



NEET - 2026

BIOLOGY

STUDY MATERIAL

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CONTENTS

BOTANY

1.	Biological Classification -----	05
2.	Plant Kingdom-----	13
3.	Morphology of Flowering Plants -----	22
4.	Anatomy of Flowering Plants-----	30
5.	Cell : The unit of life -----	37
6.	Cell Cycle and Cell Division -----	45
7.	Photosynthesis in Higher Plants-----	56
8.	Respiration in Plants -----	66
9.	Plant Growth and Development -----	75
10.	Sexual reproduction in Flowering Plants -----	81
11.	Biotechnology : Principles and processes -----	91
12.	Biotechnology and its Applications-----	101
13.	Organism and Population -----	110
14.	Ecosystem -----	119

ZOOLOGY

1.	The Living World-----	127
2.	Animal Kingdom - Non Chordata-----	133
3.	Animal Kingdom - Phylum Chordata -----	145
4.	Structural organisation in Animals (Animal Tissues) Morphology of Animals (Cockroach, Frog) -----	155
5.	Biomolecules -----	169
6.	Breathing and Exchange of Gases -----	175
7.	Body Fluids and Circulation -----	184
8.	Excretory Products and Their Elimination -----	193
9.	Locomotion and Movement -----	201
10.	Neural Control and Co-ordination -----	212
11.	Chemical Co-ordination and Integration -----	222
12.	Human Reproduction -----	228
13.	Reproductive Health-----	240
14.	Principles of Inheritance and Variation -----	247
15.	Molecular Basis of Inheritance -----	256
16.	Evolution -----	266
17.	Human Health and Disease -----	278
18.	Microbes in Human Welfare-----	288
19.	Biodiversity and Conservation -----	296

Page 4 blank

SYNOPSIS**■ Introduction to Classification**

- 2-Kingdom - Demerits
- 5-Kingdom

Characteristics of the Five Kingdoms

Characters	Five Kingdoms				
	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell wall	Noncellulosic (Polysaccharide + amino acid)	Present in some	Present (without cellulose)	Present (cellulose)	Absent
Nuclear membrane	Absent	Present	Present	Present	Present
Body organisation	Cellular	Cellular	Multicellular / loose tissue	Tissue / organ	Tissue / organ / organ system
Mode of nutrition	Autotrophic (chemosynthetic and photosynthetic) and Heterotrophic (saprophytic/parasitic)	Autotrophic (Photosynthetic) and Heterotrophic	Heterotrophic (Saprophytic / Parasitic)	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic / Saprophytic etc.)

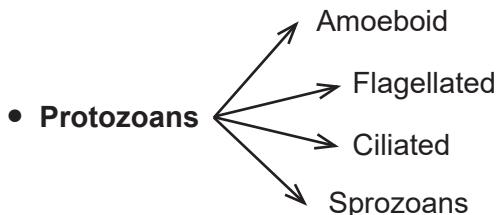
- Criteria for 5-kingdom classification
- Merits and Demerits of 5-kingdom classification

► **Kingdom Monera**

- Archaebacteria - Methanogens, Halophiles and Thermoacidophiles
- Eubacteria - (Shape, Nutrition, Reproduction, Economic importance etc.)
 - ◆ Cyanobacteria
- Mycoplasma

► **Kingdom Protista**

- **Photosynthetic protists**
 - Chrysophytes
 - Dinoflagellates
 - Euglenoids
- **Consumer / Decomposer protists (Saprophytic protists)** → Slime moulds



► **Kingdom Fungi**

- Habit, Habitat, Nutrition, Reproduction
- Fungal classification - Characteristics with examples.
 - ◆ Phycomycetes
 - ◆ Ascomycetes
 - ◆ Basidiomycetes
 - ◆ Deuteromycetes

► **Kingdom Plantae**

► **Kingdom Animalia**

► **Virus** - Characteristics and Structure

► **Viroids**

► **Prions**

► **Lichens**

QUESTIONS

LEVEL - I

- 1.** Criteria used for the two kingdom classification?

 - 1) Cell membrane
 - 2) Cell wall
 - 3) Mesosome
 - 4) Pigments

2. Which of the following is correctly matched pair?

 - 1) Methanogens - Live in marshy area and produce methane
 - 2) Halophiles - Extreme salt loving bacteria
 - 3) Thermoacidophiles - Hot springs
 - 4) All are correct

3. Match column I with column II and select the correct option :

Column I	Column II
A) Photosynthetic bacteria	1) Fix nitrogen
B) Chemosynthetic bacteria	2) Cyanobacteria
C) Parasitic bacteria	3) Nitrifying bacteria
D) Symbiotic bacteria	4) Cause diseases

1) $\frac{\text{ABCD}}{1234}$ 2) $\frac{\text{ABCD}}{4321}$

3) $\frac{\text{ABCD}}{3421}$ 4) $\frac{\text{ABCD}}{2341}$

4. What is true for mycoplasma?

 - 1) They lack cell wall
 - 2) They are the smallest living cell known
 - 3) They can survive without oxygen
 - 4) All the above

- 5.** Mode of nutrition in protists are :

 - 1) Photosynthetic
 - 2) Saprophytic
 - 3) Parasitic
 - 4) All the above

6. Which of the following organisms possess locomotory structure :

1. Nostoc	2. Chlamydomonas
3. Golden algae	4. Euglena
5. Gonyaulax	6. Plasmodium

 - 1) 1, 2, 3, 4, 6
 - 2) 2, 4, 5
 - 3) 2, 3, 4, 5
 - 4) All of these

7. Which of the following statements are true regarding fungi?

 1. Fungi are heterotrophic
 2. Basidiomycetes exhibit dikaryotisation
 3. Edible mushrooms are called toad stool
 4. Deuteromycetes are decomposers, parasites and biocontrol agents.
 - 1) All are true
 - 2) All except 2 are true
 - 3) Only 4 is false
 - 4) 1, 2 and 4 are true

- 8.** Which one of the following matches is incorrect?

1)	Alternaria	Sexual reproduction absent	Deuteromycetes
2)	Mucor	Aseptate fungi	Phycomycetes
3)	Agaricus	Edible mushroom	Endogenous basidiospore
4)	Yeast	Unicellular	Budding

- 9.** Which of the following is incorrect?
- a) Yeast is unicellular Ascomycetes
 - b) Morels and truffles are edible Ascomycetes
 - c) In ascomycetes conidia are the asexual spores
- 1) All true except b
 - 2) All true except a
 - 3) All true except c
 - 4) All true
- 10.** Albugo and Puccinia are :
- 1) Autotrophs
 - 2) Parasites
 - 3) bear ascocarp
 - 4) bear basidiocarp

- 11.** Read the following statements and select the correct option.

Statement I : All members in plant kingdom exhibit alternation of generation.

Statement II : Kingdom plantae includes eukaryotic chlorophyll containing organisms.

- 1) Statement I is false and statement II is true
- 2) Statement I and II are incorrect.
- 3) Statement I and II are correct
- 4) Statement I is true and statement II is false

- 12. Assertion** : Animals follow a definite growth pattern.

Reason : Higher forms shows elaborate sensory and neuromotor mechanism.

- 1) Assertion and reason are true, the reason is correct explanation of assertion.
- 2) If both assertion and reason are true, but reason is not a correct explanation of assertion.
- 3) Assertion is true but the reason is false
- 4) Both assertion and reason are false

- 13.** Read the following statements and select the correct option.

Statement I : In general, viruses that infect plants have single stranded RNA

Statement II : Bacteriophages have double stranded DNA with polyhedral head.

- 1) Statement I is false and statement II is true
- 2) Statement I and II are incorrect.
- 3) Statement I and II are correct
- 4) Statement I is true and statement II is false

- 14.** How many of the following disease are caused to plant by viral infection.

(Influenza, Vein clearing, Dwarfing, Stunted growth, Leaf rolling, Yellowing)

- 1) 5
- 2) 6
- 3) 4
- 4) 7

- 15.** Mad cow disease in cattle is cause by :

- 1) Viroids
- 2) Abnormally folded protein
- 3) Free RNA with protein coat
- 4) Free DNA without protein coat

QUESTIONS

LEVEL - II

- 1.** In Whittaker five Kingdom classification eukaryotes present in:
 - 1) Only four kingdom
 - 2) Only three kingdom
 - 3) Only two kingdom
 - 4) All five kingdom
- 2.** Many drawbacks was in two kingdom classifications system, because this system did not distinguish between :
 - 1) Eukaryotes and Prokaryotes
 - 2) Unicellular and multicellular organisms
 - 3) Photosynthetic and non photosynthetic
 - 4) All of these
- 3.** Select the correct combination of the statements (i-iv) regarding the characteristics of certain organisms.
 - i) Methanogens are archaeabacteria which produce methane in marshy areas.
 - ii) Nostoc is a blue-green algae which fix atmospheric nitrogen.
 - iii) Chemosynthetic autotrophic bacteria synthesize glucose in presence of light energy.
 - iv) Mycoplasma lack a cell wall and can survive without oxygen.

The correct statements are

 - 1) (ii) and (iii)
 - 2) (i),(ii) and (iii)
 - 3) (ii), (iii) and (iv)
 - 4) (i), (ii) and (iv)

- 4.** A few organisms are known to grow and multiply at very high temperature above 100°C. They belongs to
- 1) Thermophilic archaebacteria
 - 2) Blue-green algae
 - 3) Methanogenic archaebacteria
 - 4) Halophilic archaebacteria
- 5.** The most abundant prokaryotes helpful to humans in making curd from milk and in production of antibiotics are the ones categorised as
- 1) Cyanobacteria
 - 2) Archaeabacteria
 - 3) Chemosynthetic autotrophs
 - 4) Heterotrophic bacteria
- 6.** Select the wrong statement.
- 1) The walls of diatoms are easily destructible.
 - 2) 'Diatomaceous earth' is formed by the cell walls of diatoms.
 - 3) Diatoms are chief producers in the oceans.
 - 4) Diatoms are microscopic and float passively in water
- 7.** In protozoa like Amoeba the organ for osmoregulation is
- 1) Contractile vacuole
 - 2) Mitochondria
 - 3) Nucleus
 - 4) Food vacuole
- 8.** Dikaryon formation is characteristic of:
- 1) Phycomycetes and Basidiomycetes
 - 2) Ascomycetes and Basidiomycetes
 - 3) Ascomycetes and Phycomycetes
 - 4) Phycomycetes and Deuteromycetes
- 9.** Correct sequence of sexual cycle in fungi
- 1) Karyogamy, Plasmogamy, Meiosis
 - 2) Plasmogamy, Karyogamy, Meiosis
 - 3) Plasmogamy, Meiosis, Karyogamy
 - 4) Meiosis, Plasmogamy, Karyogamy
- 10.** Sexual spore are produced exogenously inA..... and endogenously inB.....:
- 1) A - Ascomycetes, B - Phycomycetes
 - 2) A - Basidiomycetes, B - Ascomycetes
 - 3) A - Ascomycetes, B - Basidiomycetes
 - 4) A - Dueteromycetes, B - Ascomycetes
- 11.** Which of the following organism are parasites:
- 1) Cuscuta and Albugo
 - 2) Bladderwort and Albugo
 - 3) Bladderwort and Venus fly trap
 - 4) Agaricus and Slime moulds

12. Select the wrong statement.

- 1) The term '*Contagium vivum fluidum*' was coined by M. W. Beijerinck.
- 2) Mosaic disease in tobacco and AIDS in human being are caused by viruses.
- 3) The viroids were discovered by D.J. Ivanowsky.
- 4) W.M. Stanley showed that viruses could be crystallised

13. Which of the following statements is wrong for viroids?

- 1) They cause infections.
- 2) Their RNA is of high molecular weight.
- 3) They lack a protein coat.
- 4) They are smaller than viruses

14. CJD in human is caused by an organism which has

- 1) RNA with protein coat
- 2) Abnormal folded protein
- 3) Free RNA without protein coat
- 4) Free DNA without protein coat

15. Lichens indicate SO_2 pollution because they

- 1) Show association between algae and fungi
- 2) Are acellular
- 3) Are sensitive to SO_2
- 4) Flourish in SO_2 rich environment

QUESTIONS LEVEL - III

1. Consider the following statements and select the correct option :

Statement I : Chemoautotrophic bacteria obtain energy from inorganic substances for the synthesis of food substances.

Statement II: Nitrogen fixing bacteria, iron bacteria, phosphate solubilising bacteria and sulphur bacteria are involved in nutrient recycling process and they are chemosynthetic autotrophs.

- 1) Statement I is true
- 2) Statement II is true
- 3) Statement I and II are correct
- 4) Statement I and II are incorrect

2. How many of the following statements are true :

- A) Archaebacteria are primitive organisms; can survive in extreme conditions but they have no economic importance.
- B) Heterocyst present in filamentous forms of cyanobacteria only
- C) Endospores are asexual spores produced in all eubacteria under unfavourable conditions.
- D) Cyanobacteria resembles characters of algae and bacteria

- 1) One
- 2) Two
- 3) Three
- 4) Four

- 3.** Observe the following characteristics :
- A) Vegetative body is an aggregate mass of multinucleate protoplasm without cell wall.
- B) Body composed of aggregation of diploid cells and are called plasmodium.
- The above characters shows the described organism is :
- 1) Cellular slime mould
 - 2) Acellular slime mould
 - 3) Mycoplasma
 - 4) Both 1 and 2
- 4.** How many different types of fruiting bodies (ascocarp) are present in ascomycetes :
- 1) One
 - 2) Two
 - 3) Three
 - 4) Four
- 5.** Dikaryon formation occurs in :
- 1) Albugo and Penicillium
 - 2) Aspergillus and Agaricus
 - 3) Neurospora, Ustilago and Alternaria
 - 4) Rhizopus, Morels, Puccinia and Claviceps
- 6.** Which of the following is true regarding Lichen :
- A) Do not include any of the kingdom of five kingdom classification because they are acellular.
 - B) Symbiotic association between cyanobacteria and ascomycetes
 - C) Symbiotic association between green algae and fungi
 - D) Master-slave relationship
- 1) All except A
 - 2) C only
 - 3) A, B and C
 - 4) A and C

SYNOPSIS

1. Systems of classification

- 1) Artificial
- 2) Natural
- 3) Phylogenetic

New systematics

- Numerical Taxonomy
- Cytotaxonomy
- Chemotaxonomy

2. Classification of Plant Kingdom

A) Algae

- General characters and Economic importance
- Classification of Algae
 - Chlorophyceae - General characters with examples
 - Phaeophyceae - General characters with examples
 - Rhodophyceae - General characters with examples

Examples strictly based on NCERT

B) Bryophytes

- General characters and Economic importance

Classification of Bryophytes

1. Liverworts - General characters. Eg. *Marchantia*

2. Mosses - General characters. Eg. *Funaria*

Polytrichum

Sphagnum

C) Pteridophytes

- General characters and Economic importance.

Classification of Pteridophytes

1. Psilopsida - Eg. *Psilotum*

2. Lycopsida - Eg. *Selaginella, Lycopodium*

3. Sphenopsida - Eg. *Equisetum*

4. Pteropsida - Eg. *Pteris, Dryopteris, Adiantum, Salvinia*

- Heterospory and seed habit.

D) Gymnosperms

- General characters

- Examples - *Cycas, Pinus, Ginkgo, Cedrus* etc.

E) Angiosperms

- General Characters

- Classes - Dicotyledonae and Monocotyledonae

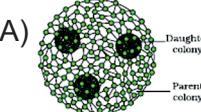
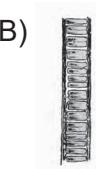
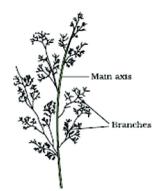
QUESTIONS**LEVEL - I**

- 1.** Natural system of classification made by George Bentham and Joseph Dalton Hooker for :
- 1) All living organisms
 - 2) Prokaryotes only
 - 3) All eukaryotes
 - 4) Angiosperms only

- 2.** Find the matching series :

	A	B
A)	Artificial system of classification	Gave equal weightage to vegetative and sexual characteristics
B)	Phylogenetic system of classification	Based on evolutionary relationship between various organisms
C)	Numerical taxonomy	Each character is give equal importance and at the same time hundreds of characters can be considered
D)	Cytotaxonomy	Based on chromosome number, structure and behaviour
E)	Chemotaxonomy	Based on chemical constituents of cell

- 1) A, B, C, D and E
- 2) B, C, D and E
- 3) C, D and E
- 4) D and E only

- 3.** Identify the criteria of classification of algae:
- A) Flagellation
 - B) Pigmentation
 - C) Assimilatory product
 - 1) A only 2) A & B only
 - 3) B only 4) A, B & C
- 4.** Pyrenoids contains :
- 1) Central core of starch surrounded by protein
 - 2) Central core of protein surrounded by starch
 - 3) Starch only
 - 4) Protein only
- 5.** Which of the following plants generally produces both asexual spores and sexual spores :
- A) Algae B) Bryophytes
 - C) Pteridophytes D) Gymnosperms
 - E) Angiosperms
 - 1) A only 2) All except A
 - 3) B, C, D only 4) A, B, C, D & E
- 6.** Which of the following is an edible marine algae
- A)  B) 
- C)  D) 
- 1) A 2) B
 - 3) C 4) D

7. How many of the following statements are true :
- In lower group of plants such as algae, chloroplast shows variation in shape.
 - In all green algae, starch is the only reserve food material
 - Green algae, sexually reproduces by isogamy, anisogamy and oogamy
 - Green algae possess chlorophyll a and chlorophyll b and found only in fresh water.
- One
 - Two
 - Three
 - Four
8. Which of the following algae possess air bladders :
- Porphyra
 - Fucus
 - Laminaria
 - Polysiphonia
9. In oogamous species of brown algae, fertilisation occurs :
- In water
 - Within oogonium
 - Within antheridium
 - Either in water or within oogonium
10. In phaeophycean algae, plant body differentiates into :
- Hold fast, stipe and frond
 - Rhizoids, stipe and frond
 - Foot, seta and capsule
 - Rhizome, stipe and capsule
11. Reserve food material of which group of algae resembles the structure of amylopectin and glycogen :
- Green algae
 - Brown algae
 - Red algae
 - Both 1 and 2
12. Which of the following algae reproduce sexually by non-motile and non-flagellated gametes :
- All green algae and few red algae
 - All red algae and few green algae
 - All green algae and all red algae
 - All brown algae and all red algae
13. **Assertion** : Red algae occur in well - lighted region close to the surface of water and also at great depths in oceans where relatively little light penetrates.
- Reason** : Red algae possess phycoerythrin in addition to chlorophyll a and chlorophyll d.
- Assertion and reason are true, the reason is correct explanation of assertion.
 - If both assertion and reason are true, but reason is not a correct explanation of assertion.
 - Assertion is true but the reason is false
 - Both assertion and reason are false
14. Which group of plants reproduce asexually by gemmae :
- | | |
|---------------|---------------|
| 1) Liverworts | 2) Pteropsida |
| 3) Mosses | 4) Psilopsida |

- 15.** Which of the following plants produce biflagellated antherozoids
 A) Liverworts
 B) Gymnosperms
 C) Mosses
 D) Homosporous Pteridophytes
 1) A & C 2) B & C
 3) A & D 4) A, C, & D
- 16.** Which of the following is a rootless pteridophyte :
 1) Equisetum 2) Salvinia
 3) Selaginella 4) Sphagnum
- 17.** Consider the following statements :
 A) Both algae and Bryophytes are non-vascular embryophytes.
 B) Seed bearing plants are Gymnosperms and Angiosperms.
 C) Coralloid root and mycorrhizal associations are present in Pinus and Cycas respectively.
 D) Protonema is a haploid structure formed from haploid spores due to mitosis.
 E) Gymnosperms are pollinated by wind only.
 Of the above statements ;
 1) A, B & C are true
 2) B, C & D are true
 3) B, D and E are true
 4) All except C & D are true
- 18.** Which of the following plant groups are evolutionary more advanced :
 1) Gymnosperms
 2) Dicotyledonae
 3) Monocotyledonae
 4) All Angiosperms

QUESTIONS LEVEL - II

- 1.** Consider the following statements and select the correct option?
Statement I : In most of the algae, meiosis occur in zygote that leads to development of haploid gametophytic thallus.
Statement II : Carrageen, Agar and Algin are hydrocolloids that are obtaining from cell wall of all red algae and all brown algae respectively.
- 1) Both statements are correct.
 2) Both statements are incorrect
 3) Statement I is correct.
 4) Statement II is correct
- 2.** Internal fertilization and undoubtful maternity is guaranteed in the following type of sexual reproduction :
 1) Isogamy and Anisogamy
 2) Oogamy and Anisogamy
 3) Anisogamy only
 4) Oogamy only
- 3.** Which of the following statement is/are true regarding Bryophytes :
 A) Amphibians in the plant kingdom
 B) Usually occur in damp, humid and shaded places
 C) Biflagellated antherozoids
 D) Non-vascular, non-embryophytes
 E) Protonema formation occur in life of liverworts and mossess.
 F) Mossess along with lichens are the first organisms to colonise rocks and hence are of great ecological importance.
- 1) A, B & C only 2) D, E, F only
 3) All except D & E 4) All except E

4. Plants like Chara and Marchantia shows diversity of sexuality such that these plants are respectively :
- Monoecious and Unisexual
 - Dioceious and Unisexual
 - Monoecious and Dioecious
 - Dioecious and Monoecious
5. In which group of plants, Oogamous sexual reproduction occur :
- Angiosperms only
 - Gymnosperms and Angiosperms only
 - Gymnosperms, Angiosperms and Pteridophytes
 - Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms
6. Antheridiophore and archegoniophore are present in which group of plants:
- Algae
 - Liverworts
 - Mosses
 - Pteridophytes
 - Gymnosperms
- All except A
 - All except E
 - B only
 - All except D
7. How many of the following statements are false :
- In both liverworts and mosses, sporophyte is partially depended on gametophyte
 - In most of the algae, sex organs are unicellular and are haploid in structure
 - Rhizoids of mosses and liverworts are multicellular
 - Zoospores of brown algae are pear shaped biflagellated and motile
 - Different forms of Carbohydrate is the common stored food materials of chlorophycean, Phaeophyean and Rhodophycean algae and some green algae may store food in the form of oil droplets.
- Two
 - Three
 - Four
 - Five
8. Which of the following statement is true regarding prothallus :
- Gametophyte of pteridophyte
 - Independent from sporophyte
 - Photosynthetic
 - Group of antheridia and archegonia are developed
 - Haploid inconspicuous and requires cool and damp and shady places to grow.
- All except C
 - A, B and E only
 - All except B & C
 - A, B, C, D and E

- 9.** Consider the following statements :
- Most of the pteridophytes are homosporous but some members are heterosporous.
 - Heterospory is more advanced than homospory
 - In both homosporous and heterosporous pteridophytes, fertilization and development of zygote into young embryo takes place within female gametophyte.
 - In heterosporous pteridophytes fertilization and development of zygote into young embryo takes place within female gametophyte and it is considered as the precursor of seed habit
- Of the above statements ;
- A & B are false
 - Only C is false
 - A, B and C are false
 - Only B is false
- 10.** Consider the following statements and select the correct option?
- Statement I** : The spores germinate to produce dioecious thalloid gametophyte in Marchantia.
- Statement II** : All the members in Lycopodiidae are homosporous.
- Both statements are correct.
 - Both statements are incorrect
 - Statement I is correct.
 - Statement II is correct

- 11.** How many of the following parts exhibit haploid number of chromosome :
- Gemmae
 - Spore mother cells in capsule of funaria
 - Spores of pteridophytes
 - Sporophyte of Bryophytes
 - Rhizome of Pteridophyte
 - Gametophyte of Gymnosperms
 - Gametophyte of algae
- | | |
|---------|--------|
| 1) One | 2) Two |
| 3) Four | 4) Six |
- 12.** Consider the following statements and select the correct option?
- Statement I** : In cycas, megasporophyll arranged loosely and it is considered as lax instead of female cone.
- Statement II** : In cycas, microsporophylls arranged compactly to form male cone.
- Both statements are correct.
 - Both statements are incorrect
 - Statement I is incorrect.
 - Statement II is incorrect
- 13.** Which of the following pair of plants possesses both embryo and archegonia :
- Eucalyptus and Sequoia
 - Fucus and Selaginella
 - Funaria and Pinus
 - Wolffia and Marchantia

- 14.** In which of the following plants, gametophyte is not free living and totally dependent on sporophyte :
- A) Pinus
 - B) Marchantia
 - C) Cycas
 - D) Cedrus
 - E) Spirogyra
 - F) Lycopodium
 - G) Ginkgo
 - H) Funaria
- 1) A, C, D and G
 - 2) B, E, F and H
 - 3) B, C, D, E and F
 - 4) A and B
- 15.** Consider the following statements and select the correct option?
- Statement I** : Spores produced by different groups of plants are asexual spores only.
- Statement II** : Sexual and asexual spores are produced in all plant group with in plant kingdom.
- 1) Both statements are incorrect.
 - 2) Both statements are correct
 - 3) Statement I is correct.
 - 4) Statement II is correct
- 16.** Identify the similarity shared by the plants : **Funaria, Selaginella, Pinus and Eucalyptus.**
- 1) Presence of vascular tissues
 - 2) Presence of archegonium
 - 3) Presence of heterospory
 - 4) Presence of embryo
- 17.** Consider the following statements :
- A) Gametophyte of all plant groups with in plant kingdom are non-vascular.
 - B) In Gymnosperms, both male and female gametophytes are highly reduced structures and are completely dependent on sporophyte.
 - C) In Gymnosperms, pollengrains and endosperm cells are considered as male and female gametophyte respectively :
- 1) A, B and C are true
 - 2) A is false
 - 3) B & C are false
 - 4) C is false

QUESTIONS

LEVEL - III

- 1.** Consider the following statements and select the correct option?
- Statement I** : Linnaeus system of classification is artificial..
- Statement II** : The demerit of Bentham and Hooker's classification is the phylogeny of plants is not considered because in it gymnosperms are placed in between dicots and monocots.
- 1) Statement I is false.
 - 2) Statement II is false
 - 3) Statement I statement II are false
 - 4) Statement I statement II are true

- 2.** Multicellular female gametophyte is present in :
A) Selaginella and Lycopodium
B) Equisetum and Pinus
C) Cycas and Ginkgo
D) Salvinia and Cedrus
1) A only 2) C & D
3) A & C 4) B, C & D
- 3.** In which of the following plants water is required for movement of antherozoids towards archegonium for fertilization?
1) Liverworts only
2) Mosses only
3) Liverworts, mosses and homosporous pteridophytes only
4) Liverworts, mosses, homosporous pteridophytes and heterosporous pteridophytes
- 4.** Which among the following gymnosperm is most primitive type :
1) Cycas
2) Pinus
3) Ginkgo
4) Cedrus
- 5.** Most of the gymnosperms are :
1) Arborescent and some are shrubs
2) Herbs and few are arborescent
3) Shrubs and few are arborescent
4) Medium sized plants and few are arborescent

SYNOPSIS

Introduction

- Parts of Flowering Plant
- Underground parts - Root system
- Aerial parts - Shoot system

► **The Root**

- Types of root system
- Regions of the Root
- Functions of Root
- Modifications of Root
 - Storage
 - To provide additional support
 - Respiration

► **The stem**

- Characteristics and functions
- Modifications of stem
 - Underground stems
 - Aerial stems
 - Sub-aerial stems

► The Leaf

- Parts of a leaf
- Venation
- Types of leaves
- Phyllotaxy

Modifications of leaves**► The Inflorescence**

- Types of inflorescence
 - Racemose
 - Cymose

► The Flower

- Floral description
- Parts of a flower
 1. Calyx
 2. Corolla

Aestivation

 3. Androecium (Adhesion and cohesion)
 4. Gynoecium (Placentation)

► The Fruit

- True fruit
- Parthenocarpic fruit

► The Seed

- Structure of a Dicotyledonous seed
- Structure of Monocotyledonous seed

► Technical description of a flowering plant**► Description of some important families**

1. Fabaceae
2. Solanaceae
3. Brassicaceae
4. Malvaceae
5. Asteraceae
6. Poaceae

QUESTIONS

LEVEL - I

1. Primary root is long lived in the root system of :
 - 1) Wheat
 - 2) Mustard
 - 3) Grasses
 - 4) All the above
2. Which among the following description is wrong about the different regions of root :
 - 1) Cells in the region of meristematic activity are very small, thin-walled and with dense protoplasm
 - 2) Cells of the elongation zone gradually differentiate and mature
 - 3) Cells in the region of elongation and maturation form very fine and delicate, thread - like structures called root hairs.
 - 4) Root hairs absorb water and minerals from the soil
3. In some plants such as Rhizophora growing in swampy areas, many roots come out of the ground and grow vertically upwards, such roots are called :
 - 1) Pneumatophode
 - 2) Pneumatophore
 - 3) Prop root
 - 4) Stilt root
4. Read the following statements and identify the correct option.

Statement A: Stem is generally green when young and later often become woody and dark brown.

Statement B: The region of the stem where leaves are borne are called nodes and stem bears only one type of bud.

 - 1) Statement A and statement B are correct
 - 2) Statement A and statement B are incorrect
 - 3) Statement A is correct, B is incorrect
 - 4) Statement A is incorrect, B is correct

5. How many among the following plant contains stem meant for perennation and storage :

Grass, Pistia, Ginger, Turmeric, Jasmine, Eichornia, Zaminkand, Citrus

 - 1) 3
 - 2) 4
 - 3) 5
 - 4) 6
6. An aerial stem is modified into green fleshy cylindrical structure meant for photosynthesis is found in :
 - 1) Euphorbia
 - 2) Opuntia
 - 3) Bougainvillea
 - 4) 1 and 2
7. Match the name of part of leaf or characteristics of leaf given in column I with that of explanation given in column II

Column I	Column II
A) Pulvinus	1. Expanded leaf base
B) Sheathing leaf base	2. Two leaf at a node
C) Opposite phyllotaxy	3. One leaf at a node
D) Alternate phyllotaxy	4. Swollen leaf base

 - 1) A - 1 ; B - 2 ; C - 3 ; D - 4
 - 2) A - 4 ; B - 3 ; C - 2 ; D - 1
 - 3) A - 4 ; B - 1 ; C - 2 ; D - 3
 - 4) A - 2 ; B - 4 ; C - 3 ; D - 1

- 8.** Which among the following is wrong about the characteristic of inflorescence or flower:
- 1) A flower is a modified shoot where in the shoot apical meristem changes to floral meristem
 - 2) In racemose type of inflorescence the main axis continues to grow.
 - 3) In some plants like *Salvia* and mustard the calyx and corolla are not distinct and are termed as perianth.
 - 4) The arrangement of sepal/petal in flower bud is termed as aestivation.
- 9.** Observe the figure explaining the aestivation the corolla of certain plants. Identify the set of plants which exhibit it :



- 1) *Calotropis*, *Solanum*
 - 2) China rose, Lady's finger
 - 3) *Cassia*, Gulmohar
 - 4) Pea, Bean
- 10.** Which among the following feature is a similarity shared by hypogynous and perigynous flowers :
- 1) Superiormost position of ovary
 - 2) Inferiormost position of ovary
 - 3) Floral parts like stamen, petal and sepal start below the ovary
 - 4) Lateral wall of ovary free from thalamus

- 11.** How many of the following terms explains the types of cohesion in a whorl of flower :

Monadelphous, Polyadelphous, Polyandrous, Syncarpous, Apocarpous, Epipetalous, Epiphyllous

- 1) 5
- 2) 4
- 3) 3
- 4) 2

- 12.** Match the name of plants given in column I with that of their placentations given in column II.

Column I	Column II
A) Dianthus	1. Marginal
B) Argemone	2. Basal
C) Sunflower	3. Free central
D) China rose	4. Parietal
E) Pea	5. Axile

- 1) A - 4 ; B - 3 ; C - 5 ; D - 2 ; E - 1
- 2) A - 1 ; B - 2 ; C - 3 ; D - 4 ; E - 5
- 3) A - 3 ; B - 4 ; C - 5 ; D - 2 ; E - 3
- 4) A - 3 ; B - 4 ; C - 2 ; D - 5 ; E - 1

- 13. Assertion** : Parthenocarpic fruits are devoid of seeds.

Reason : Parthenocarpic fruits are developed from the ovary of flower without completing fertilization.

- 1) Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
- 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
- 3) Assertion is true but the Reason is false
- 4) Both Assertion and Reason are false

- 14.** Which among the following is not correct about a typical monocot seed :
- 1) Outermost layer of endosperm in monocot seed is called as aleurone layer
 - 2) All monocot seeds are endospermic
 - 3) The single shield shaped cotyledon of monocot seed is called as scutellum
 - 4) The plumule and radicle are enclosed in sheath which are called coleoptile and coleorhiza respectively
- 15.** In Salvia and Mustard there is variation in the :
- 1) Number of pollen sac in an anther
 - 2) Length of filaments of stamen
 - 3) Type of cohesion in androecium
 - 4) Sexuality of flower
- 16.** How many among the following plants posses only two leaves at a node :
- China rose, Mustard, Sunflower, Calotropis, Guava, Alstonia**
- 1) 5
 - 2) 4
 - 3) 3
 - 4) 2
- 17.** Diadelphous androecium and monadelphous androecium are characteristic of the following families respectively :
- 1) Fabaceae and Malvaceae
 - 2) Malvaceae and Fabaceae
 - 3) Brassicaceae and Solanaceae
 - 4) Solanaceae and Brassicaceae
- 18.** Which among the following character is shared by the families Malvaceae and Solanaceae :
- 1) Number of carpels in gynoecium
 - 2) Type of placentation
 - 3) Number of stamens in androecium
 - 4) Type of aestivation in corolla
- 19.** Epipetalous syngenesious stamen and basal placentation is found in the following family :
- 1) Solanaceae
 - 2) Asteraceae
 - 3) Poaceae
 - 4) Fabaceae
- 20.** Which among the following option contains group of plants belongs to the same family:
- 1) Arabidopsis, Cotton, Lady's finger
 - 2) Sun flower, Marigold, China rose
 - 3) Tomato, Paddy, Cassia
 - 4) Arhar, Soyabean, Lupin

QUESTIONS LEVEL - II

- 1.** Same type of root system is present in :
 - 1) China rose, wheat
 - 2) Monstera, Mustard
 - 3) Paddy, Maize
 - 4) Grasses, Tomato
- 2.** Which among the following is not a similarity shared by prop root and stilt root :
 - 1) Adventitious origin
 - 2) Aerial position
 - 3) Non-embryonic origin
 - 4) Origin from the same part of shoot
- 3.** The part of root which is chiefly involved in the absorption of H_2O and mineral ion is/ are:
 - i) Maturation region
 - ii) Elongation region
 - iii) Meristematic region

1) iii only	2) i and iii
3) i only	4) i, ii and iii

- 4.** Read the following statements and identify the correct option.

Statement A: Stem is always green when young and later always become woody and dark brown.

Statement B: The stem may not always be typically like what they are expected to be.

- 1) Statement A and statement B are correct
- 2) Statement A and statement B are incorrect
- 3) Statement A is correct, B is incorrect
- 4) Statement A is incorrect, B is correct

- 5.** Which among the following statement is correct about stem modification.

- 1) In citrus, axillary buds of stem get modified into woody, curved and pointed structures.
- 2) Underground stems of grass and strawberry act as organs of storage and perennation.
- 3) A lateral branch with short internode and each node bearing a rosette of leaves and tuft of root is found in plants like Mint and Jasmine.
- 4) In Gourds, stem tendrils develop from axillary buds.

- 6.** How many leaves are present on the stem of china rose with ten nodes :

- 1) 10
- 2) 20
- 3) 30
- 4) Many

- 7.** Read the following sentences and identify the correct option :

- 1) A bud is present in the axil of leaflet of compound leaf.
- 2) Palmately compound leaf is present in Neem
- 3) A bud is present in the axil of petiole of simple leaf
- 4) Pinnately compound leaf is present in silk cotton

- 8.** Which among the following part / parts of flower is not attached to the thalamus :

- 1) Sepal and petal
- 2) Stamen and carpel
- 3) Bract and bracteole
- 4) Sepal, petal and tepals

- 9.** Vexillary and imbricate aestivation share the following similarity :

- 1) No overlapping
- 2) Regular overlapping
- 3) Irregular overlapping
- 4) Found in the corolla of Fabaceae

- 10.** Which among the following placentation exist in unilocular gynoecium :

- | | |
|----------|-----------------|
| 1) Basal | 2) Free central |
| 3) Axile | 4) 1 and 2 |

- 11.** The fruit of Mango and Coconut share the following similarities except :

- 1) They develop from monocarpellary superior ovary
- 2) One seeded fruits
- 3) Pericarp is differentiated into outer epicarp, middle mesocarp and an inner endocarp.
- 4) The fruit is known as drupe where the mesocarp is hard

12. Aleurone layer is the part of :

- 1) Embryo of dicot
- 2) Embryo of monocot
- 3) Endosperm of dicot
- 4) Endosperm of monocot

13. Dicotyledonous plant posses :

- 1) Mostly endospermic seeds
- 2) Only endospermic seeds
- 3) Mostly non-endospermic seeds
- 4) Only non-endospermic seeds

14. Which among the following floral character can be exhibited through both floral formula and floral diagram :

- 1) Type of placentation
- 2) Type of aestivation
- 3) Position of ovary
- 4) Cohesions and adhesions

15. Which among the following families posses placentation which transforms the respective ovary into one seeded fruit.

- i) Malvaceae
 - ii) Brassicaceae
 - iii) Asteraceae
 - iv) Poaceae
 - v) Fabaceae
- 1) i, ii and iv
 - 2) iii and iv only
 - 3) ii, iv and v
 - 4) i and ii only

QUESTIONS

LEVEL - III

1. The modified part of Opuntia, Euphorbia and Australian acacea are having the similarities in that :

- 1) All are aerial stem modifications responsible for reducing transpiration and storage
- 2) All are leaf modifications responsible for storage and support
- 3) All are leaf modifications responsible for both photosynthesis and reducing transpiration.
- 4) All are shoot modifications responsible for photosynthesis.

2. Observe the following group of modifications and identify the series with functional similarity :

- 1) Conical root of carrot, Napiform of Beetroot, Pneumatophores in Rhizophora, stilt root of pandanus.
- 2) Rhizome of ginger, corm of Amorphophallus, tendril of cucumber, bulb of onion.
- 3) Corm of Zaminkand, Bulb of onion, adventitious root of sweet potato, tap root of turnip
- 4) Conical root of turnip, prop root of Ficus, Tuberous root of potato, Tuberous root of Dahlia

- 3.** Consider the following statements and select the correct option?

Statement I : Flower is the modified shoot and floral whorls are the modified leaves and are arranged in four circles on thalamus.

Statement II : In a cymose inflorescence, main axis terminates in a flower, the flowers are borne in a basipetal order and development is centrifugal type.

- 1) Statement I is false.
- 2) Statement II is false
- 3) Statement I statement II are false
- 4) Statement I statement II are true

- 4.** How many of the following plants produce fruits developed from monocarillary superior ovary :

- | | |
|--------------|--------------|
| A) Lupin | B) Trifolium |
| C) Arhar | D) Coconut |
| E) Trifolium | F) Makoi |
| G) Sunhemp | H) Bellafona |
| 1) Two | 2) Three |
| 3) Five | 4) Six |

- 5.** Identify the ornamental plant having bilocular ovary with many ovules :

- 1) Lupin
- 2) Petunia
- 3) Sunflower
- 4) Wheat

SYNOPSIS**The Tissues:**

1. Meristematic
2. Permanent

Meristematic tissues : Classification based on origin and position

Permanent tissues :

1. Simple - Parenchyma, Collenchyma, Sclerenchyma
2. Complex - Xylem and phloem

The tissue systems:

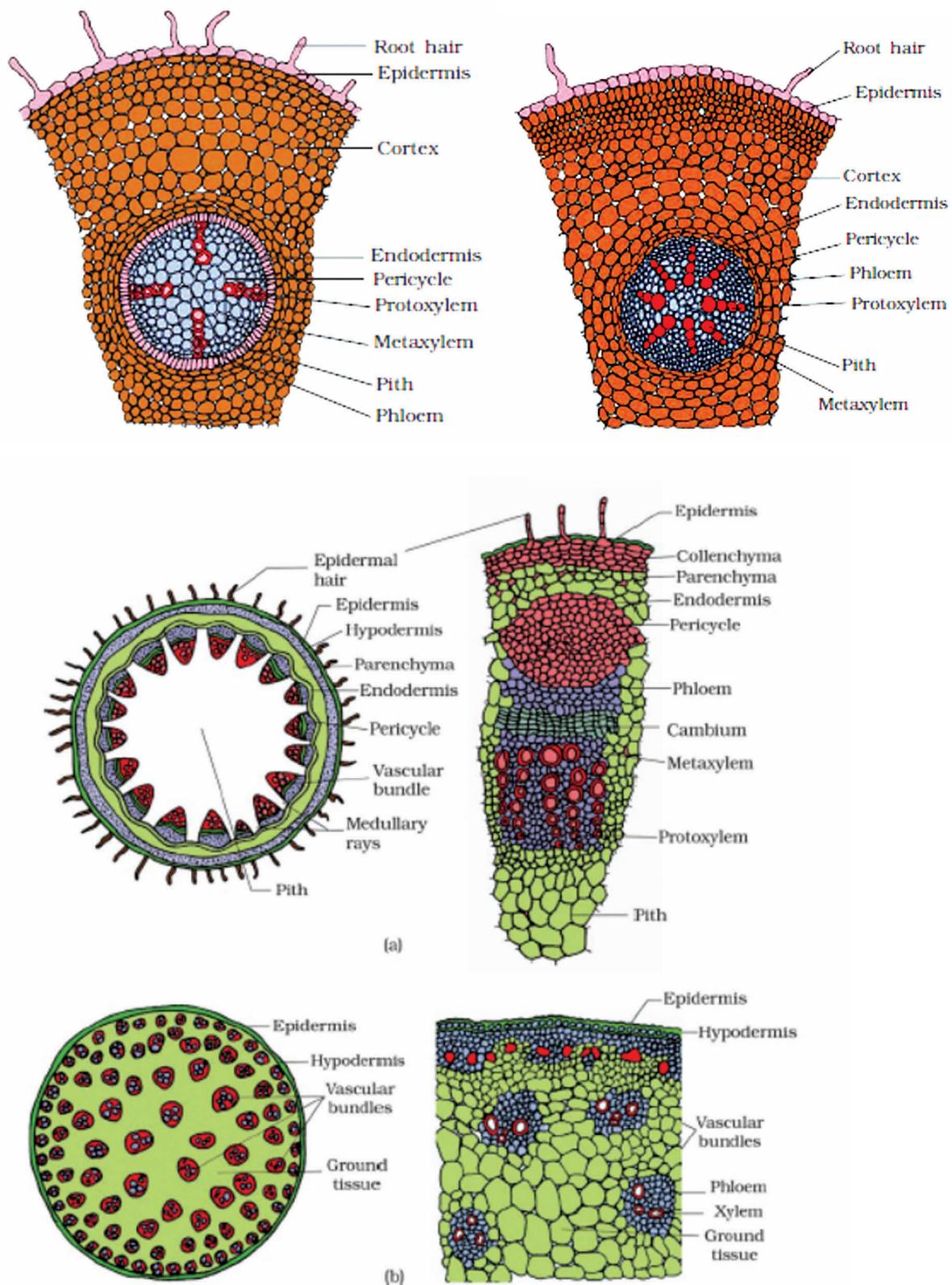
- i) Epidermal tissue system
- ii) Ground tissue system
- iii) Vascular tissue system

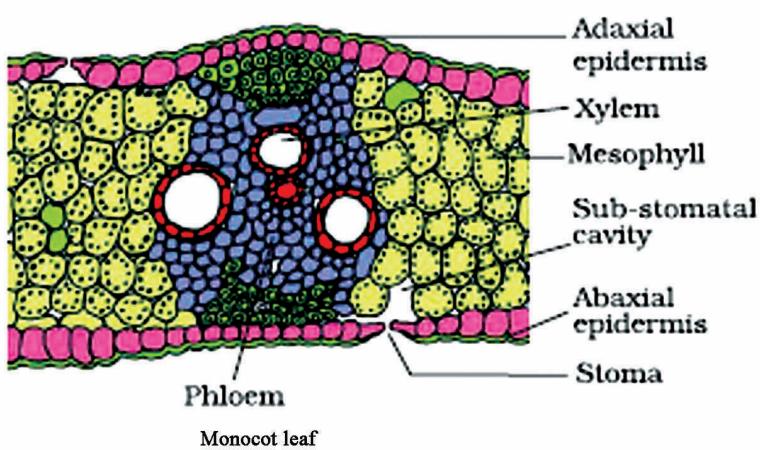
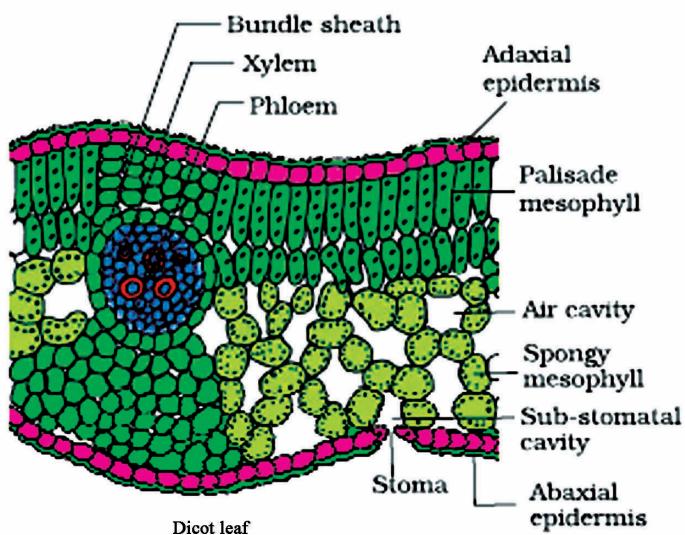
Anatomy of Dicotyledonous and Monocotyledonous plants.

- | | |
|---------------------------------------|---|
| 1. Dicotyledonous root | 2. Monocotyledonous root |
| 3. Dicotyledonous stem | 4. Monocotyledonous stem |
| 5. Dorsiventral (Dicotyledonous) leaf | 6. Isobilateral (Monocotyledonous) leaf |

Secondary growth

- | | |
|--|--|
| 1. Secondary growth in Dicot stem | 2. Secondary growth in Dicot root |
|--|--|
- Spring wood and autumn wood
- Heart wood and sap wood
- Periderm formation





QUESTIONS**LEVEL - I**

- 1.** Tissues are :
- 1) Group of cells which are similar in origin and function :
 - 2) Group of cells which are similar in origin, but not in function.
 - 3) Group of cells which are not similar in origin, but similar in function.
 - 4) Group of cells which are not similar in origin and function.
- 2.** Which of the following is a meristem classified based on its position?
- 1) Apical meristem
 - 2) Intercalary meristem
 - 3) Lateral meristem
 - 4) All the above
- 3.** Which among the following are absent in collenchyma?
- 1) Chloroplasts
 - 2) Vacuole
 - 3) Cellulose
 - 4) Intercellular spaces
- 4.** Which of the following statement is correct?
- 1) Xylem tracheids have obliterated central lumen
 - 2) Xylem parenchyma are living and store food material like starch and fat.
 - 3) Xylem vessels, end walls of cells are generally imperforated.
 - 4) Xylem fibres are only living component of xylem
- 5.** The specialised epidermal cells present in the vicinity of guard cells are called:
- 1) Companion cells
 - 2) Epiblema
 - 3) Subsidiary cells
 - 4) Trichomes
- 6.** Root hairs are :
- 1) Unicellular and branched
 - 2) Soft or stiff
 - 3) Usually multicellular and branched
 - 4) Unicellular and unbranched
- 7.** Cuticle is absent in :
- 1) Monocot leaf epidermis
 - 2) Dicot leaf epidermis
 - 3) Stem epidermis
 - 4) Root epidermis
- 8.** Find the odd one with tissues present in 'Ground tissue system'.
- 1) Parenchyma
 - 2) Albuminous cells
 - 3) Collenchyma
 - 4) Sclerenchyma
- 9.** Lateral roots arise from :
- 1) Cortex
 - 2) Endodermis
 - 3) Cork cambium
 - 4) Pericycle
- 10.** Vascular bundles surrounded by a sclerenchymatous bundle sheath is the feature of :
- 1) Dicot root
 - 2) Dicot stem
 - 3) Monocot stem
 - 4) Monocot root

- 11.** The size of vascular bundles in a dorsiventral leaf is dependent on :
- 1) Size of lamina
 - 2) Size of veins
 - 3) Number of stomata
 - 4) Number of veins
- 12.** During water stress, the bulliform cells :
- a) Become turgid
 - b) Become flaccid
 - c) Make the leaf curl inwards
 - d) Make the leaf surface exposed
- 1) a and c 2) a and d
3) b and d 4) b and c
- 13.** In a dicot stem, the interfascicular cambium strip arises :
- 1) Between xylem and phloem
 - 2) From medullary rays
 - 3) Between vascular bundles
 - 4) Both 2 and 3
- 14.** Bark refers to all tissues exterior to the :
- 1) Cork cambium
 - 2) Endodermis
 - 3) Vascular cambium
 - 4) Pericycle
- 15.** Periderm comprises :
- 1) Phellem / cork
 - 2) Phelloderm / secondary cortex
 - 3) Phellogen / cork cambium
 - 4) All of these

QUESTIONS

LEVEL - II

- 1.** Grasses regenerate after herbivore attack by the activity of :
 - 1) Secondary meristem
 - 2) Lateral meristem
 - 3) Apical meristem
 - 4) Intercalary meristem
- 2.** Select the mismatch pair :
 - 1) Parenchyma - Cellulose
 - 2) Collenchyma - Hemicellulose, Pectin
 - 3) Sclerenchyma - Lignin
 - 4) Xylem tracheids - Suberin
- 3.** Endarch xylem bundle refers to :
 - 1) Protoxylem facing the pericycle
 - 2) Protoxylem facing the pith
 - 3) Secondary xylem facing the pith
 - 4) Metaxylem facing the pith
- 4.** Which of the following is considered as living mechanical tissue?
 - 1) Collenchyma
 - 2) Parenchyma
 - 3) Sclerenchyma
 - 4) Chlorenchyma
- 5.** Epidermal tissue system consists of all except :
 - 1) Epiblema
 - 2) Stomatal apparatus
 - 3) Epidermal appendages
 - 4) Pith

- 6.** Stele includes :
- 1) Endodermis, Pericycle, Pith
 - 2) Pericycle, Vascular bundles, Pith
 - 3) Vascular bundles and cortex
 - 4) Epidermis and pith
- 7.** Pericycle in dicot stem :
- 1) is found as semi-lunar patches of sclerenchyma
 - 2) play important role during secondary growth
 - 3) contain starch grains
 - 4) is made with parenchyma
- 8.** Conjoint, closed vascular bundles are found in :
- 1) Dicot leaf
 - 2) Monocot leaf
 - 3) Monocot stem
 - 4) All of these
- 9.** Which of the following statement is incorrect with respect to dicot stem ?
- 1) Vascular bundle is conjoint, open with endarch xylem
 - 2) Hypodermis is sclerenchymatous
 - 3) Endodermis contain starch grains
 - 4) Ring like arrangement of vascular bundles
- 10.** Pith is completely absent in :
- 1) Dicot stem
 - 2) Dicot root
 - 3) Monocot stem
 - 4) Monocot root
- 11.** Match the column I and column II and find the correct option.
- | Column I | Column II |
|-----------------|--------------------------------------|
| A) Dicot root | (i) Water cavity in vascular bundles |
| B) Monocot root | (ii) Medullary rays |
| C) Dicot stem | (iii) Polyarch xylem bundles |
| D) Monocot stem | (iv) Bulliform cells |
| E) Dicot leaf | (v) Caspary strips |
| F) Monocot leaf | (vi) Stomata more in lower epidermis |
- | A | B | C | D | E | F |
|--------|-----|-----|----|----|----|
| 1) v | iii | ii | i | vi | iv |
| 2) iii | v | i | ii | iv | vi |
| 3) v | iii | i | ii | vi | iv |
| 4) iv | ii | iii | i | v | vi |
- 12.** Which of the following is not the part of bark:
- 1) Phellogen
 - 2) Cork
 - 3) Secondary phloem
 - 4) Secondary xylem
- 13.** Complementary cells are formed from :
- 1) Vascular cambium
 - 2) Phellem
 - 3) Periderm
 - 4) Phellogen
- 14.** Vascular cambium is completely secondary origin in :
- 1) Dicot stem
 - 2) Dicot root
 - 3) Dicot leaf
 - 4) Both 1 and 2

- 15.** Older central secondary xylem and younger outer secondary xylem are respectively known as :
- 1) Spring wood and early wood
 - 2) Autumn wood and late wood
 - 3) Heart wood and sap wood
 - 4) Periderm and bark
- 3.** How many of the following are lateral meristems :
- A) Intrafascicular cambium
 - B) Interfascicular cambium
 - C) Cork cambium
 - D) Vascular cambium
- 1) One
 - 2) Two
 - 3) Three
 - 4) Four

QUESTIONS LEVEL - III

- 1.** Consider the following statements regarding ground tissue system :
- A) Differentiated from meristem
 - B) Formed of simple permanent tissues only
 - C) Contains living and dead cells
 - D) In all monocots, ground tissues are not differentiated into cortex, endodermis, pericycle and pith
- Of the above statements :
- 1) A is false
 - 2) A and C are false
 - 3) C and D are false
 - 4) A, B, C and D are true
- 2.** Casparyan stripes are present in :
- 1) Dicot root
 - 2) Dicot stem and dicot root
 - 3) Monocot root
 - 4) Both dicot root and monocot root

- 3.** How many of the following are lateral meristems :
- A) Intrafascicular cambium
 - B) Interfascicular cambium
 - C) Cork cambium
 - D) Vascular cambium
- 1) One
 - 2) Two
 - 3) Three
 - 4) Four
- 4.** Which of the following statements are true :
- A) Secondary xylem is not differentiated into protoxylem and metaxylem
 - B) Complementary cells are non-living produced due to the activity of phellem
 - C) During secondary growth, more amount of phellem is produced than phellogen
 - D) Vascular cambium become equally active during spring and autumn season.
 - E) Secondary growth occur due to the physiological factors of plant body only
- 1) All except A
 - 2) A and C
 - 3) All except C
 - 4) A, B, C, D and E
- 5.** Bark includes :
- A) Differentiated, dedifferentiated and redifferentiated tissues.
 - B) Dedifferentiated and redifferentiated tissues only
 - C) Simple and complex permanent tissues
 - D) Simple permanent tissues only
 - E) Living and dead tissues
 - F) Tissues present in stele
- 1) B, D and E
 - 2) A, C, E only
 - 3) B and E
 - 4) A, C, E and F

SYNOPSIS

- ❖ Cell-discovered by Robert Hooke (1665) in thin slices of cork (dead cells)
- ❖ Leeuwenhoek - discovered the first living cell
- ❖ Robert Brown - discovered Nucleus (1831) from orchid root cells.
- ❖ Schleiden and Schwann (1839) - Proposed cell theory
- ❖ Rudolf Virchow - proposed modified cell theory (1855)
- ❖ Size and shape of cells vary in different organisms. It depends on the function they perform.

Structure of Prokaryotic cell

It consists of the following parts

- ◆ **Cell envelope - Glycocalyx, Cell wall, Cell membrane**
- ◆ **Mesosome**
- ◆ **Ribosome (70s)**
- ◆ **Nucleoid**
- ◆ **Inclusion bodies**
- ◆ **Plasmid**
- ◆ **Flagella, Fimbriae and Pili**

Structure of Eukaryotic cell

1. Cell membrane - Fluid mosaic model

2. Cell wall

3. Endomembrane system

- ◆ **Endoplasmic reticulum**

 1) SER

 2) RER

◆ Golgi apparatus

◆ Lysosome

◆ Vacuole

4. Mitochondria → Power house of the cell

5. Plastid - Generally absent in animal cells; 3 types

i) Leucoplast → colourless plastids stores substances other than pigments.

Subdivided into 3-

a) Amyloplast → Store starch

b) Elaioplast → Store oils and fat

c) Aleuroplast → Store proteins

ii) Chromoplast → Contain pigments other than chlorophyll

iii) Chloroplast → Contain chlorophyll and other pigments

6. Ribosomes - (80s)

7. Cytoskeleton - composed of 3 types of proteinaceous components

a) Microtubules

b) Microfilaments

c) Intermediate filaments

8. Cilia and flagella

• It has 9 + 2 arrangement of microtubules

9. Centrosome and centrioles

• It has 9 + 0 (cart wheel) arrangement of microtubules

10. Nucleus

• It has a nuclear membrane, nucleoplasm, chromatin and nucleolus

• Chromosome :- types of chromosome according to the position of centromere

◆ Metacentric

◆ Submetacentric

◆ Acrocentric

◆ Telocentric

11. Microbodies

QUESTIONS**LEVEL - I**

- 1.** Who first saw and described a living cell? :
 - 1) Anton van Leeuwenhoek
 - 2) Theodore Schwann
 - 3) Rudolf Virchow
 - 4) Matthias Schleiden

- 2.** What was Schleiden's main contribution to the development of cell theory?
 - 1) He discovered the nucleus
 - 2) He observed that all plants are composed of cells
 - 3) He concluded that cells arise from pre-existing cell
 - 4) He identified the plasma membrane in animal cell

- 3.** Match the column I with column II and select the correct option.

Column I	Column II
I) Mycoplasma	a) 0.02 - 0.2 μm
II) Bacteria	b) 0.3 μm
III) Human RBC	c) 3 - 5 μm
IV) Virus	d) 7.0 μm
V) Eukaryotic cell	e) 10 - 20 μm

I	II	III	IV	V
1) b	c	d	a	e
2) b	c	a	d	e
3) c	b	d	a	e
4) b	c	d	e	a

- 4.** What is the fundamental difference between prokaryotes and eukaryotes?
 - 1) Eukaryotes are generally smaller than prokaryotes
 - 2) Eukaryotes have a nucleus, while prokaryotes do not
 - 3) Prokaryotes have a cell wall, while eukaryotes do not
 - 4) Prokaryotes contain ribosome, while eukaryotes do not

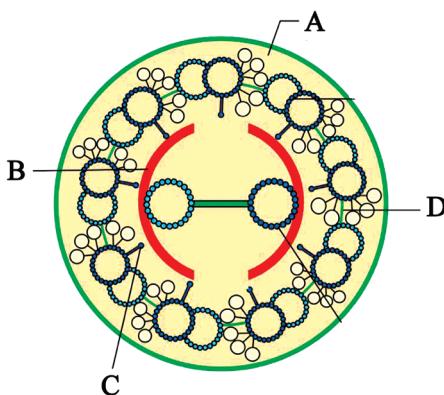
- 5.** Which is not a function of mesosome :
 - 1) Cell wall formation
 - 2) DNA replication
 - 3) Respiration
 - 4) Protein synthesis

- 6.** Read the following statement and select the correct option stating them as True (T) and False (F) :
 - A) Bacterial cell envelope composed of three layers
 - B) Glycocalyx is always thick and tough structure called capsule
 - C) Cell membrane of bacteria is structurally different from the plasmamembrane of eukaryotic cell
 - D) Chromatophore are pigment containing structures found in some prokaryotes
 - E) Pili and Fimbriae are primarily involved in bacterial motility

A	B	C	D	E
1) T	F	T	T	F
2) T	T	F	T	F
3) T	F	F	T	F
4) T	F	F	T	T

7. Many ribosomes may associate with a single mRNA to form :
- Polysome
 - Polyribosome
 - Ribosome
 - Both 1 and 2
8. The ratio of proteins and lipids in the membrane of the human erythrocyte :
- 40% protein and 52% lipid
 - 52% protein and 40% lipid
 - 50% lipid and 42% protein
 - 42% protein and 50% lipid
9. Read the following statements and select the appropriate options :
- Carrier proteins of the membrane facilitate the transport of polar molecules
 - The primary wall of adjacent cells are holds together by means of middle lamella
 - The endomembrane system include ER, Golgibodies, Lysosomes and Vacuoles
 - ER divides the intracellular space into luminal and extra luminal compartments.
 - Lysosomes are membrane bound vesicular structures
- A, B, C and D are correct
 - A, B, C are not correct
 - D and E are incorrect
 - A, B, C, D and E are correct
10. Read the following statements and identify the correct option.
- Statement I** : Proteins synthesised on the ER are modified in the cisternae of the golgi apparatus.
- Statement II** : Modified proteins are released from the cis face of the golgi apparatus.
- Both the statements are correct
 - Both the statements are incorrect
 - Statement I is incorrect
 - Statement II is incorrect
11. Read the following and select the incorrect statement :
- Mitochondria are the site of aerobic respiration.
 - 70s ribosomes are present in mitochondrial matrix.
 - The inner chloroplast membrane is relatively more permeable.
 - Stroma contain enzymes for the synthesis of proteins

- 12.** Recognise the figure and find out the correct matching :



- 1) A - Plasma membrane
B - Central sheath
C - Radial spoke
D - Interdoublet bridge
- 2) A - Plasma membrane
B - Central sheath
C - Interdoublet bridge
D - Radial spoke
- 3) A - Peripheral microtubule
B - Interdoublet bridge
C - Central microtubule
D - Plasma membrane
- 4) A - Central sheath
B - Radial spoke
C - Doublets
D - Radial spoke

- 13.** The nucleus of a cell contains :

- 1) Centriole and centrosome
- 2) Chromatin, nuclear matrix and nucleoli
- 3) Ribosome and centrosome
- 4) Lysosome and microbodies

- 14. Assertion** : Sub-metacentric chromosome have one shorter and one longer arms.

Reason : In sub-metacentric chromosome centromere lies slightly away from the middle.

- 1) Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
- 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
- 3) Assertion is true but the Reason is false
- 4) Both Assertion and Reason are false

- 15.** Find the mismatched pair :

- 1) Microbodies - membrane bound vesicles in plants and animals
- 2) Satellite - Non-staining secondary constriction
- 3) Kinetochore - Holds two chromatids of chromosome
- 4) Telocentric chromosome - Centromere is lies at the tip

QUESTIONS

LEVEL - II

1. Read the following statements and select the correct option :
 - a) Prokaryotic cells are represented by bacteria, BGA and mycoplasma.
 - b) All prokaryotes have a cell wall
 - c) The genetic material in prokaryotes is enclosed by a membrane
 - d) Plasmid can confers antibiotic resistance to bacteria
 - e) Prokaryotes have inclusion bodies
 - 1) a, b and c are correct
 - 2) only b and c are correct
 - 3) a, d and e are correct
 - 4) a, b, c, d and e are correct
2. Read the following statements and identify the correct option.

Statement I : The fluidity of the cell membrane is measured by the ability of lipids to move laterally within the bilayer.

Statement II : Fluid nature of the membrane is important for cell growth and cell division.

 - 1) Both the statements are correct
 - 2) Both the statements are incorrect
 - 3) Statement I is correct
 - 4) Statement II is correct
3. Endomembrane system is characterised by:
 - 1) Independent functions of its organelles
 - 2) Co-ordinate functions of its organelles
 - 3) Absence of membranous organelles
 - 4) Present in prokaryotic cell

4. Smooth Endoplasmic Reticulum (SER) is the major site for :
 - 1) Protein synthesis
 - 2) Lipid synthesis
 - 3) Carbohydrate synthesis
 - 4) DNA replication
5. Find the incorrect one related to Golgi bodies:
 - 1) Glycolipids and glycoproteins are formed in golgi bodies
 - 2) Golgibodies are closely associated with ER
 - 3) Trans face of the golgi bodies are also known as maturing face
 - 4) Golgi apparatus is primarily involved in protein synthesis
6. Lysosomes are formed by the process of packing in the :
 - 1) Golgi bodies
 - 2) Mitochondria
 - 3) SER
 - 4) RER
7. The membrane that bound vacuole are called :
 - 1) Amyloplast
 - 2) Cell membrane
 - 3) Tonoplast
 - 4) Aleuroplast
8. Find the correct statement about mitochondria :
 - 1) Mitochondria are easily visible under microscope without staining
 - 2) The number of mitochondria is constant in all cells
 - 3) Cristae increase the surface area of outer membrane
 - 4) They divide by fission

- 9.** Plastids responsible for trapping light energy for photosynthesis :
- Chromatophores
 - Leucoplast
 - Chloroplast
 - Amyloplast
- 10.** Read the following statements and identify the correct option.
- Statement I** : Sedimentation coefficient is indirectly a measure of density and size.
- Statement II** : 'S' stands for sedimentation coefficient.
- Both the statements are correct
 - Both the statements are incorrect
 - Only statement I is correct
 - Only statement II is correct
- 11.** A non-membranous organelle that actively participate in protein synthesis found in :
- Only in cytoplasm
 - Only in nucleus
 - Only in mitochondria and chloroplast
 - In cytoplasm, mitochondria and chloroplast
- 12.** Flagella are :
- Comparatively longer than cilia
 - Structurally identical in prokaryotes and eukaryotes
 - Responsible for cell movement
 - Both 1 and 3
- 13.** Non membrane bound organelle found in animal cell which helps in cell division :
- Ribosome
 - Centrosome
 - Lysosome
 - Polysome
- 14. Assertion** : Centrosome contain two cylindrical structures called centrioles.
- Reason** : Centrioles have 9+0 arrangement of microtubules.
- Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
 - Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - Assertion is true but the Reason is false
 - Both Assertion and Reason are false
- 15. Assertion** : Nuclear membrane is interrupted by nuclear pore at number of places.
- Reason** : Nuclear pore allow the unidirectional movement of RNA and proteins.
- Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
 - Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - Assertion is true but the Reason is false
 - Both Assertion and Reason are false

QUESTIONS

LEVEL - III

1. Endocytosis is :

- A) Passive transport
- B) Active transport
- C) Bulk transport
- 1) A & C 2) A only
- 3) B & C 4) B only

2. Microbodies are :

- 1) Multimembrane bounded present in prokaryotes and eukaryotes
- 2) Many membrane bounded present in prokaryotes only
- 3) Double membrane bounded present in eukaryotes only
- 4) Single membrane bounded present in eukaryotes only

3. In a eukaryotic cell endoskeleton and cytoskeleton are respectively :

- 1) Microtubules and microfilaments
- 2) Microtubules and intermediate filaments
- 3) Endoplasmic reticulum and Microtubules, microfilaments, intermediate filaments
- 4) Microfilaments and intermediate filaments

4. In a eukaryotic cell, nucleic acid present in :

- 1) Nucleus only
- 2) Cytoplasm and Nucleus only
- 3) Mitochondria, chloroplast and nucleus only
- 4) Cytoplasm, Mitochondria, Chloroplast, Ribosome and Nucleus

5. Which of the following statement is true :

- 1) Prokaryotic and eukaryotic flagella are structurally and functionally similar.
- 2) Prokaryotic and eukaryotic cilia are structurally and functionally similar.
- 3) Prokaryotic and eukaryotic flagella are functionally similar but structurally different
- 4) Eukaryotic and prokaryotic cilia are functionally similar but structurally different.

SYNOPSIS❖ **Introduction**❖ **Cell cycle**

■ Phases of cell cycle

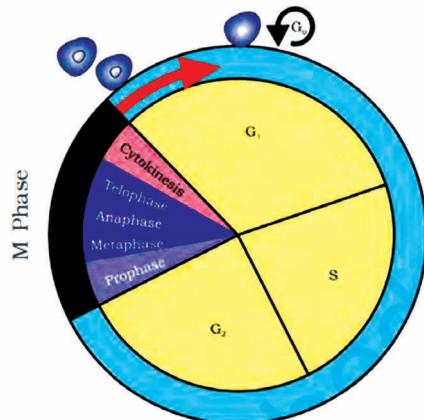
a) Interphase

- ◆ G_1 phase
- ◆ S phase
- ◆ G_2 phase

G_0 phase

b) M-phase

- ◆ Amitosis
- ◆ Mitosis
- ◆ Meiosis



A diagrammatic view of cell cycle indicating formation of two cells from one cell

❖ **Mitosis**

1. Stages

- ◆ **Karyokinesis**
- ◆ **Cytokinesis**

A. Karyokinesis

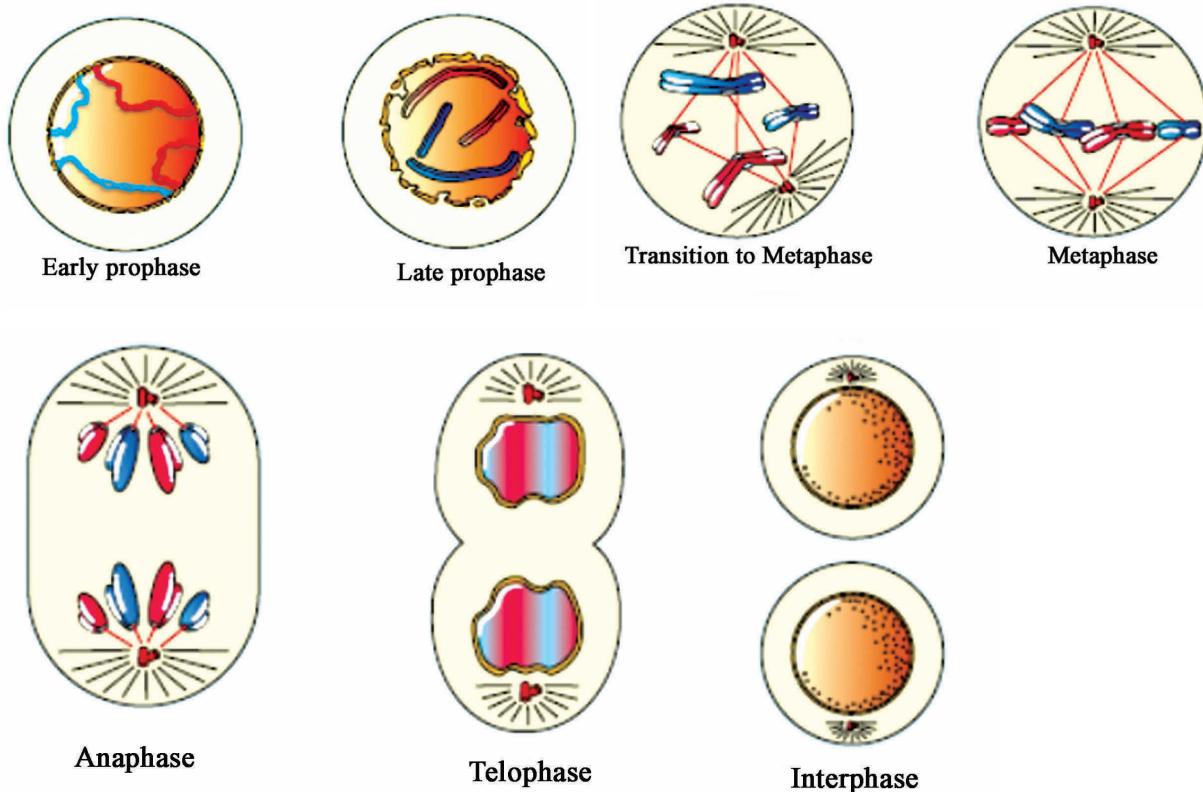
- Definition
- Stages
 - Prophase
 - Metaphase
 - Anaphase
 - Telophase

B. Cytokinesis

- Definition
- Cytokinesis in plant and animal cells

2. Significance of Mitosis

Stages of mitosis



❖ **Meiosis**

1. Stages

♦ **Meiosis I**

♦ **Meiosis II**

♦ **Meiosis I**

A) Karyokinesis - I

B) Cytokinesis - I

A) Karyokinesis - I

♦ **Prophase - I**

- Leptonene
- Zygotene
- Pachytene
- Diplotene
- Diakinesis

♦ **Metaphase - I**

♦ **Anaphase - I**

♦ **Telophase - I**

B) Cytokinesis - I

- Cytokinesis in plants and animals

- Interkinesis - Diad of cells

♦ **Meiosis II**

A) Karyokinesis - II

B) Cytokinesis - II

A) Karyokinesis - II

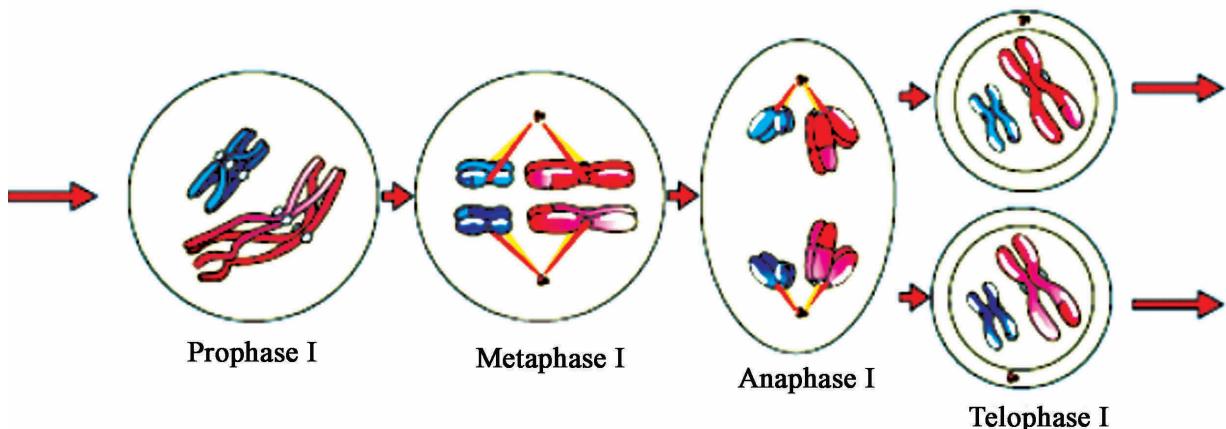
- Prophase - II
- Metaphase - II
- Anaphase - II
- Telophase - II

B) Cytokinesis - II

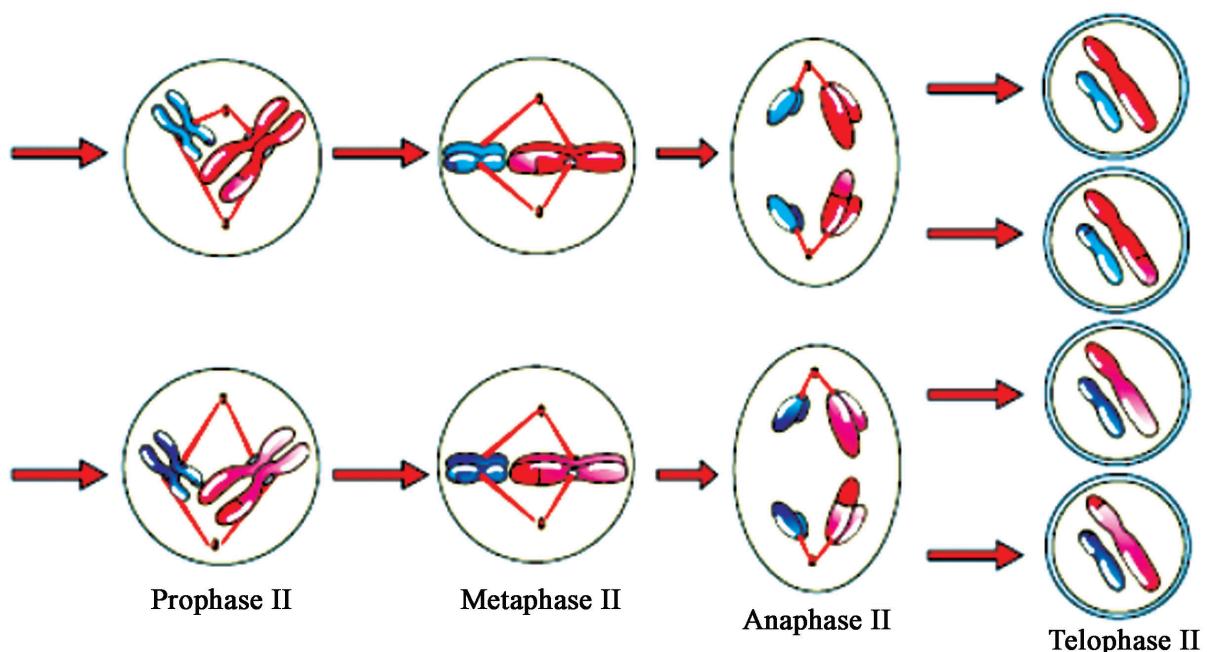
- Cytokinesis in plants and animals
- Tetrad of cells

2. Significance of Meiosis

Stages of Meiosis I



Stages of Meiosis II



QUESTIONS**LEVEL - I**

- 1.** Which of the following processes occurs continuously during the cell cycle?
 - 1) DNA replication
 - 2) Cell growth (cytoplasmic increase)
 - 3) Chromosome segregation
 - 4) Nuclear division

- 2.** What ensures the correct division and formation of progeny cells containing intact genomes?
 - 1) Random division of cells
 - 2) Coordination between cell division, DNA replication and cell growth
 - 3) DNA replication occurring after cell division
 - 4) Unequal distribution of chromosomes

- 3.** In which stage of the cell cycle, replicated chromosomes distributed to daughter nuclei?
 - 1) G₁ phase
 - 2) S phase
 - 3) M phase
 - 4) G₂ phase

- 4.** What is the approximate duration of M phase in a typical human cell cycle?
 - 1) 24 hours
 - 2) 23 hours
 - 3) 60 minutes
 - 4) 90 minutes

- 5.** Which of the following statements is true regarding chromosome number during the S phase?
 - 1) The chromosome number doubles
 - 2) The chromosome number remains the same
 - 3) The chromosome number is reduced
 - 4) The chromosome number fluctuates randomly

- 6.** Which of the following cells in adult animals remain in the quiescent (G₀) phase and do not divide?
 - 1) Liver cells
 - 2) Neuron
 - 3) Skin cells
 - 4) Bone marrow stem cells

- 7.** What is the primary characteristic of cells in the quiescent (G₀) phase?
 - 1) They are metabolically inactive
 - 2) They continue to grow and divide rapidly
 - 3) They remain metabolically active but do not proliferate
 - 4) They undergo continuous DNA replication

- 8.** Which of the following is a key event of cell division in animal cells but not in plant cells?
 - 1) Chromosome condensation
 - 2) Spindle fiber formation
 - 3) Centrosome duplication and migration
 - 4) Disappearance of nuclear envelope

- 9.** The mitotic apparatus consists of which of the following structures?
- 1) Asters
 - 2) Spindle fibers
 - 3) Both asters and spindle fibers
 - 4) Ribosomes
- 10.** Which of the following represents a correct sequence of events in M-phase?
- 1) DNA replication → Spindle fiber formation → Chromosome condensation
 - 2) Centriole migration → Disappearance of nuclear envelope → Spindle fibre attachment to Kinetochore.
 - 3) Chromosome condensation → DNA replication → Golgi body fragmentation
 - 4) Nucleolus reformation → Centrosome migration → Spindle fiber formation
- 11.** Which of the following events occurs during prophase of mitosis?
- 1) Chromatin condenses into visible chromosomes.
 - 2) The nuclear envelope remains intact.
 - 3) The centrosomes begin to migrate towards opposite poles.
 - 4) Golgi complexes and the endoplasmic reticulum disappear.
- 1) Only 1 and 3 2) Only 1, 3, and 4
 - 3) Only 2 and 4 4) 1, 2, 3 and 4
- 12.** Among the following which one is/are the significance of mitosis?
- 1) Maintenance of nucleo-cytoplasmic ratio
 - 2) Cell repair and regeneration
 - 3) Maintain multicellularity in multicellular organism
 - 4) All of these
- 13.** How does cytokinesis differ in animal and plant cells?
- 1) Animal cells form a cleavage furrow, while plant cells form a cell plate
 - 2) Plant cells divide by pinching inwards, while animal cells form a cell wall
 - 3) Cytokinesis does not occur in animal cells
 - 4) Cytokinesis does not occur in plant cells
- 14.** The middle lamella in plant cells is formed during:
- 1) Anaphase
 - 2) Metaphase
 - 3) Cytokinesis
 - 4) Interphase
- 15.** In which stage of prophase I, oocytes of certain vertebrates last for months or years?
- 1) Leptotene 2) Diplotene
 - 3) Zygote 4) Pachytene
- 16.** Chiasmata is clearly visible in :
- 1) Diplotene 2) Zygote
 - 3) Leptotene 4) Diakinesis
- 17.** Maximum condensation of chromosome material is in which stage of meiosis I
- 1) Diplotene 2) Zygote
 - 3) Diakinesis 4) Pachytene

18. During which sub-stage of prophase I do recombination nodules appear?

- 1) Leptonene 2) Zygote
3) Pachytene 4) Diplotene

19. Assertion (A) : In meiosis I, the chromosome number is reduced from diploid to haploid.

Reason (R) : Here homologous chromosomes separate, but sister chromatids remain attached at their centromeres.

- 1) Both A and R are true, and R is the correct explanation of A.
2) Both A and R are true, but R is not the correct explanation of A.
3) A is true, but R is false.
4) A is false, but R is true.

20. Assertion (A) : Interkinesis is a resting phase between meiosis I and meiosis II.

Reason (R) : DNA replication occurs during interkinesis.

- 1) Both A and R are true, and R is the correct explanation of A.
2) Both A and R are true, but R is not the correct explanation of A.
3) A is true, but R is false.
4) A is false, but R is true.

QUESTIONS LEVEL - II

1. The M-phase ends with

- 1) Nuclear division
2) Cytokinesis
3) Karyokinesis
4) Both 1 and 2

2. Statement I : In animals, mitotic cell division is only seen in the diploid somatic cells (except in male honey bees)

Statement II : The plants shows mitotic division in both haploid and diploid cells.

- 1) Only statement I is correct
2) Only statement II is correct
3) Both statement I and II are correct
4) Both statement I and II are incorrect

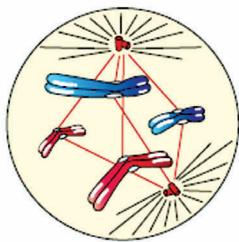
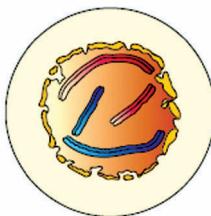
3. Match column I with column II and choose the correct combination from the option given below.

	Column I		Column II
A)	Centriole duplication	1)	Telophase
B)	Disintegration of nuclear membrane	2)	Anaphase
C)	Golgi complex and ER reforms	3)	S-phase
D)	Spliting of centromere	4)	Prophase

- 1) A-3, B-4, C-2, D-1
2) A-3, B-4, C-1, D-2
3) A-4, B-3, C-1, D-2
4) A-3, B-1, C-4, D-2

- 4.** How many chromosome will the cell have after S phase, G₂ phase and M phase if it has 8 chromosome in G₁ phase
- 1) 16, 16, 8 2) 16, 16, 16
 3) 8, 16, 8 4) 8, 8, 8

- 5.** Identify the stages



- 1) Metaphase - Late prophase
 2) Late prophase - transition to metaphase
 3) Metaphase - Early prophase
 4) Transition to metaphase - Early prophase

- 6.** Which of the following events are incorrect regarding anaphase of mitosis
- a) Complete condensation of chromatin material occurs.
 b) Centromere splits and chromatids separate
 c) Chromatids move to opposite pole
 d) Spindle fibres disappear
- 1) b and c only
 2) b and d only
 3) a and c only
 4) a and d only

- 7.** Which of the following pair is incorrectly matched ?
- 1) Anaphase - Daughter chromosome move towards opposite poles
 2) Zygotene - Pairing of homologous chromosome
 3) Pachytene - Exchange of genetic material between sister chromatids
 4) Diakinesis - Terminalisation of chiasmata

- 8.** Match the column I and column II.

	Column I		Column II
A)	Tetrad clearly visible	1)	Anaphase I
B)	Homologous chromosome separate	2)	Meiosis II
C)	Dyad of cells	3)	Pachytene
D)	Genetic nature of gametes determined	4)	Telophase I

- 1) A - 3; B - 4; C - 1; D - 2
 2) A - 3; B - 1; C - 4; D - 2
 3) A - 3; B - 1; C - 2; D - 4
 4) A - 3; B - 2; C - 4; D - 1

9. **Assertion :** In plants, furrow formation does not occur during cytokinesis.

Reason : In plants, cell wall is relatively inextensible.

- 1) Assertion and reason are true, the reason is correct explanation of assertion.
 2) If both assertion and reason are true, but reason is not a correct explanation of assertion.
 3) Assertion is true but the reason is false
 4) Both assertion and reason are false

10. Which of the following events takes place during metaphase of mitosis ?

- I) Complete condensation of chromosome
 - II) Formation of metaphase plate
 - III) Chromosome coming to lie at the pole
 - IV) Spindle fibres attached to kinetochore
- 1) I, II, III and IV
2) I, II and III
3) I, II and IV
4) II, III and IV

11. Consider the following statement related to cell cycle and select the correct option stating them as **true (T)** or **false (F)**.

- I) ER and golgi complex reforms during telophase
- II) Cytokinesis is not followed by karyokinesis resulting in the formation of syncytium
- III) The number of chromosome doubled in S-phase
- IV) Heart cell that do not divide further exit the G₁ phase to enter a Quiescent stage.

	I	II	III	IV
1)	T	F	T	F
2)	F	T	T	T
3)	T	F	F	F
4)	T	F	F	T

12. Statement I : Mitotic division results in the continuous growth of plants through out their life.

Statement II : Mitotic division take place during gamete formation in haploid organisms.

- 1) Only statement I is correct.
- 2) Only statement II is correct.
- 3) Both statements I and II are incorrect.
- 4) Both statements I and II are correct.

13. The events shown below occur during different phases.

- A) Bivalent clearly appear as tetrad
- B) Bivalent chromosomes align on the equatorial plate
- C) Nuclear membrane reappears.
- D) Centromere split
- E) DNA replication

	Interphase	Prophase I	Metaphase I	Telophase I	Anaphase II
1)	E	B	A	C	D
2)	B	D	A	C	E
3)	E	A	B	C	D
4)	E	B	A	D	C

14. During _____ stage the chromosomes become gradually visible under the light microscope :

- 1) Leptotene
- 2) Zygote
- 3) Pachytene
- 4) Diplotene

15. The amount of DNA in each chromosome in telophase I is

- 1) Half of the normal chromosome at G₁ phase
- 2) Double of the normal chromosome at G₁ phase
- 3) Equal to the normal chromosome at G₁ phase
- 4) 1/4 of the normal chromosome at G₁ phase

- 16.** Find the correct statement from the following.
- A) Meiosis involve a cycle of nuclear division and cell division
 - B) DNA replication takes place during interkinesis
 - C) Crossing over is an enzyme mediated process takes place during pachytene stage of meiosis I.
 - D) Tetrad of cells are formed as a result of cytokinesis following telophase II.
 - E) Prophase I is much simpler than prophase II.
- 1) A, B and C are correct
 - 2) B, C and D are correct
 - 3) C, D and E are correct
 - 4) Only C and D are correct
- 17.** A bivalent consist of
- 1) Two chromatids and one centromere
 - 2) Two chromatids and two centromere
 - 3) Four chromatids and two centromere
 - 4) Four chromatids and four centromere
- 18.** How do cells at the completion of meiosis compare with cells that have replicated their DNA and are just about to begin meiosis ?
- 1) They have twice the amount of cytoplasm and half the amount of DNA
 - 2) They have half the number of chromosome and half the amount DNA
 - 3) They have the same number of chromosome and half the amount of DNA
 - 4) They have half the number of chromosome and one-fourth the amount of DNA
- 19.** Arrange the events of meiosis in correct sequence.
- A) Synapsis
 - B) Crossing over
 - C) Bivalent
 - D) Disappearance of nucleolus
 - E) Chiasmata
 - F) Terminalisation of chiasmata
 - G) Dissolution of synaptonemal complex
- 1) A, C, G, B, E, F, D
 - 2) A, C, B, G, F, E, D
 - 3) A, C, B, E, F, G, D
 - 4) A, C, B, G, E, F, D
- 20.** Chromosome number is reduced during meiosis because the process consist of
- 1) Two cell division without any chromosome replication
 - 2) A single cell division without any chromosome replication
 - 3) Two cell division in which half of the chromosomes are destroyed
 - 4) Two cell division and a only single round of chromosome replication

QUESTIONS**LEVEL - III**

- 1.** Consider the following statements and select the correct option?

Statement I : In all living organisms, DNA replication occur during S phase of interphase.

Statement II : In both prokaryotes and eukaryotes most of the cell organelles are duplicated during G_1 and G_2 phase of interphase.

- 1) Statement I and statement II are true
- 2) Statement I and statement II are false
- 3) Statement I is true.
- 4) Statement II is true

- 2.** Consider the following statements and select the correct option?

Statement I : In certain cells, DNA replication occur without mitotic division.

Statement II : Mitosis occur without DNA replication.

- 1) Statement I and statement II are true
- 2) Statement I is true
- 3) Statement II is true
- 4) Statement I and statement II are false

- 3.** When crossing over is completed in prophase I, non-sister chromatids :

- I. are fused together by synaptonemal complex.
 - II. are attached by their ends to the nuclear envelope
 - III. are held together at their chiasmata
 - IV. are completely drift away from each other
- 1) I, III, IV
 - 2) III only
 - 3) III and IV only
 - 4) II, III, IV

- 4.** A diploid plant has 14 chromosomes but its egg cell has 6 chromosomes. Which one of the following is the most likely explanation of this condition :

- 1) Non-disjunction of chromosomes occur in meiosis I and II
- 2) Non-disjunction of chromosomes occur in meiosis I
- 3) Non-disjunction of chromosomes occur in meiosis II
- 4) Disjunction of chromosomes occur in Meiosis II

- 5.** After meiosis II, daughter cells differ from the parent cell and each other in their genotypes. This can occur because of which one of the following mechanism :

- 1) Synapsis only
- 2) Only crossing over and independent assortment of chromosomes
- 3) Crossing over and chromosomal segregation only
- 4) Crossing over, independent assortment and segregation of chromosomes.

07 PHOTOSYNTHESIS IN HIGHER PLANTS

SYNOPSIS

1. Introduction and Significance

2. Early experiments

- Two leaf / variegated leaf experiment
- Half-leaf experiment
- Bell-Jar experiment
 - Hydrilla experiment Jan Ingenhousz - Proposed the importance of sunlight in photosynthesis
 - Julius von Sachs - Proposed that starch is the first visible and storage product of photosynthesis
 - Cornelius van Niel - Proposed that H_2S is the hydrogen donor of photosynthesis in photosynthetic bacteria.

3. Photosynthetic apparatus - Chloroplast

4. Pigments involved in photosynthesis

Chlorophyll a – Major pigment

Chlorophyll b
Carotene
Xanthophyll

} Accessory pigments

5. Pigment systems:

- Pigment system I - P₇₀₀
- Pigment system II – P₆₈₀
 - LHC
 - LHS

6. Absorption spectrum

7. Action spectrum

8. Mechanism of photosynthesis - Two phases

1. Light reaction/photochemical phase
2. Dark reaction/Biosynthetic phase

Light reaction

- a. Photolysis of water
- b. Photophosphorylation - Two types, cyclic and noncyclic
- c. Chemiosmotic hypothesis

Dark reaction - Light independent phase

Various pathways of carbondioxide fixation:

1. C₃ pathway/Calvin cycle
2. C₄ pathway/Hatch and slack cycle

9. Photorespiration - A metabolically adjunct to Calvin cycle in C₃ plants

Three cell organells are involved

- ◆ Chloroplast
- ◆ Peroxisome
- ◆ Mitochondria

10. Factors affecting photosynthesis (Blackman's law of limiting factor)

QUESTIONS

LEVEL - I

- 1.** Select the true statement/s regarding significance of photosynthesis :
- The single most important biological process required for human existence.
 - Primary source of all food on earth
 - Photosynthesis has great role in purifying air, by consuming CO_2 and releasing O_2 helpful in maintaining percentage of O_2 and CO_2 constantly in the atmosphere.
- A only
 - B and C only
 - B only
 - A, B & C
- 2.** Consider the following statements and select the correct option.
- Statement I** : Photosynthesis is an oxidoreduction, endergonic and physico chemical process.
- Statement II** : Photosynthesis occur in algae, green plant cells, some bacteria and few protista.
- Statement I is false
 - Statement II is false
 - Statement I & II are false
 - Statement I & II are true
- 3.** Consider the following statements and select the correct option.
- Statement I** : Two leaf / variegated leaf experiments prove that photosynthesis occur in chlorophyll containing green parts of the plant body in the presence of light.
- Statement II** : Half leaf experiment proposed the importance of CO_2 in photosynthesis.
- Statement I is false
 - Statement II is false
 - Statement I & II are false
 - Statement I & II are true

- 4.** Find the mis-matching series :

A)	Joseph Priestly	Bell jar experiment	Essential role of air in the growth of plants
B)	Jan Ingenhousz	Hydrilla experiment	Propose the importance of sunlight in photosynthesis
C)	Julius von Sachs	Reserve food material is starch	1854
D)	T.W. Engelmann	Cladophora and aerobic bacteria	Action spectrum and absorption spectrum
E)	Cornelius van Niel	Green and purple bacteria	H_2S is the hydrogen donor

- A & C
 - All except C
 - B & E
 - D only
- 5.** Which of the following statements are true regarding chlorophyll a :
- Primary photosynthetic pigments
 - Both reaction centre and antenna region contains chlorophyll a that are primary / chief photosynthetic pigments.
 - All the chlorophyll a present in PSI, absorb light in the region of same wavelength.
 - All phototrophs which evolve oxygen during photosynthesis possess chlorophyll a
- All except C
 - A & B only
 - B & D only
 - A, B, C & D

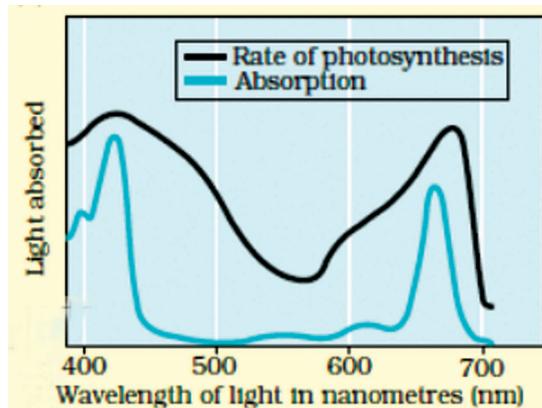
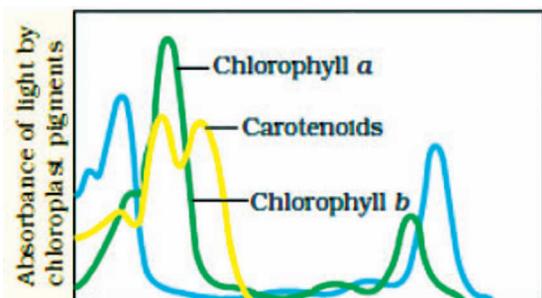
- 6.** Which of the following pigments are secondary photosynthetic pigments / accessory pigments in higher plants?
- Chlorophyll a, chlorophyll b and carotenoids
 - Chlorophyll b and carotenoids
 - Chlorophyll b only
 - Carotenoids only
- 7.** LHS / antenna region contains :
- Primary photosynthetic pigments
 - Secondary photosynthetic pigments
 - Accessory pigments
 - Both primary pigments and secondary photosynthetic pigments / accessory pigments
- 8.** How many reaction centre present in the membrane of grana and stroma thylakoid respectivley :
- Indefinite and indefinite
 - Two and one
 - Two and two
 - One and one
- 9.** Consider the following statements and select the correct option.
- Statement I** : $CF_0 - CF_1$ particle present in the membrane of both grana thylakoid and stroma thylakoid.
- Statement II** : CF_0 is a facilitated diffusion channel and CF_1 is the site of photophosphorylation.
- Statement I & II are false
 - Statement I & II are true
 - Statement I is false
 - Statement II is false
- 10.** The enzymes for light dependent reactions are present in :
- Membrane of grana thylakoid only
 - Membrane of stroma thylakoid only
 - Both the membrane of grana thylakoid and stroma thylakoid
 - Stroma and membrane of thylakoid
- 11.** During Z - scheme of electron transport :
- Both PS I and PS II are involved
 - Both PS I and PS II excited simultaneously
 - Photo-oxidation of water occur in the luminal surface of grana thylakoid in association with PS II, protons and oxygen are released into lumen and atmosphere respectively.
 - Only A is true
 - Only B & C are true
 - Only A & C only
 - A, B & C are true
- 12.** When light of wavelength above 680 nm are available for excitation, which of the following is likely to takesplace.
- Cyclic photophosphorylation
 - Non-cyclic photophosphorylation
 - Photo-oxidation of water
 - Photo-oxidation of chlorophyll
- 13.** During non-cyclic electron transport, ATP synthesis occur in accordance with :
- Uphill transport of electrons
 - Downhill transport of electrons
 - Redox potential scale
 - A only
 - A & B
 - B only
 - B & C

- 14.** The biochemical objective of PS I in non-cyclic photophosphorylation is to :
- Oxidise NADPH
 - Phosphorylate ADP
 - Reduce NADP^+
 - Both 2 and 3
- 15.** With regards to photosynthesis, chemiosmotic hypothesis is applicable to :
- Only cyclic photophosphorylation
 - Only non-cyclic photophosphorylation
 - Both cyclic and non-cyclic photophosphorylation
 - Both light reaction and dark reaction
- 16.** Radioactive isotope technique was used to experimentally proved by :
- Light reaction of photosynthesis
 - Dark reaction of photosynthesis
 - Both light reaction and dark reaction of photosynthesis
 - Only photo-oxidation of water and evolution of oxygen occur during light reaction.
- 17.** How many NADPH_2 are oxidised and number of ATP consumed in the reduction step of a single Calvin cycle respectively :
- one and one
 - one and two
 - two and two
 - two and one
- 18.** In C_4 plants, reducing power of photosynthesis is formed in :
- Chloroplast of mesophyll
 - Cytoplasm of mesophyll
 - Cytoplasm of bundle sheath
 - Chloroplast of bundle sheath
- 19.** In C_4 photosynthesis, number of C_4 and C_3 cycles are required for the synthesis of one glucose molecule :
- One C_4 cycle and one C_3 cycle
 - One C_4 cycle and six C_3 cycle
 - Six C_4 cycles and six C_3 cycles
 - Twelve C_4 cycles and six C_3 cycles
- 20.** **Assertion** : Photorespiration interfere with successful functioning of Calvin cycle.
Reason : Photorespiration oxidises the pentose phosphate which is the acceptor of CO_2 in Calvin cycle
- Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
 - Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - Assertion is true but the Reason is false
 - Both Assertion and Reason are false

QUESTIONS LEVEL - II

- 1.** Consider the following data with respect to chromatogram and select the correct option :
- Orange → Carotene
 → Yellow → Xanthophyll
 → Yellow-green → Chlorophyll b
 → Blue-green → Chlorophyll a
 - Yellow → Xanthophyll
 → Orange → Carotene
 → Yellow-green → Chlorophyll b
 → Blue-green → Chlorophyll a
 - Orange → Carotene
 → Yellow → Xanthophyll
 → Blue-green → Chlorophyll a
 → Yellow-green → Chlorophyll b
 - Blue-green → Chlorophyll a
 → Yellow-green → Chlorophyll b
 → Orange → Carotene
 → Yellow → Xanthophyll

2. Consider the following graph given below and select the correct option



- A) There is a complete one to one overlap between absorption spectrum of chlorophyll a and action spectrum of photosynthesis.
- B) No complete one to one overlap between absorption spectrum of chlorophyll a and action spectrum of photosynthesis
- C) Rate of absorption maximum in blue light and rate of photosynthesis occur maximum in red light.
- 1) A and C are true
- 2) B and C are true
- 3) B is false
- 4) A and C are false

3. A photosystem includes :

- A) Antenna pigments
 - B) Reaction centre
 - C) Primary electron acceptor
 - D) All the electron carriers in the ETS
- 1) A, B, C & D
 - 2) A, B & C
 - 3) A & B only
 - 4) A, B & D

4. Consider the following statements :

- A) In Cyclic electron transport, the electron released by reaction centre (P_{700}) is ultimately returned back to the original reaction centre and results in the formation of ATP only
- B) Non-cyclic electron transport results in the formation of ATP, $NADPH_2$ and O_2
- C) All oxygen evolving photosynthetic cells contains both PS I and PS II
- D) Stroma lamellae lack NADP and NADP reductase

Of the above statements ;

- 1) C is false
- 2) Only B is true
- 3) C & D are false
- 4) A, B, C & D are true

5. Find the mis-matching series :

A)	ATP & NADPH ₂	Assimilatory powers of photosynthesis	Connecting link between light phase and dark reaction
B)	Proton pumping	Occur from stroma to lumen and requires energy	Occur during both cyclic and non-cyclic
C)	Plasto Quinone	Proton pump	Present in the membrane of grana thylakoid only
D)	Photo-oxidation of chlorophyll	Occur when continuous strong light become available above optimum for photosynthesis	Chlorophylls are less stable than carotenoids

- 1) A only 2) A & B
 3) C only 4) C & D

6. Which of the following statement is true :

- A) FNR and Ferredoxin is associated with PS I and present in both the membrane of grana thylakoid and stroma thylakoid
 B) PQ and NADP are hydrogen carriers
 C) Light reactions or photochemical phase include photoexcitation of chlorophyll, photolysis of water, evolution of oxygen and formation of high energy intermediate - ATP and NADPH₂
 1) C only 2) A & B
 3) B & C 4) A, B & C

7. How many non-cyclic electron transport reactions are essential for the production of required reducing power, for the synthesis of one molecule of glucose in calvin cycle.

- 1) One 2) Six
 3) Three 4) Twelve

8. Identify the true statements regarding the details of light independent reaction of photosynthesis, which occur in the stroma of chloroplast in C₃ plants :

- A) Discovered by Melvin Calvin using algae and radioactive isotope of carbon (¹⁴C)
 B) Involve three major stages; carboxylation, reduction and regeneration.
 C) Occur in day time and dependent on product of light reaction; considered as a misnomer.
 D) Primary CO₂ acceptor is RuBisCO and primary CO₂ fixation occur in 3-PGA
 1) A, B & C 2) A & B only
 3) B only 4) A, B, C & D

9. Primary carboxylation enzyme of Calvin cycle present in :

- 1) Stroma of chloroplast of mesophyll - C₃ plants
 2) Stroma of chloroplast of bundle sheath - C₄ plants
 3) All photosynthesizing plants
 4) All the above

10. How many of the following statements are true regarding C₄ photosynthesis.

- A) The objective of the pathway is to build up high concentration of CO₂ in vicinity of RuBisCO in the bundlesheath and to avoid photorespiration.
 B) No synthesis of glucose occur in C₄ cycle, it is a way to concentrate CO₂ in bundlesheath for C₃ cycle.
 C) Light reaction and primary carboxylation occur in mesophyll and C₃ cycle occur in bundle sheath.
 D) Every C₄ cycle consume 2 ATP and every C₃ cycle requires 3 ATP
 1) One 2) Three
 3) Two 4) Four

- 11.** How many ATP and NADPH₂ are required in Calvin cycle for the synthesis of one molecule of sucrose :
- 18 ATP & 12 NADPH₂
 - 12 ATP & 18 NADPH₂
 - 6 ATP & 6 NADPH₂
 - 36 ATP & 24 NADPH₂
- 12.** How many CO₂ molecules are used up by C₄ plants in one C₄ cycle and C₃ cycle :
- 12 and 6
 - 6 and 6
 - 1 and 1
 - 2 and 3
- 13.** Which of the following is false regarding PEPcase :
- Found in both mesophyll and bundle sheath cell of C₄ plants
 - Primary CO₂ acceptor in C₄ plants
 - Present in both C₃ and C₄ plants, but photosynthetically involved in C₄ plants
 - Most efficient enzyme for carboxylation even if the CO₂ concentration is limiting in the atmosphere.
- A & B
 - C only
 - A, B & C
 - A, B, C & D
- 14.** Consider the following statements and select the correct option.
- Statement I** : RuBisCO has much greater affinity for CO₂ when the CO₂ and O₂ is nearly equal in the atmosphere.
- Statement II** : Binding of CO₂ or O₂ is competitive and relative concentration of O₂ and CO₂ determine which will bind to the active site of RuBisCO.
- Statement I is false
 - Statement II is false
 - Statement I & II are false
 - Statement I & II are true
- 15.** Which of the following is true regarding photorespiration :
- Occur in C₃ plants only
 - Occur when concentration of O₂ increases and CO₂ decreases.
 - More than one cell organelles are involved
 - Plants which are subjected to photorespiration possess chloroplast dimorphism.
- All except D
 - All except A
 - All except C
 - All are true
- 16.** Observe and identify A, B, C, D, and E in the given graph :
-
- | Column I | | Column II | |
|----------|----------------|-----------|--|
| I | A represent to | A | Some factor other than light intensity is becoming the limiting factor |
| II | B represent to | B | Light is no longer limiting factor |
| III | C represent to | C | Light intensity |
| IV | D represent to | D | Maximum rate of photosynthesis |
| V | E represent to | E | Saturation point for light intensity |
- I - A, II - B, III - C, IV - D, V - E
 - I - C, II - A, III - B, IV - E, V - D
 - I - D, II - B, III - E, IV - C, V - A
 - I - E, II - D, III - C, IV - B, V - A

17. How many of the following statements are true :
- CO₂ fixation rate increases in both C₃ and C₄ plants under high CO₂ and high light conditions.
 - Light duration, light quality and light intensity affect the process of photosynthesis.
 - Except for plants in shade or dense forest, light is rarely a limiting factor in nature.
 - Tropical plants have higher temperature optimum than the plants adapted to temperate climate.
 - Photosynthesis is affected by both internal (plant factors) and external factors.
- 1) One 2) Two
3) Three 4) Five
18. **Assertion** : In terrestrial conditions, CO₂ usually act as main determining factor of photosynthesis.
- Reason** : Usually CO₂ is available at suboptimal level in terrestrial conditions.
- Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
 - Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - Assertion is true but the Reason is false
 - Both Assertion and Reason are false

QUESTIONS

LEVEL - III

1. Consider the following statements and select the correct option?
- Statement I** : Photosynthesis cannot continue for a long time if cyclic photophosphorylation occur only during light reaction.
- Statement II** : Thylakoid membrane is virtually impermeable of protons, a substantial electrochemical proton gradient can develop across the thylakoid membrane in illuminated chloroplast.
- Statement I statement II are false
 - Statement I statement II are true
 - Statement I is false but statement II is true.
 - Statement I is true but statement II is false
2. Consider the following statements and select the correct option?
- Statement I** : In all photoautotrophic organisms, photosynthesis occur in green cells containing chloroplast.
- Statement II** : The process of photosynthesis requires chloroplast in all photoautotrophic organisms.
- Statement I statement II are false
 - Statement I statement II are true
 - Statement I is false but statement II is true.
 - Statement I is true but statement II is false

3. Identify the site where ATP is synthesised and utilised during photosynthesis in chloroplast respectively :
- 1) Stroma and stroma
 - 2) CF_1 and stroma
 - 3) CF_0 and stroma
 - 4) Stroma and $CF_0 - CF_1$
4. With regards to C_4 plants, synthesis of $NADPH_2$ occur in :
- 1) Chloroplast of mesophyll
 - 2) Chloroplast of bundlesheath
 - 3) Both granal chloroplast and agranal chloroplast
 - 4) Both chloroplast of mesophyll and chloroplast of bundlesheath.
5. Identify the number of ATP, $NADPH_2$ and glucose synthesised in photorespiration respectively :
- 1) One, One , One
 - 2) One, Two, Zero
 - 3) Two, Two, One
 - 4) Nil

SYNOPSIS

- Types of respiratory substrates.
 - Carbohydrates
 - Fat
 - Proteins
 - Organic acids
- Classification of cellular respiration on the basis of availability of oxygen
 - Aerobic respiration
 - Anaerobic respiration
- Mechanism of anaerobic respiration
 - Glycolysis
 - Fermentation
 - * Alcoholic fermentation
 - * Lactic acid fermentation
- Mechanism of aerobic respiration
 - Glycolysis
 - Krebs cycle / Tricarboxylic acid cycle
 - Electron transport system (ETS) and oxidative phosphorylation.
- The respiratory balance sheet
- Amphibolic pathway
 - ▣ Interrelationship among metabolic pathway of oxidation of fat, carbohydrates and proteins
- Respiratory Quotient / Respiratory ratio of carbohydrates, fats and proteins.

QUESTIONS**LEVEL - I**

- 1.** In the given reaction of cellular respiration, (P), (Q) and (R) are respectively :



- 1) (P) - 12, (Q) - 12, (R) - 12
- 2) (P) - 6, (Q) - 6, (R) - 6
- 3) (P) - 3, (Q) - 18, (R) - 18
- 4) (P) - 6, (Q) - 12, (R) - 12

- 2.** Consider the following statements and select the correct option :

Statement I : The fate of the pyruvate depends on the availability of oxygen and the organism.

Statement II : Fermentation takes place under anaerobic conditions in many prokaryotes, unicellular eukaryotes and in germinating seeds.

- 1) Both statements are true
- 2) Both statements are false
- 3) Statement I is true but statement II is false
- 4) Statement II is true but statement I is false

- 3.** In which of the following processes, CO_2 is not released :

- 1) Glycolysis
- 2) Alcoholic fermentation
- 3) Lactic acid fermentation
- 4) Both 1 and 3

- 4.** Select the false statement from the following.

- 1) Yeast poison themselves to death when the concentration of alcohol reaches about 13%.
- 2) The key product of glycolysis is acetyl Co.A.
- 3) ATP is utilized in 2 steps in glycolysis.
- 4) Less than 7% of energy in glucose is released in fermentation.

- 5.** In glycolysis, $\text{NADH} + \text{H}^+$ is formed from NAD^+ , when :

- 1) 3-phosphoglyceraledehyde is oxidised to 1,3-bisphosphoglycerate
- 2) Glucose is phosphorylated to Glucose - 6 - phosphate
- 3) 2-phosphoenol pyruvate is dephosphorylated to pyruvate
- 4) 2-phosphoglycerate undergo dehydration to form 2-phosphoenol pyruvate

- 6.** Hexokinase is involved during :

- 1) Dephosphorylation of PEP
- 2) Phosphorylation of fructose -6-phosphate
- 3) Isomerisation of Glucose-6-phosphate
- 4) Phosphorylation of Glucose

- 7.** Match the following suitably and select the correct option :

Column I (Process)	Column II (Site)
A) Glycolysis	(i) Matrix of mitochondria
B) TCA cycle	(ii) Inner membrane of mitochondria
C) Oxidative phosphorylation	(iii) Cytoplasm(Cytosol)

- 1) A - (iii); B - (ii); C - (i)
- 2) A - (ii); B - (i); C - (iii)
- 3) A - (iii); B - (i); C - (ii)
- 4) A - (i); B - (ii); C - (iii)

- 8.** In glycolysis, fructose 1, 6-bisphosphate splits into trioses. They are:

- 1) PGAL and DHAP
- 2) BPGA and PGAL
- 3) DHAP and 3-PGA
- 4) 3-PGA and 2-PGA

- 9.** Read the following statements and select the correct option :

Statement I : In Glycolysis, during oxidation, two redox equivalents are removed from PGAL and transferred to a molecule of NAD⁺.

Statement II : There is a net gain of 38ATP molecules by the complete oxidation of one molecule of glucose in aerobic respiration.

- 1) Both statements are true
- 2) Both statements are false
- 3) Only statement I is correct
- 4) Only statement II is correct

- 10.** At the end of glycolysis (**X**) is the net energy gain from one molecule of glucose via (**Y**), but there is also energy stored in the form of (**Z**) :

	(X)	(Y)	(Z)
1)	1 ATP	Oxidative phosphorylation	NADH + H
2)	2 ATP	Oxidative phosphorylation	NADH + H ⁺
3)	2 ATP	Substrate level phosphorylation	NADPH + H ⁺
4)	2 ATP	Substrate level phosphorylation	NADH + H ⁺

- 11.** Oxidative decarboxylation of pyruvic acid in eukaryotes occurs in :

- 1) Cytosol
- 2) Cytoplasm
- 3) Mitochondrial matrix
- 4) Inner mitochondrial membrane

- 12.** During aerobic respiration, a 3C compound and a 5C compound undergoes oxidative decarboxylation. They are respectively :

- 1) Isocitric acid and OAA
- 2) Pyruvic acid and alpha-ketoglutaric acid
- 3) Alpha-ketoglutaric acid and Acetyl Co.A
- 4) Succinic acid and Pyruvic acid

- 13.** Match column I with column II and select the correct answer.

Column I	Column II
A) Conversion of glucose to pyruvate	i) Substrate level phosphorylation
B) Conversion of pyruvate to acetyl Co. A	ii) Glycolysis
C) Conversion of succinyl Co.A to succinic acid	iii) Oxidative decarboxylation
D) Conversion of PGAL → BPGA	iv) Oxidation

- 1) A-(ii) ; B-(iii) ; C-(iv) ; D-(i)
- 2) A-(ii) ; B-(iii) ; C-(i) ; D-(iv)
- 3) A-(iv) ; B-(iii) ; C-(ii) ; D-(i)
- 4) A-(iv) ; B-(i) ; C-(iii) ; D-(ii)

- 14.** Select the enzymes which are present in mitochondria :

- a) Hexokinase
 - b) Invertase
 - c) Pyruvic dehydrogenase
 - d) Citrate synthase
 - e) Succinate dehydrogenase
 - f) Pyruvic acid decarboxylase
 - g) Alcohol dehydrogenase
 - h) Lactate dehydrogenase
- 1) a, b, f, g and h only
 - 2) a, f and g only
 - 3) c and d only
 - 4) c, d and e only

- 15.** Which of the following statement is wrong about Krebs cycle?

- 1) There is one point in the cycle where FAD⁺ is reduced to FADH₂
- 2) There is one point where GDP is converted to GTP
- 3) The cycle starts with condensation of acetyl group with pyruvic acid to yield citric acid
- 4) There are three points in the cycle where NAD⁺ is reduced to NADH + H⁺

- 16.** Which of the following is wrong about cytochrome c ?

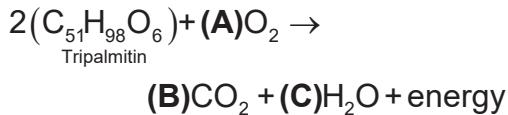
- 1) Small protein attached to outer surface of the inner membrane of mitochondria
- 2) Acts as mobile electron carrier
- 3) Transfer electrons between complex III and IV
- 4) It carry both electrons and protons

- 17.** Match the following columns suitably and select the correct option :

Column I	Column II
A) NADH dehydrogenase	1) Complex IV
B) ATP synthase	2) Complex III
C) Cytochrome bc ₁ complex	3) Complex I
D) Cytochrome c oxidase complex	4) Complex V
E) Succinate dehydrogenase	5) Complex II

- 1) A-3; B-4; C-1; D-2; E-5
- 2) A-4; B-3; C-2; D-1; E-5
- 3) A-1; B-4; C-2; D-3; E-5
- 4) A-3; B-4; C-2; D-1; E-5

- 18.** Before entering into the respiratory pathway, fats would need to be broken down into :
- Fatty acids and pyruvic acid
 - Fatty acids and glycerol
 - Glycerol and aminoacids
 - Pyruvic acid and Acetyl Co.A
- 19.** During aerobic respiration of Tripalmitin, what will be the value of (A), (B) and (C) in the given reaction?



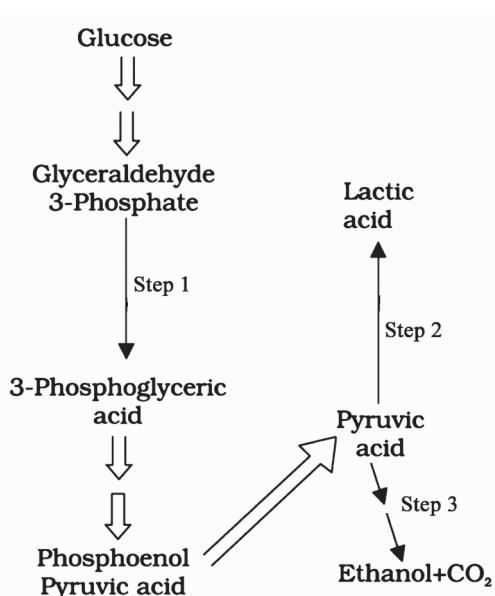
	(A)	(B)	(C)
1)	145	102	98
2)	72	51	49
3)	102	145	98
4)	145	98	102

- 20.** RQ value of carbohydrate is :
- Less than one
 - Greater than one
 - One
 - Infinity

QUESTIONS LEVEL - II

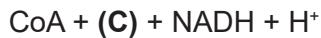
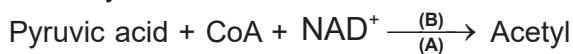
- 1.** Which of the following is true about cellular respiration?
- It is the breaking of C - C bonds of complex organic molecules by oxidation within the cells, leading to release of considerable amount of energy.
 - Most of the energy is liberated as heat while rest of energy is stored in the form of ATP.
 - ATP acts as the energy currency of the cell
 - All the above

- 2.** In glycolysis, a molecule of glucose is:
- Reduced to pyruvic acid with the help of O_2
 - Reduced to pyruvic acid without the help of O_2
 - Partially oxidised to pyruvic acid with the help of O_2
 - Partially oxidised to pyruvic acid without the help of O_2
- 3.** Pathways of anaerobic respiration are shown in the diagram. Select the step/s in which synthesis and utilisation of $NADH_2$ occurs:



	Synthesis of $NADH_2$	Utilisation of $NADH_2$
1)	Step 2	Step 1 and 3
2)	Step 1	Step 2 and 3
3)	Step 2 and 3	Step 1
4)	Step 1 and 3	Step 2

4. Oxidative decarboxylation is summarised in the following reaction. (A) is an enzyme for which (B) is a cofactor (mineral activator) and (C) is one of the product. Identify them correctly.



	(A)	(B)	(C)
1)	Citrate synthase	Mg ²⁺	CO ₂
2)	Hexokinase	Cu ²⁺	ATP
3)	Pyruvate dehydrogenase	Cu ²⁺	ATP
4)	Pyruvate dehydrogenase	Mg ²⁺	CO ₂

5. Select the incorrect statement from the following:

- 1) Sucrose is converted into glucose and fructose by the enzyme invertase.
- 2) Pyruvate, after it enters mitochondrial matrix undergoes oxidative decarboxylation.
- 3) Acetyl Co.A is the first member in Krebs cycle.
- 4) Krebs cycle is also known as TCA cycle.

6. A to E are some processes in cellular respiration.

A - Fermentation,

B - Glycolysis,

C - Oxidative decarboxylation,

D - Krebs cycle

E - ETS

Which set occur in mitochondria?

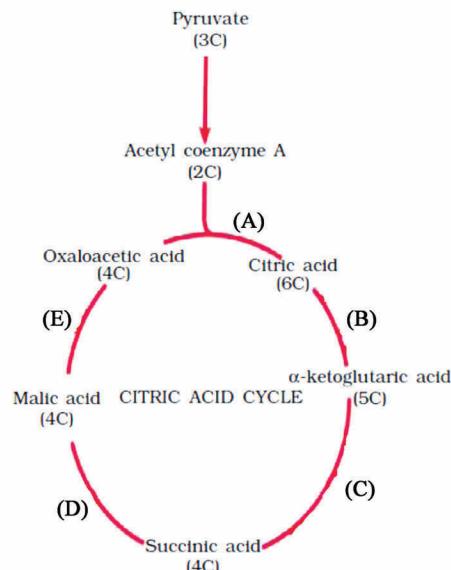
- 1) C, D and E
- 2) A, C and D
- 3) B, C and D
- 4) B, D and E

7. Assertion : In aerobic respiration, the final product of glycolysis is transported to mitochondria.

- Reason : The site of glycolysis in aerobic respiration is cytoplasm.

- 1) Both Assertion and Reason are true, the Reason is correct explanation of Assertion.
- 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
- 3) Assertion is true but the Reason is false
- 4) Both Assertion and Reason are false

8. Citric acid cycle is shown in the diagram. Select the incorrect statement:



- 1) CO₂ is released in (B) and (C)
- 2) FADH₂ is released in (D)
- 3) NADH₂ is released in (B), (C) and (D)
- 4) GTP is synthesised in (C)

- 9.** Which of the following are the products of oxidative decarboxylation of pyruvic acid?
- Acetyl Co.A
 - NADH₂
 - CO₂
 - All the above
- 10.** Some enzymes are given below.
- A - Invertase
 B - Citrate synthase
 C - Pyruvate dehydrogenase
 D - Pyruvic acid decarboxylase
 E - Lactate dehydrogenase
 F - Alcohol dehydrogenase
- Which set of enzymes are required for conversion of pyruvic acid into CO₂ and ethanol.
- A, D, E and F
 - B and C
 - D and F
 - B, C, D and F
- 11.** How many molecules of CO₂ will be produced if 2 molecules of Acetyl Co.A are completely oxidised in aerobic respiration?
- None
 - one
 - Two
 - Four
- 12.** How many NADH + H⁺, FADH₂ and CO₂ are produced, if one pyruvic acid is completely oxidised in aerobic cellular respiration?
- | | NADH + H ⁺ | FADH ₂ | CO ₂ |
|----|-----------------------|-------------------|-----------------|
| 1) | 4 | 1 | 3 |
| 2) | 3 | 1 | 3 |
| 3) | 10 | 2 | 6 |
| 4) | 5 | 2 | 3 |
- 13.** Select the incorrectly matched pair:
- F₁ component of ATP synthase - Site for ATP synthesis
 - Electron transport system - Inner mitochondrial membrane
 - Tricarboxylic acid cycle - EMP pathway
 - Most favoured substrate for respiration - Glucose
- 14.** Following are the critical events in aerobic respiration :
- The complete oxidation of pyruvate by the stepwise removal of all the hydrogen atoms, leaving three molecules CO₂.
 - The passing on of the electrons removed as part of the hydrogen atoms to molecular O₂ with simultaneous synthesis of ATP.
- Identify the site of the above processes and select the correct option:
- I - Matrix of Mitochondria,
 II - Inner membrane of mitochondria
 - I - Inner membrane of mitochondria,
 II - Matrix of Mitochondria
 - I - Matrix of Mitochondria,
 II - Outer membrane of mitochondria
 - I - Outer membrane of mitochondria,
 II - Matrix of Mitochondria
- 15.** How many ATP will be synthesized if 3 molecules of FADH₂ enter ETS (Electron Transport System)?
- 3
 - 6
 - 9
 - 12

- 16.** Consider the following statements and select the false one :

- 1) Complex IV contains cytochrome a, a₃ and two copper centres
- 2) Complex II is a proton pump
- 3) FMN is a part of complex I
- 4) Complex I, II & III contain Fe-S

- 17.** In ETS (Electron Transport System), ubiquinone is reduced by:

- 1) Complex I only
- 2) Complex II only
- 3) Complex I and complex III
- 4) Complex I and complex II

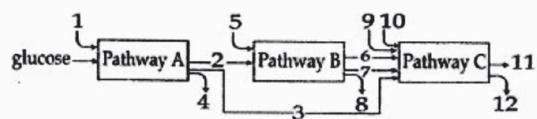
- 18.** Cytochrome c is a small(A).... attached to the outer surface of(B)..... mitochondrial membrane and act as a mobile electron carrier between(C)..... and (D).....

	(A)	(B)	(C)	(D)
1)	Protein	Inner	Complex III	Complex IV
2)	Protein	Outer	Complex II	Complex IV
3)	Carbohydrate	Inner	Complex III	Complex IV
4)	Carbohydrate	Outer	Complex II	Complex II

- 19.** By electron transport chain (ETS) :

- 1) Energy stored in ATP is utilised for synthesis of NADH+ H⁺
- 2) Energy stored in ATP is utilised for synthesis of FADH₂
- 3) Energy stored in NADH+ H⁺ and FADH₂ is utilized for synthesis of ATP
- 4) Energy stored in glucose is utilized for synthesis of NADH + H⁺, FADH₂ and ATP

- 20.** The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products.



Which of them represent reduced co-enzymes ?

- 1) 5 & 11
- 2) 4, 8 & 12
- 3) 3, 6 & 7
- 4) 2, 5, 9 & 10

QUESTIONS LEVEL - III

- 1.** Which of the following intermediate compounds undergo oxidative decarboxylation during aerobic respiration when one molecule of glucose is used as substrate :

- A) One molecule of pyruvic acid
- B) Two molecule of pyruvic acid
- C) One molecule of α-ketoglutaric acid
- D) Two molecule of α-ketoglutaric acid
- E) One molecule of oxalosuccinic acid
- F) Two molecule of oxalocussinic acid
- 1) A, C & E
- 2) B, D & F
- 3) B & D
- 4) A & C

- 2.** Identify the role of NAD in cellular respiration:

- 1) Carry electrons from more than one respiratory intermediates
- 2) Carry electrons and protons from succinic acid only
- 3) Carry electrons from succinic acid to electron transport chain
- 4) All the above

3. Consider the following statements and select the correct option?
- Statement I :** Respiratory pathway is considered as amphibolic pathway.
- Statement II :** Many carbon skeleton produced during respiration is used as precursors for the biosynthesis of other molecules in the cell.
- 1) Statement I and statement II are true but statement II is not correct explanation of statement I
- 2) Statement I and statement II are true but statement II is the correct explanation of statement I
- 3) Statement I is true but statement II is false.
- 4) Statement I is false but statement II is true
4. When one molecule of glucose participating in Krebs cycle in the form of acetyl Co.A, how many oxido-reductions occur in it :
- 1) Three
 - 2) Four
 - 3) Five
 - 4) Eight
5. Which of the following enzyme complex do not possess electron carriers :
- 1) Complex I & III
 - 2) Complex III & IV
 - 3) Complex II & III
 - 4) Complex V

SYNOPSIS

I. Growth - definition

1. Introduction

- ◆ Seed germination
- ◆ Meristems, open form of growth
- ◆ Primary growth, secondary growth

2. Parameters for measurement of growth

3. Growth phases - meristematic, elongation and maturation

II. Growth rates

- ◆ Arithmetic growth and geometric growth
- ◆ Absolute growth rate and relative growth rate

III. Conditions for growth**IV. Differentiation, dedifferentiation and redifferentiation****V. Development**

- ◆ Plasticity - definition and examples

VI. Conditions for Development**VII. Intercellular Intrinsic Factors - Plant Growth Regulators**

1. Definition, characteristics and classification

2. Discovery and Physiological effects of PGRs

- | | |
|------------------|-----------------|
| a) Auxins | b) Gibberellins |
| c) Cytokinins | d) Ethylene |
| e) Abscisic acid | |

3. Antagonistic and synergistic effects of PGRs.

QUESTIONS

LEVEL - I

- 1.** All cells of a plant are descendants of :
 - 1) Apical meristem
 - 2) Zygote
 - 3) Lateral meristem
 - 4) Both 1 and 3

- 2.** Root apical meristem and shoot apical meristem are responsible for :
 - 1) Primary growth of plants
 - 2) Secondary growth of plants
 - 3) Elongation of plants along axis
 - 4) Both 1 and 3

- 3.** **Assertion (A)** : Plant growth is indefinite
Reason (R) : Plant retain the capacities of continuous growth throughout their life
 - 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 - 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - 3) (A) is true but (R) is false
 - 4) Both (A) and (R) are false

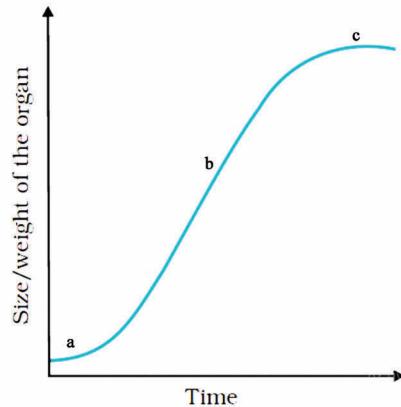
- 4.** Growth can be measured by :
 - 1) Increase in fresh weight
 - 2) Increase in area
 - 3) Increase in volume
 - 4) All of these

- 5.** Growth is maximum in the zone of :
 - 1) Cell elongation
 - 2) Cell maturation
 - 3) Cell division
 - 4) Meristematic activity

- 6.** Cells having thin, cellulosic primary cell walls with abundant plasmodesmatal connections without vacuoles are seen in :
 - 1) Elongation zone 2) Meristematic zone
 - 3) Maturation zone 4) Both 1 and 2

- 7.** In the equation $L_t = L_0 + rt$; 'r' represents :
 - 1) Initial size
 - 2) Growth rate
 - 3) Length at time t
 - 4) Base of natural logarithm

- 8.** Label the following sigmoid graph correctly



- 1) a - Log phase, b - Lag phase, c - Stationary phase
- 2) a - Lag phase, b - Log phase, c - Stationary phase
- 3) a - Lag phase, b - Stationary phase, c - Log phase
- 4) a - Lag phase, b - Log phase, c - Exponential phase

- 9.** Which of the following tissues are examples for Dediifferentiation :
- 1) Phellem, Phelloiderm
 - 2) Cork cambium, Inter fascicular cambium
 - 3) Secondary xylem, Secondary phloem
 - 4) Endodermis, Pericycle
- 10.** Plasmatic growth is seen in :
- 1) Differentiated tissue
 - 2) Redifferentiated tissue
 - 3) Mature tissue
 - 4) Meristematic tissue
- 11.** Find out the correctly matched pair :
- 1) Cytokinin - Hasten maturity period in Juvenile conifers
 - 2) Ethylene - Initiate root from stem cuttings
 - 3) Gibberellins - Promote seed dormancy
 - 4) Auxin - Promote apical dominance
- 12.** Lateral shoot growth is promoted by :
- 1) Auxin
 - 2) Cytokinin
 - 3) Ethylene
 - 4) ABA
- 13.** 'Zeatin' was isolated from :
- 1) Herring sperm DNA
 - 2) Coleoptiles of oat seedlings
 - 3) Corn kernels
 - 4) Rice seedlings
- 14.** Which of the following statements is false?
- 1) Auxin generally produced by growing apices of stem and root
 - 2) Gibberellin controls xylem differentiation
 - 3) Abscisic Acid (ABA) is known as stress hormone
 - 4) Natural cytokinins are synthesized in regions where rapid cell division occurs
- 15.** **Statement I** : ABA plays an important role in seed development, maturation and dormancy.
Statement II : In most situations, ABA acts antagonistic to cytokinin
- 1) Both statement I and II are correct
 - 2) Both statement I and II are incorrect
 - 3) Statement I is correct but II is incorrect
 - 4) Statement I is incorrect but II is correct

QUESTIONS LEVEL - II

- 1.** Which of the following statements is/are incorrect?
- 1) Development is the sum of growth and differentiation
 - 2) Developmental processes are controlled by both Intrinsic and extrinsic factors
 - 3) Development is regarded as one of the most fundamental and conspicuous characteristics of all living cells.
 - 4) Both 1 and 3

- 2.** Select the true statements from the following:
1. In plants, vegetative phase always precedes flowering
 2. First step in process of plant growth is fertilization
 3. Expansion of leaf can be considered as growth
 4. Plants retain capacity of unlimited growth throughout their life
- 1) 1 and 3 only
 2) 1, 2 and 3
 3) 2, 3 and 4
 4) All except 2
- 3.** One single maize root apical meristem can give rise to more than _____ cells per hour, whereas cells in a watermelon may increase in size by upto _____ times.
- 1) 17,500 ; 3, 50, 000
 2) 17,500 ; 35,000
 3) 3,50,000 ; 17,500
 4) 1,750 ; 3,50,000
- 4.** Which of the following is not a character of cell in region of elongation?
- 1) Increased vacuolation
 - 2) Cell enlargement
 - 3) New cell wall deposition
 - 4) Cells attaining their maximum size
- 5.** Select the mismatched pair :
- 1) Arithmetic growth - Linear growth curve
 - 2) Geometric growth - root elongating at constant rate
 - 3) Sigmoid curve - living organism growing in a natural environment
 - 4) Relative growth rate - growth of given system per unit time expressed on a common basis
- 6.** Match the following correctly :
- | A | B |
|--------------|-----------------------------|
| a) Water | p) Synthesis of protoplasm |
| b) Oxygen | q) Cell enlargement |
| c) Nutrients | r) release metabolic energy |
- 1) a - p ; b - r ; c - q
 2) a - q ; b - r ; c - p
 3) a - q ; b - p ; c - r
 4) a - r ; b - q ; c - p
- 7.** Secondary growth of the plant occurs due to the action of :
- 1) Lateral meristem
 - 2) Vascular cambium
 - 3) Cork cambium
 - 4) All of these
- 8.** Select the false statement/s from the following :
1. Formation of tracheary elements is an example for dedifferentiation
 2. Formation of cork cambium is an example for dedifferentiation
 3. Growth in plants and animals are 'open'
 4. Cells positioned away from root apical meristem differentiate as epidermis
- 1) 1, 2 and 3 2) 1 and 3 only
 3) All except 1 4) 1, 3 and 4

9. Heterophylly due to phases of life is observed in :

- 1) Buttercup
- 2) Larkspur
- 3) Cotton
- 4) Both 2 and 3

10. Match the following correctly :

A	B
a) Auxin	p) E. Kurosawa
b) Gibberellin	q) H.H. Cousins
c) Cytokinin	r) Skoog and Miller
d) Ethylene	s) F.W. Went

- 1) a - s ; b - p ; c - r ; d - q
- 2) a - p ; b - s ; c - r ; d - q
- 3) a - s ; b - p ; c - q ; d - r
- 4) a - p ; b - s ; c - q ; d - r

11. Which of the following is not a function of Auxin?

- 1) Initiate rooting in stem cuttings
- 2) Induce parthenocarpy
- 3) Increase length of stem in sugarcane
- 4) Promote flowering in Pineapple

12. Which plant growth hormone is responsible for promoting bolting in cabbage and speeding up of malting processes?

- 1) Gibberellins
- 2) ABA
- 3) IAA
- 4) Cytokinin

13. Which of the following is not a physiological function of ABA?

- 1) Promotes seed dormancy
- 2) Response to various kinds of stresses
- 3) Apical Hook formation in dicot seedlings
- 4) Act antagonistic to GA

14. Which of the following acid is a derivative of carotenoids?

- 1) Abscisic acid
- 2) Indole Butyric acid
- 3) Gibberellic acid
- 4) Indole - 3- acetic acid

15. The term 'Respiratory climactic' is related to which PGR?

- | | |
|-------------|----------------|
| 1) Auxin | 2) Gibberellin |
| 3) Ethylene | 4) Cytokinin |

QUESTIONS LEVEL - III

1. Which of the following is true regarding 2, 4-D

- A) Synthetic auxin
- B) Selective weed killer
- C) Does not affect dicot plants
- D) Does not affect monocot plants
- E) Eradicate only dicot broad leaved weeds
- F) Eradicate only monocot narrow leaved weeds

- 1) A, B & F only
- 2) A, B, D & E
- 3) A, B & C only
- 4) A, B, C, F

- 2.** What would be expected to happen if dividing cells stop differentiating
- A) No plant organs like root, stem and leaves will be formed
B) Tumour formation occur
C) Callus formation occur
1) A only 2) C only
3) B only 4) A, B and C
- 3.** What would you call the parenchyma cells that are made to divide under controlled laboratory conditions during plant tissue culture
- 1) Differentiation
2) Dedifferentiation
3) Redifferentiation
4) Cell proliferation
- 4.** What would be expected to happen if GA_3 is applied to rice seedlings
- 1) Internode elongation
2) Early seed production
3) Delay senescence
4) Initiating rooting
- 5.** Older mature fruit drop is caused by
- 1) Less auxin in fruit than in stem
2) More auxin in fruit than in stem
3) Equal distribution of auxin in stem and fruit
4) Absence of auxin in stem and fruit

SYNOPSIS

❖ Pre-fertilisation : Structure and events

I. Stamen, Microsporangium and Pollen grain

- ❖ Structure of microsporangium
- ❖ Microsporogenesis
- ❖ Microgametogenesis

II. Pistil, Megasporangium and Embryo sac

- ❖ Ovule
- ❖ Megasporogenesis
- ❖ Megagametogenesis

❖ Pollination

• Kinds of pollination:

- ❖ Self pollination/Autogamy
- ❖ Cross pollination/Allogamy
- ❖ Geitonogamy
- ❖ Xenogamy

• Agents of pollination:

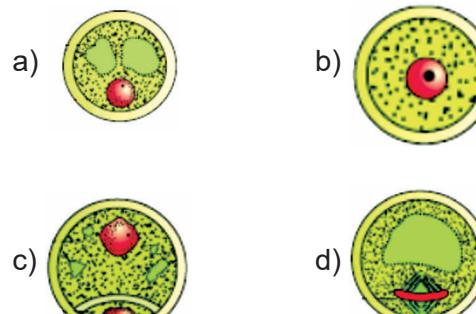
- ❖ Animals
- ❖ Wind
- ❖ Water

Pollinating Agents in Some Plants	
Plants	Agents
Cucumber	Honey bee
Mango	Insects
Peepal	Insects
Coriander	Honey bee
Papaya	Bees
Onion	Honey bee
Lobia	Insects
Cotton	Bees, Birds
Tobacco	Moth
Rose	Butterflies, Bees, Humming birds / Wind
Lemon	Bees, Insects
Eucalyptus	Insects / Wind
Banana	Bats, Birds

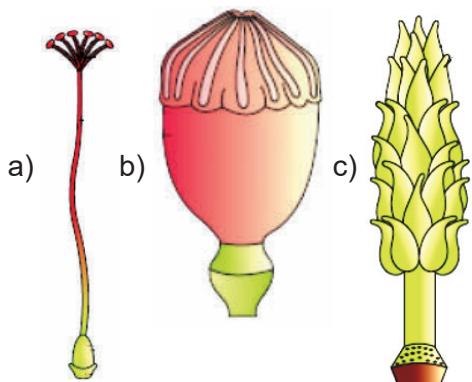
- ❖ Out breeding devices
 - Devices to promote cross pollination
- ❖ Pollen - Pistil interaction
- ❖ Artificial hybridisation
- ❖ Double fertilisation
 - ❖ Syngamy
 - ❖ Triple fusion
- ❖ Post-fertilisation : Structure and events
 - I. Endosperm development
 - ❖ Free -nuclear type
 - ❖ Cellular type
 - II. Embryo development
- ❖ Seed - Albuminous and Non-albuminous
 - Dormancy, viability and advantages of seed
- ❖ Fruit - Fleshy and dry fruit
 - True and false fruit
 - Parthenocarpic fruit
- ❖ Apomixis
- ❖ Polyembryony

QUESTIONS**LEVEL - I**

- 1.** Typical Angiospermic anther is :
- Bilobed, Monothecous and Bisporangiate
 - Bilobed, Dithecous and Tetrasporangiate
 - Unilobed, Monothecous and Bisporangiate
 - Unilobed, Dithecous and Tetrasporangiate
- 2.** If we observe anther walls from outside to inside, then which sequence will be correct?
[A - Endothecium, B - Tapetum, C - Epidermis, D - Middle layers]
- C → D → A → B
 - C → A → D → B
 - B → D → A → C
 - C → D → B → A
- 3.** Which of the following match/matches is/are correct?
- | | |
|----------------------------|--------------------|
| 1) Microsporangium | - Pollen sac |
| 2) Microspore mother cell | - Potential pollen |
| 3) Microspore | - Pollen grain |
| 4) All matches are correct | |

- 4.** Read the following statements and select the correct option.
- Statement I** : The process of formation of microspores from a pollen mother cell through meiosis is called microsporogenesis.
- Statement II** : The pollen grains represent the male gametophytes.
- Both statements I and II are correct
 - Both statements I and II are wrong
 - Statement I is correct but II is wrong
 - Statement II is correct but I is wrong
- 5.** a, b, c and d are four developmental stages of a pollen grain. Arrange them in the sequence of development and select the correct option.
- 
- b → a → c → d
 - b → a → d → c
 - a → b → d → c
 - a → b → c → d
- 6.** Which of the following plant came into India as a contaminant with imported wheat and has become ubiquitous in occurrence and causes pollen allergy?
- Vallisneria
 - Zostera
 - Hydrilla
 - Parthenium / Carrot grass

7. Identify the following figures and select the correct statement/s regarding them :



- 1) It shows the gynoecium of Hibiscus, Papaver and Michelia respectively.
 - 2) All of them are similar in being multicarpellary.
 - 3) (a) and (b) are syncarpous pistil and (c) is apocarpous gynoecium.
 - 4) All the above statements are correct
8. Megasporogenesis means :
- 1) The process of formation of pollen grains from pollen mother cell
 - 2) The process of formation of male gametes from pollen grain.
 - 3) The process of formation of megasporangia from megasporangium.
 - 4) The process of formation of egg from megasporangium.

9. Read the following statements and select the correct option.

Statement I : Embryo sac is also known as female gametophyte and is usually one in number in an ovule.

Statement II : A typical Angiosperm embryo sac at maturity is 8-nucleate and 7-celled.

- 1) Both statements I and II are correct
- 2) Both statements I and II are wrong
- 3) Statement I is correct but II is wrong
- 4) Statement II is correct but I is wrong

10. Select the type of pollination which brings genetically different types of pollen grains to the stigma.

- 1) Autogamy
- 2) Geitonogamy
- 3) Xenogamy
- 4) Cleistogamy

11. Refer the given characteristics of some flowers :

- I. Light and non-sticky pollen grains.
- II. Well exposed stamens
- III. Large, often feathery stigma
- IV. Flowers often have a single ovule in each ovary

Above features are the characteristics of :

- 1) Wind pollinated flowers
- 2) Water pollinated flowers
- 3) Insect pollinated flowers
- 4) Self pollinated flowers.

12. Monoecious plants of Castor and Maize prevents :

- 1) Both autogamy and geitonogamy
- 2) Autogamy but not geitonogamy
- 3) Geitonogamy but not xenogamy
- 4) Both autogamy and xenogamy

13. In Angiosperms, which of the following pairs are diploid and triploid respectively ?

- 1) Polar nuclei and secondary nucleus
- 2) Embryo and Endosperm
- 3) Secondary nucleus and primary endosperm nucleus (PEN)
- 4) Both 2 and 3

14. The Coconut water from tender Coconut is (i) endosperm and the surrounding white kernel is (ii) endosperm.

	(i)	(ii)
1)	Cellular	Free-nuclear
2)	Free-nuclear	Cellular
3)	Cellular	Cellular
4)	Free-nuclear	Free-nuclear

15. Dicot embryo do not possess :

- 1) Coleoptile and coleorhiza
- 2) Scutellum and epiblast
- 3) Epicotyl and hypocotyl
- 4) Both 1 and 2

16. The residual, persistent nucellus in Black pepper and Beet is called :

- 1) Endosperm
- 2) Perisperm
- 3) Pericarp
- 4) Embryo

17. Match column I with column II and select the correct option :

	Column I		Column II
A)	Ovule	(i)	Fruit
B)	Ovary	(ii)	Seed
C)	Ovary wall	(iii)	Seed coat
D)	Integument	(iv)	Pericarp

1) A - (ii) ; B - (i) ; C - (iv) ; D - (iii)

2) A - (i) ; B - (ii) ; C - (iii) ; D - (iv)

3) A - (iv) ; B - (iii) ; C - (ii) ; D - (i)

4) A - (ii) ; B - (i) ; C - (iii) ; D - (iv)

18. The seed of which plant germinated and flowered after an estimated record of 10,000 years of dormancy :

- 1) *Lupinus arcticus* from Arctic Tundra
- 2) *Phoenix dactylifera* from King Herod's palace near the Dead Sea.
- 3) Parasitic species like *Orobanche* and *Striga*
- 4) Apomictic seeds of Asteraceae

19. Apomixis is the production of :

- 1) Fruits without fertilization
- 2) Seeds without fertilization
- 3) Seeds with fertilization
- 4) Fruits from ovary

20. Occurrence of more than one embryo in a seed is referred to as :

- 1) Polyembryony
- 2) Syngamy
- 3) Parthenocarpy
- 4) Gametogenesis

QUESTIONS

LEVEL - II

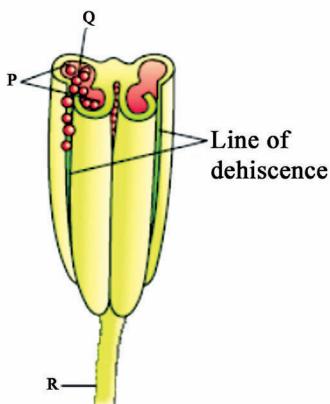
- 1.** Read the following statements and select the correct option.

Statement I : Androecium consists of a whorl of stamens, representing the male reproductive organ.

Statement II : Gynoecium represents the female reproductive organ.

- 1) Both statements I and II are correct
- 2) Both statements I and II are wrong
- 3) Statement I is correct but II is wrong
- 4) Statement II is correct but I is wrong

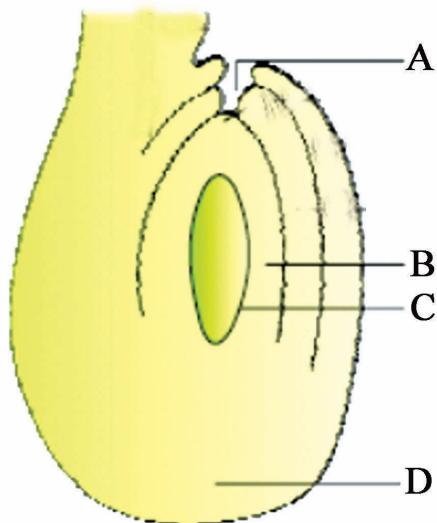
- 2.** Refer the given figure and identify the labelled parts and select the correct option :



- 1) 'P' - Pollen sacs which are developed from microsporangia.
- 2) 'R' - Filament, which is attached proximally to thalamus or petal of the flower.
- 3) 'Q' - Pollen grains which are the male gametophytes in Angiosperms.
- 4) All the above are correct.

- 3.** Which of the following matches are false :
- a) Exine - Made up of sporopollenin
 - b) Intine - Made up of cellulose and pectin
 - c) Germ pores - Through which pollen tube emerges
 - d) Vegetative cell - Give rise to 2 male gametes
 - e) Generative cell - Give rise to pollen tube
- 1) a, b, c and d
 - 2) d and e only
 - 3) b, c and d only
 - 4) a and b only
- 4.** Read the following statements and select the correct option :
- a) The ability of the pollen grains to germinate on stigmatic surface and bring about fertilization is called pollen viability.
 - b) The period for which pollen grains remain viable is highly variable and to some extent depends on the prevailing temperature and humidity.
 - c) In some cereals such as Rice and Wheat pollen grain lose viability within 30 minutes of their release.
 - d) In some members of Rosaceae, Leguminosae and Solanaceae, they maintain viability for months.
 - e) Pollen grains can be stored for years in liquid nitrogen at -196°C (Cryopreservation)
- 1) a and b only
 - 2) b and c only
 - 3) c and d only
 - 4) a, b, c, d and e

5. Identify the parts labelled as A, B, C and D in the given figure and select the incorrect option about it :

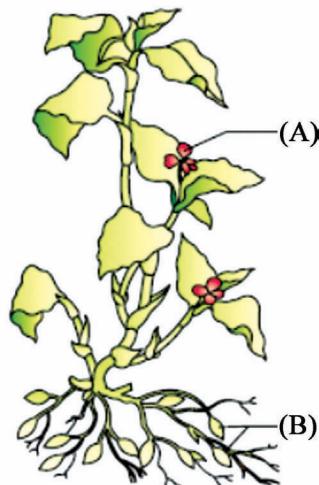


- 1) A - Micropyle, through which pollen tube enters into the ovule.
- 2) B - Nucellus, in which the archesporium differentiates.
- 3) C - Embryo sac, which is the female gametophyte in Angiosperms
- 4) D - Chalaza, where body of the ovule fuses with funicle.

6. Find out the mis-matched one :

- 1) Nucellus - Diploid
- 2) Megasporangium - Diploid
- 3) Functional megasporangium - Haploid
- 4) Female gametophyte - Triploid

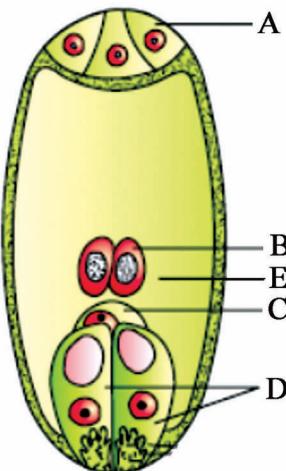
7. Diagram of a plant is given with two types of flowers A and B. Select the correct option from the following :



- 1) (A) is chasmogamous flower and it is invariably autogamous.
- 2) (A) is cleistogamous flower and it promotes allogamy.
- 3) (B) is chasmogamous flower and it promotes allogamy
- 4) (B) is cleistogamous flower and it is invariably autogamous.

8. Read the following statements and select the false one :

- 1) Bees are the dominant biotic pollinating agents among insects.
- 2) Both wind and water pollinated flowers are not very colourful and do not produce nectar.
- 3) Vallisneria, Hydrilla and Zostera are examples of water pollinated plants.
- 4) All aquatic plants use water as pollinating agent.

- 9.** Which of the following is not an outbreeding device?
- Self incompatibility
 - Synchronised pollen release and stigma receptivity
 - Dioecy
 - Different positions of anthers and stigma
- 10.** While planning for an artificial hybridisation programme involving dioecious plants, which of the following step would not be relevant?
- Bagging of female flower
 - Dusting of pollen on stigma
 - Emasculation
 - Collection of pollen
- 11.** Which of the cells in embryosac, labelled in the given figure is involved in double fertilization?
- 
- The diagram shows a longitudinal section of an embryo sac. At the top, there are two polar nuclei labeled 'B'. Below them is an egg cell labeled 'C'. At the bottom, there are two synergids labeled 'D' and a central cell labeled 'E'. Labels 'A' and 'D' point to the outer layers of the embryo sac.
- A - Antipodals and E - Central cell
 - B - Polar nuclei and D - Synergids
 - C - Egg cell and E - Central cell
 - D - Synergids and A - Antipodals
- 12.** Find out the matched pair/s from the following:
- | | | |
|----|---------------------------------|----------------------|
| a. | Pea, Bean and Groundnut | Non-albuminous seeds |
| b. | Wheat, Rice and Maize | Albuminous seeds |
| c. | Black pepper and Beet | Perispermic seeds |
| d. | Citrus and Mango | Polyembryonic seeds |
| e. | Guava, Orange, Mango | Fleshy fruits |
| f. | Apple, Strawberry, Cashew apple | False fruits |
| g. | Banana | Parthenocarpic fruit |
| h. | Groundnut and Mustard | Dry fruits |
- a, b and d only
 - c, d and f only
 - a, d, e, f and h only
 - All matches are correct
- 13.** **Assertion (A)** : In 40% Angiosperms, the pollen tube carry the two male gametes from the beginning.
- Reason (R)** : In these plants the pollen grains are shed at the 3-celled stage
- Both (A) and (R) are true, and (R) is the correct explanation of (A)
 - Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - (A) is true but the (R) is false
 - Both (A) and (R) are false

14. Which of the following statements are correct?

- A few flowering plants such as some species of Asteraceae and Grasses, have evolved a special mechanism, to produce seeds without fertilization, called apomixis.
 - Apomixis is a form of asexual reproduction that mimics sexual reproduction.
 - If hybrids are made into apomicts, there is no segregation of characters in the hybrid progeny.
 - The genetic nature of apomictic embryos are similar to their parent.
- a and b only
 - c and d only
 - b and c only
 - a, b, c and d

15. Assertion (A) : There is a relationship between number of ovules in an ovary and the number of seeds present in a fruit.

Reason (R) : After fertilization ovules develop into fruit and ovary develops into seed.

- Both (A) and (R) are true, and (R) is the correct explanation of (A)
- Both (A) and (R) are true but (R) is not the correct explanation of (A)
- (A) is true but the (R) is false
- Both (A) and (R) are false

QUESTIONS LEVEL - III

1. Which of the following is true regarding anther wall?

- Tapetum become binucleated or multinucleated due to free nuclear division and tapetum involved in the formation of sporopollenin and provide sticky nature of pollengrain.
 - Epidermis is originated from archesporial cell.
 - Endothelial cells show the characteristic fibrous bands of thickening and involved in anther dehiscence.
 - The cells of endothecium along the line of dehiscence of the anther are devoid of the fibrous bands of thickening.
 - Middle layer contains only a single layer of thin walled cells in all angiosperms and get crushed at the time of meiosis in the pollen mother cells
- All except B and E
 - A, B, D and E
 - All except A and B
 - A, B, C, D and E

2. Consider the following statements and select the correct option :

Statement I : The outer surface of the exine exhibit a fascinating array of patterns and designs (sculptures) due to the presence of sporopollenin in the region of germpore.

Statement II: Asymmetric spindle is formed during mitosis in pollen grain to form a larger vegetative cell and a smaller generative cell.

- 1) Both statement I and II are true
 - 2) Both statement I and II are false
 - 3) Statement I is false
 - 4) Statement II is false
3. During megasporogenesis, archesporium developed :
- 1) Subepidermal cells from nucellus
 - 2) Hypodermal cells from nucellus
 - 3) Deep seated from nucellus
 - 4) Both 1 and 2

4. How many of the following statements are false :

A) In all angiosperms, megagametogenesis and microgametogenesis are initiated as well as completed in megasporangium and microsporangium respectively

B) The microsporangium and megasporangium in an angiosperm is functionally equivalent to anther and embryosac.

C) In all angiosperms, sporogenesis involve meiosis and gametes are formed due to mitosis

D) In angiosperms male and female gametophytes are dissimilar in structure and function.

- 1) One
- 2) Two
- 3) Three
- 4) Four

5. Consider the following statements :

i) Castor is a dicot plant, produce seeds having caruncle, perisperm and endosperm

ii) In all submerged hydrophytes, pollination occur below the surface of water.

iii) Perisperm provide nutrients for the development of pericarp

iv) Parthenocarpy occur in plants due to lack of pollination, lack of fertilization and lack of embryo development; parthenocarpic fruits are true fruits.

v) Those plants exhibit apomixis strictly produce polyembryonic seeds.

Of the above statements ;

- 1) i, ii and iii are false
- 2) iv and v are false
- 3) ii, iii and v are false
- 4) i, ii, iii, iv and v are false

SYNOPSIS

I. Biotechnology definition**II. Core techniques**

1. Genetic Engineering
2. Bioprocess Engineering / Biochemical Engineering

Genetic Engineering

- ◆ Cohen and Boyer's experiment

III. Process involved in Recombinant DNA technology

- A. Identification of Desired DNA
- B. Isolation of Desired DNA
- C. Introduction of DNA into the host
- D. Obtaining Foreign Gene Product

A. Identification of Desirable gene

- ◆ Bioinformatics
- ◆ Gene library

B. Isolation of DNA**1. Cutting of DNA for getting Desirable gene**

- ◆ Nucleases
 - 1. Exonucleases
 - 2. Endonucleases

Restriction Endonucleases

1. Discovery of Restriction Endonucleases
2. Naming of Restriction Endonucleases
3. Cutting pattern

2. Separation of Digested DNA fragments

1. Electrophoresis
2. Blotting
3. Hybridisation with probes
4. Elution

3. Amplification of gene

1. *“in vivo”*
 - * Cloning
2. *“in vitro”*
 - PCR
 - * Requirements of PCR
 - * Steps in PCR

C. Introduction of Recombinant DNA into the host

I. Direct gene transfer

1. Heat shock treatment
2. Chemically mediated uptake - (Just mention)
3. Microinjection
4. Biolistics / gene gun

II. Indirect gene transfer

1. Vectors

A. Features of vectors

B. Types of Vectors

1. pBR322

2. pUC⁸

3. Plant vectors

4. Animal vectors

D. Obtaining Foreign gene product**1. Maintenance of introduced DNA and culture of recombinant cells****Bioreactors**

a) Stirred tank bioreactor

b) Sparged tank bioreactor

2. Downstream processing (Isolation and Purification)

QUESTIONS

LEVEL - I

- 1.** The source of antibiotic resistance gene used by Herbert Boyer and Stanley Cohen for creating the first genetically modified organism was :
 - 1) *E. coli*
 - 2) *Salmonella*
 - 3) *Selaginella*
 - 4) From an artificial gene

- 2.** Restriction endonucleases hydrolyzes polynucleotide from :
 - 1) Only the 5' end
 - 2) Either terminal
 - 3) At an internal phosphodiester bond
 - 4) A phosphodiester bond with a specific sequence

- 3.** Bacteria protect themselves from viruses by fragmenting viral DNA upon entry with :
 - 1) Methylase
 - 2) Endonucleases
 - 3) Ligase
 - 4) Exonuclease

- 4.** DNA ligase is used to connect :
 - 1) 5' phosphate end to the 3' hydroxyl end of DNA molecule
 - 2) 3' phosphate end to the 5' hydroxyl end of DNA molecule
 - 3) 5' hydroxyl end to the 3' phosphate end of DNA molecule
 - 4) 5' hydroxyl end to the 3' hydroxyl end of DNA molecule

- 5.** The mismatched pair from the following is :
 - 1) Transformation of plant cell - Gene gun
 - 2) Lysis of bacterial cell wall - Cellulase
 - 3) Lysis of fungal cell wall - Chitinase
 - 4) Transformation of animal cell - Micro injection

- 6.** Read the following statements and choose the appropriate option.

Statement I : Gel electrophoresis is used to separate DNA fragments based on size.

Statement II : DNA moves towards the anode because it is positively charged.

 - 1) Both the statements are true
 - 2) Statement I is true but statement II is false
 - 3) Both statements are false
 - 4) Statement I is false but statement II is true

- 7.** Match the following :

Column I	Column II
A) Exonuclease	I. Produce phosphodiester bonds
B) Endonuclease	II. Break bacterial cell wall
C) Ligase	III. Break phosphodiester bonds any specific location
D) Lysozyme	IV. Break phosphodiester bonds from the terminal position

 - 1) A - II, B - IV, C - III, D - I
 - 2) A - IV, B - III, C - II, D - I
 - 3) A - IV, B - III, C - I, D - II
 - 4) A - II, B - III, C - IV, D - I

- 8.** To be a cloning vector, a plasmid does not require :
- An origin of replication
 - A selectable marker
 - A restriction site
 - A large size
- 9.** pBR322 which is frequently used as a vector for cloning gene in *E. coli* is :
- An original bacterial plasmid
 - A modified bacterial plasmid
 - A viral genome
 - A transposon
- 10.** Eukaryotic genes may not function properly when cloned into bacteria because of :
- inability to excise introns
 - Destruction by native endonuclease
 - Failure of promoter to be recognized by bacterial RNA polymerase
 - All of the above
- 11.** The T-DNA of Ti-plasmid of *Agrobacterium tumefaciens* replicate within host plant cell :
- Replicate independently of host - DNA
 - Replicate dependent of host-DNA
 - Replicate along with plasmid
 - All of these
- 12.** What is the sequence of steps for introducing foreign gene into a host.
- Transform bacteria with recombinant DNA molecule
 - Cut the plasmid DNA using restriction enzymes
 - Extract plasmid DNA from bacterial cells
 - Hydrogen bond the plasmid DNA to desirable foreign DNA fragments
 - Use ligase to seal plasmid DNA to foreign gene.
- P, Q, S, R, T
 - Q, R, T, S, P
 - R, Q, S, T, P
 - R, S, T, P, Q
- 13.** What outcome is expected if pBR322 vector is cut with *Pvu* II?
- Affect plasmid replication
 - Loss of ampicillin resistance
 - Loss of tetracycline resistance
 - Retain tetracycline resistance

14. Blue-white screening selection is used :

- 1) to test for the presence of a plasmid in bacteria
- 2) to reveal the identity of a cloned DNA fragment
- 3) to express the product of a cloned gene
- 4) to test for the presence of a cloned insert in a plasmid

15. Consider the following Assertion and Reason and choose the appropriate option.

Assertion : Some bioreactors have a sparger to provide oxygen in the form of fine bubbles.

Reason : Fine bubbles decrease the surface area for oxygen transfer into the medium.

- 1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
- 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
- 3) Assertion is true but the Reason is false
- 4) Both Assertion and Reason are false

QUESTIONS LEVEL - II

1. Consider the following Assertion and Reason and choose the appropriate option.

Assertion : Stanley Cohen and Herbert Boyer were the first to successfully clone recombinant DNA molecules.

Reason : They isolated Antibiotic resistance gene of *Salmonella* and then introduced into the native plasmid of *E.coli*.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.

3) Assertion is true but the Reason is false

4) Both Assertion and Reason are false

2. A certain purified DNA sample was cut with two restriction endonucleases E_1 and E_2 . The following results were obtained from agarose gel electrophoresis :

Sample cut with E_1 alone \rightarrow Two bands of size 35kb and 15kb

Sample cut with E_2 alone \rightarrow Two bands of size 40kb and 10kb

Sample cut simultaneously with E_1 and E_2 \rightarrow Three bands of size 35kb, 10kb and 5 kb

From these data, it can be inferred that the DNA has :

- 1) Two sites for E_1 and one site for E_2
- 2) One site for E_1 and two site for E_2
- 3) One site each for E_1 and E_2
- 4) Three sites for E_1 and one site for E_2

- 3.** What is the role of the *rop* gene in pBR322?
- It controls the copy number of the plasmid
 - It provides resistance to a third antibiotic
 - It promotes plasmid replication
 - Both 1 and 3
- 4.** After treatment with lysozyme, what is the next common step in a bacterial DNA isolation protocol?
- Centrifugation to remove cell debris
 - Addition of RNase and protease to degrade RNA and proteins respectively.
 - Ethanol precipitation of DNA
 - Heating to denature proteins
- 5.** Why does thermostable DNA polymerase is essential in PCR?
- To withstand the high temperature used during denaturation of DNA
 - To withstand the high temperature used during primer annealing
 - To withstand the high temperature used during the extension step
 - DNA amplification reaction occurs at high temperature
- 6.** What is the role of ethanol in the DNA isolation and purification procedure?
- To dissolve DNA
 - To precipitate DNA out of solution
 - To lyse cells
 - To denature proteins
- 7.** In which type of research is microinjection frequently used?
- Bacterial transformation
 - Creation of transgenic animals
 - PCR amplification
 - Gene therapy
- 8.** Which of the following chemicals is frequently used to prepare competent E.coli cells?
- Sodium chloride
 - Calcium chloride
 - Magnesium sulfate
 - Potassium nitrate

9. Read the following statements A, B and C and choose the incorrect one.
- A) To cover many copies of target DNA, it should be cloned in a vector whose marker gene support high copy number.
- B) Bacteriophages and plasmids have the ability to replicate their DNA within bacterial cells each time when the bacterial chromosome replicates.
- C) Origin of replication in a vector does not influence its copy number within the host cell
- 1) C only
2) A and C
3) B and C
4) A, B and C
10. What is the primary purpose of making a host cell competent in genetic engineering?
- 1) To increase the cell size
2) To make the cell membrane more permeable to DNA
3) To enhance the cells metabolic rate
4) To reduce the cells genetic material
11. Insertional inactivation of tet^R gene occurs when :
- 1) pBR322 is cut with $Pvu\ I$ and inserted foreign DNA
2) pBR322 is cut with $Pst\ I$ and inserted foreign DNA
3) pBR322 is cut with $Sal\ I$ and inserted foreign DNA
4) pBR322 is cut with $EcoRI$ and inserted foreign DNA
12. Read the following statements and choose the appropriate option.
- Statement I :** During r-DNA technology, while selecting the transformed host cells using colony hybridisation, the transformed cells are first incubated in a medium without antibiotic for about an hour.
- Statement II :** When the transformed cells are first incubated in a medium with antibiotic, the antibiotic resistant genes will be expressed.
- 1) Both the statements are true
2) Statement I is true but statement II is false
3) Both statements are false
4) Statement I is false but statement II is true

- 13.** All of the following are required for the creation of a recombinant DNA molecule except :

- 1) E.coli
- 2) Restriction endonucleases
- 3) Ligase
- 4) DNA fragments

- 14.** Match the items given in column I with those in column II

Column I	Column II
A) Sticky end pairing	I) Gel matrix
B) Agarose	II) Formation of phosphodiester bonds
C) β -Galactosidase	III) Formation of Hydrogen bonds
D) Taq polymerase	IV) DNA stain
E) Ethidium bromide	V) Chromogenic reaction

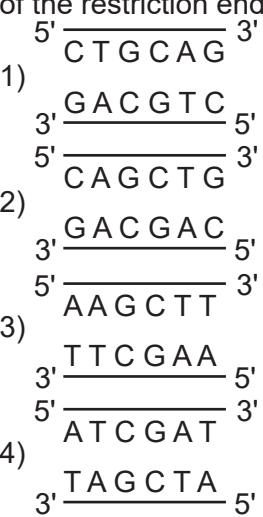
- 1) A-V, B-IV, C-I, D-III, E-II
 - 2) A-III, B-I, C-V, D-II, E-IV
 - 3) A-III, B-I, C-V, D-IV, E-II
 - 4) A-III, B-I, C-IV, D-V, E-II
- 15.** Marketing a recombinant product involves :

- 1) Biosynthesis
- 2) Down stream processing
- 3) Making the product into suitable formulation
- 4) All the above

QUESTIONS

LEVEL - III

- 1.** Identify the specific palindromic sequence of the restriction endonuclease Pst I :



- 2.** Consider the following statements :

- A) 2.70×10^{25} is the molar concentration of human DNA in a diploid cell.
- B) Restriction endonuclease are present in both prokaryotes and eukaryotes
- C) pBR322 is an artificial plasmid similar to the plasmid of Agrobacterium
- D) Cloning vectors are used for the multiplication of desired foreign gene in bacteria

Of the following statements ;

- 1) A, B and C are false
- 2) B, C and D are true
- 3) A, B and D are false
- 4) B and D are true

3. Consider the following statements and select the correct option :
- Statement I :** Only antibiotic resistance genes are used as selectable marker.
- Statement II :** Chromogenic substrate is a colourless chemical and changes to blue colour only in the presence of β -galactosidase enzyme.
- 1) Statement I is true
2) Statement II is false
3) Statement I is incorrect and statement II is correct
4) Statement I and statement II are false
4. Which of the following statement is correct regarding gene gun method?
- 1) Chances of transformation of host cell is negligible
 - 2) Applicable in plants and animals
 - 3) Vector is needed
 - 4) Both 2 and 3
5. Which of the following is true regarding the insertion of foreign gene into dicot plants using Ti plasmid of *Agrobacterium tumefaciens* :
- 1) Foreign gene replicate independently from host DNA
 - 2) Foreign gene replicate dependent on host DNA
 - 3) Foreign gene do not integrate with host DNA
 - 4) Both 1 and 3

BIOTECHNOLOGY AND ITS APPLICATIONS

SYNOPSIS

Application of Biotechnology

1. Therapeutics
2. Diagnostics
3. Genetically modified crops for agriculture
4. Processed food
5. Bioremediation
6. Waste treatment
7. Energy production

* **Critical research areas of Biotechnology**

* **Biotechnological application in Agriculture**

1) Green Revolution

2) Tissue culture and procedure

3) GM crops for

- A) Stress resistance
- B) Pest resistance
- C) Reduction in post harvest loss
- D) Increased efficiency of mineral usage
- E) Enhanced nutritional value of food

4) Bt Cotton

5) RNA interference (RNAi)

- Nematode Resistant Tobacco

*** Biotechnological applications in Medicine**

1) Genetically engineered Insulin

2) Gene therapy

3) Molecular Diagnosis

* PCR

* Autoradiography

* ELISA

TRANSGENIC ANIMALS

1) To study the normal physiology and development

2) To study disease

3) To obtain biological products

4) To test the safety of vaccine

5) To ensure the chemical safety

VACCINE PRODUCTION AND TYPES

ETHICAL ISSUES

* GEAC

* Biopatent

* Biopiracy

QUESTIONS**LEVEL - I**

- 1.** The applications of biotechnology includes:
 - 1) Production of biopharmaceuticals, therapeutics and processed food
 - 2) Diagnostics, bioremediation and waste treatment
 - 3) Production of genetically modified crops for agriculture and energy
 - 4) All of the above

- 2.** Read the statements and find the correct option.

Statement I : Growth of tissue or cell separated from parent organ in an artificial medium is called Tissue Culture.

Statement II : The method of producing thousands of genetically similar plants through tissue culture is called micropropagation.

 - 1) Both the statements I and II are true
 - 2) Statement I is true but statement II is false
 - 3) Both statements I and II are false
 - 4) Statement I is false but statement II is true

- 3.** Food production can be increased through :
 - 1) Agrochemical based agriculture
 - 2) Organic agriculture
 - 3) Genetically engineered crop based agriculture
 - 4) All the above

- 4.** Organisms, whose genes have been altered through manipulation is called :
 - 1) Genetically modified organism
 - 2) Genetic engineering
 - 3) Bioprocessing
 - 4) Both 2 and 3

- 5.** Tailor made plants are designed to supply :
 - 1) Natural resource for agriculture
 - 2) Alternative resource to industries
 - 3) Alternative resource for pesticide only
 - 4) Pest resistant plant

- 6.** Match the following and choose the correct option :

Column I	Column II
1) Lepidopterans	A) Beetles
2) Coleopterans	B) Cryl Ab
3) Dipterans	C) Cryl Ac
4) Corn borer	D) Mosquitoes
5) Cotton boll worms	E) Army worms

 - 1) 1 - D, 2 - E, 3 - A, 4 - C, 5 - B
 - 2) 1 - E, 2 - A, 3 - D, 4 - B, 5 - C
 - 3) 1 - A, 2 - D, 3 - E, 4 - C, 5 - B
 - 4) 1 - A, 2 - D, 3 - E, 4 - B, 5 - C

- 7.** Among the following which are Bt plants :
 - 1) Cotton and Corn
 - 2) Rice and Tomato
 - 3) Potato and Soybean
 - 4) All of the above

- 8.** Within the gut of insects, protoxin produced by *Bacillus* bacteria is activated by :
- 1) Alkaline pH of gut
 - 2) Low H⁺ concentration in gut
 - 3) Binding of toxin into epithelial surface
 - 4) Both 1 and 2 are correct
- 9.** RNA interference (RNAi) is a :
- 1) post transcriptional process
 - 2) prevent translation
 - 3) Both 1 and 2
 - 4) Transcriptional process
- 10.** The vector that is used for introducing Nematode specific gene in host plant for RNAi is :
- 1) Agrobacterium
 - 2) *Bacillus*
 - 3) Transposons
 - 4) Both 1 and 3
- 11.** The main challenge in the production of human insulin is through rDNA technology is :
- 1) Removal of 'C' peptide
 - 2) Maturation of pro-hormone
 - 3) Getting insulin assembled into a mature forms
 - 4) Production of A and B chains separately
- 12.** In gene therapy, removal of faulty genes with functional genes is done with a vector :
- 1) Reovirus
 - 2) Retrovirus
 - 3) Adenovirus
 - 4) Bacteriophage

- 13.** Match column I with column II

Column I	Column II
1) Adenosine deaminase	A) Introduced into lymphocytes
2) ADA cDNA	B) Immune system
3) Autoradiography	C) HIV and Cancer
4) PCR	D) Prob and mutated gene

1) 1 - A, 2 - B, 3 - C, 4 - D

2) 1 - A, 2 - D, 3 - C, 4 - B

3) 1 - B, 2 - A, 3 - D, 4 - C

4) 1 - C, 2 - A, 3 - B, 4 - D

- 14.** Find the correct statement ?

- 1) Transgenic disease models are exist for cystic fibrosis, cancer, Alzheimer's and rheumatoid arthritis
- 2) Biological product for emphysema is Alpha - 1 - antitrypsin
- 3) PCR can detect HIV in suspected AIDS patient and mutated gene in cancer patient
- 4) All of the above are correct

- 15.** How many documented varieties of Basmati rice and varieties of rice are present in India respectively :

- 1) 2,00,000 and 27
- 2) 27 and 200,000
- 3) 20000 and 72
- 4) 27 and 20000

QUESTIONS**LEVEL - II**

- 1.** The critical research areas of biotechnology are :
 - 1) Provide catalyst as microbe or pure enzyme
 - 2) Create optimal conditions for catalytic action through Engineering
 - 3) Identify downstream technology for purify the product
 - 4) All of the above

- 2.** Read the statements and find the correct option.
 - 1) Capacity to generate a whole plant from explant is totipotency.
 - 2) Tissue culture medium contains sucrose, inorganic salts, vitamin, aminoacids and growth regulators like Auxin and Cytokinin
 - 3) Through meristem culture virus free plant can be developed even from virus infected plants
 - 4) All the statements are correct

- 3.** Which one of the following is not related to genetically modified organism :
 - 1) More tolerant to abiotic stresses
 - 2) Pest-resistance of crop and reduce dependency to chemical pesticides
 - 3) Early exhaustion of soil fertility due to increased efficiency of mineral usage
 - 4) Reduced post harvest losses and high nutrition value of food

- 4.** Read the statements and find the correct option.

Statement I : Bt toxin gene has been cloned and expressed in bacteria to provide resistance to insects.

Statement II : Bt in Bt cotton code for *Bacillus thuringiensis*.

 - 1) Statement I only correct
 - 2) Statement II only correct
 - 3) Both the statements are true
 - 4) Both the statements are false

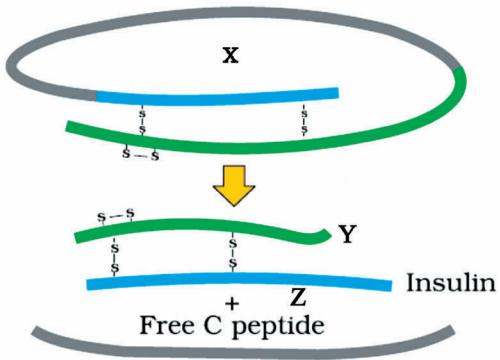
- 5.** Read the statements and find the correct option.

Statement I : Cry protein is an intracellular toxic insecticidal protein produced at the time of sporulation.

Statement II : Bt toxin protein exists as an inactive protoxin and activate only at alkaline pH.

 - 1) Both the statements are true
 - 2) Statement I is true but statement II is false
 - 3) Both statements are false
 - 4) Statement I is false but statement II is true

- 6.** When insecticidal protoxin becomes active it:
 - 1) Binds the surface of epithelial cells
 - 2) Create pores on epithelial cells
 - 3) Cause cell swelling and lysis
 - 4) All of the above

- 7. Assertion :** The choice of cry genes depends upon the crop and the targeted pest.
- Reason :** Bt toxins are insects - group specific.
- 1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 - 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - 3) Assertion is true but the Reason is false
 - 4) Assertion is false but the Reason is true
- 8.** Which one of the following is incorrect about RNAi :
- 1) This is a cellular defence in all eukaryotic organism
 - 2) It involve the silencing of specific mRNA using complementary double stranded DNA
 - 3) The source of complementary RNA is come from virus with RNA genome or transposons which replicated via, RNA intermediate.
 - 4) The parasite could not survive in a transgenic host expressing specific interfering RNA
- 9.** Recombinant DNA technology have impact in healthcare by :
- 1) Production of effective recombinant therapeutics
 - 2) Gene therapy and production of biological products
 - 3) Molecular diagnosis for early detection of diseases
 - 4) All the above
- 10.** Observe the given diagram and identify X, Y and Z from the diagram.
- 
- 1) X - A peptide, Y - Proinsulin , Z - B peptide
 - 2) X - Proinsulin, Y - A peptide, Z - B peptide
 - 3) X - A peptide, Y - B peptide, Z - Proinsulin
 - 4) X - Proinsulin, Y - B peptide, Z - A peptide

11. Statements related to human insulin are given below. Which statement(s) is/are correct about genetically engineered insulin?

- i) Pro-hormone insulin contain extra stretch of C-peptide.
- ii) A-peptide and B-peptide chains of insulin were produced separately in *E.coli*, extracted and combined by creating disulphide bond between them.
- iii) Insulin used for treating Diabetes was extracted from Cattles and Pigs.
- iv) Pro-hormone insulin needs to be processed for converting into a mature and functional hormone.
- v) Some patients develop allergic reactions to the foreign insulin.

Choose the most appropriate answer from the options given below :

- 1) (ii) only
- 2) (iii) and (iv) only
- 3) (iii), (iv) and (v) only
- 4) (i), (ii) and (iv) only

12. Match the column I with column II and choose the correct option given below.

Column I	Column II
A) Serum and urine analysis	1. Molecular diagnosis
B) Recombinant DNA technology	2) Antigen-antibody interaction
C) Polymerase chain reaction	3) Probe hybridisation
D) ELISA	4) Conventional method
E) Autoradiography	5) HIV and genetic disorders

1) A - 4 ; B - 3 ; C - 2 ; D - 1 ; E - 5

2) A - 5 ; B - 1 ; C - 2 ; D - 3 ; E - 4

3) A - 4 ; B - 1 ; C - 5 ; D - 2 ; E - 3

4) A - 4 ; B - 2 ; C - 3 ; D - 5 ; E - 1

13. Which one of the following statement is correct about transgenic animals :

- 1) By inserting gene from other species, formation of protein is altered, this help to study normal physiological development
- 2) In many transgenic animals genes contribute to develop disease, that are considered as disease models
- 3) In 1997 the first transgenic cow Rosie, produced milk which contain human protein alpha-lactalbumin
- 4) All statements are correct

14. Read the following and find the correct statement.

- 1) Hepatitis B vaccine is the first recombinant vaccine.
- 2) Edible vaccines are subunit vaccines where selected genes are introduced in plants.
- 3) In DNA vaccine immune response of the body is stimulated by a DNA molecule.
- 4) All the above statements are correct

15. Which of the following statements is correct?

- 1) GEAC makes decision regarding the validity of GM research.
- 2) GEAC ensures the safety of introducing GM-organisms for public services.
- 3) Genetic modification of organisms can have unpredictable results when such organisms are introduced into the ecosystem. Therefore, the Indian government has set up organisation such as GEAC
- 4) All of these

QUESTIONS

LEVEL - III

1. Which of the following statements are true regarding tailor made plants :
 - A) Helps in improving the yield of crops
 - B) Improving the nutrient content of the crops
 - C) Growing plants for high yield and disease resistance
 - D) Growing plants for to supply alternative resources to industries in the form of fuel, starch and pharmaceuticals.
 - 1) D only
 - 2) C & D only
 - 3) A, C and D only
 - 4) A, B, C, & D
2. Consider the following statements regarding RNA interference :
 - A) Natural defence against dsRNA virus.
 - B) Natural defence against nematode
 - C) Induced defence against nematode
 - D) Induced defence against ssRNA virus
 - E) Occurs at transcriptional level
 - F) Occurs at post-transcriptional level
 - G) Occurs at translational level
 - 1) B & E
 - 2) A, B & E
 - 3) A, C, F & G
 - 4) B, E & F

3. Which of the following is true regarding

Transposons :

A) Mobile genetic elements present in eukaryotes.

B) Mobile genetic elements present in prokaryotes

C) Jumping genes present in virus / mobile genetic elements in virus.

D) dsRNA may be formed due to transposons

1) A & B

2) B & D

3) C & D

4) A & D

4. ADA deficiency occurs due to :

1) Point mutation

2) Frame shift mutation

3) Deletion

4) Both 2 and 3

5. Autoradiography is :

A) a technique by which radioactive isotopes are detected using an x-ray film.

B) used to detect the location of desirable foreign gene in the nitrocellulose filter paper during the isolation of gene of interest

C) used in serum and urine analysis

1) A only

2) B only

3) A & B

4) A, B & C

SYNOPSIS

❖ **Ecological levels of organisation**

❖ **Organism and its Environment**

❖ **Major Biomes**

- a) Desert
- b) Grassland
- c) Tropical forest
- d) Temperate forest
- e) Coniferous forest
- f) Arctic and alpine tundra

❖ **Biomes of India**

- a) Tropical rain forest
- b) Deciduous forest
- c) Desert
- d) Sea coast

❖ **Habitat and Ecological Niche**

❖ **Environmental factors**

❖ **Major Abiotic factors**

- ❖ Temperature
- ❖ Water
- ❖ Light
- ❖ Soil

❖ **Response to abiotic factors**

- ❖ Regulate
- ❖ Conform
- ❖ Migrate
- ❖ Suspend

❖ **Populations:**

❖ **Population Attributes**

- ❖ Birth rate and death rate
- ❖ Sex ratio
- ❖ Population age group and age pyramid
- ❖ Population density

❖ **Population growth**

- ❖ Natality
- ❖ Mortality
- ❖ Immigration
- ❖ Emigration

❖ **Population Growth Models:-**

- ❖ Exponential growth - J shaped curve
- ❖ Logistic growth - S shaped curve

❖ **Life History variations**

❖ **Population Interactions:-**

❖ **Negative interactions:**

- ❖ Predation
- ❖ Competition :
- ❖ Parasitism
- ❖ Amensalism

❖ **Positive interactions:**

- ❖ Commensalism
- ❖ Mutualism

QUESTIONS

LEVEL - I

1. Identify the correct sequence of ecological levels of organisation.
 - 1) Cell - Tissue - Organ - Organism
 - 2) Organism - Population - Community - Ecosystem - Biome
 - 3) Species - Genus - Family - Order - Class
 - 4) Biomolecules - Cell - Tissues - Species - Kingdom
2. Read the following statements and choose the correct options.

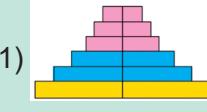
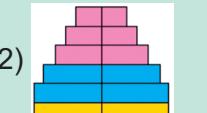
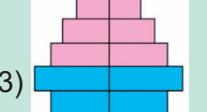
Statement I : Ecology is the study of interaction between organisms and between organisms and their environment.

Statement II : Ecology at organismic level includes physiological mechanisms of organism to adapt to environment for their survival and reproduction.

 - 1) Statement I is true but statement II is false
 - 2) Statement I is false but statement II is true
 - 3) Both the statements are true
 - 4) Both statements are false

3. Which one of the following statement is wrong?
 - 1) Temperature is the most important abiotic factor that control life of an organism.
 - 2) Most important source of energy to organisms on earth is solar radiation.
 - 3) Many fresh water animals cannot live for long in sea water and vice versa because of the osmotic problems.
 - 4) Change in body conditions with change in environmental conditions are called homeostasis.
4. Which of the following acts as a mechanism of organisms to respond to varying environment or manage with various stressfull conditions like salinity differences, temperature variations etc.?
 - 1) Regulate
 - 2) Conform
 - 3) Suspend
 - 4) All the above
5. Find the mis-matched pair from the following?
 - 1) Regulate - Birds and mammals
 - 2) Conform - All vertebrates and plants
 - 3) Migrate - Siberian crane
 - 4) Suspend - Bacteria, fungi, dormant seed etc.
6. Find the odd one related to population in an area?
 - 1) Deers in a grassland
 - 2) Teak wood trees in a forest
 - 3) Fishes in a pond
 - 4) Rhizopus in a piece of bread

7. Match the following correctly :

Column I	Column II
A) Expanding age pyramid	1) 
B) Stable age pyramid	2) 
C) Declining age pyramid	3) 

1) $\frac{ABC}{123}$

2) $\frac{ABC}{321}$

3) $\frac{ABC}{213}$

4) $\frac{ABC}{231}$

8. A population has certain attributes than an individual organism does not, select an attribute which is not applicable to population?

1) Birth rate

2) Mortality

3) Sex

4) Age distribution

9. Match the following correctly.

Column I	Column II
A) $B + I > D + E$	1) 'N' stable
B) $B + I < D + E$	2) 'N' increases
C) $B + I = D + E$	3) 'N' decrease

1) $\frac{ABC}{123}$

2) $\frac{ABC}{231}$

3) $\frac{ABC}{321}$

4) $\frac{ABC}{132}$

10. Select the mis-matched option related with exponential and logistic model growth forms.

Exponential growth	Logistic growth
1) Growth curve 'J' shaped	'S' shaped growth model
2) Growth in limited resources	Resources unlimited
3) Growth of insect population	Growth of most animals
4) $\frac{dN}{dt} = rN$	$\frac{dN}{dt} = rN \left[\frac{K - N}{k} \right]$

11. Which of the following is a mis-matched pair?

1) Mutualism - Beneficial to both A and B

2) Competition - Harmful to both A and B

3) Commensalism - A is benefited and B is neutrally affected

4) Predation - A is harmed and B is neutrally affected

12. What is the significance of predation in the environment ?

1) It acts as a method of energy transfer across trophic level

2) It keep the prey populations under control

3) It helps in maintaining species diversity in a community

4) All the above

- 13.** Which of the following is an adaptation of an ideal parasite?
- 1) Presence of adhesive organs
 - 2) Lack of suckers
 - 3) Well developed digestive system
 - 4) Slow rate of reproduction
- 14.** An association of two organisms, where one is negatively affected and the other remains unaffected is :
- 1) Commensalism
 - 2) Amensalism
 - 3) Competition
 - 4) Parasitism
- 15.** Match the following correctly :

Column I	Column II
A) Mycorrhiza	1) Competition
B) Cattle and egret	2) Parasitism
C) Plasmodium	3) Mutualism
D) Flamingoe and Fishes	4) Commensalism

1) $\frac{ABCD}{3421}$

2) $\frac{ABCD}{1234}$

3) $\frac{ABCD}{4321}$

4) $\frac{ABCD}{2341}$

QUESTIONS

LEVEL - II

- 1.** Consider the following Assertion and Reason and choose the appropriate option.

Assertion : Habitat is the place where an organism lives and adapt there through natural selection.

Reason : Habitat provide most favorable condition to an organism with maximum shelter, support and environmental stress conditions.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.

3) Assertion is true but the Reason is false

4) Both Assertion and Reason are false

- 2.** Find the correctly matched pair?

1) Tropical rain forest - heavy rain fall

2) Desert - high temperature with low moisture

3) Arctic regions - very low temperature

4) All are correct

3. **Statement I** : Environment is the sum total of all biotic and abiotic factors that surrounds and potentially influence organisms.

Statement II : Temperature, water, light and soil are major abiotic factors that control life of an organism.

- 1) Both Statement I and II are correct
- 2) Both Statement I and II are incorrect
- 3) Statement I is correct but Statement II is incorrect
- 4) Statement I is incorrect but Statement II is correct

4. Find the mis-matched pair.

- 1) Eurythermal - Organisms tolerate wide range of temperature differences
- 2) Stenothermal - Organisms tolerate narrow range of temperature differences
- 3) Euryhaline - Organisms tolerate large scale variation in salinity concentrations
- 4) Stenohaline - Organisms grow well equally in high salinity as well as fresh water

5. Read the following statements and select the correct option.

Statement I : Regulators are evolutionally more successful than conformers.

Statement II : Regulators successfully change their body conditions with change in the environmental conditions.

- 1) Both Statement I and II are correct
- 2) Both Statement I and II are incorrect
- 3) Statement I is correct but Statement II is incorrect
- 4) Statement I is incorrect but Statement II is correct

6. Which of the following parameter/s is used as a method for measuring population density of a particular area?

- 1) Count the total number
- 2) Measuring percent cover / Biomass
- 3) Sample collections and indirect methods
- 4) All the above

7. Population density increased and decreased respectively by :

- 1) Natality, Mortality and Immigration, Emigration
- 2) Birth rate, Immigration and Death rate, Emigration
- 3) Birth rate, death rate and Migration
- 4) Immigration, Emigration and Birth, Death

8. If in a laboratory population of 40 fruitfly 8 died during a week. The death rate of fruitfly individuals per week is :

- 1) 0.2
- 2) 0.4
- 3) 0.5
- 4) 5

9. The size of a population for any species is not a static parameter. It keeps changing in time, depending on various factors including:

- 1) Food availability
- 2) Adverse weather
- 3) Reproductive ability
- 4) All the above

10. A population growing in a habitat with limited resources shows phases of growth in the following sequence:

- 1) Acceleration → deceleration → lag phase
→ asymptote
- 2) Log phase → Acceleration → lag phase
→ deceleration
- 3) Lag phase → Acceleration → deceleration
→ asymptote
- 4) Acceleration → log phase → crash phase

11. Match the following correctly

	Column I		Column II
A.	Breed only once in life time	1)	Birds and Mammals
B.	Breed many times in life	2)	Oysters
C.	Produce large number of small sized offspring	3)	Trees
D.	Produce small number of large sized offspring	4)	Pacific Salmon fish

1) A - 1, B - 2, C - 3, D - 4

2) A - 2, B - 1, C - 4, D - 3

3) A - 2, B - 4, C - 1, D - 3

4) A - 4, B - 3, C - 2, D - 1

12. Which of the following is an adaptation of organisms against predator attack?

- 1) Camouflage - Frog or insects
- 2) Poisonous chemical - Monarch butterfly
- 3) Thorns / spines - Acacia / Cactus
- 4) All the above

13. Which of the following statement is incorrect regarding competition?

- 1) Competition is a process in which fitness of one species is significantly lower in presence of another species.
- 2) Generally competition occurs between totally unrelated species for their unlimited resources
- 3) Competition is a potent force in organic evolution.
- 4) Generally herbivores and plants to be more adversely affected by competition than carnivores.

14. Which of the following is not related with interaction between mediterranean orchid 'Ophrys' and bumble bee?

- 1) Sexual deciet
- 2) Mimicry
- 3) Resource partitioning
- 4) Pseudocopulation

15. Match the following correctly :

Column I	Column II
A) Mycorrhiza	1) – 0
B) Cuscuta on plants	2) + +
C) Penicillium & Staphylococcus	3) + –
D) Epiphytes on tree	4) + 0

1) $\frac{ABCD}{2314}$

2) $\frac{ABCD}{4321}$

3) $\frac{ABCD}{3412}$

4) $\frac{ABCD}{1234}$

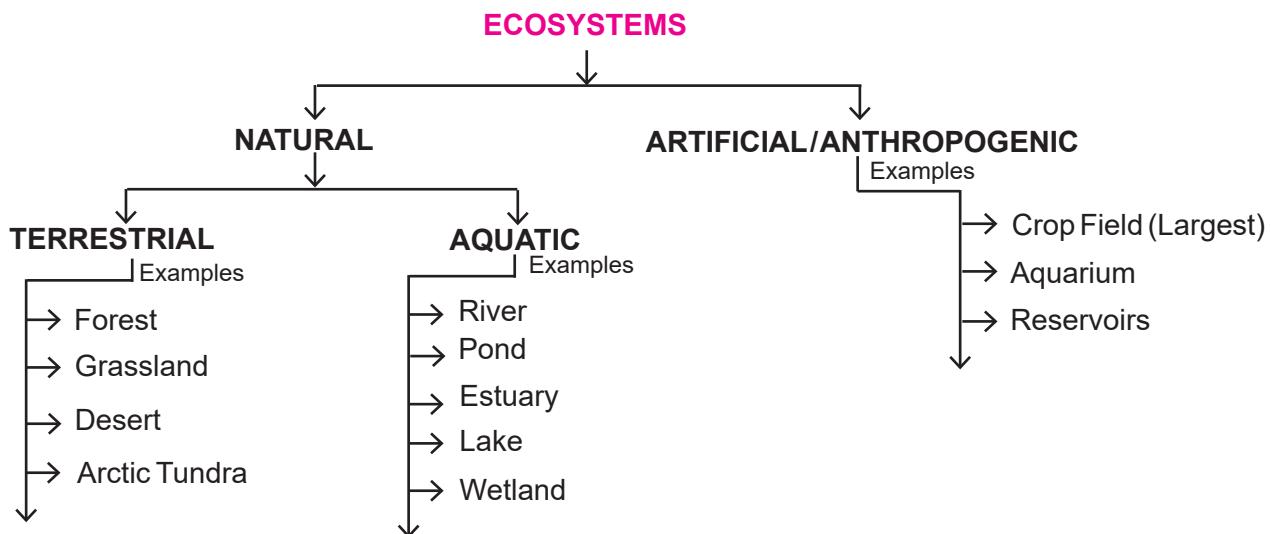
QUESTIONS

LEVEL - III

1. A biome with heavy annual rainfall range between 150 - 400 cm and moderate temperature (20 - 30°C) is characterised by:
 - 1) Diversity rich region
 - 2) Commonly found in tropical region
 - 3) Climate is more or less constant and support more diversity
 - 4) All the above
2. Deer population in a grass land is 2000. In the year 2024, 125 birth and 145 death were reported. 85 deers immigrated into that particular area and 35 deers permanently move onto another area. What was the population density of the respective grass land area at the end of the year 2024.

1) 2030	2) 2150
3) 2210	4) 2120
3. Which of the following statement is false about age pyramid?
 - 1) Age pyramid reflects, growth status of population
 - 2) It represents proportionate number of pre-reproductive, reproductive and post-reproductive individuals.
 - 3) It includes age distribution of male and female individuals of each age group in each bar diagram
 - 4) It graphically represent age groups with pre-reproductive at the top and post - reproductive at the bottom.

4. Identify the incorrect statement from the following :
- 1) In presence of unlimited resources population growth is exponential
 - 2) Limited resources support logistic growth upto carrying capacity
 - 3) Maximum number of individuals of a population that can be sustained indefinitely in a given habitat is carrying capacity.
 - 4) If population density reaches to carrying capacity, the intrinsic rate of natural increase value is increases very rapidly.
5. Consider the following Assertion and Reason and choose the appropriate option.
- Assertion** : Interspecific interactions arise from the interaction of populations of two different species.
- Reason** : They could be beneficial, detrimental or neutral to interacting species.
- 1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 - 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - 3) Assertion is true but the Reason is false
 - 4) Both Assertion and Reason are false

SYNOPSIS◆ **Types /Pattern of an Ecosystem**◆ **Components of ecosystem**❖ **Biotic components**

- ❖ Producers
- ❖ Consumers
- ❖ Decomposers

❖ **Abiotic components**

- ❖ Temperature
- ❖ Water
- ❖ Light
- ❖ Soil

◆ **Structural components of an ecosystem**

- ❖ Species composition
- ❖ Stratification
- ❖ Trophic organization
- ❖ Standing crop
- ❖ Standing state

◆ **Functions of an ecosystem**

A) Productivity

- ❖ Primary productivity
 - ❖ Gross primary productivity
 - ❖ Net primary productivity
- ❖ Secondary productivity

B) Decomposition

* Steps : ❖ Fragmentation

- ❖ Leaching
- ❖ Catabolism
- ❖ Humification
- ❖ Mineralisation

* Factors affecting decomposition

C) Energy flow

- ❖ Definition of food chain and types of food chains
- ❖ Food web

❖ Ecological pyramids

- ❖ Pyramid of number
- ❖ Pyramid of biomass
- ❖ Pyramid of energy
- ❖ Limitations of ecological pyramids

QUESTIONS**LEVEL - I**

- 1.** Many ecologists regard the entire biosphere as a :
 - 1) Terrestrial ecosystem
 - 2) Aquatic ecosystem
 - 3) Local ecosystem
 - 4) Global ecosystem

- 2.** The interaction of biotic and abiotic components result in :
 - 1) Food chain
 - 2) Vertical distribution
 - 3) Physical structure
 - 4) Ecological pyramids

- 3.** Top vertical strata or layers of a forest is occupied by :

1) Herbs	2) Grasses
3) Trees	4) Shrubs

- 4.** Which conditions regulate the rate of function of the pond ecosystem ?
 - 1) Solar input
 - 2) Cycle of temperature
 - 3) Day length
 - 4) All of these

- 5.** Basic requirement of an ecosystem to function and sustain is :
 - 1) Constant input of solar energy
 - 2) Stratification
 - 3) Trophic structure
 - 4) Species composition

- 6.** Net primary productivity is :

1) GPP - R	2) GPP + R
3) NPP - R	4) GPP = R

- 7.** Formation of new organic matter by consumers:
 - 1) Primary productivity
 - 2) Net primary productivity
 - 3) Gross primary productivity
 - 4) Secondary productivity

- 8.** Annual net primary productivity of the whole biosphere is approximately about the organic matter :
 - 1) 115 billion tons dry weight
 - 2) 115 million tons dry weight
 - 3) 170 billion tons dry weight
 - 4) 170 million tons dry weight

- 9.** Raw material for decomposition is :

1) Humus	2) Detritus
3) Minerals	4) Soil

- 10.** By the process of leaching _____ nutrients go down into the soil horizon and get precipitated as unavailable salts
 - 1) Water soluble, inorganic
 - 2) Water insoluble, inorganic
 - 3) Water soluble, organic
 - 4) Water insoluble, organic

- 11.** Decomposition is inhibited by :
 - 1) Warm and moist environment
 - 2) Presence of water soluble substances
 - 3) Low temperature and anaerobiosis
 - 4) Both 1 and 2

- 12.** PAR denotes :
- 1) Primary active radiation
 - 2) Photosynthetically active reaction
 - 3) Photosynthetically active radiation
 - 4) Photosynthetically absorbed radiation
- 13.** Based on the source of nutrition or food, organisms occupy a specific place in the food chain is known as :
- | | |
|------------------|------------------|
| 1) Trophic level | 2) Standing crop |
| 3) Strata | 4) Ethos |
- 14.** 10 percent law is applicable in :
- 1) Productivity
 - 2) Humification
 - 3) Energy flow
 - 4) Decomposition
- 15.** The group of organisms which are not given any place in an ecological pyramids even though they play a vital role in the ecosystem :
- 1) Consumers
 - 2) Producers
 - 3) Saprophytes
 - 4) Phytoplanktons
- 2.** Select the incorrect match :
- 1) Estuary - Aquatic ecosystem
 - 2) Forest - Terrestrial ecosystem
 - 3) Crop field - Man made ecosystem
 - 4) Aquarium - Natural ecosystem
- 3.** In the structure of an ecosystem, we can observe :
- 1) Input of energy (productivity)
 - 2) Transfer of energy (food chain and food web)
 - 3) Energy loss and degradation
 - 4) All of the above
- 4.** Select the incorrect statement from the following :
- 1) The interaction of biotic and abiotic components result in physical structure of ecosystem
 - 2) Identification and enumeration of plant and animal species of an ecosystem gives its species composition
 - 3) Vertical distribution of different species occupying different levels is stratification
 - 4) Trees occupy the bottom layer of forest ecosystem

QUESTIONS

LEVEL - II

- 1.** Read the following statements regarding ecosystem and select the correct statement:
- 1) Visualised as a functional unit of nature
 - 2) It shows interaction among living organism
 - 3) Organism interact with surrounding physical environment
 - 4) All of these
- 5.** Which components of the ecosystem are seen to function as a unit ?
- 1) Productivity
 - 2) Decomposition
 - 3) Energy flow and nutrient cycle
 - 4) All of these

- 6.** Find the incorrect statement from the following :
- Pond is fairly a self sustainable unit
 - Pond is a shallow water body
 - Abiotic components of pond is light, soil and water.
 - The secondary consumers of pond is represented by zooplankton.
- 7.** The primary productivity of ecosystem depends on which of the following factors.
- Plant species inhabiting a particular area
 - Variety of environment factors
 - Photosynthetic capacity of plants
 - All of these
- 8.** Match the following :
- | Column I | Column II |
|-------------------|---|
| A) Fragmentation | i) water soluble inorganic nutrients go down into soil horizon and precipitated |
| B) Leaching | ii) Microbial enzymatic degradation |
| C) Catabolism | iii) Lead to the accumulation of humus |
| D) Humification | iv) Detritus into smaller particle |
| E) Mineralisation | v) Microbial degradation of humus |
- A - iv, B - ii, C - i, D - iii, E - v
 - A - iv, B - i, C - ii, D - iii, E - v
 - A - i, B - ii, C - iii, D - iv, E - v
 - A - ii, B - iii, C - iv, D - v, E - i
- 9.** In a particular climatic conditions, decomposition rate is slower if :
- Detritus rich in nitrogen
 - Detritus rich in water soluble substances
 - Detritus rich in sugar
 - Detritus rich in lignin and chitin
- 10.** Select the incorrect statement from the following :
- Energy flow is unidirectional from sun to producer and then consumers
 - Plants capture only 1 - 5 per cent of PAR
 - No energy that is trapped into an organism remains in it for ever
 - Death of an organism is the beginning of the detritus food chain
- 11.** Match the following :
- | Column I | Column II |
|-----------------------|--------------------------|
| A) Producer | i) Herbivore |
| B) Primary consumer | ii) Primary carnivore |
| C) Secondary consumer | iii) Secondary carnivore |
| D) Tertiary consumer | iv) Plant |
- A - iv, B - ii, C - i, D - iii
 - A - i, B - ii, C - iii, D - iv
 - A - iv, B - i, C - ii, D - iii
 - A - iv, B - iii, C - ii, D - i

- 12.** Extinction of a species in a food chain is compensated by :
- 1) Food chain
 - 2) Ecological pyramid
 - 3) Food web
 - 4) Trophic structure
- 13.** Select the correct statement or statements from the following :
- 1) Ecosystems are exempt from the second law of thermodynamics
 - 2) Ecosystem need a constant supply of energy to synthesize the molecule they require
 - 3) Ecosystem counteract the universal tendency towards decreasing disorderliness
 - 4) All of these
- 14.** Select the incorrect statement from the following :
- 1) A given species may occupy more than one trophic level at a time.
 - 2) A sparrow is a primary consumer when it eats seeds, fruits, and peas
 - 3) A sparrow is a secondary consumer when it eats insects and worms
 - 4) Pyramid of biomass in a sea is generally upright
- 15.** Consider the following Assertion and Reason and choose the appropriate option.
- Assertion** : Pyramid of energy is always upright.
- Reason** : When energy flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step.
- 1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.
 - 2) Both Assertion and Reason are true, but Reason is not a correct explanation of Assertion.
 - 3) Assertion is true but the Reason is false
 - 4) Both Assertion and Reason are true

QUESTIONS LEVEL - III

- 1.** Physical structure of ecosystem is due to :
- 1) Identification and enumeration of biotic components
 - 2) Interaction of biotic and abiotic components
 - 3) Vertical distribution of vegetation
 - 4) Interactions and enumeration of plants

- 2.** What are the four basic functional components of ecosystem that are well exhibited in a pond ecosystem :
- Productivity, food chain, trophic structure, standing crop
 - Productivity, decomposition, energy flow, nutrient cycling
 - Productivity, energy loss, food web, food chain
 - Species composition, stratification, energy flow, productivity
- 3.** Which of the following is the unit of productivity of an Ecosystem :
- Kcal m^{-2}
 - Kcal m^{-3}
 - gm^{-2}
 - $(\text{Kcal m}^{-2}) \text{ yr}^{-1}$
- 4.** Select the odd one :
- Herbivore
 - Primary carnivore
 - Secondary carnivore
 - Primary producer
- 5.** Read the following statements regarding ecological pyramid and choose the correct answer.
- It is the graphical representation of various trophic levels.
 - Any calculation of energy content, biomass or number has to include one group of organism at that trophic level
 - In most ecosystem all the pyramid of number, biomass and energy are upright.
 - Pyramid of biomass in sea is generally inverted
 - Pyramid of energy is always inverted and never be upright.
- i, iii and iv are wrong
 - i and iii are wrong
 - ii and v are wrong
 - i and v are wrong

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LIVING WORLD

SYNOPSIS

Characteristics of living organisms

- Growth
- Reproduction
- Metabolism
- Cellular organisation
- Consciousness

Biodiversity

Taxonomy

Binomial Nomenclature

Systematics

Taxonomic Hierarchy

Taxonomic categories

- Species
- Genus
- Family
- Order
- Class
- Phylum / Division
- Kingdom

QUESTIONS

LEVEL - I

1. Which among the following are characteristic features of living organisms?

 - 1) Reproduction
 - 2) Metabolism
 - 3) Cellular organisation
 - 4) All the above
2. Which of the following is wrongly matched pair about organisms and its common reproductive mechanism:

 - A) Bacteria - Binary fission
 - B) Fungi - Asexual spores
 - C) Yeast - Fragmentation
 - D) Hydra - Budding
 - E) Planaria - Regeneration

1) A only	2) B and C only
3) C only	4) D and E only
3. Total number and type of organisms present on earth constitute :

 - 1) Ecosystem
 - 2) Biodiversity
 - 3) Population
 - 4) Taxonomy
4. The biodiversity range is :

 - 1) 17 - 18 million
 - 2) 1.7 - 1.8 million
 - 3) 17 - 18 billion
 - 4) 1.7 - 1.8 trillion
5. Which of the following are the basic steps of taxonomy?

 - A) Characterisation
 - B) Identification
 - C) Classification
 - D) Nomenclature
 - 1) A and B only
 - 2) B and C only
 - 3) A and C only
 - 4) A, B, C and D
6. Scientific names of plants are standardised by rules and regulations of the code :

 - 1) ICNB
 - 2) ICVN
 - 3) ICBN
 - 4) ICZN
7. Which of the following statement is false?

 - 1) Biological names are generally in Latin and printed in italics
 - 2) Both the words in a biological name, when handwritten are jointly underlined
 - 3) The binomial system given by Linnaeus being practiced by biologists all over the world
 - 4) In binomial system, first component is genus name and second word is specific epithet

- 8.** Read the following statements and find out the incorrect one
- Systematics deals with the diversity of different organisms and their interrelationship
 - The word 'systematics' is derived from the Latin word 'systema'
 - Ernst Mayr used 'Sytema Naturae' as the title of his publication
 - Systematics takes into account evolutionary relationship between organisms
 - The scope of systematics include identification, nomenclature and classification
- 1) Both ii and iii
2) i, ii, iv and v
3) i, ii and iii
4) only iii
- 9.** Which is the correct order?
- Kingdom - Division - Class - Order - Family - Genus - Species
 - Kingdom - Class - Division - Order - Family - Genus - Species
 - Kingdom - Order - Class - Division - Family - Genus - Species
 - Species - Genus - Order - Family - Class - Division - Kingdom

- 10.** Match the column-I with column-II

Column I	Column II
1) Genus	a) Solanum
2) Family	b) Mammalia
3) Class	c) Felidae
4) Order	d) Carnivora
	e) Primata

- 1) 1 → a; 2 → e; 3 → b, d; 4 → c
2) 1 → a; 2 → c; 3 → b; 4 → d, e
3) 1 → a; 2 → c; 3 → b, d; 4 → e
4) 1 → a; 2 → d; 3 → b; 4 → c, e

QUESTIONS LEVEL - II

- 1.** Which of the following is not a result of cell division?
- Growth
 - Repair
 - Metabolism
 - Reproduction
- 2.** Choose the correct statement
- Growth is considered as a defining property of living organisms
 - Metabolic reactions can be demonstrated outside the body in cell free systems
 - Reproduction is an inclusive defining feature of all living organisms
 - Metabolism is exhibited by non living objects also

3. Which of the following statements regarding the response of living organisms to external stimuli are correct?
- The external environmental stimuli can be physical, chemical or biological
 - All organisms, from the prokaryotes to the most complex eukaryotes can sense and respond to environmental stimuli
 - Consciousness and response to external stimuli is the defining property of living organisms
 - Photoperiod never affect reproduction in seasonal breeders
 - All organisms handle chemicals entering their bodies
- i, ii and iii are correct
 - i, iii, iv and v are correct
 - i, ii, iii and v are correct
 - All are correct
4. **Assertion** : Linnaeus developed binomial system of nomenclature.
- Reason** : Binomial system ensures that each organism has 2 names, common and scientific.
- Both Assertion and Reason are true and Reason is the correct explanation of Assertion
 - Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
 - Assertion is true but Reason is false
 - Both Assertion and Reason are false
5. Identify the missing categories A, B and C. Select the correct answer from the options
- (A) is the taxonomic category which contains a number of related genera
 - Examples of category (B) in plants are Monocotyledonae and Dicotyledonae
 - (C) represents the basic unit of taxonomic hierarchy
- (A) - Family, (B) - Class, (C) - Species
 - (A) - Order, (B) - Class, (C) - Genus
 - (A) - Family, (B) - Phylum, (C) - Kingdom
 - (A) - Family, (B) - Order, (C) - Species
6. In case of plants, classes with a few similar characters are assigned to a higher category called:
- Order
 - Phylum
 - Family
 - Division
7. Which of the following taxonomic categories are being described by the given statements
- The basic unit of classification
 - Group of related families
 - Highest category in the hierarchy
 - The category which lie between order and division
- i-Species, ii-Class, iii-Phylum, iv-Kingdom
 - i-Species, ii-Order, iii-Kingdom, iv-Phylum
 - i-Species, ii-Order, iii-Phylum, iv-Class
 - i-Species, ii-Order, iii-Kingdom, iv-Class

8. How many of the following statements are not correct:

- a) Lower the taxon, more are the characteristics that the members within the taxon share
- b) Order is the assemblage of genera which exhibit a few similar characters
- c) Cat and dog are included in the same family Felidae
- d) Binomial nomenclature was introduced by Carolus Linnaeus

- 1) 4
- 2) 3
- 3) 2
- 4) 1

9. Which of the following statement is wrong ?

- 1) Tiger, Lion and Leopard are belonging to same genus *Panthera*
- 2) An order includes related classes
- 3) In the taxonomic hierarchy from species to kingdom, number of common characters goes on decreasing.
- 4) Convolvulaceae, Solanaceae like families are belonging to the order polyphiales based on floral characters.

10. Complete the table

Mango	<u>a</u>	Anacardia-ceae	<u>b</u>	Dicotyledonae	Angiospermae
<u>c</u>	<i>Triticum aestivum</i>	<u>d</u>	<u>e</u>	Monocotyledonae	Angiospermae

- 1) a - *Musca domestica*, b - Polyphiales, c - Rice, d - Poaceae, e - Poales
- 2) a - *Mangifera indica*, b - Sapindales, c - Wheat, d - Poaceae, e - Poales
- 3) a - *Musca domestica*, b - Diptera, c - Brinjal, d - Muscidae, e - Poales
- 4) a - *Mangifera indica*, b - Poales, c - Rice, d - Poaceae, e - Sapindales

QUESTIONS LEVEL - III

1. Cellular organization is a

- A) Non-defining property
- B) Defining character
- C) Not present in all organisms
- D) Restricted to few organisms

- 1) A & B
- 2) B only
- 3) A & D
- 4) B & C

2. Consider the following statements and select the correct option:

Statement-I: Determinate growth occur in all living organisms.

Statement-II: All organisms reproduce by both asexual and sexual methods

- 1) Statement-I is true
- 2) Statement-II is true
- 3) Statement-I and II are false
- 4) Statement-I & II are true

3. Consider the following statements and select the correct option:

Statement I: In taxonomy, the determination of species is mainly based on morphological characters.

Statement II: Modern taxonomic studies are based on external and internal structures along with the structure of cell, development process and ecological information

- 1) Statement-I is false
- 2) Statement-II is false
- 3) Both statement-I and II are true
- 4) Both statement-I and II are false

4. Consider the following statements and select the correct option

Statement I: In hierarchical system, families are characterised on the basis of only vegetative characters and not by reproductive characters.

Statement II: Genus comprises a group of related species which has more characters in common in comparison to species of other genera.

- 1) Statement-I is false
 - 2) Statement-II is false
 - 3) Statement-I and II are false
 - 4) Statement-I and II are true
5. Polymoniales is
- | | |
|-------------|-----------------|
| 1) Category | 2) Taxon |
| 3) Order | 4) Both 2 and 3 |

SYNOPSIS

BASIS OF CLASSIFICATION

Different criteria for classification

1) Presence or absence of notochord

2) Levels of organisation with examples

 1) Cellular level

 2) Tissue level

 3) Organ level

 4) Organ system level

3) Symmetry:

Examples i) Radial symmetry : Examples.....

 ii) Bilateral symmetry : Examples.....

 III) Asymmetry : Examples

4) Number of germ layers:

1) Diploblastic animals : Examples.....

2) Triploblastic animals : Examples.....

5) Nature of coelom:

1) Acoelom : Examples.....

2) Pseudocoelom: Examples.....

3) Coelom [Euocoelom / True coelom] : Example.....

6) Segmentation : [Metamerism]

i) No metamerism : Examples.....

ii) Pseudometamerism : Examples.....

iii) True metamersim : Examples.....

7) Type of body plan with examples

1) Cell aggregate body plan

2) Blind sac body plan

3) Tube within a tube body plan

8) Patterns of organ systems

1. Digestive system

A) Incomplete digestive system with example.....

B) Complete digestive system with example.....

2. Circulation

a) Open circulation : Examples.....

b) Closed circulation : Examples.....

3. Reproduction

PHYLUM : PORIFERA

Salient features:

Examples : Sycon (Scypha), Spongilla (fresh water sponge) Euspongia (bath sponge)

PHYLUM : CNIDARIA [Coelenterata]

Salient features:

Examples : Hydra, Adamsia (Sea anemone), Obelia (Sea fur), Pennatula (Sea pen),

Gorgia (Sea fan), Aurelia (Jelly fish), Physalia (Portuguese man-of war)

PHYLUM : CTENOPHORA

Salient features:

Examples: Pleurobrachia and Ctenoplana

PHYLUM : PLATYHELMINTHES

Salient features:

Eg: Planaria, Fasciola (Liver fluke)

Taenia (Tapeworm)

PHYLUM : ASCHELMINTHES

Salient features:

Examples :

1) Ascaris (Round worm)

2) Wuchereria (Filarial worm)

3) Ancylostoma (Hook worm)

PHYLUM : ANNELIDA

General Characters

Examples :

- (1) **Nereis** (Sand worm)
- (2) **Pheretima** [Earthworm]
- (3) **Hirudinaria** [Leech]

PHYLUM : ARTHROPODA

Examples : Economically important insects

- Apis** (Honey bee)
- Bombyx** (Silk worm)
- Laccifer** (lac insect)

Vectors : (Aedes, Anopheles, Culex), Locust (Locusta-Gregarious pest), Limulus, (King crab-Living fossil)

PHYLUM : MOLLUSCA

Salient features:

Examples : **Pila** (Apple snail), **Pinctada** (Pearl oyster), **Sepia** (Cuttle fish), **Loligo** (Squid), **Octopus** (Devil fish), **Aplysia** (Sea hare), **Dentalium** (Tusk shell), **Chaetopleura** (Chiton), **Unio** (Fresh water mussel)

PHYLUM : ECHINODERMATA

Salient features:

Examples : **Asterias** (star fish), **Ophiura** (Brittle star), **Echinus** (Sea urchin), **Antedon** (Sea lily / Feather star), **Cucumaria** (Sea cucumber).

PHYLUM : HEMICHORDATA

Salient features:

Examples : **Balanoglossus**
Saccoglossus

QUESTIONS

LEVEL - I

1. i) Ventral, solid, double nerve cords
ii) Absence of gill slits
iii) Absence of notochord and ventral heart
All the above features are '**NOT**' related to :
1) Annelida 2) Chordata
3) Non-chordata 4) Cnidaria
2. "Body has certain functional systems and each one is specialised for specific physiological functions". This kind of body organisation is found in animals like :
1) Cnidaria and Ctenophora
2) Porifera and Platyhelminthes
3) Mollusca and Echinodermata
4) Ctenophora and Aschelminthes
3. Based on the type of symmetry, cnidarians and echinoderms are under radially symmetrical animals, because :
1) they are exclusively marine in nature
2) their body cannot be divided into two equal halves through any plane passing on its centre
3) their body can be divided into identical left and right halves in only one plane.
4) their body can be divided into two equal halves through any plane passing through the central axis of the body

4. Select the **mismatched** pair from the following :
- 1) Mesoderm present as scattered pouches between ectoderm and endoderm - Pseudocoelom
 - 2) Undifferentiated layer between ectoderm and endoderm - Mesoglea
 - 3) Body cavity is lined by mesoderm - Eucoelom
 - 4) Body is divided into external and internal segments - Metagenesis
5. Relevant character found in Sycon, Euspongia and Spongilla is/are :
- 1) All are sessile without even a single exception
 - 2) Choanocytes lines the gastro-vascular cavity
 - 3) Extracellular digestion and sexual reproduction only
 - 4) Direct development and dioecious condition
6. Which of the following functions are completed through the action of cnidoblasts / cnidocytes in sea pen, sea anemone and sea fan?
- 1) Capture of prey, removal of waste, respiratory gas exchange
 - 2) Prey capture, defence and anchorage
 - 3) Reproduction, transport of food and gases
 - 4) Locomotion, respiratory gas exchange, transport of food

- 7.** From the given characteristics below, identify the common features seen in both comb jellies and coelenterates :
- Radial symmetry
 - External fertilization
 - Sexual reproduction only
 - Exclusively marine in nature
 - Indirect development
- 1) c, d 2) c, e, e
3) a, b, e 4) a, b, c, e
- 8.** Organ level of organisation, bilateral symmetry and acoelomate condition are exemplified by animals like :
- Tape worm, Hook worm, Liver fluke
 - Fasciola, Taenia, Wuchereria
 - Planaria, Physalia, Pleurobrachia
 - Taenia, Fasciola, Planaria
- 9.** Which of the following features are NOT related to animals that have dorso-ventrally flattened body?
- Presence of hooks and suckers
 - Mostly endoparasites in plants and animals
 - Development through many larval stages
 - Exhibit both sexual and asexual reproduction
- 10.** Complete digestive system with well developed muscular pharynx and excretory tube with excretory pore are the most relevant features related to :
- Round worms
 - Segmented worms
 - Flatworms
 - Ring worm

- 11.**
- i) Parapodia helps in swimming
 - ii) Dioecious condition and indirect development
 - iii) Sexual reproduction only
- The above features are related to segmented worms like :
- Pheretima
 - Hirudinaria
 - Nereis
 - Leech
- 12.** Match column I (Animals) with column II (Respiratory structures) and select the correct option.
- | Column I | Column II |
|----------------|------------------------|
| A) Pheretima | i) Book gills |
| B) Periplaneta | ii) Feather like gills |
| C) Pila | iii) Moist skin |
| D) Limulus | iv) Tracheal tubes |
| E) Prawn | v) Gills |
- 1) $\frac{ABCDE}{\text{iii i iv ii v}}$ 2) $\frac{ABC D E}{\text{iii iv i ii v}}$
 3) $\frac{ABCDE}{\text{iii iv ii v}}$ 4) $\frac{AB CDE}{\text{iii iv i v ii}}$
- 13.** All the following characteristics are found in animals having jointed appendages, **except:**
- Chitinous exoskeleton
 - Body consists of head, thorax and abdomen
 - Malpighian tubules for excretion
 - Usually internal fertilization

- 14.** Select the **correct** feature found in animals having soft unsegmented body :
- 1) Feather like gills present in anterior head
 - 2) Radula in mouth helps for respiration
 - 3) All of them have a calcareous shell
 - 4) A soft and spongy layer of skin over the visceral hump
- 15.**
- i) Bilateral larvae transforms into radial adult
 - ii) Complete digestive system with dorsal anus and ventral mouth
 - iii) Indirect development with free-swimming larva
- All the above features are related to :
- 1) Dentalium, Aplysia, Antedon, Ophiura
 - 2) Pinctada, Asterias, Cucumaria, Echinus
 - 3) Sea urchin, Sea lily, Sea cucumber, Star fish
 - 4) Ophiura, Asterias, Antedon, Chae-topleura
- 16.** What is the significance of the presence of pharyngeal gills in hemichordates?
- 1) Similar to the characteristics of phylum chordata
 - 2) Rudimentary structure in collar region
 - 3) Helps for excretion and osmoregulation
 - 4) Advantages for respiration and circulation
- 17.** Match the following animals with respect to their distinctive features.
- | Column I | Column II |
|---------------------------------|-----------------------------|
| A) Pleurobrachia and Ctenoplana | P) Chitinous exoskeleton |
| B) Ophiura and Echinus | Q) Ring like segments |
| C) Locust and Limulus | R) Cnidocytes in body |
| D) Aurelia and Obelia | S) Tube feet for locomotion |
| E) Pheretima and Hirudinaria | T) Light emit from body |
- 1) $\frac{\text{ABCDE}}{\text{TSPQR}}$ 2) $\frac{\text{ABCDE}}{\text{RSPTQ}}$
- 3) $\frac{\text{ABCDE}}{\text{TSPLQ}}$ 4) $\frac{\text{ABCDE}}{\text{RSPQT}}$
- 18.** How many of the following are **TRUE** regarding following group of animals.
[Taenia, Bombyx, Octopus, Balanoglossus]
- a) All are triploblastic and eucoelomates
 - b) Except Taenia rest others reproduce sexually
 - c) Body can be divided into two identical halves only in one plane
 - d) All exhibits indirect development
 - e) Segmented body and double ventral nerve cords
- 1) 3 2) 4
 3) 1 4) 2

19. Read the following statements.

- a) All coelomates are triploblastic in nature
- b) Ctenophores and annelids exhibit sexual reproduction only
- c) Water canal system in Echinus and Asterias helps for transport of food and locomotion.
- d) All molluscs have a calcareous shell
- e) Hooks and suckers present in all flatworms

Choose the correct answer from the options given below.

- 1) a, b, c are correct
- 2) c, d, e are incorrect
- 3) c, d, e are correct
- 4) All except d is correct

20. Given below are two statements, one is labelled as Assertion and the other is labelled as Reason.

Assertion : In Pila and Aplysia feather like gills present in the space between visceral hump and shell that helps in respiration.

Reason : Pila and Aplysia are aquatic and they use gills for respiration and locomotion.

- 1) Assertion is true but Reason is false
- 2) Both Assertion and Reason are false
- 3) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion
- 4) Both Assertion and Reason are true and Reason is the correct explanation of Assertion

QUESTIONS

LEVEL - II

1. Which of the following are **correct** related to kingdom animalia?
 - i) All animals are multicellular and eukaryotic in nature
 - ii) Different animals have similar structure and form but fundamental features are not common
 - iii) Single opening which serves as both mouth and anus seen in incomplete digestive system.
 - iv) Most of the animals have organ level of organisation.
 - v) In open circulation cells and tissues are directly bathed in blood.
- 1) i, iii, iv
- 2) i, iii, v
- 3) ii, iv
- 4) iii, iv, v

- 2.** Following are some of the fundamental features given in column I. Match it with animals given in column II which shows the correct feature and select the correct option.

Column I	Column II
i) Embryonic cells arranged as two layers	a) Round worms
ii) Mesoderm present as scattered pouches between ectoderm and endoderm	b) Annelids and arthropods
iii) Body cannot be divided into equal halves through any plane passes on central axis	c) Cnidarians and ctenophores
iv) Distinct body divisions with serial repetition of atleast some organs	d) Molluscs and echinoderms
v) Mesoderm lines the cavity between ectoderm and endoderm	e) Pore bearing animals

1) $\frac{i \ ii \ iii \ iv \ v}{c \ e \ a \ b \ d}$

2) $\frac{i \ ii \ iii \ iv \ v}{c \ a \ e \ b \ d}$

3) $\frac{i \ ii \ iii \ iv \ v}{c \ a \ e \ d \ b}$

4) $\frac{i \ ii \ iii \ iv \ v}{c \ a \ b \ d \ e}$

- 3.** Select the **incorrect** statement from the following :
- 1) All segmented animals have a true coelom
 - 2) Platyhelminthes and aschelminthes do not possess true coelom
 - 3) Flatworms are the only animals exemplify triploblastic and acoelomate condition
 - 4) Sponges are the only animals exhibit asymmetrical condition.

- 4.** All of the following are **incorrect** regarding pore bearing animals **except** :

- 1) Exclusively marine and radially symmetrical
- 2) Extracellular and intracellular digestion
- 3) External fertilization and direct development
- 4) Spicules and spongin fibres are skeletal elements

- 5.** Which of the following features are found only in sponges like spongilla, euspongia and sycon?

- 1) Eggs and sperms are produced by the same individual.
- 2) Ostia, spongocoel and osculum are involved in water canal system.
- 3) Choanocytes lines the body wall and tentacles
- 4) Respiratory gas exchange and excretion through general body surface

- 6.** Select the **correct** features related to cnidarians :

- a) First animals have diploblastic condition and radial symmetry
 - b) Exist in two different body forms
 - c) All cnidarians exhibit metagenesis
 - d) Cnidoblasts are used for prey capture
 - e) Digestion is extracellular in coelenteron
- | | |
|---------------|---------------|
| 1) a, b, d, e | 2) a, b, c, d |
| 3) b, c, d, e | 4) c only |

7. i) Poison filled stinging capsule inside the _____ (a) is called nematocyst
- ii) Some of the cnidarians like : _____ (b) have a skeleton composed of calcium carbonate
- iii) Polyp produce medusae _____ (c)
- iv) Central gastrovascular cavity with a single opening present on _____ (d)

Select the **correct** option with respect to
a,b,c,d

	a	b	c	d
1)	Cnidoblast	Physalia	Sexually	Mouth
2)	Comb plates	Corals	Asexually	Hypos-tome
3)	Cnidoblast	Corals	Asexually	Hypos-tome
4)	Coelenteron	Obelia	Sexually	Mouth

8. Select the **relevant feature** found in animals like Pleurobrachia and Ctenoplana.
- Bioluminescence, sexual reproduction and bilateral symmetry
 - Eight external rows of comb plates with cilia for locomotion
 - Internal fertilization and direct development
 - Eggs and sperms are produced by two different individuals

9. Select the **correct** features related to animals having dorso-ventrally flattened body :
- All are endoparasites with hooks and suckers
 - Flame cells helps for digestion and excretion
 - Some of them absorbs nutrients from host through their general body surface.
 - Development through many larval stages
 - Some of them shows high power of regeneration.
- 1) a and b 2) c, d, e
 3) a, d, e 4) b, c, d
10. Complete digestive system with well developed muscular pharynx, excretory tube with excretory pore and sexual dimorphism. Above mentioned features are applicable to:
- Taenia, Fasciola, Planaria
 - Ancylostoma, Ascaris, Wuchereria
 - Hook worm, Tape worm, Liver fluke
 - Filarial worm, Hook worm, Tapeworm
11. All of the following features are common to both flatworms and roundworms **except**:
- Triploblastic and acoelomate condition
 - All are endoparasites and possesses hooks and suckers
 - Bilateral symmetry and absence of true coelom
 - Unsegmented body and indirect development
 - All of them absorbs nutrients from host directly through their body surface
- 1) a,b,d 2) c,d
 3) a,b,e 4) b.c.e

12. Paired ganglia connected by lateral nerves to double ventral solid nerve cords and circular and longitudinal muscles aid in locomotion. These are the features related to :

- 1) Earthworm, Leech and Ancylostoma
- 2) Pheretima, Nereis and Hirudinaria
- 3) Silk worm, Sand worm, Tape worm
- 4) Wuchereria, Ancylostoma, Pheretima

13. Select the **correct** features related to the following group of animals.

[Apis, Bombyx, Laccifer, Locust]

- i) Antennae and compound eyes act as sense organs
 - ii) Tracheal tubes helps for respiration
 - iii) Body is divisible into head, thorax and abdomen
 - iv) All are vectors and economically important insects
 - v) Internal fertilization, direct development and oviparity
- | | |
|---------------|---------------|
| 1) iii, iv, v | 2) ii, iii, v |
| 3) i, ii, iii | 4) ii, iv |

14. Match column I with column II and select the **correct** option.

Column I	Column II
a) Polyphagous gregarious pest	i) Limulus
b) Living fossil	ii) Statocyst
c) Body balancing organ	iii) Laccifer
d) Economically important insect	iv) Locust
e) Vector	v) Anopheles

1) $\frac{a \ b \ c \ d \ e}{iv \ i \ v \ ii \ iii}$

2) $\frac{a \ b \ c \ d \ e}{iv \ i \ ii \ v \ iii}$

3) $\frac{a \ b \ c \ d \ e}{iv \ i \ ii \ iii \ v}$

4) $\frac{a \ b \ c \ d \ e}{iv \ v \ i \ iii \ ii}$

15. Which of the following features are applicable to the following group of animals coming under phylum Mollusca?

Pearl oyster, Apple snail, Sea hare

- a) Mantle formed as a spongy layer over the visceral hump
 - b) Space between mantle and shell is mantle cavity
 - c) Radula present in mouth helps in feeding
 - d) Body is divisible into head, thorax and abdomen
 - e) Usually dioecious and oviparous with indirect development
- | | |
|----------|----------|
| 1) a,c,e | 2) b,c,d |
| 3) a,c,d | 4) b,d,e |

16. Select the **incorrect** character related to animals having spiny skinned body :

- 1) Exclusively marine
- 2) Calcareous ossicles acts as endoskeleton
- 3) Indirect development with free-swimming larva
- 4) Complete digestive system with dorsal mouth and ventral anus.

17. How many of the following are **TRUE** regarding animals coming under connecting link between non-chordata and chordata?

- a) Elongated body is divisible into head, visceral hump and muscular foot
- b) Proboscis gland helps for excretion
- c) Stomochord present in collar region
- d) External fertilization and direct development
- e) It is now placed as a separate subphylum under non-chordata

- | | |
|------|------|
| 1) 3 | 2) 4 |
| 3) 2 | 4) 5 |

18. Given below are two statements :

Statement I : Calcareous shell in molluscs are secreted by soft spongy glandular layer of skin.

Statement II : Ctenophores, echinoderms and hemichordates are exclusively marine in nature.

In the light of the above statements choose the **most appropriate answer** from the following

- 1) Both statement I and statement II are correct
- 2) Both statement I and statement II are incorrect
- 3) Statement I is correct but statement II is incorrect
- 4) Statement I is incorrect but statement II is correct

Given below are two statements, one is labelled as Assertion and the other is labelled as Reason.

In the light of the below statements (Assertion and Reason) choose the most appropriate answer from the options given below.

- 1) Assertion is true but Reason is false
- 2) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- 3) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion
- 4) Both Assertion and Reason are false

19. Assertion : Asterias, Cucumaria and Antedon are considered as echinoderms.

Reason : In star fish, sea cucumber and sea lily, their body bears spiny skin and calcareous ossicles acts as endoskeleton.

20. Assertion : Hemichordates are currently grouped under non-chordata as a separate phylum.

Reason : Hemichordates have rudimentary structure in collar region which is not considered as a notochord.

QUESTIONS LEVEL - III

1. The probable reason for the presence of poisonous stinging cells on the body wall and tentacles in hydra and jelly fish are :
 - 1) Helps for locomotion and reproduction
 - 2) To protect their body from the attack of enemies and capture of aquatic insects
 - 3) Helps for locomotion and reproduction
 - 4) To emit light from their body

- 2.** Identify the '**TRUE**' and '**FALSE**' characteristics regarding first triploblastic, acoelomate group of animals.
- All have indirect development through many larval forms
 - Reproduce only by sexual means
 - Hooks and suckers used for the absorption of food from host.
 - Exhibits organ and organ system level of organisation
 - All are monoecious without even a single exception.
- 4.** Segmented worms are more advanced than round worms and flat worms in many aspects **except** :
- Presence of true coelom and metamermism
 - Paired ganglia and double, ventral nerve cord
 - Closed circulation and locomotory structures
 - Symmetry and reproduction

	TRUE	FALSE
1)	a, c, d	b, e
2)	a, d, e	b, c
3)	d	a, b, c, e
4)	a, b, c, e	d

- 3.**
- Free living or parasites in plants and animals
 - Exhibit sexual dimorphism
 - Internal fertilization and indirect development

All the above features are related to :

- Filarial worm, Tape worm, Hook worm
- Round worm, Hook worm, Tape worm
- Wuchereria, Ancylostoma, Ascaris
- Silk worm, Pin worm, Hook worm

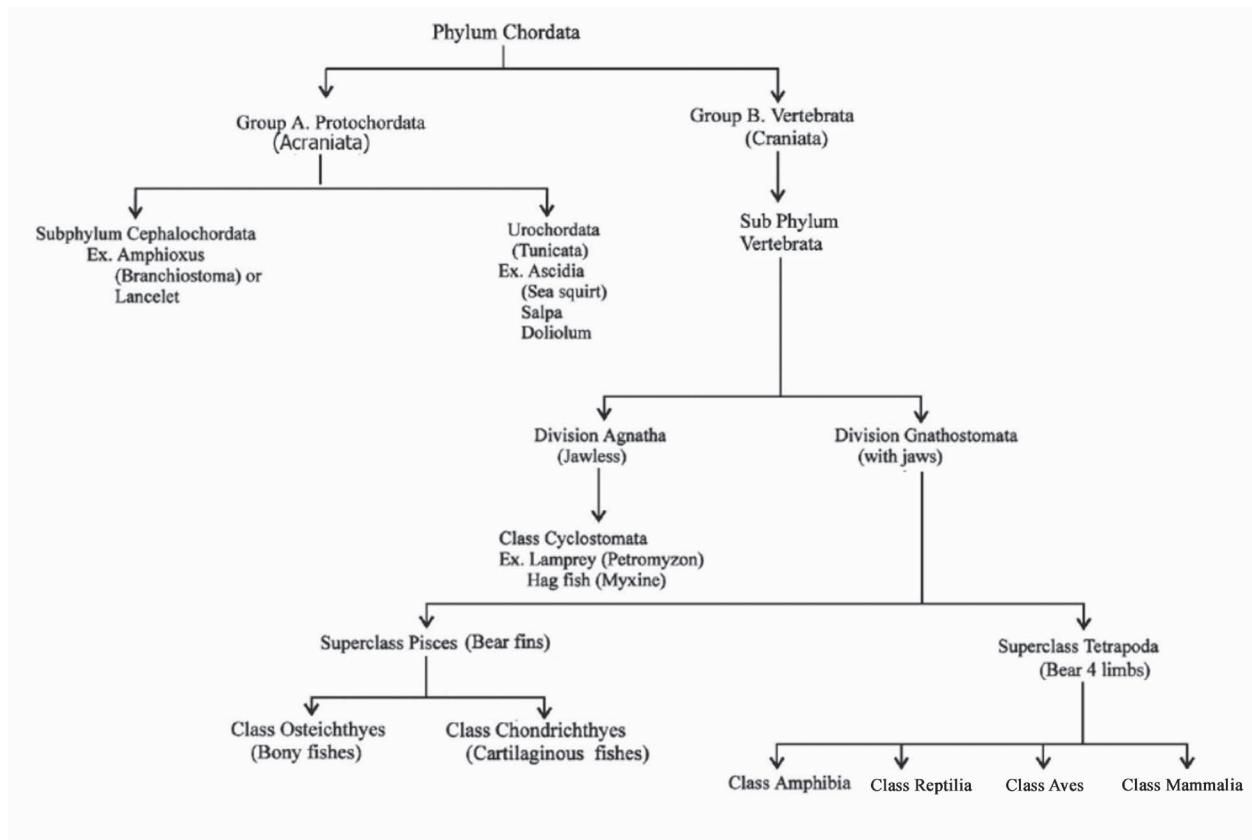
- 5.** **Assertion** : All triploblastic animals are true coelomates and exhibit bilateral symmetry.
- Reason** : A mesodermally lined cavity present in all triploblastic animals except aschelminthes only.

In the light of the above statements (Assertion and Reason) choose the most appropriate answer from the options given below.

- Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- Both Assertion and Reason are true and Reason is not the correct explanation of Assertion
- Assertion is true but Reason is false
- Both Assertion and Reason are false

SYNOPSIS**• Basic features of Chordates**

- 1) Dorsal hollow nerve chord
- 2) Notochord
- 3) Paired pharyngeal gill slits
- 4) Post anal tail

Classification

1. Subphylum Urochordata (Tunicata)

- Notochord is present only in the larval tail
- Exhibit retrogressive metamorphosis

Eg. Ascidia, Salpa, Doliolum

2. Subphylum - Cephalochordata

- Notochord is present throughout the life.
- Notochord extends from head to tail and is persistent throughout life.
- Excretion by protonephridia / solenocytes.

Eg. Branchiostoma [Amphioxus or Lancelet]

3. Subphylum - Vertebrata

- Notochord is replaced by vertebral column in adults.

Division - Agnatha - Class Cyclostomata

- Jawless vertebrates with circular mouth.
- Endoskeleton is cartilaginous
- Presence of 6-15 pairs of gills for respiration
- Exhibit Anadromous migration for spawning

Eg. Petromyzon [Lamprey], Myxine [Hag fish]

Division - Gnathostomata

Super Class - Pisces

- Presence of 2 pairs of paired fins
- Exoskeleton consists of scales - placoid/cycloid/ctenoid
- Two chambered heart
- Excretion by a pair of mesonephric kidneys

Comparison between class chondrichthyes and class osteichthyes.

Class Chondrichthyes		Class Osteichthyes
1)	Exclusively Marine	• Fresh water and Marine
2)	Persistent notochord	• Notochord - only in embryonic stage
3)	Placoid scales	• Ctenoid/cycloid scales
4)	5-7 pairs of gills without operculum	• 4 pairs of gills with operculum
5)	Mouth ventral	• Mouth terminal
6)	Ureotelic	• Ammonotelic
	Eg. Scoliodon (Dog fish)	Eg. Exocoetus - flying fish
	Pristis - Saw fish	Hippocampus - Sea horse
	Carcharodon - Great white shark	Clarias - Magur
	Trygon - Sting ray	Pterophyllum - Angel fish

Super class - Tetrapoda

Class - Amphibia

- Body is divisible into head and trunk
- Skin is moist, glandular and without scales
- Tympanum represents the ear
- Heart 3 chambered
- Mesonephric kidneys
- Presence of cloaca

Eg. Rana, Bufo, Hyla

Salamander

Ichthyophis

Class - Reptilia

- Creeping and crawling animals
- Exoskeleton consists of scales, scutes and plates
- Pulmonary respiration
- Heart 3 chambered except crocodile
- Kidneys are metanephric
- Fertilization internal

Eg. Chelone/ turtle - Marine

Testudo /Tortoise - Fresh water and terrestrial

Chameleon - Tree lizard

Hemidactylus - Wall lizard

Snakes

Naja - Cobra, Bangarus, - Krait

Vipera - Viper

Class Aves

- Presence of feathers
- Beak without teeth
- Forelimbs are modified into wings
- Presence of crop and gizzard
- Presence of pneumatic bones
- Lungs with airsacs

Eg. Corvus - Crow

Columba - Pigeon

Psittacula - Parrot

Pavo - Peacock

Aptenodytes - Penguin

Neophron - Vulture

Struthio - Ostrich

Class - Mammalia

- Presence of mammary gland, hairs on skin, pinna, diaphragm
- Homeothermic, viviparous with few exceptions

Eg. Ornithorhynchus, Macropus, Pteropus, Balaenoptera, Delphinus, Camelus, Panthera tigris etc.

QUESTIONS**LEVEL - I**

- 1.** Which of the following statements are true for phylum chordata?
 - i) In urochordates notochord extends from head to tail and persists throughout their life time.
 - ii) Nerve cord is ventral, solid and single
 - iii) In most chordates, notochord is present only during the embryonic period
 - iv) Chordata is divided into four different subphyla

1) ii only 2) iii and i only
 3) iii and iv only 4) iii only
- 2.** One of the primary characters of chordate is :
 - 1) Ganglionated nerve cord
 - 2) Paired nerve cord
 - 3) Solid ventral nerve cord
 - 4) Dorsal hollow nerve cord
- 3.** Which of the following is a chordate feature, not shared by the non-chordates?
 - 1) Triploblastic body
 - 2) True coelom
 - 3) Bilateral symmetry
 - 4) Notochord
- 4.** Body of the urochordate is enclosed in a :
 - 1) Mantle
 - 2) Test or tunic
 - 3) Shell
 - 4) Shield

- 5.** Which among the following animals exhibit a notochord only in the larval stage?
 - 1) Amphioxus
 - 2) Carcharodon
 - 3) Doliolem
 - 4) Myxine
- 6.** The correct classification of Branchiostoma is:
 - 1) Chordata → Protochordata → Vertebrata
 - 2) Chordata → Protochordata → Cephalochordata
 - 3) Chordata → Cephalochordata → Vertebrata
 - 4) Chordata → Protochordata → Urochordata
- 7.** Which one of the following structure is present in all adult vertebrates?
 - 1) Notochord
 - 2) Dorsal solid nerve cord
 - 3) Pharyngeal gill slits
 - 4) Kidneys for excretion and osmoregulation
- 8.** Which of the following statements is not true for Agnatha members?
 - 1) They include hag fishes and lampreys
 - 2) They have notochord throughout their lives
 - 3) They are known as Cyclostomes
 - 4) They have bony skeleton

- 9.** Read the following statements.
- A) Male sharks bear a pair of claspers attached to the pectoral fins that help in copulation.
- B) Teeth are modified placoid scales which are backwardly directed in Osteichthyes.
- 1) Both statements are incorrect
2) Statement A is correct and B is incorrect
3) Statement A is incorrect and B is correct
4) Both statements are correct
- 10.** What is common among Labeo, Catla and Pterophyllum ?
- 1) Operculum absent
2) Terminal mouth
3) Absence of air bladder
4) Cartilaginous endoskeleton
- 11.** Which of the following is correct about class Amphibia ?
- i) Fertilization is internal
ii) Respiration is through gills only
iii) Body is divisible into head and trunk
iv) Heart is two chambered - one ventricle and one auricle
- 1) only (i)
2) only (iii)
3) (i), (ii) and (iv)
4) All are correct
- 12.** Find the correct statement about class Reptilia :
- 1) dry and cornified skin, epidermal scales and absence of external ears
2) marine habitat, endoskeleton is cartilagenous and have placoid scales
3) members of class reptilia having four chambered heart
4) They are homeothermous
- 13.** Which of the following classes exhibit only internal fertilisation ?
- (i) Osteichthyes
(ii) Chondrichthyes
(iii) Aves
(iv) Reptilia
(v) Mammalia
(vi) Amphibia
- 1) i, iii, iv and v only
2) i, ii, iv, vi only
3) iii and iv only
4) ii, iii, iv and v only
- 14.** Which of the following is not related to Pteropus, Rattus, Elephas and Equus?
- 1) Endoskeleton is fully ossified with pneumatic bones
2) Body possess hairs and external ear or pinna
3) All are viviparous without exception
4) Internal fertilization and direct development

- 15.** Match the columns I and II and choose the correct combination from the options given.

Column I	Column II
a) Tree lizard	i) Hemidactylus
b) Turtle	ii) Neophron
c) Wall lizard	iii) Calotes
d) Limbless amphibia	iv) Chelone
e) Garden lizard	v) Chameleon
f) Vulture	vi) Ichthyophis

- 1) e - iii, b - iv, a - v
- 2) a - iv, d - vi, c - i
- 3) c - i, e - v, d - vi
- 4) b - v, a - iii, f - ii

QUESTIONS LEVEL - II

- 1.** Which one of the following is not a characteristic feature of all the chordates?
- 1) Presence of coelom
 - 2) A diaphragm separating thorax from abdomen
 - 3) Dorsal nerve cord
 - 4) Pharyngeal gill slits in the early embryonic stages
- 2.** All of them are characteristics of Protochordates except :
- 1) It includes tunicates and cephalochordates
 - 2) They are exclusively marine forms
 - 3) Vertebral column is absent
 - 4) Paired appendages present

- 3.** Which of the following statements is false about Branchiostoma (Amphioxus) ?
- 1) Amphioxus belongs to subphylum - Urochordata
 - 2) In Amphioxus notochord extends from head to tail and it is persistent throughout life
 - 3) Amphioxus is a typical chordate with all chordate characters
 - 4) In Amphioxus excretion is carried out by protonephridia
- 4.** Which animals belong to the subphylum Urochordata?
- 1) Branchiostoma and Lancelet
 - 2) Salpa and Lancelet
 - 3) Ascidia and Dolium
 - 4) Salpa and Amphioxus
- 5.** Which one of the following statement is not correct regarding cyclostomes ?
- 1) All living members of cyclostomes are ectoparasites on some fishes
 - 2) Cyclostomes have an elongated body bearing 6 - 15 pairs of gill slits for respiration
 - 3) Cyclostomes have a circular mouth with jaws and teeth
 - 4) The body of cyclostomes is devoid of scales and paired fins

- 6.** (i) Marine with streamlined body
 (ii) Cartilaginous endoskeleton
 (iii) Mouth is ventral
 (iv) Notochord is persistent throughout life
- Select the total number of following organisms that possess the above mentioned characteristics :
- Dog fish, Saw fish, Flying fish, Fighting fish, Angel fish, Jelly fish, Star fish, Trygon, Torpedo, Rohu, Katla, Magur**
- 1) 3 2) 4
 3) 6 4) 7
- 7.** Match the entities in column I with their character in column II
- | Column I | Column II |
|-----------------|------------------|
| A) Hippocampus | i) Fighting fish |
| B) Labeo | ii) Sea horse |
| C) Pterophyllum | iii) Magur |
| D) Clarias | iv) Angel fish |
| E) Betta | v) Rohu |
- 1) A - (iii); B - (iv); C - (v); D - (i); E - (ii)
 2) A - (ii); B - (v); C - (iv); D - (i); E - (iii)
 3) A - (ii); B - (v); C - (i); D - (iii); E - (iv)
 4) A - (ii); B - (v); C - (iv); D - (iii); E - (i)
- 8.** Which one is the common character shared by class osteichthyes and class amphibia?
- 1) external fertilization
 2) internal fertilization
 3) two chambered heart
 4) indirect development
- 9.** The following features belong to which class?
 A) Body is divisible into head and trunk, tail may be present in some
 B) Skin is moist and acts as respiratory organ
 C) Eye has eye-lids
 D) Exoskeleton is absent
- 1) Osteichthyes 2) Reptilia
 3) Amphibia 4) Cyclostomata
- 10.** Sexes separate, internal fertilization, oviparous and direct development is seen in case of :
 1) Chelone 2) Testudo
 3) Ichthyophis 4) 1 and 2
- 11.** Select the total number of lizards from the following :
Chelone, Calotes, Chameleon, Crocodiles, Hemidactylus, Aptenodytes, Neophron
- 1) 2 2) 4
 3) 3 4) 5
- 12.** How many statements are correct from given statements ?
- (i) The hindlimbs of birds have generally scales
 (ii) Skin of bird is dry without glands except oil gland at the base of the tail
 (iii) Long bones of mammals are hollow with air cavities
 (iv) Reptiles, Aves and Mammals are homoiothermous animals
 (v) Ornithorhynchus, Macropus and Pteropus are members of class mammalia.
- 1) One 2) Three
 3) Four 4) Five

- 13.** How many of the following statements are true about class mammalia ?
- Some of them are adapted to fly
 - Presence of mammary glands to nourish young ones
 - Skin has hairs and pinna are present in most of the mammals
 - Heart is four chambered and poikilotherms
- iii and iv
 - ii and iii
 - i, ii and iii
 - ii, iii and iv

- 14.** Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion : Amphibia, Reptilia, Aves and Mammals included in super class tetrapoda.

Reason : They have two pairs of limbs, adapted for walking, running, climbing, burrowing, swimming or flying.

In the light of the above statements (Assertion and Reason) choose the most appropriate answer from the options given below.

- Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- Both Assertion and Reason are true and Reason is not the correct explanation of Assertion
- Assertion is false but Reason is true
- Assertion is true but Reason is false

- 15.** Read the following statements.
- Duck billed platypus is a connecting link between reptiles and mammals.
 - Presence of muscular diaphragm is a universal feature of all the mammals
 - The unique features of mammals are the presence of mammary glands and hairs on skin
 - Humans belong to the order Primata
 - Skin of most mammals possess sudoriferous and sebaceous glands

How many of the above statements are correct?

- Four
- Two
- Five

QUESTIONS LEVEL - III

- Which of the following is true for all amphibians ?
 - All have tail
 - Excretion by kidneys
 - Alimentary canal, urinary and reproductive tracts open into different chambers and then to the exterior
 - Heart is three-chambered with two ventricles

- 2.** Which of the following statements are true ?
- i) All sharks possess claspers and have forwardly directed teeth
 - ii) Hippocampus possesses two chambered heart
 - iii) Magur must swim constantly to avoid sinking
 - iv) Labeo has a constant body temperature
- 1) All 2) i and ii only
3) ii only 4) i, ii and iii only
- 3.** Which of the following statements are true or 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 and caudal fins in swimming
 - iii) reptilian skin is moist with thick scales
 - iv) birds have no cutaneous glands
 - v) the most unique mammalian characteristic is the presence of four chambered heart
- 1) i, ii and iii are true; iv and v are false
2) i and ii are true; iii, iv, v are false
3) i, iv and v are true; ii, iii are false
4) i, ii and iv are true; iii and v are false
- 4.** Select the correct statement about class - Aves
- 1) They are warm blooded animals and are able to maintain a constant body temperature
 - 2) Respiration occurs through lungs and air sacs connected to lungs for supplement respiration
 - 3) They are oviparous with separate sexes, internal fertilization and direct development
 - 4) All of the above
- 5.** Given below are two statements, one is labelled as Assertion (A) and the other is labelled as Reason (R).
- Assertion** : A bony fish can stay at a particular depth without expending energy in swimming.
- Reason** : Bony fishes have swim bladder.
- In the light of the above statements (Assertion and Reason) choose the most appropriate answer from the options given below.
- 1) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
 - 2) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion
 - 3) Assertion is true but Reason is false
 - 4) Both Assertion and Reason are false

SYNOPSIS

ANIMAL TISSUES

Definitions : - Histology, Cytology, Cell, Tissue, Organ, Organ system, Organism

Basic types of tissues

- 1) Epithelial tissue
- 2) Connective tissue
- 3) Muscular tissue
- 4) Neural tissue

their origin from primary germ layers - ectoderm, endoderm and mesoderm

I. EPITHELIAL TISSUE

- i) Simple epithelium
- ii) Compound epithelium

i) Simple epithelium / Unilayered epithelium

- * Functions, peculiarities

Different types of simple epithelium, on the basis of structural modification of cells, their location and functions, such as

- 1) Squamous epithelium

- 2) Cuboidal epithelium
- 3) Columnar epithelium
- 4) Ciliated epithelium

- * Mention brush bordered columnar epithelium and brush bordered cuboidal epithelium, their sites and function.
- * Mention the modifications of simple epithelium such as
 - 1) germinal epithelium
 - 2) sensory epithelium
 - 3) Glandular epithelium
 - I) Unicellular glands
 - II) Multicellular glands, examples
- * Briefly mention endocrine glands, exocrine glands, mixocrine glands/ heterocrine glands
- * Different types of cell junctions (gap junction, tight junction and adhering junction etc.) their functions

ii. Compound epithelium :- Nature, Site, Function

II. CONNECTIVE TISSUE :-

Loose connective tissue, Dense connective tissue (Regular and Irregular) and Specialised connective tissue.

- * **Loose connective tissue** - Examples: Areolar tissue, Adipose tissue, their location and functions, components, nature of matrix etc
- * **Dense connective tissue** - Regular - Examples - 1)Tendon 2) Ligaments
- * **Dense connective tissue** - Irregular- Examples - skin, periosteum, renal capsule etc.
- * **Specialised connective tissue** - Examples - Blood, Bone, Cartilage

III. MUSCULAR TISSUE:

- 1) Skeletal muscles / voluntary muscles / striated muscles
- 2) Smooth muscles / visceral muscles / Non striated muscles / Involuntary muscles
- 3) cardiac muscles - Intercalated disc, functions

IV. NEURAL TISSUE - Neurons, neuroglial cells- mention their function**MORPHOLOGY OF ANIMALS - COCKROACH (*Periplaneta americana*)**

Taxonomic position,

Habit and habitat

Body divisions, metamerism

Legs, wings, their functions, location etc

Mouth parts, functions.

Chitinous exoskeleton, sclerites, their names

Alimentary canal and associated glands

Open circulation - dorsal heart, haemocoel, haemolymph

Tracheal respiration

Excretory system - Malpighian tubules, location, Uricotelism, Additional excretory structures

Nervous system - Compound eyes, Mosaic vision, Antennae

Male reproductive system, structure and function

Female reproductive system, structure and function

Brood pouch in female cockroach

Ootheca formation, Nymph

Paurometabolous development

MORPHOLOGY OF FROG - Indian bull frog

- * Taxonomic position
- * External features, body divisions
- * Sexual dimorphism
- * Dicondylic skull
- * Alimentary canal and accessory glands
- * Carnivorous & poikilothermic nature
- * Respiratory organs, different modes of respiration depending on their life stage and environmental conditions : Branchial respiration, cutaneous respiration, buccopharyngeal respiration, pulmonary respiration etc.
- * Aestivation and hibernation
- * Circulatory system, three chambered heart
- * Mixed double circulation / incomplete double circulation
- * Sinus venosus, conus arteriosus
- * Hepatic portal system and renal portal system
- * Nucleated RBCs
- * Prominent endocrine glands
- * Nervous system, cranial nerves, spinal nerves, divisions of brain, functions, different sense organs
- * Urinogenital system of male frog, Bidder's canal, functional connection of testis with kidney
- * Copulation, external fertilisation, indirect development
- * Economical importance of frog - biological pest controller

QUESTIONS**LEVEL - I**

- 1.** Read the following statements :
- In unicellular organisms, all functions like digestion, respiration and reproduction are performed by a single cell.
 - Unicellular organisms like protistan protozoans are believed to be primitive relatives of animals.
 - A group of similar cells along with intercellular substances perform a specific function is called a tissue.
 - Many tissues are organised in specific proportion and pattern to form an organ.
 - When two or more organs work together to perform a common function by their interaction, they together form an organ system.
- Of the above statements;
- Only two are true
 - Only three are true
 - Only four are true
 - all are true
- 2.** All complex animals consists of only four basic types of tissues. They are :
- Areolar tissue, adipose tissue, cuboidal epithelial tissue and neural tissue
 - Epithelial tissue, connective tissue, muscular tissue and adipose tissue
 - Epithelial tissue, connective tissue, muscular tissue and neural tissue
 - Connective tissue, muscular tissue, skeletal tissue and neural tissue

- 3.** Select the incorrect statement :
- The term epithelium means epithelial tissue
 - Epithelial tissue has a free surface, which faces either a body fluid or the outside environment
 - Epithelium provides a covering or a lining for some parts of the body
 - In epithelial tissue, the cells are loosely packed with plenty intercellular matrix.
- 4.** Select the incorrect statement :
- Simple epithelium is composed of a single layer of cells and functions as a lining for body cavities, ducts and tubes
 - Compound epithelium consists of two or more cell layers and has protective function.
 - Based on structural modification of the cells, simple epithelium is divided into squamous epithelium, cuboidal epithelium and columnar epithelium etc.
 - Epithelial tissue has rich blood supply
- 5.** Match the columns suitably :
- | | Epithelium | | Site |
|------|---------------------|----|-------------------------------|
| i) | Squamous epithelium | a) | inner surface of bronchioles |
| ii) | Ciliated epithelium | b) | ducts of glands |
| iii) | Cuboidal epithelium | c) | inner lining of blood vessels |
| iv) | Columnar epithelium | d) | lining of intestine |
- i - c; ii - a; iii - b; iv - d
 - i - c; ii - a; iii - d; iv - b
 - i - c; ii - d; iii - a; iv - b
 - i - b; ii - c; iii - d; iv - a

- 6.** Glandular epithelium is formed from :
- modified columnar or cuboidal cells
 - specialised ciliated cells
 - modified squamous cells
 - specialised goblet cells
- 7.** Select the incorrect statement :
- Pancreas is a mixocrine gland
 - Mucus, earwax etc are secreted by endocrine glands
 - Thyroid gland is not an exocrine gland
 - Compound epithelium is present in the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and pancreatic ducts.
- 8.** Match the columns suitably :
- | Cell junctions | | Function / nature | |
|----------------|-------------------|-------------------|--|
| i) | Adhering junction | a) | unicellular |
| ii) | Gap junction | b) | help to stop substances form leaking across a tissue |
| iii) | Tight junction | c) | perform cementing to keep neighbouring cells together |
| iv) | Goblet cells | d) | facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells |
- 1) i - c; ii - d; iii - b; iv - a
 2) i - a; ii - d; iii - c; iv - b
 3) i - d; ii - a; iii - c; iv - b
 4) i - b; ii - d; iii - a; iv - c
- 9.** Select the incorrect statement :
- Connective tissue is grouped into loose connective tissue, dense connective tissue and specialised connective tissue.
 - Blood and lymph are examples for specialised connective tissue
 - Blood is an example for liquid connective tissue
 - In all connective tissues, the cells secrete collagen fibres or elastin fibres.
- 10.** How many of the following statements are true?
- Connective tissue cells secrete modified polysaccharides, which accumulate between cells and fibres and act as matrix.
 - In areolar tissue and adipose tissue, the cells and fibres loosely arranged in a semifluid ground substance.
 - Areolar tissue is present beneath the skin and often serves as a support framework for epithelium.
 - Areolar tissue contains macrophages, mast cells, fibroblasts etc.
- Only two
 - Only one
 - Only three
 - All
- 11.** Ligaments are used for connecting :
- bones to bones
 - organs to organs
 - organs to body wall
 - all of these

- 12.** Mast cells present in connective tissue secrete :
- histamine and heparin
 - white fibres and yellow fibres
 - keratin
 - actin fibres
- 13.** The kind of tissue that forms the supportive structure in the tip of nose is also found in :
- pinna
 - tendon
 - stomach
 - large intestine
- 14.** **Assertion** : In cardiac muscles, impulses are transmitted rapidly
Reason : Intercalated discs allow quick passage of ions from one cell to the other cell
- Both Assertion and Reason are true and Reason is the correct explanation of Assertion
 - Both Assertion and Reason are true but Reason is not a correct explanation of Assertion
 - Assertion is true but Reason is false
 - Both Assertion and Reason are false
- 15.** **Statement I** : Bone is the hardest tissue that provides structural frame to the body
Statement II : Bones have a hard and non-pliable ground substance rich in calcium salts and collagen fibres, which make bones more strong.
- Both Statement I and Statement II are correct
 - Both Statement I and Statement II are incorrect
 - Statement I is correct but Statement II is incorrect
 - Statement I is incorrect but Statement II is correct
- 16.** Select the incorrect statement :
- Skeletal muscle fibres are cylindrical and multinucleated / syncytial.
 - Skeletal muscles are attached to bones
 - Muscular tissue is divided into three types such as skeletal, smooth and cardiac
 - Intercalated discs, which are present all over the cardiac muscles help heart to contract as separate units.
- 17.** Select the incorrect statement :
- Neuroglia make up more than one half the volume of neural tissue in our body
 - Neural tissue exerts the greatest control over body
 - Neuroglia protect and support neurons
 - Neurons have high regeneration capacity
- 18.** Read the following statements.
- Morphology refers to the study of form or externally visible features.
 - Anatomy is conventionally used for the study of morphology of internal organs in the animals.
 - Each organ in the body is made up of one or more type of tissues
 - An organ system is a group of organs that work together to perform a specific function in the body
- Of the above statements ;
- Only two are true
 - Only one is true
 - Only three are true
 - All are true

MORPHOLOGY OF COCKROACH

1. Select the incorrect statement :
 - 1) In male cockroach, the wings extend beyond the tip of abdomen.
 - 2) The entire body of cockroach is covered by chitinous exoskeleton
 - 3) In each segment, exoskeleton has hardened plates called sclerites.
 - 4) The dorsal sclerites are called as sternites and ventral sclerites as tergites
2. Read the following statements about cockroach.
 - i) Head is triangular in shape and formed by the fusion of six segments and shows great mobility due to flexible neck
 - ii) Cockroach shows a pair of simple eyes
 - iii) A pair of antennae arise from sockets lying in front of eyes and help in monitoring the environment.
 - iv) Mouth parts consists of a labrum, a pair of mandibles, a pair of maxillae and a labium
 - v) The tongue is known as hypopharynx
 - 1) Only one is true 2) Only four are true
 - 3) Only one is true 4) All are true
3. **Statement I** : The forewings / mesothoracic wings / tegmina are opaque dark and cover the hind wings at rest.
Statement II : The hind wings / metathoracic wings / flight wings are membranous, and transparent.
 - 1) Statement I is correct but Statement II is incorrect
 - 2) Statement I is incorrect but Statement II is correct
 - 3) Both Statement I and Statement II are correct
 - 4) Both Statement I and Statement II are incorrect
4. Which of the following statement is true about female cockroach?
 - 1) The genital pouch or chamber lies at the hind end of abdomen, bounded dorsally by 9th and 10th terga and ventrally by the 9th sternum.
 - 2) Genital pouch shows a ventral anus and dorsal genital pore and gonapophysis
 - 3) The 7th sternum is boat shaped and together with 8th and 9th sterna forms the genital pouch or brood pouch.
 - 4) A pair of anal styles / caudal styles arise from 9th abdominal segment
5. Mouth parts of cockroach is :
 - 1) biting and chewing type
 - 2) piercing and sucking type
 - 3) siphoning type
 - 4) sponging type
6. Select the incorrect statement about cockroach:
 - 1) The alimentary canal of cockroach is divided into three regions : foregut, midgut and hindgut.
 - 2) Crop is meant for storing food and present in the foregut region
 - 3) Gizzard / Proventriculus contains six chitinous plates called teeth help in grinding food.
 - 4) The entire foregut is not lined by cuticle
7. A ring of 6 - 8 blind tubules called hepatic caecae or gastric caecae is present at the junction of :
 - 1) foregut and midgut
 - 2) midgut and hindgut
 - 3) ileum and colon
 - 4) crop and gizzard

- 8.** In cockroach, the visceral organs are located in blood filled spaces known as :
- haemolymph
 - haemocoel
 - haemopoiesis
 - haemocyte
- 9.** Alary muscles are associated with :
- digestive system of cockroach
 - circulatory system of cockroach
 - excretory system of frog
 - circulatory system of Pheretima
- 10.** Select the correct sequence of organs in the alimentary canal of cockroach starting from the mouth :
- Pharynx → oesophagus → gizzard → crop → ileum → colon → rectum
 - Pharynx → oesophagus → crop → gizzard → ileum → colon → rectum
 - Pharynx → oesophagus → gizzard → ileum → crop → colon → rectum
 - Pharynx → oesophagus → ileum → crop → gizzard → colon → rectum
- 11.** In Periplaneta the ostium of heart chamber guides the flow of haemolymph from :
- haemocoel to heart
 - heart to haemocoel
 - one heart chamber to another
 - anterior chamber to posterior chamber
- 12.** Haemolymph of cockroach shows no haemoglobin because :
- it respires through book lungs
 - it shows cutaneous respiration
 - it shows branchial respiration
 - it has some other means to carry oxygen directly into the tissues
- 13.** Which of the following is the correct sequence of air passage in cockroaches?
- Spiracles in thorax → trachea → tracheoles → tissues
 - Spiracles → tracheoles → trachea → tissues
 - Trachea → spiracles → tracheoles → tissues
 - Tracheoles → trachea → spiracles → tissues
- 14.** In addition to Malpighian tubules, which of the following is / are helpful in excretion of cockroach?
- fat body
 - nephrocytes
 - uricose glands
 - all of the above
- 15.** Read the following statements about cockroach :
- If the head is cut off, it will still live for as long as one week.
 - Cockroach shows mosaic vision with more resolution, but less sensitivity
 - Thorax shows three ganglia and abdomen shows six
 - The brain is represented by supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.
 - Each compound eye contains 2000 ommatidia.
- Of the above statements :
- Only three are true
 - Only two are true
 - Only one is true
 - four are true

- 16.** Select the incorrect statement about cockroach :
- 1) A pair of testes seen on each lateral side in 4th - 6th abdominal segment of male cockroach.
 - 2) A pair of ovaries present laterally in the 2nd - 6th abdominal segments of female cockroach
 - 3) A mushroom shaped gland is present in the 6th - 7th abdominal segments of female cockroach
 - 4) Sperms are stored in the seminal vesicles
- 17.** Which of the following statement about spermatheca is true?
- 1) A pair of spermatheca is present in the 6th segment of male cockroach
 - 2) A pair of spermatheca present in female cockroach and used for storing spermatophores.
 - 3) Spermatheca is an accessory reproductive gland in male
 - 4) Spermatheca help in ootheca formation
- 18.** Select the incorrect statement :
- 1) Each ovary is formed of a group of eight ovarian tubules or ovarioles.
 - 2) On an average, a female cockroach produces 9-10 oothecae, each containing 14 - 16 eggs.
 - 3) The development of Periplaneta is paurometabolous
 - 4) The nymphs differ from the adult in many aspects
- 19. Assertion** : Cockroaches exhibit sexual dimorphism.
- Reason** : Male cockroaches show a pair of anal styles at the end of their abdomen.
- 1) Both Assertion and Reason are correct and R is the correct explanation of Assertion
 - 2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - 3) Assertion is correct but Reason is not correct
 - 4) Both Assertion and Reason are correct
- 20. Assertion** : Periplaneta americana shows internal fertilization.
- Reason** : During copulation, the male transfers spermatophores into the genital pouch of female.
- 1) Both Assertion and Reason are correct and R is the correct explanation of Assertion
 - 2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - 3) Assertion is correct but Reason is not correct
 - 4) Both Assertion and Reason are incorrect

MORPHOLOGY OF FROG

- 1.** Select the correct statement about Indian bull frog :
 - 1) Body of a frog is divisible into head, neck and trunk
 - 2) The scaly skin is slippery due to the presence of mucus
 - 3) The colour of dorsal and ventral sides of the body is generally olive green
 - 4) Frog never drinks water but absorbs it through the skin

- 2.** Which of the following characteristics is not found in Indian bull frog?
 - 1) Nictitating membrane
 - 2) Webbed hind limbs
 - 3) Pinna
 - 4) Sexual dimorphism

- 3.** Male frogs can be distinguished by the presence of :
 - 1) Sound producing vocal sacs and copulatory pad on the first digit of the forelimbs.
 - 2) Sound producing vocal sacs and copulatory pad on the first digit of the hind limbs
 - 3) Copulatory pads on the first digits of both forelimbs and hind limbs
 - 4) Bulged eyes and webbed hind limbs

- 4.** **Assertion** : Frog shows a short alimentary canal.
Reason : Nutritionally frog is a carnivore.
 - 1) Both Assertion and Reason are correct and R is the correct explanation of Assertion
 - 2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - 3) Both Assertion and Reason are incorrect
 - 4) Assertion is correct but Reason is incorrect

- 5.** In frogs cloaca is common chamber for the urinary tract, reproductive tract and :
 - 1) portal vein
 - 2) alimentary canal
 - 3) spinal canal
 - 4) copulatory organ

- 6.** Choose the correct statement about the digestive system of frog :
 - 1) oesophagus is very long
 - 2) food is captured by the bilobed and sticky tongue
 - 3) The alimentary canal is divided into oesophagus, intestine and rectum but lacks duodenum.
 - 4) Fully digested chyme is passed from stomach to intestine.

- 7.** Frog shows :
 - 1) Cutaneous respiration
 - 2) Pulmonary respiration
 - 3) Buccopharyngeal respiration
 - 4) All

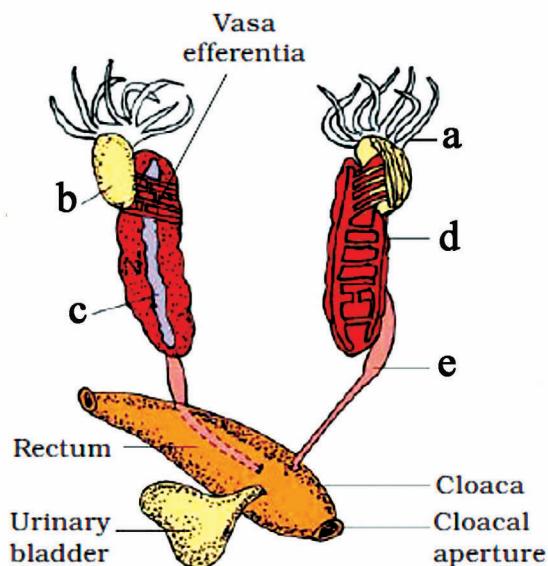
- 8.** During aestivation and hibernation, a frog shows :
 - 1) pulmonary respiration
 - 2) Cutaneous respiration
 - 3) Buccopharyngeal respiration
 - 4) Both 1 and 2

9. Select the incorrect statement about Rana tigrina :
- 1) It shows a double circulation pattern however the circulation is considered as incomplete double circulation.
 - 2) It shows two atria and one ventricle, sinus venosus and conus arteriosus
 - 3) The left atrium receives the oxygenated blood from sinus venosus.
 - 4) It shows both hepatic portal system and renal portal system
10. Renal portal system of frog starts from :
- 1) Kidneys
 - 2) Diaphragm
 - 3) Intestine
 - 4) Posterior parts of the body and capillaries of hind limbs
11. When a frog is transferred from 26°C to 30°C, its body temperature :
- 1) remains same
 - 2) changes to 30°C
 - 3) changes to 28°C
 - 4) may or may not change
12. Select the incorrect statement :
- 1) Adult frog is ureotelic
 - 2) Tadpole larva is ammonotelic
 - 3) Neural system and endocrine system are highly evolved in frog
 - 4) The prominent glands include hypothalamus, pituitary, thyroid, pineal body and salivary glands
13. Select the incorrect statement :
- 1) Frog shows central nervous system (CNS) peripheral nervous system (PNS) and autonomic nervous system (ANS)
 - 2) Brain is divided into forebrain, midbrain and hind brain
 - 3) Forebrain shows olfactory lobes, paired cerebral hemispheres and unpaired diencephalon
 - 4) A pair of optic lobes are present in forebrain
14. **Statement I** : Frog shows ten pairs of cranial nerves.
Statement II : Erythrocytes of frog are oval, biconvex and nucleated.
- 1) Both statements are true
 - 2) Statement I is true, whereas statement II is false
 - 3) Both Statements are false
 - 4) Statement I is false, whereas statement II is true
15. **Statement I** : Frog has different sense organs namely sensory papillae, taste buds, nasal epithelium, eyes and internal ears.
Statement II : The medulla oblongata passes out through the foramen of magnum and continues into spinal cord.
- 1) Both statements are true
 - 2) Statement I is true, whereas statement II is false
 - 3) Both Statements are false
 - 4) Statement I is false, whereas statement II is true
16. **Assertion** : Male frogs produce croaking sound during breeding season.
Reason : Croaking helps in attracting females and establishing territory.
- 1) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
 - 2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
 - 3) Both Assertion and Reason are false
 - 4) Assertion is true but Reason is false

17. Select the incorrect statement about frog:

- 1) Testes show a functional connection with kidneys
- 2) Ovaries show no functional connection with kidneys
- 3) Bidder's canal is present in the urino-genital system of female frog
- 4) A mature female frog can lay about 2500 - 3000 ova at a time.

18. Choose the correct combination of labelling from the options given below.



- 1) a - fat bodies, b - testis, c - adrenal gland, d - kidney, e - urinogenital duct.
- 2) a - testis, b - fat bodies, c - kidney, d - adrenal gland, e - urinogenital duct.
- 3) a - kidney, b - fat bodies, c - testis, d - adrenal gland, e - urinogenital duct.
- 4) a - adrenal gland, b - testis, c - kidney, d - urinogenital duct, e - fat bodies.

19. Match the columns suitably :

	Column I		Column II
i)	Camouflage	a)	capturing prey
ii)	Webbed feet	b)	leaping
iii)	bilobed, sticky tongue	c)	to hide from enemies
iv)	hind limbs	d)	aquatic adaptation
v)	Chyme	e)	partially digested food

1) i - c; ii - d; iii - a; iv - b; v - e

2) i - d; ii - a; iii - c; iv - b; v - e

3) i - e; ii - d; iii - a; iv - c; v - b

4) i - b; ii - e; iii - b; iv - c; v - a

QUESTIONS LEVEL - III

1. Which of the following statements is true for the tegmina of cockroach?

- 1) Known as mesothoracic wings and help in thermoregulation
- 2) Known as prothoracic wings and used for flight
- 3) Known as metathoracic wings and help in defence
- 4) Known as mesothoracic wings and meant for the protection of hindwings.

- 2.** Which of the following statements are applicable for cockroach?
- The number of ovarioles present in each ovary is eight.
 - Gizzard is not a part of hind gut.
 - Respiratory system of cockroach consists of eight pairs of spiracles.
 - Spermathecal pores receive spermato-phones during mating.
 - Ocellus is a light sensitive spot without image formation.
- 1) i, ii, iv only 2) i, ii, iii, iv only
3) i, iv, v only 4) i, ii, iv, v only
- 3.** Compare a frog and a fox and identify which of the following structures is absent in frog?
- cloaca
 - hepatic portal system
 - three chambered heart
 - diaphragm
- 4.** **Assertion** : In frogs the renal portal system brings blood from the hind limbs and pelvic region to the kidneys.
- Reason** : Renal portal system helps the kidneys to filter the blood from the lower parts of the body.
- 1) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- 2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- 3) Assertion is true but Reason is false
- 4) Both Assertion and Reason are false
- 5.** Webbed hind limbs in frog are an adaptation for :
- terrestrial mode of life
 - aquatic mode of life
 - arboreal mode of life
 - aerial mode of life

SYNOPSIS**Part – I**

- Cellular pool
- Major elements present in nonliving and living matter
- Inorganic components
- Organic components
- Biomolecules (Macro & Micro)
- Micromolecules :Eg; water, minerals, simple sugars, amino acids, nucleotides, fatty acids etc.
- Macromolecules :Eg; Polysaccharides, proteins and nucleic acids
- Chemical analysis of inorganic components (Ash test)
- Acid solubility test
- Average composition of cell
- Metabolites : (2 types)
 - ◆ Primary Metabolites
 - ◆ Secondary Metabolites

Part – II**Major Biomolecules**

- 1) Carbohydrates**
- 2) Lipids**
- 3) Proteins**
- 4) Nucleic Acids :- (DNA & RNA)**

- Enzymes : Biological catalysts
- Nature of enzyme action
- Factors affecting enzyme activity
- Enzyme inhibition (Competitive and Non-competitive)
- Classification and Nomenclature of enzymes
- Co-factors

QUESTIONS

LEVEL - I

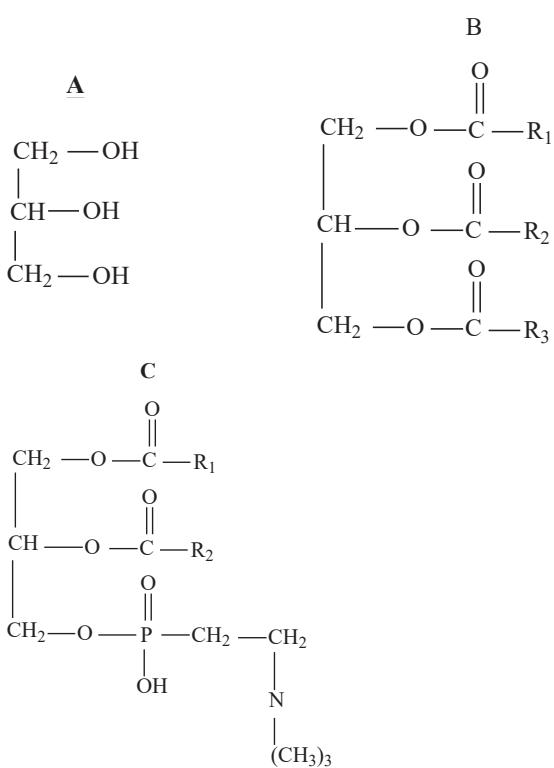
- 1.** The most abundant element on earth's crust and in human body, on the basis of percentage weight is :
- 1) Carbon 2) Nitrogen
3) Oxygen 4) Hydrogen
- 2.** The sum total composition of acid soluble and acid insoluble fractions, represent the :
- 1) Biomolecules
2) Inorganic molecules
3) Micromolecules
4) Cellular pool
- 3.** How many among the following are secondary metabolites?
 [Cholesterol, Cellulose, DNA, Fat, Alkaloids, Flavonoids, Spices, Rubber]
- 1) 7 2) 6
3) 5 4) 4
- 4.** Which of the following biomolecule has the molecular weight less than 1000 Da ?
- 1) Starch 2) Collagen
3) Lecithin 4) Chitin
- 5.** Animal cells store food, mainly in the form of:
- 1) Glucose 2) Starch
3) Glycogen 4) Maltose
- 6.** Find out the mis-matched pair from the following :
- 1) Fructose - Sweetest natural sugar
2) Sucrose - Reducing sugar
3) Inulin - Storage polysaccharide
4) Chitin - Structural polysaccharide
- 7.** In the aminoacid serine the R group is :
- 1) Methyl group
2) Carboxyl group
3) Amino group
4) Hydroxy methyl group
- 8.** Which one is a monoamino dicarboxylic amino acid?
- 1) Lysine
2) Arginine
3) Glutamic acid
4) Valine
- 9.** A long protein chain folded upon itself like a hollow woolen ball, giving rise to the :
- 1) Primary structure
2) Secondary structure
3) Tertiary structure
4) Quarternary structure
- 10.** Match the following proteins with their function and choose the correct option.
- | Column I | Column II |
|---------------|-----------------|
| a) Antibodies | i) Immunity |
| b) Trypsin | ii) Sensation |
| c) Rhodopsin | iii) Locomotion |
| d) Myosin | iv) Enzyme |
| e) GLUT-4 | v) Transport |
- 1) $\frac{a \ b \ c \ d \ e}{i \ iii \ ii \ v \ iv}$ 2) $\frac{a \ b \ c \ d \ e}{i \ iv \ ii \ iii \ v}$
 3) $\frac{a \ b \ c \ d \ e}{i \ v \ ii \ iv \ iii}$ 4) $\frac{a \ b \ c \ d \ e}{i \ ii \ iv \ iii \ v}$

- 11.** Arachidonic acid is a :
- Saturated fatty acid contains 20 carbons
 - Essential fatty acid contain 16 carbons
 - Common fatty acid contains 18 carbons
 - Unsaturated fatty acid contains 20 carbons
- 12.** Which of the following heterocyclic compound is a substituted purine?
- Guanine
 - Cytosine
 - Uracil
 - Thymine
- 13.** The pentose sugar, ribose is present in :
- RNA
 - ATP
 - DNA
 - Both 1 and 2
- 14.** Which of the following correctly represents the method of enzyme action?
- $E + S \rightarrow ES \rightarrow EP \rightarrow E + P$
 - $E + S \rightarrow ES \rightarrow EP \rightleftharpoons E + P$
 - $E + S \rightleftharpoons ES \rightarrow EP \rightarrow E + P$
 - $E + S \rightarrow ES \rightleftharpoons EP \rightarrow E + P$
- 15.** Which class of enzyme can catalyse the following type of reaction?
- $$\begin{array}{c} X \quad Y \\ | \quad | \\ C - C \rightarrow X - Y + C = C \end{array}$$
- Ligase
 - Lyase
 - Transferase
 - Isomerase

QUESTIONS**LEVEL - II**

- 1.** The most abundant chemical in living organisms is :
- Proteins
 - Nucleic acids
 - Minerals
 - Water
- 2.** Find out the incorrect statement from the following w.r.t the acid solubility test :
- The acid soluble pool represents the cytoplasmic composition.
 - Microbiomolecules and inorganic molecules are present in the filtrate.
 - Cell membrane fragments in the form of vesicles get separated along with the acid soluble pool.
 - Macromolecules from cytoplasm and organelles becomes the acid insoluble fraction
- 3.** Which of the following is correct about metabolites?
- Primary metabolites are present only in animal cells.
 - Some secondary metabolites are present in animal cells.
 - Secondary metabolites have direct role in growth and reproduction
 - The most abundant organic compound on earth is a secondary metabolite.
- 4.** The organic compound having polyhydroxy aldehydes or ketones is :
- Proteins
 - Carbohydrates
 - Lipids
 - Nucleic acids
- 5.** Which one of the following is not an aromatic amino acid?
- Tyrosine
 - Threonine
 - Tryptophan
 - Phenyl alanine

- 6.** Identify the following biomolecules A, B and C.



- 1) Triglyceride, glycerol, lecithin
 2) Lecithin, glycerol, triglyceride
 3) Triglyceride, lecithin, glycerol
 4) Glycerol, triglyceride, lecithin
- 7.** Which of the following biomolecules is correctly characterised?
- 1) Palmitic acid - Saturated fattyacid with 18 carbons
 2) Lactose - Milk sugar formed from glucose and fructose
 3) Alanine - Amino acid contains methyl group as 'R' group
 4) Adenylic acid - Adenosine with a glucose phosphate molecule

- 8.** The condensation bond forms between a phosphate group and hydroxyl group of sugar is :

- 1) Ester bond
- 2) N-glycosidic bond
- 3) Hydrogen bond
- 4) Peptide bond

- 9.** Match the following and choose the correct option.

Column I	Column II
a) Insulin	i) Substituted methane
b) Glycerol	ii) Catalytic nucleic acid
c) Glycine	iii) Heteropolymer of aminoacids
d) Ribozyme	iv) Trihydroxy propane

1) $\frac{\text{a b c d}}{\text{ii iii i iv}}$ 2) $\frac{\text{a b c d}}{\text{iii iv i ii}}$

3) $\frac{\text{a b c d}}{\text{ii i iv iii}}$ 4) $\frac{\text{a b c d}}{\text{iii ii iv i}}$

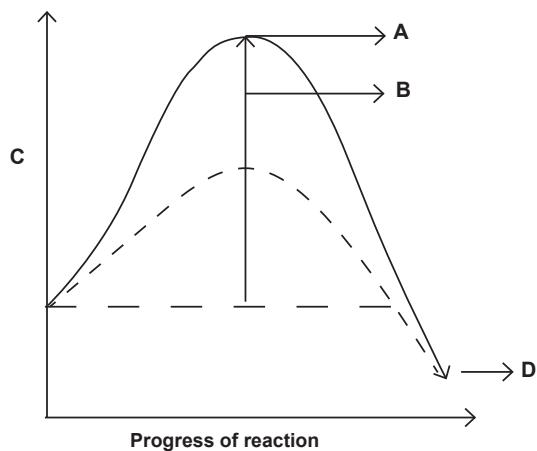
- 10.** Find out the incorrect statement about biomolecules from the following :

- 1) In polypeptide the right end represents the N-terminal amino acid
- 2) Unsaturated fatty acids have double bond between carbons
- 3) In glycogen the right end represents the reducing end.
- 4) In polynucleotide chain 5' end has free phosphate group.

11. Find out the incorrect statement about biochemical reactions :

- 1) The rate of reaction refers to the amount of product formed per unit time $\left(\frac{\delta p}{\delta t}\right)$
- 2) In the absence of an enzyme 200 molecules of H_2CO_3 being formed every second.
- 3) The rate of reaction doubles or decreases by half for every $10^\circ C$ change in either direction.
- 4) Carbonic anhydrase can accelerate the rate of H_2CO_3 formation by about 10 million times.

12. The given graph shows the conversion of substrate into product. Identify the components labelled as A, B, C and D.



	A	B	C	D
1)	Transition state	Potential energy	Activation energy	Product
2)	Transition state	Activation energy	Potential energy	Product
3)	Transition state	Activation energy	Potential energy	Substrate
4)	Transition state	Potential energy	Activation energy	Substrate

13. The co-factor for the proteolytic enzyme carboxypeptidase is :

- 1) Zinc
- 2) Haem
- 3) NAD
- 4) FAD

14. Statement I : Inorganic catalysts work efficiently at high temperature and high pressure.

Statement II : Enzymes isolated from thermophilic organisms lose their catalytic power after $60^\circ C$.

- 1) Both statements I and II are correct
- 2) Statements I is correct whereas II is incorrect
- 3) Statement I is incorrect whereas II is correct
- 4) Both the statements I and II are incorrect

15. Assertion (A) : After V_{max} the rise in concentration of the substrate cannot increase the velocity of enzyme.

Reason (R) : The free enzyme molecules cannot bind with additional substrate molecules.

- 1) If both A and R are true and R is the correct explanation of A.
- 2) If both A and R are true but R is not the correct explanation of A
- 3) Assertion is true but Reason is false
- 4) Both Assertion and Reason are false

QUESTIONS

LEVEL - III

1. Which of the following is the chemically modified sugar present in complex polysaccharides?
- Galactose amine
 - Acetyl glucosamine
 - Glucuronic acid
 - All of the above
2. **Statement I** : Proteins are polymers of same type monomers, which are substituted methanes.
Statement II : Cell membrane is made up of the bilayer of compound lipids, which have amphoteric nature.
- Both statements I and II are correct
 - Statements I is correct whereas II is incorrect
 - Statement I is incorrect whereas II is correct
 - Both the statements I and II are incorrect
3. How many different types of nucleotides and proteinaceous amino acids are present in living organisms ?
- 4 and 20
 - 4 and 19
 - 5 and 20
 - 5 and 19
4. **Assertion (A)** : An enzyme can convert the substrate into product within a short period.
- Reason (R)** : Enzyme increases the activation energy of the reaction, which increases the collision among the substrate molecules.
- If both A and R are true and R is the correct explanation of A.
 - If both A and R are true but R is not the correct explanation of A
 - Assertion is true but Reason is false
 - Both Assertion and Reason are false
5. Find out the correct statement about co-factors of enzymes :
- Any non-protein which are tightly bound to the apoenzyme is a prosthetic group
 - Haem is an inorganic activator in the enzyme catalase
 - Co-enzymes are inorganic compounds which are transiently bound to the apoenzyme
 - Zinc is the co-enzyme of the proteolytic enzyme carboxy peptidase.

SYNOPSIS

Introduction

Need for respiration

Anaerobic and aerobic respiration

Types of respiration :-

Cutaneous, Branchial, Pulmonary, Tracheal, Buccopharyngeal respiration. etc.

Human respiratory system

Structure :-

External nostrils

Nasal passage

Nasal cavity

Pharynx

Glottis, Adam's apple, Vocal cords

Trachea

Lungs:- Lobes, Pleura, Mediastinum, Cardiac notch, Bronchus, Bronchioles, Alveoli etc.

Mechanism of breathing

Inspiration and expiration

Role of diaphragm, intercostal muscles, abdominal muscles in breathing.

Respiratory volumes and capacities

TV, IRV, ERV, RV, IC, EC, FRC, VC, TLC

Pulmonary and alveolar ventilation rates.

Exchange of gases

Partial pressure of O₂ and CO₂

Diffusion membrane.

Transport of gases

Oxygen transport : - As oxyhaemoglobin. As dissolved form in plasma. Oxygen dissociation curve, role of Hb. Factors affecting O₂ transport.

CO₂ transport :- As carbonic acid, As carbaminohaemoglobin, As bicarbonates

Mention - Carbonic anhydrase.

Control of breathing : - Respiratory rhythm centre

 Pneumotaxic centre

Chemosensitive area in brain

Chemoreceptors in aortic arch and carotid artery

Lung disorders :-

Asthma

Emphysema

Occupational lung disorders - Silicosis, Asbestosis etc.

QUESTIONS LEVEL - I

- 1.** Which of the following animals use special vascularised structure called gills as respiratory organ?
 - 1) Aquatic arthropods, Aquatic insects and reptiles
 - 2) Aquatic molluscs, Reptiles and Sponges
 - 3) Aquatic arthropods, Amphibian tadpole and Molluscs
 - 4) Aquatic insects, Aquatic mammals and Molluscs

- 2.** How many statements are true about human respiratory system :
 - A) The branching network of trachea, bronchi, bronchioles and alveoli comprise the lungs.
 - B) Trachea is a straight tube extending upto mid-abdominal cavity
 - C) Larynx is bony box which helps in sound production
 - D) Epiglottis is an elastic cartilaginous flap that prevents the entry of food into the larynx.

1) 1	2) 2
3) 3	4) 4

- 3.** Read the following statements and find incorrect statements :
 - A) Human lungs are covered by single layered pleura, with pleural fluid between them.
 - B) The outer pleural membrane is in close contact with lung surface
 - C) Inner pleural membrane is in contact with the thoracic lining
 - D) The part starting with the external nostril upto the terminal bronchioles constitute the conducting part of respiratory system.

1) 1	2) 2
3) 3	4) 4

- 4.** What is the function of exchange part of human respiratory system?
 - 1) Clears inspired air from foreign particles
 - 2) Humidifies the air
 - 3) Brings the air to body temperature
 - 4) Site of actual diffusion of O₂ and CO₂ between blood and atmospheric air

- 5.** The lungs are situated in the A, it is formed dorsally by B, ventrally by the C, laterally by the D and on the lower side by the dome shaped E.

Identify A, B, C, D and E respectively.

 - 1) A → Abdominal cavity, B → Sternum, C → Vertebral column, D → Ribs, E → Diaphragm
 - 2) A → Thoracic chamber, B → Ribs, C → Sternum, D → Diaphragm, E → Vertebral column
 - 3) A → Thoracic chamber, B → Vertebral column, C → Ribs, D → Sternum, E → Diaphragm
 - 4) A → Thoracic chamber, B → Vertebral column, C → Sternum, D → Ribs, E → Diaphragm

- 6.** Contraction of external intercostal muscles :
 - 1) decreases the volume of the thoracic chamber in the antero-posterior axis
 - 2) decreases the volume of the thoracic chamber in the dorso-ventral axis
 - 3) increases the volume of the thoracic chamber in the antero-posterior axis
 - 4) increases the volume of the thoracic chamber in the dorso-ventral axis

- 7.** On an average, a healthy human breathes _____ times / minute.

1) 16 - 20	2) 12 - 16
3) 70 - 75	4) 20 - 25

- 8.** Match items given in column I with those in column II and select the correct options given below.

Column I	Column II
p) Tidal volume	i) 1200 ml
q) Residual volume	ii) 1600 ml
r) Vital capacity	iii) 500 ml
s) Expiratory capacity	iv) 4000 ml

- 1) p - i, q - ii, r - iii, s - iv
- 2) p - iii, q - i, r - ii, s - iv
- 3) p - iii, q - i, r - iv, s - ii
- 4) p - iii, q - ii, r - i, s - iv

- 9.** The volume of air that will remain in the lungs after a normal expiration can be represented as :

- 1) TV + IRV 2) TV + ERV
- 3) TLC - IC 4) TLC - RV

- 10.** Which of the following is a non-cellular layer found in diffusion membrane?

- 1) Squamous epithelium of alveoli
- 2) Basement membrane
- 3) Endothelium of alveolar blood capillary
- 4) All of the above

- 11.** Select the favourable conditions for the formation of oxyhaemoglobin?

- 1) Low PO₂, high CO₂, high temperature, higher H⁺ concentration
- 2) High PO₂, Low CO₂, high temperature, low H⁺ concentration
- 3) High PO₂, low CO₂, low temperature, high H⁺ concentration
- 4) High PO₂, low CO₂, low temperature, low H⁺ concentration

- 12.** Read the following statements carefully and choose the true statement.

- A) Total thickness of diffusion membrane is much less than a millimetre.
 - B) About 7 percent of CO₂ is carried in dissolved state through plasma and nearly 20 - 25 percent of CO₂ is transported by WBCs
 - C) Every 100ml deoxygenated blood can deliver around 4 ml of CO₂ to the alveoli under normal physiological conditions.
 - D) Blood plasma contains a very high concentration of carbonic anhydrase and minute quantities in the RBCs too.
 - E) In human blood, haemoglobin is a red coloured iron containing pigment present in the RBCs and O₂ binds with haemoglobin in a irreversible manner to form oxyhaemoglobin.
- 1) A and B
 - 2) A and C
 - 3) All except A
 - 4) A, C and E
- 13.** Find the true statement about the regulation of respiration in humans :
- 1) A chemosensitive area is associated with aortic arch and carotid artery
 - 2) Chemoreceptors are situated in Pons varolii.
 - 3) Neural signal from pnumotaxic centre can reduce the duration of inspiration and thereby alter the respiratory rate.
 - 4) The role of CO₂ in the regulation of respiratory rhythm is quite insignificant.

14. Statement I : Emphysema is a chronic disorder in which alveolar walls are damaged.

Statement II : Major cause of emphysema is inflammation of bronchi and bronchioles.

- 1) Both statements I and II are correct
- 2) Statements I is correct whereas II is incorrect
- 3) Statement I is incorrect whereas II is correct
- 4) Both the statements I and II are incorrect

15. Assertion (A) : Vital capacity is the maximum volume of air a person can breathe in after a forced expiration.

Reason (R) : Vital capacity includes RV, ERV, TV and IRV.

- 1) If both A and R are true and R is the correct explanation of A.
- 2) If both A and R are true but R is not the correct explanation of A
- 3) Assertion is true but Reason is false
- 4) Both Assertion and Reason are false

QUESTIONS LEVEL - II

1. Select the correct sequence from the following list.

Respiratory Organs	Types of respiration	Example
I. Skin	P) Branchial respiration	i) Mammals
II. Gills	Q) Pulmonary respiration	ii) Cockroach
III. Lungs	R) Cutaneous respiration	iii) Frog
IV. Tracheoles	S) Tracheal respiration	iv) Fish

- 1) I - R - iii, II - P - iv, III - Q - ii, IV - S - i
- 2) I - R - iii, II - Q - ii, III - P - i, IV - S - iv
- 3) I - P - i, II - Q - ii, III - R - iii, IV - S - iv
- 4) I - R - iii, II - P - iv, III - Q - i, IV - S - ii

2. Which of the following structures are supported by incomplete cartilaginous rings?
- a) Trachea
 - b) Primary bronchi
 - c) Secondary bronchi
 - d) Tertiary bronchi
 - e) Initial bronchioles
 - f) Terminal bronchioles
 - g) Duct of alveoli
 - h) Alveoli
- 1) a, b, c, d and e
 - 2) a, b, c, d, e and f
 - 3) a, b, c, d, e, f and g
 - 4) a, b, c, d, e, f, g and h

- 3.** Read the statements regarding human respiratory system.
- p) Alveoli are very thin, irregular walled and non vascularised bag like structures.
- q) Exchange part is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air
- r) The part starting with the external nostrils upto the terminal bronchioles constitute the conducting part of respiratory system.
- s) The lungs are situated in the thoracic chamber which is anatomically an air tight chamber.

Of the above statements

- 1) p is correct, q, r and s are incorrect
- 2) p and q are correct, r and s are incorrect
- 3) p is incorrect, q, r and s are correct
- 4) p, q, r and s are correct

- 4.** Select the correct events that occur during expiration :

- a) Contraction of diaphragm
 - b) Relaxation of diaphragm
 - c) Contraction of external intercostal muscle
 - d) Relaxation of external intercostal muscle
 - e) Pulmonary volume increase
 - f) Intrapulmonary pressure decrease
- | | |
|------------------|------------------|
| 1) a, c, d and e | 2) a, c, d and f |
| 3) b, d, and f | 4) b and d |

- 5.** Which of the following structures are involved in breathing movements :

- 1) Diaphragm
- 2) Ribs and sternum
- 3) External intercostal muscles
- 4) All of the above

- 6.** Find true statements from the following :

- A) We have the ability to increase the strength of inspiration and expiration with the help of additional muscles in the abdomen.
- B) The volume of air involved in breathing movements can be estimated by using spirometer.
- C) We can directly alter the pulmonary volume
- D) We cannot alter the volume of thoracic chamber

- 1) A and B
- 2) B and C
- 3) C and D
- 4) All of the above

- 7.** Match column I and II and choose the correct combination from the options given below.

Column I	Column II
a) IC	p) $ERV + RV$
b) EC	q) $TV + IRV$
c) FRC	r) $TV + ERV$
d) VC	s) $TV + IRV + ERV + RV$
e) TLC	t) $TV + IRV + ERV$

- 1) a - q, b - t, c - s, d - p, e - r
- 2) a - q, b - r, c - t, d - p, e - s
- 3) a - q, b - r, c - s, d - t, e - p
- 4) a - q, b - r, c - p, d - t, e - s

- 8.** What is the pO_2 and pCO_2 in the deoxygenated blood?
- pO_2 - 40 mmHg, pCO_2 - 95 mmHg
 - pO_2 - 95 mmHg, pCO_2 - 40 mmHg
 - pO_2 - 40 mmHg, pCO_2 - 45 mmHg
 - pO_2 - 40 mmHg, pCO_2 - 45 mmHg
- 9.** Which of the following factors affect the rate of diffusion :
- Pressure / concentration gradient
 - Solubility of gases
 - Thickness of diffusion membrane
 - All of the above
- 10.** A are the primary sites of exchange of gases. Exchange of gases takes by B. Identify A and B respectively :
- Alveoli and active transport
 - Tissues and osmosis
 - Alveoli and simple diffusion
 - Trachea and simple diffusion
- 11.** Respiratory rhythm centre of brain is stimulated by :
- Oxygen concentration in venous blood
 - Carbon dioxide concentration in venous blood
 - Oxygen concentration in arterial blood
 - Carbon dioxide and H^+ ions concentration in arterial blood
- 12. Statement I** : Every 100ml of oxygenated blood delivers approximately 5ml of O_2 to the tissues.
- Statement II** : When pCO_2 is high and pO_2 is low in the tissues, more binding of CO_2 with haemoglobin occurs.
- Both statements I and II are correct
 - Statements I is correct whereas II is incorrect
 - Statement I is incorrect whereas II is correct
 - Both the statements I and II are incorrect
- 13.** Conditions favourable for oxyhaemoglobin dissociation is :
- High pO_2 , low pCO_2 , lesser H^+ concentration and low temperature
 - High pO_2 , high pCO_2 , higher H^+ concentration and high temperature
 - Low pO_2 , high pCO_2 , higher H^+ concentration and high temperature
 - Low pO_2 , high pCO_2 , lesser H^+ concentration and low temperature

14. Assertion (A) : Penumotaxic centre present in the medulla region of brain can moderate the function of respiratory rhythm centre.

Reason (R) : Neural signal from penumotaxic centre can increase the duration of inspiration.

- 1) If both A and R are true and R is the correct explanation of A.
 - 2) If both A and R are true but R is not the correct explanation of A
 - 3) Assertion is true but Reason is false
 - 4) Both Assertion and Reason are false
- 15.** Find the correct match ?

- 1) Asthma - inflammation of alveoli
- 2) Emphysema - alveolar walls are damaged
- 3) Silicosis - inflammation of bronchi and bronchioles
- 4) Pneumonia - due to cigarette smoking

QUESTIONS LEVEL - III

- 1.** How many statements are **incorrect** about human respiratory system?
 - A) Larynx is a bony box which helps in sound production and participated in breathing movement.
 - B) The nasal chamber opens into the larynx, a portion of which is the common passage for food and air
 - C) Trachea divides at the level of 5th lumbar vertebra into a right and left primary bronchi.
 - D) The trachea, primary, secondary and tertiary bronchi and initial bronchioles are supported by complete cartilaginous rings

1) One 2) Two
 3) Three 4) Four
- 2.** Which of the following are the conditions for inspiration?
 - 1) intrapulmonary pressure is less than the atmospheric pressure
 - 2) There is a negative pressure in the lungs with respect to atmospheric pressure.
 - 3) Intrapulmonary pressure is higher than the atmospheric pressure.
 - 4) Both 1 and 2
- 3.** Match column I and II and choose the correct combination from the options given below.

Column I	Column II
a) IC	p) TLC - IC
b) EC	q) IC + FRC
c) FRC	r) TV + ERV
d) TLC	s) TLC - FRC

1) a - s, b - r, c - q, d - p
 2) a - r, b - s, c - q, d - p
 3) a - r, b - s, c - p, d - q
 4) a - s, b - r, c - p, d - q

- 4.** Read the following statements carefully and choose the true statements?
- Every 100ml of deoxygenated blood can deliver around 4ml of O_2 to the tissues.
 - In the alveoli, high pO_2 , low pCO_2 , lesser H^+ concentration and lower temperature are the factors favourable for the formation of oxyhaemoglobin.
 - Every 100ml of deoxygenated blood deliver 5ml of CO_2 to the alveoli
 - Solubility of CO_2 is 20 - 25 times higher than that of O_2
- 1) A and B 2) A and C
 3) B and C 4) B and D
- 5. Assertion (A)** : Asthma is a chronic disorder in which alveolar walls are damaged.
- Reason (R)** : The major causes of asthma is cigarette smoking, inflammation of trachea, bronchi, bronchioles and alveoli.
- If both A and R are true and R is the correct explanation of A.
 - If both A and R are true but R is not the correct explanation of A
 - Assertion is true but Reason is false
 - Both Assertion and Reason are false

SYNOPSIS

- Introduction
- Blood and Lymph
- Types of circulations in various phyla

eg : Water canal system (Poriferans)

Gastro vascular system (Coelenterates)

Water vascular system (Echinoderms)

Blood vascular system (vertebrates)

- **Human circulatory system.**

- **Blood** : Plasma, plasma proteins
 - : Formed elements (RBC, WBC and blood platelets)

- **Coagulation of blood**

- Serum

- **Blood groups**

: ABO grouping

: Rh grouping

- Erythroblastosis foetalis (Rh incompatibility)

- **Lymph** - formation, constituents and function

- Comparison of blood and lymph

- **Circulatory Pathways**

- Open type and Closed type circulations

- **Single circulation (fishes)**

- Incomplete double circulation (amphibians, reptiles)

- Complete double circulation (Crocodiles, Aves, mammals)

- **Human Heart :** Structure - Chambers of heart, blood vessels attached

- Nodal tissues - SA node, AV node, Bundle of His, Purkinje fibres

- Heart valves

- Function - Flow of blood through heart

- Cardiac cycle, Heart sounds (lub and dup)

- **Cardiac out put, stroke volume**

- **Double circulation** - Systemic, pulmonary and coronary circulations

- **Blood vessels** - arteries, veins and capillaries

- **Major blood vessels**

- **Histology of blood vessels**

- **ECG** : Cardiac cycle and cardiac functioning

- Regulation of cardiac activity

- Neural control, action of sympathetic and parasympathetic NS on heart beat

- Hormonal control of heart activity

- Disorders of circulatory system

- * BP, hypertension & hypotension

- * Atherosclerosis/CAD

- * Angina pectoris

- * Heart failure, heart attack, Cardiac arrest

QUESTIONS

LEVEL - I

- 1.** All the following are correct about circulation in animals , except
 - 1) Different groups of animals have evolved different methods of transport.
 - 2) Simple animals circulate water from their surroundings through their body cavities to facilitate exchange of materials.
 - 3) Blood is the most commonly used body fluids by most of the higher animals.
 - 4) Lymph is the commonly found body fluid in lower animals.

- 2.** Which one of the following is incorrect?
 - 1) Blood = plasma, erythrocytes, leucocytes & thrombocytes
 - 2) Plasma = blood without formed elements
 - 3) Plasma proteins = albumins, globulins & haemoglobin
 - 4) Serum = plasma without clotting factors

- 3.** Find out the incorrect matches
 - a. Plasma - straw coloured fluid matrix of blood
 - b. Plasma proteins - 6 to 8 % of plasma
 - c. Formed elements - 55 % of blood
 - d. Globulins & albumins - defense mechanism
 - e. Fibrinogen and prothrombin - active clotting factors
 - 1) a, b & c
 - 2) b, c & d
 - 3) c, d & e
 - 4) b, d & e

- 4.** Which among the following formed elements are produced by megakaryocytes?
 - 1) Erythrocytes
 - 2) Thrombocytes
 - 3) Neutrophils
 - 4) Basophils

- 5.** Select the correct match regarding various leucocytes

	Blood cells	Per-cent-age	Function
1)		20-25	Cell mediated immunity
2)		6 - 8	Phagocytosis
3)		60-65	Humoral immunity
4)		0.5 - 1.0	Inflammatory response

- 6.** Which of the following statements is correct?
 - 1) Blood group is named on the presence/ absence of antibodies in RBCs
 - 2) 'O' blood group can accept blood from any group under ABO system
 - 3) AB blood group is devoid of both antigens
 - 4) Majority of human RBCs have Rh antigen

- 7.** How many of the following are true about erythroblastosis foetalis?
- It is a special Rh incompatibility between Rh-ve foetus and an Rh+ve mother
 - Foetal Rh antigens can easily cross placenta
 - Rh+ve blood from the foetus enter maternal blood during delivery
 - It causes severe anaemia and jaundice
 - Anti-Rh antibody injection to the mother just after first delivery is its prevention
- 1) one 2) two
 3) three 4) four
- 8.** Read the statements about lymphatic system and choose the wrong one
- Most of the formed elements and larger proteins are absent in lymph
 - It has the same mineral distribution as that of blood plasma
 - Lymphatics collect tissue fluid and drains it back to the major arteries.
 - Fats are absorbed through lacteals in the intestinal villi
- 9.** Find out the incorrect match
- Open circulation -Arthropods & Molluscs
 - Closed circulation -Annelids & Chordates
 - Single circulation - Pisces
 - Incomplete double circulation - Birds & Reptiles
- 10.** Select the correct option about the septa and valves of human heart?
- Inter-atrial septum – thick and muscular
 - Atrio-ventricular septum – thin and muscular
 - Inter-ventricular septum – thin and fibrous
 - Atrio-ventricular valves - muscular flaps
- 11.** Find the option showing correct sequence of the given events in cardiac cycle ?
- SA node activation.
 - Dup sound
 - Flow of blood into great arteries.
 - Systolic sound
 - Atrial systole.
 - Atrial depolarisation
- 1) 1 - 6 - 2 - 3 - 5 - 4
 2) 1 - 6 - 5 - 4 - 3 - 2
 3) 1 - 6 - 5 - 2 - 4 - 3
 4) 1 - 6 - 2 - 3 - 4 - 5
- 12.** The given diagram shows various events in cardiac cycle
- CARDIC CYCLE**
-
- AS = Atrial Systole
 VS = Ventricular Systole
 AD = Atrial Diastole
 VD = Ventricular Diastole
- Which of these events coincide with ventricular systole?
- Joint diastole
 - Ventricular diastole
 - Atrial diastole
 - Atrial systole
- 13.** An incorrect statement regarding auto excitable tissues of the heart is
- Normal cardiac activity is regulated intrinsically by nodal tissues
 - SAN is the natural pacemaker of the heart
 - AVN is situated in the right atrium near the AV septum.
 - Purkinje fibres continue from AVN passes through AV septum divides into left and right bundles.

- 14.** All the following are correct about ventricular systole, except
- Closure of atrio ventricular valves
 - Opening of aortic valve and pulmonary valve
 - Increases the flow of blood into the ventricles by about 30%
 - Each ventricle pumps out about 70 ml of blood
- 15.** Select the incorrect representation regarding human circulation
- LV $\xrightarrow{\text{Arterial system}}$ Tissues $\xrightarrow{\text{Venous system}}$ RA
 - RV $\xrightarrow{\text{Pulmonary artery}}$ Lungs $\xrightarrow{\text{Pulmonary veins}}$ RA
 - LV $\xrightarrow{\text{Coronary arteries}}$ heart wall $\xrightarrow{\text{Coronary veins}}$ RA
 - Digestive tract $\xrightarrow{\text{Hepatic portal vein}}$ Heart
- 16.** How many of them are true about a standard ECG
- P wave - electrical excitation of atria
 - QRS complex - initiates ventricular contraction
 - T wave - return of atria from excited to normal state
 - End of T wave - End of ventricular systole
- one
 - two
 - three
 - four
- 17.** Which is false about the histology of arteries and veins?
- Tunica externa - fibrous connective tissue with collagen fibres.
 - Tunica adventitia - smooth muscles and collagen fibres.
 - Tunica media - smooth muscles and elastic fibres
 - Tunica intima - squamous endothelium
- 18.** 'Cardiac activity could be moderated by the autonomous neural system'. Identify the correct one regarding this control
- The sympathetic system increases ventricular contraction but decreases stroke volume
 - The sympathetic neural signals stimulates heart rate and cardiac output
 - The parasympathetic system decreases the heart rate and but increases stroke volume
 - The parasympathetic system stimulates heart rate and stroke volume
- 19.** Which of the following are correct with respect to blood pressure?
- 90 over 60 mmHg or lower - hypotension
 - 190 over 110 mmHg - affects vital organs like brain and kidney
 - 140 over 90 mmHg or higher - hypertension
 - 120 over 80 mmHg - ideal blood pressure
- a,c & d
 - a,b & d
 - a,b & c
 - a,b,c & d
- 20.** The state of heart when it is not pumping enough blood to meet the needs of the body is
- Atherosclerosis
 - Angina pectoris
 - Congestive heart failure
 - Coronary artery disease

QUESTIONS

LEVEL - II

- 1.** How many of the following statements are true?
 - a) Monocytes are the largest granulocytes
 - b) Neutrophils are the most abundant blood cells
 - c) Basophils are the least among the formed elements
 - d) Neutrophils and monocytes are wandering granulocytes
 - e) Eosinophils and basophils are agranulocytes
 - 1) one
 - 2) two
 - 3) three
 - 4) four

- 2.** Select the correctly matching option regarding formed elements and their features.

	Formed Elements	Characters	
1)	Neutrophils and monocytes	a)	Agranulocytes
2)	Lymphocytes and monocytes	b)	Allergic reactions
3)	Erythrocytes and thrombocytes	c)	Phagocytic cells
4)	Basophils and Eosinophils	d)	Blood cells without nucleus

- 1) $\frac{1234}{cabd}$
- 2) $\frac{1234}{cadb}$

- 3) $\frac{1234}{dacb}$
- 4) $\frac{1234}{bcad}$

- 3.** In a blood group testing, the blood agglutinated with Anti A and Anti Rh but not with Anti B. The blood group is :
 - 1) A positive
 - 2) B negative
 - 3) AB negative
 - 4) AB positive

- 4.** For Safe blood transfusion
 - 1) Donor's RBC should not contain antibodies against recipient's serum
 - 2) Recipient's serum should not contain antigens against donor's antibodies
 - 3) Recipient's serum should not contain antibodies against donor's antigen
 - 4) Recipient's RBC should not contain antibodies against donor's antigen

- 5.** What is the recommended method to prevent Rh sensitization in an Rh-ve mother carrying an Rh+ve foetus?
 - 1) Inject anti-Rh to the mother before conception
 - 2) Inject anti-Rh to the baby after birth
 - 3) Inject anti-Rh to the mother after the delivery of the baby
 - 4) Inject anti-Rh to the mother after the delivery of second baby

- 6.** Match items in column I and II and select the correct option.

	Column I		Column II
a)	Bicuspid valve	p)	At the mouth of great arteries
b)	Tricuspid valve	q)	Between left atrium and left ventricle
c)	Semilunar valves	r)	Between right atrium and right ventricle
d)	SA node	s)	Left lower corner of right atrium
e)	AV node	t)	Right upper corner of right atrium

	a	b	c	d	e
1)	q	r	p	s	t
2)	q	r	p	t	s
3)	p	r	q	t	s
4)	r	q	p	s	t

- 7.** If there is some damage to the chordae tendinae of AV valves, the immediate effect would be
- the backflow of blood from aorta to the ventricles
 - the backflow of blood from ventricles to the atria
 - the reduced flow of blood from atria to the ventricles
 - the reduced flow of blood from vena cavae to the atrium
- 8.** If a person's heart beats 80 times/minute and their cardiac output is 6 litres, then the volume pumped out by each ventricle per beat is approximately is
- 70 ml
 - 72 ml
 - 75 ml
 - 80 ml

- 9.** Systemic artery differs from systemic vein in having

- endothelium
- valves
- narrow lumen
- thin muscular walls

- 10.** How do parasympathetic neural signals affect the working of the heart?

- Heart rate decreases but cardiac output increases.
- Heart rate is increased without affecting the cardiac output.
- Both heart rate and cardiac output increases
- Reduces both heart rate and cardiac output.

Assertion(A) Reason(R) Type Questions

- If both A and R are true and R is the correct explanation of A
- If both A and R are true but R is not correct explanation of A
- If A is true but R is false
- If both A and R are false

- 11. Assertion** : Before blood transfusion, the blood of a donor has to be carefully matched with the blood of a recipient.

Reason : The donor's compatibility is required to avoid severe problems of clumping.

- 12. Assertion** : Human body has the ability to alter the stroke volume as well as the heart rate and thereby the cardiac output.

Reason : A special centre in the medulla oblongata can moderate the cardiac function through ANS.

13. Assertion : ECGs obtained from different individuals have roughly the same shape for a given lead configuration.

Reason : For a detailed evaluation of cardiac activity, multiple leads are attached to the chest region.

Statement type questions

- 1) Statement I is true, but statement II is false
- 2) Statement II is true, but statement I is false
- 3) Both statements are true.
- 4) Both statements are false.

14. Statement I : Trauma stimulates the platelets to release certain factors which activate the mechanism of clotting.

Statement II : Certain factors released by the tissues at the time of injury also can initiate coagulation.

15. Statement I : For normal cardiac activity, the nodal musculature has the ability to generate action potentials in response to external stimuli.

Statement II : The number of action potentials generated in a minute is same by different parts of the nodal system.

QUESTIONS LEVEL - III

1. People with blood group AB are considered universal recipients because they have
 - 1) both antigens and antibodies on the surface of RBCs
 - 2) both A and B antigens in the plasma but no antibodies.
 - 3) both A and B antigens on RBC but no A and B antibodies in the plasma
 - 4) both antigens and antibodies in the plasma.
2. Which one of the following statement is correct regarding the principle of safe blood transfusion ?
 - 1) Recipient's serum should not contain antigens against the donor's antibody
 - 2) Donor's RBCs should not contain antibodies against the recipient serum
 - 3) Recipient's RBC should not contain antibodies against the donor's RBC
 - 4) Recipient's serum should not contain antibody against donor's antigen on RBC
3. What will be the immediate effect if the chordae tendinae of the mitral valve of the human heart is partially non-functional ?
 - 1) The flow of blood into the pulmonary artery will be reduced
 - 2) The flow of blood into the pulmonary vein will be reduced
 - 3) The blood will tend to flow back into the right atrium
 - 4) The flow of blood into the aorta will be slowed down

4. All the components of the conducting system can generate an action potentials but the sino-atrial node acts as the pacemaker because
- 1) the SA node has a lower rate of depolarization
 - 2) the SAN is innervated by sympathetic nerves
 - 3) only the sino-atrial node is auto-excitatory
 - 4) the sino-atrial node has a highest rate of depolarization
5. Which of the following is incorrect about cardiac activity ?
- 1) The ventricular filling is not only due to atrial systole but also due to joint diastole
 - 2) Major part of the ventricular filling occurs during atrial systole
 - 3) Atrial systole and ventricular systole never overlap
 - 4) Atrial diastole and ventricular diastole overlap partially

SYNOPSIS

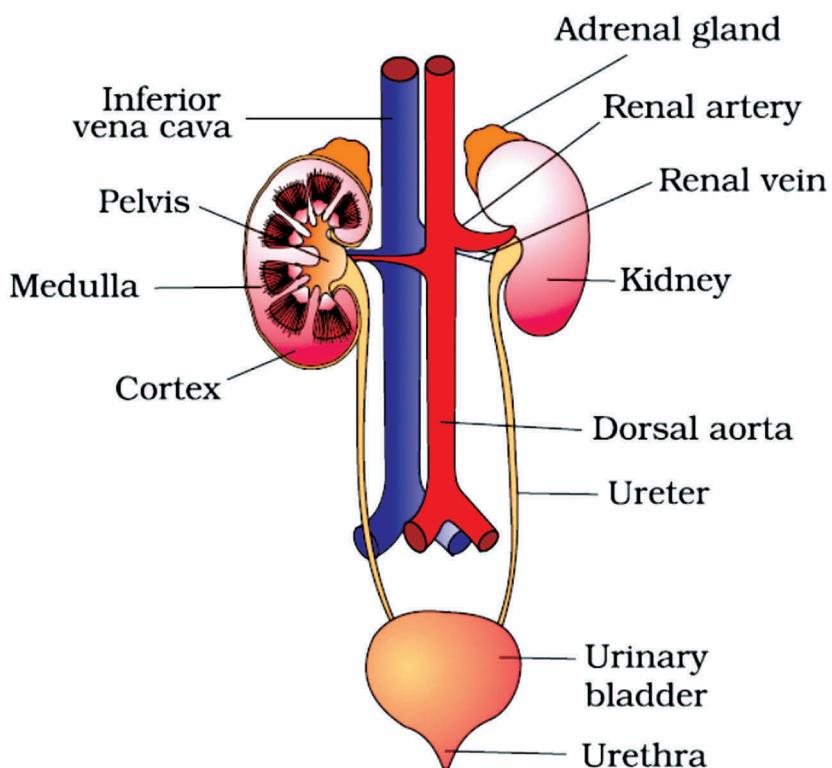
1) Excretion

- Ammonotelism - Aquatic invertebrates, Bony fishes.....
- Uricotelism - Insects, Land snails, Land Reptiles, Birds.....
- Ureotelism - Cartilaginous fishes, terrestrial amphibians, mammals.....

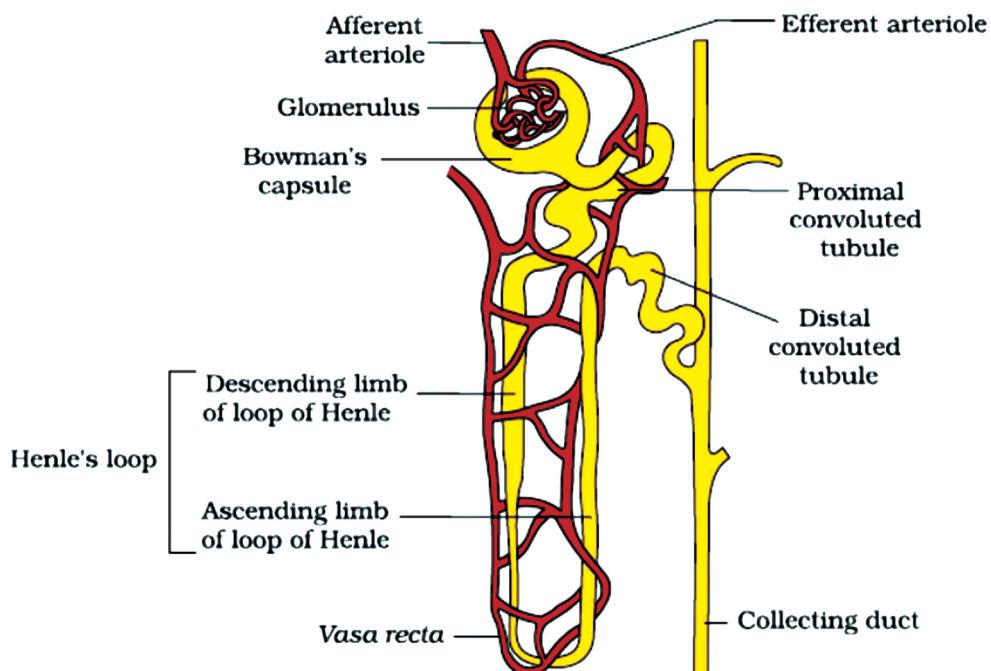
2) Different types of excretory organs in animals

3) Human excretory system

1. Structure of human kidney



2. Nephron



4) Urine formation

1. Glomerular filtration
2. Tubular reabsorption
3. Tubular secretion

5) Functions of renal tubule

1. PCT
2. Henle's Loop
3. DCT
4. Collecting duct

6) Mechanism of concentration of the filtrate

7) Regulation of Kidney functions

1. ADH
2. RAAS
3. ANF

8) Micturition

9) Abnormal constituents of urine

10) Accessory excretory organs

1. Skin
2. Liver
3. Lungs

11) Disorders

1. Uremia
2. Renal Calculi
3. Glomerulonephritis

12) Haemodialysis

QUESTIONS**LEVEL - I**

- 1.** The primary function of excretion is to eliminate
 - 1) Excess nutrients
 - 2) Metabolic wastes
 - 3) Hormones
 - 4) Digestive enzymes

- 2.** Which of the following is the most toxic nitrogenous waste
 - 1) Urea
 - 2) Ammonia
 - 3) Aminoacid
 - 4) Uric acid

- 3.** Find the incorrect match:

1)	Tadpole	Ammonotelic
2)	Frog	Ureotelic
3)	Aquatic insect	Uricotelic
4)	Reptiles	Uricotelic

- 4.** How many of the following chordates have flame cell as excretory organ
 - A. Planaria
 - B. Ascaris
 - C. Amphioxus
 - D. Tapeworm
 - E. Nereis
 - 1) 2
 - 2) 4
 - 3) 1
 - 4) 3

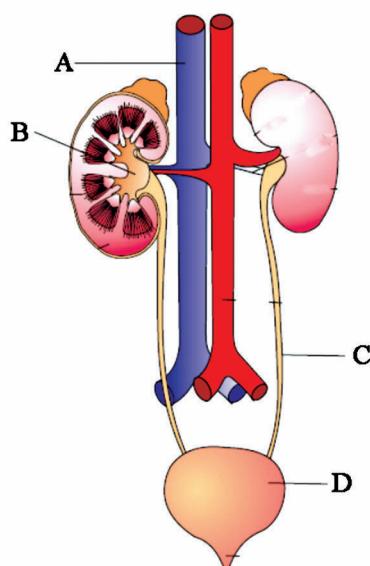
- 5.** The Proximal Convoluted Tubules of the kidneys are found in
 - 1) Renal Pelvis
 - 2) Renal Cortex
 - 3) Renal Medulla
 - 4) Renal Capsule

- 6.** Which part of kidney acts as gateway for ureter, nerves and blood vessels
 - 1) Medullary pyramid
 - 2) Calyces
 - 3) Hilum
 - 4) Renal pelvis

- 7.** Which of the following is not true about Bowman's capsule
 - 1) Double walled cup like structure
 - 2) Glomerulus along with Bowman's capsule is called Malpighian corpuscle
 - 3) Glomerulus encloses Bowman's capsule
 - 4) Podocytes are the epithelial cells of Bowman's capsule

- 8.** How many of the following statements are TRUE about Cortical Nephrons
 - A. They are about 85% of total nephrons
 - B. The loop of Henle is too short and extends only very little into the medulla
 - C. They are small in size
 - D. Vasa recta is absent or highly reduced
 - 1) 2
 - 2) 3
 - 3) 4
 - 4) 1

9. Consider the diagram given below and choose the correct option with respect to parts labelled A, B, C, and D



1) A- Inferior Venacava, C- Renal Artery

2) B- Calyces, D- Urinary Bladder

3) C- Renal Artery, D- Urinary Bladder

4) A- Inferior Venacava, B- Renal pelvis

10. Read the statements given below

- A. Reabsorption in this region is minimum
- B. This region plays a significant role in the maintenance of high osmolarity of medullary interstitial fluid
- C. Hairpin shaped portion of renal tubule
- D. Filtrate is hypertonic first and then become hypotonic

The above characters are associated with

- 1) Proximal Convolute Tubule
- 2) Henle's loop
- 3) Distal Convolute Tubule
- 4) Collecting Duct

11. **Assertion** : Glomerular filtration is considered as a process of ultra filtration.

Reason : Almost all the constituents of the plasma except the proteins pass onto the lumen of the Bowman's capsule

1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) If Assertion is true but Reason is false.

4) If both Assertion and Reason are false.

12. Find out the incorrect statement

1) Henle's loop and vasa recta maintain an increasing osmolarity towards the inner medullary interstitium

2) Osmolarity of the inner medullary interstitium is 300 mOsmolL^{-1}

3) Osmolarity of filtrate increases while moving down the descending limb of Henle's loop

4) Human kidneys can produce urine nearly four times concentrated than the initial filtrate

13. In response to decrease in blood volume and blood pressure which of the following do not occur

- 1) Secretion of Renin
- 2) Secretion of Aldosterone
- 3) Secretion of ADH
- 4) Secretion of ANF

- 14.** A fall in GFR can activate A to release B
Find A & B

	A	B
1)	Adenohypophysis	ADH
2)	Neurohypophysis	Aldosterone
3)	Heart	ANF
4)	JGA	Renin

- 15.** Read the following statement and choose the correct statements

- I. An adult human excretes, on an average, 1 to 1.5 mL of urine per day
 - II. On an average, 25-30 gm of urea is excreted out per day
 - III. Presence of glucose in urine is called Glycosuria and ketone bodies is called Ketonuria
 - IV. Glycosuria and Ketonuria are not indicative of diabetes mellitus
- 1) I and III alone are correct
2) II and IV alone are correct
3) III and IV alone are correct
4) II and III alone are correct

QUESTIONS LEVEL - II

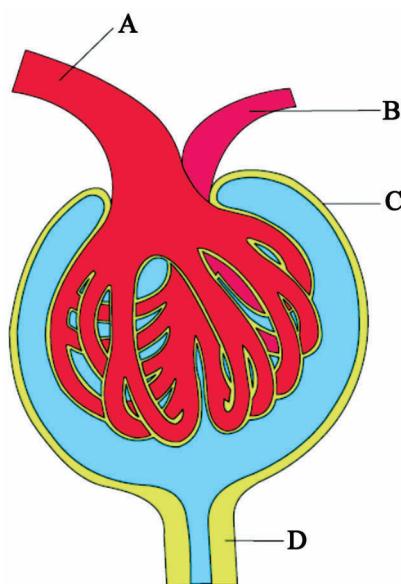
- 1.** How many statements are true
- I. Mammals are primarily Uricotelic
 - II. Ammonia is readily soluble in water
 - III. Urea is less toxic than ammonia
 - IV. Uric acid excreted in the form of pellet or paste
- 1) All 2) Three
3) Two 4) One

- 2. Assertion** : Uricotelism is terrestrial adaptation

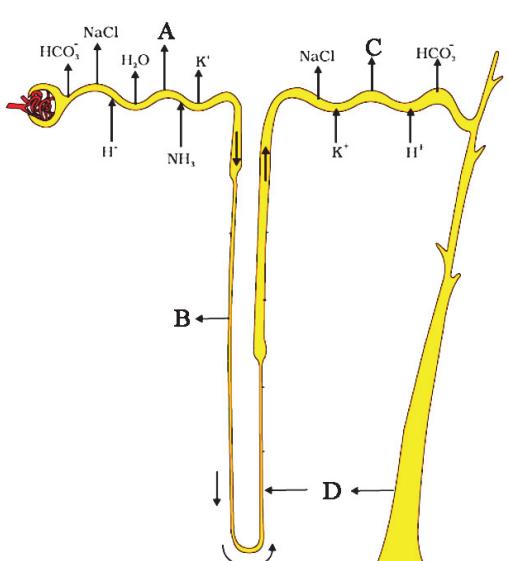
Reason : Uric acid is least toxic, can be removed with a minimum loss of water.

- 1) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- 2) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- 3) If Assertion is true but Reason is false.
- 4) If both Assertion and Reason are false.

- 3.** Identify the labelled parts A to D and select the correct option



- 1) A - Efferent arteriole - which is broader than afferent arteriole
- 2) B - Afferent arteriole - a fine branch of renal artery
- 3) C - Bowmans capsule - single layered cup like structure
- 4) D - PCT - lined by simple cuboidal brush border epithelium

- 4. Statement I :** The medullary zone of kidney is divided into a few conical masses called medullary pyramids projecting into the calyces
- Statement II :** The cortex extends in between the medullary pyramids as renal pelvis
- 1) Both statement I & II are correct
 2) Both statement I & II are incorrect
 3) Statement I is correct, but statement II is incorrect
 4) Statement I is incorrect , but statement II is correct
- 5. Identify A,B,C,D**
- 
- | | A | B | C | D |
|----|------------------|------------------|-------|-----------|
| 1) | Nutrients | Water | Water | Urea |
| 2) | Bicarbon-
ate | Urea | Water | Water |
| 3) | Water | Bicarbon-
ate | Urea | NaCl |
| 4) | Urea | NaCl | Water | Nutrients |
- 6. How many statements are false**
- About 1100-1200 L of blood is filtered by the kidneys per minute
 - The amount of the filtrate formed by the kidneys per minute is called glomerular filtration rate (GFR).
 - GFR in a healthy individual is approximately 180 litres per minute
 - Nearly 99 per cent of the filtrate has to be reabsorbed by the renal tubules
 - JGA is formed by the distal convoluted tubule and the efferent arteriole
- 1) Four 2) Three
 3) Two 4) All
- 7. Comparing the osmolarity of blood and filtrate, filtrate in the**
- PCT is hypertonic
 - Glomerular filtrate is hypertonic
 - Henle's loop is isotonic
 - DCT is hypotonic
- 8. Counter current mechanism helps to maintain a concentration gradient. This gradient help in**
- Inhibition of passage of water between collecting tube and medulla
 - Passage of water from medulla to collecting tube
 - Passage of water from interstitial fluid to collecting tube
 - Passage of water from collecting tube to interstitial fluid

- 9.** A marathon runner completes a long race and is mildly dehydrated . Which of the following changes would you expect to see in their nephrons compared to before the race
- Decreased permeability of the collecting duct to water
 - Decreased sodium reabsorption in the collecting duct
 - Increased water reabsorption in the collecting duct due to higher ADH level
 - Decreased secretion of aldosterone from the adrenal medulla
- 10.** Which of the following is the correct sequence of events in the reabsorption of sodium
- Aldosterone is released
 - Kidney tubules reabsorb sodium
 - Renin is released
 - JGA recognizes a drop in GFR
 - Angiotensin II is produced
- IV,III,V,I,II
 - I,II,III,IV,V
 - III,II,IV,V,I
 - V,IV,III,II,I
- 11. Assertion :** ANF is released by wall of atria of heart.
- Reason :** ANF is a vasodilator.
- If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
 - If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
 - If Assertion is true but Reason is false.
 - If both Assertion and Reason are false

- 12.** Choose the correct statement
- The process of release of urine is called micturition and the hormonal mechanisms causing it is called the micturition reflex
 - The osmoreceptors on the walls of the bladder send signals to the CNS
 - The relaxation of smooth muscles of the bladder and simultaneous contraction of the urethral sphincter causing the release of urine
 - The urine is a light yellow coloured watery fluid which is slightly acidic
- 13.** Which of the following is not a constituent of sweat
- NaCl
 - Urea
 - Lactic acid
 - Uric acid
- 14.** Find the mismatch
- Renal calculi : Precipitation of oxalate stones within the kidney.
 - Uremia : Presence of uric acid in joints
 - Glomerulonephritis : Inflammation of glomeruli of kidney
 - Glycosuria : presence of glucose in urine
- 15.** The outline of main events during haemodialysis is given below in a random manner. Arrange them in the correct sequence
- Blood drained from a convenient artery and anticoagulant is added
 - Removal of nitrogen waste from blood
 - Blood passed through a porous cellophane membrane of the tube
 - Blood mixed with anti-heparin and passed to vein
- I,II,II,IV
 - I,III,II,IV
 - IV,II,I,III
 - II,III,I,IV

QUESTIONS

LEVEL - III

1. If the vasa recta were non-functional, how would it affect the kidney's ability to concentrate urine

 - 1) The kidney would be able to produce more concentrated urine.
 - 2) The kidney would be able to produce less concentrated urine.
 - 3) There would be no change in the kidney's ability to concentrate urine.
 - 4) The kidney would only be able to produce hypertonic urine.
2. If the efferent arteriole constricts, what direct effect will this have on glomerular capillary pressure and GFR?

 - 1) Both glomerular capillary pressure and GFR will increase.
 - 2) Both glomerular capillary pressure and GFR will decrease.
 - 3) Glomerular capillary pressure will increase and GFR will decrease.
 - 4) Glomerular capillary pressure will decrease and GFR will increase.
3. A person is given a medication that inhibits the release of ADH. What would be the likely effect on their urine output and composition?

 - 1) Increased urine output, increased concentration
 - 2) Increased urine output, decreased concentration
 - 3) Decreased urine output, increased concentration
 - 4) Decreased urine output, decreased concentration
4. A person is experiencing a condition that causes a decrease in the number of podocytes in Bowman's capsule. What is the likely consequence?

 - 1) Increased glomerular filtration rate (GFR)
 - 2) Decreased glomerular filtration rate (GFR)
 - 3) No change in glomerular filtration rate (GFR)
 - 4) Increased reabsorption in the loop of Henle
5. Which of the following scenarios would result in the activation of the renin-angiotensin mechanism?

 - 1) Increased blood pressure
 - 2) Increased glomerular filtration rate (GFR)
 - 3) Decreased blood volume
 - 4) Increased sodium reabsorption

SYNOPSIS

Introduction

- Comparison and examples of 'locomotion' and 'movement'.

Types of movements

- Amoeboid, Ciliary, Flagellar, Tentacular and Muscular movements with examples.

Muscular system

- Properties of muscles

Types of muscles

- Comparison of Skeletal, Visceral and Cardiac muscles

Structure of skeletal muscle

- Fascicle, Fascia, Muscle fibre, Sarcolemma, Sarcoplasm, Sarcosome, Sarcoplasmic Reticulum [SR], Myofibril, Myofilaments, Sarcomere

Structure of Sarcomere

- A-band, I-band, H-zone, Z-line, M-line etc.

Structure of Contractile proteins

- Actin - F-actin, Tropomyosin, Troponin
- Myosin - Meromyosin, LMM, HMM

Muscle Contraction

- Sliding filament theory
 - Motor unit, Neuro Muscular Junction, [Motor end plate], Neurotransmitter - Acetyl choline, sarcoplasmic cisternae
- Major events in muscle contraction

Types of skeletal muscle

- Comparison of Red muscle fibre and White muscle fibre

SKELETAL SYSTEM - Consists of bones and few cartilages

Axial skeleton - 80 Bones

- Skull--- cranium, facial bones, hyoid, ear ossicles
- Vertebral column---cervical, thoracic, lumbar, sacrum, coccyx
- Sternum / Breast bone
- Ribs - true ribs, false ribs, floating ribs

Appendicular skeleton - 126 bones

- Limb bones** ($4 \times 30 = 120$)

Forelimb bones - Humerus, Radius, Ulna, Carpals, Metacarpals, phalanges

Hindlimb bones - Femur, Tibia, Fibula, Patella, Tarsals, Metatarsals, Phalanges

- Girdle bones** - pectoral & pelvic bones

Pectoral girdle - Scapula/shoulder blade, spine, acromion process, glenoid cavity, clavicle / collar bone

Pelvic girdle - Coxal bone, ilium, ischium, pubis, pubic symphysis, acetabulum

JOINTS - points of contact between bones, or between bones & cartilage

- Fibrous joint** - immovable joint or fixed joints. eg:- cranial joint
- Cartilaginous joint** - slightly movable joint eg:-intervertebral joints, pubic symphysis
- Synovial joints** - freely movable joints
 - (i) Ball & socket joint - shoulder joint, hip joint
 - (ii) Hinge joint - elbow joint, knee joint, inter phalangial joints.
 - (iii) Pivot joint - atlas-axis joint
 - (iv) Gliding joint - intercarpal joint and intertarsal joint
 - (v) Saddle joint - carpo-metacarpal joint of thumb

DISORDERS

- (i) Myasthenia gravis - Autoimmune disorder
- (ii) Muscular dystrophy - genetic disorder
- (iii) Tetany - Rapid spasm of muscle
- (iv) Osteoporosis - Calcium depletion [Demineralisation]
- (v) Arthritis----- (a) Osteo arthritis (b) Gouty arthritis (c) Rheumatoid arthritis

QUESTIONS**LEVEL - I**

1. Find out the **wrong** one regarding simple form of movement :
 - 1) Amoeba engulf food by phagocytosis
 - 2) Euglena exhibits locomotion by the use of cilia
 - 3) Paramecium collects food into their body by ciliary movement
 - 4) Choanocytes in sponges create water current with the help of flagella

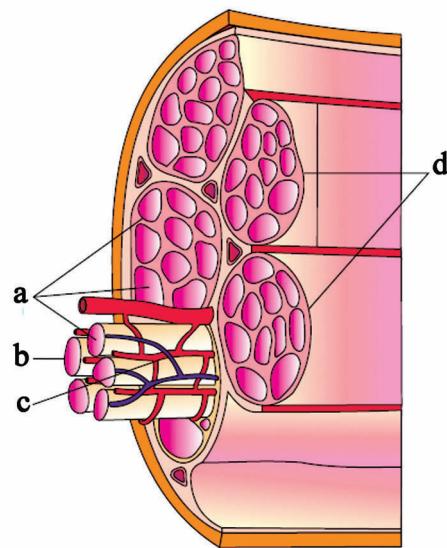
2. i) Tentacles in hydra
ii) Cilia in paramecium
iii) Limbs in humans

All the above structures in respective animals will justify all of the following **except**:
 - 1) Locomotory structures need not be different from those affecting other type of movements
 - 2) All locomotions are movements but all movements are not locomotion
 - 3) Structures involved in general movements used for locomotion as well
 - 4) All movements are locomotion, but all locomotions are not movements

3. Select the **mismatched** option from following:
 - 1) Macrophages and microfilaments - Amoeboid movement
 - 2) Involuntary and fusiform muscles - Heart wall
 - 3) Skeletal muscle fibres - Syncitial
 - 4) Presence of intercalated discs - Cardiac muscle

4. Which of the following is **TRUE** regarding skeletal muscles in human body?
 - 1) Contributes 40 - 50% of total body weight
 - 2) Ectodermal in origin
 - 3) Attached to bones by ligaments
 - 4) Excitability, contractility, extensibility and elasticity are its properties.

5. Diagrammatic cross sectional view of a muscle showing fascicles and muscle cells are given below.



Select the **correct** statement from the following with respect to the diagram.

- 1) 'a' and 'b' are held together by white fibrous tissue.
 - 2) 'c' and 'd' are arranged as parallel bundles
 - 3) 'c' provides nutrients and oxygen to 'a' which are syncytial in nature
 - 4) 'b' is the plasma membrane of 'd'
-
6. Select the **correctly** matched muscle cell organelle with respect to their function.
 - 1) Sarcoplasmic reticulum - ATP synthesis
 - 2) Sarcosome - Storage house of calcium
 - 3) Myoglobin - Storage of oxygen
 - 4) Sarcolemma - Possess acetyl choline

7. Select the **correct** statements.

- i) Sarcoplasm of myocyte contain parallelly arranged myofibrils
 - ii) Myofibrils show alternate arrangement of myofilaments
 - iii) Isotropic band contain only actin filaments
 - iv) Z-line is a fibrous membrane in the middle of A-band
 - v) Secondary filaments is formed of meromyosins.
- 1) iii, iv, v 2) ii, iii, iv
 3) iv, v 4) i, ii, iii

8. Match column I with column II and select the **correct** option.

Column I	Column II
A) Cross arm	i) Tropomyosin
B) Filamentous protein	ii) Head of meromyosin
C) Sarcomere	iii) Head with short arm
D) Binding site for myosin	iv) Between adjacent Z-lines
E) Actin binding site	v) G-actin

1) $\frac{ABCDE}{\text{iii i iv ii v}}$

2) $\frac{ABCDE}{\text{iii iv i ii v}}$

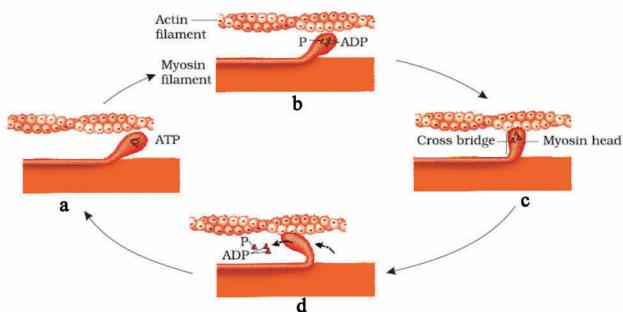
3) $\frac{ABCDE}{\text{iii i iv v ii}}$

4) $\frac{ABCDE}{\text{iii iv i ii v}}$

9. A neuromuscular junction is best described as :

- 1) Single motor neuron and all the muscle fibres that it innervates
- 2) Part of sarcolemma by which Ach-receptors present
- 3) Space between synaptic knob of sensory neuron and motor end plate
- 4) Junction between synaptic knob of motor neuron and sarcolemma

10. Go through the following diagram describing muscle contraction and identify the **correct** description given below.



- 1) c and d are Ca^{++} dependent events
- 2) a is an ATP dependent process
- 3) b is an energy utilizing event during contraction
- 4) d indicates breaking of cross bridge

11. Under the influence a stimuli actin filaments are slide over to the surface of myosin filaments leading to :

- 1) decrease in the length of A band
- 2) decrease in the length of thin and thick filaments
- 3) decrease in the length of sarcomere and I-band
- 4) decrease the width of H-zone and A-band

12. Red muscle fibres or slow twitch muscle fibres are exhibits slow and prolonged contraction, it is due to :

- 1) Plenty of mitochondria and sarcoplasmic reticulum
- 2) High amount of sarcoplasmic reticulum and little myoglobin
- 3) Abundant myoglobin and large amount of ATP-synthesis
- 4) High SR and plenty of sarcosome

13. Paired cranial bones are (a) in number, only movable bone in skull is (b) and bone does not have any articulation with other skull bone is (b). Here a, b, c respectively are :

- 1) a - 8 ; b - Mandible; c - Occipital
- 2) a - 2 ; b - Hyoid ; c - Mandible
- 3) a - 4 ; b - Occipital ; c - Mandible
- 4) a - 4 ; b - Mandible ; c - Hyoid

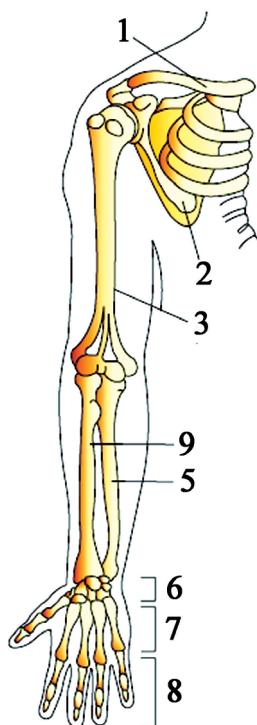
14. Following are some of the features related to vertebral column and ribs. Identify the **correct** statements.

- a) Vertebral column connects sternum through ribs.
 - b) Each vertebra has a foramen magnum by which spinal cord passes.
 - c) Ribs arises from twelve number of lumbar vertebrae
 - d) Atlas vertebra articulate with the coxal bones of pelvic girdle
 - e) Ribs articulated to vertebrae through two heads
-
- | | |
|------------|------------|
| 1) b, c, d | 2) c, d, e |
| 3) a, e | 4) a, d, e |

15. Find the **mismatch** from the following :

- 1) Number of ribs directly articulates with sternum through hyaline cartilage - 14 bones
- 2) Rib cage constitutes - 37 bones
- 3) Floating or renal ribs - 2 bones
- 4) Pair of ribs connected to costal cartilage of 7th ribs are - 3 pairs

16. Study the frontal view of right pectoral girdle and forelimb given below.



Identify the **correct** bones from above diagram regarding the following descriptions and select the **correct** option.

- a) 2 - scapula, located dorsally between 2nd and 7th rib
 - b) 3 - Humerus, directly articulated into acetabulum of pectoral girdle
 - c) 6 - Metacarpals, lies between carpals and phalanges
 - d) 1 - collar bone, articulates shoulder blade to sternum
 - e) 8 - phalanges, 14 in number with a phalangeal formula of 2, 3, 3, 3, 3,
-
- | | |
|------------|------------|
| 1) a, b, c | 2) c, d, e |
| 3) d, e | 4) a, d, e |

- 17.** Which of the following is **wrong** regarding pelvic girdle and hind limb bones?
- 1) Coxal bones are ventrally connected through fibrous cartilage
 - 2) Longest bone in hind limb articulated into acetabulum of pelvic girdle
 - 3) Ilium and ischium articulated into the sacrum and coccyx
 - 4) Patella connects femur bone to tibia
- 18.** Match the following joints with suitable examples and select the correct option :

Column I	Column II
A) Fibrous joint	p) Between adjacent vertebrae
B) Cartilaginous joint	q) Radius and ulna with humerus
C) Pivot joint	r) Between carpals in wrist
D) Hinge joint	s) Between cranial bones
E) Gliding joint	t) Atlas to axial joint

1) $\frac{ABCDE}{s\ p\ t\ q\ r}$

2) $\frac{ABCDE}{s\ t\ p\ q\ r}$

3) $\frac{ABCDE}{s\ p\ t\ r\ q}$

4) $\frac{ABCDE}{s\ p\ r\ t\ q}$

- 19.** An autoimmune disorder affects neuromuscular junction which leading to fatigue, weakening of muscles and paralysis is :
- 1) Muscular dystrophy
 - 2) Myasthenia gravis
 - 3) Muscular tetany
 - 4) Osteoporosis

- 20.** Given below are two statements :

Statement I : Accumulation of uric acid crystals in synovial cavity between bones cause inflammation in joints.

Statement II : Hypocalcemia leading to wild contraction or rapid spasm in skeletal muscles.

In the light of the above statements choose the **most appropriate answer** from the following

- 1) Both statement I and statement II are correct
- 2) Both statement I and statement II are incorrect
- 3) Statement I is correct but statement II is incorrect
- 4) Statement I is incorrect but statement II is correct

QUESTIONS

LEVEL - II

- 1.** Which of the following in human body exhibit ciliary movement?
- a) Female genital tract
 - b) Spermatozoa
 - c) Collar cells
 - d) Microfilaments
 - e) Leucocytes
 - f) Respiratory tract
- | | |
|------------|------------|
| 1) b and c | 2) d and c |
| 3) a, b, f | 4) a and f |
- 2.** Select the **correct** statement from the following regarding muscles in human body:
- 1) Muscles in urinary bladder are cylindrical and branched
 - 2) Heart muscles are striated, spindle shaped and branched
 - 3) Muscles in biceps and triceps are cylindrical uninucleated and voluntary
 - 4) Cylindrical, syncytial, voluntary muscles aid in locomotion.

- 3.** i) Rod like proteins arranged parallel to each other and also to the longitudinal axis of myofibrils
ii) Acts as contractile proteins
iii) Provides dark and light striations to myofibrils.
The above mentioned features are related to :
1) Muscle fibre
2) Fascicles
3) Sarcomere
4) Myofilaments
- 4.** In a skeletal muscle fibre, the myofibrils contains each sarcomere has :
1) a central 'I' band and two halves of 'A' band
2) 'H' zone, two halves of thick filament and two 'Z' lines
3) a central 'A' band made of myosin and two halves of 'I' band made of actin filaments
4) 'M' line on either side, H-zone and two halves of 'A' band in the middle.
- 5.** During resting rate, free edges of thick filament on either side partially overlapped by thin filament by leave out a central gap between them ie,
1) H - zone, contains actin and myosin filaments
2) M - line, hold the thick filaments together
3) H-zone, contains primary myofilaments and it disappears during contraction
4) Z-line, bisects thick filaments during contraction.
- 6.** All the following in a skeletal muscle always arranged as a parallel pattern and also to the longitudinal axis of muscle, **except** :
1) Fascicles and myocytes
2) Muscle fibres and myofibrils
3) Sarcomere and actin
4) Z-lines and M-line

- 7.** Which of the following are applicable to primary myofilament but **not** applicable to secondary myofilament?
a) Anisotropic in nature
b) Arranged as parallel pattern
c) Active sites for ATP and actin
d) Promote ATP - hydrolysis to release energy
e) Rod like contractile proteins formed of several number of tropomyosins.
1) a, b, e
2) c, d, e
3) b, c
4) a, c, d
- 8.** Which of the following will lie along the grooves of active sites for myosin in each G-actin in an F-actin during resting state of muscle fibre are :
1) Head of meromyosin
2) Calcium and magnesium
3) Meromyosin and a subunit of troponin complex
4) Tropomyosin and a subunit of troponin complex
- 9.** Which one of the following will **not** cause the release of calcium ions from sarcoplasmic cisternae during muscle contraction?
1) Conduction of impulses to sarcoplasmic reticulum
2) Transmission of impulse through transverse tubules
3) Binding of new ATP to meromyosin head
4) Excitation of sarcolemma

- 10.** All the following components in a muscle fibre undergoing certain changes during muscle contraction **except** :
- M-line
 - H-zone
 - Sarcomere
 - Length of actin and myosin
 - I - band
 - A - band
 - Head of meromyosin and tropomyosin in actin
- ii, iii, vii
 - i, iii, iv, vi
 - iv, v, vi, vii
 - i, iv, vi
- 11.** Following are the different stages of events in skeletal muscle contraction. Arrange the events in **correct** sequence :
- Depolarisation of sarcolemma and opening of voltage gated Na^+ channels
 - Neuron secrete a small amount of Ach into the neuromuscular junction
 - SR release large amount of Ca^{++}
 - An action potential travels along a motor neuron to its ending on muscle fibres
 - Ca^{++} initiate attractive forces between secondary and primary myofilaments
 - Sliding of actin over the surface of myosin and decrease the length of sarcomere
- D → A → B → C → E → F
 - D → B → A → E → C → F
 - D → E → F → A → C → B
 - D → B → A → C → E → F
- 12.** a) Slow and sustained contraction for a long time
b) Less amount of myoglobin
c) Thin muscle fibre and less amount of SR
d) Anaerobic muscle and easily get fatigue
e) Abundant sarcosome and high amount of energy production
- From the above features :
- All are related to red muscle fibres but not to white muscle fibres
 - c, d, e are related to both red and white muscle fibres
 - b and d are features of red muscle fibre but a, c, e are related to white muscle
 - a, c, e are true about red muscle fibre but b and d are true about white muscle fibre
- 13.** Which of the following are **true** regarding skull bones in humans ?
- Structural frame work of skull comprises 22 bones
 - Hyoid is the only movable bone in skull
 - Sella tursica present in occipital bone
 - Skull articulated into vertebral column through two occipital condyles
 - Parietals and temporals are the only paired bones in skull
- i, ii, iv
 - i, iv, v
 - iv, v
 - i, iv

14. Identify the **TRUE** and **FALSE** description regarding vertebral column in adult humans:

- a) Vertebral column is formed of 4 different spinal curves
 - b) Each vertebra has a central neural canal by which medulla oblongata passes.
 - c) 5 sacral and 4 coccygeal vertebrae are present
 - d) Atlas and axis are the fused vertebra in vertebral column
 - e) Fibrous cartilage present between each vertebra acts as shock proofing cushion.
- 1) b, c, d are true but a, e are false
 2) a, e are true but b, c, d are false
 3) a, c, e are true but b, d are false
 4) a, c, d are true but b, e are false

15. Fourteen number of ribs in ribcage are considered as vertebrosternal ribs, because they are :

- 1) directly connects to sternum through costa of 7th ribs
- 2) Free on their ventral side
- 3) Connected to vertebrae through two heads
- 4) Connecting thoracic vertebrae directly to sternum through hyaline cartilage

16. Dorsal, flat triangular body of scapula have a slightly elevated ridge called (a) with a flat expansion (b). Here (a) and (b) respectively as :

- 1) (a) - Acromion process ; (b) - Spine
- 2) (a) - Glenoid cavity ; (b) - Acromion process
- 3) (a) - Colalr bone ; (b) - Acromion process
- 4) (a) - Spine ; (b) - Acromion process

17. Match the following in column I with column II and select the **correct** option :

Column I	Column II
i) Acetabulum	a) 14
ii) Pubic symphysis	b) 10
iii) Ankle bones	c) 56
iv) Metatarsals	d) Articulation of thigh bone
v) Phalanges in four limbs	e) Junction between pubic bones

- 1) $\frac{i \ ii \ iii \ iv \ v}{e \ d \ b \ a \ c}$ 2) $\frac{i \ ii \ iii \ iv \ v}{d \ e \ a \ b \ c}$
- 3) $\frac{i \ ii \ iii \ iv \ v}{d \ e \ a \ c \ b}$ 4) $\frac{i \ ii \ iii \ iv \ v}{d \ e \ b \ a \ c}$

18. Which is **incorrect** regarding joints?

1)	Shoulder joint	Ball and socket joint, between glenoid cavity of scapula and head of humerus
2)	Hip joint	Synovial joint, between acetabulum of coxal bone and head of femur
3)	Inter-vertebral joint	Cartilaginous joint, between two adjacent vertebrae of vertebral column
4)	Pubic symphysis	Fibrous joint, between right and left pubic bones of vertebral column

19. Assertion : Force generated by muscle is used to carry out movement through joints.

Reason : Joints act as fulcrum which moves the bones in our body in a specific direction because of the force coming from the contraction of muscles.

In the light of the above statements (Assertion and Reason) choose the **most appropriate answer** from the options given below.

1) Both **Assertion** and **Reason** are true and Reason is the correct explanation of Assertion

2) Both **Assertion** and **Reason** are true and Reason is not the correct explanation of Assertion

3) Both **Assertion** and **Reason** are false

4) **Assertion** is true but **Reason** is false

20. Given below are two statements :

Statement I : Osteoarthritis is an age related disorder occurs due to the degeneration of synovial membrane between two bones.

Statement II : Gout is caused by the accumulation of uric acid crystals in bones.

In the light of the above statements choose the **most appropriate answer** from the following

- 1) Statement I is correct but statement II is incorrect
- 2) Statement I is incorrect but statement II is correct
- 3) Both statement I and statement II are correct
- 4) Both statement I and statement II are incorrect

QUESTIONS LEVEL - III

- 1.** Ca^{++} released from the terminal cisternae of SR is primarily responsible for :
- 1) unmasking of active site of myosin for actin
 - 2) masking of active site on actin for myosin
 - 3) unmasking of active site in actin for myosin
 - 4) unmasking of active sites in actin for tropomyosin

- 2.** Which one of the following will **not** cause any change in the length of 'A' - band during muscle contraction?
- Pulling of actin on the centre of A-band by cross bridges
 - Sliding of actin over the surface of myosin
 - Sliding or rotation of cross bridges on the surface of myosin
 - All the above
- 3.** Event in muscle which inactivate the actin and resulting the masking of active sites in actin by complex regulatory proteins is :
- release of energy by ATP - hydrolysis
 - release of Ca^{++} from sarcoplasmic cisternae
 - return back of Ca^{++} into sarcoplasmic cisternae
 - Binding of a new ATP to myosin head
- 4.** Fast twitch muscle fibres differ from slow twitch muscle fibres, in that former,
- have low ATPase activity
 - is resistant to fatigue
 - contains more SR and quick rate of contraction
 - more sarcosomes and fast rate of ATP synthesis
- 5.** Identify the symptoms of a muscular disorder that occurs due to hypoparathyroidism and hypercalcitonism?
- Progressive degeneration of skeletal muscles
 - Weakening, fatigue and paralysis of muscles due to the degeneration of Ach receptors
 - Wild contraction / rapid spasm in muscles
 - Muscle tension during rest

SYNOPSIS

- Introduction
- Neural system in various phyla
- Components of human neural system
- Explain CNS , PNS , Afferent and Efferent nerves, Sympathetic and Parasympathetic nerves
- Visceral nerves and their functions.

NEURAL TISSUES AND COMPONENTS

- Neurons – Structure of neurons , unique features of neurons , types of neurons,
- Neuroglia – types and their functions.

GENERATION AND CONDUCTION OF IMPULSES

- Explain – Resting potential , Depolarisation , Action potential , Repolarisation etc.
- Role of Na and K ions , Sodium and potassium pumps ,Energy utilisation etc.

TRANSMISSION OF IMPULSES BETWEEN NEURONS

- Explain - Synapse
- Electrical and chemical synapses
- Explain mechanism of synaptic transmission with the help of diagrams.

CENTRAL NERVOUS SYSTEM -- BRAIN AND SPINAL CORD**BRAIN**

- Formation of brain – Fore brain , mid brain , hind brain etc.
- Explain meninges. Different types and function.
- Brain – Explain the structure with labelled diagrams.

FORE BRAIN

- Cerebrum --- cerebral cortex and medulla
- Grey matter and white matter , Sulci and gyri
- Cerebral cortex , main lobes , different sensory areas , their functions etc.
- Limbic system -- amygdala , hippocampus – functions.
- Diencephalon -- mention - thalamus , hypothalamus , functions etc.

MIDBRAIN

- Corpora quadrigemina, cerebral aqueduct etc.

HINDBRAIN

- Cerebellum , pons varoli and medulla oblongata , metacoeel etc.
- Pons varoli – Pneumotaxic centre , function
- Medulla oblongata – Controlling centre of involuntary organs, posses centres such as respiratory , cardiac , peristalsis, salivation , vomiting etc.

VENTRICLES OR CAVITIES OF BRAIN

- Brief mention

SPINAL CORD

- briefly mention

PNS

- Cranial nerves – 12 pairs
- Spinal nerves – 31 pairs
- Sympathetic and parasympathetic systems

QUESTIONS

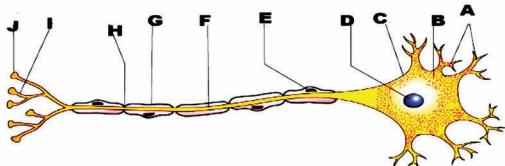
LEVEL - I

1. Coordination is the process through which two or more organs interact and complement the functions of one another. Which among the following is incorrect regarding coordination in human body
 - 1) When we do physical exercises, the rate of respiration, heart beat and blood flow increase.
 - 2) When physical exercise is stopped, the activities of all organs come back to the normal stage.
 - 3) In our body the neural system and the endocrine system jointly coordinate and integrate all the activities of the organs.
 - 4) The endocrine system provides an organised network of point-to-point connections for a quick coordination.

2. Find the incorrect statement
 - 1) The neural organisation is composed of a network of neurons in Hydra.
 - 2) The neural system is better organised in insects, where a brain is present along with a number of ganglia and neural tissues.
 - 3) Ladder like nervous system is found in Porifera
 - 4) The vertebrates have a more developed neural system

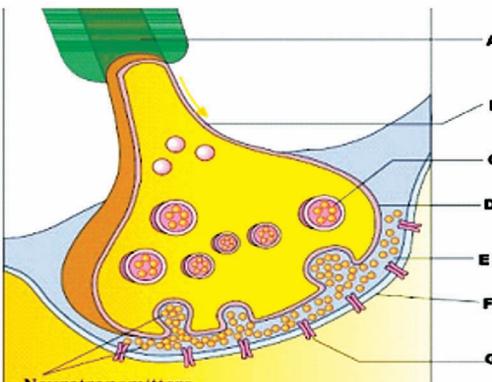
3. Which of the following is incorrect regarding visceral nervous system?
 - 1) It is the part of peripheral nervous system
 - 2) It includes only efferent fibres to the involuntary organs
 - 3) It includes whole complex of nerves, afferent and efferent nerves related with visceral organs
 - 4) It includes nerve fibres, ganglia, and plexuses related with viscera

4. The diagram of a neuron is given below. Identify the correct labelling and related characters



			carry impulses away from cell body
1)	A	Dendrites	Present in cell body and dendrites
2)	B	Nissl's granules	Carry impulses to cell body
3)	F	Axon	Contain synaptic vesicles

5. The electrical potential difference across the resting plasma membrane is called as the resting potential. Find the correct statement regarding this
 - 1) In resting, the axonal membrane is comparatively more permeable to sodium ions (Na^+) and nearly impermeable to potassium ions (K^+).
 - 2) The membrane is impermeable to negatively charged proteins present in the axoplasm.
 - 3) The axoplasm inside the axon contains high concentration of Na^+ and negatively charged proteins and low concentration of K^+
 - 4) The fluid outside the axon contains a low concentration of Na^+ , a high concentration of K^+

- 6.** Which of the following is incorrect regarding Na^+/K^+ pump?
- It is an active transport mechanism
 - The ionic gradients across the resting membrane are maintained by the Na^+/K^+ pump
 - The pump transports 3 K^+ outwards for 2 Na^+ into the cell.
 - Along with the other factors the pump also helps the axonal membrane to possess a positive charge outside and negative charge inside
- 7.** The mechanisms of generation of nerve impulse and its conduction along an axon is given below. Find the incorrect statement
- When a stimulus is applied at a site on the polarised membrane, the membrane at the site becomes freely permeable to Na^+ .
 - This leads to a rapid influx of Na^+ followed by the reversal of the polarity at that site
 - The outer surface of the membrane becomes positively charged and the inner side becomes negatively charged.
 - The electrical potential difference across the plasma membrane at the site is called the action potential, which is in fact termed as a nerve impulse and propagated to the next part
- 8.** The diagram of a chemical synapse is given below. Find the incorrect statement
- 
- The diagram illustrates a chemical synapse. On the left, a green terminal bouton contains several pink synaptic vesicles labeled 'C' containing 'Neurotransmitters'. A yellow pre-synaptic membrane is shown with a thick orange post-synaptic membrane on the right. Small pink receptor proteins labeled 'G' are embedded in the post-synaptic membrane. A vertical line on the right is labeled with letters A through G from top to bottom: A (terminal bouton), B (pre-synaptic membrane), C (vesicles), D (synaptic cleft), E (post-synaptic membrane), F (receptors), and G (post-synaptic membrane).
- C - represents synaptic vesicles which contain neurotransmitters
 - F - represents post synaptic membrane where new potential develops
 - G - represents receptors to receive neurotransmitter
 - E, F and G together form synapse
- 9.** The events in production of nerve impulse are given below.
- efflux of K^+
 - influx of Na^+
 - application of stimulus
 - closing of Na^+ channels
 - opening of Na^+ channels
- The correct order is given by
- c e a d b
 - c b a d e
 - c e b a d
 - c d b e a

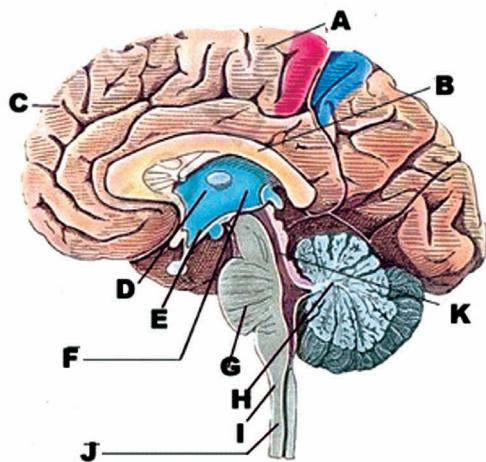
10. The human brain is well protected by the skull. Inside the skull, the brain is covered by cranial meninges. Identify the incorrect statement regarding meninges

- 1) The outer layer close to the cranial bone is called dura mater.
- 2) The thin middle layer is arachnoid membrane.
- 3) The inner layer which is in contact with the brain tissue is called pia mater.
- 4) Cerebrospinal fluid is present between all the meninges layers.

11. Cerebrum is the largest part of the brain. Identify the incorrect statement

- 1) A deep cleft divides the cerebrum longitudinally into two halves, which are termed as the left and right cerebral hemispheres
- 2) The cerebral hemispheres are connected by a tract of nerve fibres called corpus callosum.
- 3) Myelinated neurons are absent in cerebral cortex and hence it is known as grey matter
- 4) Fibres of the tracts are covered with the myelin sheath, which constitute the inner part of cerebral hemisphere is known as white matter

12. Diagram showing sagittal section of the human brain is given below. Find the correct labelling and related functions



1)	C	Cerebrum	Hunger, Thirst and Temperature regulation
2)	E	Thalamus	Coordinating centre for sensory and motor signalling
3)	D	Mid brain	receives and integrates visual, tactile and auditory inputs
4)	K	Cerebral aqueduct	Canal of mid brain

13. Find the correct match

Neural System		Functions	
a	Limbic system	p	controls respiration, cardiovascular reflexes and gastric secretions
b	Association areas	q	regulates sexual behaviour, emotional reactions and motivation
c	Cerebellum	r	for intersensory association, memory and communication
d	Medulla oblongata	s	integrates visual, tactile and auditory inputs
e	Midbrain	t	integrates informations from semicircular canal of ear

1) a - p ; b - q ; c - r ; d - t ; e - s

2) a - t ; b - q ; c - r ; d - p ; e - s

3) a - q ; b - r ; c - t ; d - p ; e - s

4) a - q ; b - t ; c - p ; d - r ; e - s

14. All the following statements are true except

- 1) Cerebellum has very convoluted surface in order to provide the additional space for many more neurons.
- 2) Mid brain, pons and medulla oblongata forms Brain stem
- 3) The dorsal portion of the midbrain consists mainly of four round swellings (lobes) called corpora bigemina.
- 4) Pons consists of fibre tracts that interconnect different regions of the brain.

15. Match the following and find the matching set.

Column I		Column II	
a	Forebrain	p	Sensory, motor and mixed nerves
b	Hind brain	q	Amygdala, hippocampus
c	Cerebral medulla	r	Cerebrum, thalamus and hypothalamus
d	Cranial nerves	s	Cerebellum, pons and medulla oblongata

1) a - r ; b - s ; c - p ; d - q

2) a - s ; b - r ; c - q ; d - p

3) a - r ; b - s ; c - q ; d - p

4) a - p ; b - s ; c - q ; d - r

QUESTIONS LEVEL - II

1. Myelinated nerve fibre is

- a) enveloped with Schwann cells, which form a myelin sheath around the axon.
- b) enclosed by Schwann cell that does not form a myelin sheath around the axon
- c) found in spinal and cranial nerves.

Find the correct option

- 1) All are correct
- 2) a and b correct
- 3) a and c correct
- 4) b and c correct

2. Depolarisation of axonal membrane is due to

- 1) Influx of potassium ions
- 2) Efflux of potassium ions
- 3) Influx of sodium ions
- 4) Efflux of sodium ions

3. Which of the following event take place when an impulse reaches the axon terminal in a chemical synapse?
- calcium channels open at presynaptic membrane
 - calcium channels open in post synaptic membrane
 - neurotransmitter bind to the post synaptic receptor
 - Both 1 and 3
4. Which of the following is incorrect regarding hypothalamus?
- It lies at the base of the thalamus.
 - Along with the limbic system, it is involved in the regulation of sexual behaviour, expression of emotional reactions
 - It has centres which control body temperature
 - It has centres which control respiration and gastric secretions
5. Which of the following is not related to limbic system
- Olfaction
 - autonomic responses
 - regulation of sexual behaviour
 - Integration of tactile inputs
6. **Statement I** : Three major regions make up the brain stem; mid brain, pons and cerebellum.
- Statement II** : Brain stem forms the connections between the brain and spinal cord.
- Statement I is true, whereas statement II is false
 - Statement I is false, whereas statement II is true
 - Statement I and II are false
 - Statement I and II are true
7. **Assertion - Reason Type Questions**
- Both A and R are correct and R is the correct explanation of A.
 - Both A and R are correct and R is not the correct explanation of A
 - A is correct but R is incorrect
 - A is incorrect and R correct
- Assertion** : Transmission of the nerve impulse across a chemical synapse is accomplished by neurotransmitters.
- Reason** : Transmission across a synapse usually requires neurotransmitters because there is a space called synaptic cleft between the neurons

- 8.** Identify the correct set of statements.
- Brain stem consists of midbrain and hind brain except cerebellum.
 - Cerebrum controls intersensory association, communication and memory
 - Medulla oblongata regulate many involuntary functions
 - Cerebellum acts as the equilibrium centre of the brain.
 - Hypothalamus regulate respiration, cardiovascular reflexes, and gastric secretions
- Choose the correct option:
- A, B, D and E only
 - B , C , D and E only
 - A, B,C and D only
 - A, C, D and E only
- 9.** Find the incorrect statement
- The cerebellum integrates information received from the semicircular canals of the ear and the auditory system.
 - Pons consist of fibre tracts that interconnect different regions of the brain
 - Limbic system is concerned with regulation of sexual behaviour, expression of emotional reactions, and motivation.
 - The medulla contains centres, which control the body temperature.

- 10.** **Statement I** : Myelinated axons have nodes of Ranvier
- Statement II** : Schwann cells produce myelin sheath in CNS
- Statement I is true, whereas statement II is false
 - Statement I is false, whereas statement II is true
 - Statement I and II are false
 - Statement I and II are true
- 11.** **Statement I** : The midbrain receives and integrates visual, tactile and auditory inputs.
- Statement II** : The dorsal portion of the midbrain consists mainly of four round swellings (lobes) called corpora quadrigemina
- Statement I is true, whereas statement II is false
 - Statement I is false, whereas statement II is true
 - Statement I and II are false
 - Statement I and II are true

- 12.** All the following statements are true except
- 1) Hypothalamus and medulla oblongata are involuntary in function
 - 2) Thalamus is the major coordinating centre for sensory and motor signalling
 - 3) For cerebrum and cerebellum, the cortex is formed of grey matter
 - 4) Midbrain is located between pons and medulla oblongata
- 13.** Schwann cells are found around the axons of
- 1) Peripheral neural system
 - 2) Myelinated neurons
 - 3) Non-myelinated neurons
 - 4) All the above
- 14.** Mark the wrong statement
- 1) All spinal nerves are mixed nerves
 - 2) Medulla controls heart beat
 - 3) Parasympathetic NS is stimulated in stress
 - 4) A part of cerebral cortex functions as “seat of intelligence”
- 15.** Sympathetic nervous system increases
- 1) Heart beat
 - 2) Secretion of digestive juices
 - 3) Secretion of saliva
 - 4) all of the above

QUESTIONS

LEVEL - III

- 1.** Which is correct regarding Autonomic Neural System (ANS)
- 1) ANS consists of afferent and efferent nerve fibres related with visceral organs
 - 2) ANS include only afferent fibres related with visceral organs
 - 3) ANS include only efferent fibres related with visceral organs
 - 4) ANS consists of nerve fibres from smooth muscles to CNS
- 2.** Identify the correct statement regarding nerve impulse transmission
- 1) Na^+ efflux occurs in depolarisation
 - 2) During depolarisation, the negative charge outside is due to negatively charged proteins
 - 3) The inside becomes more negative than resting potential which is hyperpolarisation
 - 4) During repolarisation the negative charge inside is restored by removal of Na^+ to outside

3. Which statement is incorrect regarding electrical synapses?
- 1) In electrical synapses gap junctions provide a continuous transmission of impulses
 - 2) Electrical synapses are bidirectional
 - 3) Electrical synapses are faster and not needed in human system. So, it is absent in our system
 - 4) Transmission of an impulse across electrical synapses is very similar to impulse conduction along a single axon
4. Anesthetics reduce pain by blocking the transmission of nerve impulses. The kind of chemical working as anesthetics are those that block
- 1) Voltage gated sodium and potassium channels and neurotransmitter receptors
 - 2) Only the voltage gated sodium channels in the membrane
 - 3) Only the voltage gated potassium channels in membranes
 - 4) Only the neurotransmitter receptors
5. Synaptic fatigue is due to
- 1) Repeated release of acetylcholine
 - 2) Repeated release of adrenaline
 - 3) Exhaustion of neurotransmitters
 - 4) Exhaustion of acetylcholine esterase

CHEMICAL COORDINATION AND INTEGRATION

SYNOPSIS

1. Comparison of neural and chemical coordination.
2. Human endocrine system

Structure and location of endocrine glands.
3. Hormones - their functions, disorders, synergistic and antagonistic effect, feed back control. etc.

a) Hypothalamus	b) Pituitary gland
c) Pineal gland	d) Thyroid gland
e) Parathyroid gland	f) Thymus gland
g) Adrenal gland	h) Pancreas - Islets of Langerhans
i) Gonads (Testes and Ovaries)	j) Placenta
4. Other hormones
 - a) ANF (Heart)
 - b) Erythropoietin (Kidney)
 - c) Gastrin, Secretin, CCK, GIP (GIT hormones)
5. Classification of hormones based on solubility
 - a) Lipid and water soluble hormones
6. Chemical nature of hormones with example.
 - a) Aminoacid derivatives - Serotonin, Adrenaline, Nor-adrenaline
 - b) Peptide, polypeptide, protein hormones - Insulin, glucagon, pituitary hormones, hypothalamic hormones etc.
 - c) Iodothyronines - T_3 , T_4
 - d) Steroid hormones - Aldosterone, Cortisol, Testosterone, Estrogen, Progesterone
7. Mechanism of hormone action, Intracellular and Extracellular receptors

QUESTIONS**LEVEL - I**

- 1.** Which of the following is not true of hormones?
Hormones are :
 - 1) non-nutrient chemicals
 - 2) intercellular messengers
 - 3) produced in trace amounts
 - 4) made of proteins only

- 2.** All the following options list hormone producing organs except :
 - 1) Thymus, thyroid, testis and ovary
 - 2) Pituitary, pineal, parathyroid and pancreas
 - 3) Liver, kidney, heart and gastrointestinal tract
 - 4) Spleen, thalamus, bone marrow and neurohypophysis

- 3.** Hypothalamus contains several groups of neurosecretory cells producing hormones called :
 - 1) ganglia
 - 2) nuclei
 - 3) plexus
 - 4) nerve fibres

- 4.** Which of the following is under the direct neural regulation of hypothalamus?
 - 1) Anterior pituitary
 - 2) Posterior pituitary
 - 3) Parathyroid gland
 - 4) Adrenal cortex

- 5.** Match the following and find the correctly matching set.

Column I		Column II	
A)	Diabetes insipidus	P)	Hyperproduction of growth hormone in adults
B)	Grave's disease	Q)	Hyposecretion of adrenal cortex hormones
C)	Addison's disease	R)	Hyposecretion of vasopressin
D)	Acromegaly	S)	Hyperproduction of thyroxine

- 1) A - R ; B - P ; C - Q ; D - S
 - 2) A - R ; B - Q ; C - P ; D - S
 - 3) A - Q ; B - P ; C - R ; D - S
 - 4) A - R ; B - S ; C - Q ; D - P
- 6.** The hormone secreted by Pars intermedia acts on :
- 1) Gonads
 - 2) Corpus luteum
 - 3) Melanocytes
 - 4) Leydig cells
- 7.** Which of the following is incorrect?
- 1) FSH and androgens regulate spermatogenesis
 - 2) LH and FSH stimulate gonadal activity
 - 3) PTH along with TCT regulates Ca^{2+} balance in the body
 - 4) Insulin is hyperglycemic hormone where as glucagon is hypoglycemic
- 8.** Mark the incorrect match regarding endocrine glands and their hormones :
- 1) Pineal gland → Thymosin
 - 2) Hypothalamus → Oxytocin
 - 3) Adenohypophysis → Luteinizing hormones
 - 4) Adrenal medulla → Adrenaline

- 9.** Which of the following is wrong?
- 1) LH in males - stimulates synthesis and secretion of androgens
 - 2) LH in females - Induces ovulation and maintains corpus luteum
 - 3) Melatonin - maintains normal sleep wake cycle and body temperature.
 - 4) Thyroxine - Plays a major role in differentiation of T. Lymphocytes
- 10.** Match the following and find the correct option.

Column I		Column II	
A)	Insulin	P)	Increases alertness pupillary dilation, pilo erection
B)	Adrenaline	Q)	Stimulates the secretion of HCl and pepsinogen
C)	Thyroxine	R)	enhances cellular glucose uptake and utilisation
D)	Gastrin	S)	Regulates basal metabolic rate

- 1) A - R ; B - S ; C - Q ; D - P
 - 2) A - R ; B - P ; C - S ; D - Q
 - 3) A - P ; B - R ; C - Q ; D - S
 - 4) A - P ; B - S ; C - Q ; D - R
- 11.** Find the mismatch:
- 1) ANF - decreases blood pressure.
 - 2) Estrogens - Development of female secondary sex characters
 - 3) Oxytocin - uterine contractions during labour and promotes milk ejection.
 - 4) Vasopressin - produces anti-inflammatory reactions

- 12.** Which of the following is a steroid hormone?
- 1) Glucagon
 - 2) Estradiol
 - 3) Epinephrine
 - 4) Thyrocalcitonin
- 13.** Which of the following hormone makes a direct access to genome forming hormone - receptor complex?
- 1) Insulin
 - 2) Testosterone
 - 3) Epinephrine
 - 4) Glucagon
- 14.** Statement question.
- Statement I :** Vasopressin is actually a hypothalamic hormone.
- Statement II :** Neurohypophysis stores and releases vasopressin.
- 1) Both statement I and II are true
 - 2) Both statement I and II are wrong
 - 3) Statement I is true and statement II is false
 - 4) Statement I is false and statement II true
- 15.** Assertion reason type question.
- Assertion :** Immunity of person becomes weak in old persons.
- Reason :** Thymus gets degenerated in old individuals and so decreased production of thymosins.
- 1) If both assertion and reason are true and reason is correct explanation of assertion.
 - 2) If both assertion and reason are true and reason is not the correct explanation of assertion.
 - 3) If both assertion and reason are false
 - 4) If assertion is true but reason is false

QUESTIONS**LEVEL - II**

- 1.** Which of the following statement is not true?
 - 1) Invertebrates have a very complicated endocrine system compared to vertebrates.
 - 2) Endocrine glands are ductless glands secreting hormones
 - 3) Hormones are released into the blood and transported to target organs.
 - 4) Organised endocrine glands secrete hormones.

- 2.** Hypothalamus develops from embryonic brain part called :
 - 1) diencephalon
 - 2) mesencephalon
 - 3) hind brain
 - 4) thalamus

- 3.** Which of the following is not synthesised and released by hypothalamus?
 - 1) Somatostatin
 - 2) GnRH
 - 3) Growth hormones
 - 4) Vasopressin

- 4.** Mark the incorrect statement :
 - 1) Oxytocin and vasopressin are synthesised by hypothalamus and are transported axonally to neurohypophysis.
 - 2) Adenohypophysis consists of pars distalis and pars nervosa.
 - 3) GnRH, a hypothalamic hormone, reaches anterior pituitary through hypophysial portal circulatory system.
 - 4) GH, PRL, TSH, ACTH, LH and FSH are produced by adenohypophysis.

- 5.** Match the following hormones and their target glands.

Column I		Column II	
A	Hypothalamic hormones	P	Gonads
B	Thyrotrophin (TSH)	Q	Adrenal cortex
C	Corticotrophin (ACTH)	R	Thyroid
D	Gonadotrophins (LH, FSH)	S	Pituitary gland

- 1) A - S ; B - P ; C - R ; D - Q
- 2) A - S ; B - R ; C - Q ; D - P
- 3) A - P ; B - Q ; C - S ; D - R
- 4) A - R ; B - P ; C - Q ; D - S

- 6.** The pituitary gland is located :
- 1) on the backside of thyroid gland
 - 2) on the dorsal side of forebrain
 - 3) in sella turcica of sphenoid bone
 - 4) behind breast bone
- 7.** Which of the following is a pair of antagonistic hormones?
- 1) Oxytocin and glucagon
 - 2) Thyrocalcitonin and parathyroid hormone
 - 3) Adrenaline and nor-adrenaline
 - 4) Oxytocin and vasopressin
- 8.** Statement question.
- Statement I** : PTH is a hypercalcemic hormone.
- Statement II** : Iodine deficiency in pregnancy causes cretinism in children.
- 1) Both statement I and II are true
 - 2) Both statement I and II are false
 - 3) Statement I is true, statement II is false
 - 4) Statement I is false, statement II is true

- 9.** The different layers of adrenal gland and their main hormones are marked a, b, c, d.
- i) Adrenal medulla - a
 - ii) Zona reticularis - b
 - iii) Zona fasciculata - c
 - iv) zona glomerulosa - d

The correct option is :

	a	b	c	d
1)	Adrenaline	Androgens	Aldosterone	Cortisol
2)	Androgens	Corticoids	Adrenaline	Aldosterone
3)	Adrenaline	Androgens	Cortisol	Aldosterone
4)	Cortisol	Aldosterone	Androgens	Adrenaline

- 10.** Which of the following statements is incorrect?
- 1) Immune responses in old persons become weak due to degeneration of thymus.
 - 2) Catecholamines increase the rate of heart beat and respiration
 - 3) Islets of Langerhans represents about 10 - 20% of pancreatic tissue.
 - 4) Cortisol stimulates RBC production

11. Assertion - Reason Type Question.

Assertion : Adrenal medullary hormones help in combating a stress situation.

Reason : Atrial natriuretic factor decreases blood pressure

- 1) If both assertion and reason are true and reason is correct explanation of assertion.
- 2) If both assertion and reason are true and reason is not the correct explanation of assertion.
- 3) If both assertion and reason are false
- 4) If assertion is true but reason is false

- 12.** Find the matching set of cells and hormones secreted?

Column I		Column II	
A	Corpus luteum	P	Erythropoietin
B	Juxta glomerular cells	Q	Insulin
C	Leydig cells	R	Progesterone
D	β cells of Islets of Langerhans	S	Testosterone

- 1) A - R ; B - P ; C - S ; D - Q
- 2) A - R ; B - Q ; C - S ; D - P
- 3) A - P ; B - Q ; C - R ; D - S
- 4) A - S ; B - P ; C - Q ; D - P

- 13.** Progesterone is known as :

- 1) emergency hormone
- 2) pregnancy hormone
- 3) birth hormone
- 4) anti-diuretic hormone

- 14.** Find the mismatch :

	Endocrine part	Hormone
1)	Kidney	Erythropoietin
2)	Testis	Testosterone
3)	Adrenal medulla	Cortisol
4)	Thymus	Thymosine

- 15.** Which of the following hormones interact with membrane bound receptors, generate second messengers which in turn regulate cellular metabolism?

- 1) FSH
- 2) Estrogen
- 3) Progesterone
- 4) Testosterone

QUESTIONS**LEVEL - III**

- 1.** Match the following with regard to the cells and hormones.

Column I	Column II
A) α cells of islets of Langerhans	P) Erythropoietin
B) β cells of islets of Langerhans	Q) Testosterone
C) Leydig cells of Testis	R) Insulin
D) Juxtaglomerular cells of kidney	S) Glucagon

1) A - R ; B - Q ; C - S ; D - P

2) A - S ; B - R ; C - Q ; D - P

3) A - S ; B - P ; C - R ; D - Q

4) A - Q ; B - R ; C - P ; D - S

- 2.** PTH increases the Ca^{2+} level in blood.

Which among the following is not in line with the above function of PTH?

1) Demineralisation (resorption) of bone

2) Reabsorption of Ca^{2+} by the renal tubules

3) Increasing Ca^{2+} level by lowering bone dissolution.

4) Absorption of Ca^{2+} from digested food

- 3.** Which of the following hormones work together on mammary glands for milk production?

- i) Progesterone ii) Cortisol
- iii) Estrogen iv) Oxytocin
- v) Prolactin vi) Testosterone

1) i and iii only

2) ii and vi only

3) ii, iv and v only

4) all except ii and vi

- 4.** Find the mismatch :

1) Estrogens - Development of female secondary sex characters

2) Secretin - Secretion of H_2O and HCO_3^- from pancreas

3) Oxytocin - promotes uterine contractions during child birth

4) Vasopressin - produces hypotonic urine

- 5.** Statement questions.

Statement I : Epinephrine and cortisol alleviate stress symptoms.

Statement II : Catecholamines stimulate glycogenolysis, gluconeogenesis, lipolysis and proteolysis.

1) Both statements are true

2) Both statements are false

3) Statement I is true and statement II is false

4) Statement I is false and statement II is true

SYNOPSIS

Male reproductive system

- ◆ major events in sexual reproduction
- ◆ structure and function of testis (primary sex organ)
- ◆ intra testicular genital ducts
- ◆ male secondary sex organs
- ◆ accessory genital ducts
- ◆ accessory sex glands
- ◆ male external genitalia
- ◆ spermatogenesis (phase of multiplication, phase of growth, phase of maturation)
- ◆ structure of sperm
- ◆ semen, seminal plasma
- ◆ capacitation
- ◆ correct sequence of sperm movement through the genital duct system
- ◆ castration
- ◆ orchidectomy

Female Reproductive System

- ♣ Structure and function of ovaries (primary sex organ)
- ♣ Female secondary sex organs
- ♣ Female accessory sex glands
- ♣ Female external genitalia
- ♣ Structure and function of mammary glands
- ♣ Oogenesis (phase of multiplication , phase of growth , phase of maturation)
- ♣ Structure of ovum
- ♣ Corpus luteum
- ♣ Menstrual cycle
- ♣ Menopause
- ♣ Zygote, fertilization, cleavage, morulation, blastulation
- ♣ Mention gastrulation and fate of germ layers
- ♣ Differences between zygote and morula, structure and function of blastula, significance of trophoblast, implantation
- ♣ Foetal membranes or extra embryonic membranes
- ♣ Placenta, structure and function
- ♣ Hormones of placenta
- ♣ Embryonic development , organ development during first, second, third, fifth and sixth months
- ♣ Foetal ejection reflex
- ♣ Parturition, after birth, colostrum, monozygotic twins, fraternal twins, multiple embryos etc.
- ♣ Colostrum

QUESTIONS

LEVEL - I

1. Which of the following is known as primary sex organ?
 - 1) Copulatory organ
 - 2) External genitalia
 - 3) gonad
 - 4) internal genitalia

2. Testes are seen in scrotal sac outside the abdomen because :
 - 1) it facilitates ejaculation
 - 2) other organs do not make space for the testes in the abdominal cavity
 - 3) testes in the abdomen will hamper maturation of sperms
 - 4) it provides temperature that is slightly lower than body temperature required for the formation of functional sperms.

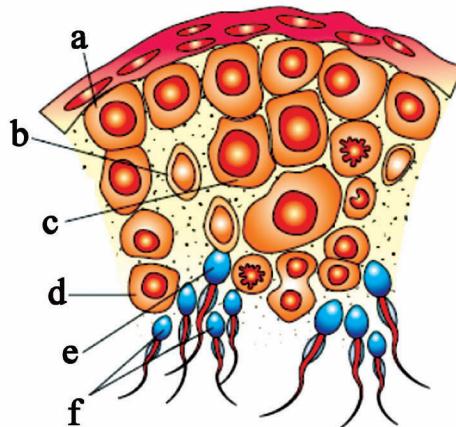
3. Which of the following synthesizes and secretes testicular hormones called androgens?
 - 1) Sertoli cells
 - 2) Interstitial cells
 - 3) immunologically competent cells
 - 4) male germ cells

4. The paired male accessory sex glands are
 - 1) prostate and cowper's gland
 - 2) prostate gland and seminal vesicles
 - 3) seminal vesicles and bulbourethral glands / cowper's gland
 - 4) seminal vesicle and bulbovestibular glands

5. Rete testes open into
 - 1) urethra
 - 2) vasa efferentia
 - 3) epididymis
 - 4) vas deferens

6. The correct sequence of sperm movement from seminiferous tubules to vas deferens
 - 1) Seminiferous tubules, rete testes, epididymis, vasa efferentia, vas deferens
 - 2) Seminiferous tubules, rete testes, vas deferens, epididymis, vasa efferentia
 - 3) Seminiferous tubules, rete testes, vasa efferentia, epididymis, vas deferens
 - 4) Seminiferous tubules, rete testis, epididymis, vas deferens

7. Choose the correct combination of labelling of seminiferous tubules



- 1) a - spermatogonium, b - Sertoli cells, c - primary spermatocyte, d - secondary spermatocyte, e - spermatid, f - spermatozoa
- 2) a - Sertoli cells, b - spermatogonia, c - primary spermatocyte, d - secondary spermatocyte, e - spermatid, f - spermatozoa
- 3) a - spermatogonium, b - primary spermatocyte, c - spermatid, d - secondary spermatocyte, e - Sertoli cells, f - spermatozoa
- 4) a-Sertolicells,b-spermatid,c-secondary spermatocyte, d spermatogonium, e - primary spermatocyte, f – spermatozoa

- 8.** Female external genitalia includes
- 1) Mons pubis, labia majora, labia minora, vagina, clitoris, hymen
 - 2) Mons pubis, labia majora, labia minora, clitoris, hymen
 - 3) Mons pubis, labia majora, labia minora, clitoris, cervix
 - 4) Mons pubis, labia majora, labia minora, vagina, cervix, clitoris, hymen

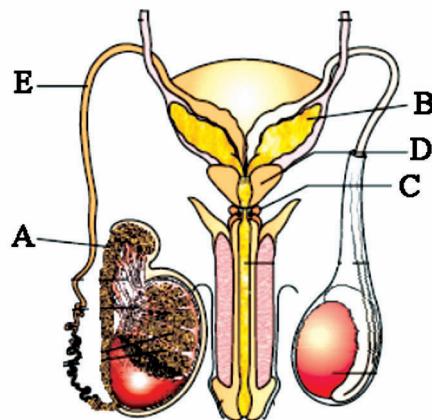
- 9.** Read the following statements

- 1) Cervical canal plus vagina constitutes birth canal
- 2) Fallopian tube, uterus and vagina constitute the female accessory ducts
- 3) The part of the oviduct closer to the ovary is fimbriae
- 4) Isthmus shows a narrow lumen and it joins with the ovary

Of the above statements

- 1) all are false
- 2) four are false
- 3) three are false
- 4) one is false

- 10.** Given below is a diagrammatic sketch of a portion of human male reproductive system. Identify the parts marked as A, B, C, D and E.



- 1) A-Seminal vesicle, B-Vas deferens, C-Epididymis, D-Bulbourethral gland, E-Prostate gland
- 2) A-Epididymis, B-Seminal vesicle, C-Bulbourethral gland, D-Prostate gland, E-Vas deferens
- 3) A-Vas deferens, B-Prostate gland, C-Seminal vesicle, D-Epididymis, E-Bulbourethral gland
- 4) A-Epididymis, B-Seminal vesicle, C-Prostate gland, D--Bulbourethral gland, E-Vas deferens

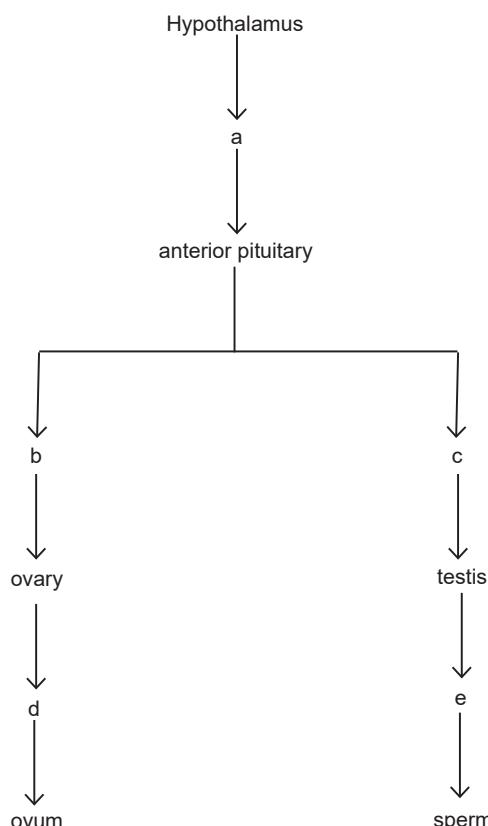
- 11.** Select the odd one from the following

- 1) infundibulum
- 2) isthmus
- 3) fimbriae
- 4) endometrium

- 12.** The main function of the fimbriae is

- 1) to help in the collection of the ovum after ovulation
- 2) to help in the release of the ovum from Graafian follicle
- 3) help in the formation of corpus luteum
- 4) helps in luteinization

- 13.** The cells of the alveoli of mammary lobules produce milk. The correct sequence of movement of milk in the mammary gland is:
- 1) Alveoli, mammary duct, mammary tubule, ampulla, lactiferous duct, nipple
 - 2) Alveoli, mammary tubule, mammary duct, ampulla, lactiferous duct, nipple
 - 3) Alveoli, mammary duct, ampulla, mammary tubule, lactiferous tubule, nipple
 - 4) Alveoli, ampulla, lactiferous tubule, mammary tubule, mammary duct, nipple
- 14.** Identify the hormones that govern oogenesis and spermatogenesis which are marked as 'a', 'b', 'c', 'd' and 'e' in the following chart.



- 1) a - GnRH, b - LH, c - FSH, d - estrogen, e - androgens
- 2) a - GnRH, b - FSH, c - ICSH, d - androgens, e - estrogen
- 3) a - GnRH, b - LH, c - ICSH, d - androgens, e - estrogen
- 4) a - GnRH, b - FSH, c - LH, d - estrogen, e - androgens

- 15.** Spermiogenesis refers to:
- 1) Spermatogenesis
 - 2) Growth phase of sperms
 - 3) Multiplication phase of sperms
 - 4) Completion of the maturation phase of sperms
- 16.** The second maturation division of mammalian ovum occurs:
- 1) after the ovum has been penetrated by a sperm
 - 2) after the nucleus of the sperm has fused with the ovum
 - 3) in the Graafian follicle following the first maturation division
 - 4) shortly before ovulation
- 17.** Which of the following develops a noncellular protective membrane called zona pellucida?
- 1) oogonium
 - 2) primary oocyte
 - 3) secondary oocyte
 - 4) ootid
- 18.** Select the incorrect statement
- 1) LH surge is required for ovulation
 - 2) LH triggers the secretion of androgens from the Leydig cells
 - 3) FSH stimulates the Sertoli cells which help in spermiogenesis
 - 4) LH and FSH decrease gradually during the follicular phase

19. Which of the following are haploid in nature?

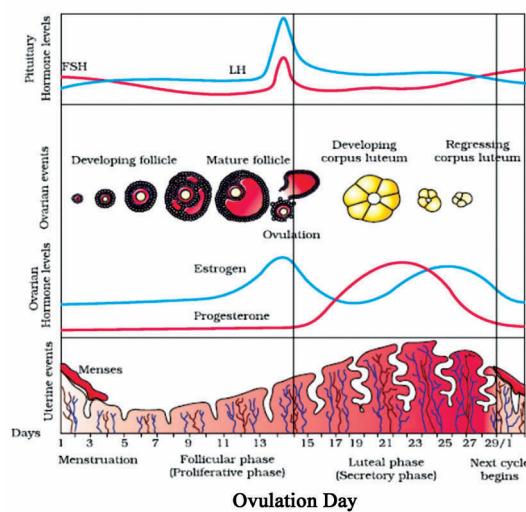
- i) spermatid
- ii) Secondary oocyte
- iii) primary spermatocyte
- iv) ootid
- v) polar body

- 1) i, ii, iv and v are haploid
- 2) i, ii and iv are haploid
- 3) i, ii and v are haploid
- 4) i and ii are haploid

20. The difference between spermiogenesis and spermiation is:

- 1) In spermiogenesis, spermatozoa from Sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed.
- 2) In spermiogenesis spermatozoa are formed, while in spermiation spermatids are formed.
- 3) In spermiogenesis spermatids are formed, while in spermiation spermatozoa are formed
- 4) In spermiogenesis spermatids change into sperms while in spermiation spermatozoa are released from Sertoli cells into the lumen of seminiferous tubules.

21.



Read the following statements and compare with the chart and find how many are true?

- i) Luteal phase is also called secretory phase and lasts for about 13 days
- ii) Ovulation occurs at the end of proliferative phase
- iii) During ovulation LH and FSH attain their peak level and a sharp fall in the secretion of progesterone occurs
- iv) Menstruation begins when the level of progesterone and estrogen decrease drastically
- v) Menstruation can be deferred by the administration of a suitable combination of progesterone and estrogen

Of the above statements

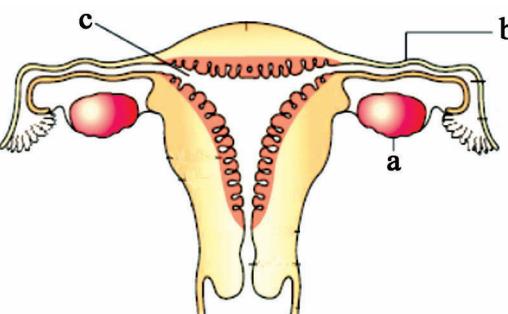
- 1) only three are true
- 2) only four are true
- 3) five are true
- 4) only two are true

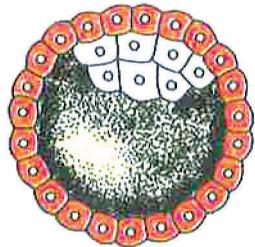
- 22.** Fertilization in humans is practically feasible only if
- 1) the ovum and sperms are transported simultaneously to infundibular region.
 - 2) the sperms are transported into cervix within 48 hours of release of ovum in uterus
 - 3) the sperms are transported into vagina just after the release of ovum in fallopian tube
 - 4) the ovum and sperms are transported simultaneously to ampullary region
- 23.** In a human female the blastocyst
- 1) forms placenta even before implantation
 - 2) gets implanted into the uterus thirteen days after ovulation
 - 3) gets implanted in endometrium by means of trophoblast cells
 - 4) gets nutrition from uterine endometrial secretion only after implantation.
- 24.** The correct sequence of early embryonic development stages is
- 1) Blastulation, Morulation, Zygote, Gastrulation
 - 2) Zygote, Morulation, Blastulation, Gastrulation
 - 3) Zygote, Blastulation, Morulation, Gastrulation
 - 4) Zygote, Morulation, Gastrulation, Blastulation
- 25.** In the given diagram, identify the parts marked a – d.
-
- 1) a - placental villi, b - yolk sac, c - umbilical cord, d- amniotic fluid
- 2) a - yolk sac, b - amniotic fluid, c - umbilical cord, d - placental villi
- 3) a - umbilical cord, b - yolk sac, c - amniotic fluid, d - placental villi
- 4) a - placental villi, b - umbilical cord, c - yolk sac, d - amniotic fluid

QUESTIONS LEVEL - II

- 1.** Male accessory ducts include
- 1) rete testes, vasa efferentia, epididymis
 - 2) rete testes, vasa efferentia, epididymis, vas deferens
 - 3) rete testes, vasa efferentia, epididymis, seminal vesicles
 - 4) rete testes, vasa efferentia, epididymis, vas deferens , seminal vesicles

- 2.** Which of the following statements concerning seminiferous epithelium is not true?
- It has a robust basement membrane
 - Its basal compartment contains spermatogonia
 - It contains Sertoli cells and spermatogenic cells
 - Before puberty it contains spermatids
- 3.** Seminal plasma shows:
- secretion of paired seminal vesicles only
 - secretion of unpaired prostate gland only
 - secretions of paired seminal vesicles, unpaired prostate gland and paired bulbourethral glands
 - secretions of paired seminal vesicles and paired bulbourethral glands only
- 4.** In humans, what is the ratio of the number of gametes produced from one male primary sex cell and one female primary sex cell respectively :
- | | |
|--------|--------|
| 1) 1:1 | 2) 1:3 |
| 3) 1:4 | 4) 4:1 |
- 5.** The male germ cells undergo division to produce sperms by the process of spermatogenesis. Choose the correct one with reference to the above.
- Primary spermatocytes divide by mitotic cell division
 - Spermatozoa are transformed into spermatids
 - Spermatogonia have 46 chromosomes and always undergo meiotic cell division
 - Secondary spermatocytes have 23 chromosomes and undergo second meiotic division
- 6.** A human primary spermatocyte contains
- 22 autosomes and x - chromosome
 - 22 autosomes and y - chromosome
 - 22 autosomes and x or y chromosome
 - 22 pairs of autosomes and x and y chromosomes
- 7.** Which one of the following statements about human sperm is correct:
- Acrosome serves as a sensory structure leading the sperm towards the ovum
 - Acrosome serves no particular function
 - Acrosome has a conical pointed structure used for piercing the egg.
 - The sperm lysins in the acrosome dissolve the egg envelope facilitating fertilization
- 8.** Which of the following is not the function of placenta?
- It secretes estrogen
 - It facilitates supply of oxygen and nutrients to embryo
 - It secretes oxytocin during parturition
 - It facilitates the removal of CO_2 and waste materials from embryo
- 9.** Which hormone secreted in a woman if pregnancy has occurred is used in pregnancy tests?
- Estrogen
 - Progesterone
 - Luteinizing Hormone
 - Human chorionic gonadotropin

- 10.** Read the following statements
- 1) The outer layer of blastomeres seen in the blastocyst is called trophoblast
 - 2) The inner group of blastomeres seen attached to trophoblast is called inner cell mass
 - 3) Inner cell mass gets differentiated as the embryo
 - 4) During implantation the trophoblast layer gets attached to the endometrium
- Of the above statements
- 1) 1, 2 and 3 are true, 4 is false
 - 2) 1 and 4 are true, 2 and 3 are false
 - 3) 1 and 2 are true, 3 and 4 are false
 - 4) 1,2,3 and 4 are true
- 11.** Corpus luteum secretes large amount of progesterone. This is
- 1) to help the development of ovarian follicles
 - 2) for the retention of the endometrium
 - 3) to promote LH surge
 - 4) to prevent implantation
- 12.** Polar bodies are:
- 1) smaller cells produced during spermatogenesis
 - 2) smaller cells formed due to unequal meiosis in primary oocytes
 - 3) larger cells formed due to meiosis in primary spermatocyte and secondary spermatocyte
 - 4) smaller cells formed due to unequal meiosis in primary oocyte and secondary oocyte
- 13.** In females' secretion of GnRH would lead to the:
- 1) Secretion of testosterone leading to mammary gland development
 - 2) Release of prolactin leading to milk production in mammary glands
 - 3) Secretion of LH and FSH from anterior pituitary leading to follicle development and ovulation
 - 4) All the above
- 14.** Diagrammatic sectional view of the female reproductive system is given below. Which of the following option shows the correct labelling and events occurring in that organ?
- 
- 1) a = ovary - follicle rupture, completion of second meiotic division, b = Fallopian tube - fertilization, blastocyst formation, c = uterus - implantation
- 2) a = ovary - follicle maturation, beginning of first and second meiotic division, b = Fallopian tube - fertilization, completion of second meiotic division, c = uterus - beginning of cleavage, implantation
- 3) a = ovary - follicle maturation, completion of second meiotic division, b = fallopian tube - beginning of cleavage, implantation, c = uterus - fertilization, blastocyst formation
- 4) a = ovary - follicle rupture, completion of first meiotic division, b = fallopian tube - completion of second meiotic division, fertilisation, beginning of cleavage, c = uterus - blastocyst formation, implantation

- 15.** In a normal pregnant woman the amount of total gonadotropin activity was assessed, the result expected was
- High level of circulating FSH and LH in the uterus to stimulate implantation of the embryo
 - High level of circulating hCG to stimulate endometrial thickening
 - High level of circulating hCG to stimulate estrogen and progesterone synthesis
 - High level of FSH and LH in uterus to stimulate endometrial thickening
- 16.** How many ova and sperms are required for the formation of fraternal twins?
- one ovum, one sperm and one zygote
 - two ova, one sperm and one zygote
 - one ovum, two sperms and two zygote
 - two ova, two sperms and two zygotes
- 17.** Which one of the following is the correct matching of the events occurring during menstrual cycle:
- Menstruation - breakdown of myometrium and ovum not fertilized
 - Ovulation - LH and FSH attain peak level and a sharp fall in the secretion of progesterone
 - Proliferation phase - Rapid regeneration of myometrium and maturation of Graafian follicle
 - Development of corpus luteum - Secretory phase and increased secretion of progesterone
- 18.** Which of the following statements are true for spermatogenesis, but do not hold true for oogenesis?
- It results in the formation of haploid gametes
 - Differentiation of gamete occurs after the completion of meiosis
 - Meiosis occurs continuously in a mitotically dividing stem cell population
 - It is controlled by LH and FSH secreted by the anterior pituitary
 - It is initiated at puberty
- Choose the most appropriate answer from the options given below.
- | | |
|--------------------|--------------------|
| 1) c and e only | 2) b and c only |
| 3) b, d and e only | 4) b, c and e only |
- 19.** Identify the embryonic developmental stage shown below as well as the related right place of its occurrence in a normal pregnant woman, and select the right option
- 
- Late morula - middle part of fallopian tube
 - Blastula - end part of fallopian tube
 - Blastocyst - uterine wall
 - 8 celled morula - ampulla part of fallopian tube

- 20.** Select the incorrect statement.
- 1) Human placental lactogen (hPL) has lactogenic and growth stimulating effects
 - 2) The presence of hCG in mother's urine is tested for pregnancy
 - 3) Mature ovum is haploid and known as ootid
 - 4) Perivitelline space present in secondary oocyte is seen between zona pellucida and corona radiata
- 2.** Select the incorrect statement
- 1) At puberty a human female shows about 1,20000 to 1,60000 primary follicles
 - 2) In a tertiary follicle the theca layer is organised into an inner theca interna and outer theca externa
 - 3) A secondary follicle shows more layers of granulosa cells and a new theca
 - 4) First meiotic division of primary oocyte will be completed in Graafian follicle only

QUESTIONS **LEVEL - III**

- 1.** Select the incorrect statement
- 1) Immunologically competent cells are present in the interstitial spaces of seminiferous tubules
 - 2) Sertoli cells are present in the germinal epithelium
 - 3) Epididymis receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct
 - 4) Epididymis, vas deferens and ejaculatory duct etc store and transport the sperms from the testis to the outside through urethra
- 3.** **Assertion** : There are remarkable differences between the reproductive events in human male and female
- Reason** : Spermatogenesis starts at the age of puberty and oogenesis begins in the embryonic stage.
- 1) Both assertion and reason are true and reason is the correct explanation of the assertion.
 - 2) Both assertion and reason are true, but reason is not a correct explanation of assertion
 - 3) Assertion is true, but reason is false
 - 4) Both assertion and reason are false

4. Read the following statements.

- a) Monozygotic twins are produced when the first cleavage of zygote is followed by separation into two
- b) Fraternal twins are also called as dizygotic twins
- c) Inner cell mass contains stem cells which have the potency to give rise to all the tissues and organs.
- d) Parturition is induced by a complex neuroendocrine mechanism involving cortisol, estrogen and oxytocin
- e) External genitalia of a foetus is developed by the end of second month of pregnancy.

Of the above statements

- 1) Only two are correct
- 2) Only three are correct
- 3) Only four are correct
- 4) All are correct

5. Read the following statements.

- i) Cleavage starts while the zygote moves through the isthmus of fallopian tube.
- ii) hCG and hPL are produced only during pregnancy.
- iii) Mammalian blastula is called blastocyst.
- iv) In the later phase of pregnancy, the hormone relaxin is produced by corpus luteum.

Of the above statements

- 1) Only two are true
- 2) Only three are true
- 3) Only one is true
- 4) All are true

SYNOPSIS

- ◆ Demography, Malthusian theory, Natality, Mortality
- ◆ Population explosion,
- ◆ Definition of reproductive health
- ◆ Reasons for population explosion in India
- ◆ Sex ratio
- ◆ Population growth rate, world population
- ◆ Reproductive and child health care programme (RCH)
- ◆ Amniocentesis, use and misuse of amniocentesis
- ◆ Legal birth control methods
- ◆ Traditional birth control methods
 - a) Lactational amenorrhoea
 - b) Periodic abstinence
 - c) Coitus interruptus / withdrawal method
- ◆ Modern birth control methods
 - I) Barrier methods
 - a) Condoms
 - b) Diaphragm
 - c) Cervical caps
 - d) Vaults

II) Intra Uterine Contraceptive Devices (IUCD / IUD)

- 1) Copper Releasing IUCDs eg. Cu-7, CuT, multiload-375
- 2) Hormone Releasing IUCDs eg. progestasert, LNG -20
- 3) Non medicated IUCD eg. Lippes loop

III) Oral contraceptives

- 1) Combined pills (steroid pills) eg. Mala - D, mode of action, dosage, method of use
- 2) Non - steroidals pills eg. Saheli - mode of action, method of use

IV) Implants - mode of action, method of introduction**V) Injections - mode of action, method of use****VI) Emergency contraceptives - example, mode of action****VII) Terminal methods/ Sterilisation methods/ surgical methods**

- ◆ Vasectomy and Tubectomy, procedure and mode of action
- ◆ Side effects of birth control methods
- ◆ MTP/ Abortion, conditions for MTP, Risks of MTP
- ◆ Sexually Transmitted Diseases/ Reproductive Tract Infections / Venereal Diseases/ STI's

Non curable viral STDs, Curable viral STDs

Bacterial STDs, Protozoan STDs etc

- ◆ After effects of STDs
- ◆ Assisted Reproductive Technology (ART)
- ◆ Test Tube Baby Technique. Its pioneers
- ◆ Different methods of ART
- ◆ ZIFT, IUT, GIFT, ICSI, AI/ IUI etc.

QUESTIONS

LEVEL - I

- 1.** The probable causes for the rapid increase in the population of India are:
 - 1) a rapid decline in death rate
 - 2) a rapid decline in maternal mortality rate
 - 3) a rapid decline in infant mortality rate
 - 4) All the above

- 2.** Natality refers to
 - 1) death rate
 - 2) birth rate
 - 3) number of individuals entering a habitat
 - 4) number of individuals leaving a habitat

- 3.** In India, family planning programme was started in:

1) 1951	2) 1956
3) 1947	4) 1955

- 4.** An ideal contraceptive must be:
 - 1) user friendly
 - 2) easily available
 - 3) effective and reversible
 - 4) All the above

- 5.** Which of the following is a natural / traditional contraceptive method?
 - 1) cervical cap
 - 2) periodic abstinence
 - 3) condom
 - 4) periodic abstinence & lactational amenorrhoea

- 6.** Match the contraceptive methods given under column I with their example given under column II.

Select the correct choice from those given below?

Column I	Column II
a) Chemicals	p) tubectomy and vasectomy
b) IUDs	q) Copper T and Lippes loop
c) Barriers	r) Nirodh and Femidom
d) Sterilization	s) Coitus interruptus
	t) Spermicidal jelly and foam

- 1) a - s, b - t, c - q, d - r
- 2) a - p, b - r, c - q, d - t
- 3) a - s, b - q, c - t, d - p
- 4) a - t, b - q, c - r, d - p

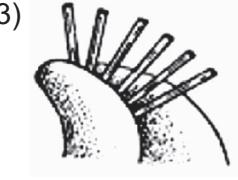
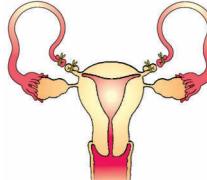
- 7.** Saheli a non-steroidal oral contraceptive for females is developed by CDRI, Lucknow. Select the correct mode of action of it from the following?

- 1) it prevents fertilization
 - 2) it prevents implantation by blocking the estrogen receptors present in uterus
 - 3) it prevents capacitation
 - 4) it increases the concentration of progesterone and prevents ovulation
- 8.** Emergency contraceptive are effective if used within
 - 1) 72 hours of Implantation
 - 2) 72 hours of menarche
 - 3) 72 hours of coitus
 - 4) 72 hours of menstruation

- 9.** Progestasert is an IUD which makes the uterus unsuitable and cervix hostile to the sperms as it is
- Copper releasing IUD
 - Ideal contraceptive
 - Non medicated IUD
 - Hormone releasing IUD
- 10.** Select the group that contains only hormone releasing intra uterine devices?
- Vaults, LNG - 20
 - Multiload - 375, Progestasert
 - Progestasert, LNG - 20
 - Lippes's loop, Cu 7
- 11.** Amniocentesis is a prenatal technique used to
- reverse the sex of the foetus
 - correct the genetic disorders of foetus
 - detect the chromosomal anomaly of the foetus
 - estimate the essential amino acids in the body
- 12.** Which of the following is not an assisted reproductive technology (ART)?
- | | |
|---------|---------|
| 1) ZIFT | 2) GIFT |
| 3) ICSI | 4) MTP |
- 13.** In vitro fertilization and Embryo Transfer Technology is commonly called as
- IUI technology
 - GIFT technology
 - ICSI technology
 - Test tube baby technique
- 14.** Which of the following is wrongly matched?
- IUI - semen collected from husband or donor is artificially introduced into the uterus
 - GIFT - Transfer of embryos with more than 8 blastomeres into the fallopian tube
 - ICSI - Sperm directly injected into the ovum
 - ZIFT - Transfer of embryos with upto 8 blastomeres into the fallopian tube
- 15.** The technique called gamete intra fallopian transfer is recommended for those females
- Who cannot provide suitable environment for fertilization
 - Who cannot retain foetus inside the uterus
 - Who cannot produce an ovum
 - Whose cervical canal is too narrow to allow the passage of sperms

QUESTIONS**LEVEL - II**

- 1.** Read the following statements about population explosion?
- Decrease in mortality and increase in natality
 - Increase in the number of people in the pre reproductive age group
 - Increase in the number of people in the reproductive age group
 - Decrease in the number of people in the post reproductive age group
- Of the above statements how many are applicable for India's population growth.
- Only Three
 - Only two are true
 - Only One
 - All

- 2.** If in a population, natality is balanced by mortality, then there will be
- decrease in population growth
 - increase in population growth
 - zero population growth
 - over population
- 3.** Foetal sex can be determined by examining somatic cells in the amniotic fluid by looking for condensed inactive X- chromosome known as
- Barr bodies
 - Centromere
 - Chiasmata
 - Kinetochore
- 4.** As long as the mother breast feeds the infant fully the chances of conception are almost nil. Which of the following is a suitable explanation?
- Excess presence of milk ejecting hormone blocks ovulation and therefore menstrual cycles do not occur
 - Excess presence of prolactin inhibits gonadotropin release and therefore menstrual cycles do not occur
 - Excess presence of thyroxine and OT inhibit ovulation and therefore menstrual cycles do not occur
 - Excess presence of progesterone inhibits ovulation and therefore menstrual cycles do not occur.
- 5.** Which of the following contraceptive device is considered as an IUCD?
- 
 - 
 - 
 - 
- 6.** Which of the following sets of contraceptive methods do involve a role of hormone in all devices?
- Barrier methods, lactational amenorrhoea, pills
 - pills, emergency contraceptives, barrier methods
 - lactational amenorrhoea, pills, emergency contraceptives
 - Cu 7, pills, emergency contraceptives
- 7.** During the first two weeks of the human menstrual cycle by artificially increasing the blood levels of estrogen and progesterone will
- cause menstruation to start early
 - cause the development of the ovarian follicle
 - prevent pregnancy by causing shrinkage and reabsorption of the uterine lining
 - inhibits ovulation by reducing the release of LH and FSH from the anterior pituitary.

- 8.** Which of the following statement is wrong regarding intrauterine devices?
- It is one of the most widely accepted methods of contraception in India
 - It is ideal for the females who want to delay pregnancy and / or space children
 - It can be self - inserted and thereby gives privacy to the user
 - It increases phagocytosis of sperms within the uterus
- 9.** Tubectomy is a method of sterilization in which
- ovaries are removed surgically
 - Small part of vas deferens is removed or tied up
 - Uterus is removed surgically
 - Small part of fallopian tube is removed and tied up
- 10.** Select the incorrect statement.
- The copper ions released from CuT, suppress sperm motility and fertilizing capacity of sperms.
 - The hormone releasing intra uterine device - progestasert - makes the uterus unsuitable for implantation and the cervix hostile to sperms
 - Diaphragms, cervical caps and vaults are barriers made of rubber, that are inserted into female reproductive tract to cover the cervix during coitus
 - Surgical removal of uterus is called oophorectomy
- 11.** From the sexually transmitted diseases mentioned below, identify the one which does not specifically affect the sex organs?
- | | |
|-------------|------------------|
| 1) Syphilis | 2) gonorrhoea |
| 3) AIDS | 4) genital warts |
- 12.** In vitro fertilisation is a technique that involves transfer of which one of the following into the fallopian tube
- Either zygote or early embryo upto 8 cell stage
 - Embryo of 32 cell stage
 - Zygote only
 - Embryo only upto 8 cell stage

QUESTIONS**LEVEL - III**

- 1.** Which of the following approaches does not give the defined action of the contraceptive?
- IUD - They increase phagocytosis of sperms, suppress sperm motility and fertilizing capacity of sperms
 - Vasectomy - It blocks the movement of sperms through vasa efferentia.
 - Barrier methods - They prevent the entry of sperms into uterus
 - Hormonal contraceptives - They prevent or retard the entry of sperms, prevent ovulation and fertilization
- 2.** Which of the following contraceptive methods do involve a role of hormone in all?
- lactational amenorrhoea, pills, barrier methods
 - barrier methods, pills, emergency contraceptive
 - pills, CuT, emergency contraception
 - lactational amenorrhoea, pills, emergency contraceptives

- 3.** Which of the following contraceptive methods create anovulatory menstrual cycles?
- IUCD
 - Progestogen-estrogen combined pills
 - Tubectomy
 - Vaults
- 4.** Read the following statements:
- The intention of Medical Termination of Pregnancy (Amendment) Act 2017 is to reduce illegal abortions
 - Abortions conducted by untrained personal may result in maternal mortality and morbidity
 - A pregnancy may be terminated on certain considered grounds within the first 12 weeks of pregnancy on the opinion of one registered medical practitioner
 - If the pregnancy has lasted more than 12 weeks but fewer than 24 weeks, two registered medical practitioners must be of the opinion, formed in good faith, that the required ground exists.
- Of the above statements
- only three are true
 - only two are true
 - only one is true
 - all are true
- 5. Assertion :** In humans, orchidectomy and oophorectomy are not considered as an ideal birth control method.
- Reason :** As a result of castration, libido will be stopped, more over the wide ranging beneficial actions of sex hormones will be lost
- 1) Both assertion and reason are true and reason is a correct explanation of assertion.
- 2) Both assertion and reason are true, but reason is not a correct explanation of assertion
- 3) Assertion is true, but reason is false
- 4) Both assertion and reason are false

SYNOPSIS

1. Mendelism

- Brief history of Mendel and his work
- Monohybrid cross explaining the ratios and test cross
- Law of Dominance
- Law of Segregation
- Dihybrid cross illustrating the independent behaviour of 2 factors
- Law of independent assortment

2. Exceptions

- Exceptions to Mendelism
- Incomplete Dominance
- Multiple allelism
- Codominance
- Polygenic Inheritance and Pleiotropy

3. Chromosomal theory of Inheritance

- Development in cytology in the beginning of 20th century co-relating to the genetics
→ chromosomal basis of inheritance.
- Introduction of Linkage through the chromosome theory

4. Linkage and applications

- Contribution of Morgan through the dihybrid crosses in Drosophila
- Findings or observations of Morgan and contribution of Alfred Sturtevant

5. Sex determination

- ◆ Chromosomal basis of sex determination : explaining the three types.
 - Allosomal basis - 3 types
 - Haplo-diploid system in Honey bee
 - Sex determination in human beings.

6. Mutation

- Introduction through the contributions of Hugo de Vries
- Mutagens
- Spontaneous and induced mutations

- ◆ Classification of mutation :

- 1) Gene mutations
- 2) Chromosomal aberrations : ie Structural change of chromosome
- 3) Numerical chromosomal mutations : Euploidy and Aneuploidy

7. Genetic disorders

Mendelian Disorders / Gene disorders

- Examples : Haemophilia, Colour blindness, Sickle cell anaemia, Thalassemia, Phenylketonuria, etc.

Chromosomal disorders

- Impact of Non-disjunction of chromosome in parents ; Aneuploidy in the offspring as the reason.
- The type of aneuploidy and symptoms behind the respective autosomal and allosomal syndromes ie; Down syndrome, Klinefelter's syndrome and Turner's syndrome.

8. Pedigree analysis

- Need of population study in human beings in connection with determination of dominance.
- Its applications eg. for tracing disorders in family.
- Understanding pedigree chart

QUESTIONS**LEVEL - I**

- 1.** Gregor Mendel selected 7 pairs of contrasting traits and conducted hybridization experiments in which specimen?
 - 1) *Antirrhinum majus*
 - 2) *Drosophila melanogaster*
 - 3) *Mirabilis jalapa*
 - 4) *Pisum sativum*

- 2.** What should be the percentage of heterozygous offsprings in the second filial generation of Mendel's monohybrid cross?
 - 1) 25%
 - 2) 50%
 - 3) 100%
 - 4) 12.5%

- 3.** In a particular bird species, feather colour shows incomplete dominance. In a cross between pure black birds with white birds produces Grey offsprings. Then Grey birds are crossed together to obtain the F_2 generation. About 200 offsprings became produced in F_2 generation. What should be the approximate number of Grey birds?
 - 1) 50
 - 2) 100
 - 3) 75
 - 4) 150

- 4.** Offspring resembles both the parents in case of :
 - 1) F_1 generation in a monohybrid cross in *Pisum sativum*
 - 2) F_1 generation in a monohybrid cross in *Antirrhinum majus*
 - 3) Offspring with AB blood group
 - 4) F_1 generation in a dihybrid cross in *Pisum sativum*

- 5.** A single gene with many alleles is an exception for Mendel's concept. This phenomena is found in :
 - 1) Skin colour in human
 - 2) ABO blood group system in human population
 - 3) Flower colour in *Mirabilis*
 - 4) Intelligence in human population

- 6.** In a family parents have two children, their blood groups are O and B respectively. Their mother has recessive blood group. What would be the possible group of father?
 - 1) AB
 - 2) Heterozygous B
 - 3) Heterozygous A
 - 4) O group

- 7.** Mendel proposed Laws of Inheritance in Genetics. Which Law / Laws is/are considered as Universal law that can be applicable in all cases :
 - 1) Law of Dominance
 - 2) Law of Segregation
 - 3) Law of Independent assortment
 - 4) Both Law of Dominance and Law of Segregation

- 8.** Based on the law of Independent assortment, the genotype $AaBBXx$ can produce how many different types of gametes?
 - 1) 8
 - 2) 4
 - 3) 16
 - 4) 2

- 9.** What should be the percentage of offsprings in F_2 which are genotypically similar to the offsprings of F_1 generation in a normal Mendelian dihybrid cross?
- 50%
 - 75%
 - 25%
 - 12.5%
- 10.** Match column I with column II and find out the correct option given below.

	Column I		Column II
A	Monohybrid phenotypic ratio	1.	1 : 1 : 1 : 1
B	Monohybrid test cross ratio	2.	1 : 2 : 1
C	F_2 phenotypic ratio in incomplete dominance	3.	1 : 1
D	Dihybrid phenotypic ratio	4.	3 : 1
E	Dihybrid test cross ratio	5.	9 : 3 : 3 : 1

1) $\frac{ABCDE}{32514}$

2) $\frac{ABCDE}{43521}$

3) $\frac{ABCDE}{53241}$

4) $\frac{ABCDE}{43251}$

- 11. Statement A:** According to Mendel's concept, factors are discrete units that control the expression of traits and of the pair of factors which did not blend with each other.

Statement B: Mendel could not provide any physical proof for the existence of factors or say what they were made of.

- Both statements are true
- Statement A is true, whereas statement B is false
- Both Statements are false
- Statement A is false, whereas statement B is true

- 12.** In 1902 the parallel behaviour of genes and chromosomes were noted by :

- T.H. Morgan
- Correns and Tschermark
- Sutton and Boveri
- Hugo de Vries

- 13.** Which of the following is a "Wild" character in Drosophila?

- Yellow body colour
- Miniature wing size
- White eye colour
- Brown body colour

- 14.** In Morgan's experiments, in cross - B the genes w and m / w^+ and m^+ are placed apart on the 'x' chromosome. In cross A the genes y and w / y^+ and w^+ are placed closely on the 'x' chromosome. This means :

- Cross A shows less linkage and more parentals in F_2
- Cross B shows more linkage and less parentals in F_2
- Cross A shows more linkage and more recombinants in F_2
- Cross B shows less linkage and more recombinants in F_2

15. Assertion : The trait or character controlled by two or more genes are called polygenic characters. These characters have quantitative or cumulative effect.

Reason : In Polygenic character the effect of each allele is additive.

- 1) Both Assertion and Reason are correct and R is the correct explanation of Assertion
- 2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
- 3) Assertion is correct but Reason is not correct
- 4) Both Assertion and Reason are correct

16. Human males are heterogametic. The chance for a male or female offspring in a fertilization is determined by male gamete and this chance should be :

- 1) 25%
- 2) 50%
- 3) 75%
- 4) Cannot be predictable

17. Read the following options. One of the disease given below is an autosomal dominant disease. Identify the disease :

- 1) Haemophilia
- 2) Sickle cell anaemia
- 3) Phenylketonuria
- 4) Myotonic dystrophy

18. A disease that is caused by point mutation on autosomal gene is :

- 1) Thalassemia
- 2) Sickle cell anaemia
- 3) Colour blindness
- 4) Haemophilia

19. Rudimentary ovaries and lack of secondary sexual characters are the diagnostic features of :

- 1) Down's syndrome
- 2) Klinefelter's syndrome
- 3) Turner's syndrome
- 4) Phenyl ketonuria

20. The karyotype 45A + XX | XY is found in :

- 1) Klinefelter's syndrome
- 2) Haemophilia
- 3) Down's syndrome
- 4) Turner's syndrome

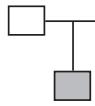
QUESTIONS LEVEL - II

1. Gregor Mendel performed hybridisation experiments in Garden Pea. He started experiments in 1856 and continued the experiments for about :

- 1) 6 years
- 2) 7 years
- 3) 2 years
- 4) 8 years

- 2.** A pure or homozygous garden pea plant for round seed is crossed with another plant having wrinkled seed. What should be the expression or phenotype in first filial generation?
- Garden Peas with Round seeds
 - Garden Peas with wrinkled seeds
 - Garden Peas with intermediate seeds
 - Both Round seeded and wrinkled seeded garden Peas in 1 : 1 ratio
- 3.** Read the following statements :
- Genes which code for a pair of contrasting traits are known as alleles.
 - Alleles are slightly different forms of the same gene.
 - 1 : 2 : 1 ratio of TT : Tt : tt obeys the mathematical binomial expression $(ax + by)^2$
 - In a typical test cross, a Pea plant showing a dominant phenotype (whose genotype to be determined) is crossed with the recessive parent instead of self crossing
 - Alleles do not show any blending is explained by Law of segregation.
- Of these, which statements are true?
- (i), (iv) and (v)
 - (i), (ii) and (iii)
 - (ii), (iii) and (v)
 - All are true
- 4.** Incomplete dominance and pleiotropy are expressed in :
- Seed shape in Garden Pea
 - Starch synthesis in Garden Pea
 - AB blood group
 - Skin colour in human
- 5.** Which of the following is correct about ABO blood group system?
- ABO system is an example for multiple allelism and incomplete dominance
 - An individual has only two alleles
 - It contains 4 genotypes and 6 phenotypes.
 - It has totally one gene with 4 alleles
- 6.** In a genotype "AaBb" the chance for the formation of "ab" gamete is:
- 25%
 - 75%
 - 50%
 - 12.5%
- 7.** The process "Crossing over", explained by Morgan, can be compared to which law proposed by Mendel?
- Law of Dominance
 - Law of segregation
 - Law of independent assortment
 - Crossing over cannot be compared to any law proposed by Mendel
- 8.** Two different pairs of homologous chromosomes can select each other and segregate into gametes in how many different ways as per the concept proposed by Sutton and Bovery?
- 2 ways
 - 3 ways
 - 4 ways
 - 8 ways

- 9.** T.H. Morgan studied in tiny fruit flies, called Drosophila, which were found very suitable for genetical studies, because of the following characters except :
- They could grow on simple synthetic medium in Laboratory
 - They complete their life cycle within two weeks
 - A single mating could produce a small number of progeny flies
 - Male and female can be easily distinguishable.
- 10.** The method of chromosome mapping is developed by :
- T.H Morgan
 - Alfred Sturtevant
 - Reginald Punnett
 - Hugo de Vries
- 11.** If we consider the concepts proposed by G.J. Mendel in his dihybrid crosses, then the recombinants are produced by :
- Crossing over or Independent Assortment
 - Independent Assortment only
 - Less linkage between genes
 - Increased distance between genes
- 12.** In a cross between $Tt Xx YY \times TTxxYY$ how many different combinations of offsprings will be produced?
- 4
 - 64
 - 12
 - 16
- 13. Assertion** : Phenylketonuria is an example for pleiotropism.
- Reason** : The recessive gene causing phenylketonuria can produce a number of phenotypic effects in patient.
- Both Assertion and Reason are correct and R is the correct explanation of Assertion
 - Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - Assertion is correct but Reason is not correct
 - Both Assertion and Reason are correct
- 14. Statement A** : Henking discovered a specific nuclear structure in insect and named it as X-body.
- Statement B** : Henking could explain the significance of X-body and later he renamed the structure as X-chromosome.
- Statement A and B are correct.
 - Statement A and B are wrong
 - Statement A is correct, B is wrong
 - Statement A is wrong, B is correct
- 15.** In which animal, the number of sets of chromosomes determine the sex?
- Domestic Fowl
 - Garden Lizard
 - Apis
 - Drosophila

- 16.** Change in a single base pair of a gene is known as :
- Aneuploidy
 - Euploidy
 - Point mutation
 - Frame shift mutation
- 17.** The decrease in quantity of α or β chains in Hb is an autosomal disease it is known as :
- Sickle cell anaemia
 - Thalassemia
 - Phenyl ketonuria
 - Cystic fibrosis
- 18.** The classical example for a point mutation is sickle cell anaemia. In this disease the mRNA for β chain shows a substitution of codon at 6th position it is :
- GAG to GUG
 - GUG to GAG
 - CTC to CAC
 - CAC to GUG
- 19.**  This symbol in a pedigree shows:
- An affected male or female child for a normal couple
 - An affected male child for a normal couple
 - An unaffected male child for a normal couple
 - An unaffected male child for an affected couple
- 20.** What should be the probability for a haemophilic patient among the daughters of a haemophilic man and carrier haemophilic woman.
- 25%
 - 75%
 - 50%
 - 100%

QUESTIONS

LEVEL - III

- 1** Meiosis is an unavoidable event in sexual reproduction. One of the stages in meiosis, crossing over is occurring and it will lead to recombinations. Read the following options, one of them is an exception for it. Find ?
- Spermatogenesis in seminiferous tubules
 - Oogenesis in ovary
 - Conjugation in E.coli
 - Microsporogenesis in Hibiscus
- 2.** **Assertion** : Based on the modern concept, study of evolution needs Mendelian genetics.
- Reason** : The allelic frequency in Hardy - Weinberg principle is expressed on the basis of mendelian binomial expansion $(ax + by)^2$.
- Both Assertion and Reason are correct and R is the correct explanation of Assertion
 - Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - Assertion is correct but Reason is not correct
 - Both Assertion and Reason are correct

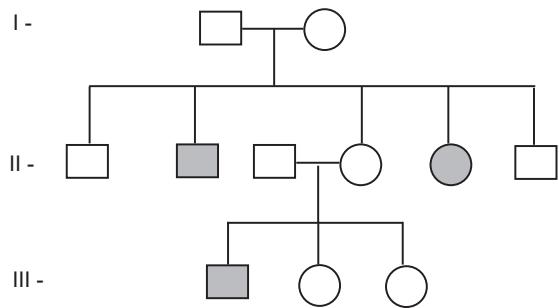
3. A man who has universal donor blood group marries a woman who has universal recipient blood group. What should be the percentage of an offspring who can produce only one type of sugar on the membrane of RBC?
- 1) 25%
 - 2) 12.5%
 - 3) 50%
 - 4) 100%

4. **Assertion** : Drosophila is an ideal specimen for genetical studies and Morgan conducted several experiments on it.

Reason : Drosophila has many types of hereditary variations that can be seen with low power microscope.

- 1) Both Assertion and Reason are correct and R is the correct explanation of Assertion
- 2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
- 3) Assertion is correct but Reason is not correct
- 4) Both Assertion and Reason are correct

5. Observe the following pedigree.



If you are using the letters 'A' and 'a' to represent the genes, then what would be the genotypes of parents in generation I?

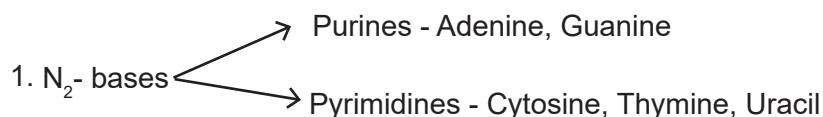
- 1) AA and aa
- 2) Aa and aa
- 3) Aa and Aa
- 4) aa and aa

15 MOLECULAR BASIS OF INHERITANCE

SYNOPSIS

I. Structure of DNA

- Formation of Nucleotides



3. Phosphate group.

Dinucleotide

Polynucleotide

II. • Chargaff rule I

$$\left[\frac{A+G}{T+C} = 1 \right]$$

• Chargaff's rule II

$$\left[\frac{A+T}{G+C} = \text{constant for species} \right]$$

III. Packaging of DNA

- Histone octamer
- Nucleosome
- Chromatin - Euchromatin, Heterochromatin
- NHC protein

IV. Search for Genetic Material :

- 1928 - Griffith's experiment (Bacterial transformation)
- 1933 - 1944 - Biochemical characterisation of Transforming Principle
- 1952 - Hershey and Chase Experiment [Unequivocal proof that DNA is the genetic material]

V. Properties of Genetic material

VI. Replication of DNA

- Experiments to prove semi-conservative model of DNA replication
- by Meselson and stahl
- by Taylor and Wood (in brief)

VII. Mechanism of DNA replication

- Machinery and enzymes

VIII. Central dogma of molecular biology

- Reverse Central dogma

IX. Transcription

- Transcription unit and Gene
- Process of Transcription.
- In eukaryotes
- In prokaryotes

X. RNA world

- Different types of RNA
- tRNA - the adapter molecule
 - Clover leaf model and inverted L shape structure

XI. Genetic code

- History
- Codon chart
- Salient features

XII. Translation**XIII. Regulation of Gene expression**

- In Eukaryotes
- In Prokaryotes
 - Operon concept
 - Lac operon

XIV. Human Genome Project

- Goals
- Methodologies
- Salient features of Human Genome
- Applications and future challenges.

XV. DNA finger printing

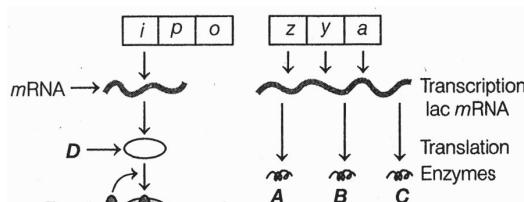
QUESTIONS

LEVEL - I

1. Identify the correct order of organisation of genetic material from largest to smallest :
 - 1) Genome, Chromosome, Gene, Nucleotide
 - 2) Chromosome, Genome, Nucleotide, Gene
 - 3) Chromosome, Gene, Genome, Nucleotide
 - 4) Genome, Chromosome, Nucleotide, Gene
2. Choose the incorrect option.
 - 1) Friedrich Miescher in 1869 identified DNA and named it nuclein.
 - 2) Erwin Chargaff said, the ratio between A and T and G and C of dsDNA are constant and equals one.
 - 3) The two strands of dsDNA are complementary to each other.
 - 4) DNA is acidic because of nitrogen bases
3. Choose the incorrect pair :
 - 1) Basic amino acid residues in histones - Lysine and arginine
 - 2) Unit of 8 molecules in histones - histone octamer
 - 3) Negatively charged DNA wrapped around positively charged DNA - Nucleosome
 - 4) Thread-like, colourless structure - Chromatin in nucleus (Upon staining)

4. In dsDNA A = 30%, what will be the percentage of G?
 - 1) 20%
 - 2) 40%
 - 3) 30%
 - 4) 60%
5. Part of chromatin which is densely packed, stain darkly and is transcriptionally inactive is called :
 - 1) euchromatin
 - 2) chromatosome
 - 3) heterochromatin
 - 4) chromosome
6. What was unique in Griffith's experiments?
 - 1) DNA was found to be the genetic material
 - 2) RNA was found to be the genetic material
 - 3) Something from dead bacteria could change the living cells
 - 4) Viruses can live in bacteria
7. Hershey and Chase used ^{35}S and ^{32}P to prove that DNA is the genetic material. DNA is genetic material because
 - 1) Infected E.coli retained S^{35} but not P^{32}
 - 2) retention of ^{32}P in infected E.coli indicated that DNA was passed on
 - 3) loss of ^{35}S in infected E.coli indicated that proteins were not passed on
 - 4) P^{32} in Capsid retained in bacteria

- 8.** What will happen when the complimentary strands of DNA are heated up and brought together?
- They repel each other due to formation of charges
 - H-bond attract each other due to phosphate groups
 - They become non-complimentary to each other
 - They combine with each other under appropriate conditions
- 9.** Choose the incorrect statement about the semiconservative scheme of DNA replication.
- Watson and Crick proposed the scheme for replication for DNA in 1953
 - The scheme suggested that the two strands would separate and act as a template for the synthesis of new complementary strands
 - The two strands would remain intact during replication
 - After the completion of replication, each DNA molecule would have one parental and one newly synthesised strand.
- 10.** On which Parental / Template strand of DNA, replication is continuous?
- 5' → 3' polarity strand of DNA
 - 3' → 5' polarity strand of DNA
 - 3' → 2' polarity strand
 - 3' → 4' polarity strand
- 11.** Why both the strands of DNA are not copied during transcription?
- Because RNA molecule with complementary sequences will be formed
 - Because RNA molecule with same sequences will be formed
 - Because RNA molecule with identical sequences will be formed
 - Because DNA molecule with complementary sequences will be formed
- 12.** Choose the incorrect pair :
- Promoter - Binding site for RNA polymerase.
 - Terminator - Define the end of transcription process
 - Cistron - Segment of DNA coding for a polypeptide
 - Regulatory genes - Do not code for any RNA or protein in lac operon.
- 13.** In bacteria, which enzyme catalyses the transcription of all types of RNA (mRNA, tRNA and rRNA)?
- DNA - dependent RNA polymerase
 - DNA - dependent DNA polymerase
 - RNA - dependent RNA polymerase
 - RNA - dependent DNA polymerase

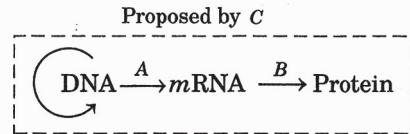
- 14.** RNA polymerase transcribes RNA from DNA. RNA polymerase can only do which step of transcription, without factors?
- Initiation
 - Elongation
 - Termination
 - All of these
- 15.** In bacteria, transcription and translation can be coupled process. Why?
- No separation of cytosol and nucleus
 - mRNA does not require any processing to become active
 - both 1 and 2
 - Due to the presence of nucleus
- 16.** Who developed the technique of synthesising RNA molecules with well-defined combination of bases (homopolymers and copolymers) to develop genetic code?
- Crick et al
 - Har Gobind Khorana
 - Severo Ochoa
 - Nirenberg
- 17.** Which among the following process occur(s) during charging of tRNA or aminoacylation of tRNA?
- The ribosomes binds to the tRNA at the start codon
 - The ribosome moves from codon to codon along with tRNA
 - Amino acids are activated in the presence of ATP is linked to their cognate tRNA
 - Linking of bond nucleotides
- 18.** The given diagram is of the lac operon. Identify components and enzymes (A, B, C, D and E)
- 
- 19.** Choose the incorrect option :
- HGP is closely associated with bioinformatics
 - HGP will help in developing new ways to diagnose, treat and some day prevent disorders affecting humans.
 - Fragments sequenced during HGP are done by method developed by Frederick Sanger.
 - Repetitive DNA sequences are stretches of DNA repeated 2-3 times in a DNA sequence.

- 20.** Satellite DNA is important because it
- codes for proteins needed in cell cycle
 - shows high degree of polymorphism, which is heritable from parents to children
 - does not code for proteins and is same in all members of the population
 - codes for enzymes needed for DNA replication

QUESTIONS**LEVEL - II**

- 1.** DNA is a :
- long polymer of deoxyribonucleotides
 - short polymer of deoxyribonucleotides
 - monomer of deoxyribonucleotides
 - long polymer of ribonucleotides
- 2.** Find the incorrect match :
- A bacteriophage ($\phi \times 174$) - 5386 nucleotides
 - Bacteriophage lambda - 48502 base pairs
 - E.coli - 4.6×10^6 bp
 - Haploid content of human DNA - 3.3×10^6 bp

- 3.** The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C.



- A-transcription, B-replication, C-James Watson
- A-translation, B-transcription, C- Erwin Chargaff
- A-transcription, B-translation, C-Francis Crick
- A-translation, B-extension, C-Rosalind Franklin

- 4.** Match the following columns.

Column I (Scientists)	Column II (Discoveries)
A. F. Miescher	1. DNA double helix
B. Griffith	2. Nuclein
C. Hershey and Chase	3. <i>Streptococcus pneumoniae</i>
D. Watson and Crick	4. Bacteriophage
E. Wilkins and Franklin	5. X-ray diffraction studies

Codes

A B C D E

- 5 4 3 1 2
- 1 4 3 2 5
- 2 3 4 1 5
- 1 3 4 2 5

5. Choose the incorrect statement/s about the experiment conducted by Meselson and Stahl is that :
- 1) equal amount of light DNA and hybrid DNA was observed in *E.coli* culture after two generations.
 - 2) the generation time of *E. coli* culture was 20 minutes.
 - 3) the equal amount of light DNA and hybrid DNA was observed in *E. coli* culture after three generations.
 - 4) Both 1 and 2
6. What will happen if the double - stranded RNA is produced during transcription?
- 1) This would prevent RNA from being translated into protein
 - 2) This would prevent RNA from being transcribed into protein
 - 3) There will be the continuous synthesis of RNA
 - 4) It will be degraded very fast
7. What will be the sequence of mRNA produced by the following stretch of DNA ?
- 3' – ATGCATGCATGCATG – 5' Template strand
5' – TACGTACGTACGTAC – 3' Coding strand
- 1) 3' – AUGCAUGCAUGCAUG – 5'
 - 2) 5' – UACGUACGUACGUAC – 3'
 - 3) 3' – UACGUACGUACGUAC – 5'
 - 4) 5' – AUGCAUGCAUGCAUG – 3'
8. Choose the incorrect statement from the following options.
- 1) Splicing represent the dominance of RNA world
 - 2) The presence of exons is reminiscent of antiquity
 - 3) Split gene arrangements represent an ancient feature of the eukaryotic genome
 - 4) In eukaryotes, atleast three RNA polymerases are found in the nucleus
9. Identify the correct statement from the following options.
- 1) Ochoa used a cell-free system for protein synthesis and to decipher the gene code
 - 2) Polynucleotide phosphorylase enzymes are also called Ochoa enzymes
 - 3) Only 20 codons codes for amino acids
 - 4) The genetic codes for arginine are UAA
10. Which statement accurately describes the process of translation initiation?
- 1) The ribosome binds to the mRNA at the UAA codon
 - 2) The ribosome binds to the mRNA at the AUG codon
 - 3) The ribosome binds randomly to any codon along the mRNA sequence
 - 4) The start codon is recognised by any tRNA molecule available in the cell
11. Codons of glycine are :
- 1) CCU, CCC, CCA, CCG
 - 2) CGU, CGC, CGA, CGG
 - 3) GGU, GGC, GGA, GGG
 - 4) ACU, ACC, ACA, ACG

- 12.** Choose the incorrect statement regarding tRNA molecule
- It has an anticodon loop that has bases complementary to the codon
 - It has an amino acid acceptor end to which it binds to amino acid
 - tRNA are not specific for each amino acid
 - tRNA looks like a clover leaf in secondary structure
- 13.** Match the following columns.

Column I (Functions)		Column II (Segments of DNA)	
A.	Segment of DNA coding for polypeptide	1.	Recon
B.	Segment of DNA goes for recombination	2.	Muton
C.	Segment of DNA goes for mutation	3.	Cistron
D.	Group of genes that work as a single unit	4.	Operon

- A - 1 ; B - 2 ; C - 3, D-4
- A - 3 ; B - 1 ; C - 2, D-4
- A - 3 ; B - 2 ; C - 1, D-4
- A - 1 ; B - 3 ; C - 2, D-4

- 14.** What happens in the tailing process of transcription?
- Adenylate residues added at 5' end of hnRNA
 - Adenylate residues added at 3' end of hnRNA
 - Guanylate residues added at 5' end of hnRNA
 - Guanylate residues added at 3' end of hnRNA

- 15.** A translational unit is present in
- t RNA
 - t RNA
 - mRNA
 - hn RNA
- 16.** Gene regulation governing lactose operon of *E. coli* that involves the *lac i* gene product is:
- positive and inducible because it can be induced by lactose
 - negative because its repressor protein prevents transcription.
 - positive and repressible because its repressor protein prevents transcription.
 - feedback inhibition because excess of β-galactosidase can switch off transcription.
- 17.** Identify the incorrect option regarding human genome project.
- It was officially completed in 2003
 - It aims to determine the sequence of 3 billion chemical base pairs and store it in data bases
 - It associated ethical legal and social issues arising from the project
 - DNA of non-human organisms were not sequenced during this period.
- 18.** Identify the incorrect pair from the following options :
- Expressed sequence tags - Genes that are expressed as RNA
 - Sequence annotation - Sequencing genome with coding sequences only
 - Automated DNA sequencers - Work on the principle developed by Frederick Sanger
 - YAC - Yeast Artificial Chromosomes

- 19.** The classification of satellite DNA based on:
- A : T - G : C composition
 - Length of segment
 - Number of repetitive units
 - All of these
- 20.** In DNA fingerprinting, why does the autoradiogram show bands of differing sizes after hybridisation with VNTR probes?
- Due to the lack of hybridisation
 - Because VNTRs have identical sequence in all individuals
 - Because VNTRs have consistent sizes
 - Due to variation in the size of VNTRs and the number of repeats

QUESTIONS **LEVEL - III**

- 1.** Consider the following statements:
- A) Prokaryotes contain only single origin, while eukaryotes have multiple ori site in dsDNA during replication.
- B) In all eukaryotes and most prokaryotes, DNA replication takes place in both direction from origin
- C) During DNA replication, leading template strand requires many primers but lagging template strand requires primer only once
- Of the above statements:
- A, B and C are true
 - A, B and C are false
 - A & B are true
 - B & C are false
- 2.** How many of the following statements true:
- RNA polymerase can differentiate exons and introns, so they transcribe both together
 - In prokaryotes, transcription and translation are coupled, both occur in cytoplasm
 - Euchromatin is transcriptionally active and possess less protein content
 - In eukaryotic ribosome, protein is rich but RNA is less
 - Euchromatin is lightly stained and replicate fast
- One
 - Two
 - Three
 - Four
- 3.** **Assertion(A):** In eukaryotes, translation is not possible if cap is lacking
- Reason (R) :** Cap is identified by 18S rRNA of ribosome unit.
- If both assertion and reason are true and reason is the correct explanation of assertion
 - If both assertion and reason are true and reason is not the correct explanation of assertion
 - Assertion is true but reason is false
 - Both assertion and reason are false

- 4.** Consider the following statements:
- A) Prokaryotes do gene regulation mainly at transcriptional level
 - B) In operon, the expression of gene regulated by metabolic and physiological conditions only
 - C) In lac operon, a polycistonic structural gene is regulated by common promotor and different regulatory genes
 - D) In lac operon, structural gene is constitutive gene and expressed always and repressor protein is regulated by inducible gene and expressed always
 - E) In lac operon, structural gene is an inducible gene and expressed only in the presence of inducer

Of the above statements:-

- 1) Only E is true
- 2) A & E are true
- 3) All except B are true
- 4) A, B, C, D and E are true

- 5.** How many of the following statements are true
- A) The length of minisatellite and position of restriction sites is different for each person and when the genome of two people are cut using the same restriction enzyme, the length and number of fragments obtained is different for both.
 - B) In general, prokaryotes and eukaryotes contain both $G \equiv C$ and $A = T$ pair, but eukaryotic DNA possess more $A = T$ pair than $G \equiv C$.
 - C) In DNA finger printing, hybridisation is done with molecular probe; probe is small DNA segment synthesized in laboratory with known sequence that recognise complementary sequence.
- 1) A, B and C are true
 - 2) A is false
 - 3) B is false
 - 4) C is false

SYNOPSIS

Evolutionary Biology is the study of history of life forms on earth.

1. Origin of Life

1.1 Formation of earth

1.2 Formation of life

Theory of Special Creation

Panspermia

Spontaneous generation

Chemical evolution

S.L. Miller experiment (1953)

2. Evolution of Life forms

◆ Charls Darwin's Theory : (during sea voyage in HMS Beagle)

3. Evidences for Evolution**1. Palaentological evidences****2. Embryological evidences**

◆ Karl Ernst von Bear

3. Anatomical and Morphological Evidences

Similarities among organisms showed that they have a common ancestor. eg. fore limbs of vertebrates.

- ◆ Divergent evolution
- ◆ Adaptive radiation
- ◆ Convergent evolution

4. Biochemical Evidences

4.1 Industrial melanism

5. Biological Evolution

- ◆ Lamarckian theory
- ◆ Darwinian theory
- ◆ Key concepts of Darwinian theory of evolution are Branching descent and Natural selection.

Examples of Natural Selection

- ◆ Thomas Malthus
- ◆ Novelty and brilliant insight of Darwin

6. Mechanism of Evolution

- ◆ Mutation theory by Hugo de Vries
- ◆ Saltation : According to Hugo de Vries the single step large mutations causes speciation.

7. Hardy - Weinberg Principle

- ◆ Disturbance in genetic equilibrium or Hardy - Weinberg equilibrium ie, change of frequency of alleles in a population would then be interpreted as resulting in evolution.
- ◆ Factors affecting the genetic equilibrium
- ◆ Founder effect

Types of Natural selection

8. A brief account of Evolution

Period	Evolutionary Significance
2000 mya	Cellular forms appeared
500 mya	Invertebrates
350 mya	Jawless fish evolved
320 mya	Sea weeds, few plants were existed
200 mya	Reptiles of different shapes dominated earth. Some land reptiles went back to water
65 mya	Dinosaur suddenly disappeared (Some say climatic changes killed them, some say they evolved into birds)

- ◆ In 1938, a coelacanth fish (Lob fins) caught in South Africa.
- ◆ Lobe fins evolved into the first amphibians (ancestors of modern day frogs and salamanders)
- ◆ Amphibians evolved into reptiles (they lay thick shelled eggs which do not dry up in sunlight)
- ◆ The first mammals were like shrews. (When reptiles came down mammals took over this earth)
- ◆ During continental drift South America joined North America the South American animals were over ridden by North American fauna; but in Australian marsupials did not faced such competition from any other mammals.

9. Origin and Evolution of Man

Period	Human evolutionary features
15 mya	Primature Dryopithecus and Ramapithecus were existing (walked like gorilla and chimpanzee)
3 - 4 mya	Fossils obtained from Ethiopia and Tanzania are man like, they are not taller than 4 feet, but walked up right
2 mya	East African grass lands - Australopithecines lived. They used stone weapon for hunting, ate fruits. Some others with hominid features lived named <i>Homo habilis</i> (brain capacity 658 - 800cc) did not eat meat.
1.5 mya	Fossils obtained from Java (1891) - <i>Homo erectus</i> brain size 900 cc, they ate meat
100,000 - 40000 years	Neanderthal man lived in east and central Asia. Brain size is 1400 cc. They used hides to protect their body, and buried their dead
75000 - 10000 year (ice age)	<i>Homosapiens</i> - arose in Africa and moved across continents
18000 year	Prehistoric cave art developed. (Bhimbetka rock shelter in Raisen Dt. of M.P)
10000 years then to till date	Modern man, civilisations etc.

Neo-Darwinian Principle or Modern Synthetic theory of Evolution

It combines Darwin's theory of natural selection with genetics and molecular biology. Neo-Darwinism explains that mutation, gene recombination and sexual reproduction create genetic diversity.

Neo Darwinism = Darwin's Natural Selection + Modern genetics + Modern molecular biology and population genetics.

1. Supporters of Natural Selection - Darwin
2. Supporters of Inheritance Laws - Mendel
3. Supporters of Popular Genetics - Haldane, Fisher, Wright
4. Supporters of Modern synthesis - Dobzhansky, Mayr, Simpson

10. Geological time scale - Important periods

QUESTIONS

LEVEL - I

1. The galaxies of the present day universe is formed by :
 - 1) the single huge explosion called "Big Bang"
 - 2) the expansion of universe and the temperature came down
 - 3) the condensation of gases under gravitation
 - 4) the formation of hydrogen and helium
2. The more or less accepted theory on origin of life is :
 - 1) Spontaneous generation
 - 2) Panspermia
 - 3) Chemical evolution by Oparin and Haldane
 - 4) Biogenesis by Louis Pasteur
3. "The first form of life come from pre-existing non-living organic molecules and life was preceded by the formation of diverse organic molecules from inorganic constituents." The above statement describes :
 - 1) Spontaneous generation
 - 2) Special creation
 - 3) Panspermia
 - 4) Chemical evolution
4. Paleontology is the study of :
 - 1) Living fossils
 - 2) Rocks and sediments
 - 3) the remains of hard parts of life - forms found in rocks
 - 4) extincted organisms
5. "Embryos never pass through the adult stages of other animals". This concept was proposed by :
 - 1) Ernst Hackel
 - 2) Karl Ernst von Baer
 - 3) Charls Darwin
 - 4) Alfred Wallace
6. Homologous organs are the structures developed due to :
 - 1) Divergent evolution
 - 2) Convergent evolution
 - 3) Parallel evolution
 - 4) Mutation
7. Structures with similar functions are evolved due to :
 - 1) Convergent evolution
 - 2) Adapptive evolution
 - 3) Divergent evolution
 - 4) Both 1 and 2
8. The thorn and tendrils of Bougainvillea and Cucurbita are examples for :
 - 1) Vestigial organs
 - 2) Homology
 - 3) Analogy
 - 4) Convergent evolution
9. Which one of the following is used as industrial pollution indicator :
 - 1) Black winged moth
 - 2) White winged moth
 - 3) Predators
 - 4) Lichens

10. The concept that, evolution is driven by use and disuse of organs, was put forward by :

- 1) Charls Darwin
- 2) Alfred Wallace
- 3) Lamarck
- 4) Hugo de Vries

11. " Life forms varied over time and certain life forms are restricted to certain geological time span". This statement substitute which of the following evidence for evolution?

- 1) Embryological evidences
- 2) Anatomical evidences
- 3) Palentological evidences
- 4) Biochemical evidences

12. Adaptive radiation is shown by :

- 1) Darwin's finches
- 2) Australian marsupials
- 3) Placental mammals
- 4) All the above

13. **Statement I** : Theoretically population size will grow exponentially if everybody reproduce maximally.

Statement II : The population size in reality are limited means, that there had been competition for resources.

- 1) Both Statement I and Statement II are correct
- 2) Both Statement I and Statement II are incorrect
- 3) Statement I is correct but Statement II is incorrect
- 4) Statement I is incorrect but Statement II is correct

14. Match the column I and column II

Scientist		Study	
1.	Hugo de Vries	A	Use and disuse of organs
2.	Lamark	B	Natural resources
3.	Charls Darwin	C	Mutations
4.	Thomas Malthus	D	Natural selection

1) 1 - C, 2 - A, 3 - B, 4 - D

2) 1 - C, 2 - D, 3 - B, 4 - A

3) 1 - C, 2 - A, 3 - D, 4 - B

4) 1 - C, 2 - B, 3 - A, 4 - D

15. Single step large mutations are called :

- 1) Branching descent
- 2) Saltation
- 3) Industrial melanism
- 4) Panspermia

16. Change in gene frequency by chance is called :

- 1) Gene flow
- 2) Genetic drift
- 3) Gene migration
- 4) Recombination

17. Match the following

Natural selection		Condition	
1.	Stabilisation	A	more individuals acquire value other than mean character value
2.	Directional change	B	more individuals acquire peripheral value at both the end of the distribution curve
3.	Disruption	C	more individuals acquire mean character value

- 1) 1 - A, 2 - B, 3 - C
- 2) 1 - B, 2 - C, 3 - A
- 3) 1 - C, 2 - A, 3 - B
- 4) 1 - C, 2 - B, 3 - A

18. In a population, if the frequency of alleles measured is deviated from expected values, it indicates :

- 1) Average life span of the population
- 2) Size and mating pattern of the population
- 3) status of the evolutionary change in the population
- 4) Life expectancy of the population

19. Which of the following is derived from psilophyton ancestor :

- 1) Conifers
- 2) Herbaceous lycopods
- 3) Arborescent lycopods
- 4) Bryophytes

20. Arborescent lycopods extincted in the period:

- | | |
|------------------|-------------|
| 1) Carboniferous | 2) Jurassic |
| 3) Permean | 4) Triasic |

21. Arrange the sequence of era in descending order :

- 1) Mesozoic, Paleozoic, Coenozoic
- 2) Paleozoic, Coenozoic, Mesozoic
- 3) Paleozoic, Mesozoic, Coenozoic
- 4) Coenozoic, Paleozoic, Mesozoic

22. The first organisms that invaded land were :

- 1) Amphibians
- 2) Reptiles
- 3) Birds
- 4) Plants

23. Mammals are evolved from :

- 1) Lycopods
- 2) Sphenopsids
- 3) Sauropsids
- 4) Synapsids

24. The extinct carnivorous reptiles with huge fearsome dagger like teeth and 20 feet in height :

- 1) Brachiosaurus
- 2) Stegosaurus
- 3) Triceratops
- 4) Tyrannosaurus

25. The more man like creatures lived during 15 mya are :

- 1) Australopithecus
- 2) Ramapithecus
- 3) Sivapithecus
- 4) Dryopithecus

QUESTIONS**LEVEL - II**

1. Which of the following substance was absent in the reducing atmosphere of primitive earth?

- 1) Water vapour
- 2) Hydrogen
- 3) Helium
- 4) Oxygen

2. Match the following :

	Scientist		Finding / Discovery
1.	Louis Pasteur	a	Panspermia
2.	Oparin and Haldane	b	Experimental demonstration of chemical evolution
3.	S.L. Miller	c	Disproved the spontaneous generation
4.	Greek philosophers	d	Chemical evolution

- 1) 1 - c, 2 - b, 3 - d, 4 - a
- 2) 1 - d, 2 - b, 3 - a, 4 - c
- 3) 1 - c, 2 - d, 3 - b, 4 - a
- 4) 1 - a, 2 - d, 3 - b, 4 - c

3. A study of fossils in different sedimentary layers indicates

- 1) the geological period in which they existed
- 2) life forms varied over time and certain forms are restricted to certain geological time spans.
- 3) New forms of life have arisen at different times in the history of earth
- 4) All the above

4. "Certain features during embryonic stage common to all vertebrates that are absent in adults". This is the observation :

- 1) Ernst Hackel
- 2) Karl Ernst von Baer
- 3) Charles Darwin
- 4) Alfred Wallace

5. Arrange the different periods in the history of earth based on the duration of time in descending order :

- 1) epochs, periods and era
- 2) epochs, era and periods
- 3) Era, periods and epochs
- 4) Periods, era, epochs

6. Alfred Wallace conducted his studies at :

- 1) Galapagos Islands
- 2) Maldives and Lakshadweep Islands
- 3) Ceylon Archipelago
- 4) Malay Archipelago

7. Due to adaptations to different needs, some structures developed along different directions is called :

- 1) Divergent evolution
- 2) Convergent evolution
- 3) Adaptive radiation
- 4) Both 1 and 3

8. Which of the following is not homologous organs?

- 1) Forelimbs of mammals
- 2) Heart of vertebrates
- 3) Brain of vertebrates
- 4) Eye of octopus and mammals

- 9.** Identify the wrong match :
- 1) Flippers of Penguins and Dolphins - Analogy
 - 2) Sweet potato and potato - Analogy
 - 3) Thorn and tendrils in Bougainvillea and Cucurbita - Homology
 - 4) Eye of octopus and eye of mammals - Homology
- 10.** Identify the evolution occurred by anthropogenic action :
- 1) Development of pesticide resistant organisms
 - 2) Antibiotic resistant bacteriae
 - 3) Drug resistant eukaryotic organisms
 - 4) All the above
- 11.** The process of evolution of different species in a given geographical area starting from a common ancestor and radiating to other habitats is called :
- 1) Convergent evolution
 - 2) Parallel evolution
 - 3) Adaptive radiation
 - 4) Anthropogenic evolution
- 12.** Among bacterial forms, new species may be formed within days, because :
- 1) They are resistant to antibiotics
 - 2) They are susceptible to antibiotics
 - 3) Their life span is less than an hour, hence they multiply and becomes millions within hours
 - 4) They can utilize any substrate available in the medium where they are living
- 13.** Elongation of the neck of Giraffes is an example proposed to explain :
- 1) Mutation theory of evolution
 - 2) Use and disuse theory of evolution
 - 3) Natural selection
 - 4) Branching descent
- 14.** **Assertion** : Adapted organisms will reproduce and leave more progeny.
- Reason** : Variations required by the organisms which are heritable and which make resource utilisation better.
- In the light of above statements choose the **most appropriate answer** from the options given below.
- 1) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion
 - 2) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - 3) Assertion is correct but Reason is not correct
 - 4) Both Assertion and Reason are false
- 15.** Hugo de Vries conducted his experiments in:
- 1) Snapdragon
 - 2) Garden pea
 - 3) Morning glory
 - 4) Evening primrose

- 16.** The factor that affect the Hardy - Weinberg equilibrium is :
- Gene flow or gene migration
 - Genetic drift and mutation
 - Recombination and Natural selection
 - All the above
- 17.** Change in frequency of genes and alleles in future generation may be due to :
- Mutation
 - Recombination during gametogenesis
 - Gene flow or genetic drift
 - All of the above
- 18.** If the frequency of the dominant allele 'A' is 0.2 find out the frequency of recessive allele 'a' and the heterozygous forms present in random mating population under Hardey - Weinberg equilibrium.
- 0.4 and 0.32
 - 0.08 and 3.2
 - 0.04 and 0.64
 - 0.8 and 0.32
- 19.** Mention the correct sequence of evolution of plant forms :
- Rhynia type plants
 - Chlorophyte ancestors
 - Psilophyton
 - Tracheophyte ancestors
- c, d, a, b
 - b, d, a, c
 - b, c, a, d
 - a, d, c, b
- 20.** Angiosperms are derived from :
- Ferns
 - Seed ferns
 - Ginkogs
 - Cycads
- 21.** Identify the plant form from the following :
- Sauropsids
 - Synapsids
 - Sphenopsids
 - Therapsids
- 22.** The common ancestor of Dinosaurs, crocodiles and birds is :
- Thecodonts
 - Synapsids
 - Triceratops
 - Stegocerous
- 23.** Which of the following is a fish like reptile :
- Brachiosaurus
 - Stegosaurus
 - Icthyosaurus
 - Tyrannosaurus
- 24.** The south American animals like horse, hippopotamus, bear, rabbit etc. were overridden by North American fauna due to:
- Genetic drift
 - Climatic changes
 - Continental drift
 - Mass extinction
- 25.** The man like primates, walked up right, and lived around 3 - 4 mya in eastern Africa is called :
- Australopithecus
 - Dryopithecus
 - Ramapithecus
 - Homoerectus

QUESTIONS**LEVEL - III**

1. Mention the expected sequence of events occurred on the primitive earth atmosphere:
- The molten mass covered the surface released H_2O vapour, CH_4 , NH_3 , CO_2 etc.
 - The water vapour cooled and fell as rain
 - UV rays from the sun breakup water into hydrogen and oxygen
 - Oxygen combined with methane and ammonia to form H_2O and CO_2
 - The water fills all the depressions and forms oceans
 - Life appeared 500 millions of years after the formation of earth.
- 1) $a \rightarrow b \rightarrow c \rightarrow d \rightarrow e \rightarrow f$
- 2) $a \rightarrow c \rightarrow d \rightarrow b \rightarrow e \rightarrow f$
- 3) $a \rightarrow c \rightarrow b \rightarrow d \rightarrow f \rightarrow e$
- 4) $a \rightarrow d \rightarrow c \rightarrow b \rightarrow e \rightarrow f$

2. Identify the statement that not associated with convergent evolution :
- Analogous organs are a result of convergent evolution.
 - More than one adaptive radiation appeared to have occurred in an isolated geographical area results in convergent evolution
 - Different structures evolving for same function and hence having similarity
 - Similar anatomical structure and performing different functions as they developed along different directions due to adaptations to different needs.
3. Which of the following statement is applicable to fitness?
- it is based on characteristics which are inherited
 - it is the end result of the ability to adapt and get selected by nature.
 - it is the efficiency of organisms that are better adapted to survive in an otherwise hostile environment
 - all the above

- 4.** Match the column A, B & C and find the correct option from the following :

Name		Brain capacity		Special features	
A	Homo habilis	P	1400 cc	X	Did not eat meat
B	Homo erectus	Q	650-800 cc	Y	They eat meat
C	Neanderthal man	R	900 cc	Z	used hides to protect their body

- 1) APZ, BRY, CQZ
- 2) AQY, BPZ, CRZ
- 3) AQX, BRY, CPZ
- 4) ARX, BQX, CQY

- 5.** Match the following :

	Evolutionary significance		Period
1.	Jawless fish evolved	A	500 mya
2.	Cellular forms appeared	B	65 mya
3.	Invertebrates evolved	C	350 mya
4.	Dinosaurs disappeared	D	2000 mya

- 1) 1 - C, 2 - A, 3 - D, 4 - B
- 2) 1 - C, 2 - D, 3 - A, 4 - B
- 3) 1 - D, 2 - C, 3 - B, 4 - A
- 4) 1 - A, 2 - C, 3 - B, 4 - D

SYNOPSIS

- **Good humor hypothesis** → Hippocrates & Indian Ayurveda system of medicine
 - Good humor hypothesis disproved by → **William Harvey**
 - **Factors affecting health**
 - 1. Genetic disorders
 - 2. Infections
 - 3. Life style
 - **Definition of health**
 - According to WHO Health is a state of complete “**physical, mental and social well being**”.
 - World health day----->7th April
 - **Disease:** - [dis-ease or discomfort]: 1) Infectious & 2) Non-infectious
 - **Pathogen:** - Disease causing organisms [Bacteria, Virus, Protozoans, Helminthes, Fungi]
- I. Common Diseases in Human**
- Causative organism, Affected organ, Mode of transmission, Symptoms & Vaccine, if any.
 - 1. **Bacterial diseases:** - Typhoid, Pneumonia, Plague, Dysentery, Diphtheria, Tetanus
 - 2. **Viral diseases:** - Common cold, Polio, Dengue fever, Chikungunya, Small pox, Chicken pox, AIDS
 - 3. **Protozoan diseases:** - Malaria – Diagram – NCERT, Amoebiasis
 - 4. **Helminthes diseases:** - Taeniasis, Ascariasis, Filariasis
 - 5. **Fungal disease:** - Ringworm
 - Prevention & control of infectious diseases – Gambusia fish [Biological control], feed on mosquito larvae

II. Types of immunity

1. **Innate immunity / Inborn immunity**
 - It is established in the form of four barriers
- a) **Physical barriers**
- Skin & mucus coating present in respiratory, digestive and urinogenital tract.

b) Physiological barriers

- Acid (HCl) in stomach
- Lysozymes (anti-bacterial agent) in saliva, tears & sweat and it prevents the microbial growth.

Physical barriers & physiological barriers----->1st line defence**c) Cellular barriers**

- Leukocytes like neutrophils (PMNL)
- Monocytes
- Natural killer cells (NK cells) – Large granular lymphocyte
- Macrophage cells in tissues

d) Cytokine barriers: - Interferon**Cellular barriers & cytokine barriers----->2nd line defence****2. Acquired /Adaptive /Induced /Specific immunity--->3rd line defence**

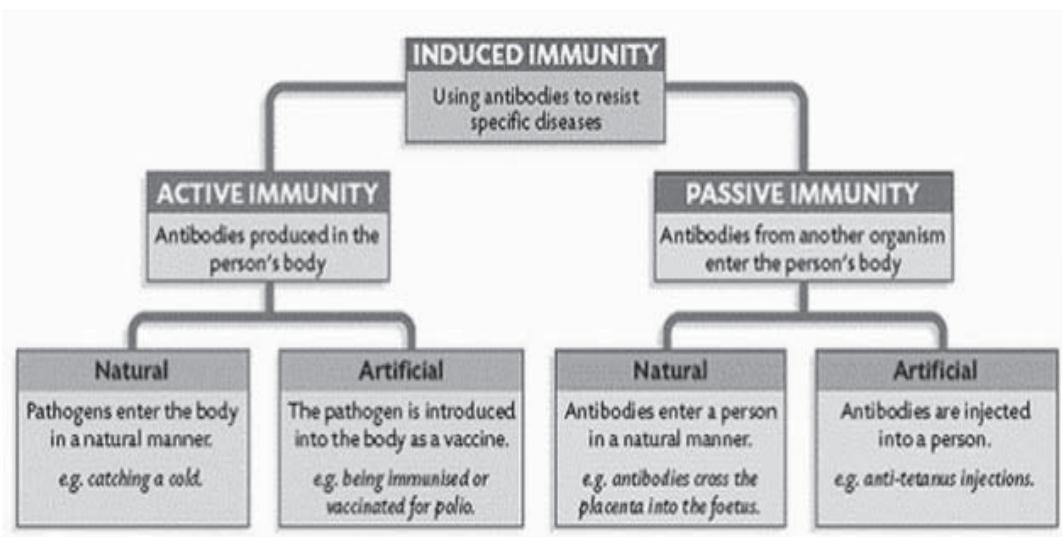
- It facilitates: -

- (i). Primary response/primary immunity
- (ii). Secondary response/anamnestic response/secondary immunity

- Primary & secondary responses are mediated by:

(a) B-Lymphocytes: - [AMI / HI]**(b) T-Lymphocytes: - [CMI]: -** It is responsible for graft rejection in an organ transplantation**Structure of antibody****Types of antibodies – 5 types**

- 1. IgG** : Most abundant (80%). It is the smallest antibody capable of crossing placenta and protects foetus.
- 2. IgA** : It is found in body fluids like mucus, saliva, and colostrum
- 3. IgM** : Largest, produced early in primary responses, first to reach in site of infection.
- 4. IgE** : It plays definite role in allergy.
- 5. IgD** : Present in plasma membrane of B-cell, responsible for antigenic recognition



Vaccination /Immunisation: -

Principle: - Based on the property of 'memory' of the immune system.

- 1st vaccine – Against small pox – By Edward Jenner – Father of immunology
- Small pox - Completely eradicated.
- Polio, Diphtheria, Pneumonia and Tetanus – Controlled to a large extent by the use of vaccine.
- DPT vaccine – Against-----> Diphtheria, Pertussis, Tetanus
- TT (Tetanus Toxoid-Vaccine-Provide Active immunity)
- ATS (Anti Tetanus Serum-Provide Passive immunity)

Allergy/Hypersensitivity: -

- Allergens, symptoms of allergy, medicines – for allergic symptoms

Auto immunity: -

- It's an abnormal immune response in which the immune system of the body starts destroying or attacking 'self-cells', due to genetic or other unknown reasons, results in the damage of the body and is called auto immune disease

Eg: -Rheumatoid arthritis, Grave's disease, Hashimoto's disease, Myasthenia gravis

Immune system in our body: - Components are

1. Lymphoid organ: -

- a) **Primary lymphoid organ:-** (Immature lymphocytes differentiate into antigen sensitive lymphocyte)-Eg: Bone marrow, Thymus gland
- b) **Secondary lymphoid organ:-** (Provide the sites for interaction of lymphocytes with the antigen, proliferate to become effector cells)
 - Spleen, lymph nodes, MALT, Tonsils, Peyer's patches, Appendix

(III) AIDS [Acquired Immune Deficiency Syndrome]

- World AIDS day----->December 1st
- HIV - Retrovirus [Genetic material – RNA] - Structure
- Replication/life cycle of HIV
- Diagnostic/confirmatory test for AIDS – ELISA/Western blot
- Transmission of AIDS
- Prevention of AIDS

(iv) Cancer

- **World cancer day – February 4th**
- Characteristic of cancer cell
- Benign tumor & Malignant tumor
- Causes of cancer (Carcinogens) & different types of carcinogens
- Types of cancer
- Cancer detection & diagnosis
- Treatment of cancer
- Cancers are treated by surgery , Radiotherapy, Chemotherapy or Immunotherapy

(v) Drugs & Alcohol Abuse

- **Commonly abused drugs**
 - Opioids (Morphine)
 - Cannabinoids (Hallucinogens)-Abused by sports person
 - Coca alkaloids (Cocaine) - If in excess, it causes hallucination.
 - Hallucinogenic plant-Cannabis sativa
 - Other well known plant with hallucinogenic property - Atropa belladonna, Datura
- **Medicinal use of drugs**
 - Smoking/Tobacco – Adverse effects.
 - Adolescence & Drug/Alcohol Abuse – Liver cirrhosis
 - Addiction & Dependence – Withdrawal syndrome
 - Effects of drug/alcohol abuse
 - Side effects of anabolic steroids---Both in male & female
 - Most common warning signs of drug/alcohol abuse among youth
 - Prevention & control

QUESTIONS

LEVEL - I

1. The person with black bile were considered to be :
 - 1) Belonged to black pigmentation group
 - 2) Belonged to hot personality
 - 3) Belonged to hot personality having fevers
 - 4) Belonged to black pigmentation will be prone to fever
2. Which of the following is wrong regarding pathogens?
 - 1) They cause morphological and functional damage in the host
 - 2) They generally enter the small intestine through blood
 - 3) Most parasites are pathogens as they cause harm to the host by living in (or on) them
 - 4) Pathogens have adapt to life within the environment of the host
3. Choose the option where disease does not match with its mode of transmission from patient to the healthy person.
 - 1) Pneumonia - Air borne / droplet
 - 2) Typhoid - Contaminated food and water
 - 3) Filariasis - Bite by female Anopheles vector
 - 4) Ring worm - from soil or by using towels, clothes or comb of infected individuals.
4. The alveoli (air filled sacs) of the lung are infected in :
 - 1) Pneumaonia
 - 2) Common cold
 - 3) Diphtheria
 - 4) Ascariasis

5. Consider the following statements.
 - I. Plasmodium falciparum causes malignant malaria.
 - II. Release of haemozoin from burst RBC is responsible for the chill and high fever recurring every three to four days
 - III. Sporozoites are the infectious forms of Plasmodium.

Which of the above statements are true?

 - 1) I and II only
 - 2) I and III only
 - 3) II and III only
 - 4) I, II and III- 6. Bacterium that can make perforation on small intestine is :
 - 1) Yersinia pestis
 - 2) Salmonella typhi
 - 3) Corynebacterium diphtheriae
 - 4) Haemophilus influenzae
- 7. Mosquito vectors are controlled using biological agents. These include :
 - 1) Gambusia
 - 2) Labeo
 - 3) Rohu
 - 4) Hilsa

8. **Statement I :** Innate immunity is non specific type of defence, that is present at the time of birth.

Statement II : Acquired immunity develops over a person's life time and pathogen specific.

- 1) Both Statement I and Statement II are correct
- 2) Both Statement I and Statement II are incorrect
- 3) Statement I is correct but Statement II is incorrect
- 4) Statement I is incorrect but Statement II is correct

9. Primary lymphoid organs serve as the site for :

- 1) Antibody formation
- 2) Lymph formation
- 3) Lymphocytes to encounter and bind to antigen
- 4) Lymphocyte formation and maturation

10. If interferon is a cytokine barrier then HCl in stomach is a-----

- 1) Physical barrier
- 2) Physiological barrier
- 3) Cellular barrier
- 4) Cytokine barrier

11. Consider the following statements :

1. After maturation, lymphocytes in primary lymphoid organ migrate to secondary lymphoid organ.
2. Secondary lymphoid organs provide the sites for antigen antibody interaction
3. Spleen acts as filter of the blood by trapping blood borne microorganisms
4. Lymph nodes also act as filter of lymph and tissue fluid by trapping tissue fluid microorganisms or antigens

How many statements are correct.

- | | |
|------|------|
| 1) 3 | 2) 4 |
| 3) 7 | 4) 1 |

12. Bone marrow is the site of :

- 1) Maturation of all types of lymphocytes
- 2) Origin of B and T lymphocytes
- 3) Origin, development and maturation of T lymphocytes and B lymphocytes
- 4) Interaction of B-lymphocytes with the antigen.

13. Select the true statement/s about AIDS :

- a) A congenital disease
 - b) HIV infected macrophages can't survive while viruses are being replicated and released
 - c) HIV infected helper T cells (T_H) can survive while viruses are being replicated and released.
 - d) Treatment of AIDS with antiretroviral drug can only prolong the life of patient but can't prevent death
 - e) HIV is an RNA virus without envelop
- | | |
|------------------|------------|
| 1) b, c, d and e | 2) d and e |
| 3) a only | 4) d only |

14. Which of the following are Autoimmune disorders ?

- A) Myasthenia gravis
- B) Rheumatoid arthritis
- C) Gout
- D) Muscular dystrophy
- E) Systemic Lupus Erythematosus (SLE)

Choose the most appropriate answer from the options given below:

- 1) A,B and E only
- 2) B, C and E only
- 3) C, D and E only
- 4) A, B and D only

15. Which of the following statement about opioid is correct?

- 1) Morphine, a natural opioid is obtained from the latex of Papaver somniferum.
- 2) Opioids bind to opioid receptors present in the cardiovascular system.
- 3) Opioids are depressants and they slow down body functions.
- 4) Both1 and 3

QUESTIONS LEVEL - II

1. Good humor hypothesis was supported by :

- 1) Indian Ayurveda system of medicine
- 2) Hippocrates
- 3) William Harvey
- 4) Both 1 and 2

2. Match column I with column II

Column I	Column II
A) Typhoid	i) Lips and finger nails turn grey to bluish
B) Pneumonia	ii) Stools with excess mucus and blood clot
C) Amoebiasis	iii) Dry, scaly lesions with intense itching
D) Ring worm	iv) Intestinal perforation and death
E) Ascariasis	v) Internal bleeding and anaemia

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

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

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

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

3. Read the following statements and choose the incorrect one :

1) Memory based acquired immunity evolved in higher vertebrates.

2) The primary lymphoid organs are bone marrow and thymus where immature lymphocytes differentiate into antigen sensitive lymphocytes.

3) Only thymus provide microenvironment for the development and maturation of T lymphocytes.

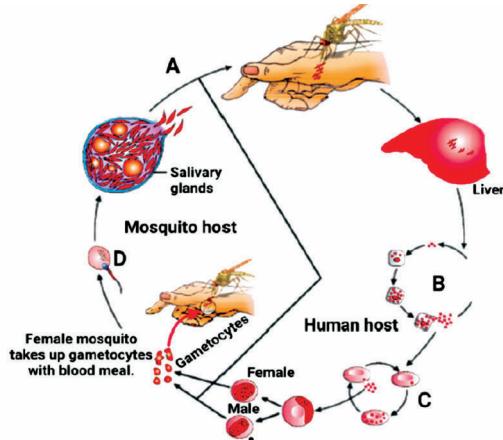
4) Modern day life style has resulted in lowering of immunity and more sensitive to allergens.

- 4.** How many statements given below are the examples of "Naturally Acquired Passive Immunity"?
- In case of snake bites, the injection which is given to the patients, contains preformed antibodies against the snake venom.
 - The foetus receives some antibodies from their mother through placenta during pregnancy.
 - Colostrum secreted by mother during initial days of lactation has abundant IgA antibodies to protect the infant.
 - Vaccine provides protection against antigens
- 1) One 2) Two
 3) Three 4) Four
- 5.** Which of the following is/are relevant to HIV infection?
- Only viral genomic RNA is introduced into the macrophage.
 - Viral DNA is incorporated with the host DNA by the help of reverse transcriptase
 - Viral genomic RNA and viral proteins are produced in the macrophage
 - Viruses released by macrophage attack by T_H cells
- 1) c and d
 2) a, c, and d
 3) a, b and d
 4) all the above
- 6.** Vaccine can stimulate immune system to produce :
- Memory T cells, Memory B cells and Antigenic polypeptide
 - Antibodies, Antigenic polypeptide, Antigenic determinant
 - Antibodies, Memory T cells and Memory B cells
 - Memory B and T cells only
- 7.** The inability of immune system to distinguish self from non-self antigens result in :
- AIDS
 - Immuno deficiency
 - Allergy
 - Autoimmune disease
- 8.** Which of the following character is / are exhibited by malignant tumor?
- Metastasis
 - Indefinite growth
 - loss of contact inhibition
 - All of these
- 9.** Match the column I, II and III
- | Column I | Column II | Column III |
|------------------|--|--|
| a) Cannabinoid | i) Erythroxylum | p) depressant and slows down body function |
| b) Coke/crack | ii) Hashish, Marijuana, Charas and Ganja | q) effects on cardiovascular system of body |
| c) Smack/ Heroin | iii) nicotine | r) potent stimulating action on central nervous system |
| d) Tobacco | iv) by acetylation of morphine | s) Oral cancer |
- 1) a - ii - q; b - i - r; c - iv - p; d - iii - s
 2) a - ii - s; b - i - q; c - iii - s; d - iv - p
 3) a - i - q; b - iii - s; c - ii - p; d - iv - r
 4) a - iii - q; b - ii - r; c - iv - s; d - i - p
- 10.** Addiction is :
- Intake of drugs
 - Intake of tobacco and alcohol
 - Both 1 and 2
 - Physiological or/and psychological dependence

11. Smoking increases _____ content in blood and reduces the concentration of haembound oxygen :
- carbon dioxide
 - carbaminohaemoglobin
 - carbon monoxide
 - carboxylic acid
12. Which of the following statements are true?
- Tumor cells are irradiated lethally by gamma radiation
 - Several chemotherapeutic drugs are used to kill cancerous cell
 - α -interferon is a biological response modifiers can activate immune system and help in destroying the tumor
 - Majority of chemotherapeutic drugs have side effect like hair loss, anaemia etc.
- a & b
 - a & c
 - b & d
 - a, b, c & d
13. **Assertion** : Vaccination provides active immunity against specific diseases.
Reason : Vaccines contain weakened or inactivated pathogens or their components which stimulate the immune system to produce antibodies.
- If both assertion and reason are true and reason is correct explanation of assertion.
 - If both assertion and reason are true and reason is not the correct explanation of assertion.
 - If assertion is true but reason is false
 - If assertion is false but reason is true
14. The use of anabolic steroids by athletes can lead to all of the following except :
- increased muscle mass
 - aggressive behaviour
 - reduced sperm production
 - improved cardio vascular health
15. Which of the following drugs is associated with "withdrawal syndrome" upon cessation of use?
- Morphine
 - Antibiotics
 - Alcohol
 - Vitamin C

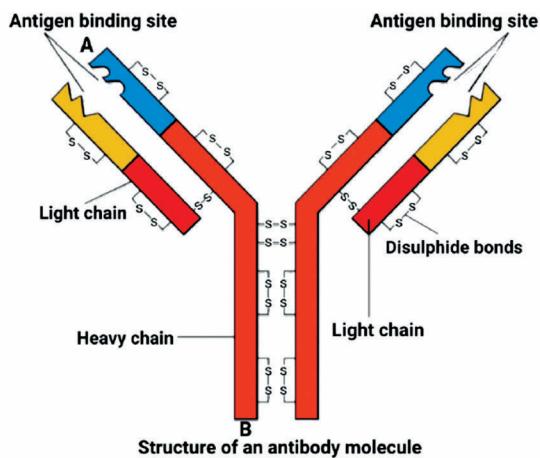
QUESTIONS LEVEL - III

1. Consider the given stages in the life cycle of Plasmodium and choose the correctly matched pair :



- A - Merozoites infect humans when mosquito bites
- B - The parasite reproduces sexually in liver cells
- C - Symptoms of malaria
- D - Fertilization in the hemocoel of the mosquito

2. In the given diagram, A and B respectively represent :



- 1) The N and the C terminal of the polypeptide
 - 2) The C and the N terminal of the polypeptide
 - 3) The constant and variable regions of the antibody molecule
 - 4) The constant and antigen binding site of the antibody molecule
3. Exaggerated response of immune system to certain antigens present in the environment is due to the
- 1) Release of haemoglobin from RBC
 - 2) Production of interferon by virus infected cells
 - 3) Production of antibodies against body's own cells
 - 4) Release of histamine and serotonin from mast cells

4. Find the false statement

- 1) Dependence is the tendency of body to manifest characteristic and unpleasant withdrawal syndrome if regular use of alcohol/drugs is abruptly stopped
- 2) Addiction is the psychological attachment to certain effects of drugs or alcohol
- 3) Use of drugs/ alcohol even for once never be a fore-runner to addiction
- 4) Withdrawal symptoms include anxiety, nausea, shakiness and sweating

5. **Assertion (A)** : 'Coke' or 'Crack' or cocaine is usually snorted.

Reason (R) : Cocaine has a potent stimulating action on CNS, producing a sense of euphoria and increased energy.

- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
- 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
- 3) (A) is true but (R) is false
- 4) Both (A) and (R) are false

SYNOPSIS

1. Types of Microbes

Bacteria, Fungi, Virus etc.

2. Microbes in house hold affairs

Microbes in fermented foods - Diary products

- Dosa & idli
- Bread making
- Traditional drink - Toddy
- Cheese

3. Microbes in industrial products

Microbes in fermented beverages - Wine, beer, brandy, whisky, rum etc.

4. Microbes in antibiotics

- Discovery of antibiotics
- Uses of antibiotics
- Examples of antibiotics

5. Microbes in Organic acid

- a) Citric acid
- b) Acetic acid
- c) Butyric acid
- d) Lactic acid

6. Microbes used as source of enzyme.

- 1) Protease
- 2) Lipase
- 3) Pectinase

7. Microbes as bioactive molecule

- 1) Streptokinase
- 2) Cyclosporin A
- 3) Statin

8. Microbes in sewage treatment

- Definition of sewage
- Explanation of BOD
- Sewage treatment (1) Primary treatment
(2) Secondary treatment

9. Microbes in Biogas production

- Methanogens
- Biogas plant - Gobar gas

10. Microbes as Biocontrol agents.

- Organic farming
- Biological control of pest and diseases and examples as per NCERT

11. Microbes as biofertilisers

- Free living and symbiotic nitrogen fixers
- Mycorrhiza

12. Role of microbes in SCP and soil (Brief account only)

QUESTIONS

LEVEL - I

1. The most abundant prokaryotes helpful to humans in making curd from milk and in production of antibiotics are ones categorised as :
 - 1) Chemosynthetic autotrophs
 - 2) Heterotrophic bacteria
 - 3) Cyanobacteria
 - 4) Archaebacteria
2. Consider the following statements and select the correct option:
 - a) Fermentation of milk into curd is done by Lactobacillus and E.coli.
 - b) During curdling, the heterotrophic lactic acid bacteria, grow in milk and ferment milk sugar lactose into lactic acid
 - c) Partial digestion of milk proteins by lactic acid increases its digestibility
 - d) Curdling of milk increases its nutritional quality by increasing vitamin B₁₂
 - 1) All statements are correct
 - 2) Statements a, b and c only are correct
 - 3) Statements c and d only are correct
 - 4) Statements b, c and d are correct
3. Among the following find out the function of lactic acid bacteria :
 - 1) It produce lactic acid
 - 2) Increase nutritional quality of curd by increasing vitamin B₁₂
 - 3) LAB check disease causing microbes that enter into our stomach
 - 4) All of the above

4. **Assertion(A)** : Cheese is one of the oldest food items in which microbes are used.
Reason (R) : Different varieties of cheese are known by characteristic texture, flavour and taste.
 - 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 - 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - 3) (A) is true but (R) is false
 - 4) Both (A) and (R) are false
5. Large holes in "Swiss cheese" are due to high fermentation activity of :
 - 1) Eukaryotic mycelial organism
 - 2) Baker's yeast
 - 3) Prokaryotic organism
 - 4) Unicellular fungi
6. Find the correct statement regarding bread making :
 - 1) During the formation of bread it becomes porous due to the release of CO₂ by the action of yeast.
 - 2) *Saccharomyces cerevisiae* is unicellular ascomycetes
 - 3) If small amount of alcohol is produced, it is evaporated during the process of baking
 - 4) All the above statements are correct
7. Undistilled beverage among the following is:
 - 1) Brandy
 - 2) Whisky
 - 3) Rum
 - 4) Wine

- 8.** Which one of the microorganism is used for production of citric acid in industries?
- Lactobacillus aceti*
 - Penicillium notatum*
 - Aspergillus niger*
 - Rhizopus*
- 9.** The enzymes helps in clarifying fruit juices are :
- Lipase and catalase
 - Pectinase and proteases
 - Amylase and lipase
 - Catalase and amylase
- 10.** Products of which of the following is modified by genetic engineering and is used as a "clot buster"?
- Trichoderma*
 - Monascus*
 - Streptococcus*
 - Aspergillus*
- 11.** Match the following list of microbes and their importance :

Column I	Column II
a. <i>Saccharomyces cerevisiae</i>	i) Production of immunosuppressive agents
b. <i>Monascus purpureus</i>	ii) Ripening of swiss cheese
c. <i>Trichoderma polysporum</i>	iii) Commercial production of ethanol
d. <i>Propionibacterium sharmani</i>	iv) Production of blood cholesterol lowering agents

- | a | b | c | d |
|--------|----|----|-----|
| 1) iii | ii | i | iv |
| 2) iv | ii | i | iii |
| 3) iii | ii | iv | iii |
| 4) iii | iv | i | ii |

- 12.** The grit (soil and small pebbles) in STP are removed by :
- Sequential filtration
 - Sedimentation
 - Sludge digesters
 - Activated sludge
- 13.** Read the following statements.
- The technology of biogas production was developed in India mainly due to efforts of IPM and KVIC.
 - The greater the BOD of waste water, more is its pollution potential.
 - All solids that settle in primary treatment form primary effluent
 - The effluent from secondary treatment plant is generally released into water body.

How many of the given statements is/are correct?

- One
- Two
- Three
- Four

- 14.** Which of the following statement is incorrect?
- Trichoderma* is free living fungi, present in root ecosystem acts as biocontrol agent.
 - The majority of Baculoviruses used as biological control agents are in the genus Nucleopolyhedrovirus.
 - Bacillus thuringiensis* control butterfly caterpillars
 - Ladybird and Dragonflies are microbes which used as biocontrol agent

- 15. Assertion(A) :** Mycorrhizal association is useful for plants.
- Reason (R) :** All fungi do not show mycorrhizal association.
- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 - 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - 3) (A) is true but (R) is false
 - 4) Both (A) and (R) are false

QUESTIONS LEVEL - II

- 1.** Read the following statements and find out the incorrect statements with respect to lactic acid bacteria :
 - a) In our stomach, they play beneficial role by checking disease causing microbes.
 - b) LAB produce acids that coagulate and completely digest the milk proteins.
 - c) Improves the nutritional quality by increasing the amount of B_2 .
 - d) Require suitable temperature for their multiplication.
 - 1) a & b
 - 2) a & c
 - 3) b & c
 - 4) b & d
- 2.** In Roquefort cheese fermentation is by :
 - 1) Bacteria
 - 2) Virus
 - 3) Fungus
 - 4) Both 1 and 3

- 3. Assertion(A) :** Wine and Beer are produced through the process of distillation.

- Reason (R) :** Microbe used for wine making is a filamentous fungi.

- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)

- 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)

- 3) (A) is true but (R) is false

- 4) Both (A) and (R) are false

- 4.** Which of the following statement is correct?

- 1) Alcoholic fermentation by yeast and conversion of alcohol to acetic acid both requires oxygen.

- 2) Alcoholic fermentation requires oxygen and conversion of alcohol to acetic acid is anaerobic one.

- 3) Alcoholic fermentation by yeast is anaerobic and conversion of alcohol to acetic acid requires oxygen.

- 4) Alcoholic fermentation by yeast and conversion of alcohol to acetic acid both are anaerobic processes.

- 5.** Match column I with column II :

Column I	Column II
a) Statins	i) Propionibacterium
b) Swiss cheese	ii) Aspergillus
c) Cyclosporin A	iii) Monascus
d) Citric acid	iv) Trichoderma

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

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

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

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

- 6.** Baculoviruses are pathogens that attack :
- Birds and mammals
 - Fishes and reptiles
 - Insects and other arthropods
 - Pathogenic fungi
- 7.** In STPs, primary sludge is produced when sewage is :
- Passed through filtration and sedimentation
 - Anaerobically digested
 - Treated with aerobic heterotrophic microbes in the aeration tank
 - Chlorinated and treated with UV rays
- 8.** Find out the incorrect statement/s
- Flocs are masses of anaerobic bacteria associated with fungal filaments
 - BOD gets reduced significantly when the secondary treatment is done using aerobic microbes
 - Activated sludge can be sedimented only after anaerobic digestion of sewage
 - Mixture of gases is released during aerobic digestion of sewage.
- a, b, c & d
 - Only c
 - All except b
 - a, b & d
- 9.** In secondary treatment organic matter is degraded by :
- Aerobic bacteria
 - Aerobic fungi
 - Autotrophic bacteria
 - Both (1) and (2)
- 10.** Which of the following statement is **incorrect**?
- The greater the BOD of waste water, more is its polluting potential.
 - Baculoviruses are pathogens that attack several insects and plants
 - Trichoderma* species are effective biocontrol agents of several plant pathogens
 - Bacillus thuringiensis* act against Butterfly caterpillars.
- 11.** **Assertion(A)** : BOD is a measure of the organic matter present in the water.
- Reason (R)** : Greater the BOD of waste water, less is its polluting potential.
- Both (A) and (R) are true and (R) is the correct explanation of (A)
 - Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - (A) is true but (R) is false
 - Both (A) and (R) are false

12. The microbial organism which act as biocontrol agent :
1) Butterfly caterpillars
2) Lady bird beetle
3) Dragon fly
4) *Bacillus thuringiensis*
13. Given below are two statements.
Statement I : Trichoderma species is used as a biological control agent against plant pathogens.
Statement II : Ladybird beetle is used for controlling aphids.
- In the light of the above statements, choose the correct answer from the options given below.
- 1) Both Statement I and Statement II are correct
2) Both Statement I and Statement II are incorrect
3) Statement I is correct but Statement II is incorrect
4) Statement I is incorrect but Statement II is correct
14. **Assertion(A)** : Nostoc, Anabaena and Oscillatoria are used as biofertilizer.
Reason (R) : They are photosynthetic prokaryotes.
- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
3) (A) is true but (R) is false
4) Both (A) and (R) are false
15. Edible protein extracted from the dried biomass of microorganisms like yeast, algae, fungi and bacteria are known as :
1) Streptokinase 2) Cyclosporin -A
3) Flocs 4) SCP

QUESTIONS

LEVEL - III

1. To make soft and porous bread, a small quantity of yeast powder is added to wheat flour and the same is kneaded. What is the correct event for it?
1) Amylase converts starch into maltose sugar
2) It is due to fermentation of glucose
3) It is due to production and accumulation of ethyl alcohol and CO₂
4) It is due to evaporation of ethyl alcohol and CO₂
2. **Assertion(A)** : Toddy is a distilled product.
Reason (R) : Toddy does not undergo fermentation.
- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
3) (A) is true but (R) is false
4) Both (A) and (R) are false
3. Compound which acts as competitive inhibitors of enzyme (HMG CoA reductase) responsible for cholesterol formation are produced from :
1) Prokaryotic unicellular organisms
2) Eukaryotic multicellular organism
3) Prokaryotic multicellular organisms
4) Eukaryotic unicellular organisms

- 4.** Three water samples were collected. Drinking water, untreated sewage water and secondary effluent. The samples were labelled A, B and C but laboratory attendant did not note the source of sample. The BOD values of the samples recorded is 20 mg/L, 2 mg/L and 400 mg/L respectively. Using this data select the correct source of water for the labels A, B and C.
- 1) A - Secondary effluent
B - Drinking water
C - Untreated sewage
- 2) A - Untreated sewage Secondary effluent
B - Drinking water
C - Untreated sewage
- 3) A - Drinking water
B - Secondary effluent
C - Untreated sewage
- 4) A - Untreated sewage Secondary effluent
B - Untreated sewage
C - Drinking water
- 5.** Find out which one of the following statement is not correct with respect to biogas plant?
- 1) It has a floating cover which keeps on rising as gas is produced
 - 2) It consists of a 10 - 15 feet deep tank in which bio-wastes are collected and a slurry of dung is fed
 - 3) Main gases produced are methane, isobutane and propane
 - 4) Spent slurry may be used as fertiliser
- 6.** **Assertion(A)** : Baculoviruses as biocontrol agents have no negative impact on plants, mammals and target insects.
- Reason (R)** : These are effective against several plant pathogens.
- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 - 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
 - 3) (A) is true but (R) is false
 - 4) Both (A) and (R) are false

19 BIODIVERSITY AND CONSERVATION

SYNOPSIS

- **Introduction, Definition**
- **Levels of Biodiversity**
 - Genetic diversity
 - Species diversity
 - Ecological diversity
- **Magnitude of global biodiversity**
- **Biodiversity of India**
- **Patterns of Biodiversity**

I. Latitudinal and altitudinal gradients

Tropical diversity with examples

II. Species - Area relationships

- **Importance of biodiversity**

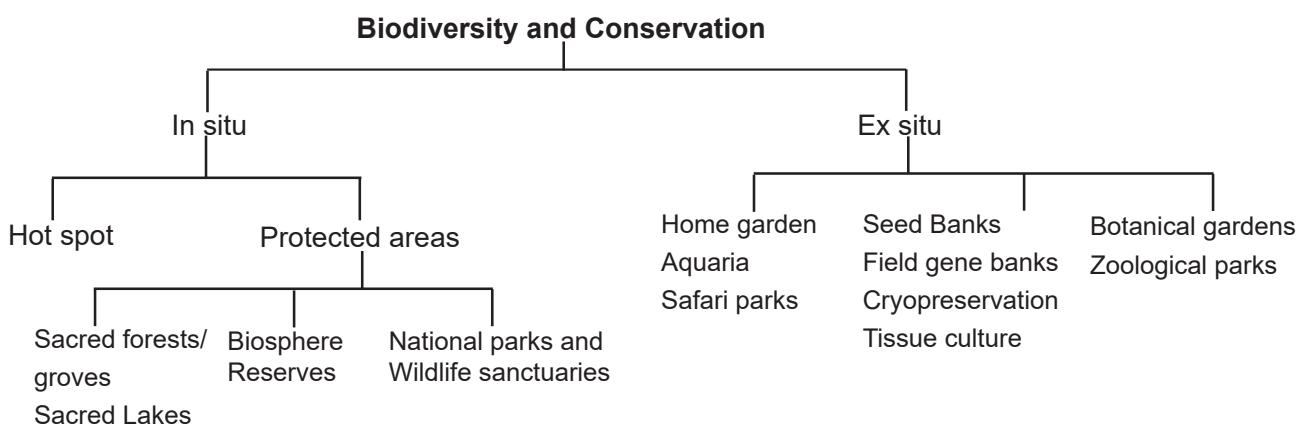
Rivet Popper Hypothesis
- **Loss of biodiversity**
- **After effect of biodiversity loss**
- **Causes of biodiversity losses (The Evil Quartet)**
 1. Habitat loss and fragmentation
 2. Over exploitation
 3. Alien species invasions
 4. Co-extinctions

- **Biodiversity conservation**

- **Reason for Conservation**

1. Narrowly utilitarian argument
2. Broadly utilitarian argument
3. Ethical argument

- **Methods of conservation**



- **National and international efforts for conservation of Biological diversity**

- Earth summit
- World Summit

Additional Points

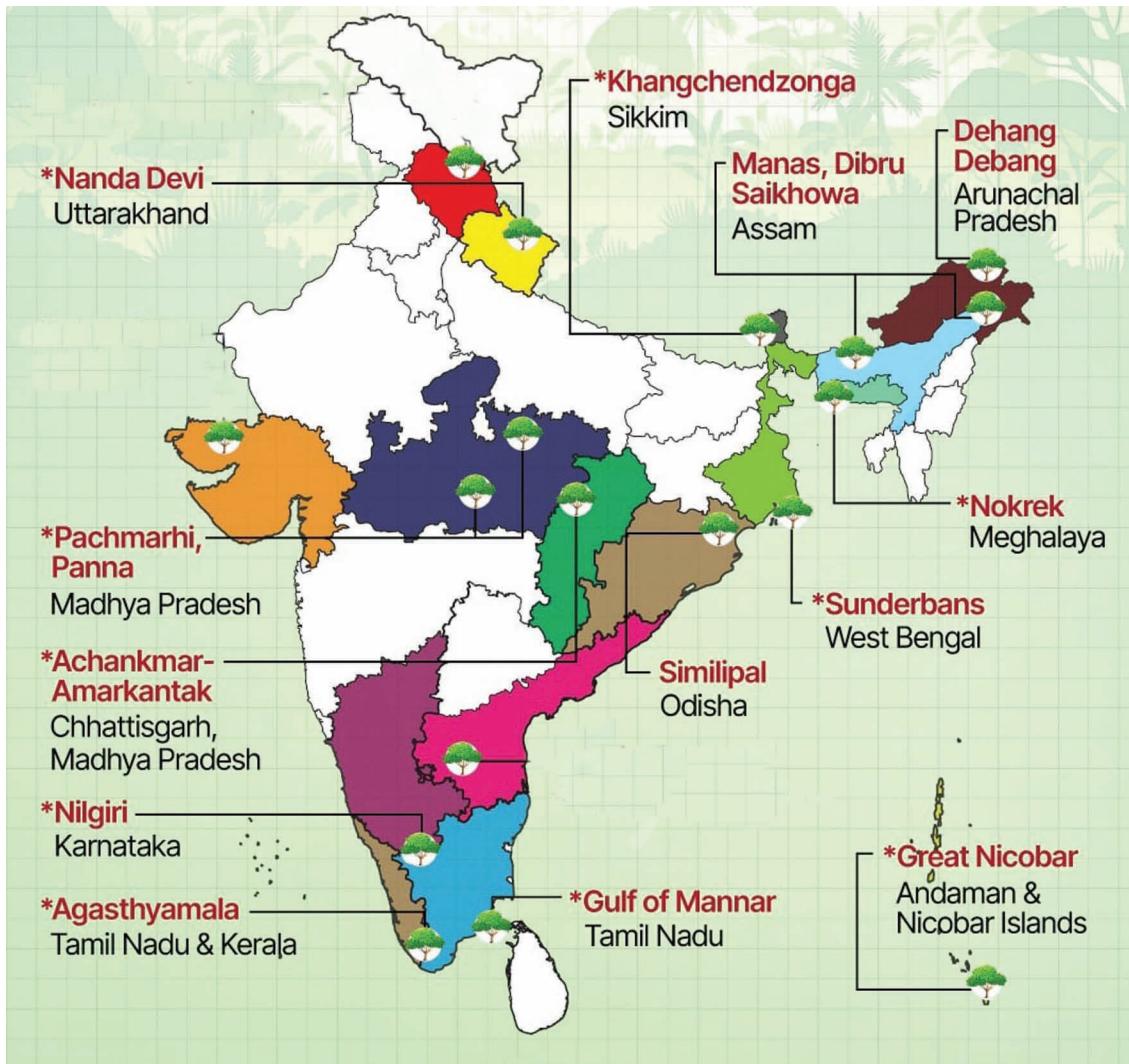
Red data book

IUCN - Red list categories - Extinct, Extinct in the wild, Critically endangered, Endangered, Vulnerable, Lower risk species, Data deficient and Non evaluated

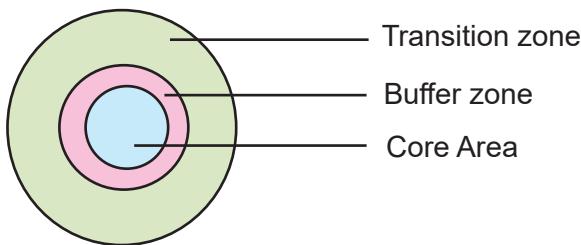
12 Megadiversity countries

- | | | | | |
|------------|----------------|---------------|---|---------|
| 1. Brazil | 2. Columbia | 3. Mexico | 4. Indonesia | 5. Peru |
| 6. Malasia | 7. Ecuador | 8. India | 9. Zaire (Democratic republic of Congo) | |
| 10. China | 11. Madagascar | 12. Australia | | |

BIOSPHERE RESERVES IN INDIA



Zonation in terrestrial Biosphere Reserve



Core zone

No human activity allowed

Buffer zone

Limited human activity like resource use strategies, research and education are allowed.

Transition zone

Activities like settlement, cropping, recreation, forestry etc. allowed

QUESTIONS**LEVEL - I**

- 1.** In our biosphere, immense diversity or heterogeneity exist at :
 - 1) Species level
 - 2) Genetic level
 - 3) Ecological level
 - 4) All of the above

- 2.** Read the following statements and find out the incorrect option :
 - 1) *Rauwolfia vomitoria* is a medicinal plant
 - 2) *Rauwolfia vomitoria* is growing in different Himalayan ranges
 - 3) India has more than 50,000 genetically different strains of rice.
 - 4) In India 10,000 varieties of Mango are found

- 3.** Robert May places the global species diversity at about :
 - 1) 6 million
 - 2) 7 million
 - 3) Slightly more than 1.5 million
 - 4) Slightly less than 1.5 million

- 4.** Among animals, the species diversity is maximum in :
 - 1) Fishes
 - 2) Vertebrates
 - 3) Insects
 - 4) Crustaceans

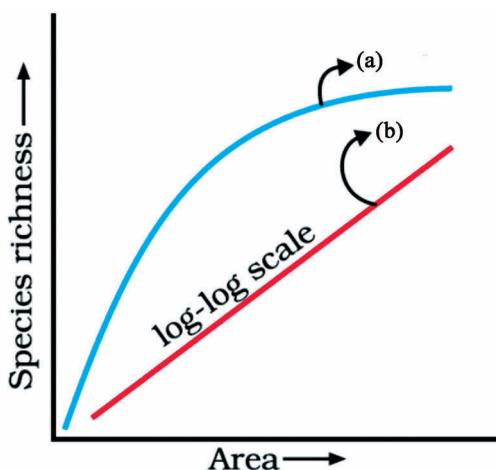
- 5.** Match the column I and II and choose the correct combination from the options given.

Column I (Locality)	Column II (Number of bird species)
I. India	a) 56
II. Amazon rain forest	b) 105
III. Greenland	c) 1200
IV. Colombia	d) 1300
V. New York	e) 1400

	I	II	III	IV	V
1)	d	c	a	e	b
2)	c	e	d	b	a
3)	e	d	c	a	b
4)	c	d	a	e	b

- 6.** What is so special about tropics that might account for their greater biological diversity.
 - 1) More evolutionary time period for speciation
 - 2) Maximum light availability and productivity
 - 3) Constant environmental conditions and less seasonal variations
 - 4) All of these

- 7.** Recognise the figure and find out the correct matching :



	a	b
1)	$S = CA^z$	$\log S = \log C + Z \log A$
2)	$\log S = \log C + Z \log A$	$S = CA^z$
3)	$S = CA^z$	$\log C = \log S + Z \log A$
4)	$C = SA^z$	$\log S = \log C + Z \log A$

- 8.** What exactly meant by stability for a biological community?
- A stable community should not show too much variation in productivity from year to year
 - A stable community must be either resistant or resilient occasional disturbances (natural or man-made)
 - A stable community must be resistant to invasion by alien species
 - All of the above
- 9.** In the last 500 years, how many species of plants have become extinct from world :
- 784
 - 359
 - 338
 - 87

- 10.** Match the animals given in column A with their location in column B

	Column A	Column B
i)	Dodo	a) Africa
ii)	Quagga	b) Russia
iii)	Thylacine	c) Mauritius
iv)	Steller's sea cow	d) Australia

	i	ii	iii	iv
1)	a	c	b	d
2)	d	c	a	b
3)	c	a	b	d
4)	c	a	d	b

- 11.** The organisation which has published 'Red Data Book' is :
- International Union for Conservation of Nature and Natural Resources.
 - Indian Agriculture Research Institute
 - National Wildlife Action Plan
 - Khadi and Village Industries Commission
- 12.** The loss of biodiversity in a region may lead to :
- Decline in plant production
 - Lowered resistance to environmental perturbations such as drought
 - Increased variability in certain ecosystem possess such as plant productivity, water use and pest and disease cycles
 - All of the above

13. The reason why should we conserve biodiversity includes :

- 1) Narrowly utilitarian arguments
- 2) Broadly utilitarian arguments
- 3) Ethical arguments
- 4) All of the above

14. Select the mismatched pair from the following:

	Conservation technique	Number in India
1)	Hotspots	34
2)	National parks	90
3)	Biosphere reserves	14
4)	Wild life sanctuaries	448

15. Read the following statements and select the correct option.

Statement I : The historic convention on Biological Diversity "The Earth Summit" held in Rio de Janeiro in 1992.

Statement II : It called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits.

- 1) Both statements are incorrect
- 2) Both statements are correct
- 3) Statement I is correct but Statement II is incorrect
- 4) Statement I is incorrect but Statement II is correct

QUESTIONS LEVEL - II

1. About the total number of species present on earth, a more conservative and scientifically sound estimate made by :

- 1) Robert May
- 2) Alexander von Humboldt
- 3) David Tilman
- 4) Paul Ehrlich

2. Fill in the blanks.

A) In general, species diversity (a) as we move away from equator towards the poles.

B) With very few exceptions, tropics harbour b species than temperate or polar region.

C) A forest in a tropical region like Ecuador has upto (c) as many species of (d) as a forest of equal area in temperate region like the Mid west of USA.

1) a - increases, b - less, c - two times, d - amphibians

2) a - decreases, b - more, c - ten times, d - vascular plants

3) a - increases, b - more, c - ten times, d - vascular plants

4) a - decreases, b - less, c - two times, d - vascular plants

- 3.** Match the columns I and II, and choose the correct combination from the options given.

Column I (Taxonomic group)	Column II (Value of 'Z')
A) Plants in Britain	i) 0.1 - 0.2
B) Birds in California	ii) 0.6 - 1.2
C) Mollusc in New York	iii) 0.2 - 1.2

	A	B	C
1)	(i)	(ii)	(iii)
2)	(i)	(ii)	(ii)
3)	(ii)	(i)	(ii)
4)	(i)	(i)	(i)

- 4.** In a comparative analogy between the airplane and ecosystem (the 'rivet popper hypothesis') used by Stanford ecologist Paul Ehrlich, find out the correct matching :

Column I	Column II
a) Rivets	i) Ecosystem
b) Airplane	ii) Species
c) Popping a rivet	iii) Key species
d) Rivets on the wings	iv) Proper functioning of ecosystem
e) Flight safety	v) A species to become extinct

- 1) a - i, b - ii, c - iii, d - iv, e - v
 2) a - ii, b - i, c - iv, d - v, e - iii
 3) a - ii, b - i, c - v, d - iv, e - iii
 4) a - ii, b - i, c - v, d - iii, e - iv

- 5.** **Assertion(A)** : Currently the 'Sixth Extinction' is in progress.

Reason (R) : The current species extinction rates are estimated to be 100 - 1,000, times faster than the pre-human times and our activities are responsible for the faster rates.

- 1) Both (A) and (R) are true and (R) is the correct explanation of (A)
 2) Both (A) and (R) are true but (R) is not the correct explanation of (A)
 3) (A) is true but (R) is false
 4) Both (A) and (R) are false

- 6.** Match the columns I and II and choose the correct combination from the options given.

Column I (Taxonomic group)	Column II (Threat of Extinction)
a) Birds	i) 12%
b) Amphibians	ii) 23%
c) Mammals	iii) 31%
d) Gymnosperms	iv) 32%

- 1) a - i, b - ii, c - iii, d - iv
 2) a - ii, b - i, c - iv, d - iii
 3) a - i, b - iv, c - ii, d - iii
 4) a - i, b - iii, c - ii, d - iv

- 7.** Which of the following is not an invasive alien species in the Indian context?

- 1) Lantana 2) Nile perch
 3) Parthenium 4) Eichhornia

- 8.** Bioprospecting is related to :
- Narrowly utilitarian argument
 - Broadly utilitarian argument
 - Ethical argument
 - All of the above
- 9.** When there are situations where an animal or plant is endangered or threatened due to habitat loss and need urgent measures to save it from extinction. Which is the most desirable approach?
- In situ conservation
 - Ex situ conservation
 - Conservation within their natural habitat
 - Both 1 and 3
- 10.** Which of the following are in situ conservation method?
- Biosphere reserves
 - Hotspots
 - National parks
 - Wild life sanctuaries
 - Sacred groves
- a, b and c only
 - a, c and e only
 - a, b, c and e
 - a, b, c, d and e
- 11.** **Assertion** : The most dramatic examples of habitat loss come from tropical rain forest.
Reason : The tropical forest once covering 6% of the earth's land surface now covers more than 14%.
- Both Assertion and Reason are correct and R is the correct explanation of Assertion
 - Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion
 - Assertion is correct but Reason is incorrect
 - Both Assertion and Reason are incorrect
- 12.** Read the following statements and select the correct option.
- Statement A**: All the biodiversity hotspots put together cover less than 2% of the Earth's land area.
- Statement B**: The strict protection of the hotspots could reduce the ongoing mass extinction by almost 19%.
- Statement A is correct, B is wrong
 - Statement A is wrong, B is correct
 - Statement A and B are correct.
 - Statement A and B are wrong
- 13.** Find the wrongly matched pair :
- Endemism - Species confined to one region and not found anywhere else.
 - Alien species to India - *Clarias gariepinus*.
 - Lungs of the planet - Amazon rain forest
 - In situ conservation - Safari parks
- 14.** Match the columns I , II and III and choose the correct combination from the options given.
- | Column I | Column II | Column III |
|---------------------|-------------------------------|------------|
| a) The Earth Summit | 1. Johannesburg, South Africa | K) 1992 |
| b) The World Summit | 2. Rio-de Janeiro, Brazil | L) 2002 |
- a - 1 - K, b - 2 - L
 - a - 1 - L, b - 2 - K
 - a - 2 - K, b - 1 - L
 - a - 2 - L, b - 1 - K

- 15.** In the “World Summit on Sustainable Development”, (a) countries pledged their commitment to achieve by (b) a significant reduction in the current rate of biodiversity loss at global, regional and local levels.
- 1) a - 190, b - 2012
 - 2) a - 192, b - 2002
 - 3) a - 190, b - 1992
 - 4) a - 190, b - 2010
- 3.** Species diversity ----- as we move away from the ----- toward -----
- 1) Increases, equator, poles
 - 2) Decreases, poles, equator
 - 3) Decreases, equator, poles
 - 4) Increases, low altitude to high altitude
- 4.** Match column I with column II and select the correct choice.

Column I	Column II
1. Most important cause of plant extinction	a) <i>Clarias gariepinus</i>
2. Huge Amazon rain forest	b) Example of Co-extinction
3. Introduction of Nile perch in Lake Victoria	c) Extinction of 200 species of Cichlid fish
4. African cat fish	d) Lungs of the planet
5. Extinction of plant pollinator mutualism	e) Habitat loss & fragmentation

- 1.** Genetic diversity refers to
- 1) The differences in alleles within species.
 - 2) Differences in entire alleles
 - 3) Differences in chromosomal structure
 - 4) 1, 2 and 3
- 2.** Which of the following statements are true to earth's biodiversity
- 1) More than 70% of all the species recorded are animals
 - 2) Plants comprise upto 22% of the total
 - 3) Among animals insects are the most species rich group forming 70% of the total.
 - 4) All

- 4.** Match column I with column II and select the correct choice.

- 1) 1 - e, 2 - d, 3 - c, 4 - a, 5 - b
- 2) 1 - a, 2 - b, 3 - c, 4 - d, 5 - e
- 3) 1 - c, 2 - a, 3 - a, 4 - e, 5 - d
- 4) 1 - d, 2 - c, 3 - a, 4 - b, 5 - e

- 5.** Red Data Book deals with :

- 1) Organisms on the verge of Extinction
- 2) Endemic plants
- 3) Organisms showing photoperiodism
- 4) Alien species