillaries. Tubular reabsorption occurs by diffusion and active transport.

**4. (c)** Liver is the primary site of detoxification and elimination of body wastes and poisons. Liver detoxifies endotoxins, *e.g.* toxic $NH_3$ combined with $CO_2$ to form less toxic urea. It also detoxifies alcohol and convert them to acetaldehyde and then harmless acetyl CoA.

**5. (c)** Renal veins connects the kidney to inferior vena cava. They carry the blood purified by the kidney and carry minimum quantity of urea.

**6. (c)** Renal collecting tubules are also known as duct of bellini. These are the long narrow tubes in the kidney that conduct urine from the nephrons to larger ducts that leads to urinary bladder.

**7. (d)**

**8. (d)** Henle's loop is responsible for the reabsorption of water and sodium chloride from the urine. Hence, in the absence of Henle's loop the urine will become more dilute.

**9. (b)** **10. (c)**

## Type B : Assertion Reason Questions

**11. (d)** Deamination is the process of converting amino acid to keto acid with the release of $NH_3$. It occurs in the liver.

**12. (d)** Hypotonic urine means concentration of urine is less than that of blood. Hypertonic urine is more concentrated than blood and has high osmotic pressure than the blood, therefore it helps in reducing the loss of water with urine. The urine is filtered by the Bowman's capsule. The tubules of nephrons reabsorb a large quantity of water making urine more concentrated.

**13. (a)** Aldosterone is one of the important mineralocorticoids in humans secreted by adrenal cortex. Its main function is to regulate sodium content of the body . It increases sodium ion concentration in the blood by absorbing sodium ions from renal tubules. Excessive production of aldosterone causes a disease aldosteronism. Its symptoms include high blood pressure, high blood volume.

**14. (c)** Ultrafiltration takes place in renal corpuscle of uriniferous tubule. It takes place in presence of effective filtration pressure. During the process, blood is filtered and contains only blood plasma – proteins. The filtered blood entering into Bowman's capsule is called glomerular filtrate.
Glomerular filtrate = Blood – (Blood corpuscles + plasma proteins)

**15. (c)** In vertebrates, the lungs, liver & skin are referred as accessory excretory organs because besides the urinary system these organs also participate in the removal of waste products from the body. The liver is the principal organ for the excretion of cholesterol, bile pigments (bilirubin and biliverdin) and inactivated products of steroid hormones, some vitamins and many drugs. It secretes these substances in the bile and indirectly helps by formation of urea through amino acids in ornithine cycle. It has no role in secretion of urine.

**16. (d)** Urea is the chief nitrogenous constituent of human urine, though it possesses small amount of ammonia. But when the urine is allowed to stand for sometime, bacterial

degradation occurs and it leads to the production of ammonia from urine. And thus it smells strongly.

**17. (a)** The blood urea level rises abnormally (uremia) in patients suffering from renal failures. In uremia patients an artificial kidney is used for removing accumulated waste products like urea from the blood by a process called hemodialysis. In this way, hemodialysis saves and prolongs the life of many uremic patients.

**18. (a)** Descending limb of Henle is permeable to water but not to sodium. Consequently water moves out into interstitium and concentration of sodium in tubular filtrate rises making filtrate hypertonic. Ascending loop is impermeable to water but permeable to sodium and makes the filtrate hypotonic.

Chapter

# 20 Locomotion and Movement

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Cranium of human contains *[2000]*
(a) 12 bones (b) 8 bones
(c) 14 bones (d) 20 bones

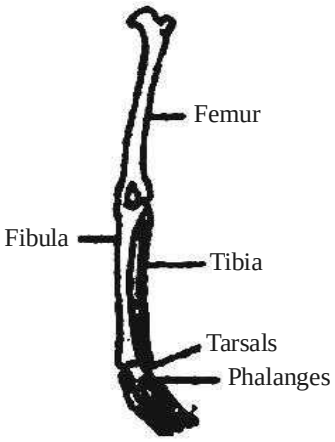
**2.** Which of the following is made up of a single bone in mammal ? *[2001]*
(a) Dentary (b) Hyoid
(c) Upper jaw (d) All of these

**3.** Sella turcica is found *[2001]*
(a) near pituitary (b) in bone
(c) in joints (d) near thyroid

**4.** Which one of the following is a sesamoid bone? *[2003]*
(a) Pelvis (b) Patella
(c) Pterygoid (d) Pectoral girdle

**5.** Two of the body parts which do not appear in MRI may be *[2005]*
(a) molar teeth and eye lens
(b) scapula and canines
(c) ligaments and ribs
(d) tendons and premolars

**6.** Given below is a diagram of the bones of the left human hindlimb as seen from front. It has certain mistakes in labelling. Two of the wrongly labelled bones are *[2005]*




(a) tibia and tarsals
(b) femur and fibula
(c) fibula and phalanges
(d) tarsals and femur

**7.** A cricket player is fast chasing a ball in the field. Which one of the following groups of bones are directly contributing in this movement? *[2006]*
(a) Femur, malleus, tibia, metatarsals
(b) Pelvis, ulna, patella, tarsals
(c) Sternum, femur, tibia, fibula
(d) Tarsals, femur, metatarsals, tibia

**8.** The shoulder blade is made of *[2007]*
(a) clavicle (b) humerus
(c) ilium (d) scapula

**9.** The sensation of fatigue in the muscles after prolonged strenuous physical work, is caused by *[2010]*
(a) a decrease in the supply of oxygen
(b) minor wear and tear of muscle fibres
(c) the depletion of glucose
(d) the accumulation of lactic acid

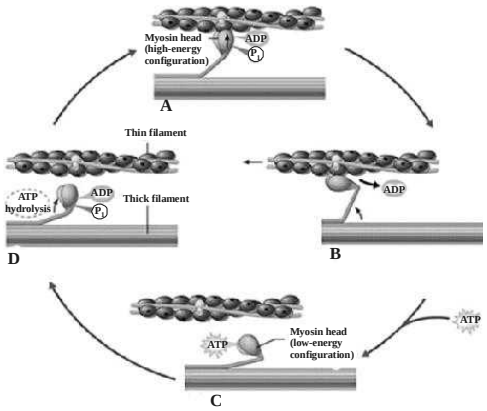
**10.** Sesamoid bone is derived from- *[2012]*
(a) Cartilage (b) Areolar tissue
(c) Tendon (d) Ligament

**11.** Select the correct matching of the type of the joint with the example in human skeletal system: *[2014]*

| | **Type of joint** | **Example** |
|---|---|---|
| (a) | Cartilaginous joint | between frontal and parietal |
| (b) | Pivot joint | between third and fourth cervical vertebrae |
| (c) | Hinge joint | between humerus and pectoral girdle |
| (d) | Gliding joint | between carpals |

**12.** Wish bone in birds is formed from the bones of *[2016]*
(a) Shoulder girdle (b) Hip girdle
(c) Keeled sternum (d) Skull bones

**13.** The given figure represents the cross bridge cycle in skeletal muscle. What does the step B in the figure represents? ***[2017]***




(a) Attachment of myosin head to actin forming cross bridge.
(b) Release of phosphate. Myosin changes shape to pull actin.
(c) Attachment of new ATP to myosin head. The cross bridge detaches.
(d) Splitting of ATP into ADP and Pi. Myosin cocks into its high energy conformation.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 14-15) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**14.** **Assertion:** Fatigue is inability of muscle to relax.
**Reason:** It is due to lactic acid accumulation by repeated contractions. ***[1998]***

**Directions for (Qs.15-19) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**15.** **Assertion :** Ball and socket joints are the most mobile joints.
**Reason :** Synovial fluid is present here. ***[2012]***

**16.** **Assertion :** Intercalated discs are important regions of cardiac muscle cells.
**Reason :** Intercalated discs function as boosters for muscle contraction waves. ***[2012]***

**17.** **Assertion :** Arthritis or inflammation of a joint makes the joint painful.
**Reason :** Some toxic substances are deposited at the joint. ***[2013]***

**18.** **Assertion :** The phase of muscle contraction occurs when myosin binds and releases actin.
**Reason :** Muscle contraction is initiated by a signal sent by the peripheral nervous system via motor neuron. ***[2016]***

**19.** **Assertion :** Inflammation of a skeletal joint may immobilize the movements of the joint.
**Reason :**Uric acid crystals in the joint cavity and ossification of articular cartilage lead to this. ***[2006, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Cranium of human body consists of 8 bones. There are 1 frontal, 2 parietal, 2 temporal, 1 occipital, 1 sphenoid and 1 ethmoid bone.

**2. (b)** Hyoid is a horse shoe shaped bone present in neck between lower law and sound box (larynx). It is not articulated to any bone, but is simply suspended, from temporal bones by means of ligaments. Hyoid provides surface for the attachment of tongue muscles.

**3. (b)** Sella turcica/turkish saddle/pituitary fossa is a depression in sphenoid bone of skull in which pituitary gland lies.

**4. (b)** Sesamoid bones are formed in the tendons at the joints, *e.g.* patella.

**5. (b)** MRI machine does not show face image of bone and calcium, *e.g.* scapula, canine. It is also not suitable for patients with cardiac pace makers.

**6. (c)** Fibula and phalanges marked parts are actually tibia and metatarsals.

**7. (d)** In a fast chasing cricketer, foot and leg bones contribute directly in this movement *e.g.* femur, tibia, tarsal and metatarsals.

**8. (d)** Shoulder blade is made up of scapula. It is a flat, triangular-shaped largest bone present in each half of the pectoral (shoulder) girdle. It is joined to the clavicle in front. The clavicle is well developed in humans that links scapula to the sternum.

**9. (d)** The sensation of fatigue in the muscles after prolonged strenuous physical work is caused by the accumulation of lactic acid.

**10. (c)** Sesmoid bones are embedded in tendons. Sesmoids are found in locations where a tendon passes over a joint, such as the hand, knee and foot. Functionally they act to protect the tendon and its mechanical effect.

**11. (d)** A gliding joint is a common type of synovial joint formed between bones that meet at flat or nearly flat articular surfaces. Gliding joints allow the bones to glide past one another in any direction along the plane of the joint - up and down, left and right, and diagonally. Many gliding joints are formed in the appendicular skeleton between the carpal bones of the wrist; between the carpals and the metacarpals of the palm; between the tarsal bones of the ankle; and between the tarsals and the metatarsals of the foot.

**12. (a)** Two clavicles fuse with one inter-clavicle to form 'Wish bone' or 'Bone of merry thought'.

**13. (b)** Step A: Attachment of myosin head to actin forming cross bridge.

Step B: Release of phosphate. Myosin changes shape to pull actin.

Step C: Attachment of new ATP to myosin head. The cross bridge detaches.

Step D: Splitting of ATP into ADP and Pi. Myosin cocks into its high energy conformation.

## Type B : Assertion Reason Questions

**14. (a)** Due to the accumulation of lactic acid, muscles do not respond to a stimuli. After a prolonged previous activity.

**15. (b)** Synovial fluid is a thick sticky fluid secreted by synovial membranes into the synovial cavity. Though the presence of synovial fluid is one of the reasons behind the mobility of the joints, but the most accurate reason is the arrangement of the bones at the joint, the spheroidal ball-like end of one bone articulates here with the cup-shaped depression in another. This allows the bone with the ball head to be moved freely in many planes. Shoulder joints and hip joints are the ball-and-socket joints.

**16. (a)** Cardiac muscle cells are short cylindrical cells joined end to end and by side branching to form a network. Intercalated discs are the dense junctions formed in between the cardiac muscle cells where

they meet each other. Intercalated discs are the specialised regions of the cell membranes. As cardiac muscle possesses considerable rhythmicity and generates its own wave of excitation, these discs function as boosters for muscle contraction wave.

**17. (c)** Arthritis or inflammation of a joint makes the joint painful and may even immobilise the movements at the joint. This may result from a lack of the synovial fluid at the joint. The ossification of the articular cartilage, deposition of uric acid crystals in the joint cavity or other changes at the joint.

**18. (c)** The phase of muscle contraction occurs when myosin binds and releases actin. Muscle contraction is initiated by a signal sent by the central nervous system via a motor neuron. A motor neuron along with the muscle fibres connected to it constitutes a motor unit.

**19. (a)** Painful inflammation of the synovial membrane of the joints results in stiffening of joints and painful movement Uric acid accumulation in the joints can lead to painful movement of joint.

Chapter

# 21 Neural Control and Coordination

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The vagus nerve is the cranial nerve numbering *[1997]*
(a) 10th (b) 9th
(c) 5th (d) 8th

**2.** Sensation of stomach pain is due to *[1998]*
(a) interoceptors (b) exteroceptors
(c) teloreceptors (d) all of these

**3.** Which is the example of conditioned reflex ? *[1999]*
(a) Eyes closed when anything enter into it.
(b) Hand took up when piercing with needle.
(c) Salivation in a hungry dog in response to ringing of a bell.
(d) Digestion food goes forward in alimentary canal.

**4.** Otorhinolaryngology is the study of *[1999]*
(a) brain cells
(b) bird anatomy
(c) locomotary organs
(d) ENT

**5.** If frog's brain is crushed, even then its leg moves on pinpointing . It is called *[2001]*
(a) simple reflex
(b) conditional reflex
(c) neurotransmitter function
(d) autonomic nerve conditions

**6.** Which of the following is not a mental disorder?
(a) Epilepsy (b) Neurosis *[2001]*
(c) Psychosis (d) Plague

**7.** The $5^{th}$ cranial nerve of frog is called *[1998, 2001]*
(a) optic nerve (b) vagus nerve
(c) trigeminal nerve (d) olfactory nerve

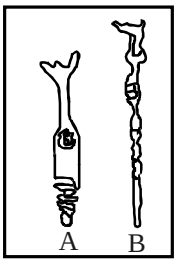
**8.** The crystal of lead zirconate is a key component of *[2003]*
(a) electroencephalography
(b) electrocardiography
(c) magnetoencephalography
(d) sonography

**9.** Excessive stimulation of vagus nerve in humans may lead to *[2003]*
(a) hoarse voice
(b) peptic ulcers
(c) efficient digestion of proteins
(d) irregular contraction of diaphragm

**10.** A person is wearing spectacles with concave lenses for correcting vision. While not using the glasses, the image of a distant object in his case will be formed *[2003]*
(a) on the blind spot
(b) behind the retina
(c) in front of the retina
(d) on the yellow spot

**11.** Unidirectional transmission of a nerve impulse through nerve fibre is due to the fact that *[2004]*
(a) nerve fibre is insulated by a medullary sheath.
(b) sodium pump starts operating only at the cyton and then continues into the nerve fibre.
(c) neurotransmitters are released by dendrites and not by axon endings.
(d) neurotransmitters are released by the axon endings and not by dendrites.

**12.** Examine the diagram of the two cell types A and B given below and select the correct option: *[2006]*




(a) Cell A is the rod cell found evenly all over retina.
(b) Cell A is the cone cell more concentrated in the fovea centralis.
(c) Cell B is concerned with colour vision in bright light.
(d) Cell A is sensitive to low light intensities.

**13.** A person, who shows unpredictable moods, outbursts of emotion, quarrelsome behaviour and conflicts with others, is suffering from
(a) borderline personality disorder (BPD)
(b) mood disorder ***[2006]***
(c) addictive disorder
(d) schizophrenia

**14.** Which of the following is an eye disease?
(a) hepatitis (b) measles
(c) glaucoma (d) bronchitis

**15.** Given below is a table comparing the effects of sympathetic and parasympathetic nervous system for four features (1-4). ***[2006]***
Which one feature is correctly described?

| | Feature | Sympathetic nervous system | Parasympahtetic nervous system |
|---|---|---|---|
| (a) | Salivary glands | Stimulates secretion | Inhibits secretion |
| (b) | Pupil of the eye | Dilate | Constricts |
| (c) | Heart rate | Decrease | Increase |
| (d) | Intestinal peristalsis | Stimulates | Inhibits |

**16.** Hearing impairment affects which part of brain? ***[2007]***
(a) Frontal lobe (b) Parietal lobe
(c) Temporal lobe (d) Cerebellum

**17.** The black pigment in the eye which reduces the internal reflection is located in ***[2007]***
(a) retina (b) iris
(c) cornea (d) sclerotic

**18.** Bipolar nerve cells are present in ***[2012]***
(a) Skin tactile corpuscles
(b) Spinal cord
(c) Retina of eye
(d) All the above

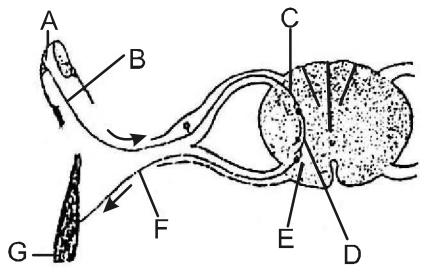
**19.** Fenestra ovalis is the opening of ***[2012]***
(a) Cranium (b) Tympanum
(c) Tympanic cavity (d) Brain

**20.** Multipolar nerve cells are present in ***[2012]***
(a) Cochlea
(b) Dorsal root ganglia of spinal cord
(c) Retina of eye
(d) Brain

**21.** Neurons receive signals through their _____ and send signals to other neurons through their _____. ***[2013]***
(a) dendrites ... receptors
(b) end feet ... cell bodies and dendrites
(c) cell bodies and dendrites ... axons
(d) transmitter vesicles ... axons

**22.** Which of the following ions are required for nerve conduction ? ***[2016]***
(a) $Ca^{++}$, $Na^{+}$ and $K^{+}$ (b) $Ca^{++}$ and $Mg^{++}$
(c) $Mg^{++}$ and $K^{+}$ (d) $Na^{+}$ and $K^{+}$

**23.** The following diagram indicates the reflex arc. Identify the parts labelled as A, B, C, D, E, F and G. Choose the correct option




***[2016]***
(a) A = sense organ; B = sensory nerve; C = dorsal horn; D = interneuron; E = ventral horn; F = motor nerve; G = effector
(b) A = sense organ; B = sensory nerve; C = ventral horn; D = interneuron; E = dorsal horn; F = motor nerve; G = effector
(c) A = effector; B = motor nerve; C = dorsal horn; D = interneuron; E = ventral horn; F = sensory nerve; G = effector
(d) A = effector; B = motor nerve; C = ventral horn; D = interneuron; E = dorsal horn; F = sensory nerve; G = sense organ.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 24-26) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**24.** **Assertion :** Transmission of nerve impulse across a synapse is accomplished by neurotransmitters.

**Reason :** Transmission across a synapse usually requires neurotransmitters because there is a small space, *i.e.*, synaptic cleft, that separates one neuron from another. ***[1999]***

**25.** **Assertion :** Tongue is a gustatoreceptor.

**Reason :** Receptors for gustatory sensations are located in taste buds. ***[2000]***

**26.** **Assertion :** Astigmatism is due to uneven curvature of lens.

**Reason :** It is treated with cylindrical lenses. ***[2007]***

**Directions for (Qs. 27-31) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**27.** **Assertion :** The brain stem contains centres for controlling activities.

**Reason :** Brain stem is very sensitive. ***[2012]***

**28.** **Assertion :** The chemical stored in the synaptic vesicles are termed as neurotransmitters.

**Reason :** Synaptic vesicles release these chemicals in the synaptic cleft. ***[2013]***

**29.** **Assertion:** The imbalance in concentration of $Na^+$, $K^+$ and proteins generates resting potential.

**Reason:** To maintain the unequal distribution of $Na^+$ & $K^+$, the neurons use electrical energy. ***[2002, 2015]***

**30.** **Assertion :** The axonal membrane of the neuron is more permeable to sodium ion ($Na^+$) and nearly impermeable to potassium ($K^+$).

**Reason :** In a resting state neuron does not conduct any impulse. ***[2016]***

**31.** **Assertion :** A cerebellum is related with skillful voluntary movement and involuntary activity like body balance, equilibrium, *etc*.

**Reason :** It is part of hind brain and it is situated behind the pons. ***[2010, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1.** **(a)** Vagus is the $10^{th}$ cranial nerve. Vagus is the longest cranial nerve. It has maximum branches and also called as wandering nerve.

**2.** **(a)** The sensation of stomach pain is due to enteroceptors (visceroreceptors).

**3** **(c)** Conditioned reflexes are acquired reflexes and dependent on past experiences, training and learning I.R. Pavlov demonstrated conditioned reflexes in a hungry dog. He called food and salivation in response to it as unconditioned stimulus and sound of bell and salivation in response to bell as conditioned reflexes.

**4.** **(d)** Otorhinolaryngology is the study of ENT.

**5.** **(a)** The withdrawl of leg in a decapitated frog when pin pointed is a type of simple-reflex.

**6.** **(d)** Plague is a bacterial disease of rat, caused by *Pasteurella pestis*. Their vector is rat flea (*Xenopsylla cheopsis*). Bubonic plague affects lymph nodes. Pneumonic plague affects lungs and septicemic plague causes anaemia.

**7.** **(c)** The $5^{th}$ cranial nerve in frog is trigeminal.

**8.** **(d)** Lead zirconate is a key component of sonography. These crystals are housed in a transducer which gets excited and starts vibrating when an electric potential is applied to it. These vibrations are the source of ultrasound.

**9.** **(d)** Vagus nerve is a mixed nerve. It controls the visceral sensations and visceral movements, *e.g.* respiratory movements.

**10.** **(c)** Concave lenses correct the eye condition of near sightedness *i.e.* myopia by bringing the light rays to a focus on retina. In such cases light rays converge at a point in front of the retina.

**11.** **(d)** Transmission of nerve impulse is always from axon of one neuron to the dendrite of another neuron *i.e.* unidirectional because neurotransmitters are produced by axons and not by dendrites.

**12.** **(b)** Cell A is the cone cell more concentrated in the fovea centralis/yellow spot of the eye. Cone cells are sensitive to bright light hence helps in differentiating colours and give high resolution. These cells are specialized for colour vision.

**13.** **(a)** Borderline personality disorder is an emotionally unstable personality disorder charactarised by impulsivity, unpredictable moods, outburst of emotion, behavioural explosions, quarrelsome behaviour and conflicts with others.

**14.** **(c)** Glaucoma is an eye disease characterized by increased occular pressure within the eye ball. Glaucoma is a group of diseases of the optic nerve involving loss of retinal ganglion cells in a characteristic pattern of optic neuropathy. Untreated glaucoma leads to permanent damage of the optic nerve and resultant visual field loss that can progress to blindness.Measles is a highly infectious viral disease that usually spread by droplet infection. Bronchitis is the inflammation of the membrane lining of the bronchial tubes.

**15.** **(b)** Sympathetic nervous system inhibits salivary gland secretion, accelerate heart rate, decreases intestinal peristalsis and dilate pupil of the eye. Whereas parasympathetic nervous system stimulates salivary gland secretion, slows heart rate, sitmulates intestinal peristalsis and constricts pupil of the eye. The sympathetic and the parasympathetic nervous system are parts of what is commonly called the autonomic nervous

system. These systems work in balance with each other and directly or indirectly affect almost every structure in the body (*e.g.* heart frequency, heart capacity, lumbar function, kidneys, blood vessels, stomach and intestines). The sympathetic nervous system has an active "pushing" function, the parasympathetic has mainly a relaxing function.

| Sympathetic | Structure | Parasympathetic |
|---|---|---|
| Rate increased | Heart | Rate decreased |
| Force increased | Heart | Force decreased |
| Bronchial muscle relaxed | Lungs | Bronchial muscle contracted |
| Pupil dilation | Eye | Pupil constriction |
| Motility reduced | Intestine | Digestion increased |
| Sphincter closed | Bladder | Sphincter relaxed |
| Decreased urine secretion | Kidneys | Increased urine secretion |

**16. (c)** Forebrain is the largest part of the brain consisting of two halves called cerebral hemispheres separated by longitudinal fissures. Each cerebral hemisphere is divided into four lobes-frontal lobe, parietal lobe, temporal lobe and occipital lobe. Temporal lobe has cells that bring to consciousness, the sensations of hearing and smell. The frontal lobe has centers that are concerned with voluntary movements and personality. The parietal lobe is concerned with general sensations like temperature, touch, pressure, pain, and proprioception. The occipital lobe has centers of visual sense.

**17. (a)** The inner layer of the posterior two-thirds of the eyeball consists of a light sensitive layer, called retina that possesses two types of photoreceptors called the rods and the cone cells. Retina reduces the internal reflection so any damage to it leads to greater internal reflection of light often causing an increase in light sensitivity.

**18. (c)** Bipolar nerve cells are present in retina of eye. Bipolar nerve cell posses one axon and one dendron.

**19. (c)** Fenestra ovalis is membrane covered opening leading from tympanic cavity into the vestibule of the internal ear.

**20. (b)** Multipolar nerve cells are present in dorsal root ganglia of spinal cord.

**21. (c)** Dendrites generally receive inputs and conduct signals toward the cell body, whereas axons conduct signals away from the cell body.

**22. (a)** **23. (a)**

## Type B : Assertion Reason Questions

**24. (a)** Transmission of nerve impulse access synapses is accomplishes by neurotransmitter because synapses comprises of a synaptic cleft between the end of one nerve fibres and the beginning of the next.

**25. (a)** Gustatoreceptors are chemoreceptors, enclosed within taste buds.

**26. (b)** Astigmatism is a kind of defect of vision in which the image of an object is distorted. It is because all the light rays do not come to focus on retina. It is due to abnormal curvature of the lens . It can be corrected by wearing cylindrical lenses.

**27. (b)** The brain stem consists of pons varoli, medulla oblongata, mid brain and diencephalon. The brain stem is the connection between brain and spinal cord. It contains centres for controlling many vital activities like respiration, body temperature, urge for eating and drinking etc. It also carries nerve tracts between the spinal cord and the higher brain structure.

**28. (b)** The axon terminal of the neuron contains many membrane bound vesicles called synaptic vesicles, in its cytoplasm. Within these vesicles, chemical substances such as adrenaline and acetylcholine remain

stored. These chemicals are called neurotransmitters, because they help to transmit nerve impulses across the synapses. When a nerve impulse passes the axon terminal, its synaptic vesicles release their stored chemicals to the synaptic cleft. These diffuse through the cleft to reach the membrane of the next neuron, stimulating the latter. This causes the nerve impulse to be transmitted along the next neuron.

**29. (c)** Resting potential is due to differential distribution of ions on two sides of cell membrane.

**30. (d)** The axonal membrane of neuron is more permeable to potassium ions ($K^+$) and nearly impermeable to sodium ions ($Na^+$). In a resting state neuron does not conduct any impulse. In the resting state the period during which a neuron is not conducting the fluids outside the cell membrane carry a relatively high positive charge. The fluids inside the cell membrane. Carry a less positive, or relatively negative, charge.

**31. (b)** Hind brain consists of cerebellum located dorsally to medulla oblongate and pons varolii. It contains centres for maintenance of posture and equilibrium of the body and for the muscle tone. All activities of the cerebellum are involuntary but may involve learning in their early stages.

Chapter

# 22 Chemical Co-ordination and Integration

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** To yield more milk, cow is injected with ***[1997]***
(a) sorbitol (b) prolactin
(c) gonadotrophs (d) stilbesterol

**2.** Treatment with alloxan destroys ***[1998]***
(a) stilt cells
(b) β-cells of Langerhans
(c) sertoli cells
(d) cells of Leydig

**3.** Addison's disease result from ***[1998]***
(a) hyposecretion of gonads
(b) hyposecretion of adrenal gland
(c) hypertrophy of kidney
(d) hyposecretion of pituitary gland

**4.** The development of adult characteristics in a moulting insect is promoted by ***[1998]***
(a) Thyroxine (b) Ecdysone
(c) Pheromone (d) None of these

**5.** Heart beat increases at the time of interview because of ***[1999]***
(a) renin (b) rennin
(c) adrenaline (d) Diuretic ADH

**6.** Conn's disease is caused by the over secretion of ***[1999]***
(a) ADH (b) ACTH
(c) Oxytocin (d) Aldosterone

**7.** Acromegaly is due to hypersecretion of ***[2001]***
(a) Insulin (b) Thyroxine
(c) Growth hormone (d) None of these

**8.** Steroid hormones are similar in structure to
(a) Tryosine ***[2001]***
(b) Cholesterol
(c) Coenzyme A
(d) Glycerol

**9.** A person passes much urine and drinks much water put his blood glucose level normal. This condition may be the result of ***[2003]***
(a) a reduction in insulin secretion from pancreas
(b) a reduction in vasopressin secretion from posterior pituitary
(c) a fall in the glucose concentration in urine
(d) an increase in secretion of glucagon

**10.** The source of somatostatin is same as that of
(a) Thyroxine and calcitonin ***[2003]***
(b) Insulin and glucagon
(c) Somatotropin and prolactin
(d) Vasopressin and oxytocin

**11.** Which one of the following four secretions is **correctly matched** with its source, target and nature of action? ***[2005]***

| | Secretion | Source | Target | Action |
|---|---|---|---|---|
| (a) | Gastrin | Stomach lining | Oxyntic cells | Production of HCl |
| (b) | Inhibin | Sertoli cells | Hypotha-lamus | Inhibition of secretion of gonadotropin releasing hormone |
| (c) | Entero-kinase | Duodenum | Gall bladder | Release of bile juice |
| (d) | Atrial Natriuretic Factor (ANF) | Sinu atrial node (SAN) M-cells of Atria | Juxta-glomerular apparatus (JGA) | Inhibition of release of renin |

**12.** Which of the following match is correct? ***[2007]***

| | Hormone | Effect |
|---|---|---|
| (a) | Oxytocin | Milk ejection hormone |
| (b) | Glucagon | Decreases blood sugar level |
| (c) | Adrenaline | Decreases heart rate |
| (d) | Thyroxine | Decreases BMR |

**13.** Which of the following statements regarding glucagon is false? ***[2007]***

(a) It is secreted by α-cells of Langerhans.

(b) It acts antagonistically to insulin.

(c) It decreases blood sugar level.

(d) The gland responsible for its secretion is heterocrine gland.

**14.** Which one of the following four gland is correctly matched with the accompanying description? ***[2005, 2008]***

(a) Thyroid - Hyperactivity in young children causes cretinism

(b) Thymus - Starts undergoing atrophy after puberty

(c) Parathyroid - Secretes para-thormone, which promotes movement of calcium ions from blood into bones during calcification

(d) Pancreas - Delta cells of the 'islets of Langerhans' secrete a hormone, which stimulates glycolysis in liver

**15.** Which row in the chart contains the words that best complete this statement? The (I) glands produce (II), which are transported by the (III) system. ***[2009]***

| Row | I | II | III |
|---|---|---|---|
| *A* | digestive | hormones | circulatory |
| *B* | endocrine | enzymes | lymphatic |
| *C* | endocrine | hormones | circulatory |
| *D* | digestive | enzymes | lymphatic |

(a) A (b) B

(c) C (d) D

**16.** The blood glucose level is commonly expressed as ***[2010]***

(a) mm. of Hg

(b) milligram per deci litre

(c) parts per million

(d) gram (mg/dl) per litre

**17.** Which one of the following hormones contains iodine? ***[2010]***

(a) Thyroxine (b) Testosterone

(c) Insulin (d) Adrenaline

**18.** The pituitary gland by virtue of its tropic hormones controls the secretory activity of other endocrine glands. Which one of the following endocrine gland can function independently of the pituitary gland? ***[2010]***

(a) Thyroid (b) Gonads

(c) Adrenals (d) Parathyroid

**19.** Match List-I (Endocrine glands) with List-II (Hormones secreted) and select the correct answer using the codes given below ***[2010]***

| | **List- I** | | **List-II** |
|---|---|---|---|
| A. | Gonads | I. | Insulin |
| B. | Pituitary | II. | Progesterone |
| C. | Pancreas | III. | Growth hormones |
| D. | Adrenal | IV. | Cortisone |

**Codes :**

(a) A – III; B – II; C – IV; D – I

(b) A – II; B – III; C – IV; D – I

(c) A – II; B – III; C – I; D – IV

(d) A – III; B – II; C – I; D – IV

**20.** Which gland is concerned with salt equilibrium in body? ***[2012]***

(a) Anterior pituitary (b) Pancreas

(c) Adrenal (d) Thyroid

**21.** Which of the following hormones have antagonistic (opposing) effects? ***[2013]***

(a) Thyroxine and calcitonin

(b) Insulin and glucagon

(c) Growth hormone and epinephrine

(d) ACTH and glucocorticoids

**22.** Select the correct option describing gonadotropin activity in a normal pregnant female: ***[2014]***

(a) High level of FSH and LH stimulate the thickening of endometrium.

(b) High level of FSH and LH facilitate implantation of the embryo.

(c) High level of hCG stimulates the synthesis of estrogen and progesterone.
(d) High level of hCG stimulates the thickening of endometrium.

**23.** Which endocrine gland is called 'the Throne of immunity'? ***[2016]***
(a) Spleen (b) Thymus
(c) Pineal (d) Adrenal medulla

**24.** Which of the following hormone acts upon the renal tubule and blood capillaries ? ***[2017]***
(a) Glucagon (b) Aldosterone
(c) Vasopressin (d) Glucocorticoids

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 25-27) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**25.** **Assertion:** The regulation of RBC production is accomplished by FSH.
**Reason:** Erythropoietin hormone circulates to red bone marrow where it increases stem cell mitosis and speed up development of RBCs. ***[2002]***

**26.** **Assertion :** Diabetes insipidus is marked by excessive urination and too much thirst of water.
**Reason :** Anti-diuretic hormone (ADH) is secreted by the posterior lobe of pituitary gland. ***[2004]***

**27.** **Assertion :** Our body secretes adrenaline in intense cold. ***[2006]***
**Reason :** Adrenaline raises metabolic rate.

**Directions for (Qs. 28-31) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**28.** **Assertion :** Mammary glands are apocrine glands. ***[2009]***
**Reason :** The distal part containing secretory granules break down and leaves as a secretion.

**29.** **Assertion :** Hormone calcitonin has antagonistic effect to that of parathormone. ***[2009]***
**Reason :** Calcitonin decreases blood calcium level while parathormone increases blood calcium level.

**30.** **Assertion :** The person with diabetes insipidus feels thirsty.
**Reason :** A person with diabetes insipidus suffers from excess secretion of vasopressin. ***[2010]***

**31.** **Assertion:** Failure of secretion of hormone vasopressin causes diabetes mellitus in the patient. ***[2011]***
**Reason:** Vasopressin increases the volume of urine by increasing the reabsorption of water from the urine.

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Prolactin (also called leuteotrophic) hormone is associated with lactation (secretion of milk from the mammary gland). Therefore, to yield more milk cow is injected with prolactin hormone. Sorbitol is a sweetner found in some fruits (like apple, peers *etc*). Gonadotrophs a type of basophil in the adenohypohysis (anterior pituitary gland) whose granules secrete FSH (follicele-stimulating hormone) and LH (luteinizing hormone). Stilbesterol is synthetic estrogen used in hormone therapy, as a post-coital contraceptive, and as a growth-promoting agent for livestock.

**2. (b)** Alloxan treatment damages β-cells of Islets of langerhans which leads to hyperglycaemia and glycosuria.

**3. (b)** Addisons disease occurs due to hyposecretion of both mineralocorticoids (aldosterone) and glucocorticoids (cortisol) from the layers of adrenal cortex called zona glomerulosa and zona fasciculata respectively. The disease is characterized by excessive loss of $Na^+$, $Cl^-$ and $HCO_3$ increased $K^+$ level in blood, weight loss, muscle weakness, fatigue, low blood pressure, and sometimes darkening of the skin in both exposed and nonexposed parts of the body.

**4. (b)** Ecdysone is a moulting hormone of insects. Ecdysone is produced from prothoracic gland that triggers moulting and metamorphosis. Thyroxine is thyroid hormone that stimulates body metabolism and helps regulate body growth and development. Pheromone is a chemical screted by an animal that influences the behavior or development of other members of the same species.

**5. (c)** Adrenaline (amine hormone) is secreted by adrenal medulla on stimulation of sympathetic nervous system for meeting an emergency or stress condition like fear injury accident *etc*. Hence, it also called as emergency hormone. It increases blood pressure, respiration rate, sugar level in blood *etc*. It prepares the body to face stress at the time of interview by increasing heart beat. So it is also called stress hormone.
Renin is proteolytic enzyme synthesized,stored, and secreted by the juxtaglomerular cells of the kidney. It plays a role in regulation of blood pressure by catalyzing the conversion of angiotensinogen to angiotensin I and II which in turn stimulates the release aldosterone from adrenal gland. Rennin, a coagulating enzyme produced from the stomach of human body, catalyzes the coagulation of milk by converting milk protein, caesin into paracaesinate. ADH (antidiuretic hormone) is secreted by the posterior portion of the pituitary gland that constricts blood vessels raises blood pressure, and reduces excretion of urine.

**6. (d)** Conn's syndrome/aldosteronism is due to hypersecretion of aldosterone. Aldosetrone is secreted from zona glomerulosa layer of adrenal cortex. The principle action of the aldosterone is retention of sodium. Conn's syndrome is characterized by rise in blood volume and blood pressure; muscular weakness; high sodium and low potassium level in the blood plasma resulting in kidney damage with polyuria and tetany and metabolic disorder.

**7. (c)** Acromegaly is due to hyposecretion of growth/somatotrophic hormone in adults after the closure of epiphysed plate at the end of long bones. Growth hormone is secreted by artesian pituitary gland.

It is characterised by abnormal elongation of limbs and lower jaw giving gorilla like appearance. Hypersecretion of insulin results in hypoglycemia, hunger, sweating and double vision. Hypersecretion of thyroxine results in Grave's disease (also called exopthalmic goiter) which is characterised by increased BMR, heart rate, pulse rate; protrusion of eyes *etc*.

**8. (b)** Steroid hormones are fat soluble and have sterol group. They are derived from cholesterol, *e.g*. hormones of adrenal cortex, testis and ovaries. Amine hormones are derived form tyrosine amino acids and have amino group, *e.g*. thyroxine, epinephrine and nor epinephrine. Coenzyme A is essential to metabolism of carbohydrates and fats and some amino acids. Glycerol is a clear, colorless, viscous, sweet-tasting liquid organic compound of the alcohol family.

**9. (b)** When a person passes more urine and drinks more water, he is suffering from diabetes insipidus. It is caused by reduction in vasopressin (ADH) secretion from post pituitary gland.

**10. (b)** The source of somatostatin is same as that of insulin and glucagons. All these hormones are secreted from endocrine part (called Islets of Langerhans) of pancreas. These endocrine parts contain different types of endorcrine cells which secretes different hormones.

| Endocrine cells | Hormones |
|---|---|
| $\alpha$ cell | Glucagon |
| $\beta$ cell | Insulin |
| $\gamma$ cell | Gastrin |
| $\delta$ cell | Somatostatin |
| F cell | Pancreatic polypeptides |

Thyroxine and calcitonin are secreted by thyroid gland. Somatotropin and prolactin are secreted from anterior pituitary gland. Vasopressin and oxytocin are secreted from posterior pituitary gland.

**11. (d)** Atrial natriuretic factor (ANF) is produced by cardiocytes of atria of heart in response to an increased return of the deoxygenated blood. It inhibits the release of renin from juxta-glomerular apparatus and thereby, inhibits NaCl reabsorption by the collecting duct and reduces aldosterone release from the adrenal cortex. Inhibin is an endocrine hormone, produced from ovary and testes. When inhibin is secreted, it inhibits the production of follicle stimulating hormone (FSH). It also limits the release of gonadotropin releasing hormone. (For other hormones refer answer no. 4)

**12. (a)** Oxytocin is the hormone secreted by posterior pituitary that causes contraction of the smooth muscles of myometrium during child birth and ejection of milk from the mammary glands. Glucagon is secreted by the $\alpha$-cells of islets of langerhans of pancreas. Its main fuction is to increase blood glucose level. Adrenaline (epinephrine) is secreted by adrenal medulla. It increases the rate and force of heart beat. Thyroid gland secretes thyroxine that regulates basal metabolic rate.

**13. (c)** Pancreas is a heterocrine gland comprising both endocrine and exocrine parts. Its endocrine part consists of small masses of hormone secreting cells called islets of langerhans. The $\alpha$-cells of latter secrete glucagons and its $\beta$-cells secrete insulin. These two hormones have antagonistic effects on the glucose level in the blood which means that insulin decreases the blood glucose level while glucagon increases blood glucose level.

**14. (b)** The thymus is an organ located in the upper anterior portion of the chest cavity just behind the sternum. The thymus continues to grow between birth and puberty and then begins to atrophy. Proportional to thymic

size, thymic activity is most active before puberty. Upon atrophy, the size and activity are dramatically reduced, and the organ is primarily replaced with fat. The atrophy is due to the increased circulating level of sex hormones, and chemical or physical castration of an adult result in the thymus increasing in size and activity.

**15. (c)** The endocrine glands produce hormones, which are transported by the circulatory system. The digestive system makes enzymes that are secreted *via* ducts to the organ that needs them.

**16. (b)** Blood glucose level is commonly expressed as milligram per deci litre.

**17. (a)** The main secretion of thyroid gland is called thyroxine. Thyroxine contains iodine. When thyroid gland becomes inactive, the lack of iodine causes goitre.

**18. (d)** Parathyroid gland secretes parathormone hormone, which regulates $Ca^{++}$ and $PO_4^{2-}$ ion in body. This gland works independently to pituitary gland.

**19. (c)** Gonads, pituitary, pancreas & adrenal are all endocrine glands which secretes progresterone, growth hormone, insulin and coltisone hormone respectively.

**20. (c)** Adrenal glands are concerned with salt equilibrium in the body. Mineralorcoticoids secreted from adrenal cortex. Aldosterone is the main mineralocorticoid in our body. Aldosterone acts mainly at the renal tubules and stimulates reabsorbtion of $Na^+$ and water and excretion of $K^+$ and phosphate ions.

**21. (b)** Insulin lowers blood sugar levels. While Glucagon raises blood sugar levels.

**22. (c)** Synthesis of estrogen and progesterone due to high level of hCG is a normal gonadotropic activity in a normal pregnant female.

**23. (b)** Thymus stimulates T-cells which regulate the production of antibodies.

**24. (c)** ADH (or vasopressin) is secreted by posterior pituitary gland. It acts on kidney tubule and blood capillaries and concentrates the urine by promoting the reabsorption of water and salts into the cortical collecting ducts.

## Type B : Assertion Reason Questions

**25. (e)** The regulation of RBC production is accomplished by erythropoietin hormone (EPO). Erythropoietin, a glycoprotein, is produced by the kidney when the oxygen level of low EPO then stimulates the bone marrow to produce more red cells and thereby increase the oxygen-carrying capacity of the blood. Follicle-stimulating hormone (FSH) is a gonadotropic hormone that is secreted by the anterior pituitary gland. FSH causes gametogenesis and stimulates estrogen production from ovaries.

**26. (b)** Diabetes insipidus (DI) occurs when the kidneys are unable to conserve water as they perform their function of filtering blood. The amount of water conserved is controlled by antidiuretic hormone (ADH) also called vasopressin which is secreted by posterior lobe of pituitary gland. Diabetes inscipidus is characterised by excessive urination and thirst. This problem appears due to the increase in permeability of collecting tubules.

**27. (a)** Adrenaline is an emergency hormone whose concentration increases under stress conditions. *e.g.* cold, stress. Adrenaline is secreted from adrenal medulla. It initiates many bodily responses, including the stimulation of heart action and an increase in blood pressure, metabolic rate, and blood glucose concentration.

**28. (a)** Based on the mode of secretion, the glands are of three types : mesocrine, apocrine and holocrine. Mammary glands that are present in mammals to feed the young ones with milk are the example of apocrine glands. In apocrine glands, the secretion accumulates as secretory granules in the distal part of the cell. This part later breaks down and leaves as a secretion.

**29. (a)** Calcitonin or thyrocalcitonin is secreted by parafollicular cells of thyroid stroma. It retards bone dissolution and stimulates excretion of calcium in urine. Thus, it lowers calcium level in extra cellular fluid (ECF). Parathormone is secreted by chief cells of parathyroid gland and is also known as Collip's hormone. It maintains blood calcium level by increasing its absorption from food in intestine and its reabsorption from nephrons in the kidney. Maintenance of proper calcium level is in fact, a combined function of parathormone and calcitonin. When calcium level falls below normal parathormone maintains it by promoting its absorption, reabsorption and also by demineralisation of bones. When blood calcium level exceeds above normal then calcitonin hormone increases excretion of calcium in urine.

**30. (c)** Vasopressin or antidiuretic hormone is secreted by posterior pituitary gland. The deficiency of vassopressin results in a disorder known as diabetes insipidus. The main symptoms of diabetes insipidus are increase in thirst and increase in urination.

**31. (d)** Vasopressin or anti-diuretic hormone (ADH) reduces the volume of urine by increasing the reabsorption of water from the urine in the distal convoluted tubules, collecting tubules and collecting ducts in the kidney. It does so by rendering the walls of these tubules leads to diabetes insipidus (increased urination). Although the volume of urine is increased. No glucose appears in the urine of such patients.

Diabetes mellitus is a disease which is caused due to the failure of insulin hormone secretion by the pancreatic islets. The osmotic effect of glucose in the urine considerably increases the volume of urine, due to which thirst is also enhanced. In extreme cases, the patient suffers from coma and may die.

Chapter

# 23 Reproduction in Organisms

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Based on cellular mechanisms there are two major types of regeneration found in the animals. Which one of the following is the correct example of the type mentioned? ***[2005]***

(a) Morphallaxis - Regeneration of two transversely cut equal pieces of a Hydra into two small Hydras.

(b) Epimorphosis - Replacement of old and dead erythrocytes by the new ones.

(c) Morphallaxis - Healing up of a wound in the skin.

(d) Epimorphosis - Regeneration of crushed and filtered out pieces of a Planaria into as many new Planarians. from chapter 25

**2.** Which form of reproduction is correctly matched? ***[2007]***

(a) *Euglena* → transverse binary fission

(b) *Paramecium* → longitudinal binary fission

(c) *Amoeba* → multiple fission

(d) *Plasmodium* → binary fission

**3.** Which reproductive adaptation is characteristic of most terrestrial vertebrates but not of most aquatic vertebrates? ***[2009]***

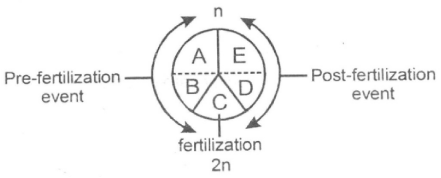
(a) External fertilization

(b) Internal fertilization

(c) Motile gametes

(d) External development

**4.** Identify the events (A, B, D and E) in life of general reproduction-




***[2015]***

(a) A-Gamete transfer, B-Gametogeneis, D-Zygote formation, E-Embryogenesis

(b) A-Gametogeneis, B-Gamete transfer, D-Zygote formation, E-Embryogenesis

(c) A-Gametogeneis, B-Zygote formation, D-Gamete transfer, E-Embryogenesis

(d) A-Gametogeneis, B-Gamete transfer, D-Embryogenesis, E-Zygote formation.

**5.** Which of the following statements is incorrect ?

(i) Bamboo species flower only once in their life time, generally after 50-100 years and produce large number of fruits and die.

(ii) In animals, the juvenile phase is followed by morphological and physiological changes prior to active reproductive behaviour.

(iii) The reproductive phase is of same duration in all organisms.

(iv) Juvenile phase is the period of growth between the birth of an individual till it reaches reproductive maturity. ***[2016]***

(a) Only (i) (b) Only (ii)

(c) Only (iii) (d) Only (iv)

**6.** In a practical test, a student has to identify the organisms in which syngamy does not occur. In those organisms the female gamete undergoes development to form new organisms without fertilization. This phenomenon is called "X". Identify the organisms and the phenomenon "X". ***[2017]***

(a) Frog, Parthenogenesis
(b) Lizards, Gametogenesis
(c) Rotifers, Embryogenesis
(d) Honeybee, Parthenogenesis

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 7) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**7.** **Assertion :** Leaves of *Bryophyllum*, *Begonia* help in vegetative multiplication.

**Reason :** Leaves of these plants possess adventitious buds. ***[2014]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1.** **(a)** Morphallaxis is the production of an entire animal from a small fragment whereas epimorphosis is the replacement of the lost part.

**2.** **(c)** Reproduction is the production of a new generation of individuals of the same species. It involves transfer of genetic material from one generation to the next.

Asexual and sexual are the two types of reproduction. Fission and budding are two most common forms of asexual reproduction in animals. During adverse conditions, amoeba reproduces by multiple fission that gives rise to many amoeba. *Euglena* reproduces by longitudinal binary fission, *Paramecium* reproduces by transverse binary fission and *Plasmodium* reproduces by multiple fission.

**3.** **(b)** Most vertebrate animals that live on land have an adaptation that allows internal fertilization, whereby the male penis inserts sperm directly into the female body. This is advantageous since sperm need liquid to swim and the moist female reproductive tract provides this. Aquatic vertebrate animals live in water so sperm can easily be deposited in the water and swim to the female reproductive tract.

**4.** **(b)** Gametogenesis leads to production of gametes (sperm and ovum). Male gametes are then transferred to the site of fertilization. Fertilization results in zygote formation. The zygote then gives rise to embryo.

**5.** **(c)** Statement (iii) is not correct. The reproductive phase is not of same duration in all organisms.

**6.** **(d)** Parthenogenesis is a form of reproduction in which an unfertilized egg develops into a new individual, occurring commonly among insects and certain other arthropods.

## Type B : Assertion Reason Questions

**7.** **(a)**

Chapter

# 24 Sexual Reproduction in Flowering Plants

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Asexual reproduction is called as *[1997]*
(a) apomixis (b) fragmentation
(c) self fertilization (d) cross fertilization

**2.** Pollination by snail and slug is called as *[1998]*
(a) entomophilous
(b) malacophilous
(c) ornithophilous
(d) chiropterophilous

**3.** In angiosperm, the endosperm is *[1998]*
(a) diploid (b) triploid
(c) haploid (d) polyploid

**4.** Female gametophyte of angiosperm is *[1999]*
(a) 7 celled (b) 8 celled
(c) 11 celled (d) 5 celled

**5.** Anemophilous flowers have *[1999]*
(a) sessile stigma
(b) small, smooth stigma
(c) coloured and scented flowers
(d) large feathery stigma

**6.** Growth of pollen tube towards embryo is *[2000]*
(a) geotropism (b) chemotaxis
(c) phototaxis (d) thigmotaxis

**7.** Which of the following statement is true? *[2000]*
(a) Spores are gametes
(b) Spores and gametes are diploid
(c) Gametes are always haploid
(d) Spores are always diploid

**8.** Which part of embryo comes out first during seed germination ? *[2001]*
(a) Radicle (b) Plumule
(c) Hypocotyl (d) Epicotyl

**9.** Xenia refers to *[2002]*
(a) effect of pollen on endosperm
(b) effect of pollen on stems
(c) effect of pollen on taste of fruits
(d) effect of pollen on vascular tissue

**10.** Ploidy of ovum of angiosperms is *[2002]*
(a) haploid (b) diploid
(c) triploid (d) polyploid

**11.** Pollen grains are able to withstand extremes of temperature and dessication because their exine is composed of *[2003]*
(a) cutin (b) suberin
(c) sporopollenin (d) callose

**12.** The pollen tube usually enters the embryo sac
(a) between the egg cell and synergid *[2004]*
(b) by directly penetrating the egg
(c) between one synergid and antipodal cell
(d) by knocking off the antipodal cells

**13.** Double fertilization involves *[2005]*
(a) fertilization of egg by two male gametes
(b) fertilization of two eggs in the same embryo sac by two sperms brought by one pollen tube
(c) fertilization of the egg and the central cell by two sperms brought by different pollen tubes
(d) fertilization of the egg and the central cell by two sperms brought by the same pollen tube

**14.** In which one of the following combinations (a - d) the number of chromosomes of the present day hexaploid wheat is correctly represented? *[2006]*

| Combination | Monosomic | Haploid | Nullisomic | Trisomic |
|---|---|---|---|---|
| (a) | 21 | 28 | 42 | 43 |
| (b) | 7 | 28 | 40 | 42 |
| (c) | 21 | 7 | 42 | 43 |
| (d) | 41 | 21 | 40 | 43 |

**15.** Apomixis is *[2007]*
(a) formation of seeds by fusion of gametes.
(b) formation of seeds without syngamy and meiosis.
(c) formation of seeds with syngamy but no meiosis.
(d) None of the above

**16.** The plant part which consists of two generations one within the other, is *[2008]*
(a) germinated pollen grain
(b) embryo
(c) unfertilized ovule
(d) seed

**17.** Chasmogamy refers to the condition where *[2012]*
(a) Flowers remains closed
(b) Flowers are absent
(c) Flowers are open
(d) Flower are gamopetalous

**18.** What is common between vegetative reproduction and apomixis? *[2013]*
(a) Both are applicable to only dicot plants
(b) Both bypass the flowering phase
(c) Both occur round the year
(d) Both produces progeny identical to the parent

**19.** Emasculation is not required when flowers are *[2013]*
(a) bisexual (b) intersexual
(c) unisexual (d) either (a) or (b)

**20.** Geitonogamy involves:
(a) fertilization of a flower by the pollen from another flower of the same plant.
(b) fertilization of a flower by the pollen from the same flower.
(c) fertilization of a flower by the pollen from a flower of another plant in the same population.
(d) fertilization of a flower by the pollen from a flower of another plant belonging to a distant population. *[2014]*

**21.** Which of the following statement is correct? *[2016]*
(a) Sporopollenin can withstand high temperatures but not strong acids.
(b) Sporopollenin can be degraded by enzymes.
(c) Sporopollenin is made up of inorganic materials.
(d) Sporopollenin can withstand high temperature as well as strong acids and alkalis.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 22-24) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**22.** **Assertion :** If pollen mother cells has 42 chromosomes, the pollen has only 21 chromosomes.
**Reason :** Pollens are formed after meiosis in pollen mother cell. *[1997]*

**23.** **Assertion:** The megaspore mother cell divide mitotically to produce four spores.
**Reason:** Megaspore mother cells are diploid and megaspore is haploid. *[2002]*

**24.** **Assertion :** Insects visit flower to gather honey.
**Reason :** Attraction of flowers prevents the insects from damaging other parts of the plant. *[2004]*

**Directions for (Qs. 25-28) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**25.** **Assertion :** Pollen mother cells (PMCs) are the first male gametophytic cells. ***[2009]***

**Reason :** Each PMC gives rise to two pollens.

**26.** **Assertion :** Chasmogamous flowers require pollinating agents.

**Reason :** Cleistogamous flowers do not expose their sex organs. ***[2012]***

**27.** **Assertion :** Double fertilization is characteristic feature of angiospersms.

**Reason :** Double fertilization involves two fusions. ***[2016]***

**28.** **Assertion :** Endosperm is a nutritive tissue and it is triploid.

**Reason:** Endosperm is formed by fusion of secondary nucleus to second male gamete. It is used by developing embryo. ***[1998, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1.** **(c)** In asexual reproduction, single parent is involved. It usually includes amitosis or mitotic division.

**2.** **(b)** Pollination by insects is entomophily, pollination by birds is ornithophily, pollination by bats is chiropterophily and pollination by molluscs (snow, slugs) is malacophily.

**3.** **(b)** Endosperm is formed as a result of triple fusion male gamete (n) + seconday nucleus (2n) = Primary endosperm nucleus (3n)
Secondary nucleus is formed by the fusion of 2 polar nuclei.

**4.** **(a)** The female gametophyte of angiosperms is eight nucleated and seven celled. The organized embryo sac comprises a 3 celled egg apparatus, three antipodal cells and a bipolar central cell. The embryo sac although eight nucleated has only seven cells.

**5.** **(d)** Anemophilous flowers have feathery stigma. It is the characteristic feature of Gramineae family (grass). In grasses, the stigma, that is plumose, works as an efficient pollen catcher. Hence, anemophilous flowers have feathery or plumose stigma.

**6.** **(b)** Growth of pollen tube towards embryo is chemotaxis due to the stimulus being chemical in nature. The chemical stimulus is supplied in the form of $Ca^{++}$ ions.

**7.** **(c)** Gametes are always haploid in order to preserve the species genetically, anatomically and morphologically also. The embryo or zygote is formed due to the union of male and female gametes. (n + n = 2n). Hence, any species which is 2n is diploid in nature.

**8.** **(a)** The radicle comes out first since it grows towards the earth. During seed germination the radicle comes out first due to gravitational force and further more it results in a differential growth.

**9.** **(a)** Xenia is the effect of pollen genes on the development of the fruit or seed.

**10.** **(a)** Ovum is a female gamete and is always haploid.

**11.** **(c)** Sporopollenin, which is the hardest substance, helps the pollen grains to withstand extremes of temperatures. It avoids transpiration or water loss. This hard proteinaceous substance present in the exine makes it also spinous in nature.

**12.** **(a)** The synergids direct the growth of pollen tube by secreting some chemical substances. The tip of pollen tube enters into one synergid.

**13.** **(d)** Double fertilization involves fertilization of the egg/oosphere (2n) and that of secondary nucleus (3N) by two different sperms produced in the same pollen tube.

**14.** **(d)** 1n = 21; monosomic (2n – 1) = 42 – 1 = 41; nullisomic (2n – 2) = 42 – 2 = 40. Trisomic (2n + 1) = 42 +1 = 43

**15.** **(b)** In plants, normal sexual reproduction includes meiosis and fertilization . It is called amphimixis. But in some plants abnormal sexual reproduction called apomixis has been observed. Apomixis includes abnormal sexual reproduction in which egg or other cells like synergids and antipodals develop into embryo without fertilization and meiosis. The term apomixis was given be Winkler (1908) *eg. Citrus, Rannunculus.*

**16. (b)** The plant which consists of two generations one within the other is embryo. In botany, a seed plant *embryo* is part of a seed, consisting of precursor tissues for the leaves, stem and root as well as one or more cotyledons. Once the embryo begins to germinate, grow out from the seed, it is called a seedling. Plants that do not produce seeds, but do produce an embryo, include the bryophytes and ferns. In these plants, the embryo is a young plant that grows attached to a parental gametophyte.

**17. (c)** Chasmogamous flowers are always open. In same bisexual plants like *Commelina* & *Viola*. Chasmogamous and cleistogamous flowers (which never opens throughout the life) are found.

**18. (d)** Vegetative reproduction and apomixis both are asexual methods of reproduction, which gives the progeny genetically similar to parent.

**19. (c)** In unisexual flowers, the female flower buds are bagged before the flowers open. When the stigma become receptive, pollination is carried out using the desired pollen and the flower rebagged. Hence, there is no need of emasculation in these flowers.

**20. (a)** Geitonogamy is the transfer of pollen grains in different flowers of same plant.

**21. (d)** Pollen grains are generally spherical and prominent two-layered wall. The hard outer layer (called the exine) is made up of sporopollenin which is one of the most resistant organic material known. It can withstand high temperatures and strong acids and alkali.

## Type B : Assertion Reason Questions

**22. (a)** Pollen mother cells undergo meiosis and produce pollen grains. The pollen grains have haploid number of chromosomes.

**23. (e)** Megaspore mother cell is a prominent cell in the nucellus. It divides by meiosis and forms a row of four haploid megaspores.

**24. (d)** Honey bee visit flowers to gather nectar and turn it into honey. Visiting of insects for nectar helps in pollination.

**25. (d)** Primary sporogenous cell gives rise to microspore mother cells or pollen mother cells (PMCs). They are sporophytic in nature *i.e.*, diploid. These cells undergo meiosis (reduction division) which gives rise to 4 microspores or pollens and this formation of microspores or pollens is called microsporo-genesis. Microspores represent the beginning of the gametophytic phase and they are haploid in nature.

**26. (b)** The majority of angiosperms bear chasmogamous flowers, which means the flowers expose their mature anthers and stigma to the pollinating agents. There is another group of plants which set seeds without exposing their sex organs. Such flowers are called cleistogamous and the phenomenon is cleistogamy.

**27. (b)** Double fertilization is a characteristic feature of angiosperms. It involves two fusions in which one female gametes fuse with egg cell to form zygote and other male gamete fuses with the diploid secondary nucleus to produce triploid primary endosperm nucleus.

**28. (a)** Male gamete (n) + secondary nucleus (2n) = primary endosperm nucleus which develops into endosperm (3n)

Endosperm is the reserve food used by developing embryo.

Chapter

# 25 Human Reproduction

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Prostate gland secretion helps in formation of
(a) larva (b) semen ***[1997]***
(b) cocoon (c) none of these

**2.** Immediately after ovulation, the mammalian egg is covered by a membrane called as ***[1998]***
(a) chorion (b) corona radiata
(c) zona pellucida (d) none of these

**3.** The extra-embryonic membranes of mammalian embryo are derived from ***[1999]***
(a) trophoblast (b) follicle cells
(c) inner cell mass (d) formative cells

**4.** Acrosome of sperm is formed by ***[1999]***
(a) nucleus (b) golgi bodies
(c) lysosome (d) E. R.

**5.** Cumulus covers ***[1999]***
(a) ovary (b) ovum
(c) embryo (d) sperm

**6.** Cessation of menstrual cycle in women is called
(a) menopause (b) lactation ***[2001]***
(c) ovulation (d) parturition

**7.** Both corpus luteum and macula lutea are ***[2003]***
(a) found in human ovaries
(b) a source of hormones
(c) characterized by a yellow colour
(d) contributory in maintaining pregnancy

**8.** The early human embryo distinctly possesses
(a) gills ***[2003]***
(b) gill slits
(c) external ear (pinna)
(d) eyebrows

**9.** The phase of menstrual cycle in humans that lasts for 7-8 days, is ***[2003]***
(a) follicular phase (b) ovulatory phase
(c) luteal phase (d) menstruation

**10.** Which one of the following statements with regard to embryonic development in humans is correct? ***[2003]***
(a) Cleavage divisions bring about considerable increase in the mass of protoplasm.
(b) In the second cleavage division, one of the two blastomeres usually divides a little sooner than the second.
(c) With more cleavage divisions, the resultant blastomeres become larger and larger.
(d) Cleavage division results in a hollow ball of cells called morula.

**11.** Women who consumed the drug thalidomide for relief from vomiting during early months of pregnancy gave birth to children with ***[2004]***
(a) no spleen
(b) hare-lip
(c) extra fingers and toes
(d) under developed limbs

**12.** A cross section at the midpoint of the middle piece of a human sperm will show ***[2005]***
(a) centriole, mitochondria and 9 + 2 arrangement of microtubules.
(b) centriole and mitochondria.
(c) mitochondria and 9 + 2 arrangement of microtubules.
(d) 9 + 2 arrangement of microtubules only.

**13.** Which one of the following events is correctly matched with the time period in a normal menstrual cycle? ***[2005]***
(a) Release of egg : 5th day
(b) Endometrium regenerates : 5-10 days
(c) Endometrium secretes nutrients for implantation : 11-18 days
(d) Rise in progesterone level : 1-15 days

**14.** Which of the following is true regarding sperm? ***[2007]***
(a) Fertilizin: For penetrating egg membrane
(b) Hyalurodinase: For penetrating egg membrane
(c) Acrosin: Dissolves corona radiata
(d) Capacitation: Takes place in penis

**15.** Both corpus luteum and macula lutea are ***[2008]***
(a) found in human ovaries
(b) a source of hormones
(c) characterized by a yellow colour
(d) contributory in maintaining pregnancy

**16.** In humans, what is the ratio of the number of gametes produced from one male primary sex cell to the number of gametes produced from one female primary sex cell? ***[2009]***
(a) 1:3 (b) 1:4
(c) 3:1 (d) 4:1

**17.** Corpus luteum is a mass of cells found in ***[2010]***
(a) brain (b) ovary
(c) pancreas (d) spleen

**18.** Cells of leydig are found in ***[1997, 2011]***
(a) Testes of frog (b) Testes of rabbit
(c) Kidney of frog (d) Kidney of rabbit

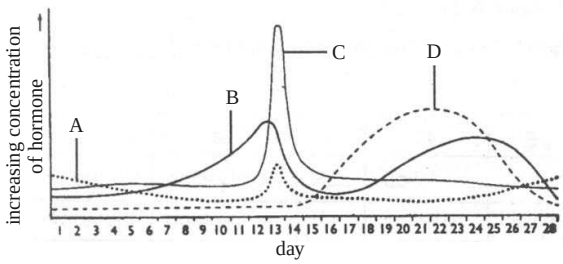
**19.** Meroblastic cleavage refers to which type of division of egg ***[2001, 2011]***
(a) Complete (b) Spiral
(c) Incomplete (d) Horizontal

**20.** Which of the following organ is differentiated first during development? ***[2012]***
(a) Heart (b) Skin
(c) Brain (d) Neural tube

**21.** The correct sequence of spermatogenetic stages leading to the formation of sperms in a mature human testis is: ***[2013]***
(a) spermatogonia-spermatid-spermatocyte-sperms
(b) spermatocyte-spermatogonia-spermatid-sperms
(c) spermatogonia-spermatocyte-spermatid-sperms
(d) spermatid-spermatocyte-spermatogonia-sperms

**22.** All of the following statements concerning pregnancy are accurate EXCEPT ***[2015]***
(a) the detection of human chorionic gonadotropin in the urine forms the basis for pregnancy tests.
(b) the cyclic release of pituitary gonadotropins and ovarian steroids is continued.
(c) the mammary gland tissue of the pregnant woman is stimulated to develop by placental hormones.
(d) the corpus luteum of pregnancy maintains the uterus until the placenta is well established.

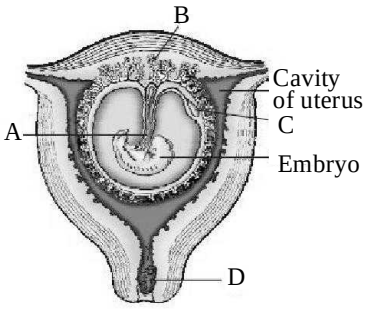
**23.** The following graph of relative concentrations of the four hormones present in the blood plasma of a woman during her menstrual cycle. Identify the hormones. ***[2015]***




| | A | B | C | D |
|---|---|---|---|---|
| (a) | FSH | Progesterone | LH | Oestrogen |
| (b) | LH | Progesterone | FSH | Oestrogen |
| (c) | FSH | Oestrogen | LH | Progesterone |
| (d) | LH | Oestrogen | FSH | Progesterone |

**24.** Ejaculation of human male contains about 200 – 300 million sperms, of which for normal fertility ____ % sperms must have normal shape and size and at least ____% must show energetic motility. ***[2016]***
(a) 40, 60 (b) 50, 50
(c) 60, 40 (d) 30, 70

**25.** The given figure shows the human foetus within the uterus with few structures marked as A, B, C and D.




Which of the following options shows the correct labeling? ***[2016]***

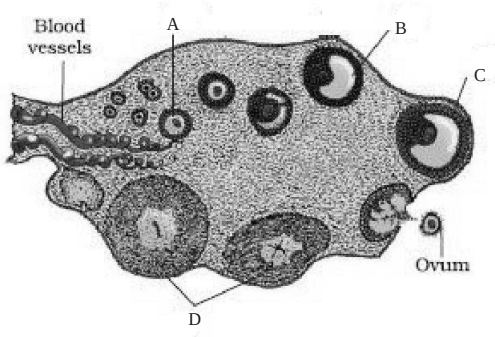
(a) A→Umbilical cord with its veins, B→ Chorionic villi, C→Antrum, D→Plug of mucus in cervix

(b) A→Umbilical cord with its vessels, B→Fimbriae, C→ Oocyte, D→Plug of mucus in vagina

(c) A→Umbilical cord with its vessels, B→Placental villi, C→Yolk sac, D→Plug of mucus in cervix

(d) A→Umbilical cord with its veins, B→Placental villi, C→Trophoblast, D→Plug of mucus in vagina ***[2016]***

**26.** The figure given below shows the sectional view of ovary. Select the option which gives correct identification of marked structure (A to D) and its feature. ***[2017]***




(a) A: Primary follicle, it is also called gamete mother cell.

(b) B: Corpus luteum, it cannot be formed and added after birth.

(c) C: Grafian follicle, mature follicle which ruptures to release secondary oocyte.

(d) D: Tertiary follicle, a large number of this follicle degenerates during the phase from birth to puberty.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 27-31) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**27.** **Assertion :** During fertilization only head of spermatozoa enters egg.

**Reason :** If several spermatozoa hit the egg at same time, all can enter the egg. ***[1997]***

**28.** **Assertion :** In morula stage, cells divide without increase in size.

**Reason :** Zona pellucida remains undivided till cleavage is complete. ***[1997]***

**29.** **Assertion :** Death is one of the important regulatory process on earth.

**Reason :** It avoids over-crowding caused by continuous reproduction. ***[2002]***

**30.** **Assertion :** Old age is not an illness. It is a continuation of life with decreasing capacity for adaptation.

**Reason :** Cessation of mitosis is a normal genetically programmed event. ***[2003]***

**31.** **Assertion :** Senescence is the time when age associated defects are manifested. ***[2005]***

**Reason :** Certain genes may be undergoing sequential switching on and off during one's life.

**Directions for (Qs. 32-38) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**32.** **Assertion :** Corpus luteum degenerates in the absence of fertilization. ***[2009]***
**Reason :** Progesterone level decreases.

**33.** **Assertion :** Clitoris is not remnant of penis in females. ***[2009]***
**Reason :** It also has high blood supply and erectile tissue.

**34.** **Assertion :** Mammalian ova produces hyaluronidase. ***[2009]***
**Reason :** The eggs of mammal are microlecithal and telolecithal.

**35.** **Assertion :** Head of sperm consists of acrosome and mitochondria.
**Reason :** Acrosome contains spiral row of mitochondria. ***[2014]***

**36.** **Assertion :** Females have less stature than males after puberty.
**Reason :** This happens because of the presence of hCG in the blood of females. ***[2014]***

**37.** **Assertion :** Testicular lobules are the compartments present in testis.
**Reason :** These lobules are involved in the process of fertilization. ***[2016]***

**38.** **Assertion :** Interstitial cell is present in the region outside the seminiferous tubule called interstitial spaces.
**Reason :** Interstitial cells provide nutrition to the sertoli cells. ***[2016, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** The prostate gland is a chestnut shaped gland which lies at the base of bladder and surrounds the first part of the urethra. This gland secretes a slightly alkaline fluid which forms the important component of semen. This fluid constitutes the major portion of seminal fluid which carries sperm and sperms move freely in this fluid. Prostate gland secretion contains lipids, small amount of citric acid, $HCO_3^-$ ions and a few enzymes. They activate and provides nutrition to sperms and neutralise the acidity of urine which may kill the sperms. They form about 30% part of semen.

**2. (d)** Immediately after ovulation, mammalian eggs are covered by vitelline membrane.

**3. (a)** Trophoblast in mammalian embryo produces extra embryonic membranes which provide protection and nourishment to foetus. These are of 4 types – chorion, amnion, allantois & yolk sac embryonic membranes.

**4. (b)** Acrosome of sperm is formed from Golgi bodies and contains hydrolysing enzymes for sperm penetration.

**5. (b)** Cumulus covers the ovum. The ovum at the matured conditions has a massy cloud formed with a flat base and rounded outlines piled up like a mountain. A granulosa cell is a somatic cell found closely associated with the developing female gamete (oocyte or egg) in the ovary of mammals. Granulosa cells form a single flattened layer around the oocyte in the primordial ovarian follicle and later in follicle development they advance to form a multi layered cumulus surrounding the oocyte.

**6. (a)** Menopause is the period when ovulation and menstrual cycle stop in human females. The period of menopause is between 45-55 years.

**7. (c)** Corpus luteum is the fluid filled yellow body in the ovary and macula lutea is the yellow spot present in the eyes.

**8. (c)**

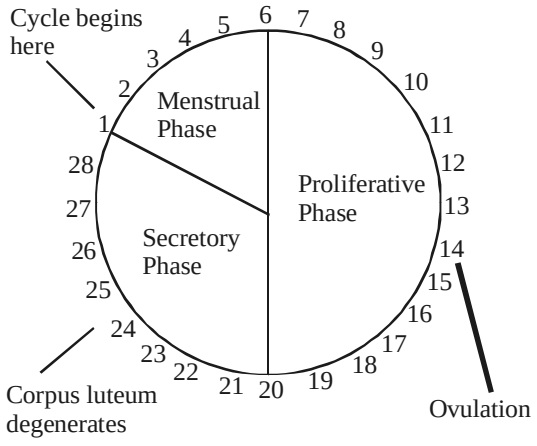
**9. (b)** In menstrual cycle, menstrual phase lasts for 4 days, proliferating/ovulating phase for about 10 days and secretory phase for 14 days.

**10. (a)** Repeated cleavage in the zygote brings about the distribution of the cytoplasm of the zygote among blastomere and increases mobility of the protoplasm which facilitates morphogenetic movements for cell differentiation.

**11. (d)** Woman who took the drug thalidomide in early pregnancy gave birth to children with severe birth defects such as missing or shortened limbs.

**12. (c)** A cross section at the midpoint of the middle piece of human sperm will show mitochondria and 9+2 arrangement of microtubules.

**13. (b)** The proliferative phase lasts for about 14 days in which the endometrium becomes thicker by rapid cell multiplication.



**14. (b)** Sperm is the male gamete that fuses with female gamete and produce a diploid cell called zygote. During fertilization, acrosome of the sperm releases some enzymes, particularly hyaluronidase, that facilitates the penetration of the sperm into ovum. These enzymes dissolve the membrane enveloping the ovum and help the sperm head to enter the ovum.

**15. (c)** Both are characterized by a yellow colour. The corpus luteum is a temporary endocrine structure in mammals, involved in production of progesterone, which is needed to maintain pregnancy. The macula or macula lutea is an oval yellow spot near the center of the retina of the human eye.

**16. (d)** Four viable sperm cells are produced from one primary sex cell, whereby only one viable egg cell is produced, due to the unequal division of cytoplasm and the formation of polar bodies, which wither and die.

**17. (b)** Corpus luteum is a yellow coloured mass of cells found in ovary. Corpus luteum secretes progesterone hormone, which is essential for maintaining pregnancy and therefore also called as "pregnancy hormone."

**18. (b)** Leydig cells are the characteristic of mammalian testis. They produce hormone, testosterone meant for developement of secondary sexual characters in males.

**19. (c)** Zygote divides partially in meroblastic cleavage.

**20. (a)** In human beings, after one month of pregnancy, the embryo's heart is formed. By the end of second month of pregnancy limbs and digits are developed. By the end of 12 weeks (first trimester) most of the major organ systems are formed.

**21. (c)**

**22. (b)** The high levels of estrogen and progesterone in the maternal circulation during pregnancy inhibit the cyclic release of pituitary gonadotropins and prevent the menstrual cycles. Pregnancy hormones include hCG, which maintains the corpus luteum of pregnancy and forms the basis for pregnancy diagnosis urine tests. Ovarian and placental estrogen and progesterone, human placental lactogen, and pituitary prolactin stimulate development of the ducts and alveoli in the mammary glands.

**23. (c)**

**24. (c)** Ejaculation of human male contains about 200 – 300 million sperms, of which for normal fertility 60 % sperms must have normal shape and size and at least 40 % must show energetic motility.

**25. (c)** A–Umbilical cord with its vessels, B–Placental villi, C–Yolk sac, D–Plug of mucus in cervix

**26. (c)** Oogonia are called as gamete mother cell. Corpus luteum is formed as a temporary endocrine structure after the ovulation. It is involved in the production of relatively high levels of progesterone and moderate levels of estradiol and inhibin A to maintain pregnancy. A large number of primary follicles degenerate during the phase from birth to puberty.

## Type B : Assertion Reason Questions

**27. (c)** Fertilization is the fusion of male and female gametes to form zygote. During fertilization only head of the sperm enters egg. After that polyspermy is avoided by fertilization membrane.

**28. (a)** Morula involves cleavage of cells till 32 cell stage is formed. It is still surrounded by Zona pellucida.

**29. (a)** Death is the ultimate goal of every organism. This is caused by the wear and tear of organs which constitute the body of a living being.

**30. (c)** Old age is the progressive deterioration in the structure and functioning of cells, tissues and organs and cessation of immune system.

**31. (a)** According to programmed senescence theory of ageing, ageing is a result of switching on and off of certain genes. B and T- lymphocytes undergo programmed cell death called apoptosis.

**32. (b)** In female, Graafian follicle forms corpus luteum after ovulation. The cells of corpus luteum are called luteal cells. The cytoplasm of luteal cells have yellow granules called lutein which secrete the hormone progesterone to maintain pregnancy if fertilization takes place. In the absence of fertilization, corpus luteum degenerates and forms corpus albicans and there is decrease in progesterone level as well.

**33. (c)** Clitoris is a female reproductive organ. It is homologous to penis of males. It is not remnant of penis. It is devoid of erectile tissue and high blood supply as in penis, penis is the copulatory organ of males.

**34. (d)** Hyaluronidase, a hydrolytic enzyme is an acrosomal content in mammalian sperm. It helps at the time of fertilization during the penetration of the sperm into the ovum. Based on the amount of yolk mammalian eggs are alecithal means egg without yolk. Microlecithal eggs contain very little yolk *e.g.*, sea urchin, starfish. On the basis of distribution of yolk telolecithal eggs are those eggs in which the yolk is concentrated towards the vegetal pole and cytoplasm and nucleus lie near the animal pole, *e.g.*, birds and reptiles.

**35. (c)** Head of a sperm has acrosome but the spiral row of mitochondria are present in the mid (connecting) piece of the sperm.

**36. (c)** Males have more stature than females because of the action of male sex hormone-testosterone which is secreted by testis in males. Body starts secreting testosterone from the age of puberty. Its secretion is under the influence of Luteinizing Hormone (LH) of the anterior lobe of pituitary gland. Testosterone controls the development of secondary sexual characters in males like hoarseness of voice, development of facial hairs, bone growth, calcium retention, closing of epiphysial cartilage. The total quantity of bone matrix increases. The pelvic outlet is narrowed and lengthened. The strength of the pelvic bones increases to carry more loads. That is why, males have more stature than females after puberty when this hormone is present in the blood.

hCG (Human Chorionic Gonadotropin) is the hormone secreted by human placenta during pregnancy. hCG enlarges the corpus luteum in the mother's ovary and stimulates it to secrete progesterone.

**37. (d)** Testicular lobules are the compartments present in the testes, are not involved in the process of fertilization as whole. Fusion of male and female gametes is called fertilization.

**38. (c)** Leydig cells, also known as interstitial cells, are found adjacent to the seminiferous tubules in the testicle. They produce testosterone in the presence of luteinizing hormone (LH).

Chapter

# 26 Reproductive Health

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** GIFT is *[2009]*

(a) transfer of a sperm in fallopian tube of a female with the help of injections.

(b) transfer of a zygote fertilized in vitro in the fallopian tube of female incapable to conceive.

(c) transfer of an ovum collected from a donor into another females fallopian tube who can't produce an ovum but can provide a good environment for further development.

(d) embryo is developed in vitro and then transferred into female's tract.

**2.** What is the function of copper-T ?

(a) Checks mutation *[2012]*

(b) Stops fertilization

(c) Stops zygote formation

(d) Stops oblituation of blastocoel

**3.** Progestasert and LNG-20 are *[2013]*

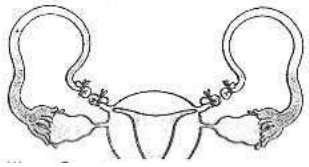
(a) Implants

(b) Copper releasing IUDs

(c) Non-medicated IUDs

(d) Hormone releasing IUDs

**4.** What is the figure given below showing in particular ? *[2014]*



(a) Ovarian cancer (b) Uterine cancer

(c) Tubectomy (d) Vasectomy

**5.** Match Column -I with Column - II. *[2015]*

| | **Column I** **Method** | | **Column II** **Mode of Action** |
|---|---|---|---|
| A. | The pill | I. | Prevents sperms reaching cervix |
| B. | Condom | II. | Prevents implantation |
| C. | Vasectomy | III. | Prevents ovulation |
| D. | Copper T | IV. | Semen contains no sperms |

(a) A – III; B – I; C – IV; D – II

(b) A – IV; B – I; C – II; D – III

(c) A – III; B – IV; C – I; D – II

(d) A – II; B – III; C – I; D – IV

**6.** Select the correct match of the techniques given in column I with its feature given in column II.

| | **Column I** | | **Column II** |
|---|---|---|---|
| A. | ICSI | I | Artificially introduction of semen into the vagina or uterus. |
| B. | IUI | II | Transfer of ovum collected from a donor into the fallopian tube where fertilization occur |
| C. | IUT | III | Formation of embryo by directly injecting sperm into the |
| D. | GIFT | IV | Transfer of the zygote or early embryo (with upto 8 blastomeres) into a fallopian tube. |
| E. | ZIFT | V | Transfer of embryo with more than 8 blastomeres into the uterus |

*[2016, 2017]*

(a) A – V; B – IV; C – I; D – III; E – IV

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

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

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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 7-9) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**7.** **Assertion :** Cu-T and Cu-7 do not suppresses sperm-motility.

**Reason :** Hormones released by them affect sperm motility. ***[2009]***

**8.** **Assertion :** HIV infection can be avoided by use of condoms.

**Reason :** Condoms secrete anti-viral interferons. ***[2014]***

**9.** **Assertion :** Copper-T is an effective contraceptive device in human females.

**Reason :** Copper-T prevents passage of sperms from vagina upwards into fallopian tubes. ***[2011, 2014]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** GIFT is an ovum donation programme and its purpose is to provide ovum to the women who suffer from infertility due to primary and premature ovarian failure which is incurable. A woman in reproductive age denotes ova to a woman which cannot produce ova but she could provide good environment for embryo development. The ovum from donor mother is transferred to the recepient or would be mother's fallopian tube where it is fertilized by sperm and develops into embryo.

**2. (b)** Copper-T is copper releasing intra uterine devices (IUD). It increases phagocytosis of sperms within the uterus and suppress sperm motility and fertilising capacity of sperms.

**3. (d)**

**4. (c)** The figure shows the tubectomy. This is a surgical method to prevent pregnancy in women. In tubectomy, small part of the fallopian tube is removed or tied through a small cut in the abdomen or through vagina. It is very effective method but reversibility is very poor.

**5. (a)**
A. The pill — Prevents ovulation
B. Condom — Prevents sperm reaching cervix
C. Vasectomy — Semen contains no sperms
D. Copper-T — Prevent implantation.

**6. (d)** ICSI (Intracytoplasmic sperm injection) - Formation of embryo by directly injecting sperm into the ovum

IUI (intrauterine insemination) - Artificial introduction of semen into the vagina or uterus

IUT (Intra uterine transfer) - Transfer of embryo with more than 8 blastomeres into the uterus

GIFT (Gamete intra fallopian transfer) - Transfer of ovum collected from a donor into the fallopian tube where fertilization occurs

ZIFT (Zygote intra fallopian transfer) - Transfer of the zygote or early embryo (with upto 8 blastomeres) into a fallopian tube.

## Type B : Assertion Reason Questions

**7. (c)** Cu-7 and Cu-T are intrauterine contraceptive devices for females. They do not suppress sperm motility. Their mode of action is different. Cu-T and Cu-7 discharge 50-75 micrograms of ionic copper into the uterus daily. These copper ions interfere with life-sustaining functions that regulate implantation in the uterus. No any hormone is released by them.

**8. (c)** The use of condoms has been shown to decrease the transmission of AIDS because condoms is contraceptic.

**9. (c)** Intra-uterine device (IUD) Copper-T is plastic or metal object placed in the uterus by a doctor. Copper-T prevent the fertilization of the egg or implantation of the embryo.

Chapter 27

# Principles of Inheritance and Variation

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The formation of multivalents at meiosis in diploid organism is due to ***[1998]***
(a) monosomy
(b) deletion
(c) inversion
(d) reciprocal translocation

**2.** If a homozygous tall plant is crossed with homozygous dwarf plant, the offsprings will be ***[1999]***
(a) all tall plants (b) all dwarf plants
(c) half tall plants (d) half dwarf plants

**3.** *XO* chromosomal abnormality in humans causes ***[1999]***
(a) Turner's syndrome
(b) Down's syndrome
(c) Patau's syndrome
(d) Klinefelter's syndrome

**4.** Polygenic genes show ***[2000]***
(a) similar genotype
(b) different phenotype
(c) different karyotype
(d) different genotype

**5.** Which disease has XXY chromosome constitution?
(a) Down's syndrome ***[2000]***
(b) Turner's syndrome
(c) Klinefelter's syndrome
(d) Okazaki syndrome

**6.** Barr-body in mammals represents ***[2001]***
(a) One of the two X chromosomes in somatic cells of females.
(b) All heterochromatin of male & female cells.
(c) Y chromosomes of male.
(d) All heterochromatin of female cells

**7.** Discontinuous variations are ***[2001]***
(a) essential features
(b) acquired characters
(c) non-essential changes
(d) mutations

**8.** *Mirabilis jalapa* shows ***[2001]***
(a) codominance
(b) incomplete dominance
(c) dominance
(d) complementary genes

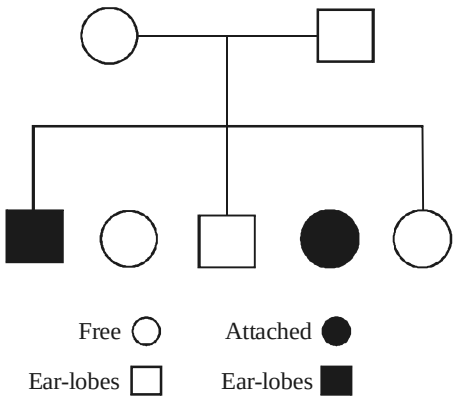
**9.** Frame shift mutation occurs when ***[2002]***
(a) base is added
(b) base is deleted
(c) base is added or deleted
(d) none of the above

**10.** Pure line breed refers to ***[2002]***
(a) homozygosity (b) heterozygosity
(c) linkage (d) both b & c

**11.** If a homozygous red flowered plant is crossed with a homozygous white flowered plant, the offsprings would be ***[2002]***
(a) all red flowered
(b) half red flowered
(c) half white flowered
(d) all white flowered

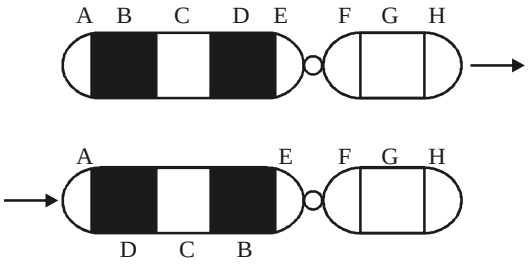
**12.** Genes of which one of the following is present exclusively on the X-chromosome in humans? ***[2003]***
(a) Baldness
(b) Red-green colour blindness
(c) Facial hair/moustaches in males
(d) Night blindness

**13.** Given below is a pedigree chart of a family with five children. It shows the inheritance of attached earlobes as opposed to the free ones. The squares represent the male individuals and circles the female individuals. Which one of the following conclusions drawn is correct? ***[2004]***




(a) The parents are homozygous recessive.
(b) The trait is Y-linked.
(c) The parents are homozygous dominant.
(d) The parents are heterozygous.

**14.** Given below is a representation of a kind of chromosomal mutation. What is the kind of mutation represented?




***[2004]***

(a) deletion
(b) duplication
(c) inversion
(d) reciprocal translocation

**15.** How many different types of gametes can be formed by $F_1$ progeny, resulting from the following cross Tt × Rr? ***[2004]***

(a) 4 (b) 8
(c) 27 (d) 64

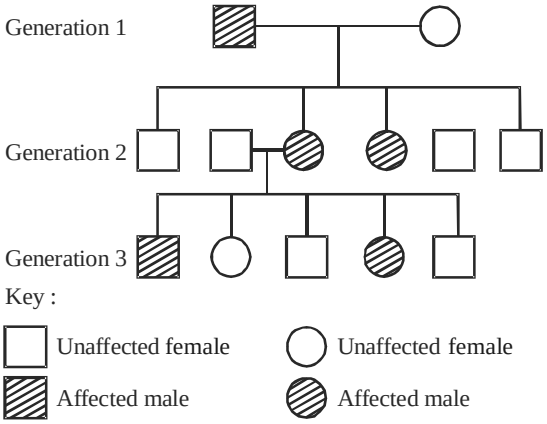
**16.** Grain colour in wheat is determined by three pairs of polygene. Following the cross AABBCC (dark colour) × aabbcc (light colour), in $F_2$ generation what proportion of the progeny is likely to resemble either parent? ***[2005]***

(a) Half (b) Less than 5 percent
(c) One third (d) None of these

**17.** Primary source of allelic variation is ***[2005]***

(a) independent assortment
(b) recombination
(c) mutation
(d) polyploidy

**18.** Given below is a pedigree chart showing the inheritance of a certain sex-linked trait in humans.



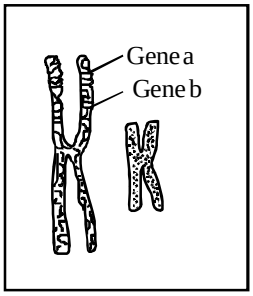

The trait traced in the above pedigree chart is ***[2005]***

(a) dominant X-linked
(b) recessive X-linked
(c) dominant Y-linked
(d) recessive Y-linked

**19.** The "Cri-du-Chat" syndrome is caused by change in chromosome structure involving ***[2005]***

(a) deletion (b) duplication
(c) inversion (d) translocation

**20.** Given below is a highly simplified representation of the human sex chromosomes from a karyotype. ***[2006]***



The genes a and b could be of
(a) colour blindness and body height
(b) attached ear lobe and Rhesus blood group
(c) haemophilia and red-green colour blindness
(d) phenylketonuria and haemophilia

**21.** In India, we find mangoes with different flavours, colours, fibre content, sugar content and even shelf-life. The large variation is on account of ***[2006]***
(a) species diversity
(b) induced mutations
(c) genetic diversity
(d) hybridization

**22.** Which one of the following pairs of features is a good example of polygenic inheritance? ***[2006]***
(a) Human height and skin colour.
(b) ABO blood group in humans and flower colour of *Mirabilis jalapa.*
(c) Hair pigment of mouse and tonque rolling in humans.
(d) Human eye colour and sickle cell anaemia.

**23.** Gene which suppresses other gene's activity but does not lie on the same locus is called as ***[2007]***
(a) epistatic (b) supplementary
(c) hypostatic (d) codominant

**24.** XO-chromosomal abnormality in human beings causes ***[2007]***
(a) Turner's syndrome
(b) Down's syndrome
(c) Klinefelter's syndrome
(d) none of the above

**25.** A normal woman whose father was colour blind, is married to a normal man. The sons would be ***[2008]***
(a) 75% colour blind
(b) 50% colour blind
(c) all normal
(d) all colour blind

**26.** Mating of an organism to a double recessive in order to determine whether it is homozygous or heterozygous for a character under consideration is called ***[2008]***
(a) reciprocal cross (b) test cross
(c) dihybrid cross (d) back cross

**27.** Bird females have chromosome arrangement as ***[2009]***
(a) XY (b) XO
(c) WZ (d) WW

**28.** Gene pool is referred to ***[2009]***
(a) the genetic drift caused in a population
(b) aggregate of all genes and their alleles in a population.
(c) deletion of non essential genes.
(d) induce cell division

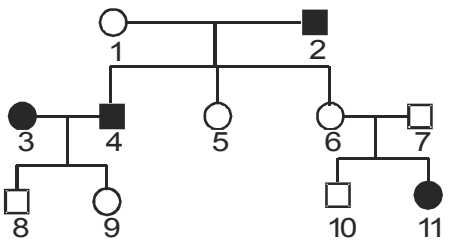
**29.** Mother and father both have blood group 'A'. They have two children one with blood group 'O' and second one with blood group 'A'. They have ***[2009]***
(a) mother has homozygotic gene father has heterozygote $I'^{A}$ $I^{A}$.
(b) both are homozygotic ($I^{A}I^{A}$).
(c) mother is heterozygotic ($I^{A}i$) and father is homozygotic ($I^{A}I^{A}$).
(d) both are heterozygotic ($I^{A}i$).

**30.** When one gene controls two or more different characters simultaneously, the phenomenon is called ***[2010]***
(a) apomixis (b) pleiotropy
(c) polyploidy (d) polyteny

**31.** Three children in a family have blood types O, AB and B respectively. What are the genotypes of their parents? ***[2013]***
(a) $I^{A}$ i and $I^{B}$i (b) $I^{A}I^{B}$ and i i
(c) $I^{B}I^{B}$ and $I^{A}I^{A}$ (d) $I^{A}I^{A}$ and $I^{B}$i

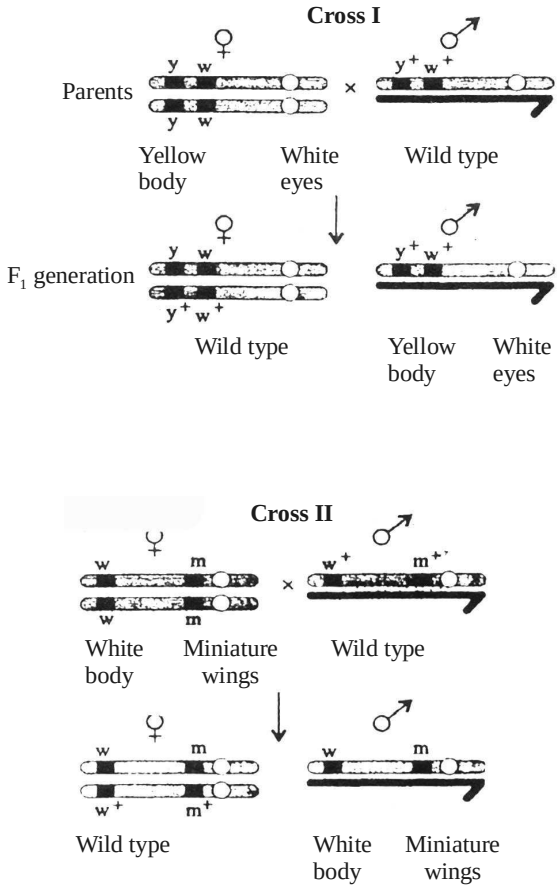
**32.** If both parents are carriers for thalassemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child? ***[2014]***
(a) 50% (b) 25%
(c) 100% (d) no chance

**33.** In Huntington's disease, the unaffected persons are homozygous for normal allele h. The following is erroneous because ***[2015]***



(a) it shows both male and female affected by Huntingtons disease
(b) either person 6 or 7 should have the disease, if individual 11 shows the disease.
(c) at least one of the 2 children (8, 9) should have the disease
(d) all of these

**34.** The experiment shown in the given figure has been carried out by Morgan to show the phenomenon of linkage and recombination. If in cross I, genes are tightly linked and in cross II, genes are loosely linked then what will be the percentage of recombinants produced in cross I and cross II respectively?




*[2016]*

(a) 98.7% and 62.8%
(b) 1.3% and 37.2%
(c) 37.2 and 1.3%
(d) 62.8% and 98.7%

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 35-38) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**35.** **Assertion :** The genetic complement of an organism is called genotype.

**Reason :** Genotype is the type of hereditary properties of an organism. *[1999]*

**36.** **Assertion :** Phenylketonuria is a recessive hereditary disease caused by body's failure to oxidize an amino acid phenylalanine to tyrosine, because of a defective enzyme.

**Reason :** It results in the presence of phenylalanine acid in urine. *[2000]*

**37.** **Assertion :** In humans, the gamete contributed by the male determines whether the child produced will be male or female.

***Reason :*** Sex in humans is a polygenic trait depending upon a cumulative effect of some genes on X-chromosome and some on Y-chromosome. *[2005]*

**38.** **Assertion :** Haemophilia is a recessive sex linked disease.

**Reason :** Haemophilia occurs due to mutation of a structural gene on chromosome 15.

*[2007]*

**Directions for (Qs.39-44) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**39.** **Assertion :** Persons suffering from haemophilia fail to produce blood clotting factor VIII.

**Reason :** Prothrombin producing platelets in such persons are found in very low concentration. ***[2008]***

**40.** **Assertion :** In case of incomplete linkage, linked gene show new combination along with parental combination**.**

**Reason :** In case of incomplete linkage, linked genes are separated by crossing over. ***[2010]***

**41.** **Assertion:** Aneuploidy may be of hypoploidy or hyperploidy type.

**Reason:** Monosomy lacks one pair of chromosomes. ***[2011]***

**42.** Assertion : Cross of $F_1$ individual with recessive homozygous parent is test cross.

**Reason :** No recessive individual are obtained in the monohybrid test cross. ***[2012]***

**43.** **Assertion :** In *Mirabilis*, selfing of $F_1$ pink flower plants produces same phenotypic & genotypic ratio.

**Reason :** Flower colour gene shows incomplete dominance. ***[2014]***

**44.** **Assertion :** In humans, the gamete contributed by the male determines whether the child produced will be male or female.

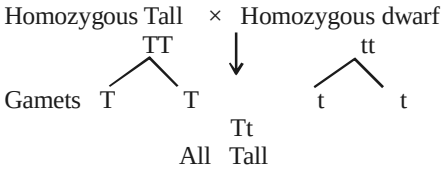
**Reason :** Sex in humans is a polygenic trait depending upon a cumulative effect of some genes on X-chromosome and some on Y-chromosome. ***[2015, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** Translocation is the separation of a chromosome segment and its union to a non homologous chromosome. In reciprocal translocation 2 non-homologous chromosomes exchange segments among themselves. Reciprocal translocation produces duplication.

**2. (a)**




**3. (a)** XO chromosomal abnormality in humans is due to monosomy of sex chromosome. Their total number of chromosomes are 45. This condition is found in Turner's syndrome.

**4. (b)** Polygenic genes show intermediate phenotypes, *e.g.* skin colour.

**5. (c)** Down's syndrome is due to trisomy of 21st chromosome; Turner's syndrome having XO genotype is caused by the absence of X chromosome in females; klinefelter's syndrome (XXY) is due to trisomy of sex chromosome.

**6. (a)** Barr body is the inactive one X-chromosome in somatic cells of female (Dosage compensation). The number of Barr bodies are always one less than the total number of X-chromosome.

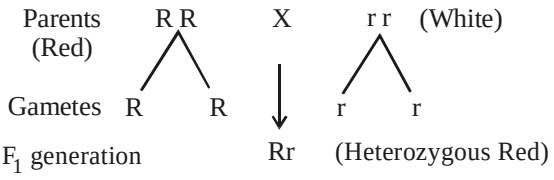
**7. (d)** Discontinuous variations lead to mutations.

**8. (b)** *Mirabilis jalapa* (4O' clock plant) shows incomplete dominance because the genes for red and white colour do not mix in the $F_1$ pink hybrids as both the pure characters reappear in the $F_2$ plants.

**9. (c)** A mutation in which there is deletion or insertion of one or few nucleotides is called frameshift mutation.

**10. (a)** The self pollinated progeny of a homozygous plant constitutes a pure line.

**11. (a)** As per Mendel's law in $F_1$ generation only dominant phenotypes appear.



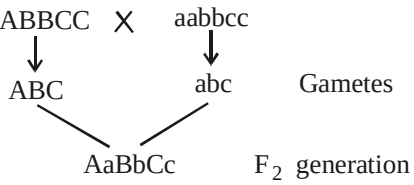

**12. (b)** Red and green colourblindness is a sex linked inheritance. Its genes are present on X-chromosome.

**13. (d)** Such types of results are obtained only if parents are heterozygous for the trait.

**14. (c)** The kind of mutation is paracentric inversion. In this a segment of a chromosome separates and rejoins in an inverted position.

**15. (a)** $F_1$ generation is always heterozygous, *e.g.* TtRr, so there are 4 types of gamete formation *i.e.* TR, Tr, tR, tr.

**16. (b)**




The $F_2$ generation will show the intermediate colour because of quantitative inheritence. In case of crossing between AA BB CC (dark colour) and aa bb cc (light colour), in $F_2$ generation seven phenotypes will be obtained with ratio 1 : 6 : 15 : 20 : 15 : 6 : 1. The total number of progeny is 64, out of which only two will be likely resemble with either parents. Hence, their percentage in $F_2$ generation would be 3.12 i.e less than 5%.

**17. (c)** Primary source of allelic variation is mutation.

**18. (b)** The genes for such traits are recessive and located on the X-chromosome. The character appears more often in males in hemizygous condition, but also in females with homozygous condition. Affected males receive their defective gene from carrier mothers who may have affected father. These exhibit criss- cross inheritance.

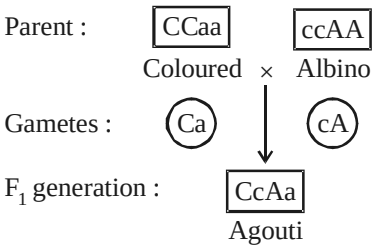
**19. (a)** Cri-du-chat/cat cry syndrome is due to the deletion of large part of the small or one of the $5^{th}$ chromosome.

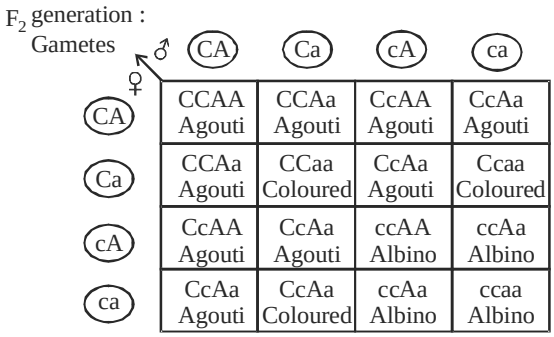
**20. (c)** Genes a and b lie very close to each other. So, they are representing linked genes. *e.g.* genes of haemophilia and colour blindness show sex linked inheritance.

**21. (c)** Genetic diversity describes an attribute which is commonly held to be advantageous for survival that there are many different versions of otherwise similar organisms, *e.g.* different varieties of mangoes.

**22. (a)** Polygenic inheritance is the trait under the control of more than one pair of genes, *e.g.* skin colour (trigenic) and human height.

**23. (a)** When one gene masks the effect or activity of another gene which does not lie on the same locus, it is called epistasis. Epistasis refers to non- allelic interactions. Like coat colour in mice is controlled by epistatic gene. When coloured (CCaa) mouse is crossed with albino (ccAA), agouti mice (ccAa) appeared in $F_1$ generation. Agouti, coloured and albino mice are obtained in 9 : 3 : 4 ratio in $F_2$ generation.

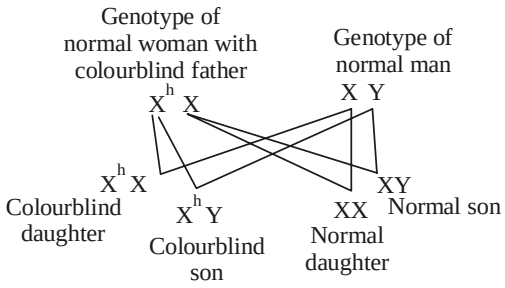



Agouti - 9
Coloured - 3
Albino - 4
Ratio - 9 : 3 : 4

**24. (a)** Turner's syndrome is caused due to the missing X chromosome. The genotype is therefore XO instead of the normal XX and the sufferer person possesses 45 chromosomes instead of 46. Patients with this condition can best be described as incompletely developed females, although there are often no obvious external differences compared with normal females. Affected females lack ovaries so they are infertile.

**25. (b)**




∴ 50% son would be colourblind.

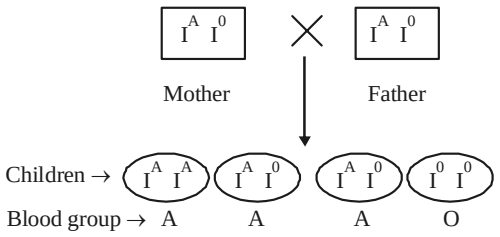
**26. (b)** In genetics, a test cross, first introduced by Mendel, is used to determine if an individual exhibiting a dominant trait is homozygous or heterozygous for that trait. Test crosses involve breeding the individual in question with another individual that expresses a recessive version of the same trait. If all offspring display the dominant phenotype, the individual in question is homozygous

dominant; if the offspring display both dominant and recessive phenotypes, then the individual is heterozygous. In some sources, the "test cross" is defined as being a type of back cross between the recessive homozygote and $F_1$ generation.

**27. (c)** In birds sex is determined by morphologically dissimilar pair of chromosomes called sex chromosomes. Z and W are two sex chromosomes of birds. A male bird has ZZ (homogenetic sex) arrangement while a female bird has ZW (heterogenetic sex) arrangement of chromosomes. Number of chromosomes in birds is 69.

**28. (b)** Gene pool is the sum total of genes and their alleles in the reproductive gametes of a population. The gene pool is transferred from one generation to the other using gametes from genetic pool. These gametes will form zygotes of next generation. Gene pool of a population will consist of a large number of genes which vary in their frequencies.

**29. (d)** In the mentioned case, one child with blood group 'O' and second with blood group 'A' are born to parents with heterozyous condition of genes for blood group A . *i.e.*, $I^AI^0$. Both mother and father have blood group A but their genotypes indicate heterozygotic condition.




30. **(b)** Pleiotropy is the condition in which a single gene influences more than one trait.

Polyploidy is a condition in which individuals have more than two complete sets of chromosomes.

Apomixis is a reproductive process in plants that superficially resembles normal sexual reproduction but there is no fusion of gametes.

**31. (a)**

**32. (b)** Genotype of carrier parents is – Aa (male parent) × Aa (female parent)

| ♀ \ ♂ | A | a |
|---|---|---|
| A | AA | Aa |
| a | Aa | *aa |

AA= normal child (25%)

Aa = carriers child (50%)

aa = affected child (25%)

**33. (b)** Since the offspring number 11 is affected (diseased) either of the two parents 6 or 7 have to be affected.

**34. (b)** The percentage of recombinants produced in cross I and cross II are respectively 1.3% and 37.2%.

## Type B : Assertion Reason Questions

**35. (a)** Genotype of the organism include all dominant and recessive characters.

**36. (b)** Phenylketonuria is an recessive autosomal gene disorder. It occurs due to the absence of enzyme phenylalanine hydroxylase which changes phenylalanine to tyrosine.

**37. (c)** In humans, sex of a child depends upon the gametes produced by the male (X, Y).

**38. (c)** Haemophilia also known as bleeder disease is an example of recessive sex linked inheritance in human beings. It is masked in heterozygous condition. The person suffering from this disease lack factors VIII and IX responsible for blood clotting. A small cut may lead to bleeding till death. Men are affected by this disease while women are the carriers.

Mutation of a structural gene on chromosome number 15 causes Marfan syndrome. This disease results in formation of abnormal form of connective tissues and characteristic extreme loosseness of joints.

**39. (c)** Haemophilia bleeding disorder is a group of hereditary genetic disorders that impair the body's ability to control blood clotting or coagulation. In its most common form, Hemophilia A, clotting factor VIII is absent. In Haemophilia B, factor IX is deficient. Factor VIII participates in blood coagulation; it is a cofactor for factor IXa which, in the presence of $Ca^{+2}$ and phospholipids forms a complex that converts factor X to the activated form Xa. Defects in this gene results in hemophilia A, a common recessive X-linked coagulation disorder. Prothrombin producing platelets in such persons are not found in very low concentration.

**40. (a)** In case of incomplete linkage, the linked gene shows new combination along with parental combination due to crossing over between chromatids.

**41. (c)** Aneuploidy can be either due to loss of one or more chromosomes (hypoploidy) or due to addition of one or more chromosomes to complete chromosome complement (hyperploidy). Hypopliody is mainly due to loss of a single chromosomes, monosomes $(2n - 1)$ or due to loss of one pair of chromosomes, nullisomes $(2n - 2)$.

**42. (c)** In the monohybrid test-cross both dominant and recessive traits are obtained in 1 : 1 ratio.

**43. (a)** $F_2$ phenotypic and genotypic ratio in monohybrid cross involving incomplete dominance is

| 1 : | 2 : | 1 |
|---|---|---|
| RR | Rr | rr |
| (red) | (pink) | (white) |

**44. (c)** In human, the gamete contributed by the male determines whether the child produced will be male or female. Sex in humans is a polygenic trait depending upon cumulative effect of some genes present on Y-chromosome. Only sex in human is amonogenic trait.

Chapter

# 28 Molecular Basis of Inheritance

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The process through which the amount of DNA, RNA and protein can be known at a time is called ***[1997]***

(a) autoradiography
(b) tissue culture
(c) cellular fractioning
(d) phase contrast microscopy

**2.** Balbiani rings are found in ***[1997]***

(a) polysomes
(b) polytene chromosomes
(c) autosomes
(d) nonsense chromosomes

**3.** In DNA helix, cytosine is paired with guanine by ***[1997]***

(a) covalent bond
(b) phosphate bond
(c) three hydrogen bonds
(d) two hydrogen bonds

**4.** Which RNAs pick up specific amino acid from amino acid pool in the cytoplasm to ribosome during protein synthesis ? ***[1998]***

(a) tRNA (b) mRNA
(c) rRNA (d) hnRNA

**5.** The structure of DNA is ***[1998]***

(a) linear (b) double helix
(c) single helix (d) triple helix

**6.** Transposon was discovered by ***[1998]***

(a) Sutton (b) Strassburger
(c) Fischer (d) B.Mc Clintock

**7.** Root cell of wheat has 42 chromosomes. What would be the number of chromosomes in the synergid cell ? ***[1999]***

(a) 7 (b) 14
(c) 21 (d) 28

**8.** Okazaki fragments form ***[2000]***

(a) leading strand (b) lagging strand
(c) non-sense strand (d) senseful strand

**9.** Wobble hypothesis was given by ***[2002]***

(a) F.H.C. Crick (b) Nirenberg
(c) Holley (d) Khorana

**10.** Which one of the following pairs of terms/names mean one and the same thing? ***[2003]***

(a) Gene pool-genome
(b) Codon-gene
(c) Cistron-triplet
(d) DNA fingerprinting - DNA profiling

**11.** What is true about *t*-RNA? ***[2003]***

(a) It binds with an amino acid at it 3' end.
(b) It has five double stranded regions.
(c) It had a codon at one end which recognizes the anticodon on messenger RNA.
(d) It looks like clover leaf in the three dimensional structure.

**12.** Which one of the following codons codes for the same information as UGC? ***[2003]***

(a) UGU (b) UGA
(c) UAG (d) UGG

**13.** During protein synthesis in an organism, at one point the process comes to a halt. Select the group of the three codons from the following, from which anyone of the three could bring about this halt. ***[2006]***

(a) UUU, UCC, UAU (b) UUC, UUA, UAC
(c) UAG, UGA, UAA (d) UUG, UCA, UCG

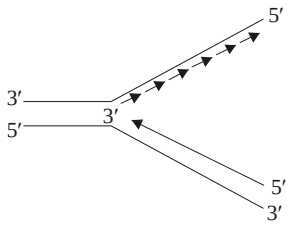
**14.** The total number of nitrogenous bases in human genome is estimated to be about ***[2004, 2008]***

(a) 3.5 million (b) 35 thousand
(c) 35 million (d) 3.1 billion

**15.** Which one of the following pairs is correctly matched with regard to the codon and the amino acid coded by it ? ***[2004, 2008]***

(a) UUA-valine (b) AM-lysine
(c) AUG-cysteine (d) CCC-alanine

**16.**




What is the error in above diagram? ***[2009]***

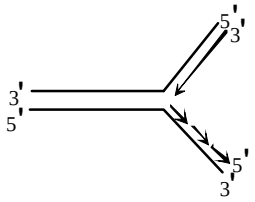
(a) Arrows are wrongly depicted.
(b) Polarity is incorrect.
(c) Both arrows and polarity are incorrect.
(d) None of the above.

**17.** TATA box of eukaryotic promotor lies ***[2010]***

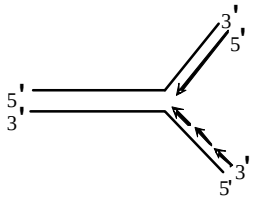
(a) about 25 bp upstream of the transcription start site.
(b) about 50 bp upstream of the transcription start site.
(c) about 75 bp upstream of the transcription start site.
(d) about 200 bp upstream of the transcription start site.

**18.** Which one of the following correctly represents the manner of replication of DNA ? ***[2003, 2012]***

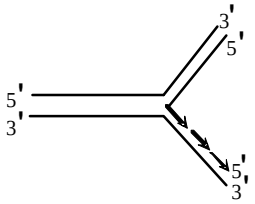
(a)



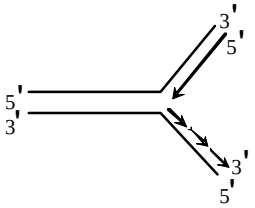

(b)




(c)




(d)




**19.** Select the correct option: ***[2014]***

| | Direction of RNA synthesis | Direction of reading of the template DNA strand |
|---|---|---|
| (a) | 5′—3′ | 3′—5′ |
| (b) | 3′—5′ | 5′—3′ |
| (c) | 5′—3′ | 5′—3′ |
| (d) | 3′—5′ | 3′—5′ |

**20.** Which one of the following represents a palindromic sequence in DNA? ***[2014]***

(a) 5' - GAATTC - 3'
3' - CTTAAG - 5'
(b) 5' - CCAATG - 3'
3' - GAATCC - 5'
(c) 5' - CATTAG - 3'
3' - GATAAC - 5'
(d) 5' - GATACC - 3'
3' - CCTAAG - 5'

**21.** Thirty percent of the bases in a sample of DNA extracted from eukaryotic cells is adenine. What percentage of cytosine is present in this DNA? ***[2015]***

(a) 10% (b) 20%
(c) 30% (d) 40%

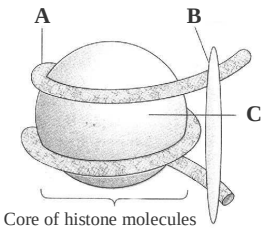
**22.** There are three genes a, b, c. Percentage of crossing over between a and b is 20%, b and c is 28% and a and c is 8%. What is the sequence of genes on chromosome? ***[2015]***

(a) b, a, c (b) a, b, c
(c) a, c, b (d) None of these

**23.** Which one of the following group of codons is called as degenerate codons? ***[2016]***

(a) UAA, UAG and UGA
(b) GUA, GUG, GCA, GCG and GAA
(c) UUC, UUG, CCU, CAA and CUG
(d) UUA, UUG, CUU, CUC, CUA and CUG

**24.** The given figure shows the structure of nucleosome with their parts labelled as A, B & C. Identify A, B and C. ***[2017]***




(a) A – DNA; B – $H_1$ histone; C – Histone octamer
(b) A – $H_1$ histone; B – DNA; C – Histone octamer
(c) A – Histone octamer; B – RNA; C – $H_1$ histone
(d) A – RNA; B – $H_1$ histone; C – Histone octamer

**25.** Match the codons given incolumn I with their respective amino acids given in column II and choose the correct answer. ***[2017]***

| Column -I (Codons) | | Column -II (Amino acids) | |
|---|---|---|---|
| A | UUU | I. | Serine |
| B | GGG | II. | Methionine |
| C | UCU | III. | Phenylalanine |
| D | CCC | IV. | Glycine |
| E | AUG | V. | Proline |

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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 26-30) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**26.** **Assertion :** Histones are basic proteins of major importance in packaging of eukaryotic DNA. DNA and histones comprise chromatin forming the bulk of eukaryotic chromosome.
**Reason :** Histones are of five major types $H_1, H_2A\ H_2B, H_3$ and $H_4$. ***[2000]***

**27.** **Assertion:** mRNA attaches to ribosome through its 3' end.
**Reason:** The mRNA has F-capsular nucleotide and bases of lagging sequence. ***[2002]***

**28.** **Assertion :** Replication and transcription occur in the nucleus but translation in the cytoplasm.
**Reason :** m-RNA is transferred from the nucleus into the cytoplasm where ribosomes and amino acids are available for protein synthesis. ***[2005]***

**29.** **Assertion:** An organism with lethal mutation may not even develop beyond the zygote. ***[2006]***
**Reason:** All types of gene mutations are lethal.

**30.** **Assertion:** Polytene chromosomes have a high amount of DNA.
**Reason:** Polytene chromosomes are formed by repeated replication. ***[2006]***

**Directions for (Qs.31-35) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**31.** **Assertion :** DNA is associated with proteins.
**Reason :** DNA binds around histone proteins that form a pool and the entire structure is called a nucleosome. ***[2013]***

**32. Assertion :** The uptake of DNA during transformation is an active, energy requiring process.

**Reason :** Transformation occurs in only those bacteria, which possess the enzymatic machinery involved in the active uptake and recombination ***[2014]***

**33. Assertion :** UAA, UAG and UGA terminate protein synthesis.

**Reason :** They are not recognised by tRNA. ***[2011, 2014]***

**34. Assertion :** In a DNA molecule, A–T rich parts melt before G–C rich parts.

**Reason :** In between A and T there are three H–bond, whereas in between G and C there are two H-bonds. ***[2010, 2015]***

**35. Assertion :** Replication and transcription occur in the nucleus but translation takes place in the cytoplasm.

**Reason :** mRNA is transferred from the nucleus into cytoplasm where ribosomes and amino acids are available for protein synthesis. ***[2008, 2015, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (a)** Autoradiography is the use of X-ray films to detect radioactive material. It produces a permanant record of positions and relative intensities of radiolabeled bands in a gel or slot. Typically, biomolecules are labeled with 32P or 35 S, and detected by over night film exposure.

Autoradiography technique may be used to determine the tissue localization of a radioactive substance, either introduced into a metabolic pathway, bound to a receptor or enzyme, or hybridized to a nucleic acid.

**2. (b)** Balbiani rings are temporary swellings in polytene chromosome having uncoiled active DNA that transcribes RNA.

**3. (c)** In DNA helix, cytosine always pairs with guanine by three hydrogen bonds.

**4. (a)** There are specific types of tRNA (because of anticodon) for specific amino acid. They transport the amino acids from the cytoplasm to the site of protein synthesis.

**5. (b)** DNA is double helical in structure. Its both strands are complementary to each other.

**6. (d)** Mc Clintock discovered transposon or (jumping genes) in maize plants in 1983.

**7. (c)** The root cell in wheat is a somatic cell and, hence, has 2n number of chromosomes which is a diploid condition. The synergid cell that is formed after meiosis along with the ovum has 21 chromosomes which is the haploid condition.

**8. (b)** Okazaki fragments are short pieces of newly synthesized DNA, which are generated during the normal process of DNA replication. They are linked up by the enzyme DNA ligase after replacing RNA primers with deoxribonucleotides. This will form lagging strand.

**9. (a)** Wobble hypothesis was given by F.H.C. Crick. It states that the first two positions of a triplet codon on mRNA have a precise pairing with the bases of the tRNA anticodon.

**10. (d)** Gene pool is the sum total of genes present in the inbreeding population whereas genome is a complete set of genes in the haploid case of chromosomes. Codon is a triplicate of nucleotide whereas gene is a linear segment of DNA. Cistron is a segment of the DNA molecule carrying information for the production of one polypeptide chain. DNA fingerprinting is also known as DNA profiling or DNA typing.

**11. (d)** t-RNA has a clover leaf like structure.

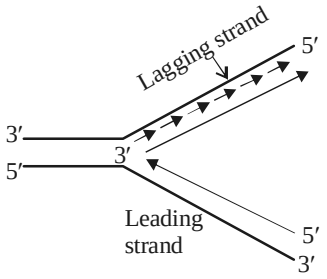
**12. (a)** UGC and UGU codes for cysteine.

**13. (c)** Protein termination occurs by nonsense codons *i.e.* UAA, UGA ,UAG.

**14. (d)** Genome size is usually stated as the total number of base pairs; the human genome contains roughly 3.1 billion base pairs organized into 24 distinct, physically separate microscopic units called chromosomes. All genes are arranged linearly along the chromosomes. The complete set of instructions for making an organism is called its genome.

**15. (a)** Valine is one of 20 proteogenic amino acids. Its codons are GUU, GUC, GUA, and GUG. Cysteine codons are UGU and UGC. With a thiol side chain, cysteine is classified as a hydrophilic amino acid. Alanine codons are GCU, GCC, GCA, and GCG. It is classified as a non-polar amino acid. L-alanine is second only to leucine. Lysine codons are AAA and AAG. Lysine is a base, as are arginine and histidine.

**16. (b)** The figure below is the replicating fork of DNA. The DNA replication takes place in 5′ to 3′ direction always. On the leading strand DNA replication is continuous while on lagging strand DNA replication is discontinuous. The polarity of lagging strand is incorrect in the given figure. The correct figure should be




Both the strands are antiparallel. In one strand carbon of sugar are in 3′ – 5′ direction and in other the carbon of sugar are in 5′ – 3′ direction.

**17. (a)** TATA box of eukaryote promoter lies about 25 bp upstream of the transcription start site.

**18. (d)** The new strands of DNA are formed in the 5' → 3' direction from the 3' → 5' template DNA by the addition of deoxyribonucleotides to the 3' end of primer RNA.

**19. (a)** Synthesis of RNA exhibits several features that are synonymous with DNA replication. RNA synthesis requires accurate and efficient initiation, elongation proceeds in the 5'–3' direction (*i.e.* the polymerase moves along the template strand of DNA in the 3'–5' direction), and RNA synthesis requires distinct and accurate termination. Transcription exhibits several features that are distinct from replication.

**20. (a)** A palindromic sequence is a nucleic acid sequence (DNA or RNA) that is the same whether read 5' (five-prime) to 3' (three prime) on one strand or 5' to 3' on the complementary strand with which it forms a double helix.

5 - GAATTC - 3

3 - CTTAAG - 5

It is a palindromic sequence of DNA cut by restriction enzyme *EcoRI*.

**21. (b)** If 30 percent of DNA is adenine, then by Chargaff's rule 30 percent will be thymine. The remaining 40 percent of the DNA is cytosine and guanine. Since the ratio of cytosine to guanine must be equal, then each accounts for 20 percent of the bases.

**22. (a)** $\frac{b\ \frac{20\%}{}\ a\ \frac{8\%}{}\ c}{28\%}$

**23. (a)** Degenerate codons (also called as non - sense codons or terminator codons) do not code for any amino acids. Three types of degenerate codons are UAG (amber), UAA (ochre) and UGA (opal).

**24. (a)** Nucleosome is a structural unit of a eukaryotic chromosome which consists of a length of DNA coiled around a core of histones and are thought to be present only during interphase of the cell cycle. In the given figure of nucleosome structure, the parts marked as A, B and C are respectively DNA, H1 histones and histone octamer.

**25. (a)**

| | | |
|---|---|---|
| UUU | – | Phenylalanine |
| GGG | – | Glycine |
| UCU | – | Serine |
| CCC | – | Proline |
| AUG | – | Methionine |

## Type B : Assertion Reason Questions

**26. (a)** Histones are basic proteins found in the eukaryotic chromosomes. These are rich in the amino acids lysine and arginine. Histonie proteins are basic proteins consisting of 5 types – $H_1$, $H_2A$, $H_2B$, $H_3$, $H_4$. DNA is coiled around it. It exists as octamers linked with $H_1$.

**27. (d)** mRNA is attached to the ribosome by means of protein ribophorin I & II. The sequence of nucleotides on mRNA is called codon.

**28. (a)** DNA is the master copy which transcribes to form working copy in the form of mRNA which translates in the form of peptide chain in the cytoplasm. It is also called central dogma.

**29. (c)** Organisms with lethal mutation bear lethal genes that result in the death of the individual which carries them. The completely lethal genes usually cause death of the zygote. Mutation is a sudden heritable change in the sequence of gene occuring on the chromosomes. Mutation may be beneficial, normal, sublethal or lethal.

**30. (a)** Polytene chromosomes show endomitosis and they have high DNA content.

**31. (a)** A chain of DNA has 140 base pairs, make $1\frac{3}{4}$ turns and twist around a histone octamer forming nucleosome. The core of nucleosome consists of 4 histones $H_2A$, $H_2B$, $H_3$ and $H_4$.

**32. (a)** Transformation does not involve passive entry of DNA molecules through permeable cell walls and membranes. It does not occur 'naturally' in all species of bacteria, only in those species possessing the enzymatic machinery involved in the active uptake and recombination processes. Even in these species, all cells in a given population are not capable of active uptake of DNA. Only competent cells, which possess a so called competence factor are capable of serving as recipients in transformation.

**33. (a)** Synthesis of polypeptide terminates when a nonsense codon of *m*RNA reaches the A– site. There are three nonsense codons– UAA, UAG and UGA. These codons are not recognised by any of the *t*RNAs. Therefore, no more aminoacyl *t*RNA reaches the A site. The P– site *t*RNA is hydrolysed and the completed polypeptide is released in the presence of a release factor.

**34. (c)** In a DNA molecule, A-T rich parts melt before G-C rich parts because there are two H-bond between A and T whereas in between G and C, there are three H-bond.

**35. (a)** In eukaryotes, the replication and transcription takes place in the nucleus. mRNA comes out from the nucleus through the nuclear pore. In cytoplasm, translation occurs. In prokaryote, there is no nuclear membrane, so replication, transcription and translation all occur in the cytoplasm.

Chapter

# 29 Evolution

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The branch of science dealing with process of improvement of human race by selective breeding is called ***[1997]***
(a) Eugenics (b) Euthenics
(c) Euphenics (d) Obstetrics

**2.** The connecting link between annelida and mollusca is ***[1998]***
(a) *Neoplina* (b) *Nautilus*
(c) Glochidium (d) Velliger larva

**3.** Theory of Pangenesis was given by ***[1998]***
(a) Lamarck (b) Oparin
(c) Darwin (d) De Vries

**4.** The cranial capacity was largest among the ***[2002]***
(a) Peking man (b) African man
(c) Java Ape man (d) Neanderthal man

**5.** A baby has been born with a small tail. It is the case exhibiting ***[2004]***
(a) retrogressive evolution
(b) mutation
(c) atavism
(d) metamorphosis

**6.** *"Homo sapiens"* implies ***[2007]***
(a) human race (b) human beings
(c) modern man (d) none of these

**7.** The study of homologous structures in mature organisms provides evidence for the evolutionary relationships among certain groups of organisms. Which field of study includes this evidence of evolution? ***[2009]***
(a) Comparative cytology
(b) Biochemistry
(c) Geology
(d) Comparative anatomy

**8.** Darwin's finches were a good example of ***[2009]***
(a) convergent evolution
(b) adaptive radiation
(c) mutation
(d) none of the above

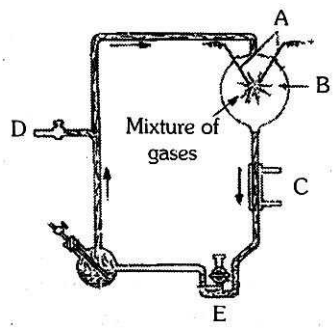
**9.** Wings of pigeon, mosquito and bat show ***[1999, 2007, 2011]***
(a) divergent evolution
(b) atavism
(c) convergent evolution
(d) all of these

**10.** Which of the following cannot be explained by Lamarckism? ***[2012]***
(a) Absence of lips in snakes
(b) Long neck of giraffe
(c) Degeneration of visual apparatus in cave dwellers
(d) Dull progeny of noble laureate

**11.** Thorn of *Bougainvillea* and tendril of *Cucurbita* are example of ***[2013]***
(a) analogous organs
(b) homologous organs
(c) vestigial organs
(d) retrogressive evolution

**12.** Forelimbs of cat, lizard used in walking; forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of ***[2014]***
(a) Analogous organs
(b) Adaptive radiation
(c) Homologous organs
(d) Convergent evolution

**13.** The diagram represents Miller's experiment. Choose the correct combination of labelling. ***[2015]***



(a) A–electrodes, B– $NH_3 + H_2 + H_2O + CH_4$, C–cold water, D–vacuum, E–U trap
(b) A–electrodes, B–$NH_4 + H_2 + CO_2 + CH_3$, C–hot water, D–vacuum, E–U trap
(c) A–electrodes, B–$NH_3 + H_2O$, C–hot water, D–tap, E–U trap
(d) A–electrodes, B–$NH_3 + H_2 + H_2O + CH_4$, C–steam, D– vacuum, E–U trap

**14.** A population is in Hardy- weinberg equilibrium for a gene with only two alleles. If the gene frequency of an allele A is 0.7, the genotype frequency of Aa is ***[2014, 2016]***
(a) 0.21 (b) 0.42
(c) 0.36 (d) 0.7

**15.** According to Hardy-Weinberg principle, allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences. It makes several assumptions which were given below. ***[2017]***
i. Random Mating
ii. Sexual Reproduction
iii. Non-overlapping Generations
iv. Occurrence of Natural Selection
v. Small size of population
Identify two assumptions which do not meet for a population to reach Hardy-Weinberg Equilibrium?
(a) iv and v (b) ii and iv
(c) iii, iv and v (d) i, ii and iii

**16.** Which of the following was most similar to modern man? ***[2017]***
(a) Java man
(b) Neanderthal man
(c) Homo habilis
(d) Cro-Magnon man

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 17-26) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**17.** **Assertion:** We have lost all the direct evidence of origin of life.
**Reason:** The persons responsible for protecting evidences were not skilled. ***[1998]***

**18.** **Assertion :** *Ginkgo biloba* is a living fossil.
**Reason :** Organism which have persisted and remain unchanged for the past several million years while their relatives disappeared. ***[2000]***

**19.** **Assertion :** Among the primates, chimpanzee is the closest relative of the present day humans.
**Reason :** The banding pattern in the autosome numbers 3 and 6 of man and chimpanzee is remarkably similar. ***[2004]***

**20.** **Assertion :** From evolutionary point of view, human gestation period is believed to be shortening.
**Reason :** One major evolutionary trend in humans has been the larger head undergoing relatively faster growth rate in the foetal stage. ***[2004]***

**21.** **Assertion :** Coacervates are believed to be the precursors of life.
**Reason :** Coacervates were self-duplicating aggregates of proteins surrounded by lipid molecules. ***[2004]***

**22.** **Assertion :** Human ancestors never used their tails and so the tail expressing gene has disappeared in them.
**Reason :** Lamarck's theory of evolution is popularly called theory of continuity of germ plasm. ***[2005]***

**23.** **Assertion :** Comparative biochemistry provides a strong evidence in favour of common ancestory of living beings.
**Reason :** Genetic code is universal. ***[2005]***

**24.** **Assertion :** Darwin's finches show a variety of beaks suited for eating large seeds, flying insects and cactus seeds.

**Reason :** Ancestral seed-eating stock of Darwin's finches radiated out from South American mainland to different geographical areas of the Galapagos Islands, where they found competitor-free new habitats. ***[2005]***

**25.** **Assertion :** The earliest organisms that appeared on the earth were non-green and presumably anaerobes.

**Reason :**The first autotrophic organisms were the chemoautotrophs that never released oxygen. ***[2006]***

**26.** **Assertion** : The earliest fossil form in the phylogeny of horse is eohippus.

**Reason** : Eohippus lived during the early pliocene epoch. ***[2007]***

**Directions for (Qs.27-30) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**27.** **Assertion :** The primitive atmosphere was reducing one *i.e.*, without oxygen. ***[2009]***

**Reason :** In the primitive atmosphere, oxygen was involved in forming ozone.

**28.** **Assertion :** Jave Ape-man, Peking man and Heidelberg man are the fossils of *Homo erectus*.

**Reason :** *Homo erectus* evolved from *Homo habilis*. ***[2009]***

**29.** **Assertion :** Natural selection is the outcome of difference in survival and reproduction among individuals that show variation in one or more traits.

**Reason :** Adaptive forms of a given trait tend to become more common; less adaptive ones become less common or disappear. ***[2004, 2012]***

**30.** **Assertion :** Organic compounds first evolved in earth required for origin of life were protein and nucleic acid.

**Reason :** All life forms were in water environment only. ***[2016]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** Eugenics deals with factors related to the improvement of human race by controlled selective breeding. It is the improvement of human race by improving body functions and treatment of defective heredity by genetic engineering. Euthenics deals with the improvement of human race by providing better conditions of life. Obstetrics is the study of the reproductive process within the female body including fertilization, pregnancy and childbirth.

**2. (a)** *Neoplina* is a connecting link between annelids and molluscs.

**3. (c)** The theory of Pangenesis was given by Darwin.

**4. (d)** The cranial capacity of Neanderthal man was the largest. The cranial capacity was about 1450 cc, roughly equal to that of modern man.

**5. (c)** Atavism is the reappearance of ancestral and not parental characters in an organisms which do not occur normally. A baby that has been born with a small tail it is exhibiting the case of atavism. Atavism is the sudden appearance of some ancestor characters which are lost during course of evolution.

**6. (b)** *Homo sapiens* imply human beings. Humans belong to an order of mammals called primates and placed in the family hominidae. Hominidae includes modern and archaic human beings and also consists of neanderthal, a sub species of *Homo sapiens*. Humans and their ancestors are more closely related to the apes.

**7. (d)** Comparative cytology is the field of study involving examination of similarities in cells of different organisms Biochemistry compares DNA and proteins made from DNA. Geology is the study of the earth.

**8. (b)** During voyage on the ship M.S. Beagle in 1931, Darwin visited Galopagos Islands of South America and studied the climate and birds of that Island. He studied the finches there, which were called Darwin's finches. The finches showed differences in their beaks based on their different feeding habits and are examples of natural selection. Darwin's Finches are good examples of adaptive radiation ( also called divergent evolution). Different types of beaks in these Finches show adaptive radiation.

**9. (c)** Wings of birds, insects, mammals are analogous organs *i.e.* have same function and different structure. The similarity developed in distantly related groups is an adaptation for the same function. So it is analogy or convergent evolution.

**10. (d)** According to Lamarck, during the lifetime of an organism new characters are developed due to internal vital forces, effect of environment, new needs, use and disuse of organs. These acquired characters are inherited from one generation to another. According to him, intelligence should also be inherited and so it fails to explain dull progeny of nobel laureate .

**11. (b)** Thorn of *Bougainvillea* and tendril of *Cucurbita* are examples of homologous chromosomes.

**12. (c)** Organs which have a common fundamental anatomical plan and similar embryonic origin whatever various functions they may perform are regarded as homologous organs. For example, the flippers of a whale, a bat's wing, fore-limb of a horse, a bird's wing and forelimbs of human are structurally as well as functionally different.

**13. (a)**

**14. (b)** For a gene with two alleles, *A* (dominant) and *a* (recessive), if the frequency of *A* is *p* and the frequency of *a* is *q*, then the frequencies of the three possible genotypes (*AA*, *Aa*, and *aa*) can be expressed by the Hardy-Weinberg

equation :

$$p^2 + 2pq + q^2 = 1$$

*where*, $p^2$ = frequency of *AA* (homozygous dominant) individuals, $2pq$ = frequency of *Aa* (heterozygous) individuals and $q^2$ = frequency of *aa* (homozygous recessive) individuals. The equation can be used to calculate allele frequencies if the numbers of homozygous recessive individuals in the population is known.

Here, $p = 0.7$ and $q = 0.3$ (given)

$\therefore$ $2pq$ (frequency of heterozygote)

$= 2 \times 0.7 \times 0.3 = 0.42$

**15. (a)** Occurrence of natural selection and small size of population do not meet the criteria for a population to reach Hardy-Weinberg Equilibrium. For Hardy-Weinberg equilibrium to be reached, natural selection should not be occurring. If populations are undergoing natural selection at the locus under consideration, allele frequencies will be continuously changing in a specific direction and Hardy-Weinberg Equilibrium predicts that allele frequencies will stay constant. It assumes that population size is very large.

**16. (d)** The skeleton of Cro-Magnon was almost identical to the modern man.

## Type B : Assertion Reason Questions

**17. (c)** We have lost all the direct evidences of origin of life only due to destruction of fossils on account of climatic changes and not due to any person/(s).

**18. (a)** *Ginkgo biloba*, belong to the Ginkgoales evolved during the Jurassic period and is still existing without any morphological or anatomical changes. Hence, both assertion and reason are correct.

**19. (a)** The banding pattern seen on stained chromosomes from humans and chimpanzee show striking similarities which indicates that they have evolutionary relationships (cytogenetic evidence).

**20. (d)** The human gestation period cannot be shortened unless there is really a problem. Complete development will not take place before the gestation period of 270 – 290 days in humans.

**21. (d)** Coacervates are large colloidal aggregates formed due to intermolecular attraction from large organic molecules synthesized abiotically on primitive earth. It mainly consists of proteins, polysaccharides and water. They do not fulfil the requirement for probable precursors of life.

A coacervate is a tiny spherical droplet of assorted organic molecules which is held together by hydrophobic forces from a surrounding liquid. Coacervates possess osmotic properties and form spontaneously from certain dilute organic solutions. They were even once suggested to have played a significant role in the evolution of cells and, therefore, of life itself. They are interesting not only in that they provide a locally segregated environment but also in that their boundaries allow the selective absorption of simple organic molecules from the surrounding medium. Coacervates do not have lipid outer membrane, hence they cannot reproduce.

**22. (c)** According to Lamarck's theory, continuous disuse of organs makes them weak. The theory of continuity of germplasm was given by Weismann.

If humans share ancestry with other primates such as prosimian, monkeys *etc*, then remnants of that common ancestory should be present in our genes.

**23. (b)** Comparative biochemistry provides a strong evidence for common ancestors of living beings (*e.g.* proteins lymph, enzymes, hormones, blood groups *etc*.)

**24. (a)** Darwin finches found on Galapagos islands differ primarily in body size, feather colour, bill shape as adaptation to type of food available. It is a type of divergent evolution.

**25. (b)** The earliest organisms that appeared on the earth were heterotrophic because of

reducing atmosphere and the first autotrophs were chemoautotrophs.

An anaerobic organism does not require oxygen for growth and may even die in its presence. Chemotrophs are the first organisms that appeared on earth & obtain energy by the oxidation of electron donating molecules in their environments. These molecules can be organic (organotrophs) or inorganic (lithotrophs). The chemotrophs utilize solar energy and can be either autotrophic or heterotrophic.

**26. (c)** Eohippus is the earliest fossil form in the phylogeny of horse. Origin of horse took place in the eocene period. The first fossil of horse was found in North America which was named Eohippus or "Dawn Horse. ", that later renamed as hyracotherium.

It was found during eocene period not during pliocene.

**27. (c)** The lightest atoms of nitrogen, carbon *etc*. formed the primitive atmosphere. Hydrogen atoms were most numerous and most reactive in primitive atmosphere. Hydrogen atoms combined with all oxygen atoms to form water leaving no free oxygen. Thus primitive atmosphere was reducing (without free oxygen) unlike the present oxidizing atmosphere (with free oxygen).

Formation of ozone layer is the consequence of modern oxidizing atmosphere having plenty of free oxygen. As more oxygen accumulated in the atmosphere (due to photosynthesis) ozone began to appear in the top layers.

**28. (b)** The fossil of Java Ape-man was discovered from pleistocene rocks in central Java. The fossil of Peking man was discovered from the lime stone caves of Choukoution near Peking while that of Heidelberg man was discovered in mid pleistocene. All these three fossils come under the category of *Homo erectus*. *Homo erectus* appeared about 1.7 million years ago in the middle pleistocene. *H. erectus* evolved from *Homo habilis*. He was about 1.5-1.8 metres tall. He had erect posture. His skull was flat than that of the modern man. He had protruding jaws, projecting brow ridges, small canines and large molar teeth. He made more elaborate tools of stones and bones, hunted big animals and perhaps knew the use of fire.

**29. (a)** The Darwin's theory of Natural Selection can be generalised as the change in species by the survival of an organism exhibiting a natural variation that gives it an adaptive advantage in an environment. Thus, leading to a new environmental equilibrium. The idea of the survival of the fittest explains the above evolution by natural selection. According to survival of the fittest, some of the variations exhibited by living things make it easier for them to survive and reproduce. Thus, more adaptive forms increase. Those which are not fit (or less adaptive) are eliminated.

**30. (b)** Organic compounds that first evolved in earth which required for origin of life were protein and nucleic acid. All life forms were in aquatic environment only.

Chapter 30

# Human Health & Diseases

## TYPE A : MULTIPLE CHOICE 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 tertain 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 immunodepressent
(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 bilharizia
(b) malaria, amoebic dysentery and leptospirosis
(c) bilharizia, 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 dimethyl amide - narcotic
(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 spoilt 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. | *Treponema pallidum* | I. | Plague |
| B. | *Yersinia pestis* | II. | Anthrax |
| C. | *Bacillus anthracis* | III. | Syphilis |
| D. | *Vibrio* | 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

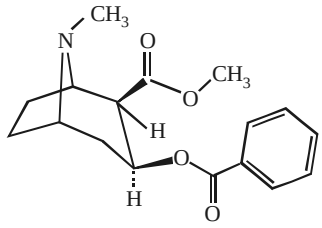
**29.** Which one of the following is a correct match? ***[2013]***
(a) Bhang – Analgesic
(b) Cocaine – Opiate narcotics
(c) Morphine – Hallucinogen
(d) Barbiturate – Tranquiliser

**30.** Which of the following is an autoimmune disorder? ***[2013]***
(a) Myasthenia gravis
(b) Osteoporosis
(c) Muscular dystrophy
(d) Gout

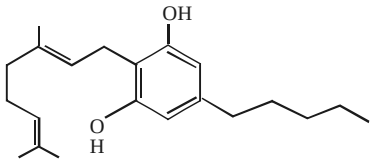
**31.** Which of the following is based upon the principle of antigen-antibody interaction? ***[2014]***
(a) PCR
(b) ELISA
(c) r-DNA technology
(d) RNA

**32.** Identify the molecules (A) and (B) shown below and select the right option giving their source and use. ***[2014,2015]***

(A)




(B)




| | Molecule | Source | Uses |
|---|---|---|---|
| (a) | (A) Cocaine | *Erythroxylum coca* | Accelerates the transport of dopamine |
| (b) | (B) Heroin | *Cannabis sativa* | Depressant and slows down body functions |
| (c) | (B) Cannabinoid | *Atropa belladona* | Produces hallucinations |
| (d) | (A) Morphine | *Papaver somniferum* | 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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 37-44) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**37.** **Assertion:** There is no chance of malaria to a man on the bite of male *Anopheles* mosquito.
**Reason:** It carries a non-virulant strain of *Plasmodium*. ***[1998]***

**38.** **Assertion :** Rabies is an infection of mammals, it involves central nervous system which may result in paralysis and finally death.
**Reason :** This is caused by neurotropic bacteria in saliva of rabies animal. ***[2000]***

**39.** **Assertion :** *Plasmodium vivax* is responsible for malaria.
**Reason :** Malaria is caused by polluted water. ***[2001]***

**40.** **Assertion:** Histamine is related with allergic and inflammatory reactions.
**Reason:** Histamine is a vasodilator. ***[2002]***

**41.** **Assertion :** Organ transplantation patients are given immunosuppressive drugs.
**Reason :** Transplanted tissue has antigens which stimulate the specific immune response of the recipient. ***[2005]***

**42.** **Assertion:** LSD and marijuana are clinically used as a analgesics. ***[2006]***
**Reason:** Both these drugs suppress brain function.

**43.** **Assertion :** A person who has received a cut and is bleeding needs to be given anti-tetanus treatment. ***[2006]***
**Reason :** Anti-tetanus injection provides immunity by producing antibodies for tetanus.

**44.** **Assertion (A)** : Antigen can be easily recognized because it has antigenic determinants.
**Reason (R)** : The recognition ability is innate. ***[2007]***

**Directions for (Qs.45-57) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**45.** **Assertion :** *Escherichia coli*, *Shigella sp*. and *Salmonella sp.* are all responsible for diarrhoeal diseases.
**Reason :** Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids and electrolytes should be ensured. ***[2008]***

**46.** **Assertion :** Dope test is used to estimate the level of blood alcohol by analyzing the breath of persons drinking alcohol.
**Reason :** A drunken person usually feels tense and less talkative. ***[2004, 2008]***

**47.** **Assertion :** Interferons are a type of antibodies produced by body cells infected by bacteria.
**Reason :** Interferons stimulate inflammation at the site of injury. ***[2004, 2008]***

**48.** **Assertion :** Mast cells in the human body release excessive amounts of inflammatory chemicals, which cause allergic reactions.
**Reason :** Allergens in the environment on reaching human body stimulate mast cells in certain individuals. ***[2003, 2008]***

**49.** **Assertion :** *Cannabis sativa* is a powerful anti-depressant.
**Reason :** Hashish and Marijuana are derived from it. ***[2009]***

**50.** **Assertion:** Epstein– Barr virus is an oncovirus.
**Reason:** It stimulates the growth of cancer. ***[2011]***

**51.** **Assertion:** HIV infected person are prone to oppurtunistic diseases.
**Reason:** Immune system weakens during HIV infection. ***[2011]***

**52.** **Assertion :** Histamine is involved in allergic and inflammatory reactions.
**Reason :** Histamine is a vasodilator. ***[2012]***

**53.** **Assertion :** The antibodies separted from serum are homogenous.
**Reason :** Monoclonal antibodies are homogenous immunological reagents. ***[2013]***

**54.** **Assertion :** Interferons are effective against viruses.
**Reason :** Proteins which can be synthesized only by genetic engineering are effective against viruses. ***[2013, 2014]***

**55.** **Assertion :** Cancer cells are virtually immortal until the body in which they reside dies.
**Reason :** Cancer is caused by damage to genes regulating the cell division cycle. ***[2006, 2015]***

**56.** **Assertion :** Cocaine has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy.
**Reason :** Injecting the microbes intentionally during immunisation or infectious organisms gaining access into body during natural infection induces active immunity. ***[2016]***

**57.** **Assertion:** Artificially acquired passive immunity results when antibodies or lymphocytes produced outside the host are introduced into a host.
**Reason:** A bone marrow transplant given to a patient with genetic immunodeficiency is an example of artificially acquired passive immunity. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** Gambusia fish is larvicidal *i.e.* feed on insect larva. They are introduced into lakes and ponds to eat mosquito larvae (*e.g.* *Anopheles*) and control malaria.

**2. (c)** Interferons are glycoproteins produced by viral infected cell. They make the cells resistant to viral infection.

**3. (c)** Incubation period of *Plasmodium vivax* is 14 days, *P. malariae* is 30 days, *P. ovale* is 14 days, and *P. falciparum* is 12 days.

**4. (d)** Colostrum (also called first milk) is the thin yellowish fluid secreted by the mammary glands at the time of parturition and which precedes the production of true milk. It provides a nursing infant with essential nutrients and infection-fighting antibodies (called immunoglobulin). $I_gA$ is the major immunoglobulin in colostrum. It provides protection from inhaled and ingested pathogens.

**5. (b)** Hay fever is due to allergic reaction.

**6. (a)** Influenza is caused by virus *Myxovirus influenzae*. It is an acute respiratory tract infection.

**7. (c)** Cancer of lymphatic tissue *i.e.* lymph nodes, spleen, is lymphoma.

**8. (a)** Amoebiasis or amoebic dysentry is caused by *Entamoeba histolytica.*

**9. (c)** Inflamatory response is due to the release of histamines by the damaged mast cells. The vascular fluid comes out of the blood vessels causing swelling of the region.

**10. (d)** Sporogony of *Plasmodium* occurs in the salivary glands of female *Anopheles*.

**11. (d)** Malignant tertain malaria is caused by *Plasmodium falciparum*.

**12. (a)** HIV (AIDS virus) consists of glycoprotein coat, double layer of lipid membrane of two protein coats. It contains ss RNA and reverse transcriptase.

**13. (b)** Cyclosporin is used as immunodepressant especially for the patients having organ transplantation. It suppresses T-lymphocytes activity in the immune response.

**14. (c)** IgE immunoglobulin acts as mediator in allergic response.

**15. (b)** Artificial passive immunity is the resistance passively transferred to a recipient by administration of antibodies, *e.g.* administration of antivenom.

**16. (c)** Electron beam therapy is a kind of radiation therapy to treat certain types of cancer. It is used as a therapeutic treatment for cancer.

**17. (d)** Valium is the anti depressant used by addicts that produces feelings of calmness, relaxation and drowsiness.

**18. (a)** In leptospirosis and bilhariziasis diseases, cercaria of the fluke penetrates the human body through the skin during bath in rivers and canals.

**19. (d)** Amphetamine is pap pill/antisleep drug which stimulates CNS. Lysergic acid diethylamide (LSD) is the most potent hallucinogen. Benzodiazepam is a sedative which switches of the CNS and is antianxiety. Heroin is a psychotropic drug which acts on the brain and alters behavior, consciousness and capacity of perception.

**20. (b)** An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as histamine and kinins. Histamine is a biogenic amine involved in local immune responses as well as regulating physiological function in the gut and acting as a neurotransmitter. It is found in virtually all animal body cells. New evidence also indicates that histamine plays an important role in chemotaxis of white blood cells. Kinin is any of various structurally related polypeptides, such as bradykinin and kallikrein. They are members of the autacoid family. They act locally to induce vasodilation and contraction of smooth muscles.

**21. (c)** Antigen binding site is Y-shaped showing lock and key pattern made up of one heavy and one light chain.

**22. (a)** The Y-shaped antibody molecule is composed of 4 polypeptide chains - two

identical light chains and two heavy chains held together by disulphide bonds. Antigen-binding site is formed on antibody molecule where a heavy chain variable and a light chain variable come closer.

**23. (d)** Leprosy is caused by *Mycobacterium leprae*, while tuberculosis is caused by bacteria *Streptococcus* or *Staphylococcus*. Rifampicin is a common medicine in treatment of both the diseases.

**24. (c)** Antigen is the only foreign substance which triggers immune system by way of antibody formation. These antibodies neutralize antigen by antigen-antibody reaction.

**25. (b)** $I_gM$ is a pentameric immunoglobulin that is produced first in a primary response to an antigen. $I_gA$, $I_gD$ and $I_gE$ consist of single monomers.

**26. (c)** Hemorrhagic syndrome of cattle are associated with the feeding of sweet clover hay containing dicumarol.

**27. (d)** Opium is a narcotic formed from the latex released by lacerating the immature seed pods of opium poppies *(Papaver somniferum*). Morphine is the most prevalent alkaloid in opium, about 10%-16% of the total alkaloids. It is responsible for most of the harmful effects such as lung edema, respiratory difficulties, coma, or cardiac or respiratory collapse.

**28. (a)** Plague is a deadly infectious disease that is caused by the enterobacteria *Yersinia pestis* (formely know as *Pasteurella pestis*). Anthrax is an infectious bacterial disease which involves skin, gastrointestinal tract or lungs. Syphilis is a sexually transmitted infection caused by bacterium *Treponema pallidium*. Cholera is an infection in the small intestine caused by the bacterium *Vibrio cholerae* that causes a large amount of watery diarrhea and vomiting.

**29. (d)**

**30. (a)**

**31. (b)** The ELISA is a fundamental tool of clinical immunology, and is used as an initial screen for HIV detection. Based on the principle of antigen- antibody interaction, this test allows for easy visualization of results.

**32. (d)** Molecule (A) represents structure of morphine. Morphine is the most abundant alkaloid found in *Opium*, the dried sap (latex) derived from shallowly slicing the unripe seedpods of the Opium, or common and/or edible poppy *Papaver* somniferum. Morphine is a potent opiate analgesic drug that is used to relieve severe pain.

**33. (b)**

**34. (d)** Tetanus is caused by *Clostridium tetani* while plague is caused by *Pasteurella pestis.*

**35. (b)** The human immunodeficiency virus is a lentivirus that causes the acquired immunodeficiency syndrome, a condition in humans in which progressive failure of the immune system allows life-threatening opportunistic infections and cancers to thrive. HIV has a protein coat and a genetic material which is single stranded RNA.

**36. (d)** Yellow fever and dengue are viral diseases, and they are transmitted by mosquitoes.

## Type B : Assertion Reason Questions

**37. (c)** Male *Anopheles* mosquito do not have piercing and sucking type of mouth parts. So, they can not inject malarial parasite into man.

**38. (c)** Rabies (hydrophobia) is caused by rabies virus. Its vectors are raboid animals especially dogs. It leads to encephalitis, fear of water (hydrophobia), high fever, severe headache, spasm of throat & chest, leading to death.

**39. (b)** Malaria is caused by *Plasmodium* whose sexual phase occurs in the mosquito *Anopheles*. When female *Anopheles* feed on blood, they can serve as vector host for malarial parasite.

**40. (a)** Histamine is produced by mast cells in response to the allergy and inflammatory reaction. When histamine is released from mast cells, it causes vasodilation and an increase in permeability of the blood vessel walls. These effects, in turn cause the common symptoms of allergy including a running nose and watering eyes.

**41. (a)** Success of organ transplant depends on proper matching of histocompatibility of antigens that occurs in all cells of the body. As there are antigens which are likely to be attacked by recipient's T-cells and antibodies, the recipient of organ transplant is always given immunosuppressants to prevent immune rejection of the transplanted tissue.

**42. (c)** LSD and marijuana are anti inflammatory, sedative, anticonvulsive and laxative in action.

**43. (c)** Anti tetanus is a disinfectant *i.e.* it prevents the infection due to the entry of bacteria through wounds.

**44. (b)** Antigen is a substance that when introduced in the body, stimulate the production of antibody. They are mostly proteins but may be carbohydrates, lipids, nucleic acids etc. One antigen can bind with many antibodies. Every antigen has many antigenic determinants called epitopes.

The recognition ability of antibody is innate and develops without exposure to the antigen.

**45. (b)** Diarrhoeal disease conditions include frequent and excessive discharge of watery material from the bowel. Such diseases mostly result from ingestion of harmful germs with food and water. *E. coli*, *Shigella sp*. & *salmonella sp*. causes diarrhoea. Diarrhoea caused by virus, bacteria or parasites possesses two characteristics- firstly, the offending organisms colonise the intestine and as a consequence cause inflammation of the intestine or enteritis; and secondly, they upset the balance of intestinal fluid absorption and secretion mechanism, often enhancing the latter very considerably, which is then manifested as watery stool discharged frequently in large volumes. *Shigella sp*, *Salmonella sp*. are quite closely related genera that are responsible for diarrhoeal diseases. Dehydration is common to all types of diarrhoeal diseases & adequate supply of fluids & electrolytes that provides ions, should be ensured.

**46. (d)** Blood alcohol test measures the amount of alcohol (ethanol) in the body. Alcohol is quickly absorbed into the blood and can be measured within minutes of having an alcoholic drink. The amount of alcohol in the blood reaches its highest level about an hour after drinking. But food in the stomach may increase the amount of time it takes for the blood alcohol to reach its highest level. About 90% of alcohol is broken down in the liver. The rest of it is passed out of the body in urine and your exhaled breath. Symptoms of alcohol intoxication include confusion, lack of coordination, unsteadiness that makes it hard to stand or walk, or erratic or unsafe driving. Dope test is not related to alcohol. Dope test is a blood test to know whether a person used any drug to improve their performance.

**47. (d)** Interferons are natural proteins produced by the cells of the immune system in response to challenges by foreign agents such as viruses, parasites and tumor cells. Interferons belong to the large class of glycoproteins known as cytokines. Interferons are produced by a wide variety of cells in response to the presence of double-stranded RNA, a key indicator of viral infection. Interferons assist the immune response by inhibiting viral replication within host cells, activating natural killer cells and macrophages, increasing antigen presentation to lymphocytes, and inducing the resistance of host cells to viral infection. When the antigen is presented to matching T and B cells, those cells multiply and strategically and specifically wipe out the foreign substance. That is why antigen presentation is so important to the immune response.

**48. (a)** A mast cell contains many granules rich in histamine serotonin and heparin. Although best known for their role in allergy and anaphylaxis, mast cells play an important protective role as well, being intimately involved in wound healing and defense against pathogens. The symptoms of an allergic reaction develop in response to

histamine. Mast cells release a large amount of histamine into the blood stream & it also act as initiator of the inflammatory response, which aids the arrival of leucocytes at a site of infection. Histamine stimulates capillary dilation increased capillary permeability, closure of bronchial tubes, mucus secretion, pain & swelling.

**49. (d)** *Cannabis sativa* or Hemp is an annual herb of cannabaceae family. It is mainly the source of fibre. *Cannabis sativa* is not an antidepressant. Antidepressant is a psychiatric medication used to alleviate mood disorders such as major depression. Hashish and Marijuana are drugs derived from it. Preparations of flowers of *Cannabis* is called marijuana while preparations of the resinous extract is called hashish. Both are consumed by smoking, vapourising and oral ingestion and are hallucinogen drugs that cause acute panic anxiety reaction.

**50. (a)** Oncoviruses are cancer – causing viruses and may be DNA or RNA virus *e.g.*, Epstein – Barr – Virus, Herpes simplex type 2 virus etc. This shows that the development of cancerous tumour is associated with certain genes.

**51. (a)** Usually, person shows symptoms of HIV infection within 2 to 6 weeks of exposure to the virus. But in some persons, the virus may remain silent for long periods (upto 10 years) before symptoms of full blown AIDS are observable. The symptoms of HIV infection include fever, lethargy, pharyngitis, nausea, headache, rashes etc. Persons suffering from AIDS have a weakened immune system due to depletion of T- helper cells. Such persons show *opportunistic infections*, *i.e.*, infection by those fungi, bacteria and viruses to which a person with normal immune system is expected to be resistant. Therefore, persons prone to opportunistic infections may be suspected to be infected by HIV, particularly, if the count of T helper cells in 200/ ml or lower.

**52. (a)** Histamine is a derivative of the amino acid histidine produced by damaged cells of vertebrates. When released, it has the effect of dilating capillaries and lowering blood pressure. Histamine is involved in allergic and inflammatory reactions also.

**53. (d)** From hyperimmunized animals, the blood serum may be taken and antibodies may be isolated from this serum. However, the antibodies, whenever separated from serum after induction due to an antigen, are usually heterogenous, because the cells keep on producing a variety of antibodies. Monoclonal antibodies (Mabs), on the other hand are homogeneous immunological reagents of defined specificity so that these can be utilized for diagnosis and screening of disease.

**54. (c)** Interferons are proteins that are effective against most viruses. They are naturally produced by virus infected cells. The proteins interact with adjacent cells and make them resistant to virus attack. Now interferons are also being manufactured through genetic engineering.

Interferons control the multiplication of virus particles by inhibiting their protein synthesis.

**55. (b)** Cancer cells divide and redivide mitotically and is due to the activation of pro-oncogenes.

**56. (c)** Cocaine is obtained from the cocaplant, erthyroxylum coca. Cocaine is commonly called as coke or crack which is usually snored. It has a potent stimulating action of euphoria and increased energy. It interferes with the transport of the neurotransmitter dopamine. Its increased dosages cause hallucinations.

**57. (b)** Artificially acquired passive immunity results when antibodies or lymphocytes that have been produced outside the host are introduced into a host. This type of immunity is immediate short lived, lasting only a few weeks to a few months. An example is bone marrow transplant given to a patient with genetic immunodeficiency.

Chapter

# 31 Strategies for Enhancement in Food Production

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The chemical which are produced by host plants due to infection as a defence reaction to pathogen, are called ***[1997]***
(a) phytotoxin (b) toxin
(c) phytotron (d) phytoalexins

**2.** Auxanometer is used to measure ***[1998]***
(a) length (b) respiration
(c) transpiration (d) ascent of sap

**3.** Crop rotation is used to increase ***[1999]***
(a) soil fertility
(b) pore size and soil particle
(c) organic content of soil
(d) viscosity of soil water

**4.** Haploid cultures can be obtained by culturing
(a) pollen grains (b) embryo ***[2000]***
(c) shoot apex (d) root apex

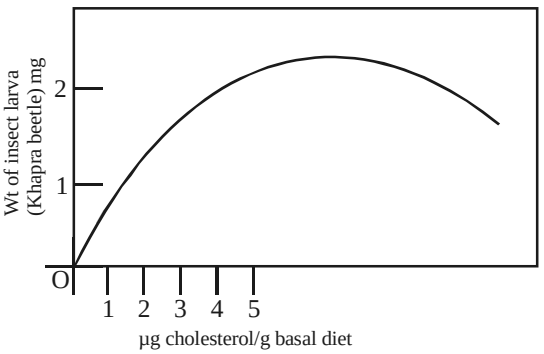
**5.** *Azolla* is used as a biofertilizer because it ***[2003]***
(a) multiplies very fast to produce massive biomass
(b) has association of nitrogen-fixing *Rhizobium*
(c) has association of nitrogen-fixing Cyanobacteria
(d) has association of mycorrhiza

**6.** Pruning of plants promotes branching because the axillary buds get sensitized to ***[2004]***
(a) ethylene (b) gibberellin
(c) cytokinin (d) indole acetic acid

**7.** Somaclonal variation can be obtained by ***[2004]***
(a) application of colchicine
(b) irradiation with gamma rays
(c) tissue culture
(d) hybridisation

**8.** Somaclonal variation appears in ***[2005]***
(a) organisms produced through somatic hybridization.
(b) plants growing in highly polluted conditions.
(c) apomictic plants.
(d) tissue culture raised plants.

**9.** In an experiment freshly hatched larvae of an insect (Khapra beetle) were reared on a basal diet (complete diet without cholesterol) with increasing amounts of cholesterol. Results obtained are shown in the given graph. ***[2005, 2008]***




The graph indicates
(a) cholesterol is an essential dietary requirement of khapra beetle.
(b) growth of khapra beetle is directly proportional to cholesterol concentration.
(c) cholesterol concentration of 2 µg/g diet is the optimum level.
(d) growth of khapra beetle is inhibited when cholesterol concentration exceeds 5 µg/g diet.

**10.** A scion is grafted to a stock. The quality of fruits produced will be determined by the genotype of ***[2006]***
(a) stock
(b) scion
(c) both stock and scion
(d) neither stock nor scion

**11.** Cocoa is the plant from which chocolate is made. Which part is used to extract it? ***[2007]***
(a) Flower (b) Fruit
(c) Seeds (d) Bark

**12.** Bean seeds were planted and put on a sunny windowsill. As the plants grew, their stems bent toward the window. This bending was most likely caused by an ***[2009]***

(a) unequal distribution of auxin in the stem.
(b) unequal distribution of a neurotransmitter in the stem.
(c) equal distribution of auxin in the stem.
(d) equal distribution of a neurotransmitter in the stem.

**13.** Phytotron is a facility to *[2010]*
(a) grow plants under disease-free conditions.
(b) conserve endangered species of plants.
(c) grow plants under controlled conditions.
(d) induce mutations.

**14.** Essential oils are those which *[2011]*
(a) are essential to the plant itself
(b) are used as lubricants
(c) produce perfumes
(d) are essential for human beings

**15.** Coconut water is rich in *[2011]*
(a) auxins (b) gibberellins
(c) abscisic acid (d) cytokinin

**16.** Which of the following is the pair of biofertilizers? *[2014]*
(a) *Azolla* and BGA
(b) *Nostoc* and legume
(c) *Rhizobium* and grasses
(d) *Salmonella* & E. coli

**17.** Hisardale is a new breed of sheep developed in Punjab by one of the breeding technique in which superior male of one breed is mated with superior females of another breed.
Identify the breeding technique from the option given below. *[2016]*
(a) Inbreeding (b) Out crossing
(c) Out breeding (d) Cross breeding

**18.** Biodiversity loss occurs due to the reasons given below. *[2017]*
(i) Habitat loss and fragmentation
(ii) Co-extinction
(iii) Over-exploitation
(iv) Alien species invasion
Identify the correct reasons.
(a) (i) and (ii) (b) (i), (ii) and (iii)
(c) (ii), (iii) and (iv) (d) (i), (ii), (iii) and (iv)

**19.** Explant is required to be disinfected before placing in culture. This is done by *[2017]*
(a) autoclaving
(b) ultra-violet rays
(c) clorax or hypochlorite
(d) X-rays

**20.** Which of the following is a viral disease of poultry birds? *[2017]*
(a) Anthrax (b) Ranikhet
(c) Coccidiosis (d) None of these

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 21-25) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**21.** **Assertion :** In plant tissue culture somatic embryos can be induced from any plant cell.
**Reason :** Any viable plant cell can differentiate into somatic embryos. *[2003]*

**22.** **Assertion :** Use of fertilizers greatly enhances crop productivity.
**Reason :** Irrigation is very important in increasing crop productivity. *[2003]*

**23.** **Assertion :** Fish meal is a rich source of protein for cattle and poultry.
**Reason :** Fish meal is produced from non-edible parts of fishes like fins, tail *etc*. *[2004]*

**24.** **Assertion :** Cattle breeds can be improved by super ovulation and embryo transplantation.
**Reason :** Superovulation in high milk-yielding cows is induced by hormonal injection. *[2004]*

**25.** **Assertion (A) :** Vernalization is acceleration of subsequent flowering by low temperature treatment.
**Reason (R) :** Site of vernalization is apical meristem. *[2007]*

**Directions for (Qs. 26-31) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**26.** **Assertion :** In plant tissue culture, somatic embryos can be induced from any plant cell.
**Reason :** Any viable plant cell can differentiate into somatic embryos. ***[2008]***

**27.** **Assertion :** Cattle breeds can be improved by superovulaton and embryo transplantaion.
**Reason :** Superovulation in high milk-yielding cows is induced by hormonal injection. ***[2013]***

**28.** **Assertion :** In case of vegetatively propagated crops, pure-line selection is not required.
**Reason :** Hybrid vigour is mostly used in vegetatively propagated plants. ***[2013]***

**29.** **Assertion :** Yeasts such as *Saccharomyces cerevisiae* are used in baking industry.
**Reason :** Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion. ***[2015]***

**30.** **Assertion :** Somatic embryos can be induced from any cell in plant tissue culture.
**Reason :** Any living plant cell is capable of differentiating into somatic embryos. ***[2017]***

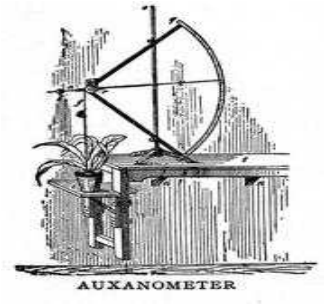
**31.** **Assertion :** A major advantage of tissue culture is protoplast fusion.
**Reason :** A hybrid is formed by the fusion of naked protoplasts of two plants. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** Phytoalexins are produced by plants that are under attack. Phytoalexins produced in plants act as toxins to the attacking organism. They may puncture the cell wall, delay maturation, disrupt metabolism or prevent reproduction of the pathogen in question. However, phytoalexins are often targeted to specific predators; a plant that has anti-insect phytoalexins may not have the ability to repel a fungal attack.

**2. (a)** Auxanometer is an apparatus for measuring increase or rate of growth in plants. It automatically detects and measures plant growth and stores information in a data logger.




**3. (a)** Crop rotation increases the soil fertility by sowing different crops, usually legume and non-legume, in successive seasons on the same piece of land.

**4. (a)** Pollen grains are used for haploid cultures since they possess n-number of chromosomes that are required for haploid cultures.

**5. (c)** *Azolla*, has cyanobacteria which is the nitrogen fixing bacteria. Due to this *Azolla* is able to fix the nitrogen as nitrates, thereby making it available to plants in the soluble form of nitrogen.

**6. (c)** Pruning causes the cutting of plant apex which lowers the amount of auxin and relatively an increase in cytokinin content. In the plant, cytokinin promotes growth of axillary buds causing branching.
Cytokinins are essential plant hormones that control cell division, shoot meristem initiation, leaf and root differentiation, senescence.

**7. (c)** Somaclonal variations are differences in plants that are raised from the callus by tissue culture. If these variations are of economic value, *e.g.* , induce tolerance of pests, diseases, etc, such plants are selected and multiplied. This technique has been used in wheat, rice, potato and tomato.

**8. (d)** Somaclonal variations refer to heritable changes which accumulate in callus (tissue culture) from a somatic explant and express in the progeny of *in vitro* regeneration obtained from callus.
These variations have been used to develop several useful.

**9. (a)** According to graph, growth of Khapra beetle is directly proportional to cholesterol concentration.

**10. (b)** The quality of fruits produced by the grafted plant is determined by the genotype of scion.

**11. (c)** Cocoa is obtained from seeds of cocoa plant *Theobroma*. It belongs to family sterculiaceae. This plant is a native of tropical America and its seeds are used to prepare cocoa and chocolate.

**12. (a)** The plant hormone, auxin, is more distributed on the side away from the unilateral illumination causing cells to grow faster in the darkerside, which in turn, causes the plant to bend toward the light. If the distribution were equal, the plant would grow just upwards. Neuro-transmitters are chemicals secreted by multicellular animals and are used in transmitting impulses in the nervous system.

**13. (c)** Phytotron is a chamber in which plants can be grown in controlled condition.

**14. (c)** Essential oils-These are volatile oils and possess strong aromatic smell.

**15. (d)** Coconut water is rich in cytokinin. Cytokinin initiates cell division and is found in dividing tissues. So, coconut water is used as a medium in tissue culture of plant tissues where it initiates cell division. Coconut water is liquid endosperm.

**16. (a)** *Azolla* and BGA are biofertilizer which increases the fertility of soil.

**17. (d)** Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Marino rams. Cross breeding is a method in which superior male of one breed is mated with superior females of another breed. It allows the desirable qualities of two different breeds to be combined.

**18. (d)** Biodiversity refers to the variety found in biota due to the genetic make-up of plants and animals to cultural diversity. The main cause of the loss of biodiversity can be attributed to the influence of human beings on the world's ecosystem. The important factors causing loss of biodiversity are - habitat loss, habitat fragmentation, disturbances, over exploitation of resources, pollution, exotic species, co-extinction, alien species invasion, intensive agriculture and forestry.

**19. (c)** Before transferring on the culture medium, the explant is first of all disinfected by surface sterilization using clorax water, sodium or calcium hypochlorite solution or methiolate. Too much care must be taken in this operation so that the cells do not die.

**20. (b)** Coccidiosis is a protozoan disease.

## Type B : Assertion Reason Questions

**21. (a)** Any living plant cell which is viable can be used to culture somatic embryos. These embryos have the characteristic features of the parent plant. The somatic cultures are viable from the stem, root or leaves and the most viable part is the meristematic cell.

**22. (b)** Irrigation relates to the supply of water to the crops. Fertilizers which are mainly NPK are required to increase the harvest of crops.

**23. (a)** Fish meal is made from nonedible parts of the fish and is rich source of protein.

Fish is a rich source of protein and many of the vitamins and minerals which is required for good health. Fish also has many other benefits including helping to protect against heart disease and a range of other illnesses. Fish is also a source of zinc, which is needed for a healthy immune system, iodine, needed for a healthy metabolism and vitamins A and $B_{12}$. Oil-rich fish are an important source of omega 3 fats. Your body cannot make these special fats so you need to eat foods containing omega 3 everyday. Fish meal, is a commercial product made from the waste of fish oil and the bones from processed fish. It is a brown powder or cake obtained by pressing the whole fish or fish trimmings to remove the fish oil. The major use of fish meal is as a high-protein supplement in aquaculture feed.

**24. (a)** Superovulation is done by hormone injection. During artificial insemination, 4-10 embryos are transplanted into carrier cows. The seven days old embryos can be preserved at a temperature of –196°C for several years. The assertion & reason are true and the reason is the correct explanation for the assertion.

**25. (b)** The physiological mechanism of flowering in plants is controlled by two factors— light period and low temperature. The cold treatment of plants to induce flowering is called vernalization. Term vernalization was first given by T.D.Lysenko(1928). As a result of vernalization a flowering hormone called vernaline is formed. Site of vernalization is apical meristem.

**26. (a)** Any living plant cell which is viable can be used to culture somatic embryos. These embryos have the characteristic features of the parent plant. The somatic cultures are viable from the stem root, or leaves & the most viable part is the meristematic cell.

**27. (b)** Cattle breeds can be improved by super ovulation and embryo transfer technique. It is also known as Multiple Ovulation Embryo Transfer Technology (MOET). In this method, a cow is administered hormones with FSH like activity, to induce super ovulation instead of one egg, which they normally yield per cycle they produce 6-8 eggs. The animal is either mated with an elite bull or artificially inseminated. The fertilised eggs at 8-32 cells stages are removed non surgically and transferred to surrogate mothers. The genetic mother is available for another round of super ovulation.

**28. (b)** In case of vegetatively propagated crops, pure line selection is not required. Pure-line selection is useful only for sexually reproducing plants. Hybrid vigour is most profitably used in vegetatively propagated crops because they do not involve sexual reproduction and hence no loss of hybrid superiority.

**29. (a)** Yeast is a fermentation agent. It is a known fact that yeast raises bread dough to rise and hence, yeast is also used to increase the volume, making the dough porous and the product soft. It is the carbon dioxide that is produced by the yeast that helps the dough to rise.

**30. (a)** Somatic embryos are non- zygotic embryo like structures that develop into from any type of tissue in plant tissue culture.

**31. (b)** An important technique of tissue culture, somatic hybridization results in the production of somatic hybrid plants. Two different plant varieties each with a desirable character can be made to undergo protoplast fusion, which further can be grown into a new plant.

Chapter

# 32 Microbes in Human Welfare

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Which of the following antibiotic was discovered by Alexander Flemming ? ***[2000]***
(a) Streptomycin (b) Tetracycline
(c) Penicillin (d) Terramycin

**2.** Which one of the following pairs is correctly matched? ***[2003]***
(a) *Rhizobium* - Parasite in the roots of leguminous plants.
(b) Mycorrhizae - Mineral uptake from soil.
(c) Yeast - Production of biogas.
(d) Myxomycetes - The ringworm diseases.

**3.** The bacteria *Pseudomonas* is useful because of its ability to ***[2004]***
(a) transfer genes from one plant to another.
(b) decompose a variety of organic compounds.
(c) fix atmospheric nitrogen in the soil.
(d) produce a wide variety of antibiotics.

**4.** Chloramphenicol and erythromycin (broad spectrum antibiotics) are produced by ***[2014]***
(a) *Streptomyces* (b) *Nitrobacter*
(c) *Rhizobium* (d) *Penicillium*

**5.** A patient brought to a hospital with myocardial infarction is normally immediately given: ***[2014]***
(a) Penicillin (b) Streptokinase
(c) Cyclosporin-A (d) Statins

**6.** Microbes are used in ***[2015]***
1. primary treatment of sewage
2. secondary treatment of sewage
3. anaerobic sludge digester
4. production of bioactive molecules
(a) 1, 3 and 4 (b) 1, 2, 3 and 4
(c) 2, 3 and 4 (d) 3 and 4

**7.** Choose the right combination

| **Column-I** | | **Column-II** |
|---|---|---|
| A. | *Escherichia coli* | I. Nif gene |
| B. | *Rhizobium melilotae* | II. Digestive hydrocarbon of crude oil |
| C. | *Bacillus thuringiensis* | III. Production of human insulin |
| D. | *Pseudomonas putida* | IV. Biological control of fungal disease |
| | | V. Bio-decomposed insectiside |

***[2016]***
(a) A – III; B – I; C – V; D – IV
(b) A – I; B – II; C – III; D – IV
(c) A – II; B – I; C – III; D – IV
(d) A – III; B – I; C – V; D – II

**8.** What would happen if oxygen availability to activated sludge flocs is reduced? ***[2016]***
(a) It will slow down the rate of degradation of organic matter.
(b) The centre of flocs will become anoxic, which would cause death of bacteria and eventually breakage of flocs.
(c) Flocs would increase in size as anaerobic bacteria would grow around flocs.
(d) Protozoa would grow in large numbers.

**9.** Which one of the following statement regarding BOD is true? ***[2017]***
(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.

**10.** The free-living fungus *Trichoderma* can be used for ***[2017]***
(a) killing insects
(b) biological control of plant diseases
(c) controlling butterfly caterpillars
(d) producing antibiotics

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 11-12) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

(e) If the Assertion is incorrect but the Reason is correct.

**11.** **Assertion :** Leguminous plants are nitrogen fixers.
**Reason :** Leguminous plants have *Rhizobium* in their root nodules. ***[1997]***

**12.** **Assertion :** Nitrogen-fixing enzyme in legume root nodules function at low oxygen concentration.
**Reason :** Low oxygen concentration is provided by leghaemoglobin. ***[2004]***

**Directions for (Qs.13-15) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**13.** **Assertion :** Lichen is important for chemical industries.
**Reason :** Litmus and Orcein are formed from lichens. ***[2009]***

**14.** **Assertion :** Yeasts such as *Saccharomyces cerevisiae* are used in baking industry. ***[2003, 2011]***
**Reason :** Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion.

**15.** **Assertion :** Vitamins $B_2$ is found in cereals, green vegetables, brewer's yeast, egg white, milk and liver.
**Reason :** It can be commercially produced by some yeasts. ***[2014]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** Alexander Flemming discovered Penicillin from a fungus penicillium accidentally. It is a natural antibiotic.

**2. (b)** Mycorrhiza is a symbiotic relationship between fungi and roots of higher plants. Mycorrhizae present in the soil help in the uptake of minerals from soil. These organisms also help in the binding of roots to the soil. Since it is active transport in the roots, the mycorrhizae help in this active transport of minerals.

**3. (b)** *Pseudomonas* is a gram negative rod shaped bacteria. It is useful because of its ability to decompose a variety of organic compounds. Other bacteria which help in purification, decay are *Streptococci*, *Clostridium*, *Micrococus*, *Proteus*, *etc*.

**4. (a)**

**5. (b)** Streptokinase is immediately given to dissolve the thrombus carring myocardial infarction.

**6. (c)** Microbes are not used in the primary treatment of sewage which basically involves settling down of sludge through sedimentation.

**7. (d)**

**8. (b)** In the secondary treatment of sewage, if oxygen availability to activated sludge flocs (masses of bacteria associated with fungal filaments to form mesh like structure) is reduced; the centre of flocs will becomes anoxic, which would cause death of bacteria and eventually breakage of flocs.

**9. (a)** BOD is the method of determining the amount of oxygen required by microorganisms to decompose the waste present in the water supply. It is a measure of organic matter present in the water. If the quantity of organic wastes in the water supply is high then the number of decomposing bacteria present in the water will also be high. As a result, BOD value will increase.

**10. (b)** *Trichoderma* is a free-living saprophytic fungi that most commonly lives on dead organic matter in the soil and rhizosphere (root ecosystem). It inhibits pathogens through release of gliotoxin, viridin, glioviri and trichodermin like substances.

## Type B : Assertion Reason Questions

**11. (a)** The *Rhizobium* bacteria converts the atmospheric nitrogen into soluble nitrates that is absorbed by the plants.
Soybean root nodules, contain billions of *Bradyrhizobium* bacteria.

**12. (a)** Leghaemoglobin is the oxygen scavenger and it protects nitrogen fixing enzyme nitrogenase from oxygen.

**13. (a)** Litmus is an important and widely used dye in chemical laboratories as an acid-base indicator. It is obtained from *Rocella montaignei*. Orcein, a biological stain, is obtained from *Rocella tinctoria*.

**14. (a)** Yeast is a fermentation agent. It is a known fact that yeast raises bread dough to rise and hence, Yeast is also used to increase the volume, making the dough porous and the product soft. It is the yeast that helps the dough to rise.

**15. (b)** Besides cereals, green vegetables, brewer's yeast, egg white, vitamin $B_2$ is also produced by intestinal bacteria. The vitamin was first obtained in 1938 using wild strain of mould *Ashbhya gossypii*. Vitamin $B_2$ is essential for normal growth and reproduction in a number of laboratory animals.

Chapter

# 33 Biotechnology: Principles and Processes

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Restriction endonucleases are used as ***[1998]***
(a) molecular build up at nucleotides.
(b) molecular degradation to DNA breakup.
(c) molecular knives for cutting DNA at specific sites.
(d) molecular cement to combine DNA sites.

**2.** In genetic engineering, which of the following is used ? ***[2001]***
(a) Plasmid (b) Plastid
(c) Mitochondria (d) E.R.

**3.** Introduction of foreign gene for improving genotype is called ***[2002]***
(a) tissue culture
(b) vernalization
(c) genetic engineering
(d) eugenics

**4.** An example of gene therapy is ***[2004]***
(a) production of injectable hepatitis B vaccine.
(b) production of vaccines in food crops like potatoes which can be eaten.
(c) introduction of gene for adenosine deaminase in persons suffering from Severe Combined Immuno Deficiency (SCID).
(d) production of test tube babies by artificial insemination and implantation of fertilized eggs.

**5.** c-DNA probes are copied from the messenger RNA molecules with the help of ***[2005]***
(a) restriction enzymes
(b) reverse transcriptase
(c) DNA polyermase
(d) adenosine deaminase

**6.** Electroporation procedure involves ***[2005]***
(a) fast passage of food through sieve pores in phloem elements with the help of electric stimulation.
(b) opening of stomatal pores during night by artificial light.
(c) making transient pores in the cell membrane to introduce gene constructs.
(d) purification of saline water with the help of a membrane system.

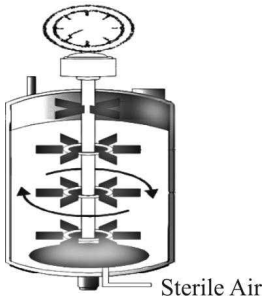
**7.** What is the first step in the Southern blot technique? ***[2004, 2008]***
(a) Denaturation of DNA on the gel for hybridization with specific probe.
(b) Production of a group of genetically identical cells.
(c) Digestion of DNA by restriction enzyme.
(d) Denaturation of DNA from a nucleated cell such as the one from the scene of crime.

**8.** The polymerase chain reaction (PCR) technology was discovered by ***[2009]***
(a) Karry Mullis
(b) Saiki *et al*
(c) Craig Venter
(d) Maxam and Gilbert

**9.** After 4 PCR cycles how many DNA molecules are formed from one DNA template molecule ? ***[2012]***
(a) 4 (b) 32
(c) 16 (d) 8

**10.** Human Genome Project (HGP) is closely associated with the rapid development of a new area in biology called as ***[2013]***
(a) biotechnology (b) bioinformatics
(c) biogeography (d) bioscience

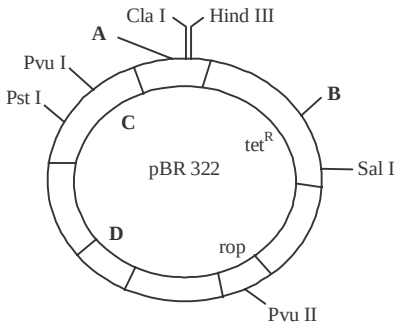
**11.** Identify the correct match for the given apparatus. ***[2013]***



| | Apparatus | Function |
|---|---|---|
| (a) | Gene gun | Vectorless direct gene transfer |
| (b) | Column chromatograph | Separation of chlorophyll pigments |
| (c) | Stirred tank bioreactor | Carry out fermentation process |
| (d) | Respirometer | Finding out rate of respiration |

**12.** Genes of interest can be selected from a genomic library by using ***[2014]***
(a) Restriction enzymes
(b) Cloning vectors
(c) DNA probes
(d) Gene targets

**13.** Choose the correct option. ***[2015]***




| | A | B | C | D |
|---|---|---|---|---|
| (a) | Hind I | EcoR I | $amp^R$ | ori |
| (b) | Hind I | BamH I | $kan^R$ | $amp^R$ |
| (c) | BamH I | Pst I | ori | $amp^R$ |
| (d) | EcoR I | BamH I | $amp^R$ | ori |

**14.** Which one of the following palindromic base sequences in DNA can be easily cut at about the middle by some particular restriction enzyme? ***[2016]***
(a) 5'.....CGTTCG.....3'
3'.....ATGGTA.....5'
(b) 5'.....GATATG.....3'
3'.....CTACTA.....5'
(c) 5'.....GAATTC.....3'
3'.....CTTAAG.....5'
(d) 5'.....CACGTA.....3'
3'.....CTCAGT.....5'

**15.** Which of the following statement is not correct about cloning vector ? ***[2017]***
(a) '*Ori*' is a sequence responsible for controlling the copy number of the linked DNA.
(b) Selectable marker selectively permitting the growth of the non-transformants.
(c) In order to link the alien DNA, the vector needs to have single *recognition site* for the commonly used restriction enzymes.
(d) The ligation of alien DNA is carried out at a restriction site present in one of the two antibiotic resistance genes.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 16-20) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.
(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**16.** **Assertion :** Plasmids are extrachromosomal DNA.
**Reason :** Plasmids are found in bacteria and are useful in genetic engineering. ***[2001]***

**17.** **Assertion:** Plasmids are single-stranded extra chromosomal DNA.
**Reason:** Plasmids are usually present in eukaryotic cells. ***[2002]***

**18.** **Assertion:** Clones are produced by sexual reproduction.
**Reason:** These are prepared by group of cells descended from many cells or by inbreeding of a heterozygous line. ***[2002]***

**19.** **Assertion :** In recombinant DNA technology human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryote).
**Reason :** Both bacteria and yeast multiply very fast to form huge population which expresses the desired gene. ***[2005]***

**20.** **Assertion :** *Agrobacterium tumefaciens* is popular in genetic engineering because this bacterium is associated with the roots of all cereal and pulse crops.
**Reason :** A gene incorporated in the bacterial chromosomal genome-gets automatically transferred to the crop with which the bacterium is associated. ***[2005]***

**Directions for (Qs. 21-24) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**21.** Assertion : Restriction enzymes cut the strand of DNA to produce sticky ends. ***[2009]***
**Reason :** Stickiness of the ends facilitates the action of the enzyme DNA polymerase.

**22.** **Assertion :** "DNA finger printing" has become a powerful tool to establish paternity and identity of criminals in rape and assault cases. ***[2010]***
**Reason :** Trace evidences such as hairs, saliva and dried semen are adequate for DNA analysis.

**23.** **Assertion :** In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryote). .
**Reason :** Both bacteria and yeast multiply very fast to form huge population, which express the desired gene. ***[2008, 2015]***

**24.** **Assertion :** Insertion of recombinant DNA within the coding sequence of β-galactosidase results in colourless colonies.
**Reason :** Presence of insert results in inactivation of enzyme β-galactosidase known as insertional inactivation. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** Restriction endonuclease cleaves DNA duplex at specific points in such a way that single stranded free ends project from each fragment of DNA duplex called sticky ends. These sticky ends can join similar complementary ends of DNA fragment from some other source.

**2. (a)** Plasmid (extrachromosomal part in bacteria) plays important role in recombinant DNA technology.

**3. (c)** The process of introduction of foreign gene for obtaining the desirable trait is called genetic engineering.

**4. (c)** Gene therapy is a new system of medicine. Excellent example of gene therapy is SCID. They have defective gene for the enzyme adenosine deaminase (ADA). They lack T-lymphocytes which fail to combat the infecting pathogen. Lymphocytes are extracted from the patients bone marrow and normal functioning copy of gene coding for ADA is introduced into these lymphocytes with the help of retrovirus. The cells so treated are reintroduced into patients bone marrow which reactivate patients immune system for life.

**5. (b)** c DNA probes are copied from the mRNA molecules with the help of reverse transcriptase.

**6. (c)** Electroporation is the method of making cell membrane permeable for the entry of recombinant DNA into the bacteria.

**7. (c)** The Southern blot is used to detect and identify certain DNA sequences in a sample of bodily fluid. It uses single-stranded DNA to search out their complementary strands. When a Southern blot is performed on DNA, the first step is digestion of DNA with restriction enzymes. Restriction enzymes cut DNA at known sequences, and produces DNA fragments of a certain length. Once the DNA is cut into pieces, scientists conduct electrophoresis to separate them by size.

**8. (a)** Developed in 1984 by Kary Mullis, PCR is now a common and often indispensable technique used in medical and biological research labs for a variety of applications. These include DNA cloning for sequencing, DNA-based phylogeny, or functional analysis of genes; the diagnosis of hereditary diseases; the identification of genetic fingerprints (used in forensic sciences and paternity testing); and the detection and diagnosis of infectious diseases. In 1993, Mullis won the Nobel Prize in Chemistry for his work on PCR.

**9. (c)** From a single DNA template molecule, it is possible to generate $2^n$ DNA molecules after n number of cycles in polymerase chain reaction.

**10. (b)** Human Genome Project (HGP) is closely associated with the rapid development of a new area in biology called Bioinformatics which is used for storage and analysis of enormous amount of data.

**11. (c)**

**12. (c)** A hybridization probe is a fragment of DNA of variable length which is used in DNA samples to detect the presence of nucleotide sequence (the DNA target) that are complementary to the sequence in the probe. The probe hybridize to single–stranded DNA whose base sequence allow probe target base-pairing due to complementary between the probe and target.

**13. (d)**

**14. (c)** Palindromic sequences in DNA molecule are group of bases that forms the same sequence when read in both forward and backward direction. In the given question, only option (c) represent a palindromic sequence.

**15. (b)** Selectable marker selectively permitting the growth of the transformants.

## Type B : Assertion Reason Questions

**16. (b)** Plasmids are the extrachromosomal part in the bacteria and are useful in recombinant DNA technology.

**17. (c)** Plasmid is a extra chromosomal DNA present in prokaryotes e.g., bacteria.

**18. (d)** Cloning is shortcut method to amplify the number of organisms with a desirable constitution. No sex is involved in their production. Members of clone are genetically identical as they are derived from single parent.

**19. (a)** In recombinant DNA technology, recombinants DNA are usually transferred to E. coli, yeast because of their rapid multiplication. This technology is employed for combining DNA from two different organisms to produce recombinant DNA.

**20. (d)** A soil inhabiting, plant pathogenic bacteria *Agrobacterium tumefaciens* infects broad leaved crops including tomato, soyabean, sunflower and cotton but not the cereals. Tumour formation (crown galls) is induced by its plasmid (Ti) into the chromosomal DNA of its host plant. The T-DNA causes tumors. As gene transfer occurs without human efforts the bacteria is known as natural genetic engineer of plants.

**21. (c)** Restriction enzyme, a type of endonuclease, functions by "inspecting" the length of a DNA sequence. Once it finds a recognition sequence, it binds and cut each of the two strands of the double helix at specific point leaving single stranded portions at the ends. This results in overhanging stretches called sticky ends. These are named so because they form hydrogen bonds with their complementary counter parts i.e., they can join similar complementary ends of DNA fragment from some other source with the help of DNA ligase. This stickness of the ends facilitates the action of the enzyme DNA ligase, not DNA polymerase.

**22. (a)** DNA finger printing has become a powerful tool due to its ability in tracing evidences of crime and to establish the paternity. These evidences can be collected from hairs, semen and saliva.

**23. (a)** Recombinant DNA is a form of synthetic DNA that is engineered through the combination or insertion of one or more DNA strands, thereby combining DNA sequences that would not normally occur together. In terms of genetic modification, recombinant DNA is produced through the addition of relevant DNA into an existing organismal genome, such as the plasmid of bacteria, to code for or alter different traits for a specific purpose, such as immunity. It differs from genetic recombination, in that it does not occur through processes within the cell or ribosome, but is exclusively engineered. Recombinant protein is protein that is derived from recombinant DNA.

**24. (a)** Alternative markers have been developed that can differentiate recombinants from non-recombinants based upon their ability to produce colour in presence of a chromogenic substrate. The plasmid in the bacteria, lacking an insert produces blue coloured colonies, while those plasmids with an insert do not produce any colour due to insertional inactivation of the enzyme, β-galactosidase.

Chapter

# 34 Biotechnology & its Applications

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** A tumour inducing plasmid widely used in the production of transgenic plant is that of ***[2005]***
(a) *Escherichia coli*
(b) *Bacillus thuringiensis*
(c) *Staphylococcus aureus*
(d) *Agrobacterium tumefaciens*

**2.** Which one of the following is a correct statement? ***[2005]***
(a) "Bt" in "Bt-cotton" indicates that it is a genetically modified organism produced through biotechnology.
(b) Somatic hybridization involves fusion of two complete plant cells carrying desired genes.
(c) The anticoagulant 'hirudin' is being produced from transgenic *Brassica napus* seeds.
(d) "Flavr Savr" variety of tomato has enhanced the production of ethylene which improves its taste.

**3.** Cultivation of *Bt cotton* has been much in the news. The prefix *Bt* means ***[2008]***
(a) barium-treated cotton seeds
(b) bigger thread variety of cotton with better tensile strength
(c) produced by biotechnology using restriction enzymes and ligases
(d) carrying an endotoxin gene from *Bacillus thuringiensis*

**4.** Golden rice is a transgenic crop of the future with the following improved trait ***[2012]***
(a) High lysine (essential amino acid) content
(b) Insect resistance
(c) High protein content
(d) High vitamin-A content

**5.** How many varieties of rice has been estimated to be present in India? ***[2013]***
(a) 2,000 (b) 20,000
(c) 200,000 (d) 2,000,000

**6.** The scientific process by which crop plants are enriched with certain desirable nutrients is called ***[2013]***
(a) crop protection (b) breeding
(c) bio-fortification (d) bio-remediation

**7.** Which of the following is a variety of *Brassica* resistance to white rust disease? ***[2014]***
(a) *Himgiri*
(b) *Pusa Kamal*
(c) *Pusa Swarnim (Karan rai)*
(d) *Pusa Sadabahar*

**8.** The first clinical gene therapy was given in 1990 to a 4 years old girl with enzyme deficiency of ***[2014]***
(a) Adenosine deaminase (ADA)
(b) Tyrosine oxidase
(c) Monamine oxidase
(d) Glutamate dehydrogenase

**9.** Select the correct statement(s)- ***[2015]***
(1) IARI has released a mustard variety rich in vitamin C.
(2) Pusa Sawani variety of Okra is resistant to aphids.
(3) Hairiness of leaves provides resistance to insect pests.
(4) Agriculture accounts for approximately 33% of India's GDP and employs nearly 62% of the population.
(a) (1) and (2) (b) (2) and (3)
(c) (1), (3) and (4) (d) None of these

**10.** Read the following four statements (1-4) about certain mistakes in two of them
1. The first transgenic buffalo, Rosie produced milk which was human alpha-lactal albumin enriched.
2. Restriction enzymes are used in isolation of DNA from other macro-molecules.
3. Downstream processing is one of the steps of R-DNA technology.

4. Disarmed pathogen vectors are also used in transfer of R-DNA into the host.

Which are the two statements having mistakes? ***[2015]***

(a) Statement 2 and 3 (b) Statement 3 and 4
(c) Statement 1 and 3 (d) Statement 1 and 2

**11.** A transgenic food crop which may help in solving the problem of night blindness in developing countries is ***[2016]***

(a) golden rice (b) *Bt* soyabean
(c) *flavr - savr* tomato (d) starlink maize

**12.** Which variety of rice was patented by a U.S. company even though the highest number of varieties of this rice is found in India ? ***[2017]***

(a) Sharbati Sonara (b) Co-667
(c) Basmati (d) Lerma Roja

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 13) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**13.** **Assertion :** Insect resistant transgenic cotton has been produced by inserting Bt gene. ***[2010]***

**Reason :** The Bt gene is derived from a bacterium.

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (d)** A tumour (crown gall) inducing plasmid widely used in the production of transgenic plant is *Agrobacterium tumefaciens*.

**2. (c)** Hirudin is a protein that stops blood clotting. The gene encoding hirudin was chemically synthesized. This gene was then transferred into *Brassica napus* where hirudin accumulates in seeds. This hirudin is purified & used as a medicine.

**3. (d)** *Bacillus thuringiensis*, or Bt, is a bacterium that occurs naturally in the soil, produces a protein that is toxic to certain insect pests, and is widely used as a pest control agent. It is also extremely host-specific.

**4. (d)** Golden rice is a variety of rice produced through genetic engineering to biosynthesize beta-carotene, a precusor of pro-vitamin A.

**5. (c)** **6. (c)** **7. (c)**

**8. (a)** Gene therapy is an experimental technique that uses genes to treat or prevent disease. The first clinical gene therapy was given for treating adenosine deaminase deficiency. A four-year old girl became the first gene therapy patient on September 14, 1990 at the NIH Clinical Center. Adenosine deaminase deficiency, also called ADA deficiency or ADA-SCID is an autosomal recessive metabolic disorder that causes immunodeficiency. ADA deficiency is due to a lack of the enzyme adenosine deaminase.

**9. (c)**

**10. (d)** Transgenic Rosie is actually cow. Restriction enzymes cut the DNA at specific sites**.**

**11. (a)** A transgenic food crop which may help in solving the problem of night blindness in developing countries is golden rice. Golden rice is genetically modified rice that has been engineered to have elevated levels of beta carotene in it. It is a pre cursor of vitamin A, which gives it a characteristic golden colour.

**12. (c)** Basmati rice was patented by a US company even though the highest number of varieties of this rice is found in India.

## Type B : Assertion Reason Questions

**13. (b)** Bt-cotton is a transgenic crop. Transgenic plants are those plants, which have foreign gene incorporated in their DNA. This insect resistant gene is derived from a bacterium, *Bacillus thuringiensis.*

Chapter

# 35 Organisms and Populations

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Territoriality occurs as a result of ***[1998]***
(a) competition (b) parasitism
(c) predation (d) co-operation

**2.** Obligate parasites live on ***[1999]***
(a) living host only
(b) living host and dead organic matter
(c) dead organic matter only
(d) artificial liquid medium

**3.** Mycorrhiza help in absorption of ***[1999]***
(a) calcium (b) nutrients
(c) metals (d) none of these

**4.** The plants which can withstand narrow range of temperature tolerance are called ***[2000]***
(a) stenothermal (b) eurythermal
(c) mesothermal (d) monothermal

**5.** Abundance of a species in a population, within habitat is called ***[2001]***
(a) niche density
(b) absolute density
(c) relative density
(d) geographic density

**6.** The maintenance of internal favourable conditions, by a self regulated mechanisms inspite of the fact that there are changes in environment, is known as ***[2001]***
(a) entropy (b) enthalpy
(c) homoeostasis (d) steady state

**7.** July 11 is observed as ***[2003]***
(a) World Population Day
(b) No Tobacco Day
(c) World Environment Day
(d) World Health Day

**8.** Which one of the following is a matching pair of certain organism(s) and the kind of association? ***[2003]***
(a) Shark and sucker fish - Commensalism
(b) Algae and fungi in lichens - Mutualism
(c) Orchids growing on trees - Parasitism
(d) *Cuscuta* (dodder) growing on other - flowering plants - Epiphytism

**9.** The great barrier reef along the east coast of Australia can be categorised as ***[2004]***
(a) population (b) community
(c) ecosystem (d) biome

**10.** Which one of the following correctly represents an organism and its ecological niche ? ***[2005]***
(a) *Vallisneria* and pond
(b) Desert locust (*Schistocerca*) and desert
(c) Plant lice (aphids) and leaf
(d) Vultures and dense forest

**11.** Keystone species deserve protection because these ***[2006]***
(a) are capable of surviving in harsh environmental conditions.
(b) indicate presence of certain minerals in the soil.
(c) have become rare due to overexploitation.
(d) play an important role in supporting other species.

**12.** A lizard-like member of reptila is sitting on a tree with its tail coiled around a twig. This animal could be ***[2006]***
(a) *Hemidactylus* showing sexual dimorphism
(b) *Varanus* showing mimicry
(c) Garden lizard *(Calotes)* showing camouflage
(d) *Chamaeleon* showing protective colouration

**13.** Carrying capacity is ***[2009]***
(a) the capacity of an individual to produce young ones.
(b) availability of resources in a given habitat to support a certain no of individuals of population, beyond which no further growth is possible.
(c) gene frequency from one generation to next.
(d) gene frequency in same generation.

**14.** Within biological communities, some species are important in determining the ability of a large number of other species to persist in the community. Such species are called ***[2010]***
(a) keystone species
(b) allopatric species
(c) sympatric species
(d) threatened species

**15.** Presence of flagellated protozoans in the gut of termites are the example ***[2012]***
(a) Symbiosis (b) Parasitism
(c) Antibiosis (d) Commensalism

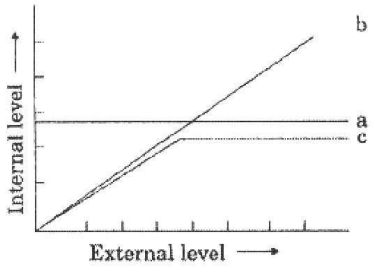
**16.** The formula for exponential population growth is ***[2013]***
(a) dN/rN = dt (b) rN / dN = dt
(c) dN / dt = rN (d) dt / dN = rN

**17.** The rate of formation of new organic matter by rabbit in a grassland, is called ***[2014]***
(a) Net productivity
(b) Secondary productivity
(c) Net primary productivity
(d) Gross primary productivity

**18.** If 4 individuals in a laboratory population of 40 fruitflies died during a specified time interval (*i.e.*, a week), the death rate in the population during that period is ***[2014]***
(a) 1 (b) 0.1
(c) 0.01 (d) 0.4

**19.** A population of 500 that experiences 55 births and 5 deaths during a one-year period. What is the reproductive rate for the population during the one-year period ? ***[2015]***
(a) 0.01/year (b) 0.05/year
(c) 0.1/year (d) 50/year

**20.** The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do A, B and C represent respectively? ***[2015]***




| | A | B | C |
|---|---|---|---|
| (a) | conformer | regulator | partial regulator |
| (b) | regulator | partial regulator | conformer |
| (c) | partial regulator | regulator | conformer |
| (d) | regulator | conformer | partial regulator |

**21.** The salinity in sea water in parts per thousand (ppt) ranges between ***[2016]***
(a) 5-15% (b) 30-35%
(c) 50-75% (d) more than 100%

**22.** In Urn shaped age pyramid of the population the trend of growth is ***[2017]***
(a) Rapid (b) Stable
(c) Declining (d) Stationary

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 23-25) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**23.** **Assertion :** Leaf butterfly and stick insect show mimicry to dodge their enemies.
**Reason :** Mimicry is a method to acquire body colour blending with the surroundings. ***[2003]***

**24.** **Assertion :** Animals adopt different strategies to survive in hostile environment.
**Reason :** Praying mantis is green in colour which merges with plant foliage. ***[2004]***

**25.** **Assertion :** The sex ratio of Kerala is highest in India.
**Reason :** In countries like India the population is increasing at a rapid rate. ***[2005]***

**Directions for (Qs. 26-30) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**26.** **Assertion :** Thick cuticle is mostly present in disease resistant plants.
**Reason :** Disease causing agents cannot grow on cuticle and cannot invade the cuticle. ***[2012]***

**27.** **Assertion :** In sigmoid growth curve, population finally stabilizes itself.
**Reason :** Finally, the death rate increases than the birth rate. ***[2013]***

**28.** **Assertion :** Tropical rain forests are disappearing fast from developing countries such as India.
**Reason :** No value is attached to these forests because these are poor in biodiversity. ***[2015]***

**29.** **Assertion :** Flora contains the actual account of habitat and distribution of plants of a given area.
**Reason :** Flora helps in correct identification. ***[2016]***

**30.** **Assertion :** Species are groups of potentially interbreeding natural populations which are isolated from other such groups.
**Reason :** Distinctive morphological characters are displayed due to reproductive isolation. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (a)** Competition exists between individuals of the same or different species for food, light, space, shelter and mate. Establishment of territories by animals is meant for ensuring availability of their needs.

**2. (a)** Obligate parasites lead only parasitic life and are host specific.

**3. (b)** The roots of higher plants possess symbiotic mycorrhizae. It is a symbiotic, non-pathogenic association between the roots and soil fungi. Several conifers lack root hair and here the mycorrhizae perform this function. The mycorrhizae are of two types : ectomycorrhizae and endo-mycorrhizae with an intermediate category as ectondomycorrhizae. The most common endomycorrhizae are Vesicular Arbuscular Mycorrhizae (VAM), generally present in herbaceous plants. Mycorrhizae perform the function of root hair, *i.e.* they absorbs essential ions.

**4. (a)** The climatic conditions in the stenothermal plants have made them to get adapted to a small variations in temperature.

**5. (a)** Density of a population is the number of individual species in a given area. Niche is a suitable habitat of a species. Niche density is the number of a particular species in a given area or suitable habitat.

**6. (c)** For metabolic processes to continue, the living things need to remain in a steady state maintained by self regulatory mechanism called *homeostasis*.

**7. (a)** July 11 has been observed as World Population Day.

**8. (b)** Algae and fungi in lichens show mutualism. Fungi provide fixation, water, minerals and shelter to the algae. The algae manufactures food for itself and for fungi.

**9. (c)** Coral reefs occur in clear, shallow, warm water where temperature rarely falls below 20°C and there is enough light for photosynthesis.

**10. (c)** Ecological niche is the status of an organism within its environment and community (affecting its survival as a species).

**11. (d)** Keystone species has disproportionate effects on its environment relative to its biomass. Such species play a critical role in maintaining the structure of an ecological community and help to determine the types and numbers of various other species in the community.

**12. (d)** *Chamaeleon* (girgit) shows protective colouration with its surrounding *e.g.* twig.

**13. (b)** Carrying capacity is the maximum number of individuals of population that can be sustained by available resources in a given habitat beyond which there is no further growth. When population reaches the carrying capacity then mortality < natality.

**14. (a)** Within biological communities, some species may be important in determining the ability of large number of other species to persist in the community. These crucial species are known as key stone species. Allopatric species are species having exclusive areas of geographic distribution. Sympatric species are species having overlapping area of geographical distribution.

**15. (a)** Presence of flagellated protozoans in the gut of termites are the example of symbiosis. In this type of association both partners are mutally benefited from each other. Termites are dependent on protozoa for breaking down their food stuff and the protozoa are dependent on the termites as host organisms.

**16. (c)** The formula of exponential growth is $\frac{dN}{dt} = rN$ where $\frac{dN}{dt}$ is the rate of change in population size, r is the biotic potential and N is the population size.

**17. (b)** At the trophic level of consumers the rate at which food energy is assimilated is called secondary productivity. Rabbit is a consumer.

**18. (b)** Mortality or Death rate refers to the death of individuals in a population.

$$\text{Death rate} = \frac{\text{No. of deaths}}{\text{Total population}}$$

$$= \frac{4}{40} = 0.1 \text{ individuals per fruitfly per week}$$

**19. (c)** The rate of growth, *r*, equals (55 births – 5 deaths)/ 500 per year, or 0.1/year.

**20. (d)** In the graph, the line **A** represents regulator, line **B** represents conformer and line **C** represents partial regulator. Organisms that are able to maintain homeostasis by physiological means that ensures constant body temperature are called regulators. Organism that are not able to maintain a constant internal temperature are called conformers.
Partial regulators are organisms that have the ability to regulate, but only over a limited range of environmental conditions, beyond which they simply conform.

**21. (b)** Sea water typically has a salinity of around 35 g/kg although lower values are typical near coasts where river enter the ocean. Rivers and lakes can have a wide range of salinities, from less than 0-0.1 g/kg to a few g/kg, although there are many places where even higher salinities are found. The dead sea has a salinity of more than 200 g/kg.

**22. (c)** In Urn Shaped pyramid the individuals below the reproductive age are fewer in number than the individuals of reproductive age.

## Type B : Assertion Reason Questions

**23. (a)** Leaf butterfly is green in colour and stick insect also mimics in order to escape from the enemies and also to catch prey. The camouflaging mechanism helps the organism to get adapted to its surroundings. The Leaf butterfly is seen more near the leaves while the stick insect camouflages with its surroundings by living on the branches.

**24. (a)** Animals blend with the surroundings or back ground to remain unnoticed for protection and aggression.

**25. (b)** Kerala has a sin ratio of 1058 Indian population is growing with 1.2% animal change.

**26. (a)** Disease resistant plants possess thick cuticle. Infectious organisms can not grow or invade cuticle.

**27. (c)** In sigmoid growth curve, finally, growth rate becomes stable because mortality and natality rates become equal to each other and finally the population shows zero growth rate as birth rate equals death rate.

**28. (c)** Tropical rain forests have disappeared mainly due to man's activities. Due to over population in countries like India, rain forests are cut to make place available for man to live and build houses. To build buildings and factories man has incessantly cut down trees. This has caused the depletion of rain forests.

**29. (b)** Flora contains the actual account of habitat and distribution of plants of a given area. It provides the index to the plant species found in particular area.

**30. (b)** A group of individuals resembling each other in morphological, physiological, biochemical and behavioural characters constitute a species. Such individuals can breed among themselves but cannot breed with members other than their own to produce fertile offsprings. New species are formed mainly due to reproductive isolation.

Chapter

# 36 Ecosystem

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** The food chain in which microbes breakdown energy rich compounds synthesized by producers is called ***[1999]***
(a) ecosystem
(b) parasitic food chain
(c) detritus level chain
(d) predator food chain

**2.** 10 % law of energy transfer was given by
(a) Lindemann (b) Tansley ***[2000]***
(c) Stanley (d) Darwin

**3.** Food chain starts with ***[2000]***
(a) autotrophs (b) herbivores
(c) carnivores (d) decomposers

**4.** Flora and fauna in lake or ponds is ***[2000]***
(a) lentic biota (b) lotic biota
(c) abiotic biota (d) field layer

**5.** The enzyme responsible for the reduction of molecular nitrogen to the level of ammonia in the leguminous root nodule is ***[2000]***
(a) nitrogenase (b) nitrate reductase
(c) nitrite reductase (d) ammoneases

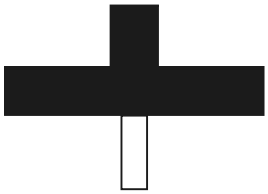
**6.** The role of bacteria in carbon cycle is ***[2000]***
(a) photosynthesis
(b) chemosynthesis
(c) decomposition of organic compounds
(d) evolution of $O_2$

**7.** Trophic levels are formed by : ***[2001]***
(a) plants
(b) animals
(c) organisms linked in food chain
(d) carnivores

**8.** Desert can be converted into green land by planting ***[2001]***
(a) oxylophytes (b) psammophytes
(c) halophytes (d) trees

**9.** Mr. X is eating curd/yoghurt. For this food intake in a food chain Mr. X should be considered as occupying ***[2003]***
(a) first trophic level
(b) second trophic level
(c) third trophic level
(d) fourth trophic level

**10.** Given below is one of the types of ecological pyramids. This type represents ***[2005]***

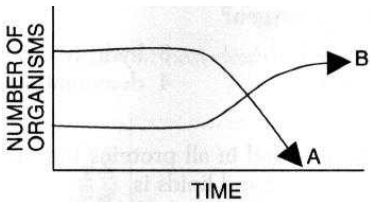


(a) pyramid of numbers in a grassland
(b) pyramid of biomass in a fallow land
(c) pyramid of biomass in a lake
(d) energy pyramid in a spring

**11.** 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

**12.** 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

**13.** 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.

**14.** 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

**15.** 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

**16.** 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

**17.** 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.

**18.** Whale is ***[2012]***
(a) Primary producer
(b) Carnivorous, secondary consumer
(c) A decomposer
(d) Herbivorous

**19.** Which one of the following is not a function of an ecosystem? ***[2013]***
(a) Energy flow (b) Decomposition
(c) Productivity (d) Stratification

**20.** 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%

**21.** 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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 22) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**22.** **Assertion:** Insectivorous habitat of plants is to cope up $O_2$ deficiency.

**Reason:** Insectivorous plants are partly autotrophic and partly heterotrophic. ***[1998]***

**Directions for (Qs. 23-28) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

**23.** **Assertion :** A network of food chains existing together in an ecosystem is known as food web.

**Reason :** An animal like kite cannot be a part of a food web. ***[2006, 2008, 2011]***

**24.** **Assertion :** Pyramid of energy may be upright or inverted. ***[2011]***

**Reason:** Only 20% of energy goes to next trophic level.

**25.** **Assertion :** Biotic community has higher position than population in ecological hierarchy.

**Reason :** Population of similar individuals remains isolated in the community. ***[2012]***

**26.** **Assertion :** Net primary productivity is gross primary productivity minus respiration.

**Reason :** Secondary productivity is produced by heterotrophs. ***[2013]***

**27.** **Assertion :** Net primary productivity is gross primary productivity minus respiration.

**Reason :** Secondary productivity is produced by heterotrophs. ***[2016]***

**28.** **Assertion :** In a food chain, members of successive higher levels are fewer in number.

**Reason :** Number of organisms at any trophic level depends upon the availability of organisms which serve as food at the lower level.

***[2003, 2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** In nature, detritus food chains are indispensable as the dead organic matter of grazing food chains is acted upon by the detritivores (bacteria, protozoa, nematodes) to recycle the inorganic elements into the ecosystem.

**2. (a)** 10 % law of energy transfer (pyramid of energy) was given by Lindemann.

In this, only 10% of total energy received by one trophic level is transferred to next trophic level.

**3. (a)** All trophic levels in an ecosystem are connected by transfer of food as energy. The transfer of food and its contained energy from one trophic level to the next trophic level is called food chain.

Food chain always starts with producers (autotrophs) $\rightarrow$ Herbivores $\rightarrow$ Carnivorous $\rightarrow$ Detrivores are placed at the top of the food chain.

**4. (a)** Lentic relates to still waters such as lakes and ponds. Hence, the flora and fauna constitue the lentic biota.

**5. (d)** The enzyme responsible for the reduction of nitrogen to ammonia is ammoneases and the process is ammonification. *e.g.* actinomycetes, *Bacillus ramosus, B. vulgaris etc.*

**6. (c)** The excretory wastes of living organisms have accumulated carbon compounds and they are decomposed after their death by micro-organisms in the soil to release $CO_2$ back into the environment for its recycling.

**7. (c)** The producers and consumers in ecosystem are arranged into several feeding groups/levels called trophic levels.

**8. (b)** Psammophytes are those plants that can grow in desert and mainly in sandy soil. Hence, psammophytes can be used to convert desert into a green land.

**9. (c)** Producers occupy first trophic level, primary consumers *i.e.* herbivores (cow produce milk formating curd) are placed at second trophic level and Mr. X will occupy third place (curd eater).

**10. (c)** The given figure shows the pyramid of biomass in a lake. An ecological pyramid of biomass shows the relationship between biomass and trophic level by quantifying the amount of biomass present at each trophic level of an ecological community at a particular moment in time.

**11. (d)** Leghaemoglobin is an oxygen scavanger. It combines with oxygen and protects nitrogenase which catalyses the fixation of nitrogen under anerobic conditions.

**12. (c)** If a ecosystem is to be self-sustaining, materials such as oxygen, carbon dioxide, water and nitrogen must to recycle between the organisms.

**13. (b)** If population B increased while population A decreased, these organisms were probably in competition for the same food (grass) and population B was better adapted. Hence, population A is competitively being excluded from the population.

**14. (c)** Because the scorpion stalks, kills and eats its food, it is a predator. Because it eats a spider it is a carnivore. Because it ingests food it is a consumer. A producer is an autotroph as it is an organism that makes its own food from inorganic substances. A decomposer breaks down dead matter and a herbivore eats only plants.

**15. (a)** *Trichodesmium erythreum* is a cyanobacteria (blue green alga). Although a blue green alga, it possesses a pigment, phycoerythrin, which is red in colour and imparts red colour to the water of the sea in which it is found, hence named Red Sea.

**16. (d)** The xerophytic plants conserve water by storing it in parenchymatous cells specialized for this purpose. Xerophytes plants are specially adapted to succeed in an arid climate. They are typically able to withstand long periods of drought and the drying effects of desert winds. Some plants have adapted to arid lands by developing the ability to store water.

**17. (d)** In desert condition, most of the activity of the plants and animals happens during night because of very high temperature in day time. As a result the desert insects make themselves active and pollinate the flowers at night. To attract the insects, most of the desert plants bloom during night.

**18. (b)** Whale is carnivorous and feeds on primary consumer and occupies the third trophic level of the ecosystem.

**19. (d)** Four important functional aspects of the ecosystem are
(i) Productivity
(ii) Decomposition,
(iii) Energy flow and
(iv) Nutrient cycling.

**20. (d)** The main source of energy for an ecosystem is the radiant energy or light energy derived from the sun. 50% of the total solar radiation that falls on earth is Photosynthetically Active Radiation (PAR).
The light energy is converted into chemical energy in the form of sugar by photosynthesis.
$6H_2O + 6CO_2 + Light \rightarrow 6C_6H_{12}O_6 + 6O_2$
Plants utilize 2-10% of PAR in photosynthesis.

**21. (d)** Net primary productivity (NPP) is the biomass or storage of energy by green plants. It is equal to the gross primary productivity minus loss due to respiration. The productivity generally increases from polar regions toward the tropics, because of the increasing sunlight and temperature.

## Type B : Assertion Reason Questions

**22. (e)** Insectivorous plants are those plants which capture and digest live prey (normally insects) to obtain nitrogen compounds that are lacking in its usual marshy habitat. These plants are partly autotrophic and partly heterotrophic.

**23. (c)** In the food web, different food chains are interconnected. Each chain is interconnected and consists of different trophic levels i.e. producers, consumers and detrivorous. So, kite can also be a part of food web.

**24. (d)** Energy flow in the ecosystem is a unidirectional manner. There is a decline in the amount of energy passing from one trophic level to the next. Thus the pyramid of energy is always upright. According to Lindemann, only 10% of energy goes to next trophic level.

**25. (c)** The organisms of all the species that live in a particular area and interact in various ways with one another form biotic community. Biotic community is a grouping that is higher than population in ecological hierarchy. It is an assemblage of all the populations of different organisms occurring in an area. The different populations of a community do not remain isolated. They show interactions and inter-dependence.

**26. (b)** Net primary productivity is the rate of organic matter built up or stored by producers in their bodies per unit time and area. Net productivity is equal to gross primary productivity minus loss due to respiration and other reasons. Rate of increase in energy containing organic matter or biomass by heterotrophs or consumers per unit time and area is known as secondary productivity.

**27. (b)** Net primary productivity is the rate of organic matter build up or stored by producers in their bodies per unit time and area. Net productivity is equal to gross primary productivity minus loss due to respiration and other reasons. Rate of increase in energy containing organic matter or biomass by heterotrophs or consumers per unit time and area is known as secondary productivity.

**28. (d)** When food is made available, automatically the next higher level of organism in the hierarchy should increase. This is because when the forest cover got depleted it led to the increase in the number of endangered species. If the deer population is more, it automatically leads to an increase in the tiger population.

Chapter

# 37 Biodiversity and its Conservation

## TYPE A : MULTIPLE CHOICE QUESTIONS

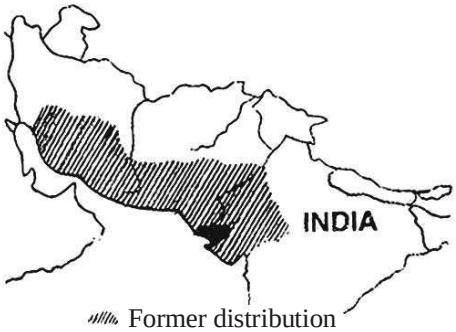
**1.** Heavy rainfall during summer produces ***[1998]***

(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 Mauritus 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

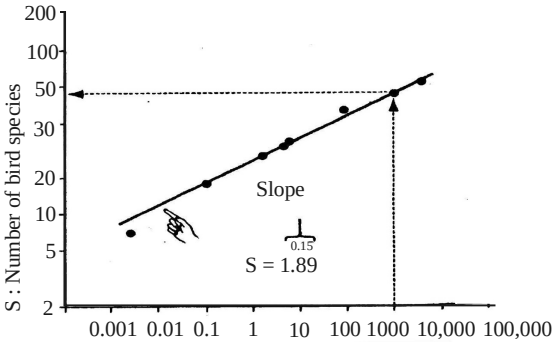
**15.** Tectonic is the study of ***[2011]***
(a) volcanos (b) earth's crust
(c) sand dunes (d) Sun

**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

**19.** Using the figure, determine the percentage of bird species that will be lost if the island's inhabitable land area is reduced from 100,000 $km^2$ to 1 $km^2$.




*A* : Island land area ($km^2$) ***[2016]***
(a) 17 percent of the bird species will be lost.
(b) 20 percent of the bird species will be lost.
(c) All of bird species will be lost.
(d) 93 percent of the bird species will be lost.

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Q. 20) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**20.** **Assertion :** In tropical rain forests. O-horizon and A-Horizon of soil profile are shallow and nutrient-poor.
**Reason :** Excessive growth of micro-organisms in the soil depletes its organic content. ***[2006]***

**Directions for (Qs. 21-24) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**21.** **Assertion :** Tropical rain forests are disappearing fast from developing countries such as India.

**Reason :** No value is attached to these forests because these are poor in biodiversity. ***[2012, 2013]***

**22.** **Assertion :** Diversity observed in the entire geographical area is called gamma diversity.

**Reason :** Biodiversity decreases from high altitude to low altitude. ***[2014]***

**23.** **Assertion :** A sanctuary is formed for the conservation of animals only.

**Reason :** Restricted human activities are allowed in sanctuaries. ***[2014]***

**24.** **Assertion:** Communities that comprise of more species tend to be more stable.

**Reason:** A higher number of species results in less animal variation in total biomass. ***[2017]***

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (b)** During summer the land becomes dry and rainfall induces formation of grass and hence, heavy rainfall during summer produces grasslands.

**2. (a)** In the deciduous forests, the leaves generally fall off during autumn. These trees are seen in temperate lands.

**3. (a)** This animal which had a wide distribution has now considerably decreased in number. This is due to the depletion of forest areas due to man's intrusion. This area has now become a protected area and hence, this animal is now considered an endangered species.

**4. (b)** The oak plant may disappear since they are seen at a high altitude and their dispersal is dependant on these birds.

**5. (d)** Endangered species are species with low population numbers that are in considerable danger of becoming extinct Hornbill and Indian Aconite are endagered species.

**6. (a)** *Prosopis fuliflora* is a shrub or small tree native to Mexico, South America and the Caribbean. Its uses include forage, wood and environmental management.

**7. (c)** *Ex situ* conservation is the method of selecting plants or animals in places outside their natural homes, *e.g.* cryopreservation, tissue culture *etc*. They are the sources of genetic material for breeders and genetic engineering.

**8. (d)** Genetic diversity is liable to undergo degradation and prone to mass scale destruction due to fungal and insects attacks and intensive use of biopesticides.

**9. (c)** Montreal protocol (1987) was a landmark international agreement to protect the stratospheric ozone by agreeing to limit the production and use the ozone-depleting substances.

**10. (b)** Biosphere reserves are a special category of protected areas of land or coastal environments where people are an integral component of the system.

**11. (c)** Tropical rain forests have a high density of organisms. Tropical rain forests are mainly found in America, South America, Cargo river basin of Africa, South East Asia. In this biome, rainfall and warmth are abundant. Plant growth is luxuriant. This biome possess more than half of the flora and fauna of the world. Productivity is very high. Diversity of life is so high that a hectare of the forest may have 200 species of trees. 70–80% of all insects and 80 – 85% of all birds are known from tropical forests.

**12. (b)** $\alpha$, $\beta$, $\gamma$ are the three types of ecosystem diversities where diversity is the diversity operating between communities.

**13. (c)** The Eastern Himalayas Region includes Bhutan, north-eastern India, and southern, central, and eastern Nepal. It is home to 163 globally threatened species, including Asia's three largest herbivores—the Asian elephant (*Elephas maximus*), the greater one-horned rhinoceros (*Rhinoceros unicornis*), and the wild water buffalo (*Bubalus bubalis*)—and its largest carnivore, the tiger (*Panthera tigris*), as well as several large birds such as vultures, adjutant storks, and hornbills. The Western Ghats are amongst the world's biodiversity Hotspots. The various human-induced threats to the rich biodiversity and the large number of endemic species have been identified and highlighted by the recently completed National Biodiversity Strategy and Action Plan; Western Ghats Ecoregion.

**14. (b)** *Dodo* became extinct in 14th century from Mauritius because of large-scale hunting. Dodo was helpful in pollinating and propagating seed of this tree species.

**15.** **(b)** Tectonic is the study of the earth's crust. It was considered that earth was made up of tectonic plates.

**16.** **(c)** If bengal tiger becomes extinct, its gene pool will be lost forever. There are various methods for conservation of biodiversity like formation of botanical gardens, zoological park, sperm bank, gene bank etc.

**17.** **(d)** Hot spot are those areas which were rich in biodiversity but now under threat due to direct or indirect interference of human activites. These regions are on the edge to get some of their species extinct due to humans. Western Ghats in India are under threat due to continuous developmental activities and Doon valley is under threat due to continuous mining activities.

**18.** **(c)** Nagarjunsagar-Srisailam Tiger Reserve is the largest Tiger reserve in India and the only Tiger Reserve in Andhra Pradesh state.

**19.** **(d)**

## Type B : Assertion Reason Questions

**20.** **(c)** O-horizon occupies the topmost soil and is rich in mineral and decomposed organic matter (humus). A-horizon is dark coloured and has abundant minerals mixed with humus.

**21.** **(c)** Tropical rain forests are located in the equatorial regions where the annual rainfall exceeds 140 cm. They are also called jungles and cover one twelveth of earth's surface but contain more than half of the earth's flora and fauna (i.e., rich in biodiversity). Now-a-days these forests are disappearing due to excessive cutting of forests for domestic purposes like fuel, furnitures, accomodations, cloths, resin, gum, etc.

**22.** **(a)**

**23.** **(a)** A sanctuary is an area which is reserved for the protection of wild animals only. The activities like harvesting of timber, collection of minor forest products and private ownership rights are allowed, however, such activities should not have any adverse effect on animals.

**24.** **(a)** Communities with higher number of species are more stable as it can resist occasional disturbances. A stable community should show less variation in productivity from year to year and resistance towards alien species.

Chapter

# 38 Environmental Issues

## TYPE A : MULTIPLE CHOICE QUESTIONS

**1.** Which of the following is biodegradable pollutant? ***[1997]***
(a) Plastic (b) Asbestos
(c) Sewage (d) Polythene

**2.** Positive pollution of soil is due to ***[1997]***
(a) reduction in soil productivity
(b) addition of waste to soil
(c) excessive use of fertilizers
(d) all of the above

**3.** Which of the following metal pollution causes sterility in human beings? ***[1998]***
(a) Mercury (b) Arsenic
(c) Manganese (d) Chromium

**4.** Which of the following is dissolved in water to make Bordeaux mixture ? ***[1998]***
(a) Calcium chloride (b) Copper sulphate
(c) Sodium chloride (d) None of these

**5.** Acid rain is due to pollution of ***[2000]***
(a) dust (b) pesticides
(c) $SO_2$ and $NO_2$ (d) carbon particle

**6.** Deforestation causes ***[2001]***
(a) soil erosion (b) soil pollution
(c) noise pollution (d) air pollution

**7.** Green mufler is useful against ***[2002]***
(a) air pollution
(b) noise pollution
(c) soil pollution
(d) radioactive pollution

**8.** In almost all Indian metropolitan cities like Delhi, the major atmospheric pollutant(s) is / are***[2003]***
(a) suspended particulate matter (SPM)
(b) oxides of sulphur
(c) carbon dioxide and carbon monoxide
(d) oxides of nitrogen

**9.** Photochemical smog formed in congested metropolitan cities mainly consists of ***[2003]***
(a) ozone, peroxyacetyl nitrate and $NO_x$
(b) smoke, peroxyacetyl nitrate and $SO_2$
(c) hydrocarbons, $SO_2$ and $CO_2$
(d) hydrocarbons, ozone and $SO_x$

**10.** Biological Oxygen Demand (BOD) is a measure of ***[2003]***
(a) industrial wastes poured into water bodies
(b) extent to which water is polluted with organic compound
(c) amount of carbon monoxide inseparably combined with haemoglobin
(d) amount of oxygen needed by green plants during night

**11.** Drinking of mineral water with very low level of pesticides (about 0.02 ppm) for long periods may
(a) produce immunity against mosquito ***[2003]***
(b) cause leukemia (blood cancer) in most people
(c) cause cancer of the intestine
(d) lead to accumulation of pesticide residues in body fat

**12.** Minimata disease is pollution related disease. It results from ***[2001, 2004]***
(a) oil spills in sea
(b) DDT pollution
(c) release of industrial waste containing mercury in fishing water
(d) accumulation of arsenic

**13.** A lake with an inflow of domestic sewage rich in organic waste may result in ***[2004]***
(a) drying of the lake very soon due to algal bloom
(b) an increased production of fish due to lot of nutrients
(c) death of fish due to lack of oxygen
(d) increased population of aquatic food web organisms

**14.** Nitrogen oxides, produced from the emission of automobiles and power plants, are the source of fine air borne particles which lead to ***[2004]***
(a) photochemical smog
(b) dry acid deposition
(c) industrial smog
(d) wet acid deposition

**15.** Formation of non-functional methaemoglobin causes blue-baby syndrome. This is due to ***[2005]***
(a) excess of arsenic concentration in drinking water
(b) excess of nitrates in drinking water
(c) deficiency of iron in food
(d) increased methane content in the atmosphere

**16.** Pollution from animal excreta and organic waste from kitchen can be most profitably minimized by ***[2006]***
(a) storing them in underground storage tanks
(b) using them for producing biogas
(c) vermiculture
(d) using them directly as biofertilizers

**17.** Which one of the following is an environment-related disorder with the correct main cause? ***[2006]***
(a) Black lung disease (pneumoconiosis) found mainly in workers in stone quarries and crushers.
(b) Blue baby disease (methaemoglobinaemia) due to heavy use of nitrogen rich fertilizers in the area.
(c) Non-Hodgkin's Lymphoma found mainly in workers involved in manufacture of neem based pesticides.
(d) Skin cancer mainly in people exposed to benzene and methane.

**18.** Ozone in stratosphere extends ***[2007]***
(a) 10-20 km (b) 20-25 km
(c) 15-30 km (d) 25-40 km

**19.** 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

**20.** 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

**21.** In the environment, ozone is known for its
(a) Harmful effects ***[2012]***
(b) Useful effects
(c) Both (a) and (b)
(d) Inert nature

**22.** 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.

**23.** Which one of the following pairs is mismatched?
(a) Fossil fuel burning - release of $CO_2$ ***[2013]***
(b) Nuclear power - radioactive wastes
(c) Solar energy - green house effect
(d) Biomass burning - release of $CO_2$

**24.** The two gases making the highest relative contribution to the greenhouse gases are ***[2014]***
(a) $CO_2$ and $CH_4$ (b) $CH_4$ and $N_2O$
(c) CFC and $N_2O$ (d) $CO_2$ and $N_2O$

**25.** 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

**26.** 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

**27.** 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.

**28.** 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

## TYPE B : ASSERTION REASON QUESTIONS

**Directions for (Qs. 29-38) :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(c) If the Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.
(e) If the Assertion is incorrect but the Reason is correct.

**29.** **Assertion :** Inhabitants close to very busy airports are likely to experience health hazards.
**Reason :** Sound level of jet aeroplanes usually exceeds 160 dB. ***[2003]***

**30.** **Assertion :** Organochlorine pesticides are organic compounds that have been chlorinated.
**Reason :** Fenitrothion is one of the organochlorine pesticides. ***[2003]***

**31.** **Assertion :** Agricultural output increased several times after introduction of DDT.
**Reason :** DDT was the first insecticide used on a wide scale. ***[2004]***

**32.** **Assertion :** A suspended particulate matter (SPM) is an important pollutant released by diesel vehicles.
**Reason :** Catalytic converters greatly reduce pollution caused by automobiles. ***[2005]***

**33.** **Assertion :** Presently, the global atmosphere is warming up.
**Reason :** The depletion of stratospheric ozone layer has resulted in increase in ultraviolet radiations reaching the earth. ***[2005]***

**34.** **Assertion :** Deforestation is one main factor contributing to global warming.
**Reason :** Besides $CO_2$, two other gases methane and CFCs are also included under green house gases. ***[2006]***

**35.** **Assertion :** UV radiation causes photo-dissociation of ozone into $O_2$ and O, thus causing damage to the stratospheric ozone layer.
**Reason :** Ozone hole is resulting in global warming and climate change. ***[2006]***

**36.** **Assertion :** The concentration of methane in the atmosphere has more than doubled in the last 250 years.
**Reason :** Wetlands and rice fields are the major sources of methane. ***[2006]***

**37.** **Assertion (A)** : Pollution is always caused by human activities.
**Reason (R) :** Pollution is not different from contamination. ***[2007]***

**38.** **Assertion (A) :** Chlorofluorocarbons are responsible for ozone depletion.
**Reason (R) :** Ozone level decreases by as much as 67% every year. ***[2007]***

**Directions for (Qs. 39-43) :** Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

**39.** **Assertion :** Secondary succession takes place in recently denuded area. ***[2009]***
**Reason :** It is caused due to baring of an area.

**40.** **Assertion :** Excess of nitrates in drinking water are harmful for infants. ***[2009]***
**Reason :** Nitrates are responsible for blue baby syndrome.

**41.** **Assertion :** Water pollutants are measured by BOD.
**Reason :** If BOD is more, the water is polluted. ***[2013]***

**42.** **Assertion :** Methane, component of green house gases, contributing to global warming is about 20 percent.
**Reason :** Introduction of multi-point fuel injection engines in automobiles has decreased methane content in the exhausts. ***[2005, 2015]***

**43.** **Assertion :** Eutrophication shows increase in productivity in water. ***[2013, 2017]***
**Reason :** With increasing eutrophication, the diversity of the phytoplankton increases.

# HINTS & SOLUTIONS

## Type A : Multiple Choice Questions

**1. (c)** Sewage is a biodegradable pollutant *i.e.* capable of being removed by microbial action.

**2. (d)** Soil pollution is of two types : positive soil pollution and negative soil pollution.
When there is addition of undesirable substance in the soil then it is called as positive pollution.

**3. (c)** Manganese causes sterility in human beings. It enters the food chain and finally reaches human beings & has an effect on the reproductive system.

**4. (b)** Bodeaux mixture is a combination of copper sulphate and hydrated lime. It is used mainly to control garden, vineyard and farm infestations of fungus.

**5. (c)** Acid rain is rainfall and other form of precipitation with a pH of less than 5. It is due to the excess of $SO_2$ and $NO_2$ in the air which along with water form sulphurous and nitric acid.

**6. (a)** In India, deforestation is the main cause of soil erosion. The quality of top soil loss in India is about 18.5% of the total global loss.

**7. (b)** Green muffler or green belt vegetation is rows of trees and shrubs grown and maintained to serve as noise absorbers.

**8. (a)** Suspended particulate matter (SPM) is maximum in metropolitan cities.

**9. (c)** Photochemical smog or oxidizing type of pollution is characterized by the presence of large concentration of ozone, oxides of nitrogen and various hydrocarbons. It occurs in Los Angeles.

**10. (b)** BOD is the measure of degree of impurity of water due to organic matter.

**11. (d)** Pesticides in a drinking water pass into food chain and they increase in amount per unit weight of organisms with the rise in trophic level due to their accumulation in fat (biomagnification).

**12. (c)** Mercury compounds in waste water are converted by bacterial action into extremely toxic compound, methyl mercury. Biomagnification of mercury into fishes through the food chain is responsible for large number of deaths due to Minamata diseases. It is characterised by numbers of limbs, lips and tongue, deafness, blurred vision, mental retardation *etc*.

**13. (c)** A lake rich in (domestic sewage) nutrients accelerates the growth of algae which use oxygen at night and deoxygenate the water enough to kill the fish and other animals (eutrophication).

**14. (a)** Nitrogen oxides form peroxyacyl nitrate (PAN) by reacting with hydrocarbons. It leads to photochemical smog formation.

**15. (b)** Excess nitrate in drinking water, leaves and fruits, changes into nitrite in alimentary canal. It reacts with haemoglobin and produces non-functional met haemoglobin. This reduces $O_2$ carrying capacity of blood. The disorder is called methaemoglobinea. It causes blue baby syndrome and breathlessness in adults.

**16. (c)** Vermiculture means artificial seating of worms whose excreta is rich in humus. These worms eat farmyard manure along with other farm wastes and pass out it through their bodies and the process converts it into vermicompost for the betterment of human beings.

**17. (b)** Blue baby disease is caused by nitrate poisoning (presence of methaemoglobin) resulting in organs & cell tissues that are deprived of oxygen & skin with the characteristic blush tint.

**18. (b)** Stratosphere extends from 20-25 km above tropospheres. It is also called ozonosphere due to presence of ozone. Temperature increases in this zone (upto 90°C) due to ozone formation. Ozone protects Earth from harmful ultraviolet radiations of the sun.

Oxides of Nitrogen + Unburnt Hydrocarbons

$$\xrightarrow{\text{UV-rays}} \underset{\text{(Ozone)}}{O_3} + \underset{\text{(Peroxy acetyl nitrate)}}{\text{PAN}}$$

**19. (c)** Biomagnification is phenomenon of increasing concentration of a compound in the tissues of chain, usually as a result of food intake. In this case, the concentration of compound increases with increasing trophic level.

Pollutant increases in concentration from Producers→ Primary consumers → Secondary consumers → Tertiary consumers → Top consumer. In the given question, only snake represents the tertiary consumer, so the concentration of DDT will be highest in snake.

**20. (a)** Excess fluorine in drinking water causes hardening of bones and stiffness of joints, black foot disease is due to arsenic and itai-itai disease is due to cadmium in contaminated water.

**21. (c)** In the environment, ozone is known for its both harmful and useful effects.

Ozone present in stratosphere is useful as it act like shield and protect the earth from harmful UV-rays. Ozone present in troposphere act as pollutant and have many deleterious effects.

**22. (a)**

**23. (c)** Solar energy coming to the earth is not responsible for green house effect. It is the increase in green house gases in atmosphere like $CO_2$ which is released by complete combustion of fossil fuels or biomass in industries or transportation vehicles that prevent the reradiation of infrared radiation from the earth and result in increase in temperature of the earth.

**24. (a)** The gases that makes highest relative contribution to the green house gases are carbon dioxide ($CO_2$) and methane ($CH_4$).

**25. (c)** Lots of urea and phosphate fertilizer were used in the crops in the vicinity and the lake water turned green and stinky. Due to this, lake near a village suffered heavy mortality of fishes within a few days.

**26. (d)** DDT residues are rapidly passed through food chain causing biomagnification because DDT is soluble in lipids. Biomagnification, also known as bioamplification or biological magnification, is the increase in concentration of a substance, such as the pesticide DDT, that occurs in a food chain as a consequence of:

- Persistence (slow to be broken down by environmental processes)
- Food chain energetics
- Low (or non-existent) rate of internal degradation/excretion of the substance (often due to water-insolubility)

**27. (b)** Lake A and B are identical in all aspects except that Lake A has higher temperature. On the basis of this difference, it is clear that Lake B has higher rate of oxygen dissolution

**28. (a)** The Govt. of India through a new auto fuel policy has laid out a roadmap to cut down the vehicular pollution in Indian cities. For example, Euro II norms stipulate that sulphur be controlled at 350 ppm in diesel and 150 ppm in petrol.

## Type B : Assertion Reason Questions

**29. (a)** Sound level of jet aeroplanes is about 150 dB beyond the level of human audible capacity (80 dB). It affects the hearing and general health of man.

**30. (c)** Organochlorine are persistent pesticides (*e.g.* DDT) which pass into food chain and increase in amount per unit weight of organisms with the rise in trophic level. Fenitrothion is organophosphate.

**31. (a)** DDT (dichloro diphenyl trichloroethane) is a organochlorine contact insecticide that kills by acting as a nerve poison. DDT was originally used during world war II to control typhus which was spread by body louse. Since then it has been used to control mosquito borne malaria and was used extensively as a general agricultural insecticide.

**32. (b)** Catalytic converters are involved in reducing gaseous pollutions by converting $CO \longrightarrow CO_2$, $NO_2 \longrightarrow N_2$ etc. Thus, decrease the amount of pollutant. They can not reduce emission of SPM.

**33. (b)** Global warming is due to the increase in concentration of green house gases resulted in increase in global temperature. These global gases prevent the escape of long wave radiations into space.

**34. (b)** Deforestation results in increase in green house gases which retains more and more UV radiations and leads to global warming. Global warming is the warming/heating up of the earth's atmosphere due to depletion of ozone in the stratosphere.

**35. (c)** Ozone in stratosphere is responsible for the protection of earth from high energy UV rays *i.e.* it acts as life saving screen. Ozone layer found in troposphere protects from warming effect of earth.

Due to human activities, the ozone layer in the stratosphere starts thinning, which is also called ozone hole. Ozone hole is resulting in rain failure, increase in radiation, cancer (skin) and reduction in crop production.

**36. (a)** Wetland and rice fields are the major sources of methane. It is a green house gas whose concentration is double now than it was 250 years ago.

**37. (d)** Pollution may be defined as an undesirable change in physical, chemical or biological characteristics of air, water and land causing harmful effects on living organisms. Pollution can be natural or man made. Natural pollution includes volcanic eruptions, soil erosion, UV- rays *etc*. Pollution is different from contamination. Contamination is the presence of harmful organisms causing disease.

**38. (b)** Stratosphere zone of Earth's atmosphere contains a layer of ozone which protects us from harmful ultraviolet radiations of the sun.A group of chlorine containing compounds called chlorofluoro carbon (CFCs) used as coolants in air conditioners and refrigerators are primary chemicals responsible for ozone depletion. After their release into troposphere, CFCs go to stratosphere where they are broken down by UV radiations releasing chlorine.In presence of sunlight, chlorine breaks $O_3$ into $O_2$. Due to ozone depletion, its levels decreases by 67% every year causing higher levels of UV radiations reaching earth which may cause eye cataracts, skin cancer etc.

**39. (a)** Biotic or ecological succession is the formation of a series of biotic communities at the same site over a period of time one after the other, till a stable climax community develops over the area. It occurs generally in bare areas. Primary succession takes place on a biological sterile soilless primary barren area. Secondary succession takes place in a recently denuded area which still contains a lot of organic debris, remains and propagules of previous living organisms. The area has become bared due to destruction of the community previously present. The baring of an area can be caused due to forest fire, deforestation for wood, timber and habitat, overgrazing, landslides or earthquakes, excessive and repeated droughts, following a cropland and repeated floods.

**40. (a)** Excess of nitrates in drinking water are harmful for human health and may be fatal for infants. Excessive use of fertilizers often leads to accumulations of nitrates in water. In infants, excess nitrate reacts with

haemoglobin to form nonfunctional methaemoglobin that impairs oxygen transport. This condition is termed as methaemoglobinemia or blue baby syndrome. This disease can damage respiratory and vascular systems and even cause suffocation.

**41. (a)** Water pollutants are commonly measured by their main common denominator, called BOD (Biochemical Oxygen Demand), *i.e.*, the amount of free oxygen absorbed by extraneous substances from water. If water is polluted, it will consume more oxygen, thereby enhancing the BOD of water.

**42. (b)** Methane is produced by incomplete biomass combustion, incomplete decomposition mostly by anaerobic methanogens.

Carbon dioxide contributes about 60% of the total global warming and share of methane ($CH_4$) and chlorofluoro carbons (CFCs) is 20% and 14% respectively. $N_2O$ also contributes 6% in total global warming. Efficient engine such as multi point fuel injection engine can reduce the unburnt hydrocarbon (methane) in auto-emissions.

**43. (b)** Eutrophication is a natural process which literally means well nourished or enriched. It is a natural state in many lakes and ponds which have a rich supply of nutrients. Eutrophication becomes excessive, when abnormally high amount of nutrient from sewage, fertilizers, animal wastage and detergent, enter streams and lakes causing excessive growth or blooms of microorganisms. With increasing eutrophication, the diversity of the phytoplankton community of a lake increases and the lake finally becomes dominated by blue - green algae.

Chapter 1

# G.K. – History

**1.** Doctors before starting their service take oath in the name of a scientist to work honestly :
(a) Hippocrate (b) Darwin *[1997]*
(c) Plato (d) Socrates

**2.** Confucianism is famous in : *[1997]*
(a) Japan (b) China
(c) Myanmar (d) Malaysia

**3.** The tomb of Qutub Shahi is situated in : *[1997]*
(a) Aligarh (b) Agra
(c) Hyderabad (d) Allahabad

**4.** "Statue of Liberty" was gifted to USA by : *[1997]*
(a) Germany (b) Canada
(c) Greece (d) France

**5.** The dynasty of Bahadur Shah (II) Jafar was in : *[1998]*
(a) 1658 to 1707 A.D. (b) 1837 to 1857 A.D.
(c) 1857 to 1862 A.D. (d) 1800 to 1829 A.D.

**6.** Swami Vivekanand was born in which one of the following year ? *[1998]*
(a) 1860 (b) 1882
(c) 1897 (d) 1863

**7.** The Simon Commission had come in which of the following year ? *[1998]*
(a) 1937 (b) 1938
(c) 1927 (d) 1942

**8.** The Fifth Day commission was headed by justice :
(a) Verma (b) Ahmadi *[1999]*
(c) Anand (d) Vadhwa

**9.** Grand Trunk road was built by : *[2000]*
(a) Sher Shah Suri (b) Shah Jahan
(c) Lord Bentic (d) Lord Mount Battan

**10.** At the first time, the song Vande Mataram has sung in : *[2001]*
(a) Indian National Congress session 1986
(b) Indian National Congress session 1896
(c) Quit India Movement 1942
(d) Congress session 1911

**11.** From where did Mahatma Gandhi start the famous Dandi March? *[2001]*
(a) Surat (b) Mumbai
(c) Bardoli (d) Ahmedabad

**12.** In which year was English recommended as the medium of instruction for higher education in India by Lord Macaulay? *[2001]*
(a) 1833 (b) 1835
(c) 1859 (d) 1825

**13.** 'Gayatri Mantra' is related with : *[2002]*
(a) Athar Veda (b) Rig Veda
(c) Yajur Veda (d) Sam Veda

**14.** The founder of 'Khalsa' was : *[2002]*
(a) Guru Gobind Singh
(b) Guru Nanak Dev
(c) Guru Ram Das
(d) Guru Tegh Bahadur

**15.** Who was the last Viceroy of India : *[2002]*
(a) Lard David
(b) Lord Wavell
(c) Lord Mountbattern
(d) Wellington

**16.** Euthanasia (mercy killing) was first legalized in :
(a) Switzerland *[2003]*
(b) Netherlands (Holland)
(c) France
(d) Italy

**17.** Which city was gifted to Charles II by the Portuguese when he married the sister of the King of Portugal in 1662? *[2003]*
(a) Bombay (b) Paris
(c) Lisoon (d) Castille

**18.** Who is the mother of Bharat in the epic 'Ramayana'? *[2003]*
(a) Kaushalya (b) Sumitra
(c) Urmila (d) Kaikayee

**19.** Which of the 'Nawab of Bengal' is supposed to be responsible for 'Back Hole Tragedy' of Calcutta (Kolkata)? *[2003]*
(a) Mir Jafer (b) Sirajuddaula
(c) Alivardi Khan (d) Sarfaraj Khan

**20.** Who among the following is known as Fuehrer?
(a) Stalin (b) Lenin *[2003]*
(c) Hitler (d) Bismarck

**21.** Since the Britishers wanted India to produce and supply raw materials to feed English factories, the pushed a policy that encouraged cultivation of : ***[2004]***
(a) jute (b) indigo
(c) cotton (d) commercial crop

**22.** 'Brahmo Samaj' was founded by : ***[2005]***
(a) Devendra Nath Tagor
(b) Keshv Chandra Sen
(c) Raja Ram Mohan Roy
(d) Annie Besant

**23.** Who was the first woman ruler of India? ***[2005]***
(a) Raziya Sultan (b) Noor Jahan
(c) Chand Biwi (d) Durga Devi

**24.** Who were the first to issue gold coins in India? ***[2005]***
(a) The Kushan's (b) The Gupta's
(c) The Mauryan's (d) The Indo Greeks

**25.** Which sea is referred to in our National Anthem? ***[2006]***
(a) Bay of Bengal
(b) Indian ocean
(c) Arabian sea
(d) No sea is mentioned in it

**26.** The national calendar of India is based on : ***[2006]***
(a) Gragorian calendar
(b) Hizrr Era
(c) Saka- Era
(d) one of the old Indian Era

**27.** Gaya is associated with Lord buddha, where he ***[2007]***
(a) was born
(b) attained enlightenment
(c) died
(d) delivered his first sermon

**28.** Which of the following places was known as a centre of learning in ancient India? ***[2007]***
(a) Nalanda (b) Ujjain
(c) Allahabad (d) none of these

**29.** In violation of the Salt Laws, Gandhiji started a movement called ***[2008]***
(a) Non-Cooperation Movement
(b) Swadeshi Movement
(c) Civil Disobedience Movement
(d) None of the above

**30.** The Cabinet Mission came to India in ***[2008]***
(a) 1943 (b) 1944
(c) 1945 (d) 1946

**31.** Who was the founder-editor of the famous newspaper 'Kesari' during the national struggle? ***[2009]***
(a) Mahatma Gandhi
(b) Jawaharlal Nehru
(c) Lokmanya Tilak
(d) Muhammad Iqbal

**32.** The earliest Iron Age in India has been associated with ***[2010]***
(a) Painted grey ware
(b) Black and red ware
(c) Ochre Coloured Pottery (OCP)
(d) Northern black polished ware

**33.** Who among the following was the ruler of Delhi at the time of the invasion of Nadir Shah? ***[2010]***
(a) Muhammad Shah
(b) Raj Raj I, the Chola
(c) Bahadur Shah
(d) Alamgir II

**34.** Most of the Ajanta Paintings were done during the period of :
(a) Harshavardhana (b) Guptas
(c) Mauryas (d) Kushan

**35.** Who was the first Indian ruler to face the Mahmud Ghaznavi ? ***[2011]***
(a) Prithviraj Chauhan (b) King Jaipal
(c) Jaichand (d) Firdausi

**36.** Which one of the following countries is "Orange Revolution" associated ? ***[2012]***
(a) Brazil (b) Sudan
(c) Turkey (d) Ukraine

**37.** Who was the Governor General of India during the Revolt of 1857 ? ***[2012]***
(a) Lord Canning (b) Lord Dalhousie
(c) Lord Dufferin (d) Lord Hardinge

**38.** Who founded the Brahma Samaj? ***[2012]***
(a) Debendranath Tagore
(b) Keshab Chandra Sen
(c) Raja Rammohan Roy
(d) Ishwar Chandra Vidyasagar

**39.** Consider the following Mughal Emperors:
i. Farrukhshiyar ii. Jahandar Shah
iii. Muhammad Shah iv. Shah Alam II
What is the correct chronological sequence of their ascending the throne ? ***[2012]***
(a) i, ii, iii, iv (b) ii, i, iii, iv
(c) i, ii, iv, iii (d) ii, i, iv, iii

**40.** Match the following : ***[2013]***

| | | | |
|---|---|---|---|
| A. | Sarojini Naidu | 1. | Muslim League |
| B. | M.A. Jinnah | 2. | Indian National Congress |

C. Sir Tej Bahadur Sapru 3. Hindu Mahasabha
D. V.D. Savarkar 4. Liberal Party

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

**41.** Identify the medical trio of Ancient India from the following names. ***[2013]***
(a) Charaka, Susruta and Vagbhata
(b) Charaka, Vatsyayana and Vagbhata
(c) Charaka, Susruta and Bharata
(d) Charaka, Susruta and Patanjali

**42.** Who among the following first propounded the idea of Basic Education? ***[2014]***
(a) Jawahar Lal Nehru
(b) Raja Ram Mohan Roy
(c) Mahatma Gandhi
(d) Dayanand Saraswati

**43.** 'Tebhega' movement is associated with which state ? ***[2015]***
(a) Maharashtra (b) Tamil Nadu
(c) Karnataka (d) Bengal

**44.** When was our national song sung for the first time? ***[2015]***
(a) 1896 session of Indian National Congress
(b) 1857 revolt
(c) 1919 - Jallianwala Bagh Massacre
(d) None of the above

**45.** The first meeting of Indian National Congress was held in Bombay in1885 A.D. under the leadership of __? ***[2015]***
(a) Dadabhai Naoroji
(b) Sir C. Sankaran Nair
(c) Womesh Chandra Banerjee
(d) Badruddin Tyabji

**46.** When did Vasco-da-Gama come to India ? ***[2016]***
(a) 1492 (b) 1494
(c) 1496 (d) 1498

**47.** The Qutub Minar at Delhi was built by ? ***[2016]***
(a) Qutbuddin Aibak (b) Shahjhan
(c) Aleu-din-khilji (d) Chandragupta

**48.** Who was the first Governor - General of India ***[2016]***
(a) Robert Clive
(b) Sir Charles Metcalfe
(c) William Bentinck
(d) Warren Hastings

**49.** 'Do or Die' (Karo ya Maro) slogan was given by which freedom fighter in 1942 ? ***[2017]***
(a) Mahatma Gandhi
(b) Subhash Chand Bose
(c) Bal Gangadhar Tilak
(d) Bhagat Singh

**ANSWER KEY**

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | (a) | **2** | (b) | **3** | (c) | **4** | (d) | **5** | (b) | **6** | (d) | **7** | (c) | **8** | (a) | **9** | (a) | **10** | (b) |
| **11** | (d) | **12** | (a) | **13** | (b) | **14** | (a) | **15** | (c) | **16** | (b) | **17** | (a) | **18** | (d) | **19** | (b) | **20** | (c) |
| **21** | (b) | **22** | (c) | **23** | (a) | **24** | (d) | **25** | (d) | **26** | (c) | **27** | (b) | **28** | (a) | **29** | (c) | **30** | (d) |
| **31** | (c) | **32** | (a) | **33** | (a) | **34** | (b) | **35** | (b) | **36** | (d) | **37** | (a) | **38** | (c) | **39** | (b) | **40** | (a) |
| **41** | (d) | **42** | (c) | **43** | (d) | **44** | (a) | **45** | (c) | **46** | (d) | **47** | (a) | **48** | (d) | **49** | (a) | | |

Chapter 2

# G.K. – Indian Polity

**1.** Sixty five year plan to promote significant expansion of employment opportunities was scheduled in the year of : ***[1998]***
(a) 1980-1985 (b) 1669-1674
(c) 1974-1979 (d) 1961-1966

**2.** Sixty first amendment in the Constitution states about ***[1998]***
(a) Extended President rule in Punjab
(b) Increasing the ceibling of profession tax
(c) Reservation of seats for scheduled castes and scheduled tribes in parliament
(d) Reducing the voting age from 21 years to 18 years

**3.** Which of the following state, becomes the 22nd state of Indian union ? ***[1998]***
(a) Tripura (b) Sikkim
(c) Meghalaya (d) Assam

**4.** At present, the total membership of Lok Sabha :
(a) 552 (b) 525 ***[1998]***
(c) 527 (d) 545

**5.** Fundamental duties were introduced in the constitution by : ***[1999]***
(a) 42nd amendment (b) 40th amendment
(c) 48th amendment (d) 53rd amendment

**6.** The person who served as the President of India twice, was : ***[1999]***
(a) Radha Krishnan
(b) Dr. Rajendra Prasad
(c) Zakir Hussain
(d) V.V Giri

**7.** President of India gives his resignation to the :
(a) Chief Justice (b) Parliament ***[1999]***
(c) Vice President (d) Prime Minister

**8.** The contribution of sarkaria commission was related between : ***[2000]***
(a) state and centre
(b) centre and union territories
(c) one state to other state
(d) none of these

**9.** Who was appointed as the first governor general of India ? ***[2000]***
(a) C. Raj Gopalachari (b) Radha Krishana
(c) Y. C. Grace (d) V.V. Giri

**10.** National Anthem "Jana Gana Mana" was adopted on ***[2001]***
(a) 26 Jan. 1950 (b) 26 July 1947
(c) 15 August 1947 (d) 24 Jan. 1950

**11.** Who is the chairman of Rajya Sabha? ***[2001]***
(a) Speaker of Lok Sabha
(b) Home Minister
(c) President
(d) Vice President

**12.** Which one of the following determines the salary of attorney General? ***[2001]***
(a) Speaker of Lok Sabha
(b) Home Minister
(c) President of India
(d) Prime Minister

**13.** The oath of office to a Supreme Court Judge is administered by : ***[2001]***
(a) The Chief Justice
(b) The President of India
(c) The Chief Justice of India
(d) The Law minister

**14.** Who addressed the U. N. General Assembly for the first time in Hindi? ***[2001]***
(a) Rajendra Prasad (b) Atal Bihari Vajpai
(c) Jawahar Lal Nehru (d) Swarn Singh

**15.** How many languages are recognised by the constitution of India in the 8th schedule? ***[2002]***
(a) 12 (b) 14
(c) 16 (d) 18

**16.** Who is known as the 'Iron Man of India'? ***[2002]***
(a) Jawaharlal Nehru
(b) Bal Gangadhar Tilak
(c) Sardar Vallabhbhai Patel
(d) Mahatma Gandhi

**17.** The design of the National Flag was adopted by the constituent assembly of India on : ***[2002]***
(a) 26 January, 1949 (b) 26 January, 1950
(c) 22 July, 1947 (d) 15 August, 1947

**18.** When was the golden jubilee of Indian Parliament celebrated ? ***[2002]***
(a) 1st January, 1997 (b) 26th January, 2002
(c) 13th may, 2002 (d) 15th August, 1997

**19.** Dravida Munnetra Kargam (DMK) was founded by : ***[2004]***
(a) M.G. Ramachandran
(b) C.N. Annadurai
(c) Kumar Swami Kamraj
(d) Lalithambika Antharjanam

**20.** The Planning Commission was set up in : ***[2005]***
(a) January, 1950 (b) March, 1950
(c) January, 1952 (d) March, 1952

**21.** How many spokes are in Indian National Flag?
(a) 22 (b) 24 ***[2005]***
(c) 26 (d) 28

**22.** Who was elected as the permanent President of constituent assembly ? ***[2005]***
(a) Dr. Sachchidanand Sinha
(b) Dr. Rajendra Prasad
(c) Dr. B. R. Ambedkar
(d) C. Rajgopalachari

**23.** How many articles and schedule are there in originally constitution ? ***[2005]***
(a) 391 articles and 7 schedules
(b) 395 articles and 8 schedules
(c) 400 articles and 10 schedules
(d) 444 articles and 12 schedules

**24.** The Tenure of first planning holiday was ***[2005]***
(a) 1964-1967 (b) 1965-1968
(c) 1966-1969 (d) 1978-1981

**25.** World Trade Organisation established in : ***[2005]***
(a) 1954 (b) 1988
(c) 1994 (d) 1995

**26.** The supreme command of the defence forces is vested with the : ***[2006]***
(a) Field Marshal
(b) Commander-in-chief
(c) Prime minister
(d) President of India

**27.** India's first battle field missile is : ***[2006]***
(a) Akash (b) Prithvi
(c) Agni (d) Nag

**28.** Who conducts the State assembly elections? ***[2007]***
(a) Chief Justice of the High Court concerned
(b) Chief Justice of the Supreme Court
(c) Chief Election Commissioner
(d) Governor of the state concerned

**29.** Who is the constitutional head of the Government of India ? ***[2008]***
(a) President
(b) Prime Minister
(c) Chief Justice of India
(d) Attorney General

**30.** Which part of Indian Constitution has been described as the soul of the Constitution ?
(a) Fundamental Rights ***[2008]***
(b) Directive Principle of State Policy
(c) The Preamble
(d) Right to Constitutional Remedies

**31.** The President of India can nominate ***[2008]***
(a) 10 members to Rajya Sabha
(b) 2 members to Rajya Sabha
(c) 15 members to Rajya Sabha
(d) 12 members to Rajya Sabha

**32.** The Constitution of India was adopted by the Constituent Assembly on ***[2008]***
(a) August 15, 1947
(b) June 30, 1948
(c) November 26, 1949
(d) January 26, 1950

**33.** Who is the Chairman of the Planning Commission ?
(a) President ***[2008]***
(b) Prime Minister
(c) Finance Minister
(d) Governor of Reserve Bank

**34.** Which Plan give emphasis on removal of poverty for the first time? ***[2009]***
(a) Fourth (b) Fifth
(c) Sixth (d) Seventh

**35.** The Council of Ministers does not include
(a) Cabinet Ministers ***[2009]***
(b) Ministers of State
(c) Cabinate Secretary
(d) Ministers without portfolio

**36.** Attorney-General of India is appointed by
(a) Chief Justice of Supreme Court ***[2010]***
(b) Parliament
(c) Law Minister
(d) President

**37.** Which one of the following Article provide 'Right to equality'? ***[2010]***
(a) Article - 14
(b) Article -19
(c) Article - 20
(d) Article - 18

**38.** First speaker of Lok Sabha was : ***[2011]***
(a) Sardar Hukum Singh
(b) G. V. Mavlankar
(c) Neelam Sanjeevan Reddy
(d) Bali Ram Bhagat

**39.** What is the intermediate tier of the Panchayati Raj System called? ***[2012]***
(a) Zilla Parishad (b) Taluka Panchayat
(c) Panchayat Samiti (d) Gram Sabha

**40.** Which of the following is associated with Panchayati Raj ? ***[2013]***
(a) Nanavati Commission
(b) Balwant Rai Mehta Committee
(c) Librahan Commission
(d) Shah Commission

**41.** How many articles are there in the Indian constitution? ***[2014]***
(a) 395 (b) 396
(c) 398 (d) 399

**42.** The Vice President of India is elected by the electoral collage consisting of the members of _____? ***[2015]***
1. Rajya Sabha
2. Lok Sabha
3. State Legislatures
Choose the correct option from the codes given below:
(a) Only 1 (b) Only 2
(c) Only 1 & 2 (d) Only 1 & 3

**43.** In Lok Sabha of India, the "Leader of the House" is nominated by ___: ***[2015]***
(a) President (b) Lok Sabha Speaker
(c) Prime Minister (d) Deputy Speaker

**44.** The President of India can nominate how many members to Rajya Sabha and Lok Sabha respectively? ***[2015]***
(a) 10, 3 (b) 12, 2
(c) 10, 2 (d) 12, 3

**45.** Supreme Court judge retires upon attaining the age of ***[2016]***
(a) 65 years (b) 60 years
(c) 55 years (d) 50 years

**46.** How many times has National Emergency been declared? ***[2016]***
(a) Six times (b) Three times
(c) Five times (d) Four times

**47.** A Municipal Corporation is set up in a city with how much population of not less than? ***[2016]***
(a) 2 lakhs (b) 5 lakhs
(c) 10 lakhs (d) 15 lakhs

| ANSWER KEY | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | (b) | **2** | (a) | **3** | (c) | **4** | (a) | **5** | (a) | **6** | (b) | **7** | (b) | **8** | (a) | **9** | (a) | **10** | (d) |
| **11** | (d) | **12** | (c) | **13** | (c) | **14** | (b) | **15** | (d) | **16** | (c) | **17** | (c) | **18** | (c) | **19** | (b) | **20** | (b) |
| **21** | (b) | **22** | (b) | **23** | (b) | **24** | (c) | **25** | (d) | **26** | (d) | **27** | (b) | **28** | (c) | **29** | (a) | **30** | (d) |
| **31** | (d) | **32** | (c) | **33** | (b) | **34** | (a) | **35** | (c) | **36** | (d) | **37** | (a) | **38** | (b) | **39** | (c) | **40** | (b) |
| **41** | (a) | **42** | (c) | **43** | (c) | **44** | (b) | **45** | (a) | **46** | (b) | **47** | (c) | | | | | | |

Chapter 3

# G.K. – Geography

**1.** Dachigan Wild life santuary in Kashmir is associated with which of the following animal ?
(a) Hangul (b) Panther ***[1997]***
(c) Horned toed Deer (d) Sagui

**2.** 'Principality of Liechtenstion' is situated between Switzerland and ***[1997]***
(a) Austria (b) France
(c) Italy (d) Germany

**3.** The largest producer of rubber is : ***[1997]***
(a) Sri Lanka (b) India
(c) Japan (d) Malaysia

**4.** Kalpakkam in Tamilnadu is known for its :
(a) temples ***[1997]***
(b) textiles mills
(c) handicrafts
(d) atomic power plants

**5.** OPEC is : ***[1997]***
(a) Organisation of petroleum Exporting Companies
(b) Oil and Petroleum exporting Corporation
(c) Oil and petroleum Exporting Countries
(d) Organisation of Petroleum Exporting Countries

**6.** Sambalpur is situated on the bank in which of the following river ? ***[1998]***
(a) Jammu (b) Saraswati
(c) Sagar (d) Mahandi

**7.** Seoul is the capital of : ***[1999]***
(a) Japan (b) South Korea
(c) Afganistan (d) Philippines

**8.** Hirakund dam is constructed on which of the following river ? ***[1999]***
(a) Mahanadi (b) Ganga
(c) Yamuna (d) Kosi

**9.** 'Sun city' is in : ***[2000]***
(a) USA (b) South Africa
(c) France (d Denmark

**10.** Which one of the least populated state in India? ***[2000]***
(a) Nagaland (b) Himachal Pradesh
(c) Orissa (d) Sikkim

**11.** Shakti sthal is the name given to : ***[2000]***
(a) The factory where India's newly designed battle tanks are being manufactured
(b) The samadhi of Indira Gandhi
(c) The nuclear reactor at KalpaKam at Chennai
(d) none of these

**12.** Khushi Nagar, the famous Buddhist pilgrimage centre in the state of : ***[2000]***
(a) U.P. (b) M.P
(c) Bihar (d) Orissa

**13.** Nasic is situated on the bank of : ***[2000]***
(a) Narmada (b) Krishna
(c) Kauvery (d) Godavari

**14.** Which city is known as Pink city ? ***[2000]***
(a) Jaipur (b) Paris
(c) New York (d) London

**15.** An indian river, that does not form any delta is :
(a) Cauvery (b) narmada ***[2002]***
(c) Yamuna (d) Singh

**16.** How many islands are there in lakshadweep?
(a) 47 (b) 36 ***[2002]***
(c) 27 (d) 17

**17.** From which of the following places the international dateline crosses? ***[2003]***
(a) Atlantic ocean
(b) Pacific ocean
(c) Greenwich
(d) Gape of Good Hope

**18.** A man-made tunnel in India transfers water from which one river to another? ***[2004]***
(a) Narmada to Tapti
(b) Betwa to Sone
(c) Beas to Sutlej
(d) Godawari to Krishna

**19.** The grand Fisher Bank is situated off : ***[2004]***
(a) the coast of New Foundland
(b) the Chilean coast
(c) the Spanish coast
(d) the coast of Great Britain

**20.** Which one of the following organisation's iron and steel plant was build to use charcoal as a source of power, to start with, but later switched over to hydroelectricity ? ***[2004]***

(a) The Tata Iron Steel Company
(b) The Indian Iron and Steel Company
(c) Mysore Iron and Steel Company
(d) Hindustan Steel Limited

**21.** Rishikesh is famous for the production of
(a) antibiotics *[2004]*
(b) heavy electricals
(c) fertilizers
(d) transistorized radios

**22.** Nepanagar is famous for : *[2004]*
(a) paper board industries
(b) craft paper industries
(c) carbon paper industries
(d) newsprint paper industries

**23.** Where is 'Indira Gandhi Rashtriya Uran Akadami's situated? *[2004]*
(a) Dehradun (b) Raebareli
(c) Allahabad (d) Mussoorie

**24.** Where is 'National Defence Academy' situated? *[2005]*
(a) New Delhi (b) Khadakvasla
(c) Dehradun (d) Pune

**25.** Which river is called 'Bengal's Sorrow'? *[2005]*
(a) Hughli (b) Ganga
(c) Damodar (d) Koshi

**26.** 'Maoris' are : *[2005]*
(a) inhabitants of New Zealand
(b) inhabitants of Hungary
(c) inhabitants of North America
(d) inhabitants of North-West Asia

**27.** 'Chittaranjan' is famous for the *[2005]*
(a) railway coaches (b) locomotives
(c) iron and steel (d) heavy machinery

**28.** Sardar Sarovar Dam is built on the river *[2006]*
(a) Jhelam (b) Narmada
(c) Tapti (d) Vyas

**29.** Lagoon refers to : *[2006]*
(a) A full moon
(b) The sea breaking into the land and then separated by the sand dunes
(c) A spot in a desert made fertile by presence of water
(d) Horse shoe shaped corel reef

**30.** Ecology deals with : *[2006]*
(a) The earth and planets
(b) The relationship between organisms and environment
(c) The life under the sea
(d) Economical growth of poor people

**31.** 'Equinox' means *[2007]*
(a) days are longer than nights
(b) days and nights are equal
(c) days are shorter than nights
(d) none of the above

**32.** Which country leads in production of aluminium and aluminium goods ? *[2007]*
(a) Australia (b) U.S.
(c) Russia (d) Japan

**33.** Which is an ore of aluminium? *[2007]*
(a) chromite (b) cuprite
(c) bauxite (d) siderite

**34.** The southern tip of India is *[2008]*
(a) Cape Comorin (Kanyakumari)
(b) Point Calimere
(c) Indira Point in Nicobar Islands
(d) Kovalam in Thiruvananthapuram

**35.** The major coffee producing state in India is
(a) Kerala (b) Karnataka *[2008]*
(c) Tamil Nadu (d) West Bengal

**36.** Bauxite is an ore of *[2008]*
(a) Aluminium (b) Boron
(c) Lead (d) Silver

**37.** Which of the following methods is used to determine the age of the earth ? *[2008]*
(a) Carbon dating (b) Germanium dating
(c) Uranium dating (d) All of the above

**38.** The coastal tract of Andhra Pradesh and Tamil Nadu is called *[2009]*
(a) Konkan (b) Coromandel
(c) East Coast (d) Malabar Coast

**39.** Diamond bearing rocks occur in *[2010]*
(a) Panna of Madhya Pradesh
(b) Mysore of Karnataka
(c) Waltair of Andhra Pradesh
(d) Ajmer of Rajasthan

**40.** Highest mustard seed producing state is *[2010]*
(a) Maharashtra (b) Rajasthan
(c) U.P. (d) Gujarat

**41.** The highest city of the world is- *[2011]*
(a) Wan Chan (China) (b) La Paz (Bolivia)
(a) Tokyo (Japan) (d) New York (USA)

**42.** Kalahari desert is in *[2011]*
(a) North Africa (b) South Africa
(c) South America (d) Australia

**43.** Which of the following latitudes passes through India ? *[2011]*
(a) Equator
(b) Arctic Circle
(c) Tropic of Capricorn
(d) Tropic of Cancer

**44.** Ghataprabha is a tributary of which one of the following rivers ? ***[2012]***
(a) Ganga (b) Indus
(c) Godavari (d) Krishna

**45.** Kiel Canal connects ***[2012]***
(a) Baltic Sea and North Sea
(b) Red Ocean and Mediterranean Sea
(c) Caribbean Sea and Pacific Sea
(d) Atlantic Ocean and Pacific Ocean

**46.** The Victoria Falls in Africa is located on which river? ***[2012]***
(a) Zaire (b) Orange
(c) Zambezi (d) Niger

**47.** The project similar to T.V.A. (Tennessee Valley Authority) of U.S.A. in India is ***[2013]***
(a) Damodar Valley Project
(b) Mahanadi Delta Project
(c) Ramganga Multipurpose Project
(d) Idukki Project

**48.** Catch crops are ***[2013]***
(a) crops palnted to attract certain insect pests to be destroyed
(b) crops planted to attract certain useful insects to be used for biological control of pests
(c) crops to be cut and fed green to the cattle
(d) substitute crops planted after the regular crop has failed.

**49.** Which one of the following National Park/ Sanctuary is not in Rajasthan ? ***[2013]***
(a) Sariska National Park
(b) Sambar Wildlife Sanctuary
(c) Rajaji National Park
(d) Rhanthambore National Park

**50.** The black part of the moon is always calm and dark which is called ***[2014]***
(a) Sea of tranquility (b) Ocean of storms
(c) Area of storms (d) None of these

**51.** The earth's magnetic field always has a vertical component except at the ***[2014]***
(a) magnetic equator
(b) magnetic poles
(c) geographic north pole
(d) latitude 45°

**52.** Which place in India is called "The Golden Mine of Liverworts"? ***[2014]***
(a) Eastern Himalayas
(b) Western Himalayas
(c) Western Ghats
(d) Eastern Ghats

**53.** As per data, which two Indian cities are at highest risk of being devastated by an earthquake?
(a) Guwahati and Nagpur ***[2015]***
(b) Guwahati and Srinagar
(c) Jamnagar and Guwahati
(d) Nagpur and Srinagar

**54.** Which is the hottest planet of the solar system.
(a) Mercury (b) Venus ***[2016]***
(c) Jupiter (d) Saturn

**55.** Which one of the following zones of the atmosphere is rich in Ozone gas ***[2016]***
(a) Mesosphere (b) Troposphere
(c) Stratosphere (d) Ionosphere

**56.** A sand deposit extending into the mouth of a bay is a ? ***[2016]***
(a) Headland (b) Sea Stack
(c) Split (d) Berm

**57.** Which is the Highest milk producer in India? ***[2016]***
(a) Madhya Pradesh (b) Andhra Pradesh
(c) Uttar Pradesh (d) Rajasthan

**58.** Which is the longest bridge in India? ***[2017]***
(a) Bandra Worli Sea Link
(b) Mahatma Gandhi Setu
(c) Dhola-Sadia Bridge
(d) Arrah-Chhapra Bridge

**59.** Asia's longest bi-direction road tunnel is located in————. ***[2017]***
(a) Jammu & Kashmir
(b) Sikkim
(c) Maharashtra
(d) Himachal Pradesh

**ANSWER KEY**

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

Chapter

# 4 G.K. – General Science

**1.** Halleys comet will be seen in : ***[1997]***
(a) 2062 (b) 2060
(c) 2068 (d) 2066

**2.** Skylab was launched into space by the US in :
(a) 1975 (b) 1974 ***[1997]***
(c) 1973 (d) 1979

**3.** Which one of the following is responsible for the disease 'dropsy' ? ***[1999]***
(a) *Argemone maxicana*
(b) *Brassica oleracea*
(c) *Oenothera lamarckiana*
(d) *Brassica campestris*

**4.** Which of the following vitamin is required in bone formation ? ***[1999]***
(a) D (b) B
(c) C (d) A

**5.** Ecology is the branch of science which deals with : ***[1999]***
(a) cell structure (b) soils surface
(c) balance of nature (d) human anatomy

**6.** The disease rheumatism effects : ***[1999]***
(a) legs (b) ears
(c) lungs (d) joints

**7.** Weight of blood in the body is : ***[2000]***
(a) about 7 litres in normal body of 7% of the total body weight
(b) about 5 litres in normal body or 5% of the total body weight
(c) about 10 litres in normal body or 10% of the body weight
(d) none of these

**8.** The earthquake is measured by : ***[2001]***
(a) Lactometer (b) Seismograph
(c) Hygrometer (d) Barometer

**9.** AIDS is caused by : ***[2001]***
(a) Helminth (b) Protozoa
(c) Virus (d) Bacteria

**10.** Which one of the following function of the platelets occurs in our body? ***[2001]***
(a) It helps in breathing
(b) It helps in strengthening of gums
(c) It helps in circulation of blood
(d) It helps in clotting of blood

**11.** Which one of the following vitamin can be most easily synthesised inthe human body? ***[2001]***
(a) Vitamin B (b) Vitamin C
(c) Vitamin A (d) Vitamin D

**12.** The spinning of the earth on its imaginary axis is known as : ***[2002]***
(a) rotation (b) circulation
(c) orbiting (d) revolution

**13.** Which organ of the body purifies the blood ?
(a) Heart (b) Lungs ***[2002]***
(c) Kidneys (d) Pancreas

**14.** Positron Emission Tomography (PET) is one of the best methods of functional imaging because ***[2003]***
(a) isotopes of basic body elements are used for imaging
(b) isotopes with long half-lives are used
(c) isotopes with short half-lives are used
(d) positrons are directly involved used in imaging

**15.** Magnetic Resonance (MR) images are derived from the proton-bearing species present principally from water and ***[2003]***
(a) long alkane chain protons of the fatty acid moieties
(b) short alkane chain protons of the fatty acid moieties
(c) long alkene chain protons of the fatty acid moieties
(d) short alkene chain protons of the fatty acid moieties

**16.** The following separation technique depends on the molecular size of the protein : ***[2003]***
(a) chromatography on a carboxymethyl (CM) cellulose column
(b) iso-electric focusing
(c) gel filtration chromatography
(d) chromatography on a diethylaminoethyl (DEAE) cellulose column

**17.** The approximate number of genes contained in the genome of Kalpana Chawala was : ***[2003]***
(a) 40,000 (b) 30,000
(c) 80,000 (d) 1,00,000

**18.** Thanatology is the science that deals with
(a) death in all its aspects ***[2003]***
(b) solving paternity of child
(c) identification of living
(d) detection of lie

**19.** The disease, Tetanus also known as ***[2003]***
(a) Gangrene (b) Shingles
(c) Lockjaw (d) Whooping cough

**20.** It lives underwater for up to three years as nymph before emerging as a flying insect, Fossils of this insect dating back about 300 million years have been found : ***[2004]***
(a) scorpion fly (b) stone fly
(c) caddis fly (d) May fly

**21.** Rayon fibre is manufactured from : ***[2004]***
(a) petroleum (b) wood and pulp
(c) chemicals (d) naphtha

**22.** Maria Montessori's name is associated with :
(a) Christian mission ***[2004]***
(b) Child education
(c) Women's rights
(d) Mission hospitals

**23.** The noise produced in office is normally at the level of : ***[2004]***
(a) 20 db (b) 30 db
(c) 40 db (d) 60 db

**24.** Ascorbic acid is the chemical name of : ***[2005]***
(a) vitamin A (b) vitamin B
(c) vitamin C (d) vitamin D

**25.** The chemical formulae of Plaster of Paris' is
(a) $CaSO_4.2H_2O$ (b) $Ca(OH)_2$ ***[2005]***
(c) $CaSO_4.1/2H_2O$ (d) $C_2H_5OH$

**26.** Biometry refers to : ***[2006]***
(a) Identification of humans by scanning face and fingerprints
(b) Measurement of mechanical displacement in humans
(c) A method of lie detection
(d) Body length relationships across the evolutionary scale

**27.** Which one of the following is one of the two days when the sun rises exactly in the east?
(a) 14th January (b) 21st March ***[2006]***
(c) 21st June (d) 23rd December

**28.** X-rays were discovered by : ***[2006]***
(a) Wilhelm K. Roentgen
(b) H. Kissinger
(c) Sir C.V. Raman
(d) Meghnad Saha

**29.** One ream of paper equal to : ***[2006]***
(a) 100 –110 sheets
(b) 256 sheets
(c) 180 -500 sheets
(d) 1000 sheets

**30.** Which of the following gases is most toxic? ***[2006]***
(a) Carbon dioxide (b) Carbon monoxide
(c) Sulpher dioxide (d) None of these

**31.** The gas used in the manufacture of vanaspati ghee is : ***[2006]***
(a) Helium (b) Oxygen
(c) Nitrogen (d) Hydrogen

**32.** Which mirror is used as a rear view mirror in vehicles? ***[2007]***
(a) plain (b) convex
(c) concave (d) spherical

**33.** Chemical change does not take place in
(a) souring of milk into curd ***[2007, 2011]***
(b) rusting of iron in atmosphere
(c) burning of magnesium ribbon in air
(d) emitting of light by a red hot platinum wire

**34.** The process of transfer of heat by matter but without actual movement of the particles themselves is called ***[2007]***
(a) conduction (d) convection
(c) radiation (b) none of these

**35.** Only zero and one are used for operating *[2007, 2011]*
(a) Calculator (b) Computer
(c) Abacus (d) Type writer

**36.** Transistor is *[2007]*
(a) semi conductor (b) inductor
(c) modulator (d) demodulator

**37.** Computer cannot *[2007]*
(a) send message (b) read files
(c) abstract thought (d) play music

**38.** Which of the following is not a carbohydrate ?
(a) wax (b) starch *[2007]*
(c) sucrose (d) maltose

**39.** Which of the following is an eye disease?
(a) hepatitis (b) measles *[2007]*
(c) glaucoma (d) bronchitis

**40.** Which of the following is the vaccine for tuberculosis? *[2007]*
(a) OPT (b) BCG
(c) salk vaccine (d) rubella vaccine

**41.** Horns, nails and hair are *[2007]*
(a) soluble fats
(b) insoluble carbohydrates
(c) keratin proteins
(d) complex lipids

**42.** If the blood group of one parent is AB and that of the other O, the possible blood group of their child would be *[2008]*
(a) A or B (b) A or B or O
(c) A or AB or O (d) A or B or AB or O

**43.** The vitamin that helps to prevent infections in the human body is *[2008]*
(a) vitamin A (b) vitamin B
(c) vitamin C (d) vitamin D

**44.** The gas which turns into liquid at the lowest temperature among the following is *[2008]*
(a) hydrogen (b) oxygen
(c) helium (d) nitrogen

**45.** Which of the following disease is caused by a virus ? *[2008]*
(a) Diphtheria (b) Malaria
(c) Cholera (d) Hepatitis

**46.** An ECG shows the functioning of the *[2009]*
(a) Brain (b) Heart
(c) Lungs (d) Kidneys

**47.** The purest form of water is *[2009]*
(a) Tap water (b) Rain water
(c) Ground water (d) Distilled water

**48.** Which of the following means 'change' in Greek
(a) Orangutam (b) Goat *[2009]*
(c) Amoeba (d) Hydra

**49.** The velocity of light in a medium is maximum for that colour for which refractive index is *[2010]*
(a) minimum (b) maximum
(c) optimum (d) very high

**50.** Which of the following is/ are the law(s) of reflection of light? *[2010]*
(a) The angle of incidence is equal to the angle of reflection.
(b) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.
(c) Both (a) and (b).
(d) The angle of incidence is never equal to the angle of reflection.

**51.** Which of the following halo-organic compounds is used as insecticide, germicide, soil fumigant and deodorant? *[2010]*
(a) Benzene hexachloride
(b) Chlorobenzene
(c) *p*-chlorobenzene
(d) All of the above

**52.** Electronic configuration of deuterium atom is
(a) $1s^2$ (b) $2s^1$ *[2010]*
(c) $1s^1$ (d) $2s^2$

**53.** Which of the material interactions will not promote co-evolution? *[2010]*
(a) Commensalism (b) Parasitism
(c) Heterothallism (d) All of these

**54.** Bence Jones protein is associated with
(a) Lymphosarcoma
(b) Leukaemia
(c) Multiple myeloma
(d) All of these

**55.** A MODEM is connected in between a telephone line and a *[2010]*
(a) Serial port
(b) Computer
(c) Network
(d) Communication adaptor

**56.** A sequence of precise and unambiguous instructions for solving a problem in a finite number of operations is referred as *[2010]*
(a) algorithm (b) address
(c) advice (d) all of these

**57.** Polio vaccine was first prepared by *[2011]*
(a) J. Salk (b) L. Pasteur
(c) G. J. Mendel (d) Watson

**58.** The Saturn rings were discovered by *[2011]*
(a) Copernicus (b) Newton
(c) Galileo (d) none of these

**59.** $\frac{4}{25}$ coulomb of charge contains _____ electrons. *[2011]*
(a) $10^{15}$ (b) $10^{18}$
(c) $10^{20}$ (d) none of these

**60.** Fish can survive inside deep frozen ponds because *[2011]*
(a) Fish are cold blooded
(c) They hibernate
(c) Ice is a good conductor of heat
(d) There is water at 4°C below frozen ice

**61.** Which one of the following diseases is not caused by virus? *[2012]*
(a) Chicken pox (b) Measles
(c) Poliomyelitis (d) Tetanus

**62.** In the plant body, the water and minerals are transported by: *[2012]*
(a) Bast (b) Collenchyma
(c) Parenchyma (d) Xylem

**63.** What is the main constituent of natural gas ?
(a) Methane (b) Ethane *[2012]*
(c) Butane (d) Hydrogen

**64.** Which one among the following has the highest first ionisation energy ? *[2012]*
(a) Carbon (b) Fluorine
(c) Nitrogen (d) Oxygen

**65.** Chemical weathering is at its maximum in :
(a) hot and dry regions *[2012]*
(b) cold and humid regions
(c) hot and humid regions
(d) cold and dry regions

**66.** Grave's disease is caused due to: *[2013]*
(a) hyperactivity of thyroid
(b) hypoactivity of thymus
(c) hypoactivity of thyroid
(d) hyperactivity of thymus

**67.** Which one among the following is the correct order of power consumption for light of equal intensity ? *[2014]*
(a) CFL tube < Fluorescent tube < Incandescent bulb < Light emitting diode
(b) Light emitting diode < CFL tube < Fluorescent tube < Incandescent bulb
(c) CFL tube < Fluorescent tube < Light emitting diode < Incandescent bulb
(d) Incandescent bulb < Light emitting diode < Fluorescent tube < CFL tube

**68.** When a particle and an antiparticle come in contact with each other, they *[2014]*
(a) repell each other
(b) annihilate each other
(c) go undisturbed
(d) spin about a common axis

**69.** Photoelectric effect is *[2014]*
(a) an instantaneous process
(b) delayed process
(c) emission of protons
(d) emission of neutrons

**70.** Candles contains a mixture of *[2014]*
(a) Bees wax and paraffin wax
(b) Bees wax and stearic acid
(c) Paraffin wax and stearic acid
(d) Higher fatty acid

**71.** In chemical terms, what are alums used for purifying water for drinking purposes ? *[2014]*
(a) Hydrated chlorides
(b) Double nitrate
(c) Double sulphates
(d) Nitrates of aluminium

**72.** Each body segment of Earthworm is called *[2014]*
(a) Proglottid (b) Metamere
(c) Scolex (d) Rostellum

**73.** The hydraulic brake used in automobiles is a direct application of *[2014]*
(a) Archimedes' principle
(b) Torricellean law
(c) Bernoulli's Theorem
(d) Pascal's law

**74.** Of the following, which is the fastest? ***[2014]***
(a) CD-ROM (b) RAM
(c) Registers (d) Cache

**75.** 'Splenic fever' is another name for ***[2014]***
(a) FMD (b) Anthrax
(c) Cow pox (d) Mastitis

**76.** Big Bang theory explains _____? ***[2015]***
(a) Origin of Universe (b) Origin of Sun.
(c) Laws of physics. (d) None of above.

**77.** Which are the main gases present in Sun?
(a) Hydrogen and Helium ***[2015]***
(b) Hydrogen and Argon
(c) Argon and Helium
(d) Hydrogen and Carbon Dioxide

**78.** Which of the following is a non metal that remains liquid at room temperature? ***[2015]***
(a) Phosphorous (b) Bromine
(c) Chlorine (d) Helium

**79.** Which of the following metals forms an amalgam with other metals? ***[2015]***
(a) Tin (b) Mercury
(c) Lead (d) Zinc

**80.** The Bipolar disorder is related to which among the following? ***[2015]***
(a) Heart (b) Lungs
(c) Brain (d) Liver

**81.** Name the first antibiotic medicine discovered. ***[2016]***
(a) Penicillin (b) Auromycin
(c) Streptomycin (d) Ampicilin

**82.** The disease scarlet fever is caused by ***[2016]***
(a) culex mosquito
(b) housefly
(c) anopheles mosquito
(d) haemolytic streptococcal infection

**83.** In India, person unable to count fingers from a distance of how many metres is categorised as blind? ***[2017]***
(a) 3 (b) 6
(c) 7 (d) 8

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

Chapter 5

# G.K. – General Awareness

**1.** In which of the following year Olympic Games were not played ? ***[1997]***
(a) 1936 (b) 1925
(c) 1916 (d) 1932

**2.** The male cricketer who scored maximum runs in one day cricket match : ***[1997]***
(a) Azharuddin (b) Vivian Richards
(c) Sachin Tendulkar (d) Sayeed Anwar

**3.** Writer of Future Shock is ***[1997]***
(a) Bernad shaw (b) Bertrand
(c) Sewitzer (d) Alwyn Toffler

**4.** Deep Blue is a : ***[1997]***
(a) computer which gives weather report
(b) computer operating system
(c) blue whale
(d) computer which plays chess

**5.** The 'AIDS' day is observed on : ***[1997]***
(a) 10th Dec. (b) 21st Dec.
(c) 20 Dec. (d) 1st Dec.

**6.** Asian Games were held in India : ***[1997]***
(a) 1961 and 1984 (b) 1956 and 1986
(c) 1962 and 1984 (d) 1957 and 1982

**7.** Ruble is the currency of : ***[1997]***
(a) USSR (b) Denmark
(c) Germany (d) Japan

**8.** The trade name IBM associated with : ***[1997]***
(a) scooters (b) refrigerators
(c) cars (d) computers

**9.** Which plant was responsible for Bhopal Gas Tragedy? ***[1997]***
(a) BHEL
(b) Union Carbide
(c) Hindustan Insecticides
(d) None of these

**10.** Libra is the currency of which of the following country? ***[1998]***
(a) Spain (b) Vietnam
(c) Philippines (d) Turkey

**11.** Which one of the following is the biggest cave temple in India ? ***[1998]***
(a) Ajanta (b) Tuljapur
(c) Ellora (d) Parli

**12.** The largest airport in the world is situated in
(a) Saudi (b) USSR ***[1998]***
(c) Russia (d) Denmark

**13.** Martyr day is observed on : ***[1998]***
(a) 18 April (b) 12 May
(c) 29 August (d) 30 January

**14.** National Housing Bank is subsidary of : ***[1998]***
(a) R.B.I. (b) I.D.B.I.
(c) I.C.I.C.I. (d) S.B.I.

**15.** What is Nikkie? ***[1998]***
(a) Index of shares in Tokyo stock exchange
(b) Rate of interest by Bank of tokyo
(c) A private firm situated in Japan
(d) Currency of Korea

**16.** 'Frank Worrel was associated with which of the following sport ? ***[1998]***
(a) Hockey (b) Football
(c) Swimming (d) Cricket

**17.** India's multi largest surface to air missile is known as : ***[1998]***
(a) Nag (b) Agni
(c) Prithvi (d) Akash

**18.** Beighton cup in India is associated with : ***[1998]***
(a) Cricket (b) Foot ball
(c) Volley ball (d) Hockey

**19.** Which one of the following book is written by Sarojini Naidu ? ***[1998]***
(a) Gandevata (b) Chitra
(c) Broken wing (d) Great Tragedy

**20.** The common wealth games of 1998 were hosted by
(a) Singapore (b) England ***[1998]***
(c) Malaysia (d) Australia

**21.** The old name of Thailand is : ***[1998]***
(a) Combodia (b) Siam
(c) Zaire (d) Persia

**22.** Which one of the following country is not the member of SAARC ? ***[1999]***
(a) Maldeiv (b) Bangladesh
(c) Nepal (d) Myanmar

**23.** Hari Prasad Chaurasia is related to which of the following instrument ? ***[1999]***
(a) Tabla (b) Flute
(c) Violin (d) Santoor

**24.** Which of the following missile of India has the longest range ? ***[1999]***
(a) Akash (b) Prithvi
(c) Pinaka (d) Both (b) and (c)

**25.** Which one of the following is the cave temple in India ? ***[1999]***
(a) Ellora (b) Ajanta
(d) Parli (d) Tuljapur

**26.** Which one of the following pair is incorrect ?
(a) Kapil – Cricket ***[1999]***
(b) M. F. Husain – Actor
(c) Abul Fazal – Author
(d) Feroz Gandhi – Politics

**27.** The great poetry 'Madhushala' was composed by : ***[1999]***
(a) Mulk Raj Anand
(b) Harivansh Rai Bachchan
(c) Mahadevi Verma
(d) Surender Sharma

**28.** Grand prix is a term associated with : ***[1999]***
(a) Chess (b) Table tennis
(c) Hockey (d) Badminton

**29.** William's cup is related to : ***[2000]***
(a) basket ball (b) table tennis
(c) volley ball (d) foot ball

**30.** Full form of H.T.T.P. is : ***[2000]***
(a) Hyper Terminal Transformation
(b) Hyper Text Transfer Protocol
(c) High Technology Test Principles
(d) Hyper Text Training Program

**31.** Tallest tower in the world is : ***[2000]***
(a) C.N.Tower (b) Kutub Minar
(c) Angel (d) None of these

**32.** 'The Satanic Verses' a controversial book is written by : ***[2000]***
(a) Gyani Jail Singh (b) Khuhwant Singh
(c) Kuldip Nayyar (d) Salman Rushdie

**33.** World Tourism day was declared on : ***[2000]***
(a) 1st October (b) 11th February
(c) 27th September (d) none of these

**34.** Which one of first Indian missile (earth to earth) was tested successfully from Shri Hari Kota ?
(a) Prithvi (b) Nag ***[2000]***
(c) Agni (d) none of these

**35.** "Divine" comedy was written by : ***[2000]***
(a) Goethe (b) Milton
(c) Dante (d) Shakespears

**36.** 'Abhigyan shakuntalam' was written by : ***[2000]***
(a) Surdas (b) Tulsidas
(c) R.N. Tagore (d) Kalidas

**37.** Who was known as the " Lady of the Lamp"?
(a) Sarojini Naidu ***[2000]***
(b) Joan of Arc
(c) Florence Nightinagale
(d) None of these

**38.** Rial is the currency of : ***[2000]***
(a) Afganistan (b) Iran
(c) Saudi Arabia (d) Jordan

**39.** The writer of "Daughter of East" is : ***[2001]***
(a) Indira Gandhi (b) Benazier Bhutto
(c) Amrita Pritam (d) Marget Tatcher

**40.** Which one of the following is the largest bridge?
(a) Seawise (b) Petronas ***[2001]***
(c) Strahov (d) George

**41.** Teacher day is celebrated on : ***[2001]***
(a) 5th September (b) 16 August
(c) 21 September (d) 1st April

**42.** Who discovered the sea route to India? ***[2001]***
(a) Vasco de Gama (b) Columbus
(c) Magellan (d) Hopkins

**43.** Garba dance is a dance style of : ***[2001]***
(a) Gujrat (b) Uttar Pradesh
(c) Nagaland (d) Bihar

**44.** A former cricketer after whose name no championship has been started in India : ***[2001]***
(a) G. K. Naidu (b) Daleep Singh
(c) Lala Amarnath (d) Vijay Merchant

**45.** Currency note bearts the signature of the : ***[2001]***
(a) Finance Minister
(b) Governor, Reserve Bank of India
(c) Cabinet Secretary
(d) President

**46.** When was the first football world cup held?
(a) 1930 (b) 1950 ***[2002]***
(c) 1954 (d) 1968

**47.** 'Human Organ Development Centre for Transplantation' is going to be established in India at : ***[2002]***
(a) Vellore (b) Mumbai
(c) Hyderabad (d) Chennai

**48.** July 11 is celebrated as ***[2002]***
(a) Doctor's Day
(b) Van Mahotsava Day
(c) AIDS Day
(d) World Population day

**49.** Which one of the classical dance forms originated in Andhar Pradesh? ***[2002]***
(a) Odissi (b) kathakali
(c) Kuchipudi (d) Bharat Natyam

**50.** Who is called Nightingale of India ***[2002]***
(a) Indira Gandhi
(b) Lata mangeshker
(c) Asha Bhonsle
(d) Sarojini Naidu

**51.** In Internet what does 'http' mean? ***[2003]***
(a) High Transfer Text Protocol
(b) Highest Transfer Text Protocol
(c) Hyper Text Transfer Protocol
(d) Hyper Transfer Text Protocol

**52.** The India-born US physicist who was awarded the Nobel Prize in Physics for his work on astrophysics is : ***[2003]***
(a) H. G. Khorana
(b) Subrahmanyam Chandrashekhar
(c) Sivaramakrishna Chandrashekhar
(d) C.V Raman

**53.** Which German Physicist invented the electron microscope which won him the 1986 Nobel Prize in Physics ? ***[2003]***
(a) E. Ruska (b) Van't Hoff
(c) J. H. D. Jensen (d) Eugene P. Wigner

**54.** Who was the first Indian to be awarded the world Food Prize in 1987? ***[2003]***
(a) M. S. Swaminathan
(b) Sunderlal Bahuguna
(c) Anna Hazare
(d) B. R. Barwale

**55.** Israel's Prime Minister Yitzhak Rabin won the Nobel Prize for : ***[2003]***
(a) Peace (b) Literature
(c) Chemistry (d) Economics

**56.** Who was the world's first space tourist? ***[2003]***
(a) Desmond Rickett (b) Dennis Tito
(c) Igor Kajlnikov (d) Li Wang

**57.** How many "World Cultural Hertitage Sites" are in India ? ***[2003]***
(a) 10 (b) 17
(c) 14 (d) 15

**58.** Birbal Sahni was a : ***[2004]***
(a) zoologist
(b) founder of Central Drug Research Institute
(c) ornithologist
(d) paleobotanist

**59.** Primary sector refers to : ***[2004]***
(a) industry (b) agriculture
(c) trade (d) banks

**60.** All of the following won the title of 'Miss World' except : ***[2004]***
(a) Lara Dutta (b) Aishwarya Rai
(c) Yukta Mukhi (d) Priyanka Chopra

**61.** All of the following are correct about 'Media Lab' except : ***[2004]***
(a) the third media lab is situated in india
(b) it is supported by government funding
(c) it is interdisciplinary i.e., involves sociologists, economist, computer sciences etc.
(d) it plans to produce wearable computer

**62.** Who one of the following is a medical doctor ?
(a) Samuel Taylor Coleridge ***[2004]***
(b) John Webster
(c) Somerset Maugham
(d) Thomas Gray

**63.** Who was the first Indian to win Nobel Prize?
(a) Mother Terresa ***[2005]***
(b) C.V. Raman
(c) Ravindra Nath Tagore
(d) Amartya Sen

**64.** Oldest religious text in the world is : ***[2005]***
(a) Rig Veda (b) Sama Veda
(c) Yajur Veda (d) Atharva Veda

**65.** Who is the inventor of 'Insulin'? ***[2005]***
(a) Loard Lister (b) Jonos Salk
(c) Ronald Ross (d) Banting and Best

**66.** Who is the author of 'An Area of Darkness'?
(a) Nirad C. Choudhari ***[2005]***
(b) Vikram Seth
(c) V.S. Naipaul
(d) B.C. Chatterjee

**67.** Which one of the following literary titles is correctly matched with its author? ***[2006]***
(a) Ramayan – Tulsidas
(b) Mahabharat – Vedvyas
(c) Kumarsambhav – Ravidas
(d) Shakuntala – Bhushan

**68.** The jungle in Rudyard Kippling's Jungle book, describes which part of Indian forest ? ***[2006]***
(a) Central Indian forest near Satpura range
(b) Uttranchal thick forest
(c) Himalayan Forest in Himachal
(d) Nilgiri Jungles

**69.** Which of the following honour is given by UNESCO? ***[2006]***
(a) The Kalinga Prize
(b) Magasay Award
(c) Pulitzer Prize
(d) Order of the Golden Ark Award

**70.** 'Body line' in the cricket refers to : ***[2006]***
(a) Bowling that hits the body
(b) The line of body chose to wicket line
(c) The white line on ground within which the player sands
(d) The line of moving ball

**71.** 'Hindu view of life' is written by : ***[2006]***
(a) S.Radhakrishnan (b) R.K. Narayan
(c) V.D. Savarkar (d) John Ruskin

**72.** The compilation "Meri Ekyawan Kavitayen's is by *[2007]*
(a) A.B. Vajpayee
(b) Harivanshrai Bachchan
(c) Dharam Vir Bharti
(d) Shiv Mangal Singh Suman

**73.** Who was known as "Nightingale of India"? *[2007]*
(a) Vijaylaxmi Pandit (b) Sarojini Naidu
(c) Suraiya (d) None of these

**74.** Kalidas was *[2007]*
(a) A poet during the Gupta period
(b) A dramatist during Harshvardhana's reign
(c) An astronomer during Gupta period
(d) None of the above

**75.** India's first human DNA Bank has been setup in
(a) Patna (b) New Delhi *[2008]*
(c) Lucknow (d) Kolkata

**76.** What is the motto incorporated under our National Emblem ? *[2008]*
(a) Satyam Shivam
(b) Satyam Shivam Sundaram
(c) Satyameva Jayate
(d) Jai Hind

**77.** Bhabha Atomic Research Centre is situated in
(a) Delhi (b) Mumbai *[2009]*
(c) Chennai (d) Hyderabad

**78.** FERA in India has been replaced by *[2009]*
(a) FEPA (b) FEMA
(c) FENA (d) FETA

**79.** The missile Agni II of India is a *[2009]*
(a) Nuclear missile
(b) Surface-to-air missile
(c) Surface-to-surface missile
(d) Surface-to-sea missile

**80.** Amjad Ali Khan is a maestro with which instrument? *[2009]*
(a) Violin (b) Sitar
(c) Sarod (d) Sarangi

**81.** With which sport do you associate the name of Geet Sethi? *[2009]*
(a) Golf (b) Billiards
(c) Lawn Tennis (d) Cricket

**82.** In which of the following games, left hand is not to be used? *[2009]*
(a) Tennis (b) Hockey
(c) Polo (d) cricket

**83.** Among countries given below, Albert Einstein had citizenship of which country along with Germany and US? *[2009]*
(a) Sweden (b) Austria
(c) Israel (b) Netherlands

**84.** Environment Day is celebrated on *[2009]*
(a) 5th June (b) 11th Sep.
(c) 20th Feb. (d) 5th Oct.

**85.** Among which of the below is a script? *[2009]*
(a) Hindi (b) English
(c) Gurumukhi (d) Sanskrit

**86.** On which cartoon character's name a gene is also named : *[2009]*
(a) Tintin (b) Sonic
(c) Asterix (d) Obedix

**87.** Which of the following river's name means 'Elephant -river' *[2009]*
(a) Krishna (b) Errabadi
(c) Godavari (d) Mahanadi

**88.** Reserve Bank of India's emblem carries the sketch of a tiger and a tree. What kind of tree is depicted in this emblem? *[2010]*
(a) Palm tree (b) Cactus
(c) Banyan (d) Banana

**89.** The term 'smash' in sports is associated with
(a) Lawn Tennis (b) Badminton
(c) Volleyball (d) Hockey

**90.** Match List-1 (personality) with List-II (their field of activity) and select the correct combination/ option : *[2010]*

| | **List - I** | **List - II** |
|---|---|---|
| (A) | Yamini Krishnamurthy | (1) Paintings |
| (B) | Wasim Jaffar | (2) Politics |
| (C) | Raja Ravi Verma | (3) Bharat Natyam |
| (D) | Rahul Gandhi | (4) Cricket |

**Code :**

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

**91.** Which of the following sites has been included in UNESCO's list of World Heritage sites? *[2010]*
(a) Akbar's Tomb at Sikandara
(b) Gateway of India (Mumbai)
(c) Agra Fort
(d) Bibi ka Maqbara (Aurangabad)

**92.** With which program, the slogan 'Do Boond Jindgi Ki' is associated? *[2010]*
(a) Blood Donation (b) Save Water
(c) Pulse Polio (d) Pollution Control

**93.** On whose birthday is Teacher's Day celebrated?
(a) S. Radhakrishnan *[2011]*
(b) Maulana Abul Kalam Azad
(c) Rajendra Prasad
(d) Jawaharlal Nehru

**94.** Dronacharya Award is given to *[2011]*
(a) fire fighting operation
(b) archery
(c) outstanding coaching in sports and games
(d) outstanding coaching in athletics

**95.** Yuan is the currency of *[2011]*
(a) China (b) Indonesia
(c) Thailand (d) Japan

**96.** National game of Australia is *[2011]*
(a) base -ball (b) cricket
(c) rugby football (d) hockey

**97.** Which one of the following pairs is not correctly matched ? *[2012]*

| | State/U.T. | | High Court |
|---|---|---|---|
| (a) | Goa | – | Bombay |
| (b) | Andaman and Nicobar Islands | – | Calcutta |
| (c) | Sikkim | – | Guwahati |
| (d) | Pondicherry | – | Madras |

**98.** Who is the author of Das Kapital ? *[2012]*
(a) Karl Marx (b) Friedrich Engels
(c) Joseph Stalin (d) Vladimir Lenin

**99.** Which National Highway connects Delhi and Mumbai? *[2012]*
(a) NH 6 (b) NH 8
(c) NH 10 (d) NH 12

**100.** Who among the following advocated scientific socialism? *[2012]*
(a) Robert Owen
(b) Proudhon Pierre Joseph
(c) Karl Marx
(d) Saint Simon Henri Claude

**101.** Where are the headquarters of the UNO ? *[2012]*
(a) Geneva (b) The Hague
(c) New York (d) Paris

**102.** For controlling inflation, the central bank should
(a) sell Government securities in the open market *[2013]*
(b) lower the bank rate
(c) purchase Government securities in the open market
(d) lower the reserve ratio of the banks

**103.** United Nations Conference on Environment and Development is called *[2013]*
(a) Earth Summit (b) Water Summit
(c) Air Summit (d) Resource Summit

**104.** The five permanent members of the U.N. Security Council are *[2013]*
(a) China, France, Russia, U.K. and U.S.A.
(b) China, Canada, France, U.S.A and Germany
(c) China, Germany, Russia, U.K. and U.S.A.
(d) China, Germany, U.S.A., U.K and Canada

**105.** Which of the following is not correctly paired?
(a) Jwala Gutta — Tennis *[2013]*
(b) Virat Kohli — Cricket
(c) Harbhajan Singh — Kabaddi
(d) Saina Nehwal — Badminton

**106.** Which one of the following is an example for a non-economic good? *[2013]*
(a) Doctor's service (b) Teacher's service
(c) Mother's service (d) Banker's service

**107.** Which one of the following does not match?
(a) Hindu Marriage Act : 1955 *[2013]*
(b) Medical Termination of Pregnancy Act : 1971
(c) Domestic Violence on women Act : 1990
(d) Cruelty against Women : 1995

**108.** Ward Cunningham is famous for developing for the first time *[2013]*
(a) the free encyclopedia on Internet
(b) a computer language called 'Java'
(c) a digital camera
(d) a software which can take Hebrew language as input

**109.** Which of the following is/are instance(s) of violation of human rights? *[2013]*
1. A person was detained by the security forces while going for casting vote in Parliamentary Election.
2. A civilian was killed by the army while undertaking combing operation.

Select the correct answer using the code given below:
***Code:***
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

**110.** Navroze is a festival celebrated in India by the
(a) Hindus (b) Muslims *[2013]*
(c) Parsis (d) Christians

**111.** Who is the author of the book 'Conquest of Self'?
(a) Aurobindo Ghosh *[2014]*
(b) Rabindra Nath Tagore
(c) Mahatma Gandhi
(d) S. Radhakrishnan

**112.** Who is known as the 'Piccaso of India'? *[2014]*
(a) Amrita Shergil (b) M.F. Hussain
(c) Sudhir Vyas (d) Shafqat Hussain

**113.** Which is the capital of Mali ? *[2014]*
(a) Mopti (b) Bamako
(c) Cairo (d) Nairobi

**114.** Which one of the following though called *a garden is infact, not a garden*? *[2014]*
(a) Vrindavan Garden of Mysore
(b) Hanging Garden of Mumbai
(c) Eden Garden of Kolkata
(d) Shalimar Garden of Kashmir

**115.** Who advocated the adoption of 'PURA' model to eradicate rural poverty? ***[2014]***
(a) Dr. A. P. J. Abdul Kalam
(b) Sri Abhijit Sen
(c) Maulana Abdul Kalam Azad
(d) Prof. A. M. Patha

**116.** Who caught the wicket of Sachin Tendulkar in his last match? ***[2014]***
(a) Chris Gayle
(b) Darren Sammy
(c) Shiv Narayan Chandrapaul
(d) Dwane Bravo

**117.** Gilt-edged market stands for…..? ***[2015]***
(a) bullion market
(b) market of government securities
(c) market of guns
(d) market of pure metals

**118.** The best indicator of economic development of a country is _____? ***[2015]***
(a) Its agriculture
(b) Its transport
(c) Its gross production
(d) Its per capita income

**119.** The data of estimation of India's National income is issued by ? ***[2015]***
(a) Planning Commision
(b) National Data Center
(c) Central Statistical Organisation
(d) None of above

**120.** First five year plan in India was from? ***[2015]***
(a) 1947 – 1952 (b) 1949 – 1954
(c) 1950 – 1955 (d) 1951 – 1956

**121.** The banks are required to maintain a certain ratio between their cash in hand and total assets. This is called ? ***[2015]***
(a) Statutory Liquid Ratio
(b) Cash Reserve Ratio
(c) Liquid Ratio
(d) Statutory Ratio

**122.** Which movie has won maximum awards at the International Indian Film Awards? ***[2015]***
(a) Queen (b) Ek Villain
(c) Haider (d) PK

**123.** Who has made the first attempt to initiate economic planning in India ***[2016]***
(a) M. Visvesvaraya (b) Zakir Hussain
(c) Amarty Sen (d) Narendra MOdi

**124.** When was decimal coinage introduced in India?
(a) 1949 (b) 1965 ***[2016]***
(c) 1935 (d) 1957

**125.** Who founded the Ayurveda system of medicine? ***[2016]***
(a) Susruta (b) Thirumoolar
(c) Atreya (d) Agasthiya

**126.** What is the full form of GST? ***[2017]***
(a) General Sales Tax
(b) Goods and Sales Tax
(c) Goods and Services Tax
(d) General Services Tax

**127.** ICMR signs agreement to provide healthcare through solar based solutions.What is the full form of ICMR ***[2017]***
(a) Indian Council of Medical Research
(b) International Council of Medical Research
(c) India Council of Medical Research
(d) Indian Counciling of Medical Research

**128.** Which tiger reserve in Madhya Pradesh has become the first tiger reserve in India in officially introduce a mascot which has been named Bhoorsingh the Barasingha? ***[2017]***
(a) Kanha Tiger Reserve
(b) Kaziranga Tiger Reserve
(c) Buxa Tiger Reserve
(d) Sunderbans Tiger Reserve

**ANSWER KEY**

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

Chapter 6

# G.K. – Current Affairs

**1.** Noble Prize for physiology and medicine for the year 1998 was given for the discovery of :
(a) Prion (b) Viagra ***[1999]***
(c) Streptomycin (d) Invading germs

**2.** How many countries adopted Euro currency?
(a) 11 (b) 6 ***[1999]***
(c) 9 (d) 8

**3.** Present speaker in 12th Lok Sabha is : ***[1999]***
(a) G. M. C. Balayogi
(b) Nazma Haptullah
(c) P. A. Sangama
(d) Murali Manohar Joshi

**4.** Miss Universe event 2000 was held at ***[2001]***
(a) Peuotro Rico
(b) London
(c) Paris
(d) Nicosia (Cyprus)

**5.** Who was chosen 'Time Magazines Person' for the year 2001? ***[2002]***
(a) Collin Powel (b) Mike Monore
(c) George Bush (d) Rudolf Guilani

**6.** Which of the following Hindi Indian movies Language film for Oscar Award 2002? ***[2002]***
(a) Mansoon Wedding
(b) Dil Chahata Hai
(c) Gadar Ek Prem Katha
(d) Lagaan

**7.** Men's Single US Open, 2001 Championship won by : ***[2002]***
(a) Leyton Herwitt (b) Pete Sampras
(c) Safin (d) Stefan Edberg

**8.** Who is CEAT International Cricketer of the year 2000-2001? ***[2002]***
(a) Sachin Tendulkar
(b) Muttiah Muralitharan
(c) Shane Warne
(d) Brayan Lara

**9.** When seen from earth, which of the following planet eclipsed (crossed a cross) of the sun on 7 May, 2003? ***[2003]***
(a) Mercury (b) Uranus
(c) Saturn (d) Jupiter

**10.** In the year (2003) the chemistry Nobel Prize was awarded to the following work : ***[2004]***
(a) aquaporins (b) $Na^{++}$ channels
(c) $Ca^{++}$channels (d) methyl chavicol

**11.** Who is known as 'Deshbandhu'? ***[2004]***
(a) Chandra Shekhar (b) C.R Das
(c) A.O. Hume (d) Annie Besant

**12.** The Ramakrishna Mission was established by
(a) Swami Vivekananda ***[2004]***
(b) Ramakrishna Paramhansa
(c) Swami Dayanand Saraswati
(d) None of these

**13.** In which space Shuttle Kalpana Chawla killed
(a) Discovery (b) Columbia ***[2005]***
(c) Sputnik (d) None of the above

**14.** A very much publicized treatment method "DOTS" is being adopted for the cure of :
(a) Dementia ***[2006]***
(b) Tetanus
(c) Tuberculosis
(d) Sexually transmitted disease

**15.** Which of the following Indian circket player after India-Pakistan ODI (one-day International) at Abudhabi became no. 1 ODI batsman in the ICC (international Cricket Club) ranking : ***[2006]***
(a) Rahul Dravid (b) Yuvraj
(c) Sachin Tendulkar (d) M.S. Dhoni

**16.** Who is the highest wicket taker in Indian Cricket team ? ***[2007]***
(a) Javagal Srinath (b) Anil Kumble
(c) Maninder Singh (d) Kapil Dev

**17.** India test-fired Agni III on ***[2008]***
(a) May 7, 2008 (b) March 20, 2008
(c) May 20, 2008 (d) March 7, 2008

**18.** The train which was started on April 14, 2008 between Kolkata (India) and Dhaka (Bangladesh) has been named ? ***[2008]***
(a) Shanti Express
(b) Maitri Express
(c) Aman Express
(d) Samjhauta Express

**19.** Which cricketer holds the record for scoring highest number of runs in a test match innings? ***[2008]***
(a) Gary Sobers (b) Vivian Richards
(c) Sunil Gavaskar (d) Brian Lara

**20.** What is the name given to the common currency of the European Union? ***[2009]***
(a) Rupee (b) Euro
(c) Rouble (d) Franc

**21.** Who has written "Two Lives'? ***[2010]***
(a) Vikram Seth (b) Kiran Desai
(c) Arundhati Roy (d) Khushwant Singh

**22.** Who amongst the following is the ICC Cricketer of the year? ***[2011]***
(a) Sachin Tendulkar (b) Kevin Pietersen
(c) M. S. Dhoni (d) Sanath Jayasuriya
(e) None of these

**23.** 'Goodbye Shahzadi' is a book written by- ***[2011]***
(a) Shyam Bhatia (b) Ashok Mehra
(c) Janardhan Thakur (d) Arun Gandhi
(e) None of these

**24.** Who is Robert Zoelick? ***[2011]***
(a) IMF Chief
(b) World Bank President
(c) ADB President
(d) Chief UNIDO
(e) None of these

**25.** Which country's Parliament has banned 'Burqa' by passing a law of 14th September, 2010?
(a) USA (b) France ***[2011]***
(c) Italy (d) Holland

**26.** Which among the following is not correct with regard to Sampoorna Garmeena Rozgar Yojana?
(1) The cash component of the programme is borne exclusively by the Central Government.
(2) Foodgrains are provided free of costs to the States/Union Territories.
Select the answer unsing the code given below:
(a) (1) only (b) (2) only ***[2012]***
(c) Both (1) and (2) (d) Neither (1) nor (2)

**27.** Which of the following countries does not belong to the group of G-8 nations? ***[2012]***
(a) Italy (b) Canada
(c) Germany (d) Australia

**28.** Who is author of *One Night @ the Call Centre* ? ***[2013]***
(a) Vikram Seth (b) Chetan Bhagat
(c) Anurag Mathur (d) Robin Sharma

**29.** Schemes run under the National Rural Employment Guarantee Act are sponsored ***[2013]***
(a) by the Central Government alone
(b) partly by the Central Government and partly by the State Government
(c) by Centre, State and Panchayat bodies together
(d) on public-private partnership basis

**30.** 'Catch Me If You Can' is a Hollywood movie made on the life of Frank Abagnale who was
(a) a famous lawyer ***[2013]***
(b) a famous swimmer
(c) a famous sprinter
(d) an infamous imposter

**31.** Who among the following was awarded the first Tagore Award for Cultural Harmony for the year 2012 ? ***[2013]***
(a) Jasraj (b) Ravi Shankar
(c) Nikhil Banerjee (d) Bhimsen Joshi

**32.** Which team has won the Men's National Hockey Championship ? ***[2015]***
(a) Karnataka (b) Telangana
(c) Indian Railways (d) Madhya Pradesh

**33.** Which bank won the Asian Banker Achievement Award ? ***[2015]***
(a) ICICI Bank
(b) Bharatiya Mahila Bank
(c) State Bank of Mysore
(d) Axis Bank

**34.** Which among the following state does not implement the National Food Security Act recently empowers 87% of the priority households? ***[2016]***
(a) Manipur
(b) Sikkim
(c) Nagaland
(d) Arunachal Pradesh

**35.** Smt. Maneka Sanjay Gandhi launched Beti Bachao Beti Padhao Scheme in additional how many districts of the country? ***[2016]***
(a) 66 (b) 67
(c) 51 (d) 61

**36.** Which Government banned digging of bore wells beyond 200ft to prevent the declining of Ground water level? ***[2016]***
(a) Tamilnadu (b) B.Karnataka
(c) Madhya Pradesh (d) Maharashtra

**37.** India is collaborated with which country on tackling offshore tax evasion and increase Co-operation in sharing of cross-border tax Information? ***[2016]***
(a) United Kingdom (b) United States
(c) Japan (d) China

**38.** Which country has been declared as drought Emergency for first time ever in the History? ***[2016]***
(a) Hungary (b) South Africa
(c) Zimbabwe (d) El Salvador

**39.** Who is the defence minister of India? ***[2017]***
(a) Sushma Swaraj (b) George Anthony
(c) Prithviraj Chauhan (d) Arun Jaitley

**40.** Who is the new chief of the Chief of the Army Staff (COAS) of the Indian Army? ***[2017]***
(a) Balbir Singh Sandhu
(b) Velu Nair
(c) Bipin Rawat
(d) Amit Sarin

**41.** The Central government has recently announced a new digital payments app called BHIM. Which of the following statements about BHIM is not true? ***[2017]***
(a) The BHIM digital payments app is based on the Unified Payments Interface
(b) It has been developed by the National Payments Corporation of India
(c) The receiver of transferred money needs to compulsorily be a BHIM user
(d) A person without a bank account cannot use BHIM

**42.** WannaCry', recently seen in the news, is which one of the following types of malware? ***[2017]***
(a) Virus (b) Worm
(c) Trojan Horse (d) Ransomware

**43.** According to Urban Jyoti Abhiyaan or Urja app which states top the list in providing uninterrupted power? ***[2017]***
(a) Jharkhand, Uttarakhand and Assam
(b) Tamil Nadu, Rajasthan and West Bengal
(c) Kerala, Maharashtra and Rajasthan
(d) Punjab, Assam and Andhra Pradesh

**44.** Who has been honoured as the Wisden's leading cricketer in the World for 2016? ***[2017]***
(a) Chris Woakes (b) Misbah-ul-Haq
(c) Younis Khan (d) Virat Kohli

**45.** How many 'priority pathogens' are listed by the World Health Organization for the first time that pose the greatest threat to human life? ***[2017]***
(a) 10 (b) 11
(c) 12 (d) 15

**ANSWER KEY**

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | (b) | **2** | (a) | **3** | (c) | **4** | (a) | **5** | (d) | **6** | (d) | **7** | (c) | **8** | (b) | **9** | (a) | **10** | (a) |
| **11** | (b) | **12** | (a) | **13** | (b) | **14** | (c) | **15** | (d) | **16** | (b) | **17** | (a) | **18** | (b) | **19** | (d) | **20** | (b) |
| **21** | (a) | **22** | (a) | **23** | (a) | **24** | (b) | **25** | (b) | **26** | (a) | **27** | (d) | **28** | (b) | **29** | (a) | **30** | (d) |
| **31** | (b) | **32** | (c) | **33** | (b) | **34** | (b) | **35** | (d) | **36** | (d) | **37** | (b) | **38** | (d) | **39** | (d) | **40** | (c) |
| **41** | (d) | **42** | (d) | **43** | (c) | **44** | (d) | **45** | (c) | | | | | | | | | | |

Chapter 7

# G.K. – Logical Thinking

**1.** A duck, a goose, a goat, and a horse all entered the bar n at different times one day last week. ***[2017]***

(1) A mammal entered the bar n first.
(2) The duck entered before the goose.
(3) The goose entered ahead of the horse.
Who entered the bar n first?

(a) A goat (b) A duck
(c) A goose (d) A horse

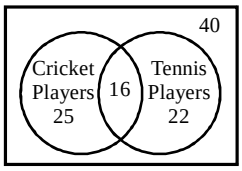
**2.** Choose or find odd word ***[2017]***

(a) Piano (b) Guitar
(c) Sitar (d) Violin

**3.** If Ram lives east of a post office. In the north of post office is big bazar. Then what is the position of Ram's house with respect to the post office? ***[2017]***

(a) North-west (b) North-east
(c) South-west (d) South-east

**4.** Find out the number of students who play only cricket. ***[2017]***




(a) 25 (b) 18
(c) 9 (d) 41

**5.** Arrange the following words as per order in the dictionary ***[2017]***

1. Eyelid 2. Eyeless 3. Eyesore 4. Eyesight

(a) 2, 1, 4, 3 (b) 2, 1, 3, 4
(c) 4, 3, 1, 2 (d) 4, 2, 3, 1

**6.** If the day before yesterday was Thursday, when will Sunday be? ***[2017]***

(a) Today
(b) Two days after today
(c) Tomorrow
(d) Day after Tomorrow

| ANSWER KEY | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | (d) | **2** | (a) | **3** | (d) | **4** | (a) | **5** | (a) | **6** | (c) |

# Mock AIIMS

**Time :** 3½ Hrs. **Questions :** 200 **Maximum Marks :** 200

**Negative Marking :** –1/3 for each incorrect answer.

## SECTION I - PHYSICS

1. A block is kept on a inclined plane of inclination $\theta$ of length $\ell$. The velocity of particle at the bottom of inclined is (the coefficient of friction is $\mu$)

   (a) $[2g\ell(\mu\cos\theta - \sin\theta)]^{1/2}$

   (b) $\sqrt{2g\ell(\sin\theta - \mu\cos\theta)}$

   (c) $\sqrt{2g\ell(\sin\theta + \mu\cos\theta)}$

   (d) $\sqrt{2g\ell(\cos\theta + \mu\sin\theta)}$

2. If earth is supposed to be a sphere of radius R, if $g_{30}$ is value of acceleration due to gravity at lattitude of 30° and g at the equator, the value of $g - g_{30}$ is

   (a) $\frac{1}{4}\omega^2 R$ (b) $\frac{3}{4}\omega^2 R$

   (c) $\omega^2 R$ (d) $\frac{1}{2}\omega^2 R$

3. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is

   (a) 1 : 2 (b) 4 : 1 (c) 8 : 3 (d) 3 : 8

4. A coil takes 15 min to boil a certain amount of water, another coil takes 20 min for the same process. Time taken to boil the same amount of water when both coil are connected in series,

   (a) 5 min (b) 8.6 min

   (c) 35 min (d) 30 min

5. Two capillary of length L and 2L and of radius R and 2R are connected in series. The net rate of flow of fluid through them will be (given rate to the flow through single capillary, $X = \frac{\pi PR^4}{8\eta L}$)

   (a) $\frac{8}{9}X$ (b) $\frac{9}{8}X$ (c) $\frac{5}{7}X$ (d) $\frac{7}{5}X$

6. A charge q is fixed. Another charge Q is brought near it and rotated in a circle of radius r around it. Work done during rotation is

   (a) zero (b) $\frac{Q.q}{4\pi\varepsilon_0 r}$

   (c) $\frac{Q.q}{2\varepsilon_0 r}$ (d) None of these

7. Advantage of optical fibre

   (a) high bandwidth and EM interference

   (b) low band width and EM interference

   (c) high band width, low transmission capacity and no EM interference

   (d) high bandwidth, high data transmission capacity and no EM interference.

8. In an electromagnetic wave, direction of propagation is in the direction of

   (a) $\vec{E}$ (b) $\vec{B}$

   (c) $\vec{E} \times \vec{B}$ (d) None of these

9. $F_1$ and $F_2$ are focal length of objective and eyepiece respectively of the telescope. The angular magnification for the given telescope is equal to

   (a) $\frac{F_1}{F_2}$ (b) $\frac{F_2}{F_1}$

   (c) $\frac{F_1 F_2}{F_1 + F_2}$ (d) $\frac{F_1 + F_2}{F_1 F_2}$

10. Critical velocity of the liquid

    (a) decreases when radius decreases

    (b) increases when radius increases

    (c) decreases when density increases

    (d) increases when density increases

11. An organ pipe, open from both end produces 5 beats per second when vibrated with a source of frequency 200 Hz. The second harmonic of the same pipes produces 10 beats per second with a source of frequency 420 Hz. The fundamental frequency of organ pipe is
(a) 195 Hz (b) 205 Hz
(c) 190 Hz (d) 210 Hz

12. Two rings of radius R and nR made up of same material have the ratio of moment of inertia about an axis passing through centre as 1 : 8. The value of n is
(a) 2 (b) $2\sqrt{2}$ (c) 4 (d) $\frac{1}{2}$

13. One drop of soap bubble of diameter D breaks into 27 drops having surface tension $\sigma$. The change in surface energy is
(a) $2\pi\sigma D^2$ (b) $4\pi\sigma D^2$
(c) $\pi\sigma D^2$ (d) $8\pi\sigma D^2$

14. The gas having average speed four times as that of $SO_2$ (molecular mass 64) is
(a) He (molecular mass 4)
(b) $O_2$ (molecular mass 32)
(c) $H_2$ (molecular mass 2)
(d) $CH_4$ (molecular mass 16)

15. A container having 1 mole of a gas at a temperature 27°C has a movable piston which maintains at constant pressure in container of 1 atm. The gas is compressed until temperature becomes 127°C. The work done is ($C_p$ for gas is 7.03 cal/mol-K)
(a) 703 J (b) 814 J (c) 121 J (d) 2035 J

16. An electron having mass ($9.1 \times 10^{-31}$ kg) and charge ($1.6 \times 10^{-19}$ C) moves in a circular path of radius 0.5 m with a velocity $10^6$ m/s in a magnetic field. Find the strength of magnetic field.
(a) $1.13\times10^{-5}$ T (b) $5.6\times10^{-6}$ T
(c) $2.8\times10^{-6}$ T (d) None of these

17. A cylinder rolls down an inclined plane of inclination 30°, the acceleration of cylinder is
(a) $\frac{g}{3}$ (b) g (c) $\frac{g}{2}$ (d) $\frac{2g}{3}$

18. A period of a planet around Sun is 27 times that of Earth. The ratio of radius of planet's orbit to the radius of Earth's orbit is
(a) 4 (b) 9 (c) 64 (d) 27

19. 3 particles each of mass m are kept at vertices of an equilateral triangle of side L. The gravitational field at centre due to these particles is
(a) 1.5 V (b) 2.0 V (c) 2.5 V (d) 5 V

(a) zero (b) $\frac{3GM}{L^2}$ (c) $\frac{9GM}{L^2}$ (d) $\frac{12}{\sqrt{3}}\frac{GM}{L^2}$

20. A solid sphere of radius R is rolling with velocity v on a smooth plane. The total kinetic energy of sphere is
(a) $\frac{7}{10}mv^2$ (b) $\frac{3}{4}mv^2$
(c) $\frac{1}{2}mv^2$ (d) $\frac{1}{4}mv^2$

21. A diode having potential difference 0.5 V across its junction which does not depend on current, is connected in series with resistance of $20\Omega$ across source. If 0.1 A current passes through resistance then what is the voltage of the source?
(a) 1.5 V (b) 2.0 V (c) 2.5 V (d) 5 V

22. Potentiometer wire of length 1 m is connected in series with $490\Omega$ resistance and 2 V battery. If 0.2 mV/cm is the potential gradient, then resistance of the potentiometer wire is
(a) 4.9 Ω (b) 7.9 Ω
(c) 5.9 Ω (d) 6.9 Ω

23. A dipole is placed parallel to the electric field. If W is the work done in rotating the dipole by 60°, then work done in rotating it by 180° is
(a) 2 W (b) 3 W (c) 4 W (d) $\frac{W}{2}$

24. An electron of charge e moves in a circular orbit of radius r around the nucleus at a frequency ν. The magnetic moment associated with the orbital motion of the electron is
(a) $\pi\nu er^2$ (b) $\frac{\pi\nu r^2}{e}$ (c) $\frac{\pi\nu e}{r}$ (d) $\frac{\pi er^2}{\nu}$

25. A and B are two identically spherical charged bodies which repel each other with force F, kept at a finite distance. A third uncharged sphere of the same size is brought in contact with sphere B and removed. It is then kept at mid point of A and B. Find the magnitude of force on C.

(a) $\frac{F}{2}$ (b) $\frac{F}{8}$ (c) F (d) Zero

26. A composite rod made of copper

$(\alpha = 1.8\times10^{-5}K^{-1})$ and steel

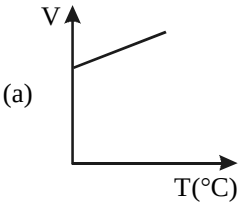
$(\alpha = 1.2\times10^{-5}K^{-1})$ is heated then it

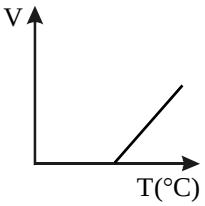
(a) bends with steel on convex side
(b) bends with copper on convex side
(c) does not expand
(d) data is insufficient

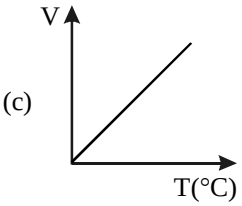
27. A wave has the equation y = 0.1 sin $[100\pi t - kx]$ and wave velocity 100 m/s, its wave number is equal to

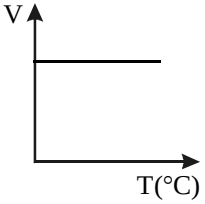
(a) $1m^{-1}$ (b) $2m^{-1}$
(c) $\pi m^{-1}$ (d) $2\pi m^{-1}$

28. Volume temperature graph at atmospheric pressure for a monatomic gas (V in $m^3$, T in °C) is

(a) 


(b) 


(c) 


(d) 


29. In X-ray experiment $K_\alpha$, $K_\beta$ denotes

(a) characteristic lines
(b) continuous wavelength
(c) $\alpha$, $\beta$ emissions respectively
(d) None of these

30. The ratio of frequencies of two pendulums are 2 : 3, then their length are in ratio

(a) $\sqrt{\frac{2}{3}}$ (b) $\sqrt{\frac{3}{2}}$ (c) $\frac{4}{9}$ (d) $\frac{9}{4}$

31. The value of escape velocity on a certain planet is 2 km/s. Then the value of orbital speed for a satellite orbiting close to its surface is

(a) 12 km/s (b) 1 km/s
(c) $\sqrt{2}$ km/s (d) $2\sqrt{2}$ km/s

32. The electrochemical equivalent of a metal is $3.3 \times 10^{-7}$ kg/C. The mass of metal liberated at cathode by 3 A current in 2 sec will be

(a) $19.8\times10^{-7}$ kg (b) $9.9\times10^{-7}$ kg
(c) $6.6\times10^{-7}$ kg (d) $1.1\times10^{-7}$ kg

33. For a paramagnetic material, the dependence of the magnetic susceptibility, $\chi$ on the absolute temperature is given as

(a) $\chi \propto T$ (b) $\chi \propto \frac{1}{T^2}$
(c) $\chi \propto \frac{1}{T}$ (d) Independent

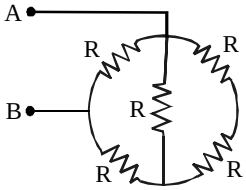
34. An optically active compound

(a) rotates the plane polarised light
(b) changes the direction of polarised light
(c) do not allow plane polarised light to pass through
(d) none of the above

35. Three particles A, B and C are thrown from the top of a tower with the same speed. A is thrown up, B is thrown down and C is horizontally. They hit the ground with speeds $V_A$, $V_B$ and $V_C$ respectively.

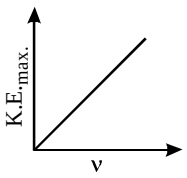
(a) $V_A = V_B = V_C$ (b) $V_A = V_B > V_C$
(c) $V_B > V_C > V_A$ (d) $V_A > V_B = V_C$

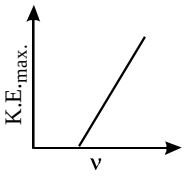
36. The equivalent resistance between A and B is

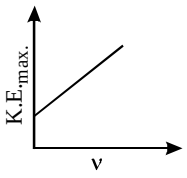


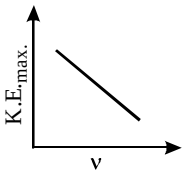

(a) $\frac{8R}{5}$ (b) $\frac{5R}{8}$ (c) $\frac{3R}{8}$ (d) $\frac{7R}{8}$

37. The variation of maximum kinetic energy photoelectrons with applied frequency ($\upsilon$) is

(a) 


(b) 


(c) 


(d) 


38. The angle of projection $\theta$ for which range is equal to maximum height attained by projectile is

(a) $\tan^{-1} 4$ (b) $\tan^{-1} 5$

(c) $\tan^{-1} 4/5$ (d) $\tan^{-1} 5/4$

39. The range of projectile will be maximum, when angle of projection is

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) None

40. Forces of 4 N and 5 N are applied at origin along x-axis and y-axis respectively. The resultant force will be

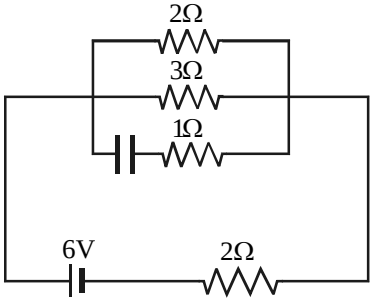
(a) $\sqrt{41}\text{N}, \tan^{-1}\left(\frac{5}{4}\right)$

(b) $\sqrt{41}\text{N}, \tan^{-1}\left(\frac{4}{5}\right)$

(c) $-\sqrt{41}\text{N}, \tan^{-1}\left(\frac{5}{4}\right)$

(d) $-\sqrt{41}\text{N}, \tan^{-1}\left(\frac{4}{5}\right)$

41. Current in $2\Omega$ resistor is (see given figure)




(a) 1 A (b) 1.5 A (c) 0.9 A (d) 0.6 A

42. Which of the following is false ?

(a) convex lens always forms image with $m < 1$

(b) a simple mirror produces virtual, erect and same-sized image

(c) a concave mirror produces virtual, erect and magnified image

(d) a convex lens can produce real and same-sized image.

43. A star having wavelength $\lambda$ is reaching with velocity $v_s$ from earth. The apparent shift in wavelength will be

(a) $\frac{\lambda v_s}{c}$ (b) $-\frac{\lambda v_s}{c}$

(c) $-\frac{\lambda v_s^2}{c^2}$ (d) $\frac{\lambda v_s^2}{c^2}$

44. The deflection in a galvanometer decreases from 25 divisions to 5 divisions when a resistor of $20\Omega$ is connected in series. Find resistance of galvanometer.

(a) $4\Omega$ (b) $5\Omega$ (c) $6\Omega$ (d) $7\Omega$

45. A current source drives a current in a coil of resistance $R_1$ for a time t. The same source drives current in another coil of resistance $R_2$ for same time. If heat generated is same, find internal resistance of source

(a) $\frac{R_1 R_2}{R_1 + R_2}$ (b) $R_1 + R_2$

(c) zero (d) $\sqrt{R_1 R_2}$

46. The waves used by artificial satellites for communication is

(a) microwaves (b) radio-waves, AM

(c) radio-waves, FM (d) X-rays

47. The ratio of de-Broglie wavelengths of proton and $\alpha$-particle having same kinetic energy is

(a) $\sqrt{2} : 1$ (b) $2\sqrt{2} : 1$

(c) $2 : 1$ (d) $4 : 1$

48. The dimensions of Planck's constant is

(a) $M^2L^2T^{-1}$ (b) $M^2LT^{-2}$

(c) $ML^2T^{-1}$ (d) $ML^2T^{-2}$

49. Which of these requires quantum nature of light for their explanation?

(a) diffraction (b) polarisation

(c) interference (d) black body spectrum

50. If blue light is used in place of red light in a diffraction experiment

(a) diffraction pattern remains unchanged

(b) fringes come closer

(c) fringes become broader

(d) none of these

**DIRECTION:**

**NOTE : Instructions for Q. 51 to Q. 60**

(a) Both Assertion and Reason are true and 'Reason' is the correct explanation of 'Assertion'

(b) Both Assertion and R are true and Reason is not the correct explanation of 'Assertion'

(c) 'Assertion' is true but 'Reason' is false

(d) Both 'Assertion' and 'Reason' are false

(e) Assertion is false but 'Reason' is true

51. **Assertion :** The dominant mechanism for motion of charge carriers in forward and reverse biased silicon p-n junction are drift in both forward and reverse bias.

**Reason :** In reverse biased, no current flow through the junction

**52. Assertion :** The force of repulsion between atomic nucleus and $\alpha$-particle varies with distance according to inverse square law.

**Reason :** Rutherford did $\alpha$-particle scattering experiment.

**53. Assertion :** The unpolarized light and polarized light can be distinguished from each other by using polaroid.

**Reason :** A polaroid is capable of producing plane polarised beams of light.

**54. Assertion :** An induced current develop in a conductor moved in direction parallel to the magnetic field.

**Reason :** An induced current is developed when the number of magnetic lines of force associated with conductor is changed.

**55. Assertion :** If the length of the conductor is doubled, the drift velocity will become half of the original value (keeping potential difference unchanged).

**Reason :** At constant potential difference, drift velocity is inversely proportional to the length of the conductor.

**56. Assertion :** Circuits containing capacitors should be handled cautiously even when there is no current.

**Reason :** The capacitors are very delicate and so quickly breakdown.

57. **Assertion :** The absorbance of a perfect black body is unity.

**Reason :** A perfect black body when heated emits radiations of all possible wavelengths at that temperature.

**58. Assertion :** The phase difference between two medium particle having a path difference $\lambda$ is $2\pi$.

**Reason :** The phase difference is directly proportional to path difference of a particle.

**59. Assertion :** The impurities always decrease the surface tension of a liquid.

**Reason :** The change in surface tension of the liquid depends upon the degree of contamination of the impurity.

**60. Assertion :** Orbital velocity of a satellite is greater than its escape velocity.

**Reason :** Orbit of a satellite is within the gravitational field of earth whereas escaping is beyond the gravitational field of earth.

## SECTION II - CHEMISTRY

61. Arene diazonium salt results from reaction of nitrous acid with
(a) 1° aliphatic amine
(b) 2° aromatic amine
(c) 1° aromatic amine
(d) 1° aromatic amide

62. Collidal system constituting the liquid as dispersed phase and solid as dispersion medium is
(a) gel (b) emulsion
(c) solution (d) suspension

63. Calculate number of valance electrons in complex $[Cr(H_2O)_5SCN]^{2+}$
(a) 17 (b) 15 (c) 16 (d) 19

64. The ground state valance shell electronic configuration of an element is $3d^5 4s^1$. The metal is
(a) Cr (b) Fe (c) Mn (d) V

65. X reacts with acid chloride to give ester X is
(a) Phenol (b) Benzoic acid
(c) Methnoyl chloride (d) Acid anhydride

66. Aldehyde which do not show Cannizarro reaction
(a) $H-\overset{\overset{O}{\|}}{C}-H$ (b) $(CH_3)_3-CHO$
(c) $C_6H_5CHO$ (d) $CH_3CHO$

67. Lucas test is used to distinguish between
(a) 1°, 2° and 3° amines
(b) 1°, 2° and 3° alcohol
(c) Aromatic and aliphatic acids
(d) 1°, 2° and 3° amides

68. The number of radial nodes in 5d is
(a) 1 (b) 2 (c) 3 (d) 4

69. Increasing order of electronegativity of hybrid orbital is
(a) $sp < sp^2 < sp^3$ (b) $sp > sp^2 > sp^3$
(c) $sp > sp^3 > sp^2$ (d) $sp^3 > sp > sp^2$

70. Which is longest bond ?
(a) $N_2$ (b) $O_2$ (c) $I_2$ (d) $Cl_2$

71. Hinsberg's reagent is used to distinguish between
(a) acids (b) alcohols
(c) amides (d) amine

72. Ozonolysis is relation in which double bond is cleaved to give carboxyl group. Which of these will gives formaldehyde as one of its product ?
(a) $CH_3CH=CH-CH_3$
(b) $CH_3-CH_2-CH_2=CH_3$
(c) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=CH_2CH_3$
(d) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=C\!<\!\!\begin{matrix}CH_3\\CH_3\end{matrix}$

73. Which of these reacts with Grignard reagent to give carboxylic acid?
(a) CO (b) $CO_2$
(c) RCOOR (d) HCHO

74. Dehydration of tertiary alcohals is presence of an acid involves
(a) Formation of carbocation
(b) Formation of carbanion
(c) Formation of free radical
(d) Formation of Transition state

75. Reagent of Clemmenson's reduction is
(a) $NH_2-NH_2$ (b) $Zn-Hg/HCl$
(c) $P_{red}/HI$ (d) $Pd/H_2, BaSO_4$

76. The number of structural isomer of $CrCl_3.6H_2O$ are
(a) 4 (b) 2 (c) 3 (d) 1

77. How many atoms are present in bcc ?
(a) 3 (b) 4 (c) 2 (d) 1

78. Which of following pair present pseudohalide and polyhalide respectively ?
(a) $OCN^-$ and $BrI_2^-$ (b) $RCOO^-$ and $BrI_2^-$
(c) $NNN^-$ and $IF_5$ (d) $OCN^-$ and $IF_5$

79. Units of rate constant of a given chemical reaction is $L\,mol^{-1}s^{-1}$. What is order of reaction?
(a) 0 (b) 1 (c) 2 (d) 3

80. Which of following is least paramagnetic in nature?
(a) Mn (b) Fe (c) Ni (d) Cu

81. Which among the following will have heighest B.P at 1 atm. pressure ?
(a) 0.1 M NaCl (b) 0.1 M $BaCl_2$
(c) 0.1 M Sucrose (d) 0.1 M urea

82. Which of the following has smallest ionic radii?
(a) $Na^+$ (b) $Mg^+$ (c) $F^-$ (d) $Al^{+3}$

83. Given compound is subjected to chemical analysis. Results are
I. –ve test to Ninhydrin
II. +ve test to Benedict's solution
Compound is
(a) Lipid (b) Monosaccride
(c) Protein (d) Amino acid

84. Iodoform test is show by
(a) Glycol (b) Propanaldehyde
(c) Ethanol (d) Diethyl ether

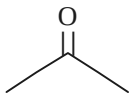
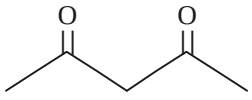
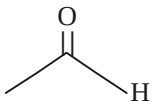
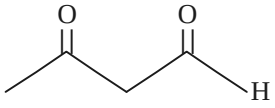
85. The correct order of penetrating power is
(a) $\gamma > \alpha > \beta$ (b) $\gamma < \alpha < \beta$
(c) $\gamma < \alpha > \beta$ (d) $\gamma > \beta > \alpha$

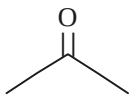
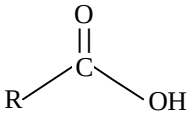
86. Given electron would enter which of the following shells first
(a) $n = 5, \ell = 0$ (b) $n = 3, \ell = 2$
(c) $n = 6, \ell = 0$ (d) $n = 5, \ell = 1$

87. $[Cr(SCN)(H_2O)_5]^{+3}$ and $[Cr(NCS)(H_2O)_5]^{+3}$ show
(a) Ionization isomerism
(b) Hydration isomerism
(c) Link age isomerism
(d) Co-ordination isomerism

88. Buna – S is polymer of
(a) Butadiene
(b) Butadiene and nitrile
(c) Butadiene and styrene
(d) Butadiene and isoprene

89. Which of following has bond order zero ?
(a) CO (b) $O_2$ (c) $F_2$ (d) $Be_2$

90. Maximum enol content is in
(a) 
(b) 
(c) 
(d) 

91. Which of following reduces Benedict's solution?
(a) 
(b) 
(c) HCHO
(d) R – O – R

92. Which of following principle/experiment shows quantisations of energy in an atom ?
(a) Heisenberg's uncertainty principle
(b) Auf baus principle
(c) Pauli's exclusion principle
(d) H-spectrum

93. Conjugate acid of $CH_3NH_2$ is
(a) $CH_3NH^-$ (b) $NH_2$
(c) $CH_3OH$ (d) $CH_3NH_3^+$

94. Sublimation energy of $I_{2(s)}$ is 57.3 kL/ mol and enthalpy of fusion is 15.5 kJ/mol.
The enthalpy of vaporisation of $I_2$ is
(a) 41.8 kJ/mol (b) 72.8 kJ/ mol
(c) – 72.8 kJ/ mol (d) – 41.8 kJ/mol

95. 2-butyne on reaction with Pd/ $BaSO_4$ gives
(a) Cis – 2 – butene (b) Trans – 2 – butene
(c) 1 – butene (d) 2 – hydroxy butene

96. If $\Delta H$ is (–) and $\Delta S$ is (+) $\Delta G$ will be
(a) (–) ve (b) (+) ion
(c) Zero (d) $> \Delta H - T\Delta S$

97. The given reaction has reagent X as $\rightarrow$

$$CH_3 - C \equiv C - CH_3 \xrightarrow[H_2O/Zn]{X} CH_3 - \underset{\underset{O}{\|}}{C} - \underset{\underset{O}{\|}}{C} - CH_3$$

(a) $O_2$ (b) $HNO_3$
(c) $O_3$ (d) $KMnO_4$

98. Which of following is most reactive towards nucleophilic substituting reaction
(a) $CH_2 = CH - Cl$
(b) $C_6H_5 - Cl$
(c) $CH_3CH = CHCl$
(d) $ClCH_2 - CH = CH_2$

99. $BaCO_3 \rightleftharpoons BaO + CO_2$ is an endothermic reaction formation of BaO is favoured by
(a) Decrease in temperature
(b) Decrease in pressure
(c) Increase in concentration
(d) Increase in pressure

100. A is 0.5M solution of $Ca(NH_3)_2$ and B is 0.75 m solution of KOH

Depression in freezing point is

(a) Greater for b due to more concentration

(b) equal in both A and B freezing point is less then zero

(c) equal to 0°C in both as ionic concentration is negligible

(d) Greater for a because number of ions is greater

101. Calculate the volume of $H_2$ gas at NTP obtained by passing 2 ampere through acidified water for 1 hour.

(a) 0.0836 L (b) 0.0432 L

(c) 0.1672 L (d) 0.836 L

102. In an antiflourite structure cation occupies

(a) Octahedral void (b) Tetra hedral void
(c) Centre of cube (d) Edges of cube

103. Which is not permissible ?

(a) $n = 3, \ell = 1, m = -1, s = \frac{1}{2}$

(b) $n = 2, \ell = 2, m = -1, s = -\frac{1}{2}$

(c) $n = 4, \ell = 2, m = -1, s = -\frac{1}{2}$

(d) $n = 4, \ell = 2, m = 2, s = -\frac{1}{2}$

104. $A \xleftarrow[\text{reagent}]{\text{Lindlar's}} CH_3 - C \equiv CH_3$

$\xrightarrow{Na/liq.NH_3}$ B; A and B are

(a) Cis, trans 2 butene

(b) Trans, trans 2 butene

(c) Cis, cis 2 butene

(d) Trans, cis 2 butene

105. Which is not true about hydrogen peroxide ?

(a) If acts as both oxidising and reducing agent
(b) If is pale blue liquid
(c) If can be oxidised by $O_3$
(d) Two OH bonds lies in same plane

106. Which is a true peroxide ?

(a) $CO_2$ (b) $MnO_2$
(c) $Na_2O$ (d) $BaO_2$

107. The conductance of Li salts is lowest of all group I metals

(a) easy difusion of $Li^+$ ion
(b) lower ability of $Li^+$ ion to polarise water molecules
(c) lowest charge to radius ratio
(d) high degree of hydration of $Li^+$

108. Which of following has highest protective power on lyophobic collids ?

(a) gum arabic (b) sodium oleate
(c) gelatin (d) starch

109. 0.1 M solution of $[Ag^+]$, $[Ba^+]$ and $[Ca^+]$ is added to solution of sodium sulphate. $K_{sp}$ values for these salts are : $BaSO_4 = 10^{-11}$; $CaSO_4 = 10^{-6}$; $Ag_2SO_4 = 10^{-5}$

Which of those will precipitate Ist ?

(a) $BaSO_4$ (b) $Ag_2SO_4$

(c) $CaSO_4$ (d) All the above

110. Which is not a reducing agent ?

(a) $LiNH_4$ (b) Na/liq ammonia

(c) Lindlar's reagent (d) $SeO_2$

**DIRECTIONS : In the following questions an Assertion (A) is given followed by a Reason (R). Mark your responses from the following options.**

(a) Both Assertion and Reason are true and Reason is the correct explanation of 'Assertion'

(b) Both Assertion and Reason are true and Reason is not the correct explanation of 'Assertion'

(c) Assertion is true but Reason is false

(d) Assertion is false but Reason is true

111. **Assertion (A) :** A very dilute acidic solution of $Cd^{2+}$ and $Ni^{2+}$ gives yellow precipitate of CdS on passing hydrogen sulphide.
**Reason (R) :** Solubility product of CdS is more than that of NiS.

112. **Assertion (A) :** $[Ni(CN)_4]^{2-}$ has square planar and $[NiCl_4]^{2-}$ has tetrahedral shape.
**Reason (R) :** $[Ni(CN)_4]^{2-}$ is diamagnetic while $NiCl_4^{2-}$ is paramagnetic.

113. **Assertion (A) :** Rusting of an iron is an example of corrosion.
**Reason (R) :** Rusting of iron is decreased by acid and electrolytes.

114. **Assertion (A):** Trihydroxyglutaric acid ($HO_2C$–CHOH–CHOH–CHOH–$CO_2H$) exists in four stereoisomeric forms; two of which are optically active while the other two are meso-forms.
**Reason (R) :** It contains two asymmetric and pseudo-asymmetric carbon atom.

115. **Assertion (A) :** The endothermic reactions are favoured at lower temperature and the exothermic reactions are favoured at higher temperature.
**Reason (R) :** When a system in equilibrium is disturbed by changing the temperature, it will tend to adjust itself so as to overcome the effect of change.

116. **Assertion (A) :** For each ten degree rise of temperature the specific rate constant is nearly doubled.
**Reason (R) :** Energy-wise distribution of molecules in a gas is an experimental function of temperature.

117. **Assertion (A) :** $HNO_3$ is a stronger acid than $HNO_2$
**Reason (R) :** In $HNO_3$ there are two nitrogen-to-oxygen bonds whereas in $HNO_2$ there is only one.

118. **Assertion (A) :** A metal having negative reduction potential when dipped in the solution of its own ions has a tendency to pass into the solution.
**Reason (R) :** Metal having negative reduction potential have large hydration energy.

119. **Assertion (A) :** If hydration energy is greater than lattice energy the solid dissolves in liquid
**Reason (R) :** The solubility of a solid in a liquid depends upon lattice energy and hydration energy

120. **Assertion (A) :** Reduction of *m*-dinitrobenzene with ammonium sulphide gives *m*-nitroaniline.
**Reason (R) :** *m*-Nitroaniline formed gets precipitated and hence further reduction is prevented.

## SECTION III - BIOLOGY

121. Sequence of taxonomic categories is
(a) Class – Phylum – Tribe – Order – Family – Genus – Species
(b) Division – Class – Family – Tribe – Order – Genus – Species
(c) Division – Class – Order – Family – Tribe – Genus – Species
(d) Phylum – Order – Class – Tribe – Family – Genus – Species

122. Genophore/bacterial genome or nucleoid is made of
(a) Histones and nonhistones
(b) RNA and histones
(c) A single double stranded DNA
(d) A single stranded DNA

123. *Claviceps purpurea* is causal organism of
(a) Smut of Barley
(b) Rust of Wheat
(c) Ergot of Rye
(d) Powdery Mildew of Pea.

124. Chloroplast of *Chlamydomonas* is
(a) Stellate (b) Cup-shaped
(c) Collar-shaped (d) Spiral

125. Oxysomes of $F_0 – F_1$ particles occur on
(a) Thylakoids
(b) Mitochondrial surface
(c) Inner mitochondrial membrane
(d) Chloroplast surface

126. Two linked genes a and b show 20% recombination. The individuals of a dihybrid cross between + +/ + + × ab/ab shall show gametes
(a) + + 80 : **ab** : 20
(b) + + 50 : **ab** : 50
(c) + + 40 : **ab** 40 : + **a** 10 : + **b** : 10
(d) + + 30 : **ab** 30 : + **a** 20 : + **b** : 20

127. In *Escherichia* coli, lac operon is induced by
(a) Lactose (b) Promoter gene
(c) β -galactosidase (d) I-gene

128. If a diploid cell is treated with colchicine then it becomes
(a) triploid (b) tetraploid
(c) diploid (d) monoploid

129. Syngenesious condition is found in
(a) Asteraceae (b) Labiate
(c) Solanaceae (d) Fabaceae

130. Floral formula of Tomato/Tobacco is
(a) ⊖☿ $K_{4-5}\,A_{10}G_{(2)}$
(b) ⊕☿ $K_{2+2}\,C_4A_{2+4}G_{\underline{1}}$
(c) ⊕☿ $P_2\,A_3G_{\underline{1}}$
(d) ⊕☿ $K_{(5)}\,\overset{\frown}{C_{(5)}A_5}\,G_{(2)}$

131. Ectophloic siphonostele is found in
(a) *Osmunda* and *Equisetum*
(b) *Marsilea* and *Botrychium*
(c) *Adiantum* and *Cucurbitaceae*
(d) *Dicksonia* and *Maidenhair fern*

132. If a cell A with DPD 4 bars is connected to cell B, C, D whose OP and TP are respectively 4 and 4, 10 and 5 and 7 and 3 bars, the flow of water will be
(a) A and D to B and C
(b) A to B,C and D
(c) B to A, C and D
(d) C to A, B and D

133. The size of chlorophyll molecule is
(a) Head 15 × 15 Å, tail 25 Å
(b) Head 20 × 20 Å, tail 25 Å
(c) Head 15 × 15 Å, tail 20 Å
(d) Head 10 × 12 Å, tail 25 Å

134. Terminal cytochrome of respiratory chain which donates electrons to oxygen is
(a) Cyt. b (b) Cyt. c
(c) Cyt. $a_1$ (d) Cyt. $a_3$

135. An ovule which becomes curved so that the nucellus and embryo sac lie at right angles to the funicle is
(a) Hemitropous (b) Campylotropous
(c) Anatropous (d) Orthotropous

136. Which of the following movement is not related to auxin level
(a) Bending of shoot towards light
(b) Movement of root towards soil
(c) Nyctinastic leaf movements
(d) Movement of sunflower head tracking the sun

137. An interesting modification of flower shape for insect pollination occurs in some orchids in which a male insect mistakes the pattern on the orchid flower for the female of his species and tries to copulate with it, thereby pollinating the flower. This phenomenon is called
(a) Mimicry
(b) Pseudopollination
(c) Pseudocopulation
(d) Pseudoparthenocarpy

138. The most common indicator organism that represents polluted water is
(a) *E. coli* (b) *P. typhi*
(c) *C. vibrio* (d) *Entamoeba*

139. In order to obtain virus-free plants through tissue culture the best method is
(a) Embryo rescue (b) Anther culture
(c) Meristem culture (d) Protoplast culture

140. Which one among the following chemicals is used for causing defoliation of forest trees?
(a) Phosphon-D
(b) Malic hydrazide
(c) 2, 4 Dichlorophenoxy acetic acid
(d) Amo-1618

141. Which of the following is **not** true for a species?
(a) Members of a species can interbreed.
(b) Gene flow does not occur between the populations of a species.
(c) Each species is reproductively isolated from every other species.
(d) Variations occur among members of a species.

142. The catalytic efficiency of two different enzymes can be compared by the
(a) formation of the product
(b) pH optimum value
(c) $K_m$ value
(d) molecular size of the enzyme

143. Fire bellied toad is
(a) *Amphiuma* (b) *Banbina*
(c) *Necturus* (d) *Salamandra*

144. American water plant that has become a troublesome water weed in India is
(a) *Cyperus rotundus*
(b) *Eichhornia crassipes*
(c) *Trapa latifolia*
(d) *Trapa bispinosa*

145. Characteristics of smooth muscle fibres are
(a) Spindle-shaped, unbranched, unstriated, uninucleate and involuntary
(b) Spindle shaped, unbranched, unstriped, multinucleate and involuntary
(c) Cylindrical, unbranched, unstriped, multinucleate and involuntary
(d) Cylindrical, unbranched, striated, multinucleate and voluntary

146. An adolescent human below 17 years of age normally has dental formula as
(a) $\frac{2,1,3,2}{2,1,3,2}$ (b) $\frac{2,2,3,2}{2,2,3,2}$
(c) $\frac{2,1,2,0}{2,1,2,0}$ (d) $\frac{2,1,2,2}{2,1,2,2}$

147. In alveoli of the lungs, the air at the site of gas exchange, is separated from the blood by
(a) alveolar epithelium only
(b) alveolar epithelium and capillary endothelium
(c) alveolar epithelium, capillary endothelium and tunica adventitia
(d) alveolar epithelium, capillary endothelium, a thin layer of tunica media and tunica adventitia

148. Splenic artery arises from
(a) Anterior mesenteric artery
(b) Coeliac artery
(c) Posterior mesenteric artery
(d) Intestinal artery

149. If Henle's loop were absent from mammalian nephron, which of the following is to be expected?
(a) The urine will be more dilute
(b) There will be no urine formation
(c) There will be hardly any change in the quality and quantity of urine formed
(d) The urine will be more concentrated

150. Number of cervical vertebrae in camel is
(a) More than that of Rabbit
(b) Less than that of Rabbit
(c) Same as that of Whale
(d) More than that of Horse

151. Which of the following cranial nerves can regulate heart beat?
(a) X (b) IX
(c) VIII (d) VII

152. Which one of the following pairs correctly matches a hormone with a disease resulting from its deficiency?
(a) Luteinizing - Failure of hormone ovulation
(b) Insulin - Diabetes insipidus
(c) Thyroxine - Tetany
(d) Parathyroid - Diabetes mellitus hormone

153. The growth of corpus luteum is initiated by
(a) Human chorionic gonadotropin
(b) Follicle stimulating hormone
(c) Luteinizing hormone
(d) Prolactin

154. Two opposite forces operate in the growth and development of every population. One of them relates to the ability to reproduce at a given rate. The force opposing it is called
(a) environmental resistance
(b) morbidity
(c) fecundity
(d) biotic potential

155. Red-green colour blindness in humans is governed by a sex-linked recessive gene. A normal woman whose father was colour-blind marries a colour blind man. What proportion of their daughters is expected to be colour-blind?
(a) 3/4 (b) 1/2
(c) 1/4 (d) All

156. Genetic drift operates only in
(a) Smaller Populations
(b) Larger Populations
(c) Mendelian Populations
(d) Island Populations

157. Which one of the following statements about fossil human species is correct?
(a) Fossils of *Homo neanderthalensis* have been found recently in South America
(b) Neanderthal man and Cro-Magnon man did exist for sometime together
(c) *Australopithecus* fossils have been found in Australia
(d) *Homo erectus* was preceded by *Homo habilis*

158. In the silk worm, if no juvenile hormone (JH) is present when it moults, it will
(a) die
(b) moult into another larval stage
(c) moult into pupa
(d) moult into an adult

159. Which one of the following is correct match?
(a) Reserpine — Tranquilizer
(b) Cocaine — Opiate narcotic
(c) Morphine — Hallucinogenic
(d) Bhang — Analgesic

160. Test tube baby is one who
(a) is born out of artificial insemination
(b) has undergone development in a test tube
(c) is born out of the technique of fertilization *in vitro*
(d) has been developed without fertilization

**DIRECTIONS :** These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following five responses.

**(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.**

**(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.**

**(c) If the Assertion is correct but Reason is incorrect.**

**(d) If both the Assertion and Reason are incorrect.**

**(e) If the Assertion is incorrect but the Reason is correct.**

161. **Assertion :** Mango dipped in concentrated sodium chloride solution will contract.
**Reason :** Water goes out due to exosmosis in hypertonic solution.

162. **Assertion :** Nissl's granules that are basophilic are present in the cyton.
**Reason :** They are composed of RNA.

163. **Assertion :** Phycobilins are destroyed by heat.
**Reason :** They are protein linked and proteins are denatured due to heat.

164. **Assertion :** The inner mucosa coat has innumerable finger like projections.
**Reason :** Absorption increases due to infolds.

165. **Assertion :** Vital capacity is the total volume of air that can be breathed out with minimum effort.
**Reason :** Vital capacity represents the maximum capacity of an individual to renew air in the respiratory system.

166. **Assertion :** Heart wood is non functional.
**Reason :** Duramen is plugged due to in-growth of collenchyma.

167. **Assertion :** Glycogen is called animal starch.
**Reason :** Glycogen is stored in the liver and muscles of animals.

168. **Assertion :** Racemose Inflorescence is an indeterminate inflorescence.
**Reason :** The Inflorescence shows definite growth.

169. **Assertion :** Mouth parts of cockroach, honey bee & mosquito are analogus organs.
**Reason :** These organs follow the same basic plan of organization during development.

170. **Assertion :** Crossing over occurs at four strand or tetrad stage.
**Reason :** Parent strand and gene linkages disappear at two strand stage.

171. **Assertion :** Oncogenes transform normal cell into cancer cell.
**Reason :** They integrate their DNA with RNA of the host cells.

172. **Assertion :** Human immuno deficiency Virus-III are retroviruses.
**Reason :** They exhibit reverse transcription.

173. **Assertion :** Genes are actual physical units of heredity.
**Reason :** Genes are in the chromosome in linear order.

174. **Assertion :** Viruses are obligatory parasites.
**Reason :** They show host specificity and multiply only inside living systems.

175. **Assertion :** Allergens are generally weak antigens, which are glycogen molecules.
**Reason :** Allergy means inappropriate reaction of a person.

176. **Assertion :** Interferons are antiviral proteins.
**Reason :** It is released from the infected and dying cells.

177. **Assertion :** Horticulture is the conscious raise of Cereal crop.
**Reason :** Growing of vegetables, fruits and ornamental plants is Horticulture.

178. **Assertion :** Viruses cannot metabolise outside host cells and use host machinery to produce own nucleic acids and proteins.
**Reason :** Viruses lack energy yielding and biosynthetic machinery.

179. **Assertion :** All aggregate and multiple fruits are false.
**Reason :** They develop from other floral parts instead of the ovary

180. **Assertion :** *Casuarina* and *Betula* show chalazogamy.
**Reason :** Pollen tube enters the ovule through micropyle end.

## SECTION IV - G.K.

181. On August 12, 2017, Dr Vishwanath Karad MIT World Peace University, considered to be the first of its kind in India was inaugurated in:
(a) Pune (b) Bhopal
(c) Jaipur (d) Chennai

182. On July 18, 2017, the Supreme Court has allowed the Centre to replace the oversight committee set up to supervise the functioning of the Medical Coucil of India (MCI) with a fresh panel of how many eminent doctors?
(a) 8 eminent doctors
(b) 7 eminent doctors
(c) 6 eminent doctors
(d) 5 eminent doctors

183. Who among the following is set to become the United Nations' youngest-ever'Messenger of Peace'?
(a) Mark Zuckerberg
(b) Malala Yousafzai
(c) Selena Gomez
(d) Virat Kohli

184. Find out the correct sequence -
(a) Pain, Doctor, Hospital, Drug
(b) Hospital, Doctor, Drug, Pain
(c) Hospital, Doctor, Pain, Drug
(d) Pain, Hospital, Doctor, Drug

185. Human : Brain :: Computer : ?
(a) USB (b) Monitor
(c) CPU (d) Internet

186. Which of these is a dwarf planet?
(a) Neptune (b) Titan
(c) Eris (d) Hydra

187. M is son of P, Q is the grand-daughter of O, who is the husband of P. How is M related to O?
(a) Son (b) Daughter
(c) Mother (d) Father

188. How many meaningful English words can be formed with the letters URLE using each letter only once in each word?
(a) None (b) One
(c) Two (d) Three

189. Name the country that will host the 2018 Table Tennis Team World Cup.
(a) South Africa (b) China
(c) USA (d) England

190. Select the related word/letters/ number from the given alternatives.
Psychology : Human Being :: Ornithology : ?
(a) Birds (b) Volcanoes
(c) Insects (d) Reptiles

191. The 2017 International Day for the Remembrance of the Slave Trade and its Abolition is observed on which date?
(a) August 24 (b) August 25
(c) August 22 (d) August 23

192. Who is the head of the 9-judge Constitution bench of the Supreme Court (SC) to determine whether privacy is a fundamental right or not under the Constitution?
(a) Abhay Manohar Sapre
(b) J S Khehar
(c) Sanjay Kishan Kaul
(d) Fali Narima

193. Which of the following is the correct description of the term 'sex ratio' as used in context of the census?
(a) Number of females per 1000 persons
(b) Number of females in a sample of 1000 persons
(c) Number of males per 1000 females
(d) Number of females per 1000 males

194. In India, which city is also known as 'City of Palaces'?
(a) Jaipur (b) Kolkata
(c) Gwalior (d) Udaipur

195. Heena Sidhu, who recently won a World Cup Gold Medal for India, is associated with
(a) Shooting (b) Archery
(c) Weightlifting (d) Boxing

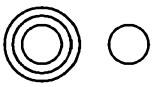
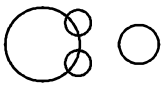
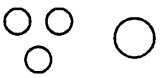
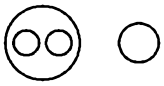
196. On July 21, 2017, Uttar Pradesh Assembly adopted two resolutions on naming the airport terminals of which two cities?
(a) Kanpur and Lucknow
(b) Lucknow and Bareilly
(c) Kanpur and Meerut
(d) Kanpur and Bareilly

197. Which country is accused of interfering and hacking the US 2016 presidential elections?
(a) Russia (b) China
(c) Germany (d) Japan

198. On July 23, 2017, Arun Jaitley inaugurated 315th Rest House of the Kendriya Sainik Board in:
(a) Shimla (b) Dehradun
(c) New Delhi (d) Amritsar

199. Arrange the following steps of AIIMS application form
(1) City Choice
(2) Payment
(3) Password received
(4) Registration
(a) 3,4,2,1 (b) 4,3,1,2
(c) 3,4,1,2 (d) 3,1,4,2

200. Which of the following diagrams indicates the best relation between Pluto,Planets, Sun and Earth ?

(a) 
(b) 
(c) 
(d) 

# SOLUTIONS

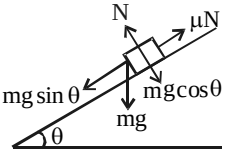
## SECTION I - PHYSICS

1. (b) From the F.B.D.

$N = mg\cos\theta$

$F = ma = mg\sin\theta - \mu N$

$\Rightarrow \quad a = g(\sin\theta - \mu\cos\theta)$




Now using, $v^2 - u^2 = 2as$

or, $v^2 = 2\times g(\sin\theta - \mu\cos\theta)\ell$

($\ell$ = length of incline)

or, $v = \sqrt{2g\ell(\sin\theta - \mu\cos\theta)}$

2. (b) Acceleration due to gravity at lattitude' $\lambda$ ' is given by $g_\lambda = g_e - R_e\omega^2\cos^2\lambda$

At equator, $\lambda = 90°$

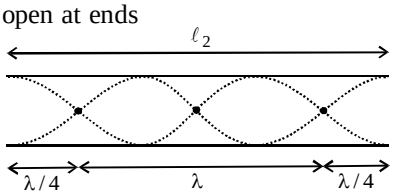
$\Rightarrow \quad \cos\lambda = \cos 90° = 0$

or $g_\lambda = g_e = g$ (as given in question)

At 30°, $g_{30} = g - R\omega^2\cos^2 30 = g - \frac{3}{4}R\omega^2$

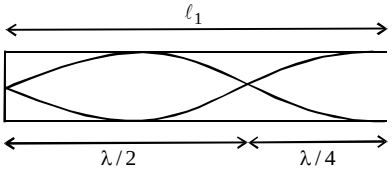
or, $g - g_{30} = \frac{3}{4}R\omega^2$

3. (a) For 3rd harmonic/2nd over tone of organ pipe open at ends




$\Rightarrow n_2 = \frac{3V}{2\ell_2}$

For 1st overtone of organ pipe open at one end




$\Rightarrow \quad n_1 = \frac{3V}{4\ell_1}$

Given $n_1 = n_2 \Rightarrow \quad \frac{3V}{2\ell_2} = \frac{3V}{4\ell_1}$ or

$\frac{\ell_1}{\ell_2} = \frac{1}{2}$

4. (c) $H = \frac{V^2}{R}t \qquad$ or $\qquad t = \frac{HR}{V^2}$

The voltage, V remains same, H is also same

$t_1 = \frac{HR_1}{V^2}; \qquad t_2 = \frac{HR_2}{V^2}$

or $t = \frac{H(R_1 + R_2)}{V^2} = t_1 + t_2$

$= 15 + 20 = 35$ min

5. (a) Fluid resistance is given by $R = \frac{8\eta\ell}{\pi r^4}$

When two capillary tubes of same size are joined in parallel, then equivalent fluid resistance is

$R_S = R_1 + R_2$

$= \frac{8\eta\ell}{\pi R^4} + \frac{8\eta\times 2L}{\pi(2R)^4} = \left(\frac{8\eta L}{\pi R^4}\right)\times\frac{9}{8}$

Rate of flow

$= \frac{P}{R_S} = \frac{\pi R^4}{8\eta L}\times\frac{8}{9} = \frac{8}{9}X \quad \left[\text{as } X = \frac{\pi PR^4}{8\eta\ell}\right]$

6. (a) The charge is moving in an equipotential line. So no work is done.

7. (d) Optical fibers carry immense no. of signals as compared to other wires. There is no EM interference in these fibres.

8. (c) An EMW is the one constituted by oscillating electric and magnetic field which oscillate in two mutually perpendicular planes. The wave itself propagates in a direction perpendicular to both of the directions of oscillations of electric $(\vec{E})$ and magnetic fields $(\vec{B})$, i.e. $\vec{E}\times\vec{B}$.

9. (a) The angular magnification,

$M = \frac{\text{angle subtended by the image at eye}}{\text{angle subtended at eye with object in actual position}}$

For telescope, $M = \frac{f_o}{f_e} = \frac{F_1}{F_2}$

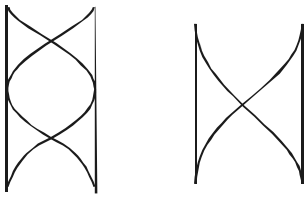
10. (c) As per Reynold's formula critical velocity of a liquid is defined as

$$v_c = \frac{K\eta}{\rho r} \Rightarrow v_c \propto \frac{1}{\rho} \text{ \& } v_c \propto \frac{1}{r}$$

Where $\eta$ is coefficient of viscosity of the liquid, $\rho$ its density and r is the radius of the tube. K is a dimensionless constant called the Reynold number. Thus critical velocity increases when density and radius of the tube decreases.

11. (b) Let the fundamental frequency of organ pipe be f

**Case I :** $f = 200 \pm 5 = 205$ Hz or 195 Hz



**Case II :** frequency of 2nd harmonic of organ pipe = 2f (as is clear from the second figure)

$2f = 420 \pm 10$ or $f = 210 \pm 5$
or f = 205 or 215
Hence fundamental frequency of organ pipe
= 205 Hz

12. (a) The moment of inertia (I) of circular ring whose axis of rotation is passing thought its center, $I_1 = m_1R^2$

Also, $I_2 = m_2(nR)^2$

Since both rings have same density,

$$\Rightarrow \quad \frac{m_2}{2\pi (nR) \times A_2} = \frac{m_1}{2\pi R \times A_1}$$

Where A is cross-section of ring,

$A_1 = A_2$ (Given) $\therefore m_2 = nm_1$

$$\text{Given } \frac{I_1}{I_2} = \frac{1}{8} = \frac{m_1R^2}{m_2(nR)^2} = \frac{m_1R^2}{nm_1(nR)^2}$$

$$\Rightarrow \frac{1}{8} = \frac{1}{n^3} \quad \text{or} \quad n = 2$$

13. (d) Volume of bigger bubble
= volume of 27 smaller bubbles

$$\Rightarrow \frac{4}{3}\pi D^3 = 27 \times \frac{4}{3}\pi d^3 \Rightarrow d = \frac{D}{3}$$

Initial surface energy $S_i = 4\pi D^2 \sigma$

Final surface energy $S_f = 27 \times 4\pi D^2\sigma$

$\Delta S = S_f - S_i$ and using $d = \frac{D}{3}$

$$\Delta S = \sigma \times 4\pi \left[ 27 \times \frac{D^2}{9} - D^2 \right]$$

$$= 2D^2 \times 4\pi \times \sigma = 8\pi\sigma D^2$$

14. (a) $\frac{V_1}{V_2} = \sqrt{\frac{M_1}{M_2}} \Rightarrow 4 = \sqrt{\frac{64}{M_1}}$

or $M_1 = 4$ i.e. He

15. (b) At constant pressure

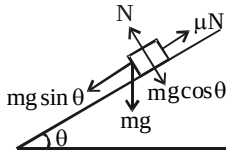
$W = P(V_f - V_i) = nR\alpha(T_f - T_i)$
$= 1 \times 8.14(127 - 27) = 8.14 \times 100 = 814$ J

16. (a) $\frac{mv^2}{r} = qvB$

$$B = \frac{mv}{qr} = \frac{9.1 \times 10^{-31} \times 10^6}{1.6 \times 10^{-19} \times 0.5}$$

$= 1.13 \times 10^{-5}$ T

17. (a) Remember that acceleration of a cylinder down a smooth inclined plane is




$a = \frac{g\sin\theta}{\left(1 + \frac{I}{mR^2}\right)}$ where $I = \frac{mR^2}{2}$ is the moment of Inertia for cylinder

$$a = \frac{g \sin 30°}{\left(1 + \frac{mR^2}{2} \times \frac{1}{mR^2}\right)} = \frac{g \times \frac{1}{2}}{1 + \frac{1}{2}} = \frac{g}{3}$$

18. (b) According to Kepler's third law,

$$R^3 \propto T^2 = \frac{R}{R_e} = \left(\frac{T}{T_e}\right)^{\frac{2}{3}} = \left(\frac{27\ T_e}{T_e}\right) = 9$$

19. (a) The gravitational field intensity at the centre (of an equilateral triangle), equidistant from the three vertices due to 3 equal masses will be zero. The vector sum of the forces due to the 3 masses will be zero.

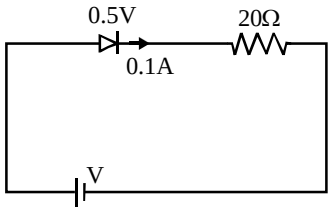
20. (a) Kinetic energy = translational kinetic energy + rotational kinetic energy

$$K.E = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

Moment of inertia of sphere $(I) = \frac{2}{5}MR^2$

$$\therefore K.E. = \frac{1}{2}mv^2 + \frac{1}{2}\times\frac{2}{5}MR^2\left(\frac{V}{R}\right)^2 = \frac{7}{10}mv^2$$

21. (c) $V' = V \times IR = 0.5 + 0.1 \times 20 = 2.5\ V$




22. (a) Pot. gradient = 0.2mV/cm

$$= \frac{0.2\times10^{-3}}{10^{-2}} = 2\times10^{-2}\ v/m$$

Emf of cell $= 2\times10^{-2}\times1m = 2\times10^{-2}\ V$
$= 0.02\ V$

As per the condition of potentiometer
$0.02\ (R + 490) = 2\ (R)$ or $1.98\ R = 9.8$

$$\Rightarrow R = \frac{9.8}{1.98} = 4.9\ \Omega$$

23. (c) Work done in rotating a dipole by an angle '$\theta$' is

$$W = pE(1-\cos\theta) = pE(1-\cos 60) = \frac{pE}{2}$$

Again, $W_{180} = pE(1-\cos 180)$

$$= pE[1-(-1)] = 2pE = 4W$$

24. (a) Magnetic moment = M = IA, where A is the area of the orbit $(\pi r^2)$ and I is the current flowing due to charge *e*. Further orbital motion of electron is equivalent to a current

$$I = \frac{e}{T} = e\upsilon$$

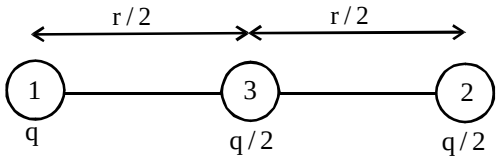
(where $T = \frac{1}{\upsilon}$ is the time period)

$$\therefore M = IA = e\upsilon\pi r^2$$

25. (c) Initial force between the two spheres carrying charge (say q) is

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{r^2}$$

(r is the distance between them)
Further when an uncharged sphere is kept in touch with the sphere of charge q, the net charge on both become $\frac{q+0}{2} = \frac{q}{2}$.
Force on the 3rd charge, when placed in center of the 1st two




$$F_3 = \frac{1}{4\pi\varepsilon_0}\frac{q\left(\frac{q}{2}\right)}{\left(\frac{r}{2}\right)^2} - \frac{1}{4\pi\varepsilon_0}\frac{\left(\frac{q}{2}\right)^2}{\left(\frac{r}{2}\right)^2}$$

$$= \frac{1}{4\pi\varepsilon_0}\frac{q^2}{r^2}[2-1] = F$$

26. (b) A bimetallic strip, on uniform heating, bends in the form of an arc and the metal with greater '$\alpha$' lies on the convex side.

27. (c) General wave equation

$$y = A\sin(\omega t - kx)$$

On comparing, we get $\omega = 100\pi$

$$\therefore \text{Wave number, } k = \frac{\omega}{v} = \frac{100\pi}{100} = \pi\ m^{-1}$$

28. (c) For constant pressure, $V \propto T$

29. (c) $K_\alpha$ and $K_\beta$ are characteristics line in the X-ray line spectrum.

30. (d) $T = 2\pi\sqrt{\frac{\ell}{g}}$

$\Rightarrow$ Frequency, $n = \frac{1}{T} \propto \frac{1}{\sqrt{\text{length}}}$

$\frac{n_1}{n_2} = \frac{\sqrt{\ell_2}}{\sqrt{\ell_1}} \Rightarrow \frac{2}{3} = \frac{\sqrt{\ell_2}}{\sqrt{\ell_1}} \Rightarrow \frac{\ell_1}{\ell_2} = \frac{9}{4}$

31. (c) $V_e = \sqrt{2gR}$ and $V_0 = \sqrt{gR}$

$V_e = \sqrt{2}V_0 \qquad V_0 \Rightarrow \frac{2}{\sqrt{2}} = \sqrt{2}$ km/s

32. (a) $m = Zit$

$\Rightarrow m = 3.3\times10^{-7} \times 3 \times 2 = 19.8\times10^{-7}$

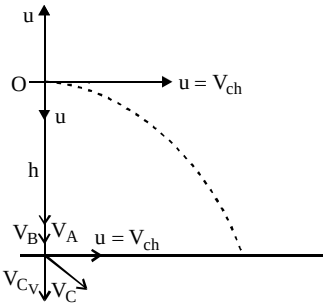
33. (c) $\chi = \frac{C}{T}$ (as per Curie's law)

Paramagnetic materials obey Curies law.
C = Curies constant

34. (a) When the plane polarised light passes through certain substance, the plane of polarisation of the light is rotated about the direction of propagation of light through a certain angle.

35. (a) For A: It goes up with velocity *u* will it reaches its maximum height (i.e. velocity becomes zero) and comes back to O and attains velocity *u*.

Using $v^2 = u^2 + 2as \Rightarrow v_A = \sqrt{u^2 + 2gh}$




For B, going down with velocity u

$\Rightarrow v_B = \sqrt{u^2 + 2gh}$

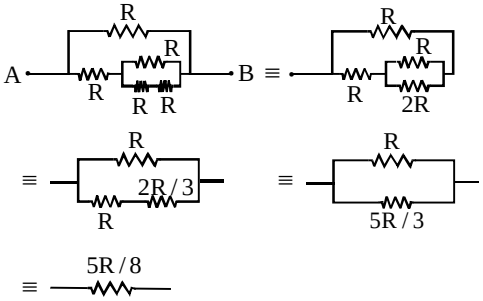
For C, horizontal velocity remains same, i.e. 'u'.

Vertical velocity = $\sqrt{0 + 2gh} = \sqrt{2gh}$

The resultant $v_C = \sqrt{v_x^2 + v_y^2} = \sqrt{u^2 + 2gh}$.

Hence $v_A = v_B = v_C$

36. (b) The equivalent circuit can be redrawn as

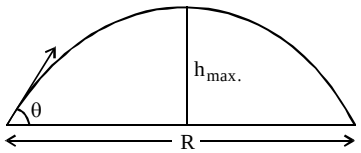



37. (b) As per Einstein's photoelectric equation :

$E = h\upsilon = wF + KE_{max}$

i.e. till a certain valve of $\upsilon$, KE remains 0, it only starts increasing once the Work function (WF) of the metal surface is achieved.

38. (a) $R = \frac{u^2 \sin 2\theta}{g}$; $R_{max} = \frac{u^2 \sin^2\theta}{2g}$




Equating we get $\sin 2\theta = \frac{\sin^2\theta}{2}$

or $4\sin\theta\cos\theta = \sin^2\theta$

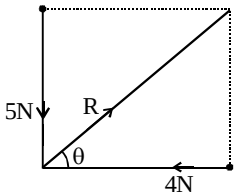
$\Rightarrow \tan\theta = 4$ or $\theta = \tan^{-1}4$

39. (c) $R = \frac{u^2 \sin 2\theta}{g}$ will be maximum for

$\sin 2\theta = 1 \Rightarrow 2\theta = \frac{\pi}{2}$ or $\theta = \frac{\pi}{4} = 45°$

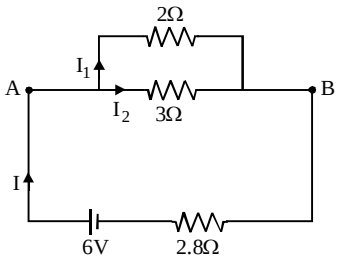
40. (a) $R = \sqrt{4^2 + 5^2} = \sqrt{41}$N

The angle $\theta$ will be given by $\tan\theta = \frac{5}{4}$




or $\theta = \tan^{-}\frac{5}{4}$

41. (c) At steady state the capacitor will $\alpha$ be fully charged and thus there will be no current in the $1\Omega$ resistance. So the effective circuit becomes




Net current from the 6V battery,

$$I = \frac{6}{\left(\frac{2\times3}{2+3}\right)+\frac{2.8}{1}} = \frac{6}{1.2+2.8} = \frac{3}{2} = 1.5A$$

Between A and B, Voltage is same in both resistances,

$2I_1 = 3I_2$ where $I_1 + I_2 = I = 1.5$

$\Rightarrow 2I_1 = 3(1.5 - I_1) \Rightarrow I_1 = 0.9A$

42. (a) Convex lens can form image with $m < 1$, $m > 1$ and $m = 1$ depending upon the positionof the object. Convex lens forms magnified image ($m > 1$) when the object is pole and 2f, same size as the object ($m = 1$) when the object is at 2f and smaller image ($m < 1$), when the object is beyond 2f.

43. (a) When the source (star) is moving towards the observer (earth),
Apparent wavelength,

$$\lambda' = \frac{C - V_s}{C}\lambda = \left(1 - \frac{V_s}{C}\right)\lambda = \lambda - \frac{V_s}{C}\lambda$$

$\Rightarrow \lambda - \lambda'$ = apparent shift in wavelength

$$= \frac{V_s}{C}\lambda \quad (C = \text{velocity of sound})$$

44. (b) **Case - I :** When resistor is not connected

Using $V = IR \Rightarrow V = 25\,(R_G)$ ..... (i)

**Case - II :** When resistor is connected

$V = 5(20 + R_G) = 100 + 5R_G$ ..... (ii)

From (i) and (ii), $20\,R_G = 100$

$\Rightarrow R_G = 5\Omega$

45. (d) Let internal resistance of source = R
Current in coil of resistance

$$R_1 = I_1 = \frac{V}{R + R_1}$$

Current in coil of resistance

$$R_2 = I_2 = \frac{V}{R + R_2}$$

Further, as heat generated is same, so

$I_1^2 R_1 t = I_2^2 R_2 t$

$$\text{or } \left(\frac{V}{R+R_1}\right)^2 R_1 = \left(\frac{V}{R+R_2}\right)^2 R_2$$

$\Rightarrow R_1(R + R_2)^2 = R_2(R + R_1)^2$

$\Rightarrow R^2R_1 + R_1R_2^2 + 2RR_1R_2$

$= R^2R_2 + R_1^2R_2^2 + 2RR_1R_2$

$\Rightarrow R^2(R_1 - R_2) = R_1R_2(R_1 - R_2)$

$\Rightarrow R = \sqrt{R_1R_2}$

46. (a) Microwaves are used for communication in artificial satellites.

47. (c) de Broglie wavelength, $\lambda = \frac{h}{\sqrt{2mE_{K.E}}}$

$$\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha}{m_p}} = \sqrt{\frac{4m_p}{m_p}}$$

$[\because E_{K.E(\alpha)} = E_{K.E(p)}]$

$$\therefore \frac{\lambda_p}{\lambda_\alpha} = \frac{2}{1}$$

48. (c) $h = \frac{E}{\upsilon} = \frac{ML^2T^{-2}}{T^{-1}} = ML^2T^{-1}$

49. (d) Black body spectrum

50. (b) Fringe width $\propto \lambda$. Also $\lambda_{blue} > \lambda_{red}$
Therefore, fringes come closer when blue light is replaced by red light in diffraction pattern.

51. (d) In p–n junction, the diffusion of majority carriers takes place when junction is forward biased and drifting of minority carriers takes place across the function, when reverse biased. The reverse bias opposes the majority carriers but makes the minority carriers to cross the p–n junction. Thus the small current in μA flows during reverse bias.

52. (b) In Rutherford's $\alpha$–particle scattering experiments, some of $\alpha$-particles was found to be scattered at very large angles, inspite

of having very high kinetic energy. This shows that there are the α–particle which will be passing very close to nucleus. Rutherford's confirmed the repulsive force on α–particle due to nucleus varies with distance according to inverse square law and that the positive charges are concentrated at the center and not distributed throughout the atom. This is the nuclear model of Rutherford.

53. (a) When a polaroid is rotated in the path of unpolarised light, the intensity of light transmitted from polaroid remains undiminished (because unpolarised light contains waves vibrating in all possible planes with equal probability). However, when the polaroid is rotated in path of plane polarised light, its intensity will vary from maximum (when the vibrations of the plane polarised light are parallel to the axis of the polaroid) to minimum (when the direction of the vibrations becomes perpendicular to the axis of the crystal). Thus using polaroid we can easily verify that whether the light is polarised or not.

54. (e) An induced current develop in a conductor cannot moved in a direction parallel to magnetic field. This is because when the conductor moved in a direction parallel to magnetic field, amount of flux linked with the conductor does not change. Thus the induced current develops only when conductor cuts the lines of magnetic force. The direction of flow of induced current can also be found by applying Fleming's right hand rule, when the direction of motion of conductor inside the magnetic field and the direction of magnetic field action on if are known.

55. (a) Drift velocity of free electrons is given by,

$$v_d = \frac{eE}{m}\tau$$

Where, $E = \frac{\text{Potential difference}}{\text{length}} = \frac{V}{\ell}$

$$\therefore \quad v_d = \frac{eV}{m\ell}\tau$$

i.e., $v_d \propto \frac{1}{\ell}$ where $\frac{eV\tau}{m}$ is constant.

56. (c) A charged capacitor, after removing the battery, does not discharge itself. If this capacitor is touched by someone, he may feel shock due to large charge still present on the capacitor. Hence it should handled cautiously otherwise this may cause a severe shock.

57. (b) A perfect black body is one which absorbs heat radiation of all wavelengths, which fall on it. Such a body neither reflects nor transmits any part of the incident heat radiation and hence appears black irrespective of the colour of the incident radiation. Obviously the absorbance of a perfect black body is unity. The radiation given out by a perfect black body are called black body radiations or full radiation or total radiations.

58. (b) As we know, $\Delta\phi = \left(\frac{2\pi}{\gamma}\right) \times \Delta x$. This is phase difference between two particles whose path difference is $\Delta x$. If $\Delta x = \lambda$, then $\Delta x = 2\pi$. Thus, the phase difference between two medium particles having a path difference $\lambda$ is $2\pi$, i.e., the particles are in the same phase of oscillations.

59. (a) The presence of impurities either on the liquid surface or dissolved in it, considerably affect the force of surface tension, depending upon the degree of contamination. A highly soluble substance like sodium chloride when dissolved in water, increased the surface tension of water. But the sparingly soluble like phenol when dissolved in water reduces the surface tension of water.

60. (c) The orbital velocity, if a satellite close to earth is $V_0 = \sqrt{gR_e}$, While the escape velocity for a body thrown from the earth's surface is $V_e = \sqrt{2gR_e}$.

Thus $\frac{V_0}{V_e} = \frac{\sqrt{gR_e}}{\sqrt{2gR_e}} = \frac{1}{\sqrt{2}}$

or $V_e = \sqrt{2}V_0$

i.e., if the orbital velocity of a satellite revolving close to the earth happens to increase to $\sqrt{2}$ times, the satellite would escape.

## SECTION II - CHEMISTRY

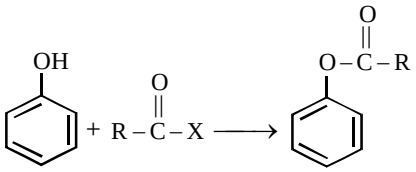
61. (a) Aromatic diazonium salts are generally prepared by adding cold aqueous solution of sodium nitrite to solution/suspension of 1° aromatic amine at 273 - 278 K

$$ArNH_2 + NaNO_2 + HX \xrightarrow[HNO_2]{273-278\,K} ArN_2^+X^- + NaX + 2H_2O$$

62. (a) Some sols have a high concentration of dispersed solid and change spontaneously into semisolid form on cooling these are called gels thus they form liquid as dispersed phase and solid as dispersion medium.

63. (c) Cr has valance shell $3d^5 4s^1$
$\therefore$ Number of valance electrons = 6
$H_2O$ is monodentate
$\therefore$ 2 electrons from each $H_2O$
$\therefore$ Total electrons contributed by $H_2O$
$= 2 \times 5 = 10$
SCN gives 2 electrons
Total valance electrons = 6 + 10 + 2 = 18
Over all charge on complex is + 2
$\therefore$ Valance electrons in complex are 16

64. (a) Valance shell is $3d^5 4s^1$, It means inner shells are $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
$\therefore$ At no. = 24. Hence element is Cr.

65. (a) 
Ester

66. (d) Aldehyde which do not contain $\alpha - H$ atom on treatment with alkali solution undergo self oxidation - reduction reaction (Cannizaro reaction) $^{\alpha}CH_3 - CHO$ has $\alpha - H$
$\therefore$ Cannot show Cannizaro reaction.
e.g. of Cannizaro reaction :
$HCHO + NaOH \longrightarrow CH_3OH + HCOONa$

67. (b) $(HCl_{(conc.)} + ZnCl_2)$ is Lucas reagent.
Different alcohals react at different rate with this reagent.

$$ROH + HCl \xrightarrow{ZnCl_2} RCl + H_2O$$

$1° alc. \xrightarrow{HCl/ZnCl_2}$ do not react at room temp.

$2° alc. \xrightarrow{HCl/ZnCl_2}$ turbidity appears in 5 min.

$3° alc. \xrightarrow{HCl/ZnCl_2}$ turbidity appears at once.

68. (b) No. of nodes = $n - \ell - 1$
For 5d = 5 – 2 – 1 = 2

69. (b) More is s-character more is electronegativity of hybrid orbital..
sp has 50 % s-character
$sp^2$ has 33 % s-character
$sp^3$ has 25 % s-character
$\therefore$ Order of electronegativity
$sp > sp^2 > sp^3$

70. (c) Bond length is in order as given
Single bond > double bond > triple bond
$N_2$ has triple bond; $O_2$ has double bond
$I_2$ and $Cl_2$ have single bond
Out of these $I_2$ has longer bond length as, due to big atoms the inter nuclear distance is large.

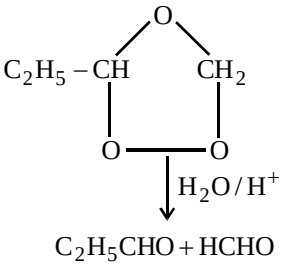
71. (d) $C_6H_5SO_2Cl$ is Hinsberg reagent

1° amine: $R - NH_2 \xrightarrow{C_6H_5SO_2Cl} C_6H_5SO_2NHR + HCl \xrightarrow{NaOH} C_6H_5SO_2N(Na)R$ Soluble

2° amine: $R_2 - NH \xrightarrow{C_6H_5SO_2Cl} C_6H_5SO_2NR_2 + HCl \xrightarrow{NaOH}$ No reaction

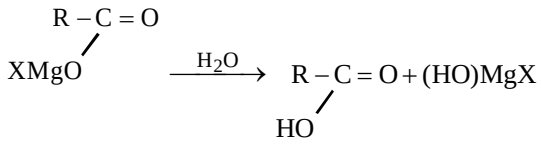
3° amine $\downarrow$ Do not react at all

72. (b) $CH_3-CH_2-CH=CH_2+O_3\longrightarrow$




$C_2H_5CHO+HCHO$

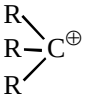
73. (b) $R-MgX + O=C=O \longrightarrow$




74. (a) 3° alcohals undergo reaction with $S_N1$ mechanism

$R_3-C-OH+H^+\longrightarrow R_3C-\overset{\oplus}{O}H_2$

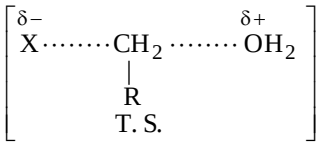
$\longrightarrow R_3\overset{\oplus}{C}$ Carbocation $\xrightarrow{X^-} R_3C-X$



is most stable carbocation.

**Note :-** 1° alcohol show $S_N2$ mechanism

$R-CH_2OH\xrightarrow{H^+}R-CH_2-\overset{\oplus}{O}H_2$

$\xrightarrow{X^-}$ 


75. (b) Clemmenson's reaction

$R-CHO\xrightarrow[HCl]{Zn/Hg}R-CH_3$

**Note :-** Wolf Kishner reduction is

$R-CHO\xrightarrow{NH_2-NH_2}RCH_3$

Also $R-CHO\xrightarrow{P/HI}R-CH_3$

Rosenmund reaction :-

$RCOCl\xrightarrow[\text{Lindlar reagent}]{Pd/H_2BaSO_4}RCHO$

76. (a) 4 Isomers are

$[Cr(H_2O)_6]Cl_3$; $[Cr(H_2O)_5Cl]Cl_2.H_2O$

$[Cr(H_2O)_4Cl_2]Cl.2H_2O$ ;

$[Cr(H_2O)_3Cl_3].3H_2O$

77 (c) Contribution by 8 atoms present at corner $= 1/8\times 8 = 1$

Contribution by atom present within the body = 1

Numbers of atoms present per unit cell $= 1+1 = 2$

78 (a) A few ions, consisting of two or more electro negative atoms of which at least one is N and properties similar to halide ions are called pseudohalides of $NNN^-$, $OCN^-$, $CN^-$ etc.

Halide ions often react with molecules of halogens or interhalogen to form poly halides like $BrI_2^-$, where as $IF_5$ is an inter halogen compound. Note - $RCOO^-$ is not pseudohalide

79. (c) $\frac{dx}{dt}=K\,[Conc]^n$

$k=\frac{dx}{dt}\times\frac{1}{[Conc.]^n}=\frac{1}{Time}\times\frac{1}{[Conc.]^{n-1}}$

For 2nd order reaction,

$k=\frac{1}{sec}\times\frac{1}{[mol/L]^{2-1}}=sec^{-1}\,mol^{-1}L$

80. (d) $_{25}Mn\longrightarrow 3d^5,\,4s^2$

Number of unpaired electrons = 5

$_{26}Fe\longrightarrow 3d^6,4s^2$

Number of unpaired electrons = 4

$_{28}Ni\longrightarrow 3d^8,4s^2$

Number of unpaired electrons = 2

$_{28}Cu\longrightarrow 3d^{10},4s^1$

Number of unpaired electrons = 1

More is number of unpaired electrons higher is paramagnetism.

81. (b) Elevation in B.P. is colligative property which depends upon number of particles.

Each $BaCl_2$ ion gives $Ba^{+2}$ and $2Cl^-$. Thus number of particles is highest out of given compounds.

82. (d) Size of ion depends upon nuclear charge. More is nuclear charge compared to number of electrons, Tightly are electrons held and thus smaller is size

| Nuclear charge | No. of electrons |
|---|---|
| $Na^{+} \longrightarrow 11$ | 10 |
| $Mg^{+2} \longrightarrow 12$ | 10 |
| $F^{-} \longrightarrow 9$ | 10 |
| $Al^{-3} \longrightarrow 13$ | 10 |

In $Al^{+3}$ 13 units of positive charge tend to attract 10 electrons more towards nucleus thus reducing sphere of electron cloud around the nucleus i.e. size.

83. (b) Ninhydrin test is shown by proteins and amino acid. Negative result show absence of these two.
Benedict's solution test is for aldehyde group which is present in monosaccrides and not lipids.

84. (c) Iodoform test is shown by compounds of aldehyde, ketone or alcohol which have $CH_3$ gp at $\alpha$ position like $\overset{\alpha}{C}H_3CHO$, $\overset{\alpha}{C}H_3-COR$, $CH_3CR(OH)$ etc. Ethyl alcohol has $CH_3CH(OH)$ thus shows iodoform test

$$CH_3-\overset{H}{\underset{|}{C}}-OH + 4I_2 + 6NaOH \xrightarrow{\Delta} CHI_3 + 5NaI + 5H_2O + HCOONa$$

85. (d). Penetration power is more when particle is small in size and is moving with high speed.
$\therefore$ order of penetrating power is $\gamma > X\,ray > \beta > \alpha$

86. (b) Order of filling follows $(n+\ell)$ rule, small is $(n+\ell)$ lower is energy so filling is first.
If $(n+\ell)$ values are same than lower n is given preference for
(a) $n = 5,\ \ell = 0,\ n+\ell = 5$
(b) $n = 3,\ \ell = 2,\ n+\ell = 5$
(c) $n = 6,\ \ell = 0,\ n+\ell = 6$
(d) $n = 5,\ \ell = 1,\ n+\ell = 6$
$n = 3,\ \ell = 2$, i.e. 3d is filled Ist

87. (c) When more than one atom in a monodentate ligand can act as donor linkage isomerism occurs.
In this case SCN has S and N as donor atom which can link with the central atom.

88. (c) $n CH_2=CH-CH=CH_2 + n$ (Styrene) $\longrightarrow$ $-(CH_2-CH=CH-CH_2-CH(C_6H_5)-CH_2-CH_2)_n-$
1,3-butadiene
Buna - S

89. (d) CO has triple bond; $\therefore$ B.O. must be 3
$O_2$ has double bond, $\therefore$ B.O. must be 2
$F_2$ is single bonded, $\therefore$ B.O. must be 1
$Be_2$ does not exist, $\therefore$ B.O. = 0
Alternatively B.O.

$$= \frac{\text{Number of bonding} - \text{No. of antibonding } e^{-}}{2}$$

$Be_2 \Rightarrow \sigma 2s^2, \sigma^* 2s$; B.O. $= \frac{2-2}{2} = 0$

90. (b) enolic form increases when there is H-bonding. If this H-bonding is further stabilised by conjugation enolic form further increases.

$\therefore$ $CH_3-C(=O)-CH_3-C(=O)-CH_3$ is max enolic form.
$\rightleftharpoons$ Tautomerism
$CH_3-C(-O-H\cdots O=)=CH-C(=O)-CH_3$ (H-bonding)
$\xrightarrow{\text{Conjugation}}$
$CH_3-C(=O\cdots H-O)=CH-C(=O)-CH_3$

91. (c) Benedict's sol. test is shown by aldehydes. Reason for easy oxidation of aldehyde to acid is presence of H- atom on carboxyl gp. Due to which it acts as strong reducing

agent and can thus reduce weak oxidising reagents like Tollens, Benedict and Fehling solution.

**Note** :– Benedict's solution is alkaline solution of $Cu^{+2}$ complexed with citrate ions.

Fehling solution is alkaline solution of $Cu^{+2}$complexes with Rochelle salt (is Sod. potassium tartrate). Tollens solution is ammonical silver nitrate ($AgNO_3/NH_4OH$).

92. (d) H – Spectrum confirms quantisation of energy within an atom.

93. (d) Conjugate acid and base differ by one hydrogen only

$CH_3NH_2$ is a base its conjugate acid is $CH_3NH_3^+$ (Which is +ve, electrons deficient species)

94. (a) Given $I_2(s) \longrightarrow I(g)$,

$\Delta H_{sublimation} = +57.3 kJ/mol$

$I_2(s) \longrightarrow I_2(\ell)$

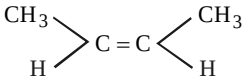
, $\Delta H_{fusion} = +15.5 kJ/mol$

$I_2(\ell) \longrightarrow I(g)$

, $\Delta H_{vap} = \Delta H_{sub} - \Delta H_{fusion}$

$= 57.3 - 15.5 = 41.8 kJ/mol$

95. (a) $HC-C\equiv C-CH_3 \xrightarrow[\text{Lindlar's reagent}]{Pb/BaSO_4}$



Cis-2-butene

96. (a) $\Delta H = (-)$ i.e. exothermic reaction

$\Delta S = (+)$ i.e. entropy factor also favours.

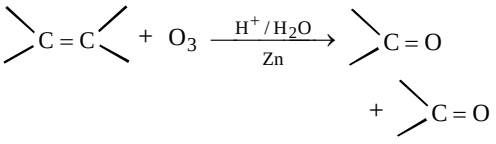
Thus for a spontaneous reaction $\Delta G$ is always negative.

$\Delta G = (-\Delta H) - T\Delta S = -(ve)$

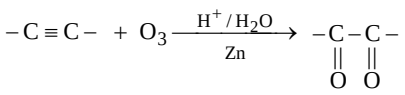
**Note :** $\Delta G = +(ve)$, reaction is non spontaneous

$\Delta G = 0$, reaction is in equlibrium.

97. (c) Ozone changes $\pi$ bond compound to carbonyl compounds



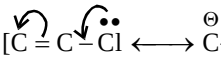
Carbonyl compounds



di ketones

98. (d) More easily Nucleophilc can replace halide ion more is reactivity. In case of vinyl C = C, C – Cl bond aquires some double bond character and become strong thus is not easily replacable.

$\therefore$ order is Allyl chloride > Vinyl > Chloro Benzene



99. (b) According to Le Chatelier's principal

(1) Increase in concentration of any reactant being consumed during the reaction favours the reaction.

(2) For an endothermic reaction increase in temperature favours reaction in forward direction.

(3) High pressure is favourable for the reaction in which there is decrease in volume.

In given case faourable conditions are :

(a) Increase in conc. of $BaCO_3$

(b) Increase in temparature

(c) Decrease in pressure

100. (b) Ionic concentration of A i.e.

$Ca(NO_3)_2 = 0.5 \times 3 = 1.5$

Ionic concentration of B i.e.

$KOH = 0.75 \times 2 = 1.5$

Ionic concentration is same for A and B

$\therefore$ depression in freezing point will also be same.

101. (d) Change Q = Current (Ampere) × time (sec)

$\therefore Q = 2 \times 60 \times 60$

$H_2O \longrightarrow H_2 + \frac{1}{2}O_2$

; $2H^+ + 2e^- \longrightarrow H_2$ (1 mole is 22400cc at NTP) For 1 mol of $H_2$ liberated 2 faradays are required $2F = 2 \times 96500$

$0.2 \times 60 \times 60$ will give $H_2$

$= \frac{22400 \times 2 \times 60 \times 60}{2 \times 96500} = 835.64cc$

$= 0.836 L$

102. (b) In fluorite structure, cations form face centered cubic a array and anions fit into tetrahedral void.
In antifluorite structure case is reversed,the oxide ions fill half tetrahedral holes.

103. (b) Fon any n; $\ell = n-1$, m = $-\ell$ to 0 to $+\ell$

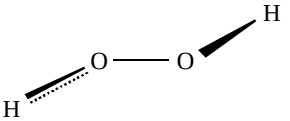
and $s = \pm\frac{1}{2}$ $\therefore$

for n = 2, $\ell \neq 2$

104. (a) Lindlar catalyst is Pd/$H_2$, $BaSO_4$ poisoned with sulphur or quinoline $\longrightarrow$ It gives us product Na / liq. $NH_3$ (Birch reduction) gives trans alkenes.
**Note** there are variety of other reducing agents which gives trans or cis products according to mechanism they follow. Some are listed below
1.Wilkinson's catalyst $\longrightarrow$
$RhCl(H_2)(PPh_3) \longrightarrow$ cis addition
2. Hydroboration
$B_2H_6 \longrightarrow$ cis addition

**Note :** $LiAlH_4$ and $NaBH_4$ normally donot reduce olefinic bonds. They are selective towards carbonyl C = O double bond.

105. (d) Value of dipole moment is not zero thus
H – O – O – H is not supposed structure where both OH are in same plane.
Dipole moment is some what near 2.1 D
$\therefore$ Struture comes out to be




106. (d) In $CO_2$ O has – 2 valency
In $MnO_2$ O has – 2 valency
In $Na_2O$ O has – 2 valency
In $BaO_2$ O is $O_2^{2-}$
$\therefore$ it is true peroxide
[Note: $Ba^{+2}O^{2-} \rightarrow$ BaO is Barium oxide]

107 (d) $Li^+$ due to small size have high degree of hydration.

108 (c) Gelatin has maximum protective power starch has minimum protective power

109. (a) Conc. of $SO_4$ is $[SO_4^{2-}]$ in $BaSO_4$

$= \frac{10^{-11}}{0.1} = 10^{-10}$

Conc. of $SO_4$ is $[SO_4^{2-}]$ in $Ag_2SO_4$

$= \frac{10^{-5}}{0.1\times 0.1} = 10^{-3}$

Conc. of $SO_4$ is $[SO_4^{2-}]$ in $CaSO_4$

$= \frac{10^{-6}}{0.1} = 10^{-5}$

Ionic product is minimum for $BaSO_4$
$\therefore$ it must precipitate Ist.

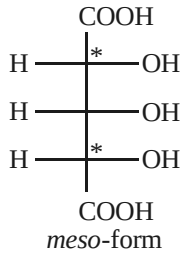
110. (d) $SeO_2$ in alkaline/acidic medium dehydrogenates ketones to give $\alpha,\beta$ unsturated ketone. (Removal of hydrogen is oxidation).

111.(b) $Cd^{2+}$ is a 2nd group radical and $Ni^{2+}$ is a 4th group radical. So solubility product of NiS has to be more than CdS. Further $Cd^{2+}$ gives yellow colour of CdS with $H_2S$, but $Ni^{2+}$ gives black colour of NiS with $H_2S$. So both assertion and statement are wrong. (d) is correct choice.

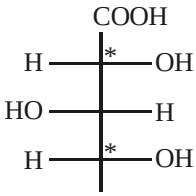
112.(b) In $[NiCl_4]^{2-}$ the $Cl^-$ ligands present in the complex ion are less basic than $CN^-$. As such no pairing of electrons in the 3d-subshell takes place. This results in $sp^3$ hybridisation and the complex so formed is tetrahedral. On the other hand in case of $[Ni(CN)_4]^{2-}$ the $CN^-$ ligands present in the complex ion are more basic than $Cl^-$. As such pairing of electrons can take place in the 3d subshell. Due to pairing of electrons in 3d subshell, one of the d-orbital becomes vacant. This results in $dsp^2$ hybridisation and the complex so formed in square planar.

113.(c) Rusting involves reduction of absorbed oxygen to $OH^-$ ions and oxidation of iron to $Fe^{2+}$ ions. The two ions and oxidation of iron to $Fe^{2+}$ ions. The two ions combine to yield $Fe(OH)_2$ which gets oxidised to give $Fe_2O_3.nH_2O$ (rust). The presence of acid helps dissolution of pure iron to ferrous ions while electrolytes increase the conductivity and assist cell action.

114.(a) R is the correct explanation of A.

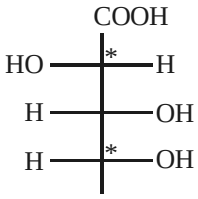



*meso*-form

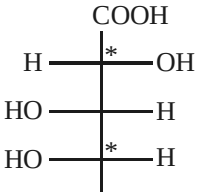



*meso*-form

MIRROR




(+)-form



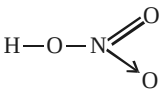

(–)-form

The central carbon atom is pseudochiral carbon atom.

**115.(d)** The statement is clearly wrong in context to Le-chateliers principle, which states that "increase in temperature shifts the equilibrium in the forward direction of those reactions which proceed with absorption of heat (**endothermic reactions**), and in the backward direction of those reactions which proceed with the evolution of heat (**exothermic reactions**)." E is clearly true again according to Le-chatelier principle.

**116.(a)** Assertion is correct as for every 10°C raise in temperature, the specific rate constant, K nearly doubles. (Although it is not correct for all reactions. For some reactions K even gets tripled for 10°C raise). The statement is clearly true and it explains the assertion, as the rate of collision among the molecules doubles for 10°C rise in temperature. So the answer is (a).

**117..(c)** Among oxyacids, the acidic character increases with increase in oxidation state of the central atom. Hence assertion is correct. Structure of $HNO_2$ : O—H—N═O ; Structure of $HNO_3$ :




The assertion is true but the reason is wrong as can be clearly seen from the above structures.

**118.(b)** Metal having negative reduction potential or positive standard oxidation potential has a tendency to get itself oxidised and pass into the solution.

**119.(a)** Lattice energy is the amunt of energy required to dissociate one mole of an ionic crystal into its ions and hydration energy is the amount of energy released when one mole of ions undergo hydration. So for the solubility of a solid in liquid hydration energy must be greater than lattice energy

**120.(c)** The correct reason is : The overall electron deficiency in *m*-nitroaniline is much less (due to –R-effect of $NO_2$ group and +R-effect of $NH_2$ group) than in *m*-dinitrobenzene (–R-effect of the two $NO_2$ groups) and hence does not accept additional electrons from a weak reducing agent such as $(NH_4)_2S$ and thus further reduction is prevented.

## SECTION III - BIOLOGY

121. (c) With the discovery of more and more organisms, sometimes, it becomes difficult to adjust an organism to the traditional categories. Therefore to make taxonomic position of a species more precise. The various obligate categories in hierarchial classification are explained below
Division ⟶ Class ⟶ order ⟶ family ⟶ Genus ⟶ Species ⟶ Tribe

122. (c) The bacterial genome/nucleoid is made of double stranded DNA without histone protein. The bacterial genome thus represented by a single circular double helical DNA. The genome contains some 100 chemical sites or loci. Each locus contains many genes. E coli contains about 4000 genes.

123. (c) The fungus that causes the disease 'Ergot of Rye' is *Claviceps purpurea*. It contains many poisonous alkaloids. The hallucinogenic drug LSD is extracted from this fungi.
- Rust of wheat is used by *Puccinia graminis*
- Powdery Mildew of Pea is caused by *Erysiphe*.

124. (b) Shape and number of chloroplast in different member of algae is different
*Chlamydomonas* – cup shaphed, 1/cell
*Zygnema* – Stellate, 2/cell
Spiral – *Spirogyra* 1/ cell
Collar shaped - *Ulothrix* 1/cell

125. (c) The inner membrane of mitochondria possess small tennis like particles called elementary particles, $F_0 - F_1$ particles or oxysomes. There are $1 \times 10^4 - 1 \times 10^5$ oxysomes in a mitochondria.

126. (c) + + 40 : **ab** 40 : + **a** 10 : + **b** : 10

127. (a) Lac operon is an inducible operon system which regulates genetic material. The genetic material remains switched off normally but becomes operational in the presence of inducer.

128. (b) Certain mitotic and meitotic irregularties such as formation of restitution nucleus, fusions of spindles lead to doubling of the chromosomes in a cell. Chromosome doubling is introduced by high temprature, X-ray treatments, callus formation hybridisation and chemical treatment like chlorofrom, chloral hydrate colchicine, auxins, gibberellins and nicotine sulphate etc. induce polyploidy.

129. (a) Asterceae constitutes the most advanced family among dicots. The syngenesious condition of the stamen is an adaptation for entomophily

130. (d) Tomato and tobacco both belong to the family Solanaceae.

131. (a) The central pith is surrounded by xylem, phloem, pericycle and endodermis . The phloem occurs only outside the xylem e.g *Equisetum*, *Osmunda*

132. (c) D.P.D. or suction pressure (S.P.)
= O.P. – T. P.
Hence D.P.D. for A = 4 bars, B = 0 bars, C = 5 bars, D = 4 bars
We know that direction of movement of water is from lower D.P.D. (S.P.) to higher D.P.D. (S.P.).
∴ flow will be from B to A, C, and D.

133. (c) Chlorophyll has a tetrapyrrole porphyrin head (15 × 15Å) and a long chain alcohol called phytol (20 Å).

134. (d) Cyt $a_3$ posseses two copper centers. The latter help in transfer of electron to oxygen.

135. (a) In campylotropous ovule, the body is curved but the embryosac is straight eg. *Capsella*. In Anatropous, the body of the ovule is inverted and gets fused with funiculus along its whole length on one side (most of the angiosperms). In orthotropous condition the body of ovule lies straight and upright over the funicle. e.g. Piperaceae, Polygonaceae.

136. (c) Nyctinastic (sleeping) movements : The diurnal (changes in day & night) movements of leaves cause sleeping movements during night which are called nyctinastic movements. It may be photonastic as in oxalis or thermonastic as in tulip flower.

137. (a) Mimicry is the resemblance of an organism to its natural surroundings, like initating a non-living object or another organism for conceding itself from its enemies. Flowers of *Ophrys muscifera* resemble the female wasps of *Colpa aurea* so that the male wasp tries to copulate with the flowers and pollinate them.

138. (a) *E. coli* are found in the human intestine. If they are present in water it indicates that the water is polluted.

139. (c) Meristem culture is done for the development of virus free plants. Meristematic tissue cells can be taken either from shoot or root tip.

140. (c) 2, 4 Dichlorophenoxy acetic acid is used for causing defoliation of forest trees.

141. (b) Species is the basic unit of classification. The term was coined by John Ray. Most taxonomists define species as morphologically distinct and reproductively isolated natural population or groups of populations where individuals resemble one another more closely that with the members of other species, interbreed freely and form a genetically closed system. Gene transfer occurs between populations of a species by gene flow i.e. emigration and immigration.

142. (c) $K_m$ (Michealis Menten constant). It is defined as that substrate concentration at which under optimum conditions the rate of an enzyme catalysed reaction reaches half the maximum rate. $K_m$ is inversely proportional to the affinity of enzyme for its substrate.

143. (b) Fire bellied toad (*Bombina*) is a member of order – Anura of the class Amphibia.

144. (b) *Eichhornia crassipes* is an American origin plant and now a troublesome water weed in India.

145. (a) Characteristics of smooth muscle cells
- range from 5 to 10 µm in diameter and 30 to 200 µm in length
- spindle-shaped
- single, centrally located nucleus
- Smooth muscle tissue occurs within almost every organ, forming sheets, bundles or sheaths around other tissues.

Smooth muscle differs from both skeletal and cardiac muscle tissues in structure and function. Sarcomeres or myofibrils are not present and are therefore not striated, ie. smooth.

146. (d) The permanent teeth appear completely by the age of 12 years, except for the last molars, which , if present, are formed after the age of 18 years. The dental formula before the wisdom teeth appear would be

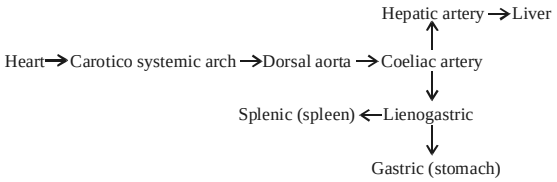
$$i\frac{2}{2}, c\frac{1}{1}; pm\frac{2}{2}, m\frac{2}{2}$$

after wisdom teeth appear

$$i\frac{2}{2}, c\frac{1}{1}; pm\frac{2}{2}, m\frac{3}{3}$$

147. (b) Alveoli are the site of the respiratory exchange of gases. Oxygen from the alveolar air diffuses through the alveolar epithelium and the capillary endotheliun into the capillary blood and carbon dioxide diffuses in the opposite direction.

148. (b)




149. (a) Henle's loop is associated with concentration of the urine and production of hypertonic urine.

150. (c) All mammals have 7 cervical vertebrae in their neck (it is one of the typical mammalian characters). Though they become long in camel & giraff but the number is 7 only. As whale is also a mammal it must possess the same 7 cervical vertebrae.

151. (a) Xth pair of cranial nerves (vagus nerves) has a motor branch called cardiac nerve which innervate cardiac muscles.

152. (a) Luteinizing hormone (LH) stimulates ovulation. Deficiency of insulin causes diabetes mellitus. Deficiency of ADH or vasopressin causes diabetes insipidus. Deficiency of parathormone causes tetany. Deficiency of thyroxine causes cretinism in infants and myxoedema in adults.

153. (c) Follicle stimulating hormone (FSH) stimulates maturation of ovarian follicles. Luteinizing hormone stimulates testes to secrete testosterone. Prolactin stimulates development of mammary glands during pregnancy. Human chorionic gonadotropin released from the placenta also maintains the corpus luteum during pregnancy.

154. (a) Biotic potential is the inherent ability of an organism to reproduce. Resistance refers to the sum total of all the limiting factors that inhibit further growth of population.

155. (b) Normal woman whose father was colour blind would have received the X chromosome from her father $\rightarrow X^cX$, marries a colour blind man $-X^cY$, their progeny would be:

$$X^cX \times X^cY$$

progeny $X^cX^c$ (colour blind daughter), $X^cX$ (normal daughter), $X^cY$ (colour blind son), $XY$ (normal son)

156. (a) Genetic drift can operate only in smaller population where in fluctuation can be observed in the proportion of allele distribution in the presence of external disturbances.

157. (c) Cro-Magnon succeeded Neanderthal. Fossils of Neanderthal man have been found from Eroupe, Asia and north Africa. Fossils of Australopithecus have been found in Africa.

158. (b) The presence of juvenile hormone is necessary for metamorphosis in to adult

159. (a) Morphine is an opiate narcotic, Bhang is a hallucinogen, Reserpine derived form *Rauwolfia,* is used a tranquilizer, cocaine is a stimulant.

160. (c) In test tube baby, fertilization of the sperm and the ova is carried out in lab conditions (in vitro) and when the embryos have reached the 32-celled stage, it is implanted back into the uterus of the surrogate mother.

161. (a) Due to the process of exosmosis, plasmolysis takes place. Hence water goes out of the mango and the mango shrinks. Hence, the reason is the correct explanation for the assertion.

162. (b) Nissl's granules are both basophilic and also contain RNA. They are basophilic since they stain with basic dyes. The reason is therefore not the correct explanation of the assertion.

163. (a) Phycobilins are accessory photosynthetic pigments present in algae. These pigments are present along with chlorophyll – α and help in capturing light for photosynthesis. Phycobilins are pigments which contain proteins and proteins are easily denatured by heat. Hence, the reason is the correct explanation for the assertion.

164. (d) The inner mucosa is mainly meant to increase the surface area and not for absorption. Hence, both assertion and reason are false.

165. (e) Vital capacity is the total volume of air that can be breathed out with maximum effort. The assertion in this case is false.

166. (c) Heart wood is non functional but it is plugged due to the growth of parenchyma that thickens later on. The reason in this case is false, but the assertion is true.

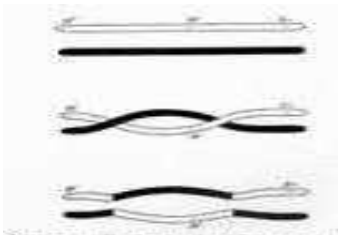
167. (a) Glucose which is the final product of carbohydrate digestion is converted to glycogen in the liver and stored both in the liver and muscles of animals. This process takes place only in animals and hence it is called as animal starch. Hence the reason is the correct explanation for the assertion.

**Electron micrograph of a section of a liver cell showing glycogen.**

168. (c) Racemose inflorescence shows an indefinite growth, which is why it is said to be an indeterminate inflorescence. The reason given is false.

169. (e) Mouth parts of cockroach, honey bee & mosquito are homologus organs. Therefore the assertion is false.

170. (b) The crossing over takes place at the four strand stage so that recombinations can take place when the chromosomes separate as chromatids. The gene linkages do disappear if crossing over takes place at two strand stage. The reason is therefore not the correct explanation of the assertion.



**A double crossing over.**

171. (c) Oncogenes integrate their DNA with DNA of the host cells and not their RNA. The reason in this case is false.

172. (a) HIV is found in body fluids like blood & semen. It is a retrovirus which has RNA as its genetic material. It hence shows reverse transcription. Hence the reason is the correct explanation for the assertion.

173. (b) Genes although show a linear order but are arranged in the DNA as a helical coiled structure. Hence the reason is not the correct explanation for the assertion given.

174. (a) The virus cannot multiply outside living systems. They require a host in order to multiply. Hence the reason is true for the assertion.

175. (e) The allergens are actually not glycogen molecules but are protein molecules. Hence the assertion is false.

176. (b) The interferons are a special defensive mechanism produced by the infected cells. On reaching the nearby uninfected cells they help in the formation of certain proteins that prevent the multiplication of the virus. Hence the reason is not the correct explanation of the assertion.

177. (e) Horticulture is the conscious raise of Vegetables, fruits & Ornamental plants and not of cereal crops. Hence the assertion is false.

178. (a) Viruses are bodies which have either DNA or RNA as a genetic material. For multiplication, it is the genetic material that enters into the host cells which then with the help of the DNA of the host cell prepare their protein shield. The reason is the correct explanation for the assertion.

179. (a) All aggregate and multiple fruits develop from other floral parts like the thalamus, calyx, etc. Hence the reason is the correct explanation for the assertion.

180. (c) In Casuarina & Betula the pollen tube enters through the Chalaza and not the microphyle. Hence the reason is false.

## SECTION IV - G.K.

| | | |
|---|---|---|
| 181. (a) | 182. (d) | 183. (b) |
| 184. (d) | 185. (c) | 186. (c) |
| 187. (a) | 188. (b) | 189. (d) |
| 190. (a) | 191. (d) | 192. (b) |
| 193. (d) | 194. (b) | 195. (a) |
| 196. (d) | 197. (a) | 198. (c) |
| 199. (b) | 200. (d) | |