

NC & NW -2024
CLASS (XI)

BIOLOGY

Module - II

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CONTENTS

CLASS NOTE

BOTANY

1. Morphology of Flowering Plants -----	05
2. Anatomy of Flowering Plants -----	14
3. Cell : The unit of life -----	23
4. Cell Cycle and Cell Division -----	32
5. Transport in Plants -----	44
6. Mineral Nutrition -----	54
7. Photosynthesis in Higher Plants -----	61
8. Respiration in Plants -----	72
9. Plant Growth and Development -----	83

ZOOLOGY

1. Structural Organization in Animals (Animal Tissues) -----	88
2. Morphology of Animals (Cockroach) -----	95
3. Biomolecules -----	102
4. Digestion and Absorption -----	111
5. Breathing and Exchange of Gases -----	127
6. Body Fluids and Circulation -----	136
7. Excretory Products and Their Elimination -----	157
8. Locomotion and Movement -----	166
9. Neural Control and Co-ordination -----	178
10. Chemical Co-ordination and Integration -----	186

WORKBOOK

BOTANY

1. Morphology of Flowering Plants -----	201
2. Anatomy of Flowering Plants -----	207
3. Cell : The unit of life -----	215
4. Cell Cycle and Cell Division -----	220
5. Transport in Plants -----	227
6. Mineral Nutrition -----	235
7. Photosynthesis in Higher Plants -----	239
8. Respiration in Plants -----	247
9. Plant Growth and Development -----	253

ZOOLOGY

1. Structural Organization in Animals (Animal Tissues) -----	258
2. Morphology of Animals (Cockroach) -----	262
3. Biomolecules -----	266
4. Digestion and Absorption -----	274
5. Breathing and Exchange of Gases -----	282
6. Body Fluids and Circulation -----	287
7. Excretory Products and Their Elimination -----	294
8. Locomotion and Movement -----	299
9. Neural Control and Co-ordination -----	309
10. Chemical Co-ordination and Integration -----	318

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BOTANY

CHAPTER -01 MORPHOLOGY OF FLOWERING PLANTS

Teaching Points

I. Vegetative Morphology

A. Root

- ◆ Types of root system : Regions of root
- ◆ Root modifications under three groups
 - Storage modifications (Tap root and adventitious)
 - Mechanical modification (Prop and stilt root)
 - Vital function modifications - Pneumatophore

B. Stem

- ◆ Difference between root axis and stem axis
- ◆ Stem modifications under three heading
 - Underground modification - Rhizome, Bulb, Corm, Tuber (examples)
 - Sub aerial modification (Creepers) - Runner, Sucker, Stolon, Offset (examples)
 - Aerial modification - Phylloclade, Cladode, Thorn, Tendril, Bulbil (examples)

C. Leaf

Parts of leaf : specifying pulvinus and sheathing leaf base

- Venation : Reticulate and parallel
- Types of leaf : Simple and Compound

Mentioning the origin of pinnately and palmately compound leaf from simple leaf

- Phyllotaxy : Alternate, Opposite, whorled.

Examples for each group.

- Leaf modifications : Spine, Scale leaf, tendril, Pitcher, Bladder, Phyllode (examples)

II. Floral / Reproductive morphology

A. Inflorescence

- Definition explaining the importance of peduncle
- Criteria for classification into two groups

- Briefing of Racemose, Cymose.

B. Flower

- Introduction as a modified shoot
- Parts of flower introducing thalamus and the floral whorls/leaves through a diagram
- Description of flower considering criteria like Essential parts, Accessory organs, Symmetry, Shape of thalamus with respect to the position of ovary, number of floral leaves in successive nodes of thalamus. (Giving examples for each type of flower).

Explanation of floral whorls - calyx, corolla, Androecium and gynoecium

Specifying → the function of each whorl

- Presence or absence of fusion of floral leaves within a whorl and between the whorls
- Types of placentations - Marginal, Basal, Parietal, Free central, axile

C. Fruit

- Introduction as fertilized ovary.
- Classification of fruits according to :

- **Origin** : True, Parthenocarpic, False fruits (One example each)
- **Number of flowers and carpels in gynoecium** : Simple, aggregate, multiple fruit (one example each)
- **Morphology of pericarp** : Dry and Fleshy fruit (One example each)

D. Seed

- Introduction as fertilized ovule
- Structure of endospermic and non-endospermic seed : Correlating these fruits into monocot and dicot respectively. (Few examples)

III. Family description

- ◆ Briefing importance of floral formula and floral diagram : Specifying the floral characters which can be shown only in any one of the devices. Briefing the Brassicaceae for floral formula and floral diagram
- ◆ **Study of three families - Fabaceae, Solanaceae and Liliaceae. Regarding each family**
 - Systematic position
 - Familiar examples (Scientific name and common name)
 - Floral characters : with respect to Calyx, Corolla, Androecium, Gynoecium, Fruit and Seed
 - Floral formula and Floral diagram

QUESTIONS**LEVEL - I**

1. Mechanically modified root originating from horizontal branches and grows vertically downward is :
 - 1) Prop root
 - 2) Stilt root
 - 3) Climbing root
 - 4) Assimilatory root
2. In some plants like Rhizophora growing in swampy areas, many roots come out of the ground and grow vertically upwards, such roots are called:
 - 1) Pneumatophores
 - 2) Pneumatophodes
 - 3) Prop roots
 - 4) Stilt roots
3. The region of root actively involved in the absorption of water and minerals lies just above the :
 - 1) Root cap region
 - 2) Meristematic region
 - 3) Elongation region
 - 4) Maturation region
4. Which among the following sentence is not correct about meristematic region :
 - 1) Growth regulators are formed
 - 2) It is the growing region of root
 - 3) Presence of few root hairs in this regions
 - 4) Cells are thin walled and are with dense protoplasm
5. Choose the plants in which tap root get swollen and store food :

a) Carrot	b) Sweet potato	c) Radish	d) Asparagus
e) Tinospora	f) Rhizophora	g) Turnip	h) Potato
1) a, b, c, d, h	2) a, c, g	3) a, c, e, f, h	4) b, d, h
6. Presence of modified stem below the soil meant for perennation and storage is found in :
 - 1) Ginger and Sweet potato
 - 2) Zaminkand and Potato
 - 3) Onion and Euphorbia
 - 4) Turmeric and Opuntia
7. Consider the following statements.

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

Statement B : Some stems perform the function of storage of food, support, protection and of vegetative propagation.

 - 1) Statement A and B are correct
 - 2) Statement A and B are wrong
 - 3) Statement A is correct, B is wrong
 - 4) Statement A is wrong, B is correct
8. Swollen base of the petiole, a common feature in members of the family Leguminosae is called:
 - 1) Pulvinus
 - 2) Petiole
 - 3) Stipule
 - 4) Bract
9. Select the set of plants in which the phyllotaxy is alternate :
 - 1) China rose, Mustard, Sunflower
 - 2) Calotropis, Guava, Ocimum
 - 3) Ixora, Calotropis, Alstonia
 - 4) Nerium, Alstonia, Allamanda

10. Match the type of flower / structure of flower given in column I with that of the examples given in column II.

Column I

- A) Epipetalous
 - B) Epiphyllous
 - C) Diadelphous
 - D) Variation in the length of stamen
- 1) A - 1 ; B - 2 ; C - 3 ; D - 4
 3) A - 3 ; B - 2 ; C - 4 ; D - 1

Column II

- 1. Mustard
 - 2. Lily
 - 3. Withania
 - 4. Garden pea
- 2) A - 4 ; B - 3 ; C - 2 ; D - 1
 4) A - 2 ; B - 1 ; C - 2 ; D - 3

11. Consider the following statements.

Statement A : In the hypogynous flower, the gynoecium occupies the lowest position while the other parts are situated above it.

Statement B : If gynoecium is situated in the centre and other parts of the flower are located on the rim of the thalamus almost at the same level, it is called perigynous.

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

12. The floral formula  is of the family :

- 1) Solanaceae
- 2) Fabaceae
- 3) Papilionaceae
- 4) Liliaceae

13. Which among the following is not a character of pea family :

- 1) Monocarpellary gynoecium with marginal placentation
- 2) Papilionaceous corolla with vexillary aestivation
- 3) Obliquely placed ovary with swollen placenta
- 4) Bisexual zygomorphic flower with diadelphous androecium

14. A set of plants which belongs to Liliaceae family are :

- 1) Solanum, Withania, Petunia
- 2) Garden pea, Crotalaria, Soyabean
- 3) Colchicum, Allium, Asparagus
- 4) Ground nut, Brinjal, Tomato

15. Maize, Tapioca, Sugarcane and Sweet potato are similar in having modified root with a common feature:

- 1) Modified for storage
- 2) All are adventitious root
- 3) Modified for mechanical support
- 4) All are tap root modifications

16. Which among the following plant possess sheathing leaf base :

- 1) China rose
- 2) Garden pea
- 3) Crotalaria
- 4) Grasses

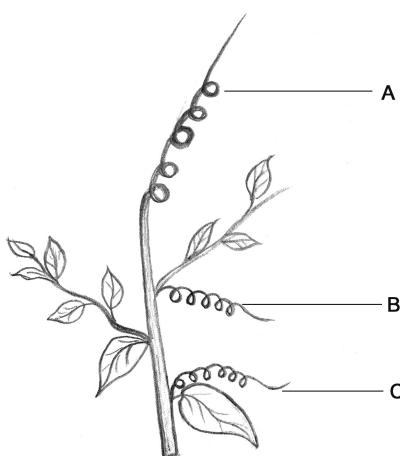
17. Which among the following is said to be an aquatic creeper :

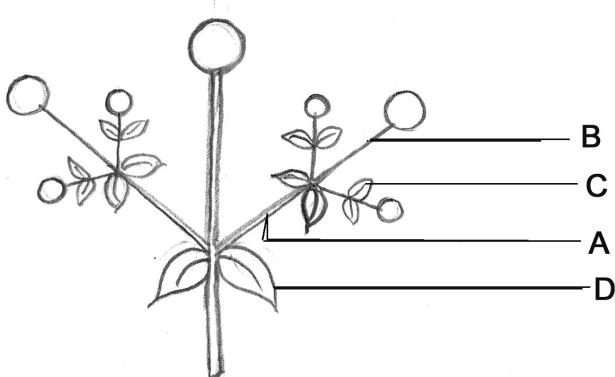
- 1) Runner
- 2) Stolon
- 3) Sucker
- 4) Offset

18. Which among the following sentence is wrong about Racemose inflorescence :

 - 1) Peduncle ends in flower
 - 2) Acropetal order of maturation of flowers
 - 3) Oldest flowers are at the base of the elongated peduncle
 - 4) Peduncle is of indefinite growth

19. Observe the following diagram indicating the origin of tendrils from different part of stem labelled as A, B and C. Identify which among them are stem tendrils :





- 1) A - Bract ; B - Bracteole ; C - Pedicel ; D - Peduncle
 - 2) A - Peduncle ; B - Pedicel ; C - Bracteole ; D - Bract
 - 3) A - Pedicel ; B - Peduncle ; C - Bracteole ; D - Bract
 - 4) A - Pedicel ; B - Peduncle ; C - Bract ; D - Bracteole

21. Which among the following explanation is wrongly matched :
- 1) Mango - Edible mesocarp
 - 2) Castor - Non-endospermous
 - 3) Pisum - Papilionaceous corolla
 - 4) Asparagus - Vegetable
22. A true fruit and seed can be better defined as :
- 1) Fertilized ovary and ovule respectively
 - 2) Fertilized ovule and ovary respectively
 - 3) Fertilized ovule and pistil respectively
 - 4) Fertilized ovary and carpel respectively
23. The similarity shared by the seeds of plants such as bean, gram, pea and orchid is that :
- 1) Food storing tissue inside the seed is endosperm
 - 2) Presence of aleurone layer
 - 3) Absence of endosperm in mature seeds
 - 4) Presence of two cotyledons for embryo
24. Match the morphological specialities of androecium and gynoecium of the families Fabaceae, Solanaceae and Liliaceae :
- | Column I | Column II | Column III |
|-----------------|----------------------------|---|
| 1. Fabaceae | A) 6 stamens in two whorls | I. Tricarpellary with axile placentation |
| 2. Solanaceae | B) Diadelphous androecium | II. Monocarpellary with marginal placentation |
| 3. Liliaceae | C) Epipetalous stamen | III. Bicarpellary with axile placentation |
- 1) 1-A-I ; 2-B-II ; 3-C-III
 - 2) 1-B-II ; 2-C-III ; 3-A-I
 - 3) 1-C-III ; 2-B-II ; 3-A-I
 - 4) 1-B-II ; 2-C-I ; 3-A-III
25. Which among the following floral formula represent Fabaceae :

1) %  K₍₅₎C₁₊₂₊₍₂₎A₍₉₎₊₁G₁

2) %  K₍₅₎ $\widehat{C}_{(5)}$ A₅G₍₂₎

3) \oplus  P₃₊₃A₃₊₃;G₍₃₎

4) \oplus  K₍₅₎C₅A₍₁₀₎G₍₅₎

LEVEL II

1. Morphological features of certain modified root and stem is given in column I. Correlate them with the name of structures in column II.

Column I

- A) Aerial, green coloured root
- B) A creeper, grows above the water surface
- C) Aerial, mechanical root originating from horizontal branch
- D) Highly reduced underground stem with fleshy scale leaf
- E) Swollen tap root with maximum swelling at middle

Column II

- 1. Bulb
- 2. Prop root
- 3. Assimilatory root
- 4. Haustoria
- 5. Offset
- 6. Bulbil
- 7. Fusiform
- 8. Fasciculated

1) A - 1 ; B - 3 ; C - 4 ; D - 6 ; E - 7

3) A - 3 ; B - 5 ; C - 4 ; D - 6 ; E - 8

2) A - 3 ; B - 5 ; C - 2 ; D - 1 ; E - 7

4) A - 4 ; B - 6 ; C - 2 ; D - 1 ; E - 7

2. A tendril at the tip of stem, a thorn in the axil of leaf, a phylloclade in cactus can have a common feature in that :

- 1) All are stem modifications
- 2) All are leaf modification
- 3) All can be stem or leaf modification
- 4) All are aerial root modification

3. The edible part of potato and sweet potato are respectively :

- | | |
|------------------|-----------------------------------|
| 1) Stem and Root | 2) Root and stem |
| 3) Stem and Leaf | 4) Tap root and adventitious root |

4. A modified stem meant for vegetative propagation which originate from the basal and underground portion of the main stem where its initial growth is below the soil and then come above bearing leafy shoot in how many of the following plants?

Grass, Strawberry, Eichhornia, Pistia, Chrysanthemum, Banana, Pineapple, Mint, Jasmine

1) 2 2) 3 3) 5 4) 7

5. A stem with opposite phyllotaxy possess 5 nodes can carry maximum how many leaves :

1) 5 2) 10 3) 15 4) 15 - many

6. Which among the following explanation and example of morphological term is wrongly matched :

- 1) Pulvinus - Swollen leaf base - Leguminous plants
- 2) Opposite phyllotaxy - Two leaf at a node - Calotropis, Guava, Ocimum
- 3) Palmately compound - Leaflets at the tip of Rachis, Silk cotton tree
- 4) Phyllode - Petiole/Rachis modified into bag like structure - Nepenthes

7. If a cell in the aleurone layer of a monocot seed contains 30 chromosome, what will be the chromosome number in the zygote of same plant :
1) 30 2) 20 3) 10 4) 60
8. **Assertion (A)** : Flower is a modified shoot meant for sexual reproduction.
Reason (R) : Flower has an axis which is highly condensed, divided into nodes and internodes, which posses lateral appendages known as floral leaves, where some floral leaves are meant for the formation of spores.
1) Both A and R are true R is correct explanation of A
2) Both A and R are true R is not correct explanation of A
3) Both A and R are false
4) A is true, R is false
9. Which among the following plant possess actinomorphic flower :
1) Pea 2) Crotalaria 3) Withania 4) Sesbania
10. Which among the following is the similarity between Salvia and Mustard :
1) They belongs to the same family
2) Same number of stamens in androecium
3) Same height / length of filaments of all stamens
4) Not all stamens in the respective androecium are in same height
11. Which among the following placentation in an ovary causes the transformation of ovary into one seeded fruit :
1) Free central 2) Axile 3) Basal 4) Marginal
12. How many among the following plants have sub-aerial stem close to the soil meant for vegetative propagation : **Mint, Jasmine, Ginger, Chrysanthemum, Turmeric, Pistia, Eichhornia, Wild strawberry, Grass, Banana, Pineapple**
1) 9 2) 7 3) 11 4) 8
13. Consider the following statements.
Statement A : Only a fertilized ovary can undergo morphological development to form a fruit.
Statement B : Pericarp, testa and tegmen are the different layers of seed coat.
1) Statement A and B are correct 2) Statement A and B are wrong
3) Statement A is correct, B is wrong 4) Statement A is wrong, B is correct
14. Similarity shared by the aestivation types, vexillary and imbricate is that :
1) Aestivation without overlapping
2) Aestivation with regular overlapping
3) Aestivation with irregular overlapping
4) Aestivation in calyx and corolla of Solanaceae
15. Which among the following plant possess modified stem below the soil not meant for storage :
1) Ginger 2) Turmeric 3) Potato 4) Onion

16. In the floral formula representation of Solanaceae : $\oplus; \frac{1}{+} K_{(5)} C_{(5)} \widehat{A_{(5)}} G_{(2)}$ Which floral whorl is wrongly described :
- Calyx
 - Corolla
 - Androecium
 - Gynoecium
17. An alkaloid colchicine is obtained from a plant belongs to the family :
- Fabaceae
 - Solanaceae
 - Liliaceae
 - Brassicaceae
18. Which among the following description is wrong about the fruit of Mango and Coconut :
- True fruit
 - Simple fruit
 - Fleshy fruit
 - Many seeded fruit
19. Undifferentiable calyx and corolla, that is perianth is not expecting in the following plants :
- Gloriosa and Asparagus
 - Withania and Sesbania
 - Allium and Smilax
 - Cochicum and Yucca
20. Same type of aestivation is found in the calyx and corolla of following family :
- Fabaceae
 - Solanaceae
 - Liliaceae
 - Both 1 and 2
21. Majority of stem modifications are meant for :
- Photosynthesis
 - Vegetative propagation
 - Pollination
 - Mechanical support
22. How many among the floral characters can be expressed in both floral diagram and floral formula :
- Symmetry of flower
 - Number of floral leaves in each whorl
 - Placentation
 - Connation / cohesion of floral leaves
 - Aestivation
 - Position of ovary
 - Adnation of floral leaves
- c, e and f
 - a, b, c, d, e, g
 - a, b, d, f, g
 - a, b, d, g
23. Persistent calyx is common in the following family :
- Fabaceae
 - Solanaceae
 - Liliaceae
 - Brassicaceae
24. Which among the following statement is wrong :
- In dicot seeds food is mainly stored in cotyledons
 - In monocot seeds food is mainly stored in endosperm
 - Coleoptile and coleorhiza are the part of dicot embryo
 - Embryo inside the seed is the product of syngamy as it is developed from zygote
25. Petiole and pedicel are stalk of :
- Flower and inflorescence
 - Leaf and flower
 - Leaf and inflorescence
 - Flower and fruit

CHAPTER -02

ANATOMY OF FLOWERING PLANTS

QUESTIONS

LEVEL - I

1. Among the following, which one is not considered as a character of tissues
 - 1) A tissue is a group of cells having a common origin and usually performing a common function.
 - 2) A plant is made up of different kinds of tissues
 - 3) Tissues are classified into three main groups, namely, meristematic ,permanent and mature based on capability of division
 - 4) Growth in plants is largely restricted to specialised regions of active cell division
2. Different plant tissues are
 - 1) Apical, lateral, intercalary, simple and complex
 - 2) Meristematic and permanent
 - 3) Epidermal, ground and vascular
 - 4) Both (1) and (2)
3. Apical meristems
 - 1) Which occurs between mature tissues
 - 2) Occurs in the mature regions of roots and shoots of many plants
 - 3) Are cylindrical meristems
 - 4) Which occur at the tips of roots and shoots and produce primary tissues
4. Growth in plants is largely restricted to specialised tissue of active cell division called
 - 1) Meristems
 - 2) Permanent simple
 - 3) Permanent complex
 - 4) Both 2 and 3
5. Meristems which are responsible for production of the secondary tissues.
 - 1) Fascicular vascular cambium and cork-cambium only
 - 2) Intra fascicular cambium and interfascicular cambium only
 - 3) Vascular cambium, Fascicular cambium and intra fascicular cambium only
 - 4) Fascicular vascular cambium, interfascicular cambium and cork-cambium

6. Which of the following has isodiametric cells which may be spherical, oval, round, polygonal or elongated in shape and walls are thin and made up of cellulose. They may either be closely packed or have small intercellular spaces without chloroplast
- 1) Parenchyma and collenchyma
 - 2) Parenchyma
 - 3) Parenchyma and chlorenchyma
 - 4) Collenchyma and sclerenchyma
7. Select the best option regarding collenchyma , from the following statements
- a) Intercellular spaces are absent
 - b) Found either as a homogeneous layer or in patches.
 - c) A living mechanical tissue.
 - d) May be oval, spherical or polygonal and often contain chloroplasts.
- Options:
- 1) All except (a) are correct
 - 2) All except (b) are correct
 - 3) All except (c) are correct
 - 4) All are correct
8. Sclerenchyma cells do not have
- 1) Long and narrow cells
 - 2) Thick and lignified cell walls
 - 3) Living cells and with protoplasts.
 - 4) Pits
9. Identify the correct statements from the following statements :
- a. Xylem functions as a conducting tissue for water and minerals from roots to the stem and leaves.
 - b. Xylem provides mechanical strength to the plant parts.
 - c. Gymnosperms lack tracheids in their xylem fibres and xylem parenchyma.
 - d. Xylem is composed of four different kinds of elements, namely, tracheids, vessels, xylem parenchyma, xylem fibres.
- Options :
- 1) (a), (c) and (d)
 - 2) (a) and (c)
 - 3) (a), (b) and (d)
 - 4) (a) and (b)
10. Which of the following is not correctly matched for its structural peculiarities:
- 1) Tracheids– elongated or tube like cells with tapering ends.
 - 2) Vessel – either be septate or aseptate
 - 3) Xylem fibres – have highly thickened walls and obliterated central lumens
 - 4) Xylem parenchyma - cells are living and thin-walled.
11. Match the Column I and II and choose the correct combination from the options given
- | Column I | Column II |
|-----------------------|---|
| a. metaxylem. | 1) the protoxylem lies towards the centre |
| b. exarch | 2) first formed primary xylem |
| c. protoxylem | 3) metaxylem lies towards the centre |
| d. endarch. | 4) later formed primary xylem |
| 1) a-4, b-3, c-2, d-1 | 2) a-4, b-1, c-2, d-3 3) a-2, b-3, c-4, d-1 4) a-2, b-1, c-4, d-3 |

12. Find out the correct option regarding the features of sieve tube elements in angiosperms
- Long, tube-like structures, arranged longitudinally
 - Associated with the albuminous cells
 - Their end walls are perforated in a sieve-like manner to form the sieve plates
 - A mature sieve element possesses a peripheral cytoplasm and a large vacuole but lacks a nucleus.
- Options :
- 1) (a), (b) and (c)
 - 2) (a) (c) and (d)
 - 3) (b), (c) and (d)
 - 4) (a) and (c) only
13. The ground tissue system is divided into
- 1) Cortex and pith
 - 2) Cortex, pericycle and pith
 - 3) Cortex, endodermis, pericycle and pith
 - 4) Epidermis, cortex, , endodermis, pericycle and pith
14. Select the correct components of stomatal apparatus
- 1) Stomata, guard cells and subsidiary cells
 - 2) Stomatal aperture, guard cells and subsidiary cells
 - 3) Guard cells and subsidiary cells
 - 4) Stomatal apparatus, guard cells and subsidiary cells
15. The vascular bundles are of different types on the basis of
- 1) Presence of cambium, location of xylem and phloem,
 - 2) Presence or absence xylem and phloem and presence or absence cambium
 - 3) Presence or absence xylem and phloem and location of cambium
 - 4) Presence or absence of pith inbetween xylem and phloem
16. Which of these statements are correct
- In collateral vascular bundles. phloem and xylem are located side by side
 - Xylem and phloem are arranged in an alternate manner in radial
 - The xylem and phloem together constitute vascular bundles
 - Presence of cambium helps to form secondary xylem and phloem tissues
- 1) (a), (b) and (c)
 - 2) (a) (c) and (d)
 - 3) (b), (c) and (d)
 - 4) (a) (b), (c) and (d)
17. How many of these features such as epiblema, casparyan strips, conjuctive tissue,conjoint, closed,more xylem bundles, endarch, small Pith, secondary growth are found in Dicot Root
- 1) 4
 - 2) 5
 - 3) 6
 - 4) 3

18. How many of these features such as
- i) Sclerenchymatous hypodermis
 - ii) A large number of scattered vascular bundles
 - iii) Sclerenchymatous bundle sheath
 - iv) Endodermis
 - v) Pericycle
 - vi) Conspicuous parenchymatous ground tissue
 - vii) Vascular cambium.
 - viii) Absence of phloem parenchyma
 - ix) Water-containing cavities in the vascular bundles
- are characteristic of monocot stem
- 1) 6 2) 7 3) 8 4) 9
19. Select the correct sequence of tissues in dicot stem:
- 1) Epidermis, hypodermis, cortex, endodermis, xylem, cambium, phloem, pith
 - 2) Epidermis, hypodermis, cortex, endodermis, pericycle, phloem, cambium, xylem, pith.
 - 3) Epidermis, hypodermis, cortex, endodermis, pericycle, xylem, cambium, phloem, pith
 - 4) Epidermis, hypodermis, cortex, pericycle, endodermis, phloem, cambium, xylem.
20. Which of the following is not a feature of dorsiventral leaf?
- 1) Adaxial epidermis generally bears more stomata
 - 2) Adaxially placed palisade parenchyma
 - 3) Loosely arranged spongy parenchyma
 - 4) Vascular bundles are surrounded by a layer of thick walled bundle sheath cells.
21. Which of the following statement is incorrect?
- 1) The activity of cambium is under the control of many physiological and environmental factors.
 - 2) In tropical regions, the climatic conditions are not uniform through the year.
 - 3) In the spring season, cambium is very active
 - 4) During spring, cambium produces a large number of xylary elements having vessels with wider cavities
22. Which one of the following statement is valid for heartwood ?
- 1) The heartwood conduct water and also gives mechanical support to the stem.
 - 2) The heartwood does not conduct water but it gives mechanical support to the stem.
 - 3) The heartwood conduct water but does not give mechanical support to the stem.
 - 4) The heartwood does not conduct water and mechanical support to the stem.

23. Phellogen is
- 1) Broad, thick-walled and nearly elongated cells.
 - 2) Narrow, thick-walled and nearly rectangular cells
 - 3) Broad, thin-walled and nearly elongated cells.
 - 4) Narrow, thin-walled and nearly rectangular cells.
24. Bark is a
- 1) Non-technical term that refers to all tissues exterior to the secondary phloem
 - 2) Non-technical term that refers to all tissues exterior to periderm.
 - 3) Non-technical term that refers to all tissues exterior to vascular cambium,
 - 4) Non-technical term that refers to all tissues exterior to the cork cambium,
25. In the dicot root, the vascular cambium is
- | | |
|-----------------------------------|----------------------------------|
| 1) Completely primary in origin | 2) Partially primary in origin |
| 3) Completely secondary in origin | 4) Partially secondary in origin |
- LEVEL - II**
1. Select the correct option from the following statements :
 - (a) Different organs in a plant show differences in their internal structure
 - (b) The monocots and dicots are seen to be anatomically different
 - (c) Internal structures show adaptations to diverse environments.
 - (d) Cells are organised into tissues and in turn the tissues are organised into organs

1) (b) ,(c) and (d)	2) (a) ,(b) and (d)
3) (a), (b) (c) and (d)	4) (a), (b) and (c)
 2. The main functions of tissues are
 - 1) Assimilation of food and its storage, transportation of water and minerals and mechanical support only
 - 2) Assimilation of food and its storage, transportation of water, minerals and photosynthates, and mechanical support
 - 3) Storage of food, transportation of water, minerals and mechanical support only
 - 4) Synthesis food and its storage, transportation of water, minerals and mechanical support only
 3. Which one of the following statement is correct, with reference to apical meristem
 - 1) Root apical meristem occupies the distant most region of the root while the shoot apical meristem occupies the tip of a shoot
 - 2) Root apical meristem occupies the tip of a root while the shoot apical meristem occupies the distant most region of the stem axis
 - 3) Root and shoot apical meristem occupies subterminally
 - 4) Root and shoot apical meristem occupies at distant most region

4. During the formation of leaves and elongation of stem, some cells 'left behind' from shoot apical meristem, constitute the
- 1) Secondary meristem
 - 2) Cylindrical meristems
 - 3) Axillary bud
 - 4) Lateral meristem
5. Which of the following is more correct as lateral meristems.
- 1) Fascicular vascular cambium and cork-cambium only
 - 2) Intra fascicular cambium and interfascicular cambium only
 - 3) Vascular cambium, Fascicular cambium and intra fascicular cambium only
 - 4) Fascicular vascular cambium, interfascicular cambium and cork-cambium
6. Which of the following statements are correct regarding lateral meristematic tissues?
- a) The meristem that occurs in the mature regions of roots and shoots of many plants
 - b) Occur particularly those that produce woody axis and appear later than primary meristem
 - c) Fascicular vascular cambium, interfascicular cambium and cork-cambium are lateral meristems
 - d) Lateral meristems are responsible for producing the secondary tissues.

Options:

- 1) (a) (b) ,(c) and (d) 2) (a) ,(b) and (d) 3) (b) (c) and (d) 4) (a), (b) and (c)
7. Sequence of tissues from tip to backwards in shoot apex
- 1) Meristematic zone, Leaf primordium, , Axillary bud, Differentiating vascular tissue
 - 2) Leaf primordium, Meristematic zone, Axillary bud, Differentiating vascular tissue
 - 3) Meristematic zone ,Leaf primordium, Differentiating vascular tissue, Axillary bud
 - 4) Leaf primordium, Meristematic zone, Differentiating vascular tissue, Axillary bud
8. During the formation of the primary plant body, specific regions of the apical meristem produce
- 1) Parenchyma, collenchyma and sclerenchyma.
 - 2) Dermal tissues, ground tissues and vascular tissues.
 - 3) Xylem and phloem.
 - 4) Simple and complex tissues
9. Identify the correct features of permanent tissues
- a. The cells of the permanent tissues do not generally divide further.
 - b. May have cells similar in structure and function
 - c. Structurally and functionally specialized
 - d. May have different types of cells
- 1) (a) (b) ,(c) and (d) 2) (a) ,(b) and (d)
 - 3) (b) (c) and (d) 4) (a), (b) and (c)

10. Which of the following has oval, spherical or polygonal cells with much thickened at the corners due to a deposition of cellulose, hemicellulose and pectin and often contain chloroplasts
- 1) Parenchyma and collenchyma
 - 2) Chlorenchyma
 - 3) Parenchyma and chlorenchyma
 - 4) Collenchyma
11. The sclereids have
- a) spherical, oval or cylindrical
 - b) highly thickened dead cells
 - c) narrow cavities (lumen)
 - d) Walls are deposited with suberin
- 1) (a) and (b) are correct
 - 2) (b) and (c) are correct
 - 3) (a), (b) (c) are correct
 - 4) All are correct
12. Xylem is a complex tissue. Which of the following statement(s) is/are most appropriate explanation for this feature?
- a. Highly thickened dead cells with very narrow cavities (lumen).
 - b. Made of more than one type of cells
 - c. Work together as a unit
 - d. Thick-walled, elongated and pointed cells
- 1) only (a)
 - 2) (a), (c) and (d)
 - 3) (b) and (c)
 - 4) (a) and (d)
13. Xylem Vessel functions as a main conducting tissue for water and minerals from roots to the stem and leaves:
- Select the correct statements from the following statements :
- a. Long cylindrical tube-like structure made up of many cells
 - b. Vessel members, each with lignified walls and a large central cavity.
 - c. Radial conduction of water takes place through vessels
 - d. Vessel members are interconnected through perforations in their common walls.
- Options :
- 1) (a), (c) and (d)
 - 2) (a) (b) and (d)
 - 3) (b), (c) and (d)
 - 4) (a) (b) and (c)
14. Select the correct option from the following statements regarding the phloem elements in Gymnosperms:
- 1) Have albuminous cells and sieve cells, but lack sieve tubes and companion cells.
 - 2) Have sieve tubes and companion cells, but lack albuminous cells and sieve cells
 - 3) Have companion cells and sieve cells , but lack albuminous cells and sieve tube
 - 4) Have sieve cells and sieve tubes, but lack albuminous cells and companion cells

15. Which of the following options best represents the types of tissue systems on the basis of their structure and location?
- 1) Epidermal, ground and vascular
 - 2) Epidermal, ground and fundamental
 - 3) Epidermal, vascular and conducting
 - 4) Fundamental, ground and vascular
16. Which of the following is a wrong statement with respect to stomata in Dicots
- 1) Each stoma is composed of two bean shaped cells known as guard cells which enclose stomatal pore
 - 2) The outer walls of guard cells are highly thickened and the inner are thin
 - 3) The guard cells possess chloroplasts and regulate the opening and closing of stomata
 - 4) Few epidermal cells, in the vicinity of the guard cells become specialised in their shape and size and are known as subsidiary cells
17. Anatomically fairly old dicotyledonous root is distinguished from the monocot root by
- 1) Fewer xylem bundles, large Pith, no secondary growth
 - 2) More xylem bundles, large Pith, no secondary growth
 - 3) Fewer xylem bundles, small Pith, secondary growth
 - 4) More xylem bundles, small Pith, secondary growth
18. Monocotyledonous and dicotyledonous plants differ in
- 1) Type and number of vascular bundles only
 - 2) Type, number and size of vascular bundles
 - 3) Type, number and location of vascular bundles
 - 4) Type, number, size and location of vascular bundles.
19. Characteristic features of an isobilateral leaf
- a. The stomata are present on both the surfaces of the epidermis
 - b. The mesophyll is not differentiated into palisade and spongy parenchyma
 - c. Absence of sclerenchymatous bundle sheath extension
 - d. Similar sized vascular bundles (except in main veins)
- 1) (a), (b) and (c)
 - 2) (a) (c) and (d)
 - 3) (b), (c) and (d)
 - 4) (a) (b) and (d)
20. With reference to activity of the cambial ring, which of the following statements are correct ?
- a. The cambial ring becomes active and begins to cut off new cells, both towards the inner and the outer sides.
 - b. The cells cut off towards periphery mature into secondary xylem and the cells cut off towards pith mature into secondary phloem.
 - c. The cambium is generally more active on the inner side than on the outer..
 - d. The amount of secondary xylem produced is less than secondary phloem
- 1) (a) and (c)
 - 2) (a) (c) and (d)
 - 3) (a), (b) and (c)
 - 4) (a) (b) (c) and (d)

21. There are different types of wood on the basis of
 - 1) Their composition and time of production
 - 2) Size and shape secondary xylem
 - 3) Quantity of secondary phloem
 - 4) Size, shape and quantity of secondary xylem
22. Which of the following statement is correct?
 - 1) The wood formed during spring season is called late wood
 - 2) The wood formed during winter season is called early wood.
 - 3) The spring wood is lighter in colour and has a lower density
 - 4) In summer, xylary elements have narrow vessels
23. Various kinds of cell layers which constitute the bark
 - 1) Phellogen, phellem ,phelloderm, secondary phloem and vascular cambium
 - 2) Cork , cork cambium, secondary cortex, secondary phloem and secondary xylem
 - 3) Phellogen, phellem ,phelloderm, secondary phloem, vascular cambium and primary cortex
 - 4) Cork , cork cambium, secondary cortex and secondary phloem
24. Which of the following options best represents the features of lenticel
 - a. Phellogen cuts off closely arranged parenchymatous cells on the outer side instead of cork cells
 - b. Rupture the epidermis, forming a lens shaped openings
 - c. Permit the exchange of gases between the outer atmosphere and the internal tissue of the stem
 - d. Not found in the roots of woody trees
 - 1) All except a
 - 2) All except b
 - 3) All except d
 - 4) All are correct
25. In the dicot root, the vascular cambium originates from
 - 1) Above the phloem bundles, a portion of pericycle tissue below the protoxylem
 - 2) Above the phloem bundles, a portion of pericycle tissue above the protoxylem
 - 3) Below the phloem bundles, a portion of pericycle tissue below the protoxylem
 - 4) Below the phloem bundles, a portion of pericycle tissue above the protoxylem

CHAPTER - 03

CELL THE UNIT OF LIFE

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

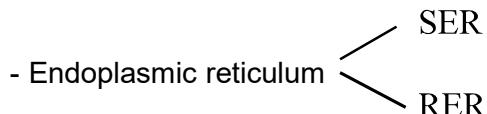
It consists of the following parts.

- ◆ Cell envelop - 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



- 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. 80 s ribosomes

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 made up of microtubules
- Consist of an axoneme which is covered by plasma membrane

9. Centrosome and centrioles

- It has 9 + 0 (cart wheel) arrangement

10. Nucleus - Largest extracytoplasmic organelle.

- It has a nuclear membrane, nucleoplasm and nuclear lamina
- Chromatin
- Nucleosome formation
- Nucleolus

Chromosome - types

- Metacentric
- submetacentric
- Acrocentric
- Telocentric

QUESTIONS**LEVEL - I**

1. Who discovered the living cell :
 1) Robert Brown 2) Robert Hooke 3) Schleiden 4) Anton Von Leeuwenhoek
2. Consider the following statements and select the correct option :
Statement I : Unicellular organisms are capable of independent existence and performing the essential functions of life.
Statement II : Anything less than a complete structure of a cell does not ensure independent living
 1) Only statement I is true 2) Only statement II is true
 3) Both the statements are false 4) Both the statements are true
3. Cell theory was proposed by :
 1) Matthias Schleiden and Theodore Schwann 2) Rudolf Virchow and Robert Brown
 3) Leeuwenhoek and Schwann 4) Schleiden and Leeuwenhoek
4. Modified cell theory was proposed in :
 1) 1838 2) 1839 3) 1855 4) 1954
5. Presence of cell wall as a unique feature of plant cell was identified by :
 1) Leeuwenhoek 2) Schleiden 3) Schwann 4) Virchow
6. Consider the following statements and select the correct option :
Statement I : The cytoplasm is the main arena of cellular activities in both the plants and animal cells.
Statement II : Various chemical reactions occur in cytoplasm to keep the cell in the living state.
 1) Statement I is false 2) Statement II is false
 3) Both the statements are true 4) Both the statements are false
7. Identify the length of Mycoplasma and bacteria respectively :
 1) 0.1 μm & 1-2 μm 2) 0.3 μm & 3-5 μm 3) 0.02 μm & 0.2 μm 4) 0.2 μm & 10-20 μm
8. Find the matching column A with column B

I. RBC	A) Smallest cell
II. WBC	B) Largest isolated single cell
III. Nerve cell	C) Amoeboid
IV. Mycoplasma	D) Round and biconcave about 7 μm in diameter
V. Egg of Ostrich	E) Longest human cell

$$1) \begin{array}{ccccc} \text{I} & \text{II} & \text{III} & \text{IV} & \text{V} \\ \hline (\text{E}) & (\text{D}) & (\text{C}) & (\text{A}) & (\text{B}) \end{array}$$

$$2) \begin{array}{ccccc} \text{I} & \text{II} & \text{III} & \text{IV} & \text{V} \\ \hline (\text{D}) & (\text{E}) & (\text{C}) & (\text{A}) & (\text{B}) \end{array}$$

$$3) \begin{array}{ccccc} \text{I} & \text{II} & \text{III} & \text{IV} & \text{V} \\ \hline (\text{E}) & (\text{C}) & (\text{B}) & (\text{A}) & (\text{D}) \end{array}$$

$$4) \begin{array}{ccccc} \text{I} & \text{II} & \text{III} & \text{IV} & \text{V} \\ \hline (\text{D}) & (\text{C}) & (\text{E}) & (\text{A}) & (\text{B}) \end{array}$$

9. How many of the following statements are false :
- A) Cells differ greatly in size, shape and activities
 - B) The shape of the cell may vary with the function they perform
 - C) Compartmentalisation present in both prokaryotic and eukaryotic cells
 - D) In both prokaryotic and eukaryotic cells, a semifluid matrix called cytoplasm occupies the volume of the cell.
- 1) One 2) Two 3) Three 4) Four
10. Which of the following is correct?
- 1) Cells of all living organisms have a nucleus
 - 2) Both animal and plant cells have a well defined cell wall
 - 3) In prokaryotes, there are no membrane bound organelles
 - 4) Cells are formed de novo from abiotic materials
11. Which of the following is true regarding plasmids :
- A) Extrachromosomal circular double stranded DNA
 - B) Plasmid DNA is used to monitor bacterial transformation with foreign DNA
 - C) Plasmid DNA contains genes that responsible for resistance to antibiotics
 - D) Plasmids are present in both prokaryotic and eukaryotic cells
- 1) All except C 2) All except D 3) Only A 4) Only B
12. Plasmamembrane of bacteria is :
- 1) Semipermeable 2) Selectively permeable
 - 3) Differentially permeable 4) Both 2 & 3
13. How many of the following statements are true regarding prokaryotic cell :
- I. Mesosomes are functional analogous to Mitochondria.
 - II. Presence of a self replicating linear DNA in the cytoplasm
 - III. Presence of 70s type of ribosome
 - IV. Flagella, pili and fimbriae are locomotory structures
 - V. The ribosomes of a polysome translate the mRNA in to proteins
- 1) One 2) Two
3) Three 4) Four
14. Which of the following is/are correct regarding inclusion body :
- A) Glycogen granules B) Phosphate granules
 - C) Gas vacuoles D) Cyanophycean granules
 - E) Present only in prokaryotes F) Non-membranous
- 1) A only 2) B only 3) C & D only 4) A, B, C, D, E, F

15. Tonoplast is :
- 1) Semipermeable membrane surrounding sap vacuole
 - 2) Selectively permeable membrane surrounding contractile vacuole
 - 3) Selectively permeable membrane surrounding sap vacuole
 - 4) Semipermeable membrane surrounding contractile vacuole
16. Identify the percentage of lipids and proteins in the plasmamembrane of human RBC :
- | | |
|--------------------------------|--------------------------------|
| 1) 52% proteins and 40% lipids | 2) 42% lipids and 50% proteins |
| 3) 40% proteins and 52% lipids | 4) 30% lipids and 70% proteins |
17. Which of the following organells found inside the another organelles :
- | | |
|--------------------|-----------------|
| 1) Lysosomes | 2) Ribosomes |
| 3) Golgi apparatus | 4) Mitochondria |
18. The important site for formation of glycoproteins and glycolipids is :
- | | |
|--------------------------|----------------|
| 1) Endoplasmic reticulum | 2) Vacuole |
| 3) Golgi apparatus | 4) Chloroplast |
19. Match the following :
- | Column I | Column II |
|-----------------|---|
| A) Cristae | I. Flat membranous sac in stroma |
| B) Cisternae | II. Infoldings in mitochondria |
| C) Thylakoids | III. Found in centriole |
| D) Hub | IV. Disc-shaped sacs in golgi apparatus |
- 1) A B C D 2) A B C D 3) A B C D 4) A B C D
 III I IV II IV I III IV II I IV III II IV I III
20. Which of the following statement is false :
- 1) ATP synthase complex present only in mitochondria
 - 2) Both mitochondria and chloroplast exhibit endosymbiotic origin by bacteria
 - 3) Chloroplast possess triple membrane system
 - 4) All the above
21. Which one of the following statement regarding mitochondria is not correct?
- 1) Porin proteins are seen on outer membrane
 - 2) Oxsomes are seen on inner membrane
 - 3) The number of mitochondria per cell is variable depending on the physiological activity of the cell
 - 4) Only inner membrane has specific enzymes associated with mitochondrial functions
22. Cytoskeletons are involved in :
- | | |
|-----------------------|---|
| 1) Mechanical support | 2) Maintenance of the shape of the cell |
| 3) Motility | 4) All the above |

23. Cart wheel structure is the characteristics of :
- A) Centrioles
 - B) Axoneme of eukaryotic cilia
 - C) Basal body of eukaryotic cilia
 - D) Basal body of prokaryotic flagella
- 1) A only 2) A & B 3) A & C 4) A, B, C, D
24. The arm ratio in a metacentric chromosome is :
- 1) 1 : 1 2) 1 : 2 3) 1 : 3 4) 2 : 3
25. How many of the following structures possess two unit membranes, single membrane and non-membrane respectively :
(Cisternae, Golgibodies, Lysosomes, Centrioles, Nucleus, Plastids, Ribosome, Nucleolus, Mitochondria)
- 1) 3 : 4 : 2 2) 4 : 3 : 2 3) 2 : 4 : 3 4) 3 : 3 : 3

LEVEL II

1. Consider the following statements :
- I. Glycocalyx, the outermost membranous structure of bacterial cell which is either thick or thin that provide protection.
 - II. Pili is a long tubular structure formed in between the adjacent bacteria during conjugation
 - III. Pili is made up of pilin, a protein
 - IV. Chromatophore is present only in photosynthetic prokaryotes where light harvesting pigments are arranged
- Of the above statements ;
- 1) Only I is true 2) II is false
- 3) All statements are false 4) All statements are true
2. Consider the following statements regarding mesosome :
- A) Formed by the extensions of plasma membrane in the form of vesicles, lamellar and tubules
 - B) Helps to increase surface area of cell
 - C) secrete enzymes
 - D) Involved in DNA replication, cell wall formation and respiration
- 1) All statements are true 2) All statements are false
- 3) All except B are true 4) All except C are false
3. Which of the following statement is/are true regarding middle lamella :
- A) Ca and Mg pectates are present in equal amount
 - B) Ca is more prominent
 - C) Mg is more prominent
 - D) Found in between the primary wall of adjacent cells
- 1) A & D 2) B & D 3) C & D 4) B only

4. Consider the following statements regarding plant cell wall :
- A) The primary wall is capable of growth, which diminishes as the cell matures
 - B) Cell wall is a living rigid structure
 - C) Galactans and Mannans are restricted to algal cell wall
 - D) Calcium carbonate is present in the cell wall of all plant cells
 - E) Plant cell wall possess cellulose, hemicellulose, pectin and proteins
 - F) Secondary wall provide mechanical support to the cell
- Of the above statements :
- 1) A, C, D are true
 - 2) B, C, D are false
 - 3) B & D are false
 - 4) All except F are true
5. Which of the following statements are false regarding plasma membrane :
- A) Lipids are arranged within cell membrane with the hydrophobic tail towards the inner part and polar head towards the outerside. This ensure that the non-polar tail of saturated hydrocarbons is protected from aqueous environment
 - B) The ratio of protein and lipids are same in all biological membrane
 - C) Integral proteins are partially or totally buried in the membrane
 - D) Neutral solutes move across the membrane with the expenditure of energy
- 1) A & B
 - 2) A & C
 - 3) C & D
 - 4) B & D
6. Keeping in view the ‘fluid mosaic model’ for the structure of cell membrane, which one of the following statement is correct with respect to the movement of lipids and proteins from one lipid monolayer to the other :
- 1) While proteins can flip-flap, lipids cannot
 - 2) While lipids can rarely flip-flop, proteins cannot
 - 3) Both lipids and proteins can flip flop
 - 4) Neither lipids nor proteins can flip flop
7. Which of the following statements are false regarding endoplasmic reticulum :
- 1) Endoplasmic reticulum divides the intracellular space into two distinct compartments
 - 2) SER is continuous with RER
 - 3) RER consists of cisternae and tubules
 - 4) SER is extensive and continuous with the outer membrane of nucleus
8. Which of the following is false regarding Golgi complex :
- 1) Pleiomorphic organelle
 - 2) It plays a major role in post translational modifications of proteins
 - 3) Involved in protein synthesis
 - 4) Produce primary lysosomes

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

Statement I : During cell death, all the lysosomes in a cell breaks open and release enzymes which digest the whole cell.

Statement II : Lysosomes are commonly known as suicidal bags in the cell

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

10. Which of the following statements are true regarding mitochondria :

- A) Replicate by fission
 - B) Matrix possess enzymes of krebs cycle and protein synthesis
 - C) ATP factory in both prokaryotic and eukaryotic cell
 - D) Possess circular dsDNA and 70s type of ribosomes
- 1) All statements are true
 - 2) Only C
 - 3) A, B & D
 - 4) All except B

11. Identify the double membrane bound organelle having 70s type of ribosome present in all eukaryotes :

- 1) Chloroplast
- 2) Mitochondria
- 3) RER
- 4) Both 1 & 2

12. Consider the following statements :

Statement I : Mitochondria are essential for aerobic respiration in all organisms.

Statement II : Wherever aerobic respiration occur, there is abundance of mitochondria

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

13. Identify the correct sequence regarding the origin of plastids in a plant cell :

- 1) Leucoplast → Chromoplast → Chloroplast
- 2) Chloroplast → Chromoplast → Leucoplast
- 3) Chromoplast → Leucoplast → Chloroplast
- 4) Leucoplast → Chloroplast → Chromoplast

14. Identify the similarities between Mitochondria and chloroplast :

I. Semiautonomous and endosymbiont

II. Enveloped by two unit membranes

III. Possess circular dsDNA and 70s ribosomes

- 1) I only
- 2) III only
- 3) II only
- 4) I, II & III

15. Find the matching series :

A)	Ribosome	Geroge Palade	1953
B)	Golgi apparatus	Camillo golgi	1988
C)	Fluid Mosaic Model of Plasma membrane	Singer & Nicolson	1971
D)	Nucleus	Robert Brown	1831

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

16. Identify the number of microtubules in the basal body of eukaryotic flagella and centrosome of animal cell respectively :

- 1) 27 & 54 2) 20 & 27 3) 20 & 54 4) 9 & 27

17. Consider the following statements ;

- I. Plant cells can make spindle fibres eventhough they do not have centrosome
- II. With regards to eukaryotes, cilia and flagella emerge from centriole like structures called basal bodies
- III. Centrosome present in all eukaryotic cell
- IV. Cross section of a eukaryotic cilia shows nine peripheral doublets, two central singlets, nine radial spokes and one central sheath.

Of the above statements ;

- 1) I & III are false 2) All except III are true
 3) Only IV is true 4) All statements are false

18. Identify the arrangement of microtubules in the centriole and axoneme region of cilia respectively :

- 1) 9 + 2 and 9 + 0 2) 9 + 0 and 9 + 2 3) 9 + 1 and 9 + 0 4) 9 + 0 and 9 + 1

19. Which of the following statement is true :

- I. The interphase nucleus has highly extended and elaborate nucleoprotein fibres called chromatin
- II. The nuclear matrix called karyolymph / Nucleoplasm, that contains nucleotides, enzymes, RNA etc.
- III. Larger and more numerous nucleoli are present in cells actively carrying out protein synthesis
- IV. Nucleus is the largest structure in the eukaryotic cell

- 1) I & II only 2) All except IV 3) II & III only 4) I, II, III & IV

20. How many of the following statements are true :

- A) Chromosome is a nucleoprotein structure
- B) Every chromosome has a primary constriction but some chromosomes having secondary constriction also
- C) Satellite chromosomes are present in human cell
- D) Kinetochore is a disc shaped protein found on either side of the centromere

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

CHAPTER - 04

CELL CYCLE AND CELL DIVISION

Teaching Points

- ❖ The orderly sequence of events by which duplication and division of cell contents is called cell cycle.
- ❖ Cell cycle consists of
 - i) Interphase (preparatory phase)
 - ii) M phase (phase of division) / Mitotic phase

Interphase is the period of intense biosynthetic activity

Interphase is divided into three stages:-

- i) G₁ phase
 - ii) S phase
 - iii) G₂ phase
- ❖ G₀ phase - Metabolically active but the cells are non-dividing

M phase (Cell division)

Three types of cell division

- i) Amitosis
- ii) Mitosis
- iii) Meiosis

Amitosis :

- ❖ Primitive type
- ❖ Mostly occurs in prokaryotes and protists
- ❖ Intranuclear division

Mitosis/Equational Division:

Involve two main segments:

i) **Karyokinesis : Division of nucleus**

It consists of four stages.

Prophase

Metaphase

Anaphase

Telophase

ii. **Cytokinesis : Division of cytoplasm**

In animals, cytokinesis by cell furrowing method

In plants, it takes place by cell plate formation method

Significance of Mitosis

Meiosis/Reduction Division :

Involve two major stages:

i. **Meiosis I**

It involves karyokinesis and cytokinesis

Karyokinesis consists of four main stage:

- ❖ Prophase - I
- ❖ Metaphase - I
- ❖ Anaphase - I
- ❖ Telophase - I

Prophase-I is sub divided into five stages:

- ❖ Leptotene
- ❖ Zygote
- ❖ Pachytene
- ❖ Diplotene
- ❖ Diakinesis

Cytokinesis I

Interkinesis

ii. **Meiosis -II**

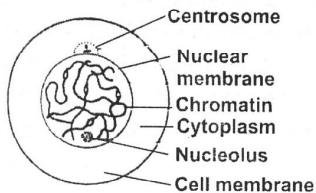
Involves karyokinesis and cytokinesis

Karyokinesis involves 4 stages

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

Cytokinesis II

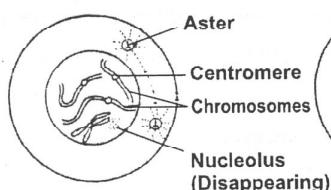
Significance of Meiosis



(i)

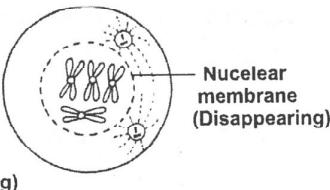
Fig:- Interphase

MITOSIS



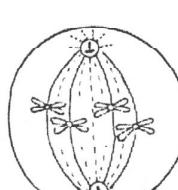
(ii)

Fig:- Early prophase



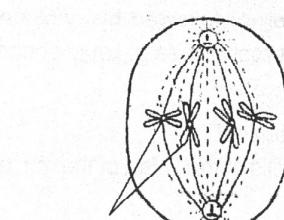
(iii)

Fig:- Middle prophase



(iv)

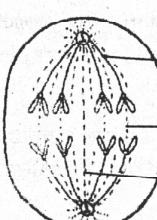
Fig :- Late prophase



Chromosomes in
Equatorial plate

(v)

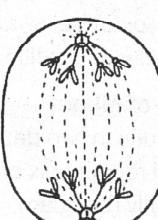
Fig:- Metaphase



Chromosomal fibre
Interzonal Fibre
Continuous Fibre

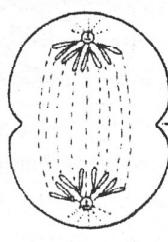
(vi)

Fig:- Early anaphase



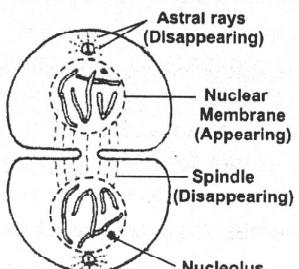
(vii)

Fig:- Late anaphase



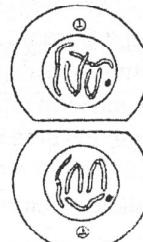
(viii)

Fig:- Early Telophase



(ix)

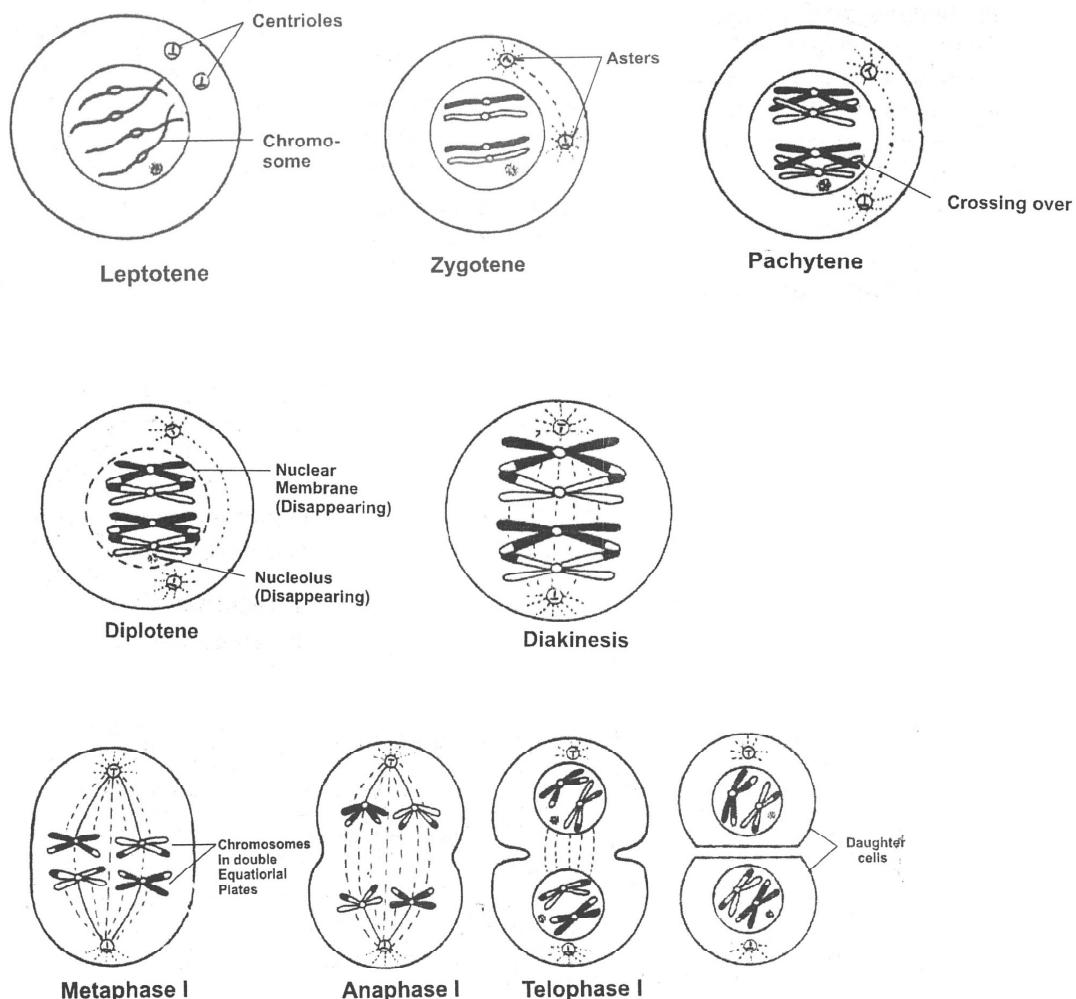
Fig:- Late Telophase



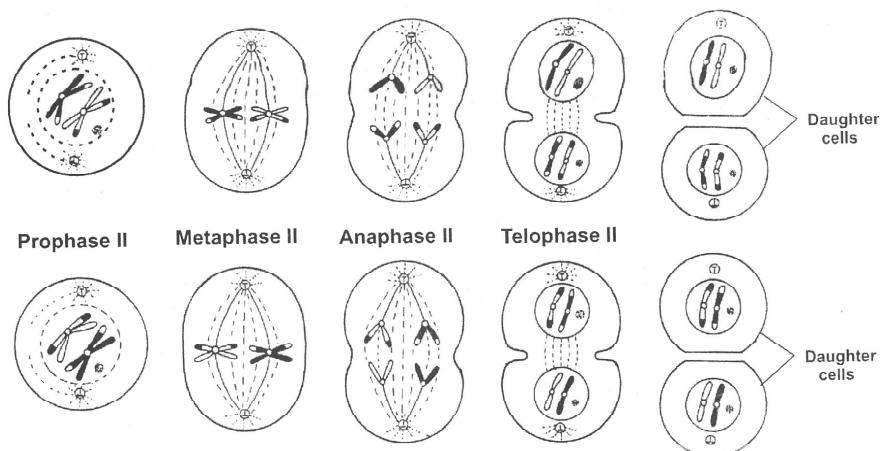
Daughter Cells

(x)

MEIOSIS I



MEIOSIS II

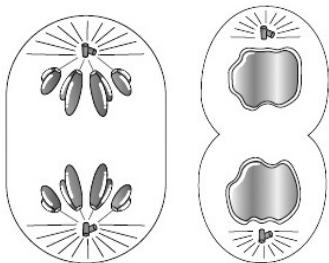


QUESTIONS

LEVEL - I

1. The events of cell cycle includes :
 - a) Duplication of genome
 - b) Synthesis of cell constituents
 - c) Division of duplicated genome
 - d) Division of cytoplasm into two daughter cells
 - 1) a and d only
 - 2) b and c only
 - 3) a, b and c only
 - 4) a, b, c, d
 2. Identify the correct statements :
 - A) During cell division, cytoplasmic increase occurs continuously
 - B) In a cell cycle DNA synthesis occurs only during one specific stage
 - C) The events of cell cycle are under genetic control
 - D) When cell division starts there is no change in the rate of metabolism
 - 1) All the statements are correct
 - 2) Only A and B correct
 - 3) Only A and D correct
 - 4) Only B and C correct
 3. The interval between mitosis and initiation of DNA replication is :
 - 1) Interphase
 - 2) G₁ phase
 - 3) S phase
 - 4) G₂ phase
 4. The diploid number of chromosomes of a cell is 24. If so the number of chromosome at G₁ and S phase are respectively :
 - 1) 24 and 48
 - 2) 12 and 24
 - 3) 12 and 48
 - 4) 24 and 24
 5. In animal cells duplication of centriole takes place at :
 - 1) G₁ phase
 - 2) S phase
 - 3) G₂ phase
 - 4) Prophase
 6. In mitotic division condensation of chromosomal material is completed in :
 - 1) Prophase
 - 2) Metaphase
 - 3) Anaphase
 - 4) Telophase
 7. Prophase is marked by :
 - 1) Alignment of chromosomes at the equatorial plate
 - 2) Terminalisation of chiasmata
 - 3) Initiation of condensation of chromosomal material
 - 4) Chromatids move to opposite poles
 8. Which of the following events are correct regarding metaphase of mitosis :
 - a) Condensation of chromatin material starts
 - b) Chromatid separate and move towards opposite poles
 - c) Chromosomes are arranged along the equator
 - d) Pairing of homologous chromosomes and are arranged along the metaphase plate
 - e) Two daughter nuclei are found in a cell
 - 1) c and d
 - 2) c only
 - 3) b, c and e
 - 4) All are correct

9. Identify the stages :



- 1) Anaphase - Telophase
 - 2) Anaphase - Metaphase
 - 3) Late prophase - Late anaphase
 - 4) Prophase - Anaphase
10. Arrangement of chromosome on equatorial line and the splitting of chromosomes takes place respectively in :
- 1) Metaphase and Anaphase
 - 2) Prophase and Telophase
 - 3) Metaphase and Telophase
 - 4) Anaphase and cytokinesis
11. Which of the following event takes place during anaphase stage of mitosis :
- I. Spindle fibres attach to kinetochore of chromosomes
 - II. Centromere split and chromatids separate
 - III. Chromatids move towards opposite poles
 - IV. Nucleolus, golgi complex and ER reform
- | | |
|--------------------|--------------------|
| 1) I & II only | 2) II and III only |
| 3) III and IV only | 4) I and IV only |
12. Match the column I with column II :

- Column I**
- A) Condensation
 - B) Congression
 - C) Synapsis
 - D) Disjunction

- Column II**
- 1) Zygote
 - 2) Prophase
 - 3) Metaphase
 - 4) Diplotene
 - 5) Anaphase

1) $\frac{ABCD}{2315}$

2) $\frac{ABCD}{1345}$

3) $\frac{ABCD}{2413}$

4) $\frac{ABCD}{3514}$

13. Arrange the following events of meiosis in the correct sequence :

- A) Terminalisation of chiasmata
- B) Crossing over
- C) Synapsis
- D) Disjunction of chromosomes
- E) Dissolution of synaptonemal complex

The correct sequence is :

- 1) A → B → C → D → E
- 2) E → D → C → B → A
- 3) C → B → D → E → A
- 4) C → B → E → A → D

14. Which of the following sentence is correct :

- 1) Synaptonemal complex is formed during Diplotene
- 2) Exchange of chromosome segments between non-sister chromatids of homologous pair occur during Pachytene stage of Prophase I
- 3) Dissolution of synaptonemal complex and disjunction of Bivalent occur during Anaphase II
- 4) Nuclear membrane and nucleolus reappears to form dikaryon during diakinesis

15. In meiosis :

- 1) Division of nucleus twice but replication of DNA only once
- 2) Division of nucleus twice and replication of DNA twice
- 3) Division of nucleus once and replication of DNA is also once
- 4) Division of nucleus once and DNA - replication is twice

16. Identify the correct statement from the following :

- 1) In meiosis bouquet stage is observed in leptotene stage
- 2) Pairing of homologous chromosome during zygotene stage is called synapsis or bivalent formation
- 3) The appearance of tetrads and crossing over takesplace in pachytene
- 4) All statements are correct

17. Match the following column I and column II.

Column I

- a) Recombinase enzyme activated
 - b) The genetic nature of gametes determined
 - c) Chiasmata become more visible
 - d) Inhibits the formation of mitotic spindle
- 1) a - 3 ; b - 4 ; c - 2 ; d - 1
 - 3) a - 2 ; b - 4 ; c - 1 ; d - 3

Column II

- 1. Colchicine
 - 2. Pachytene
 - 3. Diplotene
 - 4. Meiosis II
- 2) a - 2 ; b - 4 ; c - 3 ; d - 1
 - 4) a - 4 ; b - 2 ; c - 1 ; d - 3

18. The events shown below occur during different phases and identify the correct option.
- A) Bivalent disjunction
 - B) Dissolution of synaptonemal complex
 - C) Longitudinal splitting of chromosome and appears as sister chromatid
 - D) Two daughter nuclei with half amount of DNA in each chromosome
- 1) A - Diplotene, B - Pachytene, C - Prophase, D - Telophase
 - 2) A - Anaphase I, B - Diplotene, C - Anaphase, D - Telophase I
 - 3) A - Anaphase I, B - Diplotene, C - Prophase, D - Telophase II
 - 4) A - Anaphase, B - Pachytene, C - Anaphase, D - Telophase I
19. How do the cells at the completion of meiosis compared with the diploid cells from which they were derived?
- 1) They have twice the amount of cytoplasm and half the amount of DNA
 - 2) They have half the number of chromosomes and half the amount of DNA
 - 3) They have same number of chromosomes and half the amount of DNA
 - 4) They have the same number of chromosomes and same amount of DNA
20. A tetrad formed during meiosis I consists of :
- 1) Two chromatids and two centromere
 - 2) Two chromatids and one centromere
 - 3) Four chromatids and four centromere
 - 4) Four chromatids and two centromere

LEVEL II

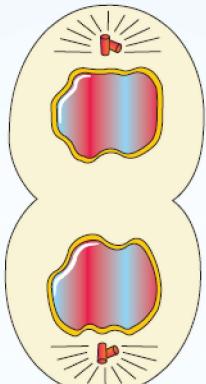
1. Which of the following statements are true regarding interphase :
- I. G_1 is the most variable phase and it controls the entire pace of the cell cycle.
 - II. DNA replication and centrosome duplication occurs in S phase
 - III. In G_2 stage DNA content is double the amount than that of G_1
 - IV. Interphase last for more than 95% of the duration of cell cycle
 - V. Period of intense biosynthetic activity
- 1) I only 2) II only 3) III only 4) All
2. Which of the following statement is/are false regarding mitosis
- i) Mitosis takes place in both diploid and haploid cells
 - ii) occur in somatic / vegetative and reproductive cells
 - iii) Two daughter cells are formed during mitosis, which are similar to their parental cell - equational division.
 - iv) It was first reported by Strasberger
- 1) i and ii only 2) ii only 3) ii and iii only 4) Nil

3. Which of the following is false regarding prophase :
- I. Longest phase in karyokinesis
 - II. Centriole moves towards opposite poles
 - III. Initiation of chromosome condensation
 - IV. Chromosomal material become untangled
 - V. Metabolism of cell increases
 - VI. Nucleolus and Nuclear membrane disintegrates
- 1) II and V 2) II, IV and V 3) I, II, IV and V 4) Only V
4. Which of the following options gives the correct sequence of events during mitosis :
- Condensation → Nuclear membrane disassembly → arrangement at equator → centromere division → segregation → Telophase
 - Condensation → Crossing over → arrangement at equator → segregation → Telophase
 - Condensation → Nuclear membrane disassembly → crossing over → segregation → Telophase
 - Condensation → arrangement at equator → bivalent disjunction → segregation → telophase
5. The events shown below occur during different phases :
- Centromere splits, chromatids separate and move to opposite poles, chromatids are now called chromosome
 - Chromosomes cluster at opposite poles, decondensation of chromosome, reappearance of nuclear membrane, Golgi bodies and ER
 - Chromosomal replication
 - Condensation of chromosome complete, kinetochores attach to spindle fibres and chromosome are arranged at equatorial plate
 - Condensation of chromosomal materials
- Which of the following correctly identifies each of the phases described.

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

6. APC (Anaphase promoting complex) become inactivated. Then what happened in cell cycle?
- Spindle fibre formation inhibited
 - Splitting of chromosome blocked
 - No metaphasic plate formation
 - Cytokinesis blocked

7. A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics



1) Late anaphase	chromosomes move away from equatorial plate, golgi complex not present
2) Cytokinesis	Cell plate formed, mitochondria distributed between two daughter cells
3) Telophase	Endoplasmic reticulum and nucleolus not reformed yet
4) Telophase	Nuclear envelop reforms, golgi complex reforms

8. Identify the correct statement?
- 1) In animal cells cytokinesis occurs by cell furrowing method and is centrifugal type
 - 2) Karyokinesis without cytokinesis leads to polyploid condition
 - 3) DNA replication several times without nuclear division leads to syncitium
 - 4) Two events restore the normal number of chromosome in the life cycle of sexually reproducing organisms are meiosis and fertilization.
9. Observe the following chromosome and identify the number of centromere, chromatids and kinetochore:



	Number of centromeres	Number of kinetochores	Number of chromatids
1)	One	One	Two
2)	One	Two	Four
3)	One	Two	Two
4)	Two	Two	Two

10. Among the following identify the significance of mitosis
- | | |
|--|--|
| a) Leads to growth | b) Maintains nucleo-cytoplasmic ratio |
| c) Involved in cell repair mechanism | d) Involved in asexual reproduction and multicellularity |
| e) Involved in regeneration and cell differentiation | |
- 1) c only 2) c and d only 3) d only 4) All

11. Match the following correctly :

- | | |
|---------------------------------|---------------------------------|
| a) Mitosis | 1. Farmer and Moore |
| b) Meiosis | 2. Fleming |
| c) Amitosis | 3. Moses |
| d) Synaptonemal complex | 4. Remak |
| 1) a - 2 ; b - 1; c - 4 ; d - 3 | 2) a - 1 ; b - 2; c - 4 ; d - 3 |
| 3) a - 4 ; b - 1; c - 3 ; d - 2 | 4) a - 3 ; b - 2; c - 4 ; d - 1 |

12. In proterminal synapsis

- 1) Pairing begins at the end of chromatid and proceeds towards the centromere
- 2) Pairing begins at the centromere and proceeds towards the end of chromatids
- 3) Pairing occurs at any part of the chromatids
- 4) Pairing occurs only in centromere

13. Find the mis-matching pair :

- | | |
|------------------------------|---------------------------------------|
| a) Congression of chromosome | - Metaphase I |
| b) Tetrad chromosome | - Two centromeres and four chromatids |
| c) Recombinase enzyme | - Endonuclease + Ligase |
| d) Centric mitosis | - All plants |
| e) Acentric mitosis | - All animals |
- 1) a, c, d 2) a, c, d, e 3) b, c, d, e 4) d and e

14. At the metaphase plate during metaphase II of meiosis, there are :

- 1) Chromosomes consisting of one chromatid
- 2) Unpaired duplicated chromosomes
- 3) Bivalents
- 4) Homologous pair of chromosomes

15. Consider the following statements :

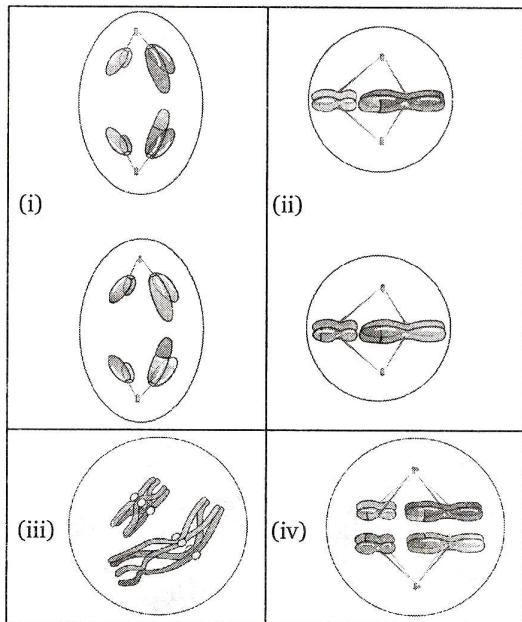
- I. In meiosis, division of nucleus takes place twice but division of chromosomes occurs only once
 - II. Meiosis II is a homotypic division
 - III. Division of centromeres occurs in both Meiosis I and Meiosis II
 - IV. All the four daughter cells produced by meiosis are genetically different from each other
- Of the above statements :

- 1) I and II are true but III and IV are false
- 2) I and IV are true but II and III are false
- 3) All except III are true
- 4) All statements are false

16. Name the stage of cell cycle at which one of the following events occur :

- (i) Chromosomes are moved to spindle equator
 - (ii) Centromere splits and chromatids separate
 - (iii) Pairing between homologous chromosomes takes place
 - (iv) Crossing over between homologous chromosomes takes place
- 1) (i) - Metaphase I ; (ii) - Anaphase II ; (iii) - Pachytene ; (iv) - Diplotene
 - 2) (i) - Metaphase ; (ii) - Anaphase II ; (iii) - Metaphase I ; (iv) - Pachytene
 - 3) (i) - Metaphase II ; (ii) - Anaphase II ; (iii) - Zygote ; (iv) - Diplotene
 - 4) (i) - Metaphase ; (ii) - Anaphase ; (iii) - Zygote ; (iv) - Pachytene

17. Arrange the different stages of meiosis (i), (ii), (iii) and (iv) in sequence:



- 1) (i) → (iv) → (ii) → (iii)
- 2) (iii) → (iv) → (ii) → (i)
- 3) (iv) → (iii) → (ii) → (i)
- 4) (ii) → (i) → (iii) → (iv)

18. Meiosis in diploid organisms results in:

- 1) Production of gametes
- 2) Reduction in the number of chromosomes
- 3) Introduction of variation
- 4) All of the above

19. Meiosis I is a heterotypic division because :

- 1) Longitudinal splitting of condensed chromosomes
- 2) Bivalents move towards the poles
- 3) Daughter nuclei are formed which have half number of chromosomes than their parental cell
- 4) Four daughter nuclei are formed

20. Consider a diploid cell having 200 chromosomes. What will be the number of chromosomes and chromatids in metaphase of mitosis and metaphase I of meiosis.

- 1) 200, 400
- 2) 200, 200
- 3) 400, 400
- 4) 200, 800

CHAPTER -05

TRANSPORT IN PLANTS

TEACHING POINTS

Plant physiology: The study of biological / life activities of plants

Direction of transport

- Unidirectional transport : Transport of water and minerals
- Multidirectional transport : Transport of photosynthates (organic compounds).
- Short distance transport : Within the cells / between adjacent cells
- Long distance transport : Bulk/mass movement over long distance.

Means of transport (Concepts, types, factors, importance)

Short distance transport

- Diffusion
- Facilitated Diffusion • Uniports, symports and antiports
- Active transport

Plant water relations

- Water potential (ψ_w)
- Solute potential (ψ_s)
- Pressure potential (ψ_p)
- Membrane permeability :
- Types of solutions:
- Osmosis
 - Osmotic pressure (π)
 - Types of osmosis
 - Demonstration of osmosis : Thistle funnel experiment
- Turgor pressure (TP)
- Wall pressure (WP)
- Plasmolysis - Concepts and significance
- Imbibition - Concepts and significance

LONG DISTANCE TRANSPORT OF WATER

Translocation : Bulk/ mass movement of substance over long distance through vascular tissues.

1. Xylem transport
 2. Phloem transport
- Absorption of Water by Plants
 - Apoplast pathway
 - Symplast pathway
 - **Ascent of sap**
 - Mechanism of ascent of sap
 1. Root pressure concept
 2. Cohesion tension / transpiration pull model
 - Cohesion, Adhesion, Surface Tension, Capillarity and Tensile strength

TRANSPERSION

- Process
- Types of transpiration
- Factors affecting transpiration rate
- Structure of stomata
- Stomatal opening and closing
- Significance of Transpiration
- Transpiration & Photosynthesis – comparison

UPTAKE AND TRANSPORT OF MINERAL NUTRIENTS

- Uptake of mineral ions
- Translocation of mineral ions

PHLOEM TRANSPORT: FLOW FROM SOURCE TO SINK

- The Pressure Flow (Mass Flow) Hypothesis
- **Girdling experiment to demonstrate translocation**

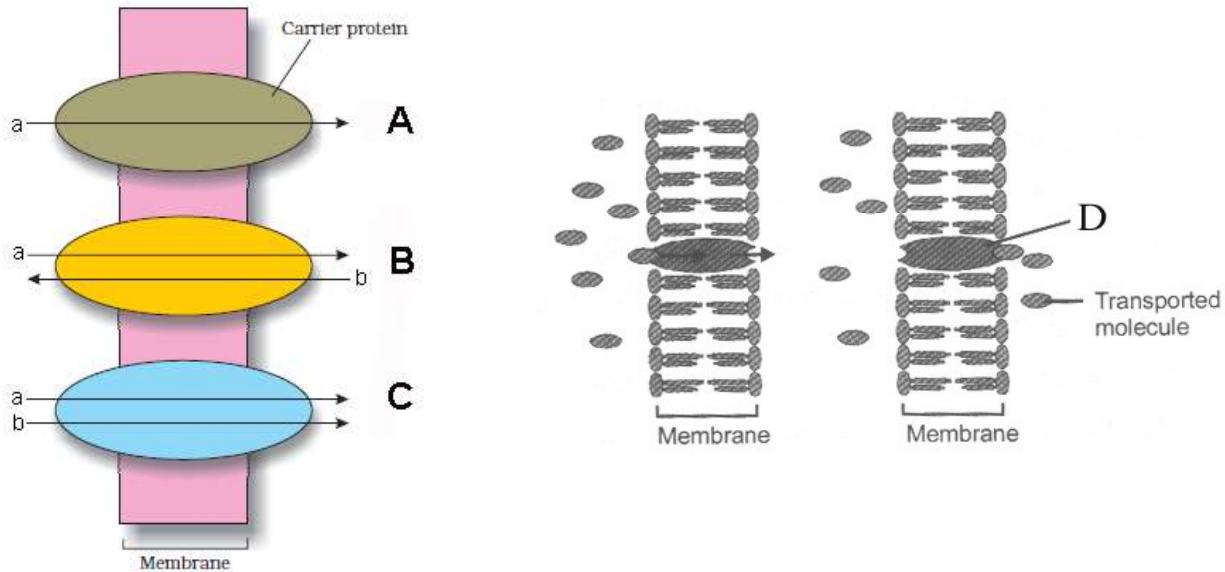
QUESTIONS

LEVEL - I

1. Diffusion may be :
 - 1) with in the cell
 - 2) between the cell
 - 3) outside the cell
 - 4) all of the above

2. Read the following and find out the incorrect statement.
 - 1) Diffusion is the movement of substances (Gas, Liquid, Solid) from their higher concentration to low concentration area
 - 2) Facilitated diffusion is an active process through a carrier protein
 - 3) Rate of diffusion is maximum in gas, then in liquids and minimum in solids.
 - 4) Both facilitated diffusion and active transport are carried out by special membrane proteins

3. Given below is the diagrammatic sketch of facilitated diffusion. Identify A, B, C and D and select the right option about them



A

B

C

D

- | | | | |
|-------------|----------|----------|-----------------|
| 1) Symport | Uniport | Antiport | Carrier protein |
| 2) Antiport | Symport | Uniport | Carrier protein |
| 3) Uniport | Symport | Antiport | Carrier protein |
| 4) Uniport | Antiport | Symport | Carrier protein |

4. Given below is a table shows a comparison of different transport mechanism. Select the wrong option about them

	Property	Simple diffusion	Facilitated Transport	Active Transport
A)	Requires special membrane proteins	No	Yes	Yes
B)	Highly Selective	No	Yes	Yes
C)	Uphill transport	No	No	Yes
D)	Requires ATP energy	Yes	No	No
E)	Transport saturates	No	Yes	Yes

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

5. Which one is correct.

- 1) $\psi_w = \psi_s - \psi_p$ 2) $\psi_w = OP + TP$
 3) $\psi_s = \psi_p + \psi_w$ 4) $\psi_w = \psi_s + \psi_p$

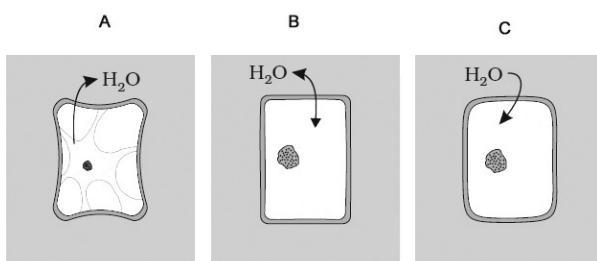
6. If the external solution balances the osmotic pressure of the cytoplasm it is said to be a. If the external solution is more concentrated, it is b and if the external solution is more dilute it is c.

- 1) a - isotonic, b - hypertonic, c - hypotonic
 2) a - isotonic, b - hypotonic, c - hypertonic
 3) a - hypertonic, b - hypotonic, c - isotonic
 4) a - hypotonic, b - hypertonic, c - isotonic

7. The pressure that is exerted by the plasma membrane or protoplasm to the cell wall due to osmotic diffusion of water inside is known as :

- 1) Turgor pressure 2) Water potential
 3) Pressure potential 4) Both 1 & 3

8. Recognise the figure and find out the correct matching :



- 1) A - flaccid, B - turgid, C - plasmolysed
 2) B - flaccid, C - turgid, A - plasmolysed
 3) C - flaccid, A - turgid, B - plasmolysed
 4) C - flaccid, B - turgid, A - plasmolysed

9. Find the mismatched pair :
- 1) Xylem - Unidirectional 2) Phloem - Multidirectional
3) Ascent of sap - Phloem transport 4) Bulk flow - Passive transport
10. Osmosis is defined as :
- 1) Movement of solvent molecules from their low to high concentration
2) Movement of solute molecules through a semipermeable membrane
3) Diffusion of solvent molecules from high to low concentration through a selectively permeable membrane
4) Movement of substances from high OP to low OP area
11. Which of the following is/are true about imbibition :
- 1) It causes an increase in the volume of imbibant
2) Rate of imbibition is affected by water potential gradient between imbibant and imbibate
3) It is a type of diffusion
4) All of the above
12. Match the following correctly :
- | Column I | Column II |
|------------------|--|
| A) Apoplast | 1) Additional structure for absorption |
| B) Symplast | 2) Intercellular space |
| C) Caspary strip | 3) Cytoplasm and plasmodesmata |
| D) Mycorrhiza | 4) Suberin in root endodermis |
- 1) $\frac{\text{ABCD}}{3214}$ 2) $\frac{\text{ABCD}}{1234}$ 3) $\frac{\text{ABCD}}{3412}$ 4) $\frac{\text{ABCD}}{2341}$
13. Ascent of sap through xylem in plants may due to :
- 1) A positive hydrostatic pressure due to root pressure (like garden hose)
2) A negative hydrostatic pressure due to transpiration (like suction through a straw)
3) Both 1 and 2
4) Diffusion or active transport supplemented by cytoplasmic streaming
14. Match the following correctly :
- | Column I | Column II |
|------------------|---|
| A) Root pressure | 1) Diffusion through stomata |
| B) Capillarity | 2) Movement of water to a small distances |
| C) Ascent of sap | 3) Ability to rise in small tubes |
| D) Transpiration | 4) Upward movement of water |
- 1) $\frac{\text{ABCD}}{3421}$ 2) $\frac{\text{ABCD}}{1234}$ 3) $\frac{\text{ABCD}}{4213}$ 4) $\frac{\text{ABCD}}{2341}$

15. Identify the incorrect statement :

- 1) Most of the mineral element enter the root by active absorption
- 2) The chief sink for mineral element are the growing regions of the plant and storage region
- 3) Elements like N, P, K are readily mobilised in plants
- 4) Calcium is structural component of plant and hence easily remobilised

16. Which statement is wrong about translocation of water through xylem :

- 1) Transpiration pull is the main driving force behind ascent of sap
- 2) Cohesion, adhesion etc. like properties of water molecules makes an unbroken continuous water column in xylem from root to top of plant
- 3) Root pressure pushes the water upto small distances and also involves in maintaining water column
- 4) Transpiration and ascent of sap are active process

17. Which of the following is not the purpose of transpiration

- 1) Supplies water for photosynthesis
- 2) Maintains shape and structure of plants
- 3) Helps in translocation of sugar from source to sink
- 4) Cools leaf surfaces

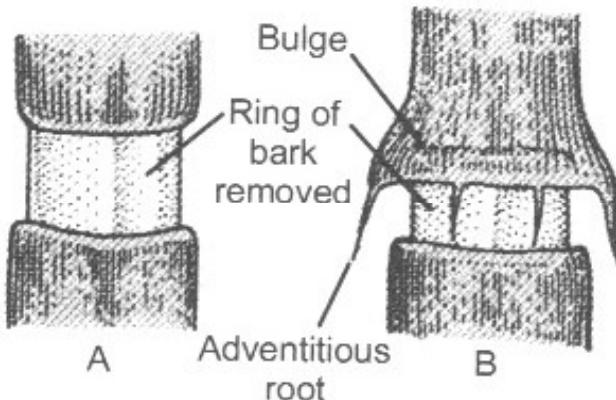
18. Most minerals must enter the cytoplasm of root epidermal cells by active absorption, because:

- 1) Soil minerals are ions
- 2) Concentration of minerals in the soil is usually higher than the concentration of minerals in the root
- 3) Concentration of minerals in the soil is usually lower than the concentration of minerals in the root
- 4) Both 1 & 3

19. Identify the incorrect statement.

- 1) Food translocation occurs through phloem form source to sink
- 2) Sieve tube is the only living component of phloem
- 3) Phloem translocation is generally multidirectional
- 4) Phloem loading and unloading are active process

20. Girdling experiment is usually performed to prove that



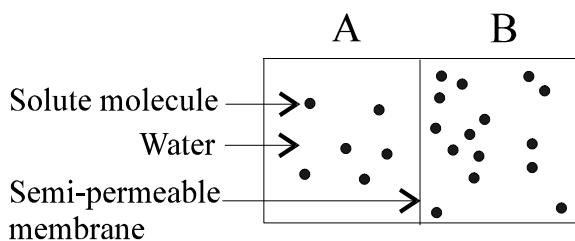
- 1) Xylem is involved in conduction of organic food
- 2) Phloem is involved in conduction of food molecules
- 3) Xylem is involved in conduction of mineral elements only
- 4) Phloem is involved in conduction of mineral elements only

LEVEL II

1. Which of the following is/are affected by rate of simple diffusion :

 - 1) Pressure and temperature
 - 2) Concentration gradient
 - 3) Size of the moving particle
 - 4) All of the above

2. Study the figure and choose the correct statement regarding the data given :



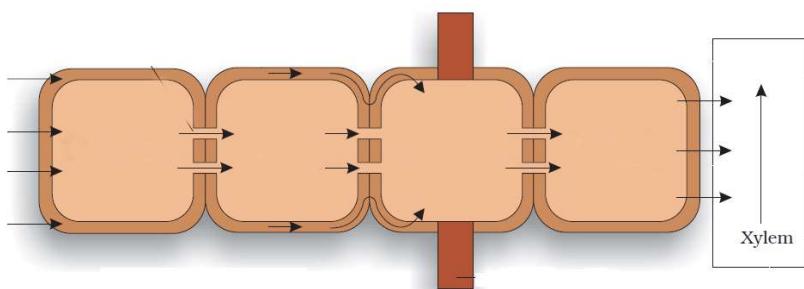
- a) Kinetic energy of water in solution A is greater than solution B.
 - b) Solution A has low ψ_w than solution B
 - c) Solution B has high solute area and the movement of water occur from A → B
 - d) Solution A has low OP than solution B and the movement of water occur from B → A
 - e) In solution B the ψ_s is more negative
- 1) a, c, d and e
 - 2) a, c and e
 - 3) a, c, d and e
 - 4) c, d and e

3. Read the following and find out the incorrect statement :
- 1) The more the solute molecules, the higher is the ψ_s
 - 2) Water will move from high ψ_w to low ψ_w
 - 3) Solute potential is always negative while pressure potential is usually positive
 - 4) If a pressure greater than atmospheric pressure is applied to pure water or a solution, its water potential increases.
4. Cell A and cell B are adjacent plant cells. In cell A $\Psi_s = -18$ bars and $\Psi_p = 5$ bars.
- In cell B $\Psi_s = -12$ bars and $\Psi_p = 2$ bars. Then
- 1) Water moves from cell A to cell B
 - 2) There is no movement of water between cell A and cell B
 - 3) Water moves from cell B to cell A
 - 4) Equal amount of water is simultaneously exchanged between cell A and cell B
5. At normal temperature and pressure water potential and pressure potential of pure water are :
- 1) Zero and zero
 - 2) 100 and zero
 - 3) 100 and 1
 - 4) zero and 100
6. Match the column I with column II and choose the correct option :
- | <u>Column I</u> | <u>Column II</u> |
|-----------------------------------|-------------------------------|
| A) Permeable membrane | 1. Suberised endodermal layer |
| B) Impermeable membrane | 2. Plant cell wall |
| C) Semipermeable membrane | 3. Plasma membrane |
| D) Selectively permeable membrane | 4. Cellophane paper |
- 1) $\frac{ABCD}{1234}$ 2) $\frac{ABCD}{4213}$ 3) $\frac{ABCD}{2143}$ 4) $\frac{ABCD}{3241}$
7. Deplasmolysis can be performed in :
- 1) Isotonic solution
 - 2) Hypertonic solution
 - 3) Hypotonic solution
 - 4) Concentrated sugar solution
8. Select the incorrect statement from the following :
- 1) Osmotic potential value is directly proportional to solute concentration
 - 2) Osmosis helps in maintaining the turgidity and shape of cell
 - 3) Osmosis takes place from low OP to high OP
 - 4) Numerically osmotic pressure is equal to osmotic potential, but opposite in sign

9. In thistle funnel experiment what will happen, if sugar is added to beaker after the stoppage of osmosis:
 - 1) Level of solution in beaker lowers
 - 2) Level of solution in thistle funnel rise up
 - 3) Level of solution in beaker remains same
 - 4) Level of solution in thistle funnel lowers
10. Tradescantia leaf epidermal peel was taken and
 - a) Placed in salt solution for five minutes
 - b) After that it was placed in distilled water

when seen under the microscope what would be observed in 'a' and 'b' respectively :

 - 1) Turgid cell and shranked cell
 - 2) Exosmosis and Deplasmolysis
 - 3) Endosmosis and Exosmosis
 - 4) Imbibition and Plasmolysis
11. The pathway of water from soil upto the xylem is :



- 1) Soil → root hair → cortex → endodermis → pericycle → protoxylem → metaxylem
 - 2) Metaxylem → protoxylem → pericycle → cortex → endodermis → soil → root hair
 - 3) Cortex → root hair → endodermis → pericycle → protoxylem → metaxylem
 - 4) Pericycle → soil → root hair → cortex → endodermis → protoxylem → metaxylem
12. Identify the mis-matched option :
 - 1) Ascent of sap - Upward movement of water through xylem
 - 2) Translocation - Long distance transport of substances through vascular tissue
 - 3) Cohesion : Adhesion - Attraction of water molecules between themselves and between water and xylem elements
 - 4) Root pressure - Pressure developed in surface of root due to transpiration pull
 13. Identify the incorrect statement :
 - 1) Plant absorb water from soil mainly by root hair region, as it increases the surface area for absorption
 - 2) Mycorrhiza is an association of fungus with root system, which enhances the absorption of water and minerals
 - 3) Casparyan strips are suberin thickened endodermal cells of root, that enhances the easy movement of water upto xylem of root
 - 4) Apoplast and symplast are 2 pathways of water movement in plant body

14. Guttation differ from transpiration in that
- Guttation takes place through openings called hydathode which is present in all green parts
 - Guttation removes pure water, but transpiratory water contains solutes
 - Guttation takes place in day time, but transpiration in night
 - Guttation remove water in liquid phase but transpiration removes it in gaseous phase
15. Select the plant factors that affect the rate of transpiration :
- | | |
|---------------------------------------|--------------------------|
| A) Number and distribution of stomata | B) Light |
| C) Wind speed | D) Soil moisture |
| E) Canopy structure | F) Water status of plant |
- A, D and F
 - A, E and F
 - B, C and D
 - All are correct
16. The amount of water loss from C_3 & C_4 plants during the same amount of CO_2 fixation is :
- Low in C_3 and high in C_4
 - Same in both C_3 and C_4 plants
 - Low in C_4 and high in C_3
 - Slightly high in C_4 than C_3
17. The elements which most readily mobilised are
- | | |
|------------------|------------------|
| 1) Potassium | 2) Calcium |
| 3) Phosphorus | 4) Nitrogen |
| 1) 1, 2, 3 and 4 | 2) 2, 3 and 4 |
| 3) 3 and 5 only | 4) 1, 3, 4 and 5 |
18. Select the incorrect events leading to the opening of the stomata
- Decline in guard cell solutes
 - High osmotic pressure of guard cells
 - Rise in potassium levels in guard cells
 - Movement of water from neighboring cells into guard cells
19. Observe the following statements and identify the correct answer :
- Statement A :** Phloem transport is explained by Mass flow hypothesis
- Statement B :** Phloem sap is mainly water, starch, inorganic nutrients, hormones and amino acids
- Statement A is correct and B is wrong
 - Statement A is wrong and B is correct
 - Both statements A and B are correct
 - Both A and B are incorrect
20. Which of the following is a wrong statement regarding the mass flow hypothesis :
- A disaccharide enters sieve tube cells by active transport in leaves
 - Loading of phloem sets up a water potential gradient
 - At the source end water moves from phloem to xylem
 - As hydrostatic pressure in the phloem sieve tube increases, pressure flow begins

CHAPTER -06

MINERAL NUTRITION

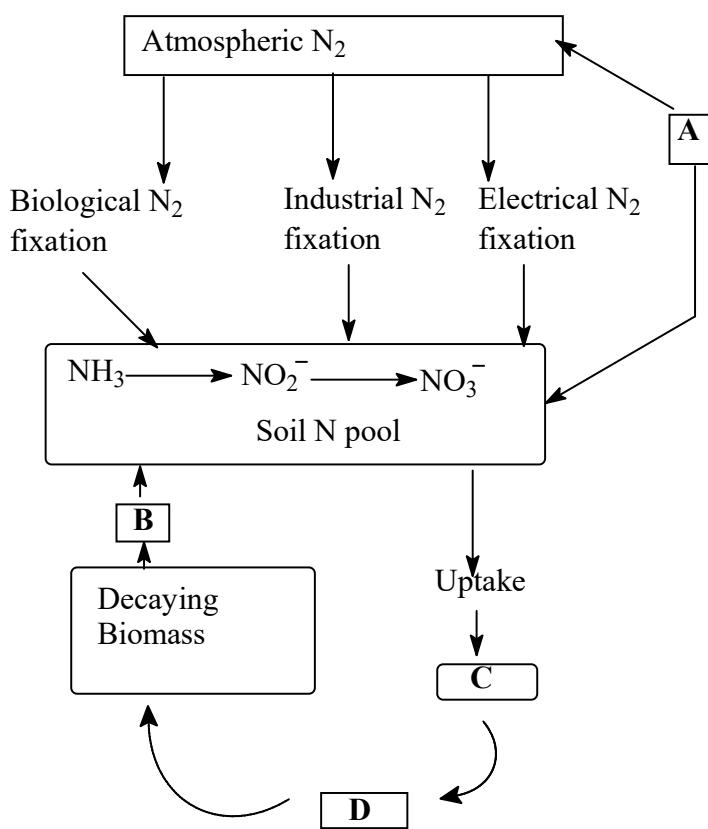
TEACHING POINTS

- ⇒ Method to study the mineral requirement of plants - hydroponics
 - ⇒ Beneficial elements
 - ⇒ Essential elements → Macronutrients and micronutrients or Trace elements
 - ⇒ Criteria for essentiality of mineral elements :
 - ⇒ Classification of Mineral elements
 - 1. Macronutrient and their role
 - 2. Micronutrients and their role
 - ⇒ Critical concentration
 - ⇒ Deficiency symptoms of essential elements
 - ⇒ Toxicity of micronutrients
 - ⇒ Mechanism of Absorption and translocation of elements.
 - Passive
 - Active
 - ⇒ Soil - Reservoir of essential elements
- Metabolism of Nitrogen**
- ⇒ Nitrogen cycle
 - ⇒ Biological nitrogen fixation
 - ⇒ Symbiotic nitrogen fixation
 - ⇒ Nodule formation
 - ⇒ Aminoacid synthesis :
 - Amides
 - Ureides

QUESTIONS**LEVEL I**

1. The technique of growing plants in a nutrient solution is known as:
 1) Hydroponics 2) Soil less culture 3) Tissue culture 4) Both 1 and 2
2. Some plants require certain elements like Co, Se, Si, Na etc. other than essential elements are known as:
 1) Beneficial elements 2) Trace elements
 3) Micro elements 4) Macro nutrients
3. Which one of the following sentence is false about criteria of essential elements :
 1) The element must be absolutely necessary for supporting growth and reproduction
 2) In the absence of the element the plants do not complete their life cycle or set the seeds
 3) Deficiency of any one element cannot be met by supplying some other element
 4) The element is not involved in the metabolism of the plants
4. Trace elements are needed by plants in the amount:
 1) In excess of 1 m mole kg-1 of fresh matter
 2) Less than 10 m mole kg-1 of dry matter
 3) In excess of 10 m mole kg-1 of dry matter
 4) Less than 50 m mole kg-1 of dry matter
5. Which of the following are the most abundant in living cells?
 1) C, H, S, P 2) C, O, Si, Co 3) C, H, O, N 4) Ca, Mg, Fe, Mo
6. Mineral involved in the maintenance of ribosome structure :
 1) Ca 2) K 3) P 4) Mg
7. Plants need one of the following group of elements for ATP formation
 1) N, P 2) N, K 3) N, Ca 4) K, S
8. Element shows reversible redox reaction :
 1) Mg 2) Mn 3) Cu 4) Ni
9. One mineral activates the enzyme catalase, other determines the osmotic potential and third one is a constituent of the ring structure of chlorophyll. These minerals are respectively
 1) Ca, Mg, S 2) Fe, Mg, S 3) Fe, K , Mg 4) N, K, S
10. The essential element required for uptake and utilisation of Calcium and membrane function is :
 1) Cu 2) B 3) Mn 4) p
11. The solute concentration and anion - cation balance in the cells are maintained by :
 1) N 2) K 3) Cl 4) Both 2 & 3
12. With reference to mineral nutrition in plants which one of the following pair is not correctly matched :
 1) Mo - Required for nitrogen fixation
 2) Mn - Required for splitting of water to liberate oxygen during photosynthesis
 3) Fe - Required for chlorophyll formation
 4) Mg - Involved in opening and closing of stomata

13. On the basis of symptoms of chlorosis in leaves a student inferred that this was due to the deficiency of nitrogen. This inference could be correct only if we assume that yellowing of leaves appears first in:
 - 1) older Leaf
 - 2) young leaves
 - 3) roots
 - 4) buds
14. Appearance of brown spot surrounded by chlorotic vein is a toxicity symptom of :
 - 1) Mo
 - 2) Mn
 - 3) Mg
 - 4) Zn
15. Study the cycle shown below and select the option which gives correct words for all the four blanks A, B, C, D



A

- 1) Nitration
- 2) Denitrification
- 3) Nitrification
- 4) Denitrification

B

- Ammonification
- Ammonification
- Denitrification
- Nitrification

C

- Animals
- Plants
- Animals
- Plants

D

- Plants
- Animals
- Plants
- Animals

16. Which one of the following is a free living anaerobic nitrogen fixing bacteria?
 - 1) Azotobacter
 - 2) Rhodospirillum
 - 3) Beijernickia
 - 4) Frankia

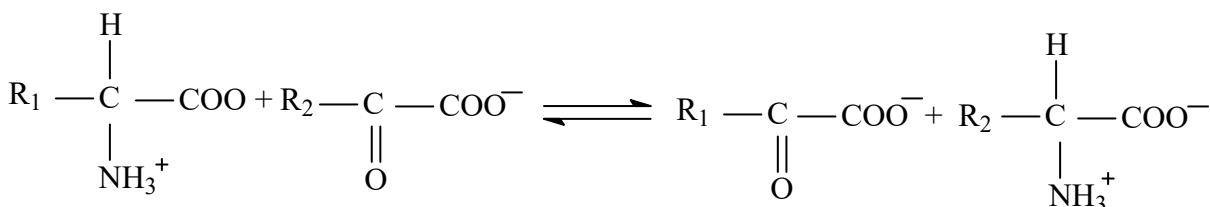
17. Match the column I with column II and select the correct option:

Column I	Column II
A) Nitrosomonas, Nitrococcus	I. Nitrogen fixation
B) Pseudomonas, Thiobacillus	II. NO_2^- to NO_3^-
C) Nitrobacter	III. Denitrification
D) Beijernickia, Rhodospirillum	IV. NH_3 to NO_2^-

- 18 How many ATP molecules are required for the reduction of one nitrogen molecule?

- 1) 16 2) 30 3) 12 4) 8

19. Refer the given reaction, what does it depict.



- | | |
|-------------------|------------------------|
| 1) Nitrification | 2) Reductive amination |
| 3) Transamination | 4) Ammonification |

20. Select the incorrect statements from following?

- 1) In soyabean fixed nitrogen is exported as ureides
 - 2) Ureides have high nitrogen to carbon ratio
 - 3) Transamination involves the transfer of amino group acid
 - 4) Amides contain less nitrogen than amino acids

LEVEL II

1. How many of the following statement/s are correct regarding essential elements :

 - i) Essential elements as components of biomolecules and hence structural elements of cells.
 - ii) Essential elements that are components of energy related chemical compounds in plants
 - iii) Essential elements that activate or inhibit enzyme
 - iv) Some essential elements can alter the osmotic potential of a cell
 - 1) only i and ii are correct
 - 2) only ii and iv are correct
 - 3) only i and iii are correct
 - 4) all statements are correct

2. How many of the following are functions of calcium?
 - A) It is used in the synthesis of cell wall
 - B) It is needed for the formation of mitotic spindle
 - C) It is involved in the normal functioning of cell membrane
 - D) Important role in regulating metabolic activities

1) A and C	2) A, B and D
3) D only	4) A, B, C and D
3. Which of the following is a component of coenzyme A , Biotin, Thiamine, ferredoxin and present in two amino acid - Cysteine and methionine :

1) Cu	2) Ca	3) S	4) B
-------	-------	------	------
4. Plants deficient in Zinc, show reduced biosynthesis of growth hormone

1) Cytokinin	2) Auxin	3) Ethylene	4) ABA
--------------	----------	-------------	--------
5. The concentration of essential elements below which plant growth is retarded termed as:
 - 1) Critical concentration
 - 2) Toxic concentration
 - 3) Osmotic concentration
 - 4) All except 1
6. Symptoms caused by deficiency of essential elements on plants are called

1) Etiolation	2) Visual symptoms
3) Hunger sign	4) Bolting
7. Lack or low level of certain elements in plants, causes an inhibition of cell division. These elements are

1) N, K, S, Mo	2) N, K, Mg, S, Fe, Mn, Zn, Mo
3) Ca, Mg, Cu, K	4) N, S, Mo
8. One observed that flowering is delayed in a plant, which group of element's concentration is probably decreased in that plant.

1) N,S, Mo	2) N,K,S, Mo	3) N,P, K	4) C, H, O
------------	--------------	-----------	------------
9. Which of the following statement is incorrect about deficiency symptoms of essential elements?
 - 1) The parts of plants that show the deficiency symptoms depends on mobility of the element in the plant
 - 2) For elements that are actively mobilised within the plants and exported to young developing tissues, the deficiency symptoms tend to appear first in older tissue
 - 3) The deficiency symptoms tend to first in young tissues whenever the elements are relatively immobile and are not transported out of the mature organs.
 - 4) The deficiency symptoms of Nitrogen, Potassium and Magnesium are visible first in young tissues.
10. Symptoms of Mn Toxicity may actually be the deficiency symptoms of:

1) Fe, Mg, Ca	2) Mn, Mg, Zn
3) Mg, Mn, Mo	4) Fe, Na, Ca

11. Find out the true statement regarding absorption of minerals
- 1) The movement of ions into the cell is known as influx and movement of ions out of cell is known as efflux.
 - 2) The entry of ions into outer space of the cell does not require metabolic energy. So it is considered as a passive process
 - 3) The movement of ions into the inner space of the cell requires metabolic energy. Therefore it is an active process.
 - 4) The passive movement of ions into apoplast usually occurs through ion channels, the transmembrane proteins that functions as selective pores.
- | | |
|-----------|-----------|
| 1) all | 2) 4 only |
| 3) 2 only | 4) 3 only |
12. Select the correct statement/s from the following :
- 1) Mineral salts are translocated through xylem along with the ascending stream of water, which is pulled up through the plant by transpiration pull.
 - 2) Majority of nutrients that are essential for the growth and development of plant become available to the roots due to weathering and breakdown of rocks
 - 3) Plants compete with microbes for the limited nitrogen that is available in soil. Thus nitrogen is a limiting nutrient for both natural and agricultural ecosystems.
 - 4) All of these statements are correct
13. Reaction carried out by N₂ metabolising microbes include:
- I. $2\text{HN}_3 + 3\text{O}_2 \rightarrow 2\text{NO}_2; + 2\text{H}^+ + \text{H}_2\text{O}$
 - II. $2\text{NO}; + \text{O}_2 \rightarrow 2\text{NO}_3;$
- Which of the following statements about these reactions is incorrect
- 1) Step I is carried out by *Nitrosomonas* or *Nitrococcus*
 - 2) Step II is carried out by Nitrobacter
 - 3) Both steps I and II can be called nitrification
 - 4) Bacteria carrying out these steps are usually photoautotrophs
14. Count the total number of true statement
1. Potassium helps to maintain an anion - cation balance in cells and is involved in protein synthesis.
 2. Mg²⁺ is an activator for both ribulose biphosphate carboxylase oxygenase and PEP carboxylase
 3. Phosphorus is a constituent of cell membrane, all nucleic acids, all nucleotides and all proteins
 4. Decomposition of organic nitrogen of dead plants and animals into ammonia is called ammonification
 5. Any mineral ion concentration in tissues that increases the dry weight of tissues by about 10% is considered toxic.
- | | |
|------|------|
| 1) 1 | 2) 2 |
| 3) 3 | 4) 4 |

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

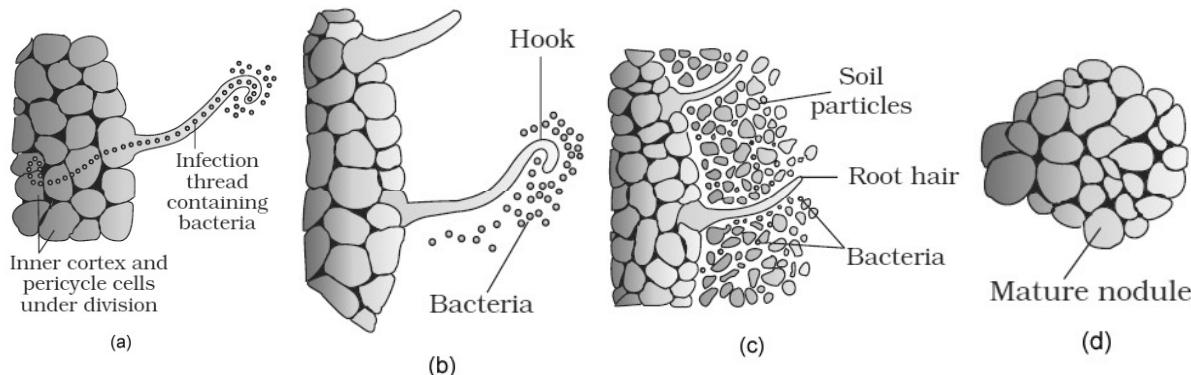
Column I

- A) Rhizobium
 - B) Frankia
 - C) Azotobacter
 - D) Rhodospirillum
- 1) A- II ; B - I ; C - III ; D - IV
 2) A- IV ; B - III ; C - II ; D - I

Column II

- I. Alnus
 - II. Leguminous plants
 - III. Aerobic N₂ fixer
 - IV. Anaerobic N₂ fixer
- 2) A- I ; B - II ; C - III ; D - IV
 4) A- III ; B - IV ; C - I ; D - II

16. Arrange the correct order of the following fixation process:



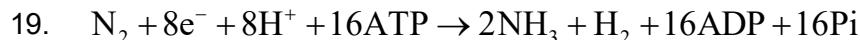
- 1) b, d, c, a 2) c, b, a, d 3) The given order is correct 4) d, a, b, c

17. Find out the false statement regarding Leg Hb

- 1) Nodule contains an oxygen- binding haem protein called Leg Hb which is present in the cytoplasm of infected nodule cells at high concentration
- 2) The host plant produce both globin portion and haeme portion of Leg Hb in response to infection by the bacteria.
- 3) It provide sufficient O₂ to bacteroids.
- 4) It is a pink or red coloured substance. It acts as oxygen scavenger

18. The enzyme nitrogenase is a

- 1) O₂ sensitive protein
- 2) Mo- Fe protein
- 3) Thermostable protein
- 4) Both 1 & 2



The above equation refers to :

- 1) Ammonification 2) Nitrification 3) Nitrogen fixation 4) Denitrification

20. Which of the following statement is correct?

- a) Asparagine and Glutamine are two important amides present in plants
- b) Amides are compounds formed by the replacement of hydroxyl part of aminoacid by NH₂ radicle
- c) The first stable product formed by the fixation of atmospheric nitrogen in leguminous plant is Ammonia
- d) In Soyabean export of fixed nitrogen takes place through ureides.

- 1) a, band c 2) a, band d 3) b, c and d 4) a, b, c and d

CHAPTER - 07

PHOTOSYNTHESIS IN HIGHER PLANTS

QUESTIONS

LEVEL - I

1. Photosynthesis is :
 - 1) Oxidative, exergonic, catabolic
 - 2) Redox - reaction, endergonic, anabolic
 - 3) Reductive, exergonic, anabolic
 - 4) Reductive, endergonic, catabolic
2. Carbohydrates, the most abundant biomolecules on earth are produced by:
 - 1) Some bacteria, fungi and few algae
 - 2) Fungi, algae and all plants
 - 3) All bacteria, green plant cells and algae
 - 4) Algae, green plant cells, some bacteria and few protista
3. Which of the following is a simplified equation of photosynthesis :
 - 1) $\text{CO}_2 + 2\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{light energy}} (\text{CH}_2\text{O})_n + \text{O}_2 \uparrow$
 - 2) $\text{CO}_2 + 2\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{light energy}} \text{C}_3\text{H}_6\text{O}_3 + \text{CO}_2 + \text{O}_2 \uparrow$
 - 3) $\text{CO}_2 + 2\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{light energy}} (\text{CH}_2\text{O})_n + \text{H}_2\text{O} + \text{O}_2 \uparrow$
 - 4) $\text{CO}_2 + 2\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{light energy}} \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \uparrow$
4. Select the true statements regarding significance of photosynthesis :
 - i) Photosynthesis provides food to organisms, directly or indirectly
 - ii) Photosynthesis has great role in purifying air, by consuming CO_2 and releasing an equal amount of O_2 ; helpful in maintaining percentage of O_2 and CO_2 constantly in the atmosphere
 - iii) It provides huge source of energy for mankind in the form of coal, petroleum, wood etc.
 - iv) Chief pigment associated with photosynthesis is chlorophyll a, other pigments like chlorophyll b, carotene and xanthophyll (carotenoids) are called accessory pigments.
 - v) Photosynthesis occur in green parts of the plant mainly in leaves, phylloclade, cladode, phyllode and assimilatory roots of certain plants.

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

5. Half leaf experiment is used to prove that :
- Light is necessary for photosynthesis
 - CO_2 is necessary for photosynthesis
 - O_2 is evolved during photosynthesis
 - Temperature is not necessary for photosynthesis
6. Correlate the scientist with their concerned work :
- | | |
|-----------------------|---|
| a) Joseph priestly | 1) proposed the essential role of air in the growth of plants |
| b) Jan Ingenhousz | 2) proposed the role of sunlight in photosynthesis |
| c) Julius Von Sachs | 3) proposed that starch is the first visible and storage product of photosynthesis |
| d) T.W Engelmann | 4) Plotted Action Spectrum |
| e) Cornelius Van Niel | 5) proposed that H_2S is the reducing power of photosynthesis in bacteria |
- 1) $\frac{\text{a b c d e}}{12345}$ 2) $\frac{\text{a b c d e}}{21345}$ 3) $\frac{\text{a b c d e}}{34512}$ 4) $\frac{\text{a b c d e}}{54321}$
7. A graph showing the effectiveness of light in carrying out photosynthesis at different wavelength is called :
- Sigmoid curve
 - S - shaped curve
 - Absorption spectrum
 - Action spectrum
8. Consider the following statements
- Both photosystem I and photosystem II are present in stroma lamellae
 - All photoautotrophs which evolve oxygen possess chlorophyll a
 - Two different photosystems exist with different forms of chlorophyll a as the reaction centre
 - LHC are made up of hundruds of pigment molecules bound to proteins
- All statements are false
 - All statements are true
 - All except a are true
 - Both a and c are false
9. Light harvesting system (LHS) consist of
- Chlorophyll a and carotenoids
 - Chlorophyll b and carotenoids
 - Carotenoids, chlorophyll b and reaction centre
 - All the pigments except chlorophyll a in the reaction centre

10. Consider the following statements

Statement I : The chlorophyll a in the reaction centre of both PSI and PSII absorb light energy

Statement II : Chlorophyll a is present in both the reaction centre and antenna region, but chlorophyll b and carotenoids are present in antenna region only

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

11. Identify the number of photosystem I and photosystem II in grana thylakoid respectively

- 1) One and One
- 2) Two and Two
- 3) One and Two
- 4) Indefinite

12. Light reactions or photochemical phase include :

- A) Photoexcitation of chlorophyll
 - B) Water splitting
 - C) Evolution of oxygen
 - D) The formation of high - energy intermediates, ATP & NADPH₂
- 1) A only
 - 2) B & C only
 - 3) A & D only
 - 4) All the above

13. The biochemical objective of PS I in non-cyclic photophosphorylation is to :

- 1) Oxidise NADPH
- 2) Phosphorylate ADP
- 3) Reduce NADP⁺
- 4) Both 2 & 3

14. During photolysis of water:

- A) Mn and Cl ions play a major role in the light dependent splitting of water which occur in luminal side of the thylakoid membrane associated with PSII
 - B) The oxygen evolved during photosynthesis comes from water
 - C) Protons are released into the lumen and O₂ is released into the atmosphere
 - D) Both protons and electorns are released into the lumen
- 1) All statements are true
 - 2) All statements are false
 - 3) A, B and C are true
 - 4) Both C and D are false

15. Identify the site of NADP reductase and NADP respectively

- 1) Membrane of stroma lamellae and stroma
- 2) Membrane of grana lamellae and stroma
- 3) The membrane of stroma lamellae and grana thylakoid
- 4) Both are present in stroma

16. The process of formation of ATP from ADP in the presence of light in chloroplast is:
- 1) Oxidative phosphorylation 2) Photophosphorylation
3) Substrate level phosphorylation 4) Both 2 and 3
17. Chemiosmotic hypothesis, proposed by Peter Mitchell is the most accepted hypothesis to explain ATP synthesis in chloroplast and mitochondrion. Chemiosmosis requires :
- A) A membrane B) A proton pump C) Proton gradient D) ATP synthase
1) A only 2) D only 3) C only 4) All the above
18. Consider the following statements and select the correct option
- Statement I : The reactions of calvin cycle is light independent but it occur only in day time
Statement II : Dark reaction is a misnomer
- 1) Both the statements are false 2) Both the statements are true
3) Statement I is false 4) Statement II is true
19. Which of the following is true regarding the primary carboxylation enzyme in C₃ plants :
- a) Bifunctional nature
b) 16% of the total protein in the chloroplast
c) Located in stroma of chloroplast
d) Restricted only in C₃ plants
e) Most abundant enzyme in the biosphere
1) a ,c & e are true but b and d are false
2) b, c & e are true but a and d are false
3) a, b, c & e are true but d is false
4) a, c and d are false but b & e are true
20. Number of ATP and NADPH₂ required for the synthesis of each molecule of sugar in C₃ plants
- 1) 3 and 2 2) 5 and 2 3) 9 and 6 4) 18 and 12
21. Consider the following statements.
- Statement I : Plants in which Hatch and Slack's cycle is operated is called C₄ plants.
Statement II : First stable product formed during this cycle is 4 carbon, oxaloacetic acid.
- 1) Only statement I is false 2) Only statement II is false
3) Both the statements are false 4) Both the statements are true
22. Which of the following statement is true regarding C₄ plants :
- I. Found only in tropical conditions. II. Monocots only
III. Dicots only IV. Both dicots and monocots
V. Respond to higher temperature
VI. Exhibit chloroplast dimorphism / KRANZ anatomy / wreath anatomy
- 1) I and II 2) I and III 3) I and IV 4) IV, V and VI

23. Find the matching pair

A) Maize	- Calvin cycle
B) Bell pepper	- Green house crop
C) Sorghum	- Lack photorespiration
D) Tomato	- C ₃ plant

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

24. A group of plants in which both Rubisco and PEP case found at the same site:

1) C₃ plants
2) C₄ plants
3) CAM plants
4) Both 2 and 3

25. According to Blackman, photosynthesis is affected by several factors but the rate of photosynthesis is limited by the :

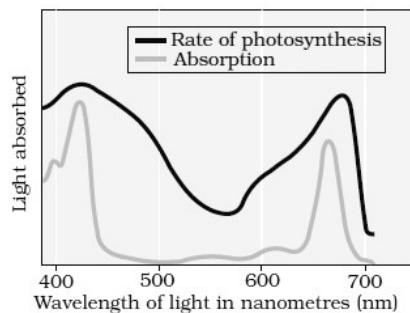
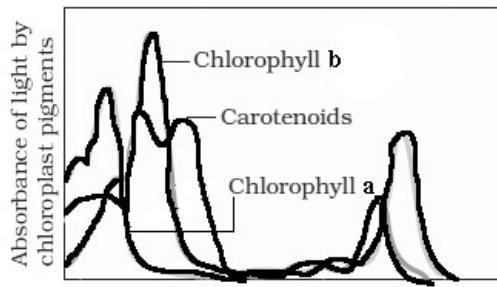
1) Fastest step in the pathway
2) Slowest step in the pathway
3) Factor present in the least amount
4) Factor present in large amount

LEVEL - II

1. Find the mis-matching series :

I. Chlorophyll a	-	First developed in Cyanobacteria	-	Dissolved in organic solvents	-	Bright or blue-green appearance in chromatogram
II. Carotene	-	Hydrocarbon	-	Found only in antenna region	-	Orange colour in chromatogram
III. Xanthophyll	-	Oxygen containing derivatives of carotene	-	Dissolved in fat	-	Yellow colour in chromatogram
IV. Phycobilins	-	Secondary light collectors found in cyanobacteria	-	Dissolved in water	-	Accessory pigment

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



- A) Chlorophyll a and chlorophyll b are chief pigments associated with photosynthesis

B) Only chlorophyll a is the chief pigment associated with photosynthesis

C) There is a complete one to one overlap between absorption spectrum of chlorophyll a and action spectrum of photosynthesis

D) No complete one to one overlap between absorption spectrum of chlorophyll a and action spectrum of photosynthesis

1) A and C are correct 2) A and D are correct 3) B and D are correct 4) B and C are correct

3. Maximum photosynthesis occur in :

A) Red light B) Blue light

C) Moon light D) Twilight E) Polychromatic light

1) A only 2) B only

3) E only 4) Both A & E

4. Consider the following statements ;

- I. Flow of electrons from donor to acceptor molecule in electron transport chain occurs along increasing redox potential values
 - II. Non-cyclic photophosphorylation results in the formation of ATP, NADPH₂ and O₂
 - III. Cyclic photophosphorylation results in the formation of ATP only
 - IV. During photosynthetic electron transport, ATP synthesis occur in accordance with downhill movement of electron and redox potential scale.
 - V. In Cyclic photophosphorylation, the electron released by reaction centre (P₇₀₀) is ultimately returned back to the original reaction centre.

Of the above statements ;

- 1) All statements are correct
 - 2) All statements are false
 - 3) Only IV is false
 - 4) Only II and III are true

5. Find the mis-matching series :

(i) F ₀ part of ATP synthase	- A channel through which protons are transported from lumen towards the stroma	- Facilitated diffusion	- No need of metabolic energy
(ii) F ₁ part of ATP synthase	- Protrudes on the outer surface of the thylakoid membrane towards the stroma	- Phosphorylation of - ADP with inorganic phosphate	- Takes place in the presence of light
(iii) Non cyclic electron transport	- Down hill movement of electron from primary electron acceptor to PS I	- According to redox potential scale	- Takes place in both grana and fret channels
(iv) ATP & NADPH ₂	- Assimilatory powers of photosynthesis	- Proposed by Van Niel	- Formed during light phase

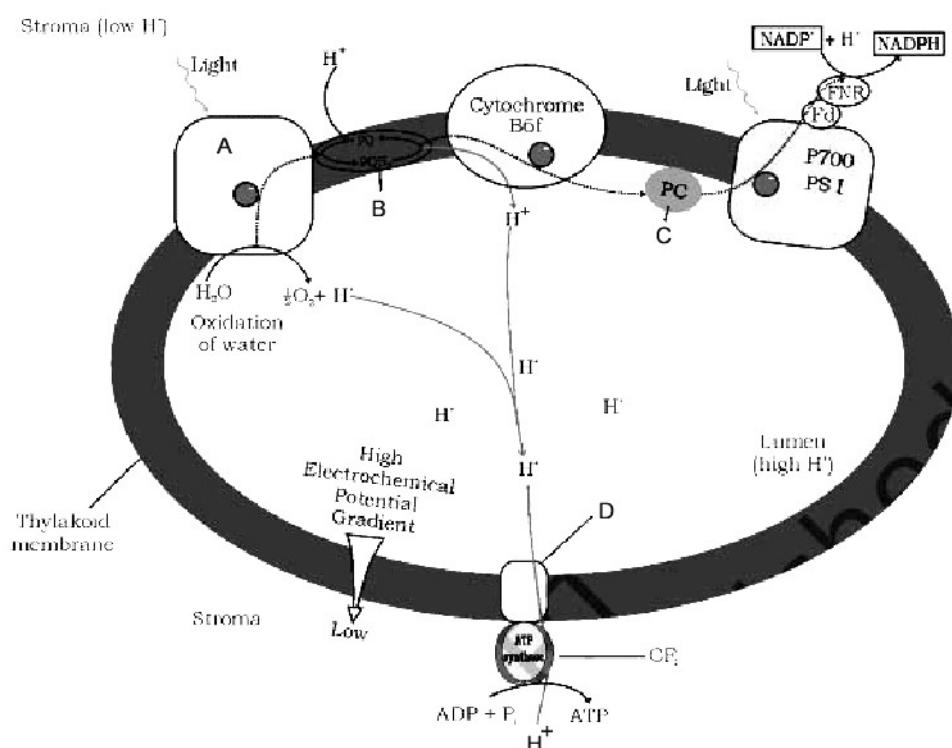
1) Both i & iii

2) Both i & iv

3) Only i

4) iii and iv

6. Observe and identify the part (A, B, C, D) in the figure.



1) A → Strong reductant ; B → Mobile carrier ; C → Copper containing protein ;

D → Proton pump

2) A → Strong oxidant ; B → Mobile carrier ; C → Copper containing protein

D → Proton pump

3) A → Strong oxidant ; B → Proton pump ; C → Connecting plug between PS II and PS I

D → Facilitated diffusion channel/Transmembrane channel

4) A → Strong reductant ; B → Proton pump ; C → Connecting plug between PS II and PS I ; D → Facilitated diffusion channel/Transmembrane channel

7. How many non-cyclic electron transport reactions are essential for the production of the required reducing power for the synthesis of one molecule of glucose in Calvin cycle :
- 1) One 2) Three 3) Six 4) Twelve
8. 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 the vicinity of Rubisco in the bundle sheath cells and to avoid photorespiration
- B) Light reactions and primary carboxylation occur in mesophylls and carbohydrate synthesis occur in bundle sheath
- C) No synthesis of glucose occur in C₄ cycle; it is a way to concentrate CO₂ in bundle sheath for C₃ cycle
- D) Involve both C₄ cycle and C₃ cycle; every C₄ cycle consumes 2ATP and every C₃ cycle requires 3ATP
- 1) One 2) Two 3) Three 4) Four
9. As compared to C₃ plants, how many additional molecules of ATP are needed for net production of one molecule of hexose sugar by C₄ plants:
- 1) Two 2) Five 3) Six 4) Twelve
10. Consider the following statements.
- Statement I : The productivity in C₄ plants, does not increase when CO₂ concentration increases
- Statement II : Present level of atmospheric CO₂ is generally not limiting factor for C₄ plant
- 1) Only statement I is false 2) Only statement II is false
- 3) Both the statements are false 4) Both the statements are true
11. Consider the following statements.
- Statement I : Photorespiration interferes with the successful functioning of calvin cycle.
- Statement II : Photorespiration oxidises the pentose phosphate which is the acceptor of CO₂ in calvin cycle.
- 1) Only statement I is false 2) Only statement II is false
- 3) Both the statements are false 4) Both the statements are true
12. Which of the following is true regarding photorespiration
- A) Occur in day time
- B) Occur only in C₃ plants
- C) Occur when concentration of CO₂ decreases
- D) Metabolic adjunct to Calvin cycle in C₃ plants
- 1) A and B only 2) All except D 3) B and C only 4) All the above

13. Find the mismatching pair

	Column A	Column B
	Plants/Pathway	Function of RubisCo
A	C ₃ Plants	Both carboxylation & oxygenation
B	C ₂ Cycle	Only oxygenation
C	C ₃ cycle	Only Carboxylation
D	C ₄ Plants	Only Carboxylation
E	C ₄ Cycle	Both carboxylation & oxygenation

- 1) Both A & C 2) Both C & E 3) Both D & E 4) E only

14. Which of the following is true regarding alignment of chloroplast in the cytoplasm in accordance with light availability :

A	Intermittent light in the atmosphere	Align perpendicular to the incident light for maximum absorption
B	Intermittent light in the atmosphere	Align perpendicular to the cell wall for maximum absorption
C	Continuous strong light in the atmosphere	Align parallel to the cell wall for minimum absorption
D	Intermittent light in the atmosphere	Align parallel to the cell wall for maximum absorption

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

15. Consider the following statements.

Statement I : In terrestrial conditions, CO₂ usually acts as main determining factor of photosynthesis.

Statement II : Usually CO₂ is available at sub optimal level in terrestrial conditions

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

16. How many of the following statements are false :

1. C₄ plants posses high CO₂ compensation point.
 2. Photosynthesis in C₄ plants are relatively less limited by atmospheric CO₂ level because primary fixation of CO₂ is mediated via PEPcase
 3. Duration of light does not affect the rate of photosynthesis, but it affect the total photosynthesis
 4. C₃ plants responds to increased CO₂ concentration and saturation is seen only about 360μ / L⁻¹
- 1) One 2) Two 3) Three 4) Four

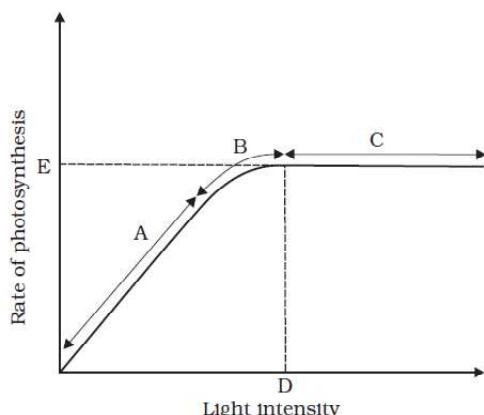
17. Consider the following statements.

- I. Carbon dioxide is the major limiting factor for photosynthesis
- II. Water stress causes the stomata to close
- III. In all plants, photosynthesis is inhibited at 0°C
- IV. Very high CO₂ concentration causes the stomata to close
- V. Photosynthesis is maximum in intermittent light as compared to continuous light.

Of the above statements :

- 1) All statements are true
- 2) All statements are false
- 3) All except IV are true
- 4) All except IV and V are true

18. Observe and identify A, B, C, D, 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 represents 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

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

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

Statement I : Except for plants in shade or in dense forest, light is rarely a limiting factor in nature.

Statement II : Increase in incident light beyond a point causes the breakdown of chlorophyll and decrease in photosynthesis.

1) Both the statements are false

2) Statement I is false

3) Statement II is false

4) Both the statements are true

20. Which of the following statement is false :

1) Current availability of CO_2 levels in the atmosphere is limiting to both C_3 and C_4 plants

2) Both Tomato and Bell pepper are allowed to grow in carbondioxide enriched atmosphere

3) C_3 plants responds to higher CO_2 concentration

4) At higher light intensities, the rate of photosynthesis does not show further increase as other factors become limiting

CHAPTER - 08

RESPIRATION IN PLANTS

SYNOPSIS

❖ **Respiratory Substrates :**

- ❖ Carbohydrates
- ❖ Fats
- ❖ Proteins
- ❖ Organic acids

❖ **Respiratory quotient/Respiratory ratio :**

- ❖
$$RQ = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ consumed}}$$
- ❖ RQ value varies depending upon the substrate
 - ❖ Carbohydrates - RQ value is one
 - ❖ Fats - RQ value is less than one
 - ❖ Proteins - RQ value is less than one
 - ❖ Organic acids - RQ value is greater than one
 - ❖ In Succulent Xerophytes/CAM plants - RQ value is zero
 - ❖ Anaerobic respiration - RQ value is infinity

❖ **Different types of respiration :**

❖ **Based on the substrate:**

- ❖ Floating respiration
- ❖ Protoplasmic respiration

❖ **Based on the availability of oxygen:**

- ❖ Aerobic respiration
- ❖ Anaerobic respiration

❖ **Phases of Aerobic respiration**

- ❖ Glycolysis
- ❖ Krebs cycle
- ❖ Terminal oxidation

❖ **Anaerobic respiration**

- ❖ Fermentation

QUESTIONS**LEVEL - I**

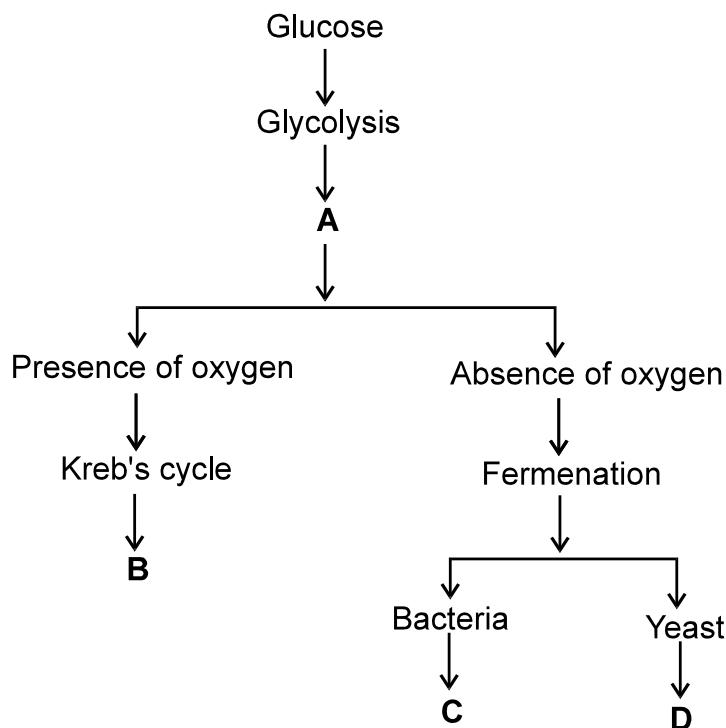
1. The mechanism of breakdown of food materials within the cell to release energy by oxidation of various organic molecules like carbohydrates, fats, proteins and organic acids, and trapping of this energy for synthesis of ATP is known as :
 - 1) Cellular respiration
 - 2) Floating respiration
 - 3) Protoplasmic respiration
 - 4) Salt respiration
2. The compounds which are broken down during respiration are called :
 - 1) Respiratory substrates
 - 2) Respiratory quotient
 - 3) Respiratory climacteric
 - 4) Antitranspirant
3. Which of the following statement/s is/are false regarding Glycolysis :
 - i) In this process, glucose undergoes partial oxidation to form 2 molecules of pyruvic acid, 2 ATP and 2 NADH₂.
 - ii) ATP is formed in four steps by substrate phosphorylation and ATP is utilised at two steps.
 - iii) The triose phosphates formed by the splitting of fructose 1, 6 bisphosphate in glycolysis are Dihydroxyacetone phosphate [DHAP] and 3 - phosphoglyceraldehyde [PGAL].
 - iv) Two molecules of CO₂ are released during glycolysis.
 - v) The enzymes involved in the chemical reactions of glycolysis are located in the fluid matrix of cytoplasm.
 - vi) During glycolysis, the mineral needed as an enzyme activator is Mg²⁺.
 - vii) Total number of co-enzymes reduced during glycolysis is two.

1) i, ii and iv only	2) ii, iii and vii only
3) iii, iv and vi only	4) iv only
4. In which one of the following reactions of glycolysis, oxidation takes place?
 - A) Glucose → Glucose - 6 - phosphate
 - B) Fructose - 6 - phosphate → Fructose -1, 6 - bisphosphate
 - C) 3 - phosphoglyceraldehyde [PGAL] → 1, 3 - bisphosphoglycerate [BPGA]
 - D) 1, 3 - bisphosphoglyceric acid [BPGA] → 3 - phosphoglyceric acid [3-PGA]
 - E) 2 - phosphoenol pyruvic acid [PEP] → Pyruvic acid

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

10. Select the option that correctly fills the blanks in the following statements.
- A. Glucose has (i) carbon atoms, pyruvic acid has (ii) carbon atoms and the acetyl group has (iii) carbon atoms.
- B. Electrons enter the electron transport system as part of hydrogen atoms attached to (i) and (ii).
- | A | B |
|---------------------------------|--|
| 1) (i) - 6; (ii) - 4; (iii) - 3 | (i) - NADH ₂ ; (ii) - FADH ₂ |
| 2) (i) - 6; (ii) - 3; (iii) - 2 | (i) - NADH ₂ ; (ii) - FADH ₂ |
| 3) (i) - 6; (ii) - 3; (iii) - 2 | (i) - ATP; (ii) - GTP |
| 4) (i) - 6; (ii) - 4; (iii) - 3 | (i) - ATP; (ii) - GTP |
11. In Electron Transport System (ETS) which of the following cytochrome reacts with oxygen and acts as the terminal electron donor ?
- | | |
|-----------|------------------------|
| 1) Cyt. b | 2) Cyt. a ₃ |
| 3) Cyt. a | 4) Cyt. c ₁ |
12. Match the following suitably :
- | Column I | Column II |
|-----------------|---------------------------------------|
| a) Complex I | 1) NADH dehydrogenase |
| b) Complex II | 2) FADH ₂ |
| c) Complex III | 3) Cytochrome bc ₁ complex |
| d) Complex IV | 4) Cytochrome c oxidase complex |
| e) Complex V | 5) ATP synthase |
- | | | | |
|-------------------|-------------------|-------------------|-------------------|
| 1) abcde
54321 | 2) abcde
52341 | 3) abcde
12345 | 4) abcde
14325 |
|-------------------|-------------------|-------------------|-------------------|
13. Complex IV refers to cytochrome c oxidase complex containing cytochromes :
- | | | | |
|---|---|--|--|
| 1) b and c ₁ and one copper centre | 2) a and a ₃ and four copper centres | 3) c ₁ and c and three copper centres | 4) a and a ₃ and two copper centres |
|---|---|--|--|
14. The small protein attached to the outer surface of the inner membrane and acts as a mobile carrier for transfer of electrons between complex III and IV :
- | | | | |
|-----------------|-----------------|-----------------|------------------------------|
| 1) Cytochrome-b | 2) Cytochrome-c | 3) Cytochrome-a | 4) Cytochrome-a ₃ |
|-----------------|-----------------|-----------------|------------------------------|

15. The following is a simplified scheme showing the fate of glucose during aerobic and anaerobic respiration. Identify the products that are formed at stages indicated as A, B, C and D. Identify the correct option from those given below :

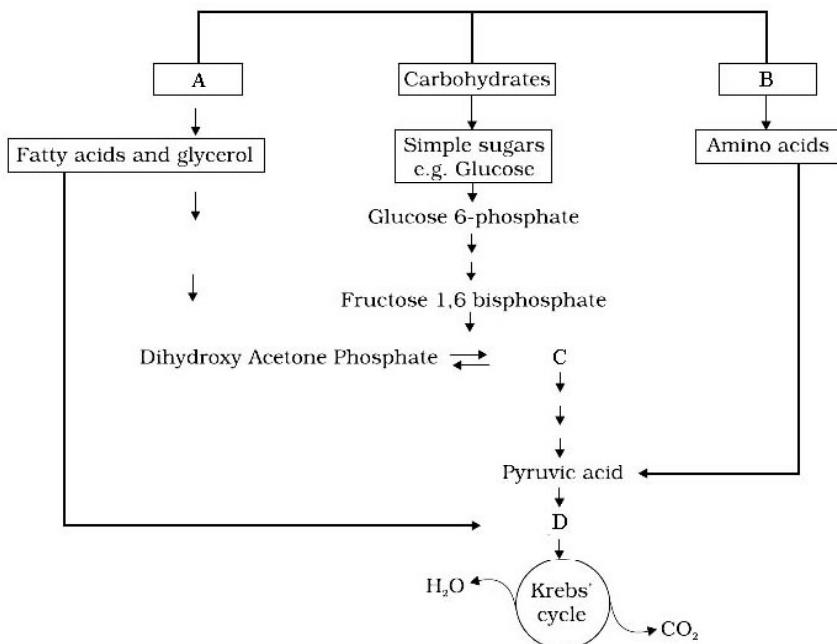


- 1) A - CO_2 and H_2O ; B - Pyruvic acid; C - Ethanol and CO_2 ; D - Lactic acid
- 2) A - Pyruvic acid; B - CO_2 and H_2O ; C - Lactic acid; D - Ethanol and CO_2
- 3) A - Pyruvic acid; B - CO_2 and H_2O ; C - Ethanol and CO_2 ; D - Lactic acid
- 4) A - Pyruvic acid; B - Ethanol and CO_2 ; C - Lactic acid; D - CO_2 and H_2O

16. Choose the false statement among the following :

- 1) Usually CO_2 is the common end product of both aerobic and anaerobic respiration.
- 2) Lactic acid fermentation, alcoholic fermentation and aerobic respiration are the three major ways in which different cells handle pyruvic acid produced by glycolysis.
- 3) The only method of ATP production is oxidative phosphorylation.
- 4) Mitochondria and chloroplast are semiautonomous organelles involved in energy transformation reactions.

17. Select the correct option for A, B, C and D.

**A**

- 1) Fats
- 2) Fats
- 3) Proteins
- 4) Proteins

B

- Proteins
- Proteins
- Fats
- Fats

C

- 3-PGAL
- 3-PGAL
- Acetyl Co. A
- PEP

D

- Acetyl Co. A
- CO₂
- PEP
- Acetyl Co. A

18. Which among the following is a mobile electron carrier :

- 1) Cyt. a
- 2) Cyt a₃
- 3) Cyt b
- 4) Cyt. c

19. The respiratory quotient depends upon the **type of respiratory substrate** used during respiration. Select the equation to calculate Respiratory quotient or Respiratory ratio :

$$1) \frac{\text{Volume of O}_2 \text{ evolved}}{\text{Volume of CO}_2 \text{ consumed}}$$

$$2) \frac{\text{Volume of CO}_2 \text{ evolved}}{\text{Volume of O}_2 \text{ consumed}}$$

$$3) \frac{\text{Volume of O}_2 \text{ consumed}}{\text{Volume of CO}_2 \text{ evolved}}$$

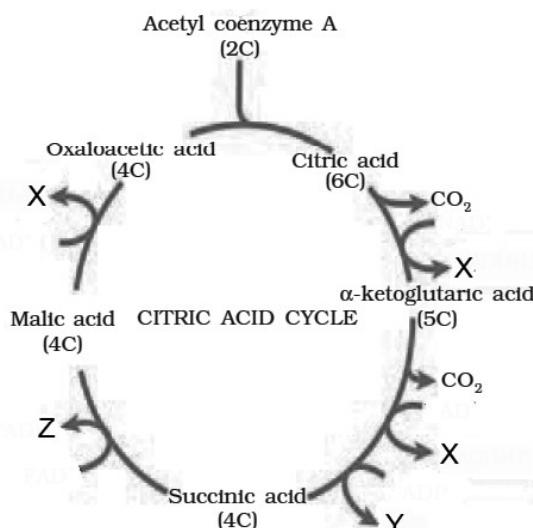
$$4) \frac{\text{Volume of CO}_2 \text{ consumed}}{\text{Volume of O}_2 \text{ evolved}}$$

LEVEL - II

1. Mark which is applicable to cellular respiration :
 - 1) Oxidative, exergonic, catabolic process
 - 2) Reductive, endergonic, anabolic process
 - 3) Reductive, exergonic, anabolic process
 - 4) Reductive, exergonic, catabolic process
 2. In which of the following reactions, the respiratory quotient is infinity?
 - 1) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$
 - 2) $2(C_{51}H_{98}O_6) + 145O_2 \rightarrow 102CO_2 + 98H_2O + \text{Energy}$
 - 3) $2(COOH)_2 + O_2 \rightarrow 4CO_2 + 2H_2O + \text{Energy}$
 - 4) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2 + \text{Energy}$
 3. If R.Q. is less than 1.0 in a respiratory metabolism, it would mean that :
 - 1) Carbohydrates are used as respiratory substrate.
 - 2) The oxidation of the respiratory substrate consumed less oxygen than the amount of CO_2 released.
 - 3) The oxidation of the respiratory substrate consumed more oxygen than the amount of CO_2 released.
 - 4) The reaction is anaerobic.
 4. The pathway of respiration common in all living organisms is X ; it occurs in the Y and the products formed are two molecules of Z .
Identify X, Y and Z and select the correct answer :

	X	Y	Z
1)	EMP pathway	Mitochondrion	Pyruvic acid, ATP, NADH ₂
2)	EMP pathway	Cytoplasm	Pyruvic acid, ATP, NADH ₂
3)	EMP pathway	Mitochondrion	Acetyl Co.A, ATP, NADH ₂
4)	Krebs cycle	Cytoplasm	Acetyl Co.A, ATP, NADH ₂

5. Consider the following statements with respect to respiration :
- Glycolysis occurs in the cytoplasm of the cell.
 - The cell organelle concerned with aerobic respiration is mitochondria.
 - Electron transport system is present in the outer mitochondrial membrane.
 - $C_{51}H_{98}O_6$ is the chemical formula for tripalmitin, a fatty acid.
 - The respiratory quotient depends upon the type of respiratory substrate used during respiration
- Of the above statements :
- | | |
|--------------------------------|------------------------------|
| 1) ii, iii and iv are correct | 2) iii, iv and v are correct |
| 3) i, ii, iv and v are correct | 4) ii, iv and v are correct |
6. In Glycolysis, ATP is formed during which of the following steps :
- Glucose → Glucose - 6 - phosphate
 - Fructose - 6 - phosphate → Fructose - 1, 6 - bisphosphate
 - 3 - phosphoglyceraldehyde [PGAL] → 1, 3 - bisphosphoglycerate[BPGA]
 - 1, 3 - bisphosphoglyceric acid → 3 - phosphoglyceric acid
 - 2 - phosphoenol pyruvic acid [PEP] → Pyruvic acid
 - 2 - phosphoglyceric acid → 2 - phosphoenol pyruvic acid [PEP]
- | | |
|--------------------|------------------------|
| 1) I and II only | 2) II, III and VI only |
| 3) III and VI only | 4) IV and V only |
7. Pyruvate, which is formed by the glycolytic catabolism of carbohydrates in the cytosol, after it enters mitochondrial matrix undergoes oxidative decarboxylation by a complex set of reactions catalysed by:
- | | |
|---------------------------|---------------------|
| 1) Hexokinase | 2) Citrate synthase |
| 3) Pyruvate dehydrogenase | 4) Invertase |
8. Refer the following figure and identify X, Y and Z :



	X	Y	Z
1)	GTP	NADH ₂	CO ₂
2)	FADH ₂	NADH ₂	GTP
3)	NADH ₂	GTP	FADH ₂
4)	CO ₂	NADH ₂	ADP

9. Match the number of carbon atoms given in List - I with that of the compounds given in List - II and select the correct option :

List I

- a. 4C compound
 - b. 2C compound
 - c. 5C compound
 - d. 3C compound
 - e. 6C compound
- 1) a – 5, b – 1, c – 4, d – 2, e – 3
 - 3) a – 3, b – 1, c – 4, d – 2, e – 5

List II

- 1. Acetyl Co. A
 - 2. Pyruvate
 - 3. Citric acid
 - 4. α - keto glutaric acid
 - 5. Malic acid
- 2) a – 2, b – 5, c – 3, d – 1, e – 4
 - 4) a – 5, b – 3, c – 1, d – 2, e – 4

10. How many reduced co-enzymes are formed with in the mitochondria during complete oxidation of one glucose molecule :

- 1) Four
- 2) Six
- 3) Eight
- 4) Ten

11. Select the durations in which $\text{NADH} + \text{H}^+$ is formed in Krebs cycle :

- i) During the formation of Oxalosuccinic acid from Isocitric acid
 - ii) During the formation of Succinyl Co. A from Alpha-ketoglutaric acid
 - iii) During the formation of Oxaloacetic acid from Malic acid
 - iv) During the formation of Succinic acid from Succinyl Co. A
 - v) During the formation of Fumaric acid from Succinic acid
 - vi) During the formation of Alpha-ketoglutaric acid from Oxalosuccinic acid
 - vii) During the formation of Acetyl Co. A from Pyruvic acid
- 1) i, ii, iii & vii only 2) ii, iii, vi & vii only 3) i, ii & iii only 4) iii, iv & v only

12. Find out the false statement from the following :

- 1) Citrate undergoes 2 decarboxylations and 4 oxidations during Krebs cycle.
- 2) First oxidative decarboxylation in respiration occurs during the link reaction and in Krebs cycle the oxidative decarboxylation is from Alpha - ketoglutaric acid.
- 3) First oxidation in Krebs cycle is during the formation of Oxalosuccinic acid from Isocitric acid.
- 4) First decarboxylation in Krebs cycle is during the formation of Acetyl CoA from Pyruvic acid.

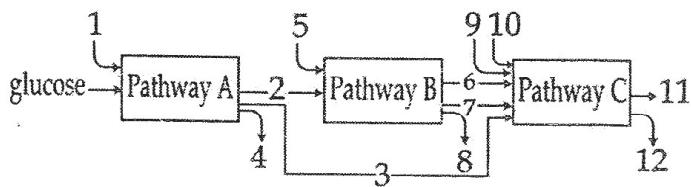
13. Which of the following statement/s is/are true :

- A) Acetyl Co. A is formed during both aerobic and anaerobic respiration.
- B) When O_2 is limiting, NADH_2 and pyruvic acid begin to accumulate.
- C) Under this condition, plants carry out fermentation [anaerobic respiration, leading to the formation of ethanol and CO_2 or lactic acid (usually ethanol)].
- D) In Yeast, the incomplete oxidation of glucose is achieved under anaerobic conditions by a sets of reactions where pyruvic acid is converted to CO_2 and ethanol.
- E) The enzymes pyruvic acid decarboxylase and alcohol dehydrogenase catalyse these reactions.
- F) In animal cells like muscles during exercise, when oxygen is inadequate for cellular respiration, pyruvic acid is reduced to lactic acid by lactate dehydrogenase.

- 1) A only 2) B only 3) C only 4) All except A

14. What is the net gain of ATP during anaerobic respiration :
 1) 4 2) 8 3) 12 4) 2
15. Which of the following step lack decarboxylation :
 i) Pyruvate → Acetyl Co. A
 ii) Oxalosuccinic acid → Alpha-ketoglutaric acid
 iii) Pyruvic acid → Ethanol
 iv) Pyruvic acid → Lactic acid
 v) Alpha-ketoglutaric acid → Succinyl Co. A
 1) i and ii only 2) iv only 3) ii and v only 4) v only
16. Which of the following stages of aerobic respiration takes place in the matrix of the cell organelle, that is referred to as "Power house of the cell" :
 I. Glycolysis II. Oxidative decarboxylation of pyruvic acid
 III. Krebs cycle IV. Oxidative phosphorylation
 1) I and II only 2) I and III only 3) III and IV only 4) II and III only
17. Which of the following statements are true :
 i) The number of glucose molecules required to produce 38 ATP molecules under anaerobic conditions by an yeast cell is 19.
 ii) Yeasts poison themselves to death when the concentration of alcohol reaches about 13 percent.
 iii) The factor that is most commonly limiting the rate of respiration is temperature.
 iv) Meristematic cells, germinating seeds etc. show high rate of respiration, because more energy is needed for cell division.
 v) In living organisms, respiratory substrates are often more than one; pure proteins or fats are never used as respiratory substrates.
 1) i and ii only 2) ii and iii only 3) iii,iv and v only 4) i, ii, iii, iv and v
18. Which of the following statements are true :
 (i) The metabolic pathway through which the electron passes from one carrier to another is called the **Electron Transport System (ETS)** and it is present in the inner mitochondrial membrane.
 (ii) **Cytochrome c** is a small protein attached to the outer surface of the inner membrane and acts as a mobile carrier for transfer of electrons between complex III and IV.
 (iii) **Complex IV** refers to **cytochrome c oxidase complex** containing cytochromes a and a₃, and two copper centres.
 (iv) When the electrons pass from one carrier to another via complex I to IV in the ETC, they are coupled to ATP synthase (Complex V) for the production of ATP from ADP and inorganic phosphate.
 (v) The complex V consists of two major components - F₁ (Peripheral membrane protein complex) and F₀ (Integral membrane protein complex).
 (vi) The correct sequence of electron carriers in the ETC is FMN, Ubiquinone(reduced form - ubiquinol), cytochrome b, c₁, c, a and a₃.
 1) (i), (iii) and (iv) only 2) (ii), (iv) and (vi) only
 3) (i), (iv) and (vi) only 4) All statements are true

19. Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins?
- 1) Fructose 1, 6 – bisphosphate
 - 2) Pyruvic acid
 - 3) Acetyl Co. A
 - 4) Glucose - 6 - phosphate
20. The three boxes in this diagram represent the three major biosynthesis pathways in aerobic respiration. Arrows represent net reactants or products.



Arrows numbered 4, 8 and 12 can all be

- 1) ATP
- 2) H₂O
- 3) FAD⁺ or FADH₂
- 4) NADH

CHAPTER - 09

PLANT GROWTH & DEVELOPMENT

TEACHING POINTS

13.1 Growth - definition

- 13.1.1. Characteristics of plant growth - indeterminate - meristems - open form of growth - primary growth - secondary growth
- 13.1.2. Growth is measurable - parameters for measurement of growth
- 13.1.3. Growth phases - meristematic, elongation and maturation
- 13.1.4. Growth rates - Arithmetic growth and geometric growth, absolute growth rate and relative growth rate
- 13.1.5. Conditions for growth - essential factors - non essential factors

13.2. Differentiation, dedifferentiation and redifferentiation - definitions and examples

13.3. Development - definition - diagrammatic representation, plasticity - definition and examples

13.4. Plant growth regulators

- 13.4.1. Definition and characteristics - classification
- 13.4.2. Discovery of PGRs - Scientists and contributions
- 13.4.3. Physiological effects of PGRs
 - 13.4.3.1. Auxins - characteristics, physiological effects and applications
 - 13.4.3.2. Gibberellins - characteristics, physiological effects and applications
 - 13.4.3.3. Cytokinins - characteristics, physiological effects and applications
 - 13.4.3.4. Ethylene - characteristics, physiological effects and applications
 - 13.4.3.5. Abscisic acid - characteristics, physiological effects and applications

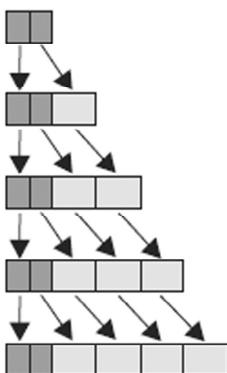
13.5 - Photoperiodism - definition - categories of plants

13.6 - Vernalisation - definition - examples

13.7 - Seed dormancy

QUESTIONS

LEVEL - I



- 1) Arithmetic 2) Geometric 3) Sigmoid 4) Linear

4. Exponential growth in plants can be expressed as
1) $L_t = L_0 + rt$ 2) $L_c = L_t rt$ 3) $W_i = W_0 e^r t$ 4) $W_i = W_0 e^{rt}$

5. The growth of an organism follows
1) J- shaped 2) Hyperbolic curve
3) Sigmoid curve 4) Parabolic curve

6. Increased vacuolation, cell enlargement and new cell wall deposition are the characteristics of the cells of which phase:-
1) Meristematic phase of growth 2) Phase of elongation
3) Phase of maturation 4) Lag phase

7. The growth of the given system per unit time expressed on a common basis is called :
1) Absolute growth rate 2) Relative growth rate
3) Facultative growth rate 4) Exponential growth

8. Formation of phellogen from living differentiated cell is an example of
1) Differentiation 2) Redifferentiation
3) Dedifferentiation 4) Intrastellar development

LEVEL - II

1. Select the statement which is not correct :
 - 1) Growth is an irreversible permanent increase in mass and size of an organism or an organ or even of an individual cell
 - 2) Growth involves only anabolic processes
 - 3) Growth occurs at the expense of energy
 - 4) Plant growth is indeterminate
2. Growth is a :

1) Qualitative change	2) Quantitative change
3) Both qualitative and quantitative	4) Reversible change
3. Growth of a pollen tube is measured in terms of :

1) Its fresh weight	2) Its dry weight
3) Its length	4) Its surface area
4. Consider the following statements and choose the correct option:-
 - i) The increased growth per unit time is termed as growth rate.
 - ii) A sigmoid curve is a characteristic feature of living organism growing in a natural environment.
 - iii) The exponential growth can be expressed as $L_t = L_0 + rt$.
 - 1) Statements (i) and (ii) are true but (iii) is false
 - 2) Statements (i) and (iii) are true but (ii) is false
 - 3) Statement (i) alone is true but (ii) and (iii) are false
 - 4) All the three statements (i), (ii) and (iii) are false
5. The phase of growth at which the growth is slow :

1) Lag phase	2) Exponential phase
3) Log phase	4) Senescence phase
6. Correct sequence of different phases of growth is
 - 1) Cell division → Cell differentiation → Cell elongation
 - 2) Cell differentiation → Cell division → Cell elongation
 - 3) Cell elongation → Cell division → Cell differentiation
 - 4) Cell division → Cell elongation → Cell differentiation
7. Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called : -
 - 1) Differentiation
 - 2) Redifferentiation
 - 3) Development
 - 4) Plasticity
8. Which one of the following is not a product of redifferentiation?

1) Secondary xylem	2) Secondary phloem
3) Phellogen	4) Secondary cortex
9. Auxins were first isolated from : -

1) Corn germ oil	2) Oats	3) Human urine	4) Coconut milk
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10. Removal of shoot tips is known as :
- Decapitation
 - Emasculation
 - Apical dominance
 - Etiolation
11. A plant hormone used to increase the fruit size and bunch length of Grapes :
- ABA
 - Gibberellin
 - Cytokinin
 - Ethylene
12. Tobacco pith callus tissue produces only roots when the medium contains :
- high cytokinin and low auxin
 - low cytokinin and high auxin
 - low cytokinin and high gibberellin
 - high cytokinin and low gibberellin
13. Select the mismatched pair
- | | |
|---------------------|-------------------------------|
| 1) Gibberellic acid | - Increase yield of sugarcane |
| 2) Cytokinin | - Promotes apical dominance |
| 3) Ethylene | - Sprouting of potato tuber |
| 4) Abscisic acid | - Inhibits seed germination |
14. ABA is an antagonist of :
- IBA
 - GA
 - IAA
 - C_2H_4
15. Promotion of female flowers in cucurbits is associated with :
- NAA
 - ABA
 - Gibberellin
 - Ethylene
16. Match the following :
- | Column I | Column II |
|-----------------|-----------------------------------|
| 1. Auxin | a) Bolting in beet |
| 2. Gibberellin | b) Apical dominance |
| 3. Cytokinin | c) Breaks seed dormancy in Peanut |
| 4. Ethylene | d) Promote nutrient mobilisation |
-
- | | | | |
|------------------------|------------------------|------------------------|------------------------|
| 1) $\frac{1234}{abcd}$ | 2) $\frac{1234}{dcba}$ | 3) $\frac{1234}{badc}$ | 4) $\frac{1234}{dbac}$ |
|------------------------|------------------------|------------------------|------------------------|
17. Assertion : Abscisic acid (AB1) is also called stress hormone
Reason : ABA increase the tolerance of plants to various kinds of stresses
- Both Assertion and Reason are true and the 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
18. Photoperiodism is
- Germination of seed
 - Elongation of internode
 - Flowering response towards light
 - Vegetative growth
19. Vernalisation stimulates flowering in :
- carrot
 - ginger
 - turmeric
 - tobacco
20. Intrinsic factors of development in plants includes :
- Genetic factors
 - Intercellular factors
 - Light
 - Both 1 and 2

ZOOLOGY

CHAPTER - 01

STRUCTURAL ORGANIZATION IN ANIMALS (ANIMAL TISSUES)

Teaching Points

Definition : - Histology, Cytology, Tissue

Basic types of tissues - Epithelial tissue, Connective tissue, Muscular tissue and Neural tissue, their mode of origin (ectoderm, endoderm and mesoderm)

Classification of epithelial tissue as

I) Covering Epithelium

II) Glandular Epithelium

I) Covering Epithelium

* Sub division of covering epithelium as

I) Simple epithelium

II) Compound epithelium

* Functions, peculiarities such as cell junctions, avascular nature, inter cellular materials etc

Different types of simple epithelium on the basis of structural modification of cells, their location and function such as

1) Squamous epithelium

2) Cuboidal epithelium

3) Columnar epithelium

4) Ciliated epithelium

5) Pseudostratified epithelium

* Mention brush bordered columnar epithelium and brush bordered cuboidal epithelium their, sites and function.

* Mention the modification of simple epithelium such as

- 1) germinal epithelium

- 2) sensory epithelium

II) Glandular Epithelium

- i) Unicellular glands

II) Multicellular glands and example

* Briefly mention Endocrine glands, Exocrine glands, mixocrine glands etc

* Mention apocrine glands, merocrine glands, holocrine glands, their examples

* Tubular glands, saccular or alveolar glands and examples

* Different types of cell junctions present in epithelial tissue and their functions (gap junction, tight junction and adhering junction etc.)

II. Connective tissue : -

Classification as Loose connective tissue, Dense connective tissue- Regular and Irregular and specialised connective tissue.

* Loose connective tissue - Examples Areolar tissue, Adipose tissue, their location and function, components of areolar tissue, nature of matrix etc

* Dense connective tissue - Regular - Examples - 1)Tendon 2) ligaments

Dense connective tissue - Irregular- examples

* Specialised connective tissue examples, Blood, Bone, cartilage

III. Muscular tissue:

- 1) Skeletal muscles,
 - 2) Smooth muscle,
 - 3) cardiac muscles - sites

Intercalated disc,functions

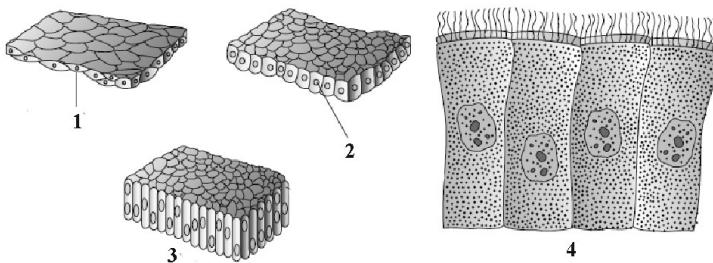
IV. Neural tissue - Neurons, neuroglial cells

Mention their function

QUESTIONS

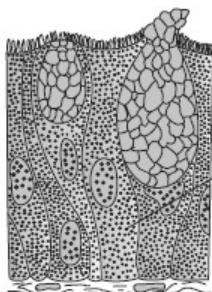
LEVEL - I

1. A tissue is
 - 1) A group of similar cells along with intercellular substances perform a specific function
 - 2) A group of separate organs that are co-ordinated in their activities
 - 3) A layer of cells surrounding an organ
 - 4) A combination of billions of cells to perform various functions
2. The type of epithelium found on the walls of blood vessels and air sacs of lungs forming a diffusion boundary is known as
 - 1) simple cuboidal epithelium
 - 2) simple squamous epithelium
 - 3) pseudo stratified epithelium
 - 4) simple columnar epithelium
3. Which cell junction helps to stop the substances from leaking across a tissue?
 - 1) Tight junction
 - 2) Adhering junction
 - 3) Gap junction
 - 4) Zona adherens
4. Brush bordered simple cuboidal epithelium is seen in
 - 1) inner lining of fallopian tube
 - 2) nasal chamber
 - 3) trachea
 - 4) PCT of nephron
5. These cells are found in the lining of stomach and intestine and help in secretion and absorption. Their nuclei are located at the base. Identify the tissue having this peculiarities from the given diagrams.

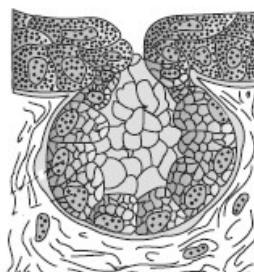


6. All glands develop from
 - 1) connective tissue
 - 2) muscular tissue
 - 3) epithelial tissue
 - 4) both connective tissue and epithelial tissue

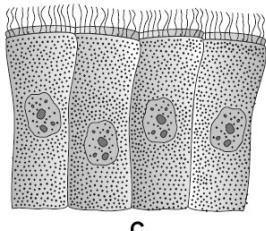
7. The four sketches [A,B,C and D] given below represent four different types of animal tissues. Which one of these is correctly identified in the option given, along with its correct location and function?



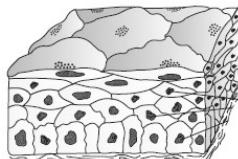
A



B



C

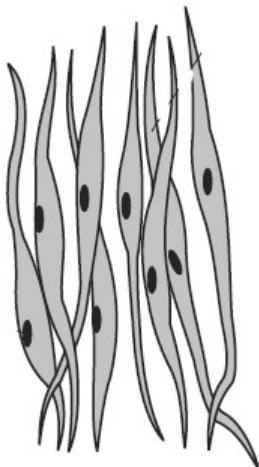


D

	Tissue	Location	Function
1	C. Ciliated epithelium	Fallopian tube	Protection
2	B. Unicellular gland	Intestine	Diffusion
3	A. Multicellular gland	Salivary gland	Secretion
4	D. Compound epithelium	Buccal cavity	Protection

8. Which of the following tissue is the most abundant and widely distributed in the body of complex animals?
- 1) muscular tissue
 - 2) connective tissue
 - 3) epithelial tissue
 - 4) neural tissue
9. Blood and lymph are examples for
- 1) loose connective tissue
 - 2) dense regular connective tissue
 - 3) specialised connective tissue
 - 4) dense irregular connective tissue
10. Collagen fibres are not found in extracellular matrix of :
- 1) Areolar connective tissue
 - 2) Adipose connective tissue
 - 3) Fluid connective tissue
 - 4) Skeletal connective tissue

11. Choose the correct option with respect to the common character of the given tissue A and B



- 1) Presence of communication junction
 - 2) Number of nuclei in a cell
 - 3) Presence of striations
 - 4) Cylindrical and striated appearance
12. Communication junctions at some points allow the cardiac muscle cells to contract as a unit. These junctions are also known as
- 1) intercalated discs
 - 2) Gap junction
 - 3) Cardiac notch
 - 4) Basement membrane
13. Which of the following is a sesamoid bone?
- 1) Cranial bones
 - 2) Internasal septum
 - 3) Patella
 - 4) Clavicle
14. Least capacity of regeneration in mammals is found in
- 1) epithelial cells of skin
 - 2) neural tissue of brain
 - 3) endothelium of blood vessels
 - 4) skeletal muscles
15. Bipolar neurons are present in:
- 1) Retina of the eye
 - 2) Embryos
 - 3) Brain
 - 4) Spinal cord

LEVEL - II

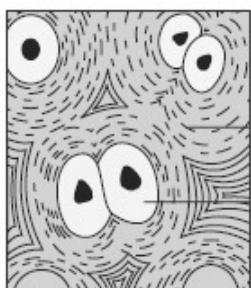
1. Epidermis of humans is made up of
- 1) Non keratinised stratified cuboidal epithelium
 - 2) Keratinised stratified squamous epithelium
 - 3) Transitional epithelium
 - 4) Stratified columnar epithelium

2. Columnar epithelium which bear cilia on their free surface helps
- to move particles or mucus in a specific direction over the epithelium
 - in the absorption of digested food
 - in the diffusion of respiratory gas
 - in protection
3. Simple squamous epithelium is made up of a single thin layer of flattened tile like cells. They are also known as
- pavement epithelium
 - glandular epithelium
 - transitional epithelium
 - endothelium
4. Choose the correctly matched pair
- | | |
|-----------------------------------|------------------------|
| 1) inner lining of salivary ducts | - ciliated epithelium |
| 2) moist surface of buccal cavity | - glandular epithelium |
| 3) tubular parts of nephron | - cuboidal epithelium |
| 4) inner surface of bronchioles | - squamous epithelium |
5. Match the following structures with its characteristic feature
- | | |
|-----------------------|--|
| a) tight junctions | i) Cement neighbouring cells together to form sheath |
| b) adhering junctions | ii) transmits information through chemical to another cells |
| c) gap junctions | iii) establish a barrier to prevent leakage of fluid across epithelial cells |
| d) synaptic junction | iv) cytoplasmic channels to facilitate communication between adjacent cells |
- Select the correct option from the following
- a-ii, b-iv, c-i, d-iii
 - a-iv, b-ii, c-i, d-iii
 - a-iii, b-i, c-iv, d-ii
 - a-iv, b-iii, c-i, d-ii
6. Match the items suitably
- | Column I | Column II |
|---------------------------------------|----------------------------------|
| a) pseudostratified epithelium | 1) endothelium |
| b) cuboidal epithelium | 2) intestinal villi |
| c) brush bordered columnar epithelium | 3) oviduct |
| d) ciliated epithelium | 4) convoluted tubules of nephron |
| e) squamous epithelium | 5) lining of trachea |
| 1) a-5, b-4, c-3, d-1, e-2 | 2) a-5, b-4, c-2, d-3, e-1 |
| 3) a-4, b-5, c-2, d-3, e-1 | 4) a-5, b-4, c-3, d-2, e-1 |
7. Germinal epithelium is present in gonads and produces gametes. It is the modification of
- simple columnar epithelium
 - simple squamous epithelium
 - simple cuboidal epithelium
 - simple ciliated columnar epithelium
8. Cell junctions such as tight junctions, gap junctions, adhering junctions etc are found plenty in
- neural tissue
 - muscular tissue
 - connective tissue
 - epithelial tissue

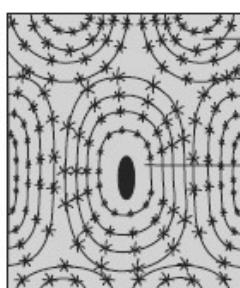
9. Beneath the skin the cells and fibres are loosely arranged in a semi-fluid ground substance. It often serves as a support frame work for epithelium. It contains cells that produce and secrete fibres, macrophages, mast cells etc.

The above description is best suited for

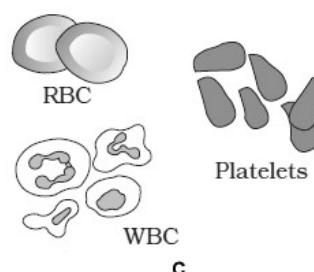
- | | |
|-------------------|--------------------|
| 1) Adipose tissue | 2) Blood and lymph |
| 3) Areolar tissue | 4) Muscular tissue |
10. Which of the following is the hardest tissue in our body
- | | | | |
|-----------|---------|----------|--------------|
| 1) enamel | 2) bone | 3) blood | 4) cartilage |
|-----------|---------|----------|--------------|
11. Identify the diagram given below



A



B



C

- 1) A-cartilage, B-Bone, C-Blood
 2) A-Bone, B-Cartilage, C-Blood
 3) A-Adipose tissue, B-Tendons, C-Blood
 4) A-Areolar tissue, B-Bone, C-Blood
12. Tendon connects muscles to bones, it is an example for
- | |
|--------------------------------------|
| 1) specialised connective tissue |
| 2) dense connective tissue regular |
| 3) dense connective tissue irregular |
| 4) loose connective tissue |
13. Any injury to cartilage takes more time for healing because
- | |
|---|
| 1) cartilage is avascular |
| 2) it has a hard and non pliable ground substance |
| 3) it is a specialised connective tissue |
| 4) it is solid and pliable |
14. The kind of tissue that form the supportive structure in tip of the nose is also found in
- | | |
|----------------------|--------------|
| 1) Internasal septum | 2) Ear lobe |
| 3) Ribs and Sternum | 4) Vertebrae |
15. Which type of neuroglia cells are involved in the formation of myelin sheath in CNS?
- | | | | |
|------------------|--------------------|------------------|---------------|
| 1) Schwann cells | 2) Oligodendrocyte | 3) Kupffer cells | 4) Astrocytes |
|------------------|--------------------|------------------|---------------|

CHAPTER - 02

MORPHOLOGY OF ANIMALS (COCKROACH)

Teaching Points

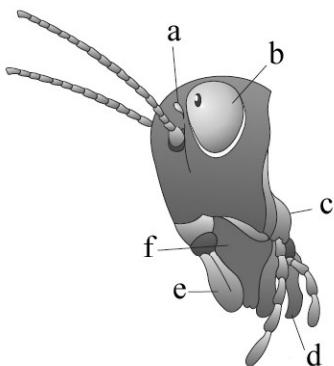
COCKROACH (*Periplaneta americana*)

- “ Taxonomical position,
- “ Habit and habitat
- Body divisions, metamerism
- Legs, podomeres, wings their function, location etc
- Mouth parts, function.
- 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
- Male reproductive system, structure and function
- Female reproductive system, structure and function
- Brood pouch
- Ootheca formation, Nymph
- Paurometabolous metamorphosis

QUESTIONS

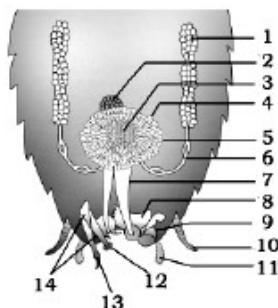
LEVEL - I

1. Cockroaches are brown or black bodies animals that are included in:
 - 1) Class Insecta of Phylum Arthropoda
 - 2) Class Arachnida of Phylum Arthropoda
 - 3) Class Insecta of Phylum Annelida
 - 4) Class Crustacea of Phylum Arthropoda
2. Which of the following statement is not applicable for cockroach?
 - 1) Bright yellow, red and green coloured cockroach have also been reported in tropical region
 - 2) Their size ranges from 1/4 inches to 3 inches [0.6-2.5cm]
 - 3) The adults of the common species of cockroach, *Periplaneta americana* are about 34 - 53 mm long
 - 4) They are diurnal omnivores that live in damp places throughout the world
3. Cockroach and other insects have exoskeleton made up of
 - 1) keratin
 - 2) spongin
 - 3) chitin
 - 4) cuticle
4. In a cockroach the sclerites are joined to each other by
 - 1) Tergum
 - 2) Sternum
 - 3) Arthrodial membrane
 - 4) Pleuron
5. The figure given below shows the head region of a cockroach. Identify the parts labelled a to f.

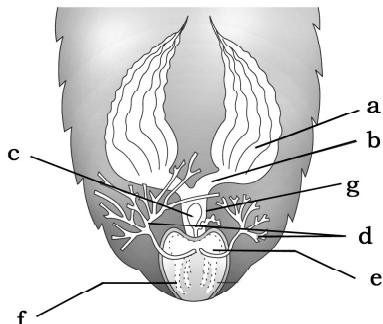


- 1) a - compound eye, b - ocellus, c - maxilla, d - mandible, e - labrum, f - labium
- 2) a - ocellus, b - compound eye, c - maxilla, d - labium, e - labrum, f - mandible
- 3) a - ocellus, b - compound eye, c - mandible, d - maxilla, e - labium, f - labrum
- 4) a - ocellus, b - compound eye, c - maxilla, d - mandible, e - labium, f - labium
6. Which type of vision is found in a cockroach?
 - 1) Binocular
 - 2) Mosaic
 - 3) Nocturnal
 - 4) Both 2 and 3
7. Pronotum is
 - 1) a sclerite seen on abdomen
 - 2) a sternite seen on thorax
 - 3) pleurite seen on metathorax
 - 4) a tergum seen on prothorax

8. The wings which are used for flying in a cockroach are;
 1) Fore wings only 2) Hind wings only 3) Tegmina only 4) Both 1 and 3
9. In cockroach the common duct of salivary reservoir opens at the base of
 1) pharynx 2) maxilla 3) mandible 4) hypopharynx
10. Hepatic caeca of cockroach are present in between
 1) foregut and midgut 2) midgut and hindgut
 3) hypopharynx and pharynx 4) colon and rectum
11. The brain of cockroach is composed of
 1) suboesophageal ganglion 2) circumoesophageal commissure
 3) supraoesophageal ganglion 4) thoracic ganglion
12. Eggs of cockroach are fertilized in
 1) ootheca 2) genital pouch of female 3) cocoon 4) genital chamber of male
13. In the male reproductive system of cockroach phallic gland and anal cerci are marked as



- 1) 2 & 5 2) 2 & 10 3) 2 & 9 4) 3& 6
14. In the reproductive system of a female cockroach a,b,c,d,e,f,g represent



- 1) a - ovary, b- oviduct, c- spermatheca, d- collateral glands, e- genital chamber, f- gonapophysis, g- vagina
- 2) a- ovary, b- oviduct, c- vagina, d- collateral gland, e- genital chamber, f- spermatheca, g- gonapophysis
- 3) a- ovary, b- oviduct, c- spermatheca, c- vagina, e- genital chamber, f- collateral gland, g- gonapophysis
- 4) a- ovary, b- oviduct, c- vagina, d- genital chamber, e- collateral gland, f- genital chamber, g - gonapophysis

15. Collateral glands of a cockroach help in

- | | |
|------------------|-------------------------|
| 1) fertilization | 2) formation of ootheca |
| 3) copulation | 4) metamorphosis |

LEVEL - II

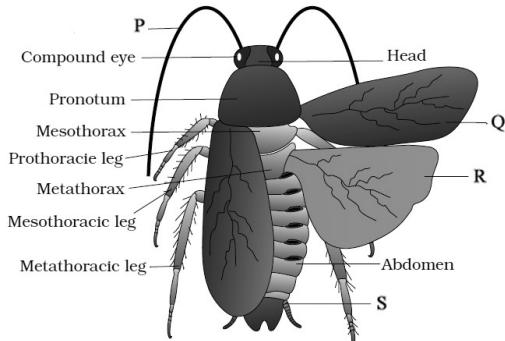
1. Read the following statements about cockroach

- i) In a female cockroach the wings extend beyond the tip of the abdomen
- ii) A pair of thread like antennae arise from the membranous sockets lying in front of eyes
- iii) Head is made up of six segments and shows little mobility due to a slightly flexible neck
- iv) The forewings called tegmina are opaque dark and leathery and cover the hind wings when at rest
- v) The abdomen of both males and females consists of ten segments

Of the above statements

- | | |
|------------------------|-----------------------|
| 1) only two are true | 2) only four are true |
| 3) only three are true | 4) all are true |

2.



Some external features of a cockroach are marked as P, Q, R, S. Identify the function conducted by them in

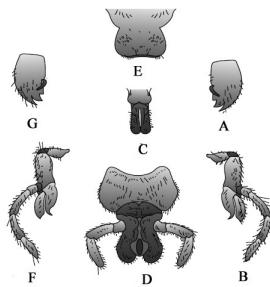
- a) sound detection
- b) flight
- c) wing protection
- d) monitoring of environment

- | | |
|-------------------------------|-------------------------------|
| 1) a - S, b - R, c - Q, d - P | 2) a - S, b - R, c - P, d - Q |
| 3) a - S, b - Q, c - R, d - P | 4) a - S, b - Q, c - P, d - R |

3. Select the mismatch

- | | |
|-----------------------|----------------------------|
| 1) antennae | - sensory receptors |
| 2) metathoracic wings | - opaque dark and leathery |
| 3) gastric caecae | - enzyme secretion |
| 4) crop | - stores food |

4.



Mouth parts of *Periplaneta americana* are marked as A,B,C,D,E,F & G. Identify correctly the structures which

a) helps in grinding and incising

b) acts as tongue

c) responds to touch and smell

1) a - B, b - D, c - F

2) a - A, b - C, c - B

3) a - A, b - D, c - B

4) a - B, b - C, c - A

5. i) Each malpighian tubule is lined by glandular and ciliated cells

ii) Fat body, nephrocytes, urecose glands etc also help in excretion

iii) Head holds a bit of the nervous system while the rest is situated along the belly side of its body

iv) The brain is represented by lateral oesophageal ganglion which supplies nerve to antennae and compound eyes

Of the above statements

1) i and ii are correct and iii and iv are wrong

2) i, ii and iii are correct and iv is wrong

3) i, iii and iv are correct and ii is wrong

4) All are correct

6. In *Periplaneta americana* the ostium of heart chamber guides the flow of blood from :

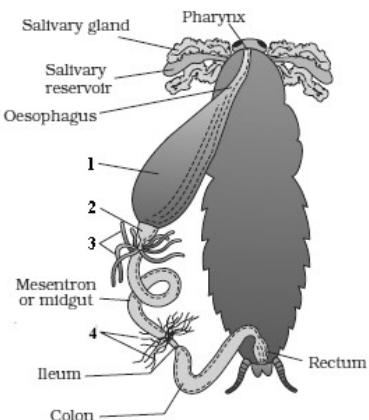
1) Heart to haemocoel

2) Haemocoel to heart

3) One heart chamber to another

4) From anterior to posterior side

7. Identify the structures labelled 1,2,3,4 in the alimentary canal of cockroach



1) 1- stomach, 2 - Hepatic caecae, 3-malpighian tubules, 4- ileum

2) 1-gizzard, 2 - Hepatic caecae, 3 - crop, 4 - malpighian tubules,

3) 1- crop, 2- gizzard, 3- malpghian tubules, 4 - ileum

4) 1- crop, 2 - gizzard, 3- hepatic caecae, 4 - malpighian tubules

8. As a result of the contraction of the tergo- sternal muscles of the abdomen of cockroach

1) air enter into the trachea

2) air goes out of the body

3) pressure decreases inside the tracheal tube

4) spiracles will be closed

9. Read the following statements about a cockroach

i) A cockroach shows a double, solid, ganglionated ventral nerve cord

ii) Three ganglia are seen in thorax and six in abdomen

iii) If the head of a cockroach is cut off, it will still lives for as long as one week

iv) A cockroach shows mosaic vision with more sensitivity but less resolution

v) Malpighian tubules convert nitrogenous waste into urea

Of the above statements

1) Only one is true

2) Three are true

3) Four are true

4) Five are true

10. Which of the following statements are applicable for *Periplaneta americana* ?

i) Crop is used for storing food and seen just after the proventriculus

ii) The entire foregut is lined by cuticle

iii) Blood vessels are poorly developed and open into haemocoel

iv) Visceral organs are located out side the coelom

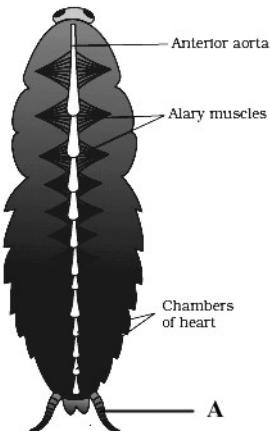
1) ii and iv are applicable

2) ii and iii are applicable

3) iii and iv are applicable

4) ii and iv are applicable

11. Haemolymph of a cockroach shows no haemoglobin because :
- It does not respire
 - It respires through book lungs
 - It respires through skin
 - It has some other means to carry oxygen directly into the tissue
12. Which of the following is the correct statement of the structure labelled 'A' in the diagram ?



- 1) A pair of anal styles
 2) Ovipositor in female
 3) A pair of anal cerci, arise from the 10th segment present in both sexes, used in detecting sound and other vibrations.
 4) Phallomeres, external genitalia of male
13. Which of the following statements are true or false.
- The nymph grows by moulting about 13 times to reach the adult form.
 - The next to last nymphal stage has wing pads but only an adult shows wings.
 - On an average a female cockroach produces 9 - 10 oothecae, each containing 14 - 16 eggs.
 - An ovary shows 16 ovarioles
 - The two compound eyes show about 2000 ommatidia.
- a, b and d are true, c and e are false
 - a, b and c are true, d and e are false
 - a, c and e are true, b and d are false
 - c and e are true, a, b and d are false
14. The young one of cockroach that hatches out from the ootheca is called:
- Nymph
 - Maggot
 - Wriggles
 - Caterpillar
15. The nymph resembles the adult in many aspects, but at the same time it differs in some aspects. Gradually the differences will be settled. This type of metamorphosis is called
- Holometabolous type / complete metamorphosis
 - Paurometabolous type / gradual metamorphosis
 - Hemimetabolous type / Incomplete metamorphosis
 - Hypermetabolous type / Hyper metamorphosis

CHAPTER - 03

BIOMOLECULES

Teaching Points

- 1. Organic analysis of tissue**
- 2. Inorganic analysis**
- 3. Carbohydrates**
 - A) Monosaccharides
 - B) Disaccharides
 - C) Polysaccharide
- 4. Proteins**
 - A) Functional classification of proteins
 - B) Aminoacids
 - C) Classification of Aminoacids
 - D) Zwitter ion
 - E) Structure of proteins
 - F) Denaturation of proteins
- 5. Lipids**
 - A) Fatty acids
 - B) Phospholipids
 - C) Sterol
- 6. Enzymes**
 - A) Holoenzyme
 - B) Classification of enzyme
 - C) Factors effecting enzyme activity
 - D) Enzyme inhibition
 - E) Mechanism of enzyme action
- 7. Nucleic acids**

QUESTIONS**LEVEL - I**

1. Some living tissues grind with trichloro acetic acid and the thick slurry is filtered through cheese cloth- two fractions obtained: **A**- filtrate/ Acid soluble pool and **B**-retentate/ acid insoluble fraction.
- I) Molecular weight ranging from 18-800 Daltons approximately
 - II) Has four types of organic compounds
 - III) Contains chemicals that have molecular weight more than 800 Da
 - IV) Has monomers
 - V) Has generally polymers
 - VI) Represent chemical rough composition of cytosol
 - VII) Represent the frame work of cytoplasm and cell organelles.
- Which of the following is the correct statements (I toVII) for A and B

A**B**

- | | |
|---------------|-----------------|
| 1) I, II, III | IV, V, VI, VII |
| 2) II, IV, VI | I, III, IV, VII |
| 3) I, IV, VI | II, III, V, VII |
| 4) I, III, V | II, IV, VI, VII |
2. Inorganic compounds like sulphate, phosphate etc. are found in:
- 1) Acid soluble pool
 - 2) Acid insoluble fractions
 - 3) Both acid soluble pool and acid insoluble pool
 - 4) Not found in cellular pool
3. In order to produce amino acids from methane, how many substituents should occupy the valency position of carbon
- 1) 1
 - 2) 5
 - 3) 2
 - 4) 4
4. Match column-I with column-II and chose the correct option
- | Column -I | Column-II |
|------------------|--------------------------|
| a) Acidic | i) Valine |
| b) Basic | ii) Lysine |
| c) Neutral | iii) Glutamic acid |
| d) Aromatic | iv) Tyrosine, Tryptophan |
- 1) a –iii, b-ii, c-i, d- iv
 - 2) a-ii, b-iii, c-iv, d-i
 - 3) a-iv, b-l, c-ii, d-iii
 - 4) A-l, b-ii, c-ii, d-iv
5. The charged molecule which is electrically neutral is known as
- 1) Amide
 - 2) Amino acid
 - 3) Zwitterion
 - 4) Polar amino acid

6. Which one is false?
- 1) Fatty acids may be unsaturated (with one or more C=C bonds) or a saturated (without double bonds)
 - 2) Fatty acid(s) may be esterified with glycerol forming monoglyceride, diglyceride and triglyceride
 - 3) Fats and oils are triglycerides
 - 4) Cholesterol has a central sterol nucleus made of five hydrocarbon ring and an amino group
7. Adenosine, guanosine, thymidine, uridine, cytidine are all _____ but adenylic acid, guanylic acid, uridylic acid, cytidylic acid are _____.
- 1) Nucleotides, nucleosides
 - 2) Nucleosides, nucleotides
 - 3) Nucleotides, nucleic acids
 - 4) Nucleotides, nucleases
8. Which of the following statement is **false**
- 1) Secondary metabolites are derivatives of primary metabolites.
 - 2) Many secondary metabolites are economically important.
 - 3) Some secondary metabolites have ecological importance.
 - 4) Secondary metabolites have restricted distribution in the plant kingdom only.
9. The correct order of chemical composition of living tissue or cells in terms of % of the total cellular mass is;
- 1) Nucleic acid > Proteins > Water > Carbohydrate > Ions > Lipid
 - 2) Water > proteins > nucleic acid > carbohydrates > Lipid > Ions
 - 3) Water > proteins > carbohydrates > Nucleic acids > lipid > Ions
 - 4) Lipid > Ions > Carbohydrates > water > proteins > nucleic acid
10. Which of the following are physically and chemically the most diverse in cells
- 1) Proteins
 - 2) DNA
 - 3) RNA
 - 4) Lipids
11. Primary structure of protein is due to the presence of
- 1) Hydrogen bonds
 - 2) Peptide bonds
 - 3) Ester bond
 - 4) Disulphide bond
12. Match the column I with column II
- | Column I | Column II |
|-----------------|---|
| A) Collagen | i) Glucose transport |
| B) Trypsin | ii) Binding with some chemicals for smell, taste and hormones |
| C) Insulin | iii) Hormones |
| D) Antibody | iv) enzymes |
| E) Receptor | v) Intercellular ground substances |
| F) GLUT-4 | vi) Fight infectious agents |
- 1) A-v, B-iv, C-iii, D- vi, E-ii, F-i
 - 2) A-ii, B-iii, C-iv, D-v, E-vi, F- i
 - 3) A-vi, B-ii, C-I, D-v, E-iv, F-iii
 - 4) A-I, B-iv, C-iii, D-vi, E-ii, F-v

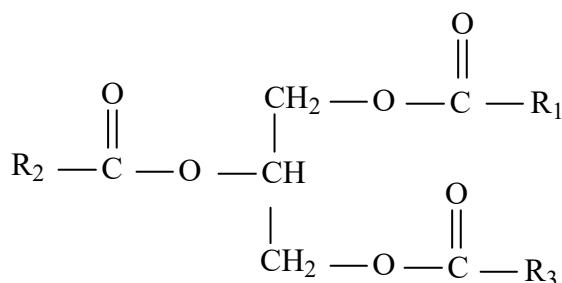
13. In animal world the most abundant protein is _____ while in the whole biosphere the most abundant protein is _____
- Albumin & keratin
 - Glycoprotein & lipoprotein
 - Elastin & myosine
 - Collagen & RuBisCo
14. Which of the following statements are correct?
- Right end of polysaccharide is called reducing end while left end is called non-reducing end
 - Starch can hold I_2 molecule in its helical secondary structure but cellulose being non helical, cannot hold I_2 .
 - Chitin, a complex homo polysaccharide occurring in exoskeleton of arthropods consists of N-acetyl glucosamine (NAG)
 - starch in plant and glycogen in animal are storehouse of energy.
- I and IV are correct
 - II and III are correct
 - Only IV is correct
 - All are correct.
15. The most common monomer of carbohydrate is:
- Glucose
 - Fructose
 - Ribose
 - Deoxyribose
16. Bond present between two nucleosides of a polynucleotide is :
- Peptide bond
 - Hydrogen bond
 - High energy phosphate bond
 - Phosphodiester bond
17. A Glycosidic bond occurs in which of the following biomolecules
- Adenine and Thymine
 - Protein and Carbohydrate
 - Carbohydrate and Fats
 - Carbohydrate and DNA
18. A nucleoside is composed of
- Nitrogenous base+ sugar +phosphate
 - Nitrogenous base
 - Nitrogenous base+ sugar moiety
 - Sugar moiety + phosphate
19. Identify the wrong statement
- Nucleic acid exhibits a wide variety of secondary structure
 - Back bone of DNA is formed of sugar – phosphate- nitrogen base chain
 - Each DNA strand appears a helical staircase and step represented by a pair of nitrogen base.
 - DNA strand turns 34° .
 - In B-DNA one full turn of helical strand involve 10 base pairs and the pitch would be 34A^0 .
 - The distance between two nucleotides in a chain is 3.4A^0 .
- B and F are wrong
 - A and D are wrong
 - C and F are wrong
 - B and D are wrong
20. The diameter of DNA molecule is :
- 20A^0
 - 10A^0
 - 34A^0
 - 36A^0

21. Choose the incorrect statement
- I) Assembly of a protein from amino acids requires energy
 - II) When glucose is degraded into lactic acid in our muscles energy is liberated
 - III) Bond energy (ATP) is utilized for biosynthesis, osmotic and mechanical work that we perform
 - IV) Majority of metabolic reactions can occur in isolation
 - V) There are many examples of uncatalysed metabolic reactions.
- 1) All 2) None 3) IV and V 4) I and II
22. Choose the **incorrect** statement (s)
- 1) The living state is a non-equilibrium steady state to be able to perform work
 - 2) The constant flow of material or energy in and out of cell prevent from reaching equilibrium
 - 3) Living state and metabolism are synonymous
 - 4) None
23. Which of the following statement about enzyme is true
- I) Enzymes are proteins whose three dimensional shape is key to their functions
 - II) Some RNAs also are enzymes
 - III) Enzymes speed up reactions by lowering activation energy
 - IV) Enzymes are highly specific for reactions
 - V) An enzyme like any protein has the secondary and tertiary structure
 - VI) The energy input needed to start a chemical reaction is called activation energy.
- 1) All except V 2) V and VI 3) II and III 4) All
24. The steps in catalytic cycle of an enzyme action are given in random order
- i) The enzyme releases the products. Now enzyme is free to bind another substrate
 - ii) The active sites, now in close proximity of substrate breaks the bond of substrate and E-P complex forms
 - iii) Binding of substrate induces the enzyme to alter its shape fitting more tightly around the substrate
 - iv) The substrate binds to the active site of enzyme ie. Fitting to the active site.
- The correct order
- 1) i, ii, iii, iv 2) iv, iii, ii, i 3) i, iii, ii, iv 4) i, ii, iv, iii
25. Which of the combination is correct
- 1) Metal ions loosely attached with apoenzyme- Activators
 - 2) Non-protein organic part attached to apoenzyme firmly – prosthetic group
 - 3) Non protein organic part attached loosely to apoenzyme –Coenzyme
 - 4) All of the above.

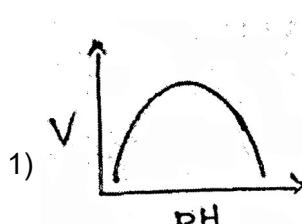
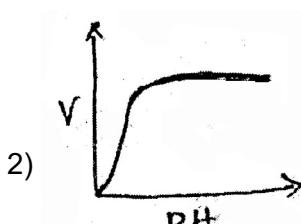
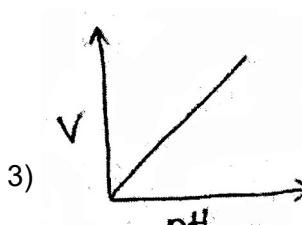
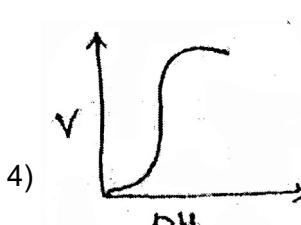
LEVEL II

1. When we homogenize any tissue in an acid, the acid soluble pool represents
- 1) Cytoplasm 2) Cell membrane 3) Nucleus 4) Mitochondria

2. Lipid comes under acid insoluble fraction during analysis of chemical composition of tissues. Why?
- It has low molecular weight
 - It has high molecular weight
 - It is polymer
 - On grinding, the biomolecules are broken into pieces and form insoluble vesicles.
3. The most abundant mineral of the animal body
- Potassium
 - Sodium
 - Calcium
 - Iron
4. The physical and the chemical properties of amino acids are essentially of the:
- Only amino group
 - Only the carboxyl group
 - Only the R functional group
 - Amino, Carboxyl and R groups
5. Corn is immersed in the boiling water. It is then cooled, the solution becomes sweet. It is due to
- Enzymes are inactivated in boiling water
 - Disaccharides are converted to monosaccharide.
 - Monosaccharides are converted to disaccharides.
 - None of these
6. The most diverse molecule in a cell are :
- Lipids
 - Carbohydrates
 - Proteins
 - Nucleic acids
7. Which of the following statement is true about the 1° (primary) structure of protein
- The helical or beta sheet structure of the protein
 - Subunit structure of protein
 - Three dimensional structure of protein.
 - The sequence amino acids joined by polypeptide bond.
8. Identify the biomolecule with the given molecular structure :

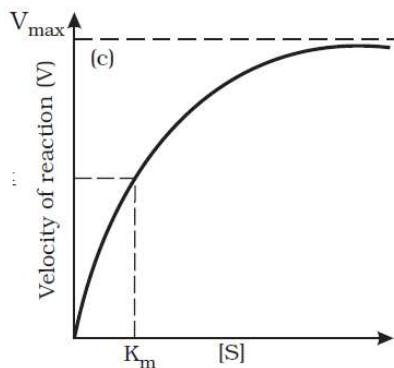


- Trisaccharide
 - Tripeptide
 - Triglyceride
 - Trinucleotide
9. Lecithin is
- Phospholipids
 - Carbohydrate
 - Protein
 - amino acid

10. Identify the substance having Glycosidic bond and peptide bond respectively:
 - 1) Glycerol & Trypsin
 - 2) Cellulose & Lecithin
 - 3) Inulin & Insulin
 - 4) Chitin & Cholesterol
11. A segment of double stranded DNA has 120 adenine and 120 cytosine bases. The total number of nucleotides present in the segment is
 - 1) 120
 - 2) 240
 - 3) 60
 - 4) 480
12. Anti parallel strands of a DNA molecules means that
 - 1) The phosphate group of the two DNA strands, at their ends share the same position
 - 2) The phosphate groups at the start of two DNA strands are in opposite position (pole).
 - 3) One strand turns clockwise
 - 4) One strand turns anti-clockwise
13. A protein having enzymatic activity is :
 - 1) Collagen
 - 2) Trypsin
 - 3) Tubulin
 - 4) Actin
14. Which of the following structure is necessary for the activity of enzymatic proteins :
 - 1) Alpha-helix
 - 2) Primary structure
 - 3) Tertiary structure
 - 4) Beta -sheet
15. Which one of the following graph shows the effect of pH on the velocity of a typical enzymatic reaction?
 - 1) 
 - 2) 
 - 3) 
 - 4) 

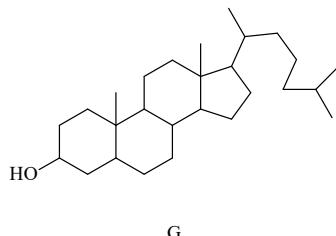
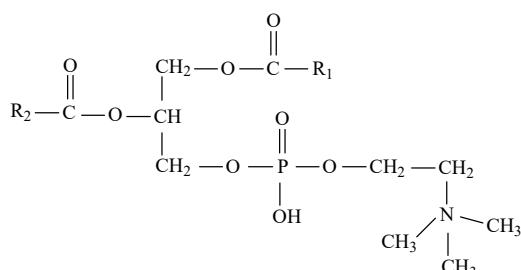
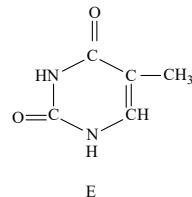
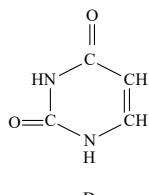
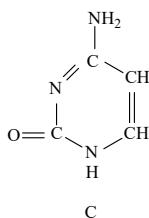
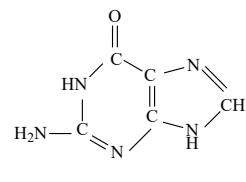
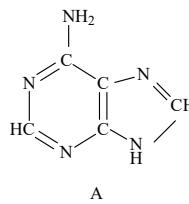
16. How many types of subunits does hemoglobin possess?
 - 1) 1
 - 2) 4
 - 3) 2
 - 4) 3
17. Transition state structure of the substrate formed during an enzymatic reaction is :
 - 1) Permanent and stable
 - 2) Transient but stable
 - 3) Transient and unstable
 - 4) Permanent but unstable

18. From the graph which of the following conclusion can be made?



- 1) Velocity decreases with increase in substrate concentration
 - 2) K_m is the substrate concentration at $\frac{1}{2} V_{\max}$
 - 3) At V_{\max} enzyme has maximum number of free active sites
 - 4) High value for K_m indicates more affinity of enzyme for its substrate
19. Inhibitor binds to the active site of the enzyme, hence blocking the reaction. This is an example of
- 1) Allosteric inhibition
 - 2) Feedback inhibition
 - 3) Non-competitive inhibition
 - 4) Competitive inhibition
20. The fastest enzyme is
- 1) DNA polymerase
 - 2) Carbonic anhydrase
 - 3) Carbonic dehydrogenase
 - 4) DNA ligase
21. Enzymes, vitamins and hormones are common in
- 1) Enhancing oxidative mechanism
 - 2) Being synthesized in the body of organisms
 - 3) Being proteinaceous
 - 4) Regulatory metabolism

22. Identify A, B, C, D, E, F & G



F

- 1) Adenine, Guanine, Thymine, Cytosine, Uracil, Lecithin, Cholesterol
 - 2) Adenine, Guanine, Cytosine, Uracil, Thymine, Lecithin, Cholesterol
 - 3) Guanine, Adenine, Thymine, Cytosine, Uracil, Lecithin, Cholesterol
 - 4) Guanine, Adenine, Cytosine, Uracil, Thymine, Lecithin, Cholesterol

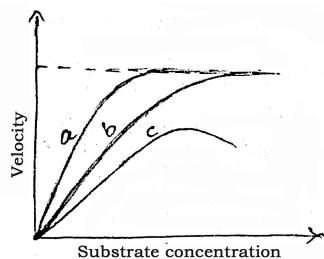
23. Glycogen is a :

- 1) Branched heteropolysaccharide 2) Unbranched heteropolysaccharide
3) Branched homopolysaccharide 4) Unbranched homopolysaccharide

24. A phosphoglyceride is always made of:

- 1) Only an un saturated fatty acid esterified to glycerol molecule to which a phosphate group is also attached.
 - 2) A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
 - 3) A saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule.
 - 4) Only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached.

25. The figure given below shows three velocity - substrate concentration curves for enzyme reaction. What do the curves a, b and c depict respectively?



- 1) a - normal enzyme reaction ; b - competitive inhibition ; c - non-competitive inhibition
2) a - competitive inhibition ; b - non-competitive inhibition ; a - normal enzyme reaction
3) a - non-competitive inhibition ; b - normal enzyme reaction ; c - competitive inhibition
4) a - normal enzyme reaction ; b - non-competitive inhibition ; c - competitive inhibition

CHAPTER - 04

DIGESTION AND ABSORPTION

Teaching Points

Nutrition : The nutrition is the procurement of substances necessary for growth, maintenance and physiology of a living body.

Animals are heterotrophs. So they have to depend directly or indirectly on plants for their nutritional requirements. The food is required to derive energy to perform work, to synthesize material, to grow and to maintain various activities of life.

Modes of Animal Nutrition

Higher animals resort to holozoic nutrition. On the basis of food, holozoic animals may be

Herbivores eg : Cow, Horse

Carnivores eg : Tiger, Frog

Omnivores eg : Man, Cockroach

Detritivores eg : Earthworm

Coprophages eg : Rabbit, Guinea pig

Sanguivores eg : Leech, petromyzon

Cannibals eg : Snake, Spiders

Steps in Holozoic nutrition

1. Ingestion - intake of food into alimentary canal

2. Digestion - Process by which complex food is converted into simple absorbable forms. eg : Starch → glucose

3. Absorption - Intake of digested food into blood or lymph through wall of small intestine

4. Egestion - Elimination of undigested food as faeces.

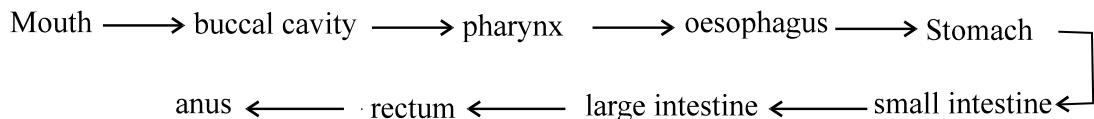
Assimilation is the utilisation of absorbed food materials for synthesis of complex components in living tissues or to get energy.

Human Digestive System

The digestive system consist of alimentary canal (GIT) and associated digestive glands.

Alimentary canal is a hollow coiled muscular and glandular tube that extends from mouth to anus . It's length is 6-9 m.

The different parts are : -

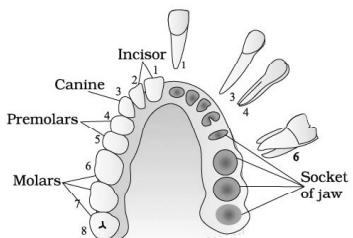


The digestive glands are classified into three types. Accessory glands, mucosal glands and submucosal glands

- 1) Accessory digestive glands are salivary glands, liver and pancreas
- 2) Mucosal glands are Goblet cells, gastric glands and crypts of Lieberkuhn
- 3) Submucosal glands - Brunner's glands in submucosa of duodenum

Mouth is a transverse slit bounded by upper and lower lips. Oral cavity is guarded by upper and lower jaw.

Teeth : Human teeth are heterodont, diphodont and thecodont. Heterodont teeth include incisors, canines, premolars and molars. Diphodont means two sets of teeth in a life span, ie milk dentition and permanent dentition. Thecodont means fixing teeth in sockets of jaw bone for better anchoring. Each tooth has three parts root, neck and crown. The crown is coated with enamel, the hardest material in human body. Dentine is secreted by odontoblasts and enamel is secreted by ameloblasts. Wisdom teeth are the last to appear. Incisors are for cutting, canines for tearing and premolars and molars for grinding. A human adult has 32 teeth .



$$\text{Dental formula of human adult} = \frac{2123}{2123}$$

$$\text{Dental formula of Deciduous teeth} = \frac{2102}{2102}$$

Number of deciduous teeth is 20. The teeth and tongue masticates food. The tongue is the gustatory organ . It detects sweet, salt, sour and bitter tastes. Papillae are small projections of the upper surface of tongue. In man they are of 3 types

1. Circumvallate
2. Fungiform and
3. Filiform

Circumvallate and fungiform serve as taste buds but filiform is devoid of taste buds.

Tongue: This movable muscular voluntary organ occupies the buccal floor. Tongue muscles are connected to hyoid.

Functions of tongue.

1. The gustatory organ
2. Helps in mastication
3. Universal tooth brush (teeth cleaning)
4. Articulated speech
5. Deglutition

Pharynx : It is the common passage for food and air. Epiglottis prevents the entry of food into the glottis. Uvula closes the nasopharynx during deglutition. The pharynx is divided into three parts.

1. Nasopharynx
2. Oropharynx and
3. Laryngopharynx

Oesophagus : 25 cm long - passes through diaphragm and opens into the stomach

Stomach : 'J' shaped bag below diaphragm. It is for mixing of food - Churning

Ruminant stomach has 4 chambers : - Rumen, Reticulum, Omasum and Abomasum

Cardiac sphincter controls the bolus entry into stomach and pyloric sphincter controls exit of chyme.

Small intestine : Longest part of alimentary canal, 6.25 m in man. Duodenum, jejunum and ileum are the three parts of the small intestine. The mucosa of duodenum and jejunum is thrown into circular mucosal folds called valves of kerckring. The mucosa of ileum has finger like projections known as villi. Duodenum is the main site of digestion . Ileum is the main site of absorption of digested food . **Large intestine** : - Has three parts ie caecum, colon and rectum. Anus is controlled by anal sphincters. Vermiform appendix is connected to caecum. Caecum & appendix are vestigial organs.

Digestive glands

1. Salivary glands are three pairs
 - a) Parotid glands - Stensen's duct
 - b) Submandibular - Wharton's duct
 - c) Sublingual glands - Bartholin's duct

Salivary glands secrete saliva. It contains 99.5% of water, mucus, salts, salivary amylase, lysozyme and thiocyanates.

pH of saliva is 6.8. The salivary glands secrete 1.0 to 1.5 litres of saliva / day.

2. **Gastric glands** are mucosal glands of stomach. The secretion is gastric juice. Digestion of proteins and absorption of simple sugars, alcohol and medicines occur in stomach. pH of gastric juice is 1.8.

3. **Liver** : Largest and heaviest gland in the body Hepatic lobules are the structural and functional units of the liver. The liver secretes bile $pH = 7.6 - 8.6$

Functions of bile

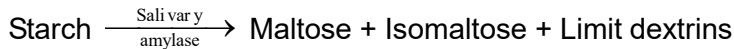
1. Emulsification of fat
2. Absorption of fat soluble vitamins
3. Make chyme alkaline

4. **Pancreas** : is a mixocrine gland ie both exocrine and endocrine. The exocrine part secretes various digestive enzymes. The endocrine part secretes insulin, glucagon and somatostatin.

5. **Crypts of Lieberkuhn** : - Its secretion is succus entericus (Intestinal juice). It contains enzymes mainly for final digestion

Digestion

1. In oral cavity and oesophagus



The masticated food is bolus and it is swallowed down to stomach.

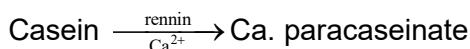
Digestion in Stomach

Functions of HCl

1. Inactivates salivary amylase
2. Makes the medium acidic
3. Kills micro organisms
4. Pepsinogen $\xrightarrow{\text{HCl}}$ pepsin



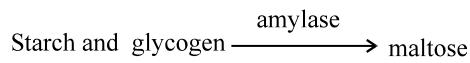
Pepsin and rennin are proteolytic enzymes.



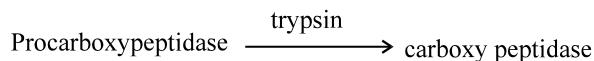
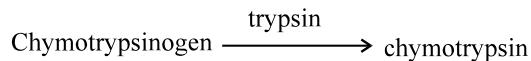
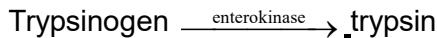
Digestion in Small intestine

Chyme enters into duodenum and it is acted by pancreatic enzymes, bile and finally by enzymes of succus entericus.

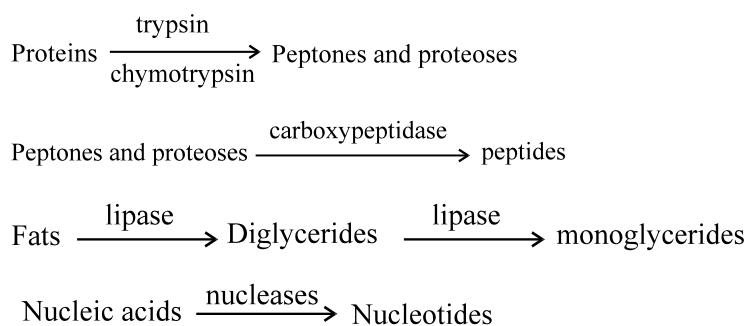
Digestion by pancreatic enzymes



Trypsinogen, chymotrypsinogen and procarboxypeptidases are activated respectively as follows.



Proteolytic enzymes from pancreas are trypsin, chymotrypsin and procarboxypeptidase



Function of bile salts

Bile doesn't contain digestive enzymes.

Fats $\xrightarrow{\text{bile salts}}$ emulsified fats / micelles

Digestion by enzymes of succus entericus

Enzymes of succus entericus are for final digestion which occur close to microvilli

Maltose $\xrightarrow{\text{maltase}}$ Glucose + Glucose

Lactose $\xrightarrow{\text{lactase}}$ Glucose + Galactose

Sucrose $\xrightarrow{\text{sucrase}}$ Glucose + fructose

Peptides $\xrightarrow{\text{amino peptidase}}$ Dipeptides and aminoacids

Dipeptides $\xrightarrow{\text{dipeptidase}}$ aminoacids

Fats / Diglycerides / monoglycerides $\xrightarrow{\text{lipase}}$ Glycerol + Fatty acids

Nucleotides $\xrightarrow{\text{Nucleotidase}}$ nucleosides $\xrightarrow{\text{nucleosidase}}$ pentose sugar + N₂ base
 ↓ phosphates

The digested end products are absorbed into blood and lymph through the epithelial lining of the intestinal villi. The different processes are

- 1. active transport.
- 2. facilitated transport
- 3. osmosis
- 4. simple diffusion

The undigested food, mucus, water etc enters into caecum through ileo- caecal valve. Ileocaecal valve prevents back flow of faecal matter. Most of the water is absorbed in the large intestine. The undigested food becomes semisolid in nature and then enters into the rectum, anal canal and is finally ejected (defaecation) out through the anus.

Caloricfic value of foods -Brain pointer

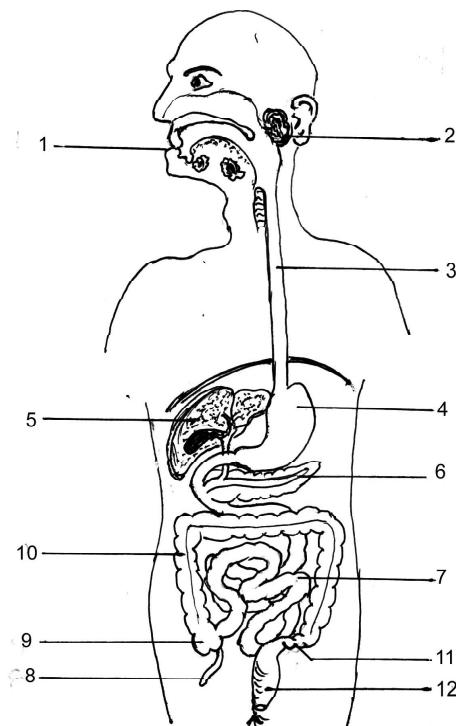
Disorders of digestive system

Infections of intestinal tract is caused by bacteria, virus, tape worm, round worm, thread worm, hook worm, pin worm etc.

QUESTIONS

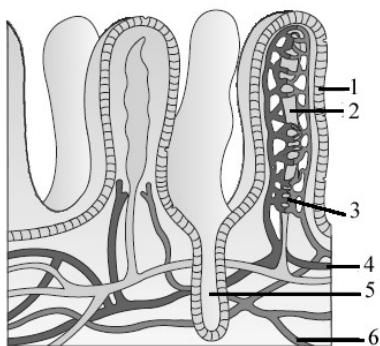
LEVEL - I

1. Appendix, sigmoid colon, parotid gland and pancreas are marked respectively as



- 1) 9,12,3 and 7 2) 5,6,11 and 12 3) 8,11,2 and 6 4) 8,2,6 and 11
2. In mammals, the teeth are
- i) Of different types
 - ii) Embedded in the cup like sockets of the jaw bone
 - iii) Two sets may appear in life
- These conditions are referred to as
- 1) Heterodont, Pleurodont, Polyphyodont 2) Heterodont, Pleurodont, Diphyodont
 - 3) Heterodont, Acrodont, Diphyodont 4) Heterodont, Thecodont, Diphyodont
3. Find different types of teeth and their number in an adult human being
- 1) Incisors (8), Canines(4), Premolars (0), Molars(12)
 - 2) Incisors(4), Canines(8), Premolars(8), Molars(12)
 - 3) Incisors (8), Canines(4), Premolars(12), Molars(8)
 - 4) Incisors(8), Canines(4), Premolars(8), Molars(12)

4. A baby boy aged two years is admitted to play school and passes through a dental check up. The dentist observed that the boy had twenty teeth. Which teeth were absent?
- 1) Incisors
 - 2) Canines
 - 3) Premolars
 - 4) Both 1 and 3
5. Select the incorrect sequence regarding human digestive tract.
- 1) Stomach → small intestine → large intestine
 - 2) Pylorus → fundus → duodenum
 - 3) Duodenum → jejunum → ileum
 - 4) Caecum → colon → rectum
6. Identify the labels 1,2,3,4,5, and 6 respectively in the following figure of T.S of small intestine



- 1) 1- Villus, 2 - Lacteal, 3 - Capillaries, 4- vein, 5 - Crypts, 6 - Artery
 2) 1 - Villus, 2- Lacteal, 3 - Vein, 4 - Artery, 5 - Crypts, 6 - Capillaries
 3) 1- Villus, 2 - Lacteal, 3 - Artery, 4 - Vein, 5 - Crypts, 6 - Capillaries
 4) 1 - villus, 2- Lacteal, 3 - Capillaries, 4 - Artery, 5 - Crypts, 6 - Vein
7. Match column I with column II and select the correct option from the codes give below

Column I**[Sphincter]**

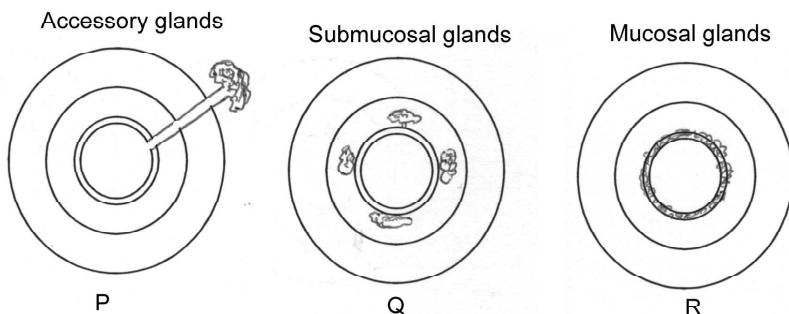
- a) Internal anal sphincter
- b) Cardiac Sphincter
- c) Sphincter of Oddi
- d) Ileo caecal valve
- e) Pyloric sphincter

Column II**[Location]**

- i) Opening of hepato pancreatic duct into duodenum
- ii) Between duodenum and posterior stomach
- iii) Guarding the terminal part of alimentary canal
- iv) Between oesophagus and anterior stomach
- v) Between small intestine and large intestine

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

8. The three types of digestive glands are represented below

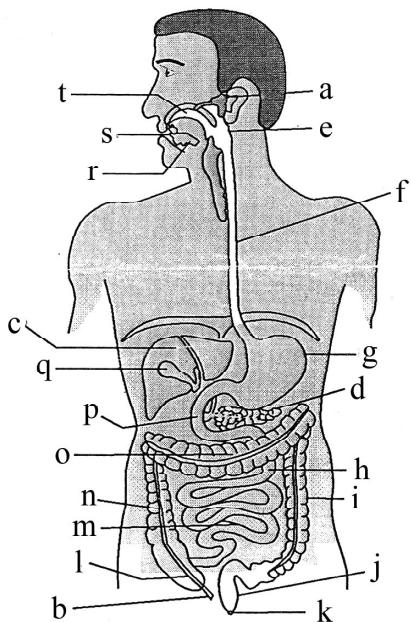


Classify the following example under P,Q and R

- | | | |
|-------------------|--------------------|--------------------------|
| i. Salivary gland | ii. Gastric gland | iii. Liver |
| iv. Pancreas | v. Brunner's gland | vi. Crypts of Lieberkuhn |

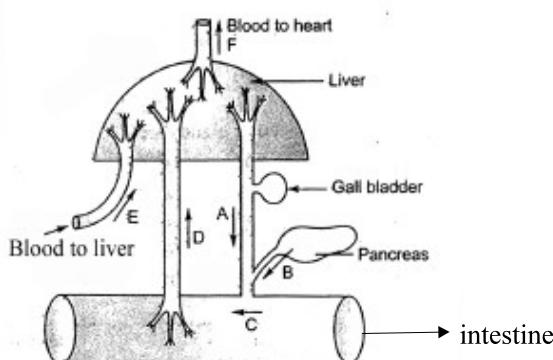
	P	Q	R
1)	ii, iii	v, vi	i, iv
2)	I, iii, iv	v	ii, vi
3)	I, ii, iii	iv, v	vi
4)	iii, iv	ii, vi	I, v

9. Identify the labelled parts and find the correct match from the following



- 1) a → largest salivary gland, b → Vestigial organ, c → Mixed gland, d → Largest gland
- 2) a → largest gland, b → Haustra, c → Vestigial organ, d → Mixed gland
- 3) a → largest salivary gland, b → Vestigial organ, c → Temporary stored bile, d → largest gland
- 4) a → largest salivary gland, b → Vestigial organ, c → Largest gland, d → Mixed gland

10. How many statements are true about human liver?
- The hepatic lobules are the structural and functional units of liver
 - Largest gland of the body weighing about 2.5 to 4kg in an adult human being
 - Liver is situated in the abdominal cavity, just below the diaphragm
 - Each hepatic lobule is covered by thin epithelial tissue sheath called the Glisson's capsule
- one
 - two
 - three
 - four
11. Identify the visceral organ from the following information
- Kupffer cells are found in it
 - Glycogenesis occurs in it
 - It is the centre for deamination and detoxification
 - Produces blood clotting factors
- Pancreas
 - Liver
 - Spleen
 - Duodenum
12. The diagram below shows how things get into and from the liver

Liver

Blood vessel (F) contains high concentration of

- Ammonia
 - Bile
 - Uric acid
 - Urea
13. Which of the following are the contents of gastric juice?
- Mucus, Pepsinogen, HCl, Ptyalin and CIF
 - Mucus, HCl, Pepsinogen, Prorennin and CIF
 - Mucus, Histamine, HCl, Serotonin and lysozyme
 - Mucus, Pepsinogen, HCl, histamine and trypsin

14. Match the types of cells listed under column I with the secretions given under column II. Choose the answer which gives the correct combination of the alphabets of the two columns.

Column I

(type of cells)

1. Beta cells
2. Peptic cells
3. Paneth cells
4. Acinar cells

Column II

(Secretions)

- p. Lysozyme
- q. Pepsinogen
- r. Insulin
- s. Pancreatic enzyme

- 1) 1 → q, 2 → p, 3 → r, 4 → s
- 2) 1 → r, 2 → q, 3 → p, 4 → s
- 3) 1 → r, 2 → p, 3 → q, 4 → s
- 4) 1 → s, 2 → p, 3 → p, 4 → r

15. Read the following statements and select the wrong one.

- 1) Lysozyme present in saliva acts as antibacterial agent that prevent infection
- 2) Paneth cells are present in small intestine and secrete major parts of intestinal juice
- 3) The intestinal mucosal epithelium has unicellular gland called goblet cells which secrete mucus
- 4) Exocrine part of pancreas is acini and it secrete pancreatic juice

16. Secretions of digestive glands and their amount and contents are given below. Find out the incorrect matches.

	Secretions	Amount	Contents
1)	Saliva	1-1.5 L/day	Ptyalin, lysozyme
2)	Bile	800-1000 ml/day	Lipase, amylase
3)	Pancreatic juice	1-1.5L/day	Amylopsin, Nuclease
4)	Succus entericus	1.5 - 3L/day	Lactase, Nucleotidase

17. Select the option for the correct completion

1) Pepsinogen \xrightarrow{a} Pepsin

2) Trypsinogen \xrightarrow{b} Trypsin

3) Chymotrypsinogen \xrightarrow{c} Chymotrypsin

1) a - Enterokinase, b- Trypsin, c- HCl

2) a - HCl, b- Enterokinase, c- Bile

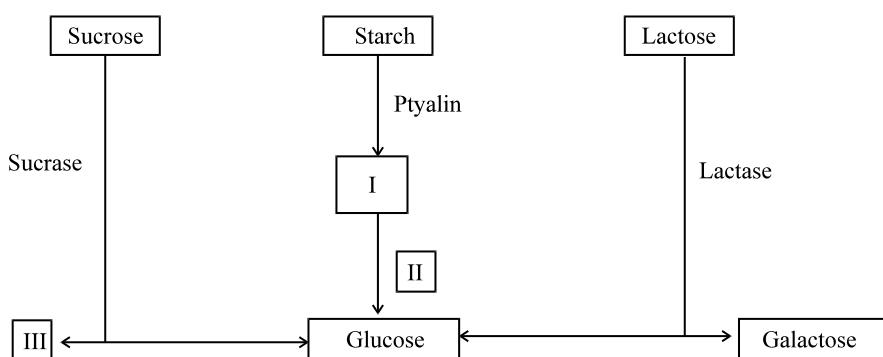
3) a- HCl, b - Rennin, c - Trypsin

4) a - HCl, b - Enterokinase, c- Trypsin

18. Select the correct set which shows the name of the enzyme, from where it is secreted and substrate up on which it acts

Enzymes	Source	Substrate
1) Nucleases	Pancreas	Nucleotides
2) Lactase	Pancreas	Lactose
3) Pepsin	Stomach wall	Protein
4) Lipase	Liver	Fat

19. Carbohydrate digestion



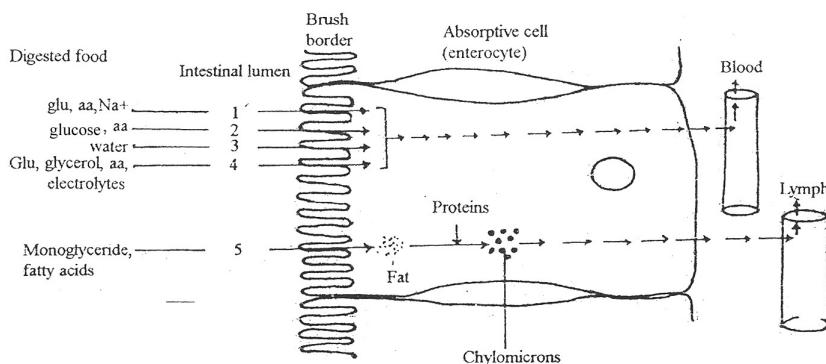
I, II and III represents.....,.....andrespectively

- | | |
|---------------------------------|---------------------------------|
| 1) Maltase, Maltose, Glucose | 2) Maltose, Maltase, Fructose |
| 3) Amylase, Maltose, Aminoacids | 4) Isomaltose, Lactase, Pentose |
20. What are the substrates and products of the digestive enzyme sucrase?
- 1) Sucrose → glucose and galactose
 - 2) Sucrose → glucose and fructose
 - 3) Proteins → peptones and proteoses
 - 4) Monoglycerides → fatty acids and glycerol
21. The intestinal mucosa is protected from acid with the help of
- 1) bilirubin and biliverdin
 - 2) saliva and HCl
 - 3) mucus and bicarbonates
 - 4) insulin and glucagon
22. Consider the following statements
- i) Carbohydrates & proteins have same physiological value.
 - ii) Crypts of Lieberkuhn occur in liver
 - iii) Lipase is pancreatic amylase
- | | |
|---------------------------|-----------------------------|
| 1) ii and iii are correct | 2) ii and iii are incorrect |
| 3) i and ii are incorrect | 4) i and iii are correct |

23. Gross calorific value of carbohydrates, proteins and fats areand.... respectively

- 1) 4 k cal/g, 4 k cal/ g, 9 k cal/g
- 2) 4.1 k cal/ g, 5.65 k cal/g, 9 k cal/g
- 3) 4 k cal/g, 5.65 k cal/g, 9.45 k cal/g
- 4) 4.1 k cal/g, 5.65 k cal/g, 9.45k cal/g

24. Absorption of digested food



The process labelled 3 is

- | | |
|---------------------|--------------------------|
| 1) Active transport | 2) Facilitated transport |
| 3) Osmosis | 4) Simple diffusion |

25. The abnormal frequency of bowel movements and increased liquidity of the faecal discharge is known as

- | | | | |
|-----------------|--------------|-------------|-------------|
| 1) constipation | 2) diarrhoea | 3) vomiting | 4) jaundice |
|-----------------|--------------|-------------|-------------|

LEVEL - II

1. The number of teeth in human milk dentition and permanent dentition are respectively

- | | | | |
|-------------|--------------|------------|--------------|
| 1) 8 and 12 | 2) 32 and 20 | 3) 4 and 8 | 4) 20 and 32 |
|-------------|--------------|------------|--------------|

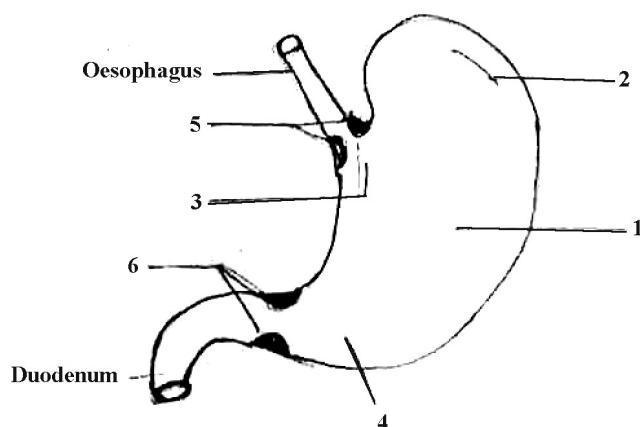
2. Find the incorrect statement

- 1) Stomach is 'J' shaped bag and duodenum is 'C' shaped tube
- 2) Pharynx serves as a common passage for food and air
- 3) From oesophagus to duodenum, the parts of stomach are cardiac, body, fundic and caecum portions
- 4) Caecum hosts symbiotic micro-organisms

3. Which one of the following statement is incorrect?

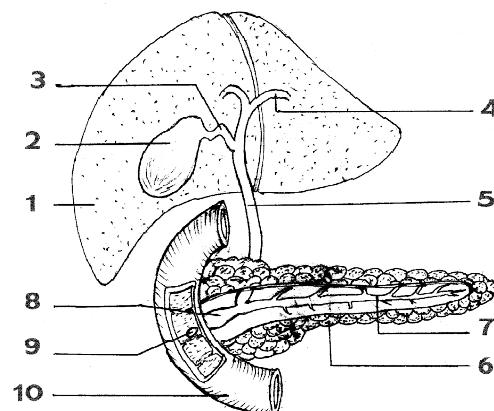
- 1) Gastro-oesophageal sphincter regulates the opening of oesophages into the stomach
- 2) Small intestine is distinguishable into three regions
- 3) The colon is divided into two parts - an ascending and a descending part
- 4) Serosa is the outermost layer and is made up of a thin mesothelium with some connective tissues

4. Which of the following statement is incorrect with respect to histology of alimentary canal?
 - 1) Rugae are irregular folds of mucosal layer of stomach
 - 2) Muscularis layer is formed by smooth muscles usually arranged into inner longitudinal layer and outer circular layer
 - 3) Submucosal layer is formed of loose connective tissue
 - 4) A layer of oblique muscle fibres is present in the muscularis of stomach
5. The region labelled 2,3 and 4 are



- 1) 2 - cardiac, 3 - pylorus, 4 - Fundus
 - 2) 2 - Fundus, 3 - Pylorus, 4 - Cardiac
 - 3) 2 - Fundus, 3 - Cardiac, 4 - Pylorus
 - 4) 2 - Pylorus, 3 - Cardiac, 4 - Fundus
6. From the given figure identify the part marked as common bile duct

Liver and Pancreas



Common bile duct is marked

- 1) 3
- 2) 5
- 3) 6
- 4) 8

7. Find the false statement

- 1) Hepatic lobules of liver containing hepatic cells arranged in the form of cords
- 2) The connective tissue sheath covering each hepatic lobule is Glisson's capsule
- 3) Bile secreted by hepatocytes is directly released into common bile duct
- 4) Common bile duct is formed of hepatic ducts and cystic duct

8. Which of the following statement is incorrect?

- 1) Liver weighs about 1.2 to 1.5kg and is the largest gland in human body
- 2) Bile salts convert fats into micelles
- 3) Chylomicrons are protein coated fats produced in lacteal
- 4) Bile contains cholesterol and phospholipids but no enzyme

9. What will happen if the brush bordered cells of intestine are not developed?

- A) Inactive trypsinogen will not be converted into active trypsin
 - B) Complete digestion of carbohydrate does not occur
 - C) Complete digestion of protein occur
 - D) Chymotrypsinogen is converted into active chymotrypsin
- 1) B and C 2) A, B and D 3) A and B 4) A, B, C and D

10. Match the following structures with their respective location in organs

- | | |
|-------------------------|----------------------|
| a) Crypts of Lieberkuhn | i) Pancreas |
| b) Glisson's capsule | ii) Duodenum |
| c) Islets of Langerhans | iii) Small intestine |
| d) Brunner's glands | iv) Liver |
- 1) a - iii, b - ii, c - i, d - iv 2) a - ii, b - iv, c - i, d - iii
3) a - iii, b - ii, c - i, d - iv 4) a - iii, b - iv, c - ii, d - i

11. Match column I with column II and select the correct option

Column I

- A) Pancreatic juice
B) Succus entericus
C) Bile juice
D) Saliva
1) A - iv B - iii, C - ii, D - i
3) A - iii, B - iv, C - i, D - ii

Column II

- i) Bilirubin and biliverdin
ii) Ptyalin
iii) Trypsinogen, Procarboxypeptidase
iv) Enterokinase
2) A - iii, B - iv, C - ii, D - i
4) A - ii, B - iii, C - i, D - iv

12. Which of the following is not true for bile?

- 1) Bile emulsifies fats
- 2) It activates lipases
- 3) Bile pigments are bilirubin and biliverdin
- 4) It contains fibrinogen, prothrombin and some enzymes

13. Which of the following options best represent the enzyme composition of pancreatic juice?
- Amylase, Peptidase, trypsinogen, Maltase
 - Amylase, Pepsin, Trypsinogen, Rennin
 - Peptidase, Amylase, Pepsin, Rennin
 - Lipase, Amylase, trypsinogen, procarboxypeptidase
14. Which of the following is not true for large intestine in man?
- Absorption of water, minerals and certain drugs
 - Secretion of mucus which helps in adhering the waste particles together and lubricating it for easy passage
 - Faeces enter into the caecum of the large intestine through ileocaecal valve
 - Significant digestive activity occurs in large intestine
15. How many of the following statements are true?
- Protein digestion starts in stomach by pepsin
 - Human adult dental formula is $\frac{2132}{2132}$
 - Emulsification and then lipase action hydrolyses fats
 - Proteolysis is affected by the absence of HCl in stomach
- One
 - Two
 - Three
 - All
16. The summary of physiology of digestion is given below. Select the incorrect one
- Starch $\xrightarrow{\text{Ptyalin}}$ Maltose $\xrightarrow{\text{Maltase}}$ Glucose
 - Proteins
Peptones
Proteoses } $\xrightarrow{\text{Pepsin /Trypsin}}$ Dipeptides $\xrightarrow{\text{Dipeptidases}}$ Aminoacid
 $\xrightarrow{\text{chymotrypsin}}$
 - Fat $\xrightarrow{\text{Lipases}}$ Di and mono glycerides $\xrightarrow{\text{Lipases}}$ Fatty acid + Glycerol
 - Lactose $\xrightarrow{\text{Lactase}}$ Glucose + Fructose
17. Which one of the following statements is true regarding digestion and absorption of food in humanbeings?
- Glucose and aminoacids are absorbed through intestinal mucosa with the help of carrier protein
 - Oxyntic cells in our stomach secrete the proenzyme pepsinogen
 - About 60% of starch is hydrolysed by salivary amylase in our mouth
 - Chylomicrons are small lipoprotein particles that are transported from intestine into blood capillaries
18. Which of the following statement is incorrect?
- Faecal accumulation in the rectum initiates a neural reflex causing an urge for its removal
 - Reflex action for vomiting is controlled by medulla oblongata
 - Irregular bowel movements cause constipation
 - In diarrhoea absorption of food is increased

19. Which of the following statement is not true?
- 1) Ileo-caecal valve prevents backflow of faeces
 - 2) Defaecation is a voluntary process
 - 3) Major portion of digestion takes place in duodenum of small intestine
 - 4) Trypsin, pepsin and chymotrypsin are active proteolytic enzymes from pancreas
20. Chylomicrons are
- 1) Undigested proteins
 - 2) Undigested carbohydrates
 - 3) Fat droplets coated with phospholipids
 - 4) Fat droplets coated with glycoproteins
21. Bile salts combine with fatty acids and monoglycerides to form very small, water soluble aggregates are known as:
- 1) Micelles
 - 2) Chylomicrons
 - 3) Fat globules
 - 4) Peristalsis
22. Which of the following substances is not a final product of digestion?
- 1) Galactose
 - 2) Aminoacids
 - 3) Fructose
 - 4) Maltose
23. Which of the following would be expected in a child suffering from congenital absence of enterokinase?
- 1) Glucose intake increases
 - 2) Carbohydrate digestion difficulty
 - 3) Protein digestion difficulty
 - 4) Fat digestion difficulty
24. The activities of the gastro-intestinal tract are controlled by
- 1) neural system only
 - 2) hormonal system only
 - 3) both neural and hormonal system
 - 4) CNS only
25. The malnutrition disorder found in infants less than a year in age due to replacement of mother's milk by other foods which are deficient in proteins and caloric value is
- 1) Diarrhoea
 - 2) Kwashiorkor
 - 3) Marasmus
 - 4) Jaundice

CHAPTER - 05

BREATHING AND EXCHANGE OF GASES

Teaching Points

I. **Introduction**

- Need for respiration
- Anaerobic respiration
- Aerobic respiration
- Different types of respiration (Cutaneous, Branchial, Pulmonary respiration)

II. **Human respiratory system**

- Structure
- External Nostrils
- Nasal canal
- Nasopharynx
- Pharynx
- Glottis
- Larynx and associated cartilages
- Adams Apple
- Vocal cords
- Trachea (Tracheal rings)
- Lungs, Lobes, Pleura, Mediastinum, Cardiac Notch, Bronchus, Bronchioles, Alveoli, Hering - Breuer Receptor, Surfactant

III. **Mechanism of Breathing**

- Inspiration and expiration
- (Diaphragm, Intercostal Muscles, Abdominal Muscles)

IV. **Lung volumes and capacities**

- TV, IRV, ERV, RV, IC, EC, FRC, VC, TLC
- Pulmonary Ventilation rate
- Alveolar ventilation rate

- Asphyxia
- Hypoxia (different types)

V. **Exchange of gases**

- Partial pressure of gases O₂ and CO₂
- Diffusion membrane

VI. **Transport of gases**

A. **Oxygen transport in blood**

- As dissolved form in plasma about - 3 %
- As oxyhaemoglobin - 97%
- Haemoglobin
- Factors affecting oxyhaemoglobin formation
- P50 value
- Bohr effect
- Haldane effect

B. **CO₂ Transport in blood**

- As carbonic Acid – 7%
- As carbamino haemoglobin – 20 – 25%
- As bicarbonates – 70 %
- Carbonic anhydrase
- Chloride shift / Hamburger phenomenon

VII. **Control of Breathing**

- Pneumotaxic centre
- Respiratory rhythm centre
- Chemosensitive area
- Aortic bodies, Carotid bodies

VIII. **Lung disorders**

- Asthma
 - Emphysema
 - Occupational lung disorders
 - (Asbestosis, Anthracosis, Byssinosis, Silicosis)
- Mountain sickness

QUESTIONS**LEVEL - I**

1. Respiration by means of gills is called
 - 1) Tracheal respiration
 - 2) Buccopharyngeal respiration
 - 3) Cutaneous respiration
 - 4) Branchial respiration
2. Which constitute the exchange part of the respiratory system?
 - 1) Nostrils to Alveoli
 - 2) Nostrils to Terminal Bronchioles
 - 3) Alveoli and their ducts
 - 4) Nostrils to Initial bronchioles
3. Which is not a function of the 'conducting part' of the respiratory system?
 - 1) Transports air to the alveoli
 - 2) Clears the air from the foreign particles
 - 3) Brings the air to body temperature
 - 4) It is the site of diffusion of oxygen and carbondioxide
4. Match the columns

Column I	Column II
(a) Larynx	(p) Lid of Larynx
(b) Trachea	(q) Air Sac
(c) Alveoli	(r) Voice Box
(d) Epiglottis	(s) Wind pipe
1) a – r , b – s, c – q, d – p	2) a – r, b – q, c – s, d – p
3) a – r, b – s, c – q, d – t	4) a – r, b – t, c – q, d – p
5. In man the inspiration occurs by contraction of
 - 1) External intercostal muscles and muscles of the diaphragm
 - 2) Internal intercostal muscles and muscles of the diaphragm
 - 3) External intercostal muscles only
 - 4) Muscles of the diaphragm only
6. During expiration diaphragm:
 - 1) Contracts and attains dome shape
 - 2) Relaxes and attains dome shape
 - 3) Contracts and becomes flattened
 - 4) Relaxes and becomes flattened

7. When diaphragm of man is completely dome shaped, it shows:
- 1) Beginning of expiration and end of inspiration
 - 2) End of expiration and beginning of inspiration
 - 3) Increased rate of breathing
 - 4) Decreased rate of breathing
8. Contraction of diaphragm, increases the volume of thoracic chamber in the
- | | |
|--------------------------|-----------------------|
| 1) Antero-posterior axis | 2) Dorso-ventral axis |
| 3) Ventro-lateral axis | 4) Dorso-lateral axis |
9. The volume of air that remains in the lungs after a normal expiration can be represented as
- | | | | |
|-------------|--------------|-------------|-------------|
| 1) TV + IRV | 2) IRV + ERV | 3) IRV + RV | 4) ERV + RV |
|-------------|--------------|-------------|-------------|
10. Residual volume is
- | | |
|--------------------------------|---------------------|
| 1) Lesser than TV | 2) Greater than IRV |
| 3) Greater than vital capacity | 4) Greater than TV |
11. Lungs are made up of air filled sacs the alveoli, they do not collapse even after forceful expiration, because of:
- | | |
|-------------------------------|--------------------|
| 1) inspiratory reserve volume | 2) tidal volume |
| 3) expiratory reserve volume | 4) residual volume |
12. Breathing rate is lowered during eating because
- 1) Our lungs do not get enough supply of blood
 - 2) Swallowing and breathing cannot go together at the same time
 - 3) Lungs are compressed as stomach enlarges
 - 4) More energy is required during eating
13. Hiccough (hiccup) is due to the activity of
- | | |
|------------------------|-------------------------------------|
| 1) Intercostal muscles | 2) Food in air tract |
| 3) Diaphragm | 4) Inadequate oxygen in environment |
14. The partial pressures (in mmHg) of oxygen (O_2) and carbon dioxide (CO_2) at alveoli (the site of diffusion) are:
- 1) $pO_2=104$ and $pCO_2=40$
 - 2) $pO_2=40$ and $pO_2=45$
 - 3) $pO_2=95$ and $pCO_2=40$
 - 4) $pO_2=159$ and $pCO_2=0.3$

15. Assertion (A): A person goes to high altitude and experiences 'altitude sickness' with symptoms like breathing difficulty and heart palpitations.

Reason (R): Due to low atmospheric pressure at high altitude, the body does not get sufficient oxygen.

- 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.

16. Identify the wrong statement with reference to transport of oxygen

- 1) Binding of oxygen with haemoglobin is mainly related to partial pressure of O_2
- 2) Partial pressure of CO_2 can interfere with O_2 binding with haemoglobin.
- 3) Higher H^+ conc. in alveoli favours the formation of oxyhaemoglobin.
- 4) Low pCO_2 in alveoli favours the formation of oxyhaemoglobin

17. Select the correct events that occur during inspiration.

- (a) Contraction of diaphragm
- (b) Contraction of external inter-costal muscles
- (c) Pulmonary volume decreases
- (d) Intra pulmonary pressure increases

- 1) a and b
- 2) c and d
- 3) a, b and d
- 4) only d

18. When O_2 is inadequate during respiration the condition is called

- 1) Anoxia
- 2) Pleurisy
- 3) Asphyxia
- 4) Hypoxia

19. In an accident a man dies immediately although there was no injury to brain, kidney, stomach and heart. The probable cause of death may be:

- 1) Larynx gets punctured
- 2) Diaphragm gets punctured
- 3) Clumping of erythrocytes
- 4) Histotoxic hypoxia

20. Maximum amount of oxygen is exchanged from the blood in the:

- 1) Arteries of the body
- 2) Capillaries surrounding tissue cells
- 3) Left atrium of the heart
- 4) Capillaries surrounding the alveoli

21. Which is true for PCO_2 ?

- 1) More in atmospheric air than in expired air
- 2) More in alveolar air than in atmospheric air
- 3) More in inspired air than in expired air
- 4) More in inspired air than in alveolar air

22. Chronic Mountain sickness in long term residents at high altitude [above 8000 feet] having pulmonary hypertension and polycythaemia is called:
- 1) Monge's disease
 - 2) Histotoxic hypoxia
 - 3) Emphysema
 - 4) Lung fibrosis
23. The toxic effect of carbon monoxide is due to its greater affinity for haemoglobin as compared to oxygen, approximately by
- 1) 2 times
 - 2) 20 times
 - 3) 300 times
 - 4) 1000 times
24. Select the incorrect statement
- 1) Inhalation of carbon monoxide result in the formation of a stable compound called carboxyhaemoglobin
 - 2) 100 ml of oxygenated blood can transport about 20 ml oxygen
 - 3) 1gram of haemoglobin combines with 1.34 ml oxygen
 - 4) Under normal physiological condition 100 ml of oxygenated blood delivers about 15 ml oxygen to the tissue
25. The haemoglobin of a human foetus:
- 1) Has only two protein subunits instead of four
 - 2) Has a higher affinity for O₂ than that of adult
 - 3) Has a lower affinity for O₂ than that of adult
 - 4) Its affinity for O₂ is the same as that of adult

LEVEL - II

1. Which of the following is not a structural feature of the left lung?
1) Superior lobe 2) Cardiac notch 3) Inferior lobe 4) Middle lobe
 2. Which of the following is the primary inspiratory muscle?
1) External intercostals 2) Internal intercostals
3) Diaphragm 4) External oblique
 3. The trachea and bronchi are provided with C- shaped cartilaginous rings which
1) Are responsible for sound production
2) Give them support and prevent their collapse
3) Divide trachea and bronchi
4) Give support to lungs
 4. Read the following statements and choose the correct option
- Statement 1-** Vital capacity is higher in athletes
- Statement 2-** Vital capacity is the amount of air which one can inhale or exhale with maximum effort
- 1) Statement 1 is correct and statement 2 is wrong
 - 2) Both statement 1 and 2 are correct
 - 3) Statement 1 is wrong and statement 2 correct
 - 4) Both statement 1 and 2 are wrong

5. Choose the correct option from the given statements
- 1) Diaphragm pulls the lungs down during expiration
 - 2) Trachea is a long tube supported by complete cartilaginous rings for conducting air
 - 3) Epiglottis is a bony flap that seals off the wind pipe during eating
 - 4) Alveoli are thin-walled vascular bag like structure for exchange of gases

6. Select the correct statement regarding Myoglobin

- 1) Helps in the transport of oxygen
- 2) Can bind to four oxygen molecules
- 3) can bind with only one oxygen molecule
- 4) Has chloride ions in addition to Fe^{2+} ion

7. Match column I and column II and choose the correct option from the given choices

Column 1

- i) Molluscs
 - ii) Pheretima
 - iii) Locust
 - iv) Rana
- 1) i – c, ii – a, iii – d, iv – b
 - 2) i – c, ii – d, iii – d, iv – a

Column 2

- a) Moist skin
 - b) Lung
 - c) Feathery gills
 - d) Tracheal tubes
- 2) i – b, ii – c, iii – a, iv – b
 - 4) i – c, ii – a, iii – b, iv – d

8. Match column I and column II and choose the correct option from the given choices

Column 1

- A) Pulmonary respiration
 - B) Cutaneous respiration
 - C) Branchial respiration
 - D) Buccopharyngeal respiration
- 1) A – III, B – IV, C – II, D – I
 - 3) A – II, B – IV, C – I, D – III

Column 2

- I) Labeo
 - II) Balaenoptera
 - III) Bufo
 - IV) Pheretima
- 2) A – III, B – IV, C – I, D – II
 - 4) A – II, B – I, C – IV, D – III

9. Match column I and column II and choose the correct option from the given choices

Column 1

- a) Hypopnoea
 - b) Dyspnoea
 - c) Apnoea
 - d) Orthopnoea
- 1) a – ii, b – iv, C – i, D – iii
 - 3) a – iii, b – ii, C – iv, D – i

Column 2

- i) No breathing
 - ii) Slow breathing
 - iii) Difficulty in breathing
 - iv) Painful breathing
- 2) a – ii, b – iv, C – iii, D – i
 - 4) a – iii, b – i, C – iii, D – iv

10. Match the percentage of carbon dioxide transported in column 1 with mode of transport in column 2-
- | Column 1 | Column 2 |
|------------------------|--------------------------------------|
| A) 20% - 25% | I) As bicarbonates |
| B) 70% | II) Dissolved in plasma |
| C) 7% | III) In combination with Haemoglobin |
| 1) A- I, B- III, C- II | 2) A- I, B- II, C- III |
| 3) A- III, B- I, C- II | 4) A- III, B- II, C- I |
11. A large proportion of O_2 is left unused in the human blood even after its uptake by the body tissues. This O_2
- 1) acts as reserve during muscular exercise
 - 2) raises the PCO_2 of blood to 75 mm Hg
 - 3) is enough to keep $Hb(O_2)$ saturation at 96%
 - 4) helps in releasing more O_2 to the epithelial tissues
12. Rate and depth of respiration shall increase when?
- 1) Oxygen concentration increases
 - 2) Carbon dioxide concentration increases
 - 3) Bicarbonate concentration increases
 - 4) Bicarbonate concentration decreases
13. Carbonic anhydrase is present in
- 1) Plasma of blood
 - 2) RBC
 - 3) WBC
 - 4) Both (1) and (2)
14. Haemoglobin acid is formed when
- 1) Haemoglobin combines with CO_2
 - 2) Haemoglobin combines with O_2
 - 3) Haemoglobin combines with hydrogen ion
 - 4) Haemoglobin combines with bicarbonate ion
15. Oxyhaemoglobin dissociation curve shifts to the right when:
- 1) PCO_2 deceases
 - 2) Body temperature decreases
 - 3) pH decreases
 - 4) Concentration of 2 – 3 DPG decreases
16. When H^+ increases the oxygen binding capacity of haemoglobin lowers and oxyhaemoglobin dissociation increases. This phenomenon is known as:
- 1) Haldane effect
 - 2) Bohr effect
 - 3) Herring – Breuer reflex
 - 4) Hamburger phenomenon
17. If concentration of CO_2 is more, the curve of oxygen will shift towards
- 1) Right
 - 2) Left
 - 3) Central
 - 4) No change
18. Carbon monoxide prevents transport of oxygen by
- 1) Forming stable compound with haemoglobin
 - 2) Destroying haemoglobin
 - 3) Forming carbon dioxide with oxygen
 - 4) Destroying RBCs

19. When a man inhales air containing normal concentration of oxygen as well as carbon monoxide, he suffers from suffocation because?
- 1) Carbon monoxide reacts with oxygen which is thus removed from the air entering the lungs
 - 2) Carbon monoxide affects the diaphragm and intercostal muscles
 - 3) Carbon monoxide affects the nerves to the lungs
 - 4) Haemoglobin combines with carbon monoxide instead of oxygen and the product cannot dissociate
20. Formation of carbonic acid in RBC is catalysed by an enzyme
- 1) Hydrolase
 - 2) Adenylate cyclase
 - 3) Carbonic anhydrase
 - 4) Oxidase
21. Bicarbonate ion is produced inside
- 1) Erythrocytes
 - 2) Leucocytes
 - 3) Thrombocytes
 - 4) Lymphocytes
22. Pneumotaxic centre is located in –
- 1) Cerebellum
 - 2) Cerebrum
 - 3) Medulla oblongata
 - 4) Pons varolii
23. Inflammation of the covering of the lungs causing severe pain in the chest region is termed as –
- 1) Emphysema
 - 2) Pleurisy
 - 3) Asphyxia
 - 4) Hypoxia
24. Which of the following statements is / are incorrect?
- A) On an average a healthy human breathes 12 to 16 times per minute
 - B) The volume of air involved in breathing can be estimated by spirometer
 - C) Diaphragm is useful only in inspiration process
 - 1) A and B
 - 2) B only
 - 3) C only
 - 4) B and C
25. Workers in stone breaking and grinding industries may suffer from which disease leading to lung fibrosis?
- 1) anthracosis
 - 2) byssinosis
 - 3) silicosis
 - 4) emphysema

CHAPTER - 06

BODY FLUIDS AND CIRCULATION

Teaching Points

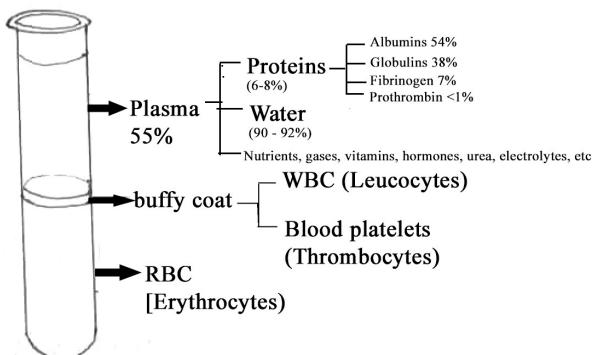
Bone marrow, heart, blood, blood vessels and lymphoid tissue are all mesodermal in origin. Blood is a fibreless fluid connective tissue, lymph is another body fluid. Blood is the most commonly used body fluid by higher organisms for providing nutrients to their living cells and for removing waste products.

Blood , lymph, CSF, synovial fluid, intraocular fluid etc are all extracellular fluids.

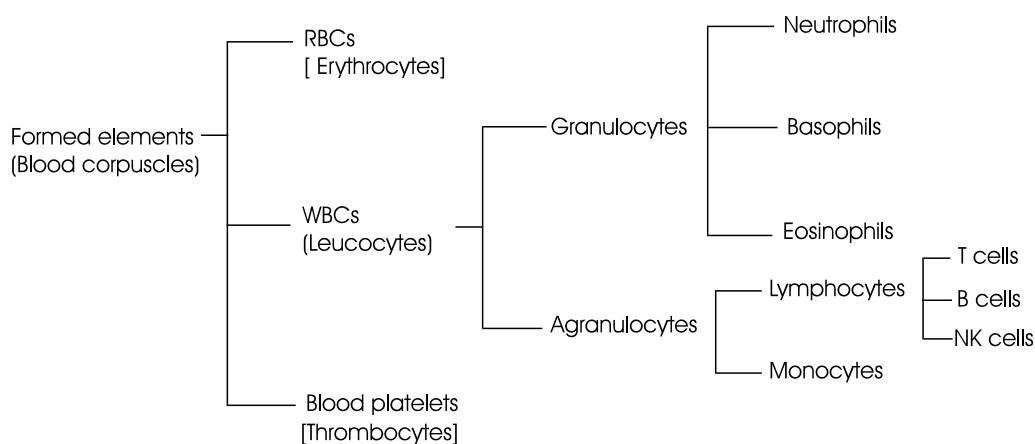
Circulatory system is the transport system through which nutrients, wastes and gases move through the fluid in a regular fashion.

Blood.

Haematology is the study of blood



Plasma : Straw coloured viscous fluid. Albumins maintains osmotic balance. Globulins are involved in defense mechanism. Fibrinogens and prothrombins are for clotting of blood. Clotting factors in plasma are in inactive form. Serum is plasma without clotting factors. Plasma contains Na^+ , Mg^{2+} , Ca^{2+} , HCO_3^- , Cl^- etc.



1) Erythrocytes (RBC)

Most abundant of all blood cells

RBCs are biconcave, discoid, anucleated cells filled with haemoglobin (about 280 million Hb molecules / RBC). Normal Hb content = 12 - 16 gm / dl blood. Erythropoiesis occurs in bone marrow. In foetus erythropoiesis occurs in liver and spleen. Life span 120 days. Diameter : 7 – 8 μ m.

Spleen is the graveyard of RBC

When blood flows slowly, RBCs adhere and form piles known as rouleaux.

Haematocrit is the percentage of total blood volume occupied by RBCs. Normal value = 42

2) Leucocytes (WBC)

WBCs	Diagram	Nuclear shape	% of all WBCs	Functions
Neutrophils		Multilobed	60 -65%	phagocytosis, micropolicemen
Eosinophils		Bilobed	2-3%	allergic reactions resist infections
Basophils		S' shaped	0.5 - 1%	liberate histamine serotonin and heparin
Lymphocytes		Oval	20- 25%	produce antibodies, immunity
Monocytes		Kidney shaped	6-8%	phagocytosis - macrophages.

Neutrophils are the most abundant WBCs and basophils are the least. At the site of wound, WBCs squeeze out of blood capillaries into tissues. The process is called diapedesis.

Thrombocytes

3) (Blood platelets)

Thrombocytes are cell fragments produced by megakaryocytes in red bone marrow. Thrombocytes store the thrombokinase necessary for coagulation of blood. Each thrombocyte is irregularly disc shaped, $2 - 4 \mu\text{m}$ diameter but no nucleus.

Blood cell count			
Blood cell	Normal count	Increase	Decrease
RBC	5-5.5 million mm^{-3}	Polycythaemia	Anaemia
WBC	6000 - 8000 mm^{-3}	Leukocytosis	Leukopaenia
Blood platelets	1.5 - 3.5 lakhs mm^{-3}	Thrombocytosis	Thrombocytopaenia

Dengue is characterised by fall in thrombocytes. Increase in WBC is indication of inflammation or infection. Leukocytosis is the symptom of Leukaemia.

Blood groups.

The surface of RBCs have antigens / agglutinogens composed of glycoproteins and glycolipids. Blood groups are based on presence or absence of the antigens.

1) ABO grouping (by Karl Landsteiner in 1900)

Blood group	Antigen on RBC	Antibodies in plasma	Compatible donor's group
A	A	Anti. B	A,O
B	B	Anti. A	B,O
AB	A,B	Nil	A,B,AB,O
O	Nil	Anti A, Anti B	O

In blood transfusion, incompatibility occurs when the recipient's antibody (agglutinin) in plasma agglutinates, donor's antigen on RBC. ie if recipient's plasma has anti A and donor's RBC has antigen A.

ABO Blood group testing

Sample	Anti.A serum	Anti B serum	Blood group
Blood drop	agglutinates	do not agglutinate	A
Blood drop	do not agglutinate	agglutinates	B
Blood drop	agglutinates	agglutinates	AB
Blood drop	do not agglutinate	do not agglutinate	O

People with AB blood → universal recipients

People with O blood → universal donors

2) **Rh grouping** (by K. Landsteiner & AS Wiener - 1940)

Nearly 80% of humans is Rh⁺.

Blood group	Antigen on RBC	Antibody in plasma
Rh ⁺	present	absent
Rh ⁻	absent	absent

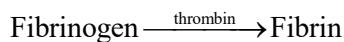
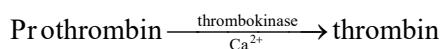
If the blood agglutinates with Rh antigen , it is Rh⁺, and if it doesnot agglutinate with Rh antigen it is Rh⁻. People with O⁻ blood are the true universal donors.

Erythroblastosis foetalis : (HDN - Haemolytic Disease of Newborn)

It affects Rh⁺ foetus of an Rh⁻ ve mother. First Rh⁺ foetus is not affected since the placenta prevents the entry of foetal RBC into maternal blood. But Rh antigen may contaminate maternal blood during delivery or miscarriage. So the second Rh⁺ foetus may be affected by the antibodies prepared by mother. It could be fatal to foetus or it may be affected by severe anaemia or jaundice.

Coagulation of Blood

Clotting of blood is a mechanism to prevent excessive loss of blood from the body. Clotting of blood is a cascade process. An injury or trauma stimulates platelets to release thrombokinase.



Blood cells (RBCs) entangle in fibrin fibre network forming a clot.

Lymph

As the blood flows through capillaries a portion of the blood oozes out into the interstitial space leaving behind most of the formed elements and larger proteins. The fluid released is interstitial fluid or tissue fluid. It serves as a mediator exchanging materials and gases between blood and tissue cells. Lymphatic system collects this fluid and drains back to major veins

Lymph	Blood
1) Clear colourless fluid	The red coloured fluid tissue
2) It has plasma and a lesser number of WBCs and platelets	It contains plasma, RBCs, WBCs and platelets
3) It lacks big proteins and RBCs	It contains big proteins and RBCs
4) The flow of lymph is slow	The flow of blood is fast
5) Clots slowly due to presence of less fibrinogen	Clots quickly due to presence more fibrinogen
6) Lymphocytes are the most abundant WBCs	Neutrophils are the most abundant WBCs

Circulatory Pathways

They are of 2 types. Open types and closed type circulatory system

Open type circulatory system	Closed type circulatory system
<pre> graph TD Heart[Heart] --> Artery[Artery] Artery --> Sinuses[Sinuses] Sinuses --> Veins[Veins] Veins --> Heart </pre>	<pre> graph TD Heart[Heart] --> Artery[Artery] Artery --> Capillaries[Capillaries] Capillaries --> Veins[Veins] Veins --> Heart </pre>
Flow is slow and under low pressure	The flow is fast and under high pressure
Molluscs, Arthropods, Leeches	Annelids, Chordates, Cephalopods

All vertebrates possess a muscular chambered myogenic heart.

Fishes - bilocular heart - one atrium + one ventricle - single circulation

Amphibians - trilocular heart - 2 atria + one ventricle - incomplete double circulation

Reptiles - trilocular heart - 2 atria + one ventricles - incomplete double circulation

Crocodiles
Aves }
Mammals } - tetralocular heart - 2 atria + 2 ventricles - complete double circulation

Human circulatory system

Human circulatory system consists of Heart, blood vessels and blood.

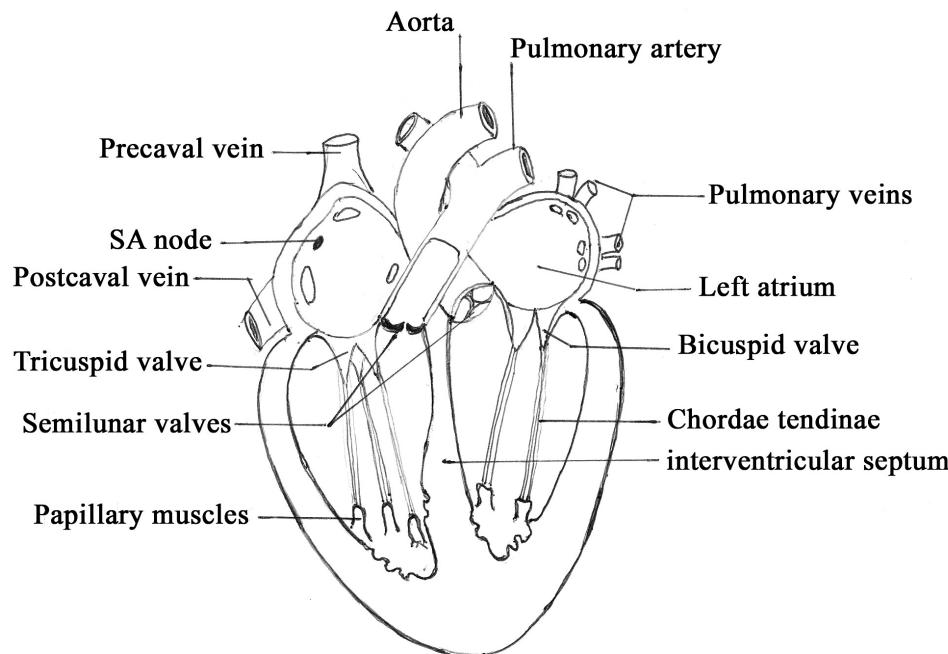
Capillaries → Venules → Veins → [Heart] → Arteries → Arterioles → Capillaries

William Harvey is the 'father of blood circulation'.

Heart: Mesodermal organ, myogenic, located in mediastinum.

It has the size of a clenched fist, mass 300g and size of about 12 cm x 9 cm. It is protected by pericardium containing pericardial fluid.

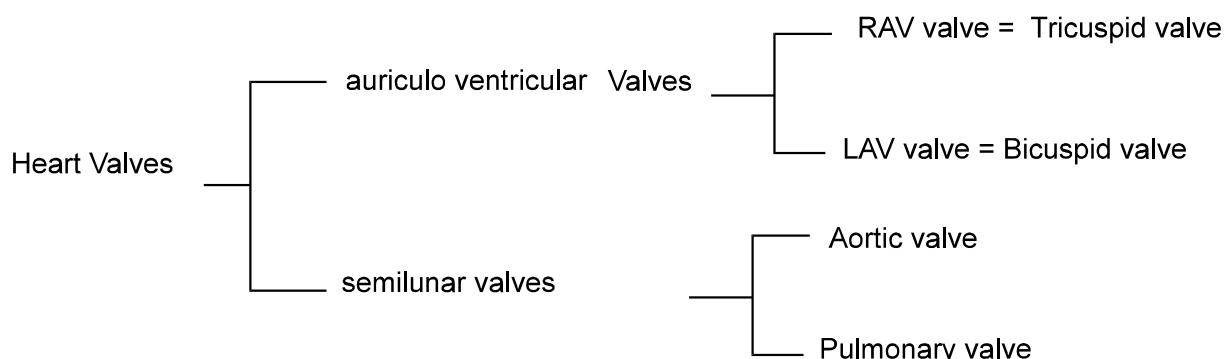
Our heart has 4 chambers: 2 atria + 2 ventricles, Ventricles are thick walled than auricles. Left ventricular wall is thickest.



Blood vessels connected to heart.

- Precaval vein and post caval vein releases venous blood into right atrium
- Pulmonary artery takes venous blood from the right ventricle to the lungs
- Pulmonary veins bring oxygenated blood to left atrium
- Aorta takes away oxygenated blood from left ventricle to all the body parts

Heart valves

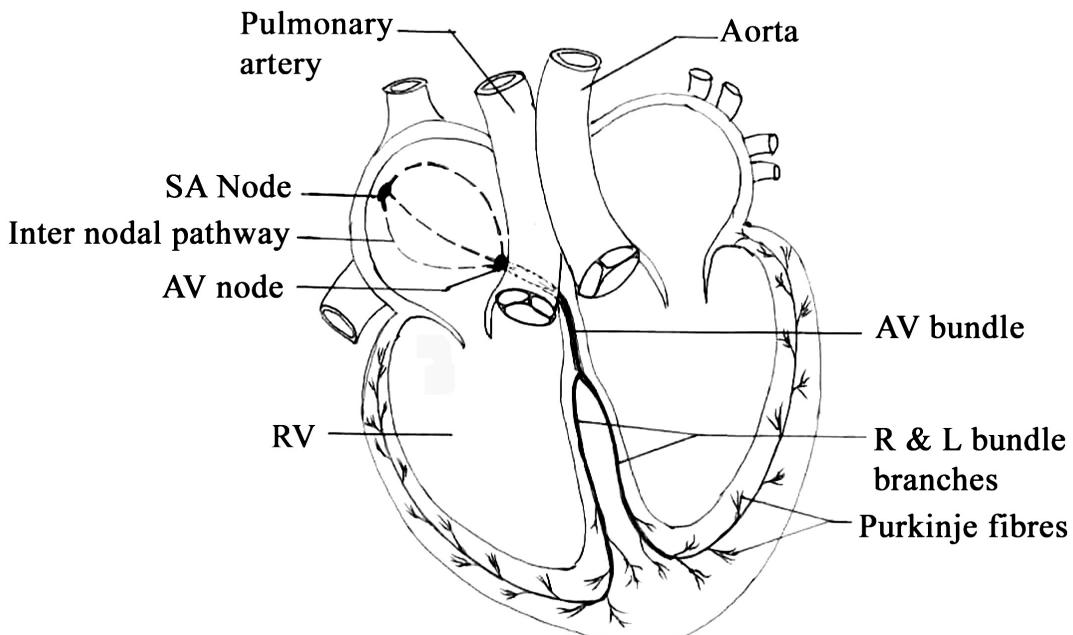


Valves prevents the back flow of blood.

For example bicuspid valve prevents the left ventricle - auricular flow.

Nodal tissues

Nodal tissues

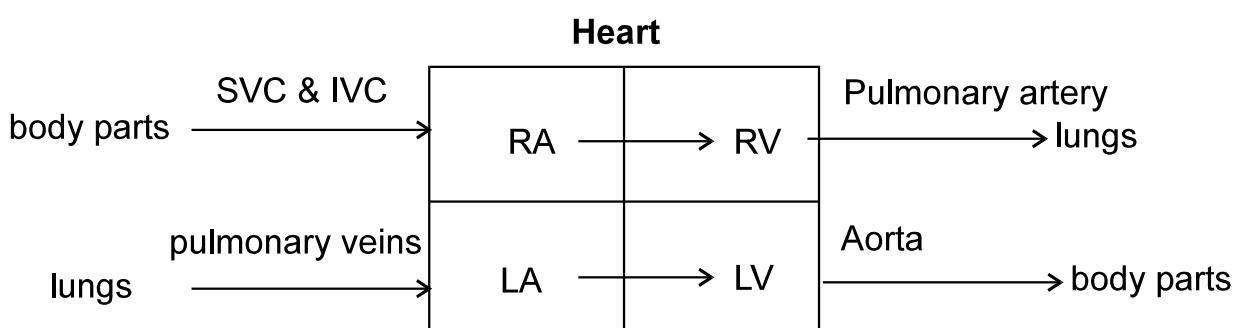


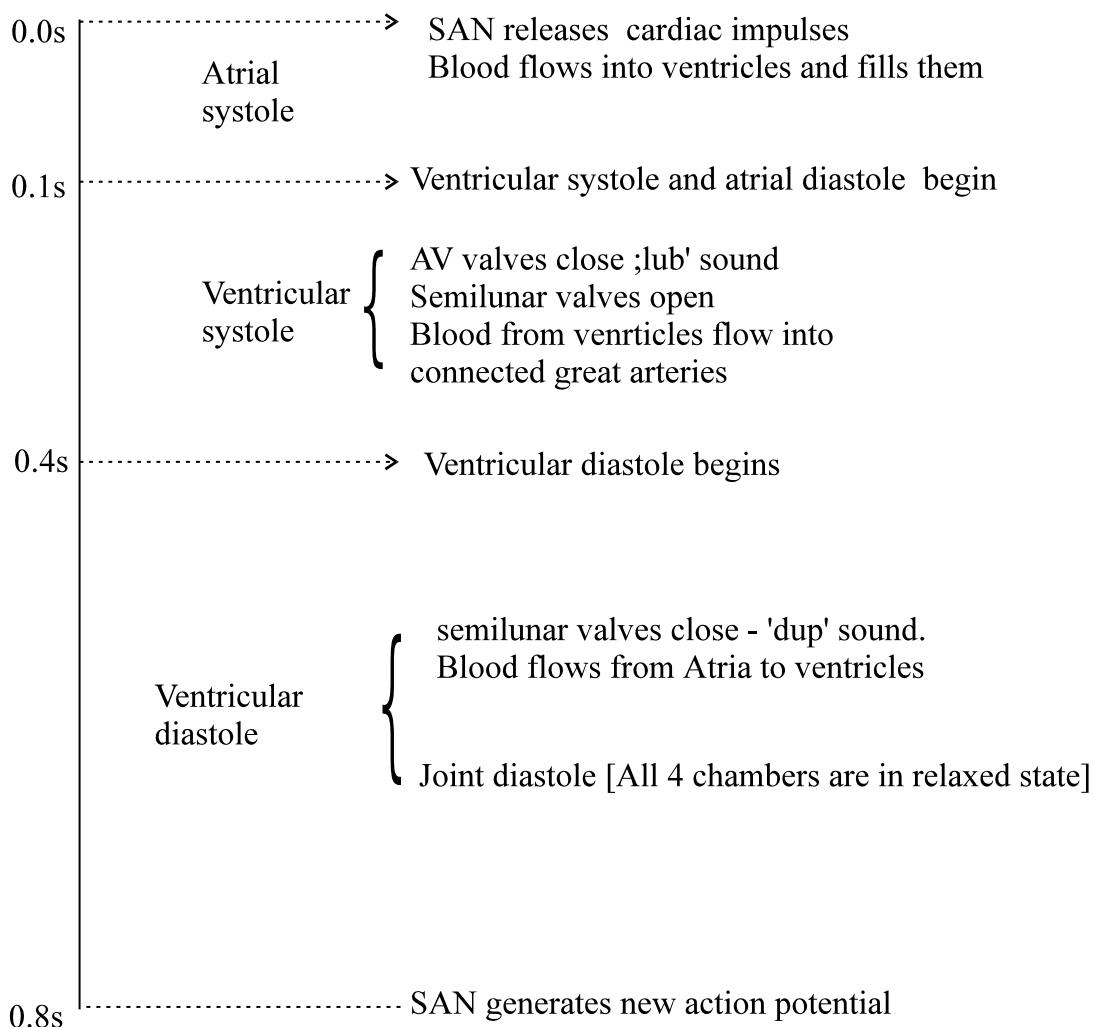
The entire heart is made of cardiac muscles. The nodal tissue is specialised cardiac musculature for production and conduction of autorhythmic cardiac impulses. The sino-atrial node in the right upper corner of right atrium serves as pacemaker. It releases cardiac impulses at the rate of $70 - 75$ times min^{-1} . Average heart rate is 72 beats min^{-1} .

Cardiac cycle

It includes all the events associated with one's heart beat. In a resting person, it takes 0.8s . Cardiac cycle consists of systole and diastole of atria plus systole and diastole of ventricles. The 2 atria work simultaneously and 2 ventricles work simultaneously.

Blood flow through heart in cardiac cycle



Cardiac cycle (0.8s)

The ventricles are under diastole during atrial systole.

The ventricles are filled to 70% at the beginning atrial systole. During ventricular systole AV valves remain closed and semilunar valves remain opened.

Cardiac output

Cardiac output is the volume of blood ejected per ventricle per minute.

Stroke volume is the volume of blood ejected per ventricle per beat.

$$\therefore \text{cardiac output} = \text{stroke volume} \times \text{heart rate}$$

$$= 70 \text{ ml} \times 72 \text{ bpm}$$

$$= 5040 \text{ ml} \approx 5\text{L}$$

Cardiac output of an athlete is much higher than that of an ordinary man

Heart sounds

1st heart sound - 'lub' - closure of AV valves - At the beginning of ventricular systole

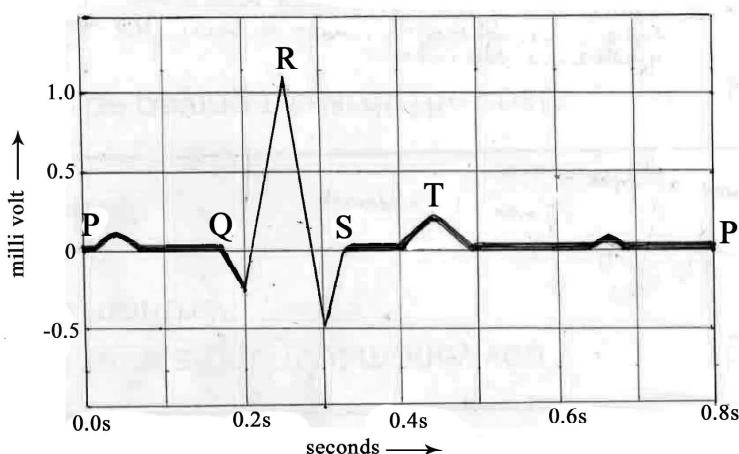
2nd heart sound - 'dup' - closure of semilunar valves - At the beginning of ventricular diastole

ECG

Electrocardiogram (ECG) is the graphical representation of electrical activity of heart during a cardiac cycle.

Electrocardiograph is the machine used to obtain electrocardiogram.

Electrocardiogram



P = release of SAN action potentials

PQ = P wave = depolarisation of the atria

Q = beginning of ventricular systole

QRS = QRS complex = depolarisation of ventricles

T wave = ventricular repolarisation

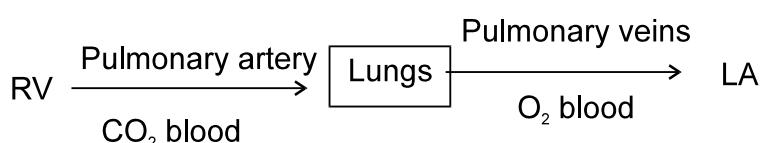
T = end of ventricular systole

Heart rate equals number of QRS complexes per min.

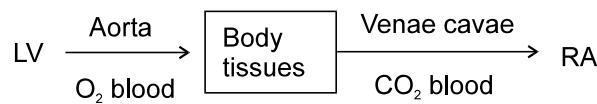
Double circulation

Right side of the heart receives and pumps deoxygenated blood and the left side oxygenated blood. The bloods do not get mixed in the heart. A drop of blood enters into the heart twice during complete course of circulation. ie complete double circulation.

1. Pulmonary circulation / lesser circulation



2. Systemic circulation / Greater circulation



3. Hepatic portal circulation

Intestine $\xrightarrow{\text{Hepatic portal vein}}$ liver

4. Hypophyseal portal circulation

Hypothalamus $\xrightarrow{\text{Hypophyseal portal vein}}$ Anterior pituitary

Renal portal system is absent in man.

Blood vessels

Arteries	Veins
1) Thick walled, lumen smaller	Thin walled, wider lumen
2) Carry blood away from heart	Carry blood towards heart
3) Pulsatory	non - pulsatory
4) Without valves	have valves
5) Aorta is the biggest artery	Inferior vena cava is the biggest vein
6) Blood flows under high pressure	Blood pressure is low

The wall of capillaries is made of a single layer of squamous epithelium - the endothelium.

Regulation of cardiac activity

Human heart is myogenic. Heart beat is auto regulated by Nodal tissue.

ANS of medulla oblongata moderate cardiac activity

Heart rate is increased by sympathetic NS. and decreased by parasympathetic activity. Adrenal medullary hormones increase the heart rate.

Disorders of circulatory System

1. Hypertension / High BP

$$\text{Normal BP} = \frac{120}{80} \text{ mm Hg} . \text{ Hypertension} > \frac{140}{90} \text{ mm Hg}$$

Hyper tension is known as a silent killer. it damages the brain and kidneys.

2. CAD - Often referred to an atherosclerosis.

The lumen of arteries becomes smaller by deposits of Ca^{2+} , fat, cholesterol and fibrous tissue.

3. Angina pectoris - acute chest pain due to hypoxia to myocardium.

4. Heart failure - Heart fails to pump enough blood. Congestion of lungs is the main symptom. So called congestive heart failure.

5. Cardiac arrest. Heart stops beating.

6. Myocardial infarction (Heart attack) : Heart suddenly damaged by inadequate blood supply.

QUESTIONS

LEVEL - I

1. Sponges circulate water from their surroundings through
 - 1) blood
 - 2) lymph
 - 3) body cavities
 - 4) heart
2. How many of the following statements are true?
 - a. Plasma is a straw coloured viscous fluid and is nearly 55% of blood by volume
 - b. 90–92% of plasma is water and 6–8% plasma proteins.
 - c. Fibrinogen and prothrombin are inactive clotting factors in plasma.
 - d. Globulins maintain osmotic pressure of blood
 - e. Albumins are responsible for defense mechanism of the body.

1) Two	2) Three
3) Four	4) Five
3. Average number of RBCs in a healthy adult man is
 - 1) 5-5.5 billions/mm³
 - 2) 4-4.5 millions/mm³
 - 3) 5-5.5 millions/mm³
 - 4) 4-4.5 millions/mm³
4. Select the correctly matching option regarding blood cells and their features.

	Blood cells		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

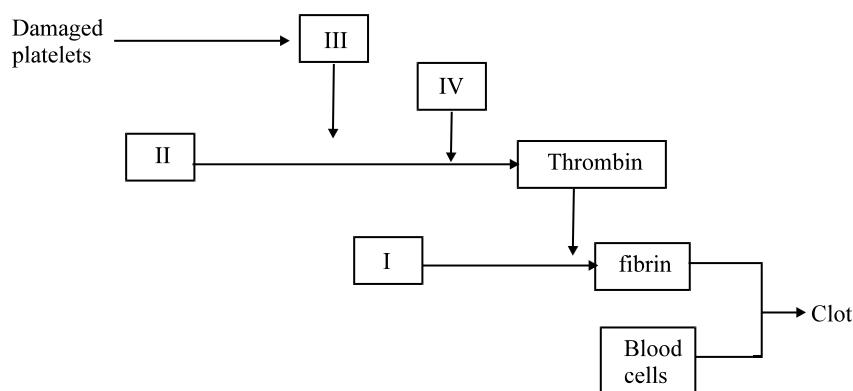
1) $\frac{1234}{cabd}$

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

3) $\frac{1234}{dacb}$

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

5. The clotting factors I to IV in the cascade process of blood clotting are given below. Identify them



	I	II	III	IV
1)	Tissue factor	Thrombin	Prothrombin	Christmas factor
2)	Thrombokinase	Fibrin	Ca^{2+}	Fibrinogen
3)	Fibrinogen	Prothrombin	Thromboplastin	Ca^{2+}
4)	Thromboplastin	fibrinogen	Prothrombin	Thrombin

6. Anti A is present in the
- 1) RBC of A group person
 - 2) RBC of B group person
 - 3) Plasma of A group person
 - 4) Plasma of B group person
7. A mother starts preparing antibodies against Rh antigen in her blood when
- 1) Rh negative mother exposes to the same blood
 - 2) Rh positive mother exposed to Rh negative blood
 - 3) Rh negative mother exposed to Rh positive blood
 - 4) Rh positive mother exposed to Rh positive blood
8. Choose the correct statement
- 1) Fishes have two chambered heart with two ventricles
 - 2) Amphibians have 3 chambered heart with a single atria and two ventricles
 - 3) Single circulation is found in fishes
 - 4) Birds possess incomplete double circulation

9. 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

10. To go to the left side of the heart from the right side, the blood will have to cross
1) Liver 2) Lungs 3) Kidney 4) Brain

11. _____is responsible for initiating and maintaining the rhythmic contractile activity of the heart.
1) Closure of bicuspid and tricuspid valve
2) Opening and closure of semilunar valves
3) Action potentials from AV node to ventricular myocardium
4) Action potentials from SA node

12. Choose the correct pathway of the transmission of impulses during cardiac cycle
1) AV node → SA node → Bundle of His → Purkinje fibres
2) SA node → AV node → Bundle of His → Purkinje fibres
3) SA node → Bundle of His → AV node → Purkinje fibres
4) AV node → Bundle of His → SA node → Purkinje fibres

13. During joint diastole,
1) blood from the left ventricles flows through aorta
2) blood from the pulmonary veins and vena cava flows into the left and right ventricle respectively
3) blood flow in to ventricles from the atria increases by about 30%
4) blood flows in to lungs through pulmonary artery

14. Which of the following statement is incorrect?
- Pacemaker releases a new action potential just after atrial systole.
 - Average heart rate is 72 beats/ minute
 - The average cardiac output is 5000 mL in a healthy man
 - Purkinje fibres innervate ventricular myocardium

15. Choose the incorrect statement regarding atrial systole

- Tricuspid and bicuspid valves are open
- Semilunar valves are closed
- Blood flow from atria to ventricles decreases
- Action potential from SAN depolarise atria

16. Match the following

Column I

- Heart beat
- Blood pressure
- Pulse pressure
- stroke volume
- Cardiac cycle

1) $\begin{matrix} 12345 \\ \hline a b c d e \end{matrix}$

2) $\begin{matrix} 12345 \\ \hline a c b e d \end{matrix}$

Column II

- 72/ minutes
- 40 mm Hg
- 120/80 mm Hg
- 0.8 sec
- 70 ml/ beat

3) $\begin{matrix} 12345 \\ \hline a c b d e \end{matrix}$

4) $\begin{matrix} 12345 \\ \hline a c d b e \end{matrix}$

17. How many of them are true about a standard electrocardiogram :



- | | | | |
|------------------|------------------------------|----------|--------|
| a) P wave | - Atrial depolarisation | | |
| b) QRS complex | - Ventricular depolarisation | | |
| c) T wave | - Ventricular repolarisation | | |
| d) End of T wave | - End of ventricular systole | | |
| 1) Only one | 2) Two | 3) Three | 4) All |

18. In a normal ECG , P wave represents

- Electrical excitation of Atria
- Electrical excitation of ventricles
- Return of ventricles from excited to normal state
- Repolarisation of atria

19. Systemic circulation refers to
- 1) the flow of deoxygenated blood in to lungs through pulmonary artery and oxygenated blood in to atria through pulmonary vein
 - 2) the flow of ,oxygenated blood from ventricles to tissue through arterial system and deoxygenated blood from the tissue to the atria through venous system
 - 3) the flow of deoxygenated blood from the lungs through pulmonary artery and deoxygenated blood from the tissue to the atria
 - 4) the flow of ,oxygenated blood from ventricles to tissue through aorta and oxygenated blood in to atria through pulmonary vein
20. Find out the incorrect statement about the regulation of cardiac activity
- 1) Normal activities of the heart are regulated by specialised muscles called nodal tissue
 - 2) Adrenal medullary hormone increases cardiac output
 - 3) Neural signals through the sympathetic nerve decreases the strength of ventricular contraction
 - 4) Parasympathetic neural signals decreases the speed of conduction of action potentials
21. Which is true for all veins?
- 1) they carry oxygenated blood without any exception
 - 2) they open into two different valves
 - 3) they carry more blood than arteries
 - 4) they all carry deoxygenated blood without any exception
22. Tunica intima of blood vessels is made up of
- 1) Smooth muscles
 - 2) Elastic fibrous connective tissue
 - 3) Collagen fibres
 - 4) Squamous epithelium
23. Arteries are best defined as vessels that
- 1) carry blood away from the heart to organs
 - 2) carry blood towards the heart
 - 3) break up in to capillaries which reunite to form veins
 - 4) have valves and non collapsible
24. Coronary artery disease is often referred to as
- | | |
|--------------------|--------------------------|
| 1) Hypertension | 2) Atherosclerosis |
| 3) Angina pectoris | 4) Myocardial infarction |
25. In hypertension, blood pressure reaches
- | | |
|------------------------------|------------------------------|
| 1) 120/80 mm of Hg and above | 2) 130/80 mm of Hg or higher |
| 3) 140/90 mm of Hg or higher | 4) 110/70 mm of hg or higher |

LEVEL - II

1. Which of the following statements is incorrect regarding blood ?
 - 1) Blood is a fluid connective tissue of mesodermal origin
 - 2) Na^+ , Ca^{++} , Mg^{++} , HCO_3^- and Cl^- are ions found in plasma
 - 3) Serum is blood without clotting factors
 - 4) Plasma contains inactive form of clotting factors
2. The most active phagocytic white blood cells are
 - 1) neutrophils and eosinophils
 - 2) lymphocytes and macrophages
 - 3) neutrophils and monocytes
 - 4) eosinophils and lymphocytes
3. Find the false one
 - 1) Erythrocytes are the most abundant of all blood cells
 - 2) Neutrophils are the most abundant WBCs
 - 3) High altitude dwellers develop polycythaemia
 - 4) Anaemia occurs when Hb content goes above 12 gm/ dl blood.
4. Select the option having all the correct characteristics of various leucocytes

Structure		Percentage	Function	Nucleus
1)		20-25	Phagocytic	Multilobed (beaded)
2)		0.5 - 1.0	Humoral immunity	S' - shaped
3)		60-65	Cell mediated immunity	Kidney shaped
4)		6 - 8	Phagocytosis	Bean shaped

5. 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
6. In a blood group testing, the blood agglutinated with Anti A and Anti B but not with Anti Rh. The blood group is :
 - 1) A positive
 - 2) B negative
 - 3) AB negative
 - 4) AB positive
7. Given below is the table of blood groups and donor compatibility

Blood Group	Antigens on RBC	Antibodies in plasma	Donor's group
A	A	Anti B	I
B	B	II	B, O
AB	III	nil	A, B, AB, O
O	Nil	Anti A, B	IV

Which of the following correctly matches the numbers I to IV ?

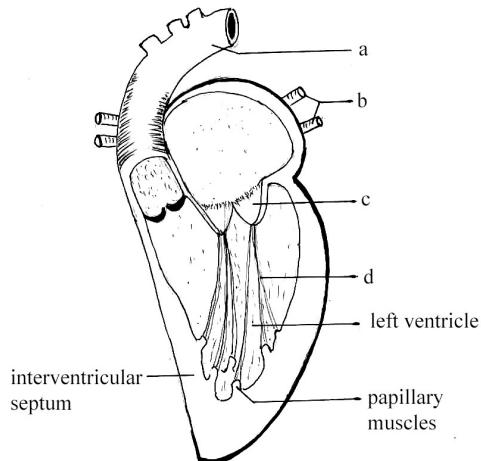
	I	II	III	IV
1	B, O	Anti, B	A, B	A, O
2	A, O	Anti A	A, B	O
3	A, O	Anti B	O	A, B, AB, O
4	A, O	Anti A	Nil	O

8. Deficiency of thrombocytes can lead to
 - 1) decreased osmotic pressure and oedema
 - 2) clotting disorders and excessive loss of blood from the body
 - 3) anaemia and general body weakness
 - 4) reduced immune response of the body

9. The scum or coagulum is formed of
- 1) Plasma proteins
 - 2) Albumins and globulins
 - 3) Thrombokinase and Ca^{2+}
 - 4) Fibrin fibres and dead formed elements
10. In which of the following situations, there is a risk factor for children of incurring erythroblastosis foetalis
- 1) Mother is Rh -ve and father is Rh -ve
 - 2) Mother is Rh -ve and father is Rh +ve
 - 3) Mother is Rh positive and father is Rh -ve
 - 4) Mother is Rh + and father Rh -ve
11. Which statement is incorrect regarding erythroblastosis foetalis?
- 1) Rh incompatibility has been observed between Rh -ve blood of a pregnant mother with Rh +ve blood of the foetus
 - 2) Rh antigen of the foetus do not get exposed to the Rh -ve blood of the mother during pregnancy
 - 3) Rh antibody secreted in mother against foetal Rh antigen cannot cross placenta and reach the next foetus
 - 4) Mother starts preparing Rh antibodies against foetal antigen due to the exposure of foetal blood during delivery
12. Read the statements about lymphatic system and spot the wrong one
- 1) The lymph has the same mineral distribution as that of blood plasma
 - 2) WBCs and larger proteins are absent in lymph
 - 3) Lymph serves as a mediator between blood and tissues
 - 4) In intestinal villi, fats are absorbed through lymph in the lacteals
13. Which of the following terms are applicable to human heart?
- a. Myogenic heart
 - b. Tetracardiac heart
 - c. Venous heart
 - d. Arterio venous heart
 - e. Complete double circulation
- 1) a, b, d & e
 - 2) b, c & d
 - 3) a, b & e
 - 4) a & b only

14.

Human Systemic Heart



Select the option giving correct labelling

	a	b	c	d
1)	pulmonary artery	vena cava	tricuspid valve	semilunar valves
2)	aorta	pulmonary veins	bicuspid valve	chordae tendinae
3)	aorta	post caval vein	mitral valve	chordae tendinae
4)	superior vena cava	pulmonary artery	bishop's valve	collagen fibres

17. How many of the following statements are correct regarding human heart
- 1) A thin fibrous wall called inter atrial septum separates the right and the left atria.
 - 2) A thick muscular tissue called atrioventricular septum separates the atrium and ventricle of the same side
 - 3) The valves in the heart allows the flow of blood only in one direction
 - 4) The walls of ventricles are much thicker than that of atria
- 1) 2 2) 1 3) 4 4) 3
18. Match the following
- | | |
|--------------------|---------------------------------------|
| 1) LUB | A) Closure of semilunar valves |
| 2) DUB | B) Between right atria and ventricles |
| 3) Tricuspid valve | C) Between left atria and ventricle |
| 4) Bicuspid valve | D) Closure of Av valves |
- 1) $\frac{1 \ 2 \ 3 \ 4}{D \ A \ B \ C}$ 2) $\frac{1 \ 2 \ 3 \ 4}{D \ A \ C \ B}$ 3) $\frac{1 \ 2 \ 3 \ 4}{A \ D \ B \ C}$ 4) $\frac{1 \ 2 \ 3 \ 4}{A \ D \ C \ B}$
19. Which of the following is not true?
- 1) At the end of joint diastole, ventricles are filled to 30% by volume
 - 2) During ventricular systole, the auricles are under diastole
 - 3) Semilunar valves remain closed in ventricular diastole
 - 4) AVN, AV bundle and purkinje fibres conduct action potentials to ventricular musculature
20. Which of the following statement is/are incorrect?
- a) By counting the number of 'QRS' complexes that occur in a given time period, one can determine the heart beat rate of an individual
 - b) P-wave represents the depolarisation of the atria, which leads to the relaxation of both the atria
 - c) The end of the T wave marks the end of atrial systole
 - d) The stroke volume multiplied by the heart rate gives the cardiac output
 - e) The heart sound 'lub' is associated with the closure of semilunar valves
- 1) b and c are incorrect
 - 2) b and e are incorrect
 - 3) e only is incorrect
 - 4) b,c and e are incorrect
21. Identify the correct path of pulmonary circulation
- 1) Right atria → right ventricle → pulmonary artery → lungs
 - 2) Pulmonary vein → left atria → left ventricle → aorta → body tissues
 - 3) Right ventricle → pulmonary artery → lungs → pulmonary vein → left atria
 - 4) Left ventricle → aorta → body tissue → vena cava → right atria

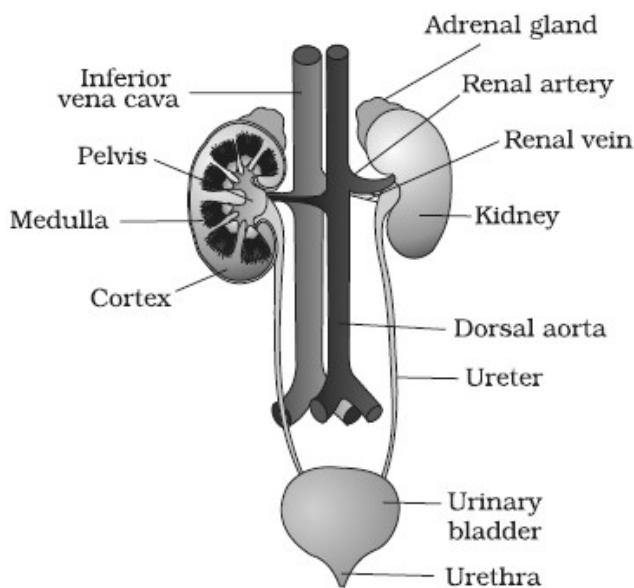
22. Look at the given features and sort out the ones pertaining to human heart
- a) It is neurogenic
 - b) It is protected by pericardium
 - c) Its left ventricular wall is thickest
 - d) SAN is placed in the right wall of right ventricle
 - e) Tricuspid valve prevents the blood flow from right ventricle to right auricle
- 1) a, b and c are true
 - 2) b, c and e are true
 - 3) c, d and e are true
 - 4) a, b and e are true
23. If each ventricle of a man has 30 ml blood at the end of ventricular systole and 100 ml blood at the end of its diastole and his heart beats 75 times/min. His cardiac output is
- 1) 225 ml
 - 2) 3000 ml
 - 3) 5000 ml
 - 4) 5250 ml
- 24 . Choose the correct match
- | | |
|------------------------|-----------|
| 1) Atrial systole | - 0.5 sec |
| 2) Atrial diastole | - 0.3 sec |
| 3) Ventricular systole | - 0.1sec |
| 4) Joint diastole | - 0.4sec |
25. A heart murmur usually indicate a defective
- 1) SA Node
 - 2) AV Node
 - 3) Bundle of His
 - 4) Heart valve

CHAPTER - 07

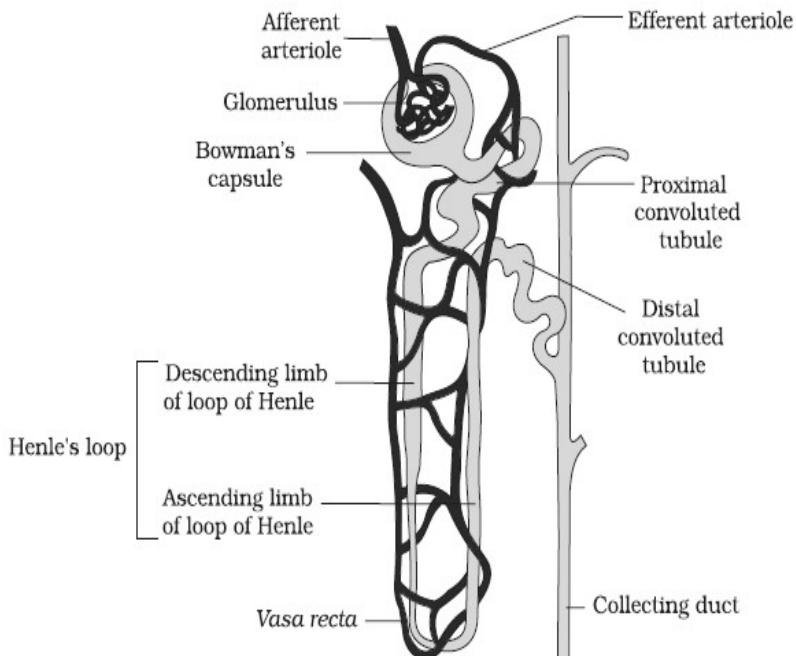
EXCRETORY PRODUCTS AND THEIR ELIMINATION

TEACHING POINTS

- 1) Excretion
 - Ammonotelism - Aquatic organisms Eg. Bony fishes
 - Uricotelism - Terrestrial organisms Eg. Birds, Lizards
 - Ureotelism - Terrestrial and marine organisms eg : 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

Regulation of Kidney functions

1. ADH
2. RAAS
3. ANF

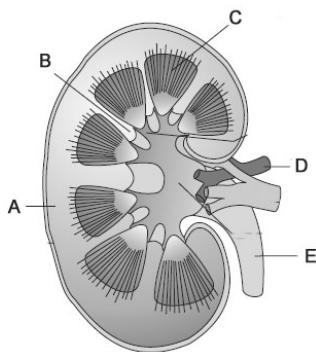
- Micturition
- Composition of urine
- Abnormal constituents
- Accessory excretory organs
 1. Skin
 2. Liver
 3. Lungs

Disorders

1. Uremia
 2. Renal Calculi
 3. Glomerulonephritis
- Haemodialysis

QUESTIONS**LEVEL - I**

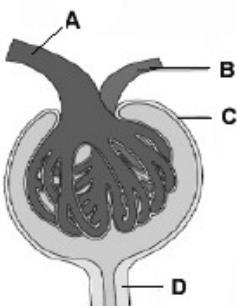
1. Excretory waste of birds and reptiles are
 - 1) Urea
 - 2) Urea and uric acid
 - 3) Uric acid
 - 4) Ammonia and uric acid
2. Which one of the following statement is incorrect?
 - 1) In cockroaches and prawns, excretion of waste material occurs through malpighian tubules.
 - 2) In Echinodermata, the excretory system is absent.
 - 3) In fasciola, flame cells take part in excretion.
 - 4) In Balanoglossus, the proboscis glands act as excretory organs.
3. Correct order of excretory organs in Cockroach, Earthworm and Rabbit respectively
 - 1) Skin, malpighian tubules, kidney
 - 2) Malpighian tubules, nephridia, kidney
 - 3) Nephridia, malpighian tubule, kidney
 - 4) Kidney, Nephridia, Malpighian tubule.
4. Malpighian corpuscles is seen in
 - 1) Medulla
 - 2) Cortex
 - 3) Pelvis
 - 4) Pyramid
5. Refer the following diagram and identify the parts of kidney indicated



- 1) A - cortex, B - renal column, C - Medullary pyramid, D - renal vein, E - Ureter
- 2) A - Cortex, B - Medulla, C - Medullary pyramid, D - Renal artery, E - Ureter
- 3) A - Cortex, B - Renal column, C - Medullary pyramid, D - Renal artery, E - Ureter
- 4) A - Cortex, B - Renal column, C - Nephron, D - Renal vein, E - Ureter
6. The blood vessel taking blood towards the Bowman's capsule is
 - 1) Afferent arteriole
 - 2) Efferent arteriole
 - 3) Renal vein
 - 4) Vasa recta.

7. The proximal convoluted tubule of nephron is lined by
- 1) Brush bordered columnar epithelium 2) Ciliated squamous epithelium
3) Brush bordered cuboidal epithelium 4) Simple columnar epithelium
8. A notch present on the medial side of kidney is known as
- 1) Ureter 2) Pelvis 3) Hilum 4) Pyramid
9. Find the incorrect statement:
- 1) Inner layer of Bowman's capsule - Squamous epithelium
2) Proximal convoluted tubule - Brush bordered cuboidal epithelium.
3) Ureter and urinary bladder - Transitional epithelium
4) The descending limb of Henle's loop - Pseudostratified epithelium.
10. In which part of the excretory system of mammals you can first use the term urine for the fluid it contains ?
- 1) Bowman's capsule 2) Loop of Henle
3) Collecting tubule 4) Ureter
11. Which of the following is the site of conditional reabsorption of water and sodium ions?
- 1) Descending limb of loop of Henle 2) Proximal convoluted tubule
3) Ascending limb of loop of Henle 4) Distal convoluted tubule.
12. Identify the correct statement regarding urine formation.
- 1) To prevent diuresis, ADH facilitates water reabsorption from the latter parts the renal tubule.
2) Maximum reabsorption of electrolytes occurs in the Henle's loop.
3) Counter current mechanism works around the glomerulus and PCT.
4) A decrease in blood pressure can increase the glomerular filtrate rate
13. In kidney ,the juxtaglomerular apparatus (JGA) is a special sensitive region formed by cellular modifications at site of contact between:
- 1) Proximal convoluted tubule and afferent arteriole
2) Distal convoluted tubule and efferent arteriole
3) Proximal convoluted tubule and efferent arteriole
4) Distal convoluted tubule and afferent arteriole
14. A decrease in blood pressure / volume will not cause the release of
- 1) Atrial Natriuretic Factor 2) Aldosterone
3) ADH 4) Renin

15. Select the incorrect match from the following ;-
- | | |
|-----------------------------------|--|
| 1) GFR of man | - 125 ml /min. |
| 2) Normal blood urea level of man | - 17 – 38 mg /100ml of blood. |
| 3) Macula densa cells | - Renin |
| 4) Nephrectomy | - Surgical removal of urinary bladder. |
16. A fall in glomerular filtration can activates
- 1) Adrenal cortex to release aldosterone
 - 2) Adrenal medulla to release aldosterone
 - 3) Juxtaglomerular cells to release renin
 - 4) Posterior pituitary to release vasopressin
17. If the liver is function less, which will increase in the blood ?
- 1) Urea
 - 2) Water
 - 3) Ammonia
 - 4) Uric acid
18. The least amount of urea is found in the blood of
- 1) Hepatic vein
 - 2) Renal vein
 - 3) Renal artery
 - 4) Inferior venacava
19. The given figure represents the malpighian body. Identify the labelled parts A to D and select the correct option



	A	B	C	D
1)	Efferent arteriole	Afferent arteriole	Bowman's Capsule	Proximal Convolved tubule
2)	Afferent arteriole	Efferent arteriole	Renal corpuscle	Proximal Convolved tubule
3)	Afferent arteriole	Efferent arteriole	Bowman's Capsule	Proximal Convolved tubule
4)	Afferent arteriole	Efferent arteriole	Bowman's Capsule	Distal convoluted tubule

20. Match the following and select the correct option :-

A

- A) Nephritis
- B) Renal calculi
- C) Gouty arthritis
- D) Podocytes
- E) Glycosuria
- 1) A - 4; B - 3; C - 1; D - 5; E - 2.
- 3) A - 3; B - 2; C - 4; D - 5; E - 1.

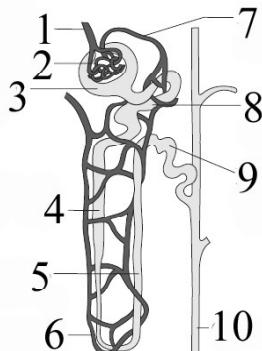
B

- 1) Uric acid crystals in joints
- 2) Presence of glucose in urine
- 3) Calcium oxalate crystals
- 4) Bright's disease
- 5) Bowman's capsule.
- 2) A- 4; B -2; C -1; D -3; E -5.
- 4) A- 3; B – 4; C – 5 ; D – 2 ; E – 1

LEVEL - II

1. In ornithine cycle which of the following wastes are removed from blood?
 - 1) Carbon dioxide and urea
 - 2) Carbon dioxide and ammonia
 - 3) Ammonia and urea
 - 4) Urea and uric acid
2. Nitrogenous waste products are excreted mainly as
 - 1) Urea in tadpole and ammonia in adult frog.
 - 2) Ammonia in tadpole and urea in adult frog.
 - 3) Urea in both tadpole and adult frog.
 - 4) Urea in tadpole and uric acid in adult frog.
3. Read the following four statements A-D
 - 1) Nephrons are the functional units of kidney
 - 2) Each Human kidney has two million nephrons.
 - 3) Calyces are the projections of renal pelvis.
 - 4) Each kidney in an adult human is 10-12 cm in width, 5-7 cm in thickness, 2 – 3 cm in length.
How many of the above statements are right?
 - 1) Four
 - 2) Two
 - 3) One
 - 4) Three
4. Which of the following is not a part of renal pyramid ?
 - 1) Peritubular capillaries
 - 2) Convoluted tubules
 - 3) Collectin duct
 - 4) Loop of Henle
5. Which of the following statement is incorrect ?
 - 1) Medullary zone of kidney is differentiated to form medullary pyramids.
 - 2) Inside kidney cortical regions extends in between medullary pyramids as columns of Bellini.
 - 3) Glomerulus along with Bowman's capsule is called Malpighian body.
 - 4) Renal corpuscles, PCT and DCT of the nephrons are situated in the cortex.

6.



1. Which part carries out first step of urine formation?
1) 1 2) 2 3) 3 4) 4
2. Which of the following part extends from the cortex of kidney to the inner parts of medulla?
1) 4 2) 6 3) 8 4) 10
3. Which of the following part has brush bordered cuboidal epithelium?
1) 2 2) 4 3) 7 4) 8
7. Aldosterone stimulates sodium reabsorption and potassium secretion mainly in :
1) Descending limb of loop of Henle 2) Ascending limb of loop of Henle
3) Proximal convoluted tubule 4) Distal convoluted tubule
8. The glomerular filtrate contains
1) Blood minus cells and proteins 2) Blood minus cells
3) Blood minus proteins 4) Plasma minus cells and proteins.
9. Identify the correct terms used to designate following letters a , b, c, d respectively
a) The double walled cup of a nephron along with glomerulus
b) A tuft of capillaries formed by the afferent arteriole
c) The efferent arteriole emerging from the glomerulus forms a fine capillary net work around the renal tubule.
d) A blood vessel that runs parallel to the loop of Henle
1) Renal capsule , Glomerulus, Vasa recta, Peritubular capillary
2) Renal corpuscle, Glomerulus, Peritubular capillaries, Vasa recta
3) Malpighian tubule, Efferent arteriole, Henle's loop, Proximal convoluted tubule
4) Renal columns, Renal calyx, Ureter, Pyramids
10. Which of the following statement is correct regarding urine formation ?
1) Filtration and secretion takes place before reabsorption.
2) Filtration and reabsorption takes place before secretion
3) Secretion takes place before reabsorption and filtration.
4) Reabsorption takes place before filtration and secretion.

11. Which of the following statements are correct ?

- (i) Glucose has high threshold value.
- (ii) Urine get concentrated in loop of Henle.
- (iii) Haemodialyser removes urea , uric acid glucose and proteins.
- (iv) In glomerulus , urea , uric acid ,water , glucose and proteins are filtered out.

Options :

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

12. In RAAS mechanism the function of angiotensin II is:

- 1) Stimulation of adrenal medulla.
- 2) To enhance the water and sodium reabsorption from renal tubule.
- 3) To decrease the heart beat and dilate arterioles.
- 4) All of the above.

13. Which of the following statements are true or false ?

- a) Glomerular filtrate is hypertonic solution.
 - b) Normal urine is two times more concentrated than initial filtrate.
 - c) The normal blood urea level of man is about 17 – 38 mg /100ml of blood
 - d) The filtrate gets diluted as it moves down in the descending limb of loop of Henle but it gets more concentrated in the ascending limb.
 - e) The filtrate in the DCT is isotonic to blood.
- 1) b , e , ture, a ,c , d , false
 - 2) c , d , e true , a , b , false
 - 3) b , c , e ,true , a , d , false
 - 4) All except c are false.

14. A fall in glomerular filtration rate (GFR) activates

- 1) Adrenal medulla to release adrenaline
- 2) Adrenal cortex to release aldosterone
- 3) Posterior pituitary to release vasopressin
- 4) Juxta-glomerular cells to release renin.

15. If the afferent arteriole that supply blood to the glomerulus become dilated

- 1) The protein concentration of the filtrate decreases.
- 2) Hydrostatic pressure of the glomerulus decreases.
- 3) Glomerular filtration rate increases
- 4) Glomerular filtration rate decreases.

16. Match the items in column I and column II and select the correct option.

Column I	Column II
a) Erythropoietin	1. Juxtaglomerular cells
b) Vasopressin	2. Stimulate the release of aldosterone
c) ANF	3. RBC production
d) Renin	4. Act as vasodilator
e) Angiotensin II	5. Hypothalamus.
1) a - 3 , b - 5 , c - 4 , d - 1 , e - 2	2) a - 3 , b - 5 , c - 4 , d - 2 ,e - 1
3) a - 3 , b - 5 , c - 2, d - 1 , e - 4	4) a - 5 , b - 4 , c - 2, d - 3, e - 1

17. The osmolarity decreases from _____ in the medulla to _____ in the outer cortex.

- 1) 300 mOsmolL⁻¹ to 1200 mOsmolL⁻¹ 2) 1000 mOsmolL⁻¹ to 400 mOsmolL⁻¹
 3) 1200 mOsmolL⁻¹ to 300 mOsmolL⁻¹ 4) 1200 mOsmolL⁻¹ to 300mOsmolL⁻¹

18. Which of the following groups of hormones are participated in the regulation of the renal function ?

- 1) ADH , TSH and ANF 2) ACTH , TSH and ANF
 3) ADH , STH and ANF 4) ADH , ANF and Aldosterone

19. The out line of main events during micturition is given below in a random manner.

- i) CNS passes motor messages to initiate the contraction of smooth muscles of bladder and simultaneous relaxation of urethral sphincter.
 ii) The bladder fills with urine and become distended
 iii) Micturition
 iv) Stretch receptors on the wall of urinary bladder send signals to CNS

The correct sequence of events is :

- 1) (iv)(i)(iii)(ii) 2) (ii)(iv)(i)(iii) 3) (ii)(i)(iv)(iii) 4) (iv)(ii)(i)(iii).

20. Select the incorrect match :

- | | |
|------------------|----------------------------------|
| 1) Renal calculi | - Kidney stones |
| 2) Glycosuria | - Glycogen in urine |
| 3) Nephritis | - Brights'disease |
| 4) Uremia | - Accumulation of urea in blood. |

CHAPTER - 08

LOCOMOTION AND MOVEMENT

TEACHING POINTS

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, 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, 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

Clavicle / collar bone

Pelvic girdle - Coxal bones → ilium, ischium, pubis, pubic symphysis, acetabulum

JOINTS - points of contact between bones, or between bones & cartilage

- **Fibrous joint** - immovable joint eg:- cranial joint
- **Cartilaginous joint** - slightly movable joint eg:- intervertebral joint, pubic symphysis
- **Synovial joint** - freely movable joint
 - (i) Ball & socket joint - shoulder joint, hip joint
 - (ii) Hinge joint - elbow joint, knee joint
 - (iii) Pivot joint - atlas-axis joint
 - (iv) Gliding joint - intercarpal joint and intertarsal joint
 - (v) Saddle joint - carpo-metacarpal joint

DISORDERS

- (i) Myasthenia gravis - rapid spasm of muscle
- (ii) Muscular dystrophy - autoimmune disorder
- (iii) Tetany - genetic disorder
- (iv) Osteoporosis - weakening of bones
- (v) Arthritis----- (a) Osteo arthritis (b) Gout arthritis (c) Rheumatoid arthritis

QUESTIONS

LEVEL - I

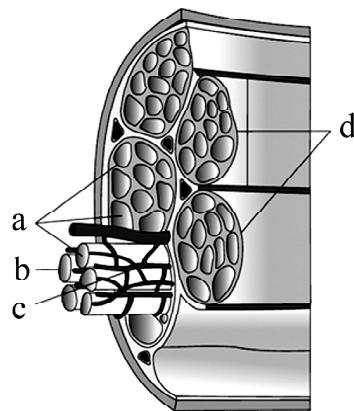
1. Match column-I with column-II and select the correct option from the codes given below.

	Column I			Column II
A)	Amoeboid movement	i)	Peristalsis	
B)	Ciliary movement	ii)	Microfilaments	
C)	Flagellar movement	iii)	Female genital tract	
D)	Muscular movement	iv)	Water canal system	

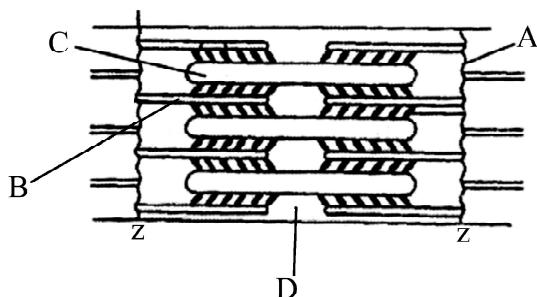
	A	B	C	D
1)	ii	iii	i	iv
2)	ii	iii	iv	i
3)	iv	ii	iii	i
4)	iv	ii	i	iii

2. All the following are correct about muscles, except
- 1) Specialised contractile tissue of mesodermal origin
 - 2) Shows properties like excitability, contractility, extensibility and elasticity
 - 3) Based on location there are 3 types of muscles namely, skeletal, visceral and cardiac
 - 4) 40 - 50% of body weight is contributed by skeletal muscles
3. Visceral muscles are
- 1) involuntary, cylindrical and striated
 - 2) voluntary, fusiform and uninucleate
 - 3) involuntary, spindle form and unstriped
 - 4) voluntary, syncytial and cylindrical
4. Which of the following muscle fibre is involved in peristaltic movement?
- | | |
|-------------------|-------------------|
| 1) Striated fibre | 2) Branched fibre |
| 3) Fusiform fibre | 4) Cardiac fibre |

5. **Diagrammatic cross sectional view of a muscle showing muscle bundles and muscle fibres**
Identify the labelled parts



- 1) a - Fascicle, b - Muscle fibre, c - Blood capillary, d - Sarcolemma
 2) a - Blood capillary, b - Fascicle, c - Sarcolemma, d - Muscle fibre
 3) a - Muscle fibre, b - Sarcolemma, c - Blood capillary, d - Fascicle
 4) a - Sarcolemma, b - Fascicle, c - Muscle fibre, d - Blood capillary
6. Correct matching set regarding striated muscle
- | | |
|-----------------|----------------------------|
| i) Myofibril | – Muscle fibre |
| ii) Fascicle | – Fascia |
| iii) Sarcolemma | – Muscle cell membrane |
| iv) Sarcosome | – Ribosome |
| v) Myofilaments | – Actin and Myosin |
| vi) Sarcoplasm | – Cytoplasm of muscle cell |
- 1) i,iii, v, vi 2) i, iii, iv, v 3) iii, iv, v, vi 4) iii, v and vi only
7. Which of the following is true for the labelled parts in the figure below?



- 1) A - Z line - located at centre of I - band
 2) B - Thin filament - occurs in A - band only
 3) C - Thick filament - confined to I - band
 4) D - H -zone - located at centre of M - line

8. Select the correct statements
- (i) Sarcoplasm of myocyte contains parallelly arranged myofibrils
 - (ii) Myofibrils show alternate arrangement of actin and myosin filaments
 - (iii) Isotropic band contains only primary filament
 - (iv) Anisotropic band contains both primary and secondary filaments
 - (v) Z-line bisects I-band
 - (vi) M-line holds thin filaments at the middle of A-band
- 1) i, ii, iii, iv 2) i, ii, iv, v 3) i, iii, v, vi 4) i, ii, v, vi
9. Which of the following options are not applicable to actin filament?
- i) Each actin filament is a polymerised protein consisting of F-actins, Tropomyosins and Troponins
 - ii) G-actins are polymers of F-actins
 - iii) An actin filament has two F-actins
 - iv) Two filamentous protein, troponins runs close to F- actin
 - v) In the resting state, a subunit of troponin masks the active sites of actin filament
- 1) ii, iii and iv 2) iv and v 3) ii and iii 4) ii and iv
10. Which among the following statements about myofilaments is true?
- 1) Two filamentous actins wound to each other to form the back bone of thick filament.
 - 2) Each troponin subunit possess a binding site for myosin
 - 3) Tropomyosin has a binding site for Ca^{++}
 - 4) Head and short arm of meromyosins project outward at regular distance and angle to form cross arms.
11. Select the wrong statement about myosin monomer
- 1) Meromyosin is the monomeric protein, consists of 2 parts
 - 2) HMM constitute globular head along with short arm
 - 3) Cross arm is the LMM component of meromyosin
 - 4) Globular head shows Mg^{2+} dependent ATPase activity
12. Select the correct order of events in muscle contraction.
- 1) Threshold stimulus — Release of Ach — Release of Ca^{2+} — Cross bridge formation — Excitation of SR — Sliding of actin filament
 - 2) Threshold stimulus — Release of Ach — Excitation of SR — Release of Ca^{2+} — Cross bridge formation — Sliding of actin filament — 'H' band diminishes
 - 3) Threshold stimulus — Excitation of SR — Release of Ach — Cross bridge formation — Sliding of actin filament — H-band diminishes
 - 4) Threshold stimulus — Release of Ach — Cross bridge formation — Excitation of SR — Sliding of actin filament

13. Match Column-I with Column-II and select the correct option

Column-I (skeletal structures)	Column-II (number of bones)
A. Cranium / Brainbox	I. 22
B. Skull (Cranial and facial bones)	II. 8
C. Face	III. 14
D. Vertebral column	IV. 24
E. Ribs	V. 26
1) A - I, B - II, C - III, D - V, E - IV	2) A - II, B - I, C - III, D - V, E - IV
3) A - I, B - II, C - III, D - IV, E - V	4) A - V, B - IV, C - III, D - II, A - I

14. Paired bones of our cranium are

- | | |
|-------------------------------|--------------------------------|
| 1) parietal and frontal bones | 2) occipital bone only |
| 3) temporal bone only | 4) parietal and temporal bones |

15. Find the mismatch

- | |
|--|
| 1) Vertebrosternal ribs - 1 st to 7 th pair, directly articulates with sternum ventrally |
| 2) False ribs - 8 th , 9 th and 10 th pair, articulates with costal cartilage of 7 th ribs |
| 3) Floating ribs - Vertebrochondral ribs, not connected ventrally |
| 4) Ribcage (37 bones) - Includes thoracic vertebrae, ribs and sternum |

16. Which of the following statements are incorrect regarding human skeleton?

- (i) The skull is dicondylic and ribs are bicephalic
 - (ii) Metacarpals are 8 in numbers but metatarsals are 7
 - (iii) Patella is a cup-shaped bone, covering the knee ventrally
 - iv) Scapula is a large triangular flat bone, situated on the ventral side of the thorax
 - v) The pelvic girdle has two coxal bones,
- | | | | |
|------------|-------------|-------------|--------------|
| 1) i and v | 2) i and ii | 3) ii and v | 4) ii and iv |
|------------|-------------|-------------|--------------|

17. Which one of the following is the correct description of a certain part of a normal human skeleton?

- 1) Parietal bone and the temporal bone of the skull are joined by fibrous joint.
- 2) First vertebra is axis which articulates with the occipital condyles
- 3) Spinal cord has a central hollow portion known as neural canal
- 4) Glenoid cavity is a depression to which the thigh bone articulates.

18. Match column I with column II and select the correct option from the codes given below.

	Column I		Column II
A.	Humerus	i	Thigh
B.	Pectoral girdle	ii	Upper arm
C.	Femur	iii	Clavicle
		iv	Acetabulum
		v	Glenoid cavity
		vi	Scapula

1) A – ii, v; B – iii, vi; C – i, iv 2) A – ii, iv; B – iii, vi; C – i, v

3) A – i, v; B – ii, iv; C – ii, iv 4) A – iii, vi; B – i, v; C – ii, iv

19. Match the following

	Column I		Column II
A	Joint between femur and acetabulum	1	Fibrous joint
B	Joint between adjacent thoracic vertebrae	2	Hinge joint
C	Joint between occipital and parietal	3	Ball and Socket joint
D	Joint between phalanges	4	Saddle joint
E	Joint between carpal and metacarpal of thumb	5	Gliding joint
		6	Cartilaginous joint

1) $\frac{ABCDE}{36124}$

2) $\frac{ABCDE}{46123}$

3) $\frac{ABCDE}{36214}$

4) $\frac{ABCDE}{16243}$

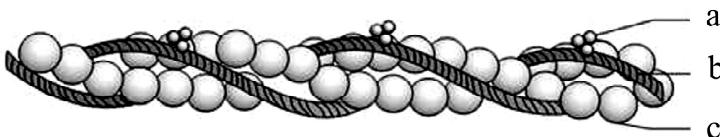
20. Match the following

	Column I		Column II
I	Muscle fatigue	a	Autoimmune disease
II	Osteoarthritis	b	Excessive formation of uric acid
III	Gout	c	Demineralization of bone
IV	Osteoporosis	d	Accumulation of lactic acid
V	Rheumatoid arthritis	e	Degeneration of articular cartilage

- 1) $\frac{\text{I}, \text{II}, \text{III}, \text{IV}, \text{V}}{\text{d} \text{ e} \text{ b} \text{ c} \text{ a}}$ 2) $\frac{\text{I}, \text{II}, \text{III}, \text{IV}, \text{V}}{\text{e} \text{ d} \text{ b} \text{ c} \text{ a}}$ 3) $\frac{\text{I}, \text{II}, \text{III}, \text{IV}, \text{V}}{\text{d} \text{ e} \text{ c} \text{ b} \text{ a}}$ 4) $\frac{\text{I}, \text{II}, \text{III}, \text{IV}, \text{V}}{\text{a} \text{ b} \text{ c} \text{ d} \text{ e}}$

LEVEL - II

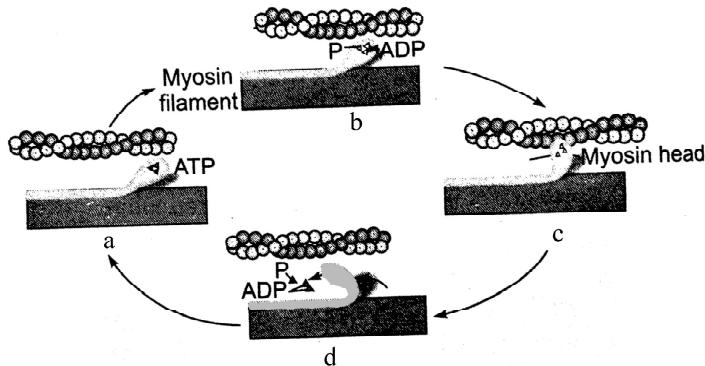
- Which one of the following condition does not justify the statement “Locomotory structures need not be different from those affecting other types of movements”?
 - Hydra can use its tentacles for capturing its prey and also use them for locomotion
 - Obelia can use their nematocysts for anchorage and swimming
 - In paramecium, cilia helps in the movement of food through cytopharynx and in locomotion as well
 - Humans use limbs for changes in body postures and locomotion as well
- Pick out the correct statement with respect to skeletal muscles
 - Each organised skeletal muscle in our body is made of a number of fascia
 - Fascicles in a muscle are held together by a collagenous connective tissue layer
 - Each sarcomere is formed of repeated myofibrils
 - A motor nerve along with the muscle fibres connected to it constitute a motor unit
- Select the correct option regarding a,b, and c



- a – Troponin – possess myosin binding site
- b – Tropomyosin – possess calcium binding site
- c – F actin – possess ATP binding site
- a and b lies along the grooves of F-actin

4. The globular head of HMM exhibits ATPase activity, and has
- actin binding site
 - myosin binding site
 - ATP binding site
 - calcium binding site
 - troponin binding site
- a, b and c
 - a, c and d
 - a, c and e
 - a and c only
5. Find the incorrectly matched pair
- | | |
|--------------------|---|
| 1) Motor unit | - a motor neuron alongwith the muscle fibres connected to it |
| 2) Motor end plate | - the site where a motor neuron ends on the sarcolemma of a muscle fibre |
| 3) Acetyl choline | - neurotransmitter released by motor neurons in the neuro muscular junction |
| 4) Ach receptors | - present on the plasma membrane of motor neuron at the motor end plate |

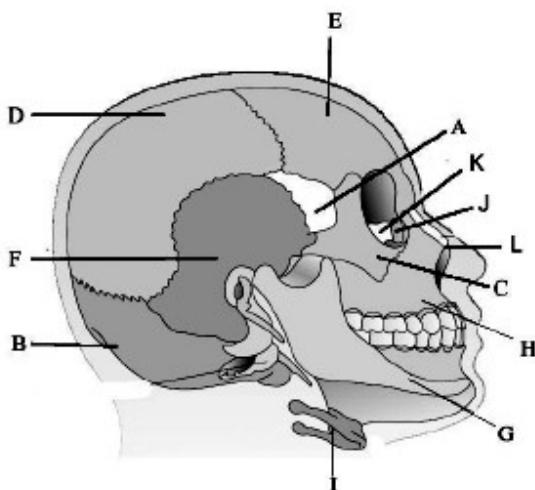
6.



Which of the following option is true regarding events in muscle contraction?

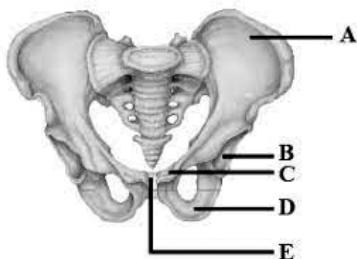
- b - sliding and rotation
 - b - formation of cross bridge
 - d - breaking of cross bridge
 - d - sliding / rotation
7. Following are certain events in muscle contraction. Arrange the events in **correct** sequence
- Binding of Ca^{++} ions with a subunit of troponin
 - Myosin head binds to the exposed active sites on actin
 - Depolarisation of sarcolemma
 - Neural signals stimulate the release of acetylcholine
 - Action potential spreads throughout the fibre via T-tubules
 - Release of Ca^{++} from SR
 - Cross bridge formation
 - Z-line pulled inwards
- v- iv- iii- vi- i- ii- vii- viii
 - iv- iii- v- vi- i- ii- vii- viii
 - iv- v- iii- vi - i- ii- vii- viii
 - iv- vi- v- iii- i- ii- vii- viii

8. During muscle contraction, which of the following events occur?
- Length of thick and thin myofilaments has changed
 - Length of I-bands got reduced and A-bands retain the length
 - Z-lines moves closer and H-zone unaffected
 - A-bands and sarcomeres shorten
9. How many of the following statements are true regarding red muscle?
- Abundant myoglobin and rich blood supply
 - Plenty of mitochondria and sarcoplasmic reticulum
 - High SR and fast rate of contraction
 - Depends aerobic process and are not easily fatigued
 - Low SR and slow rate of contraction
- One
 - Two
 - Three
 - Four
10. Find out the number of **incorrect** matches about human skeleton
- | | |
|--------------------------|---------------------------------|
| i) Axial skeleton – 80 | ii) Appendicular skeleton – 120 |
| iii) Limb bones – 126 | iv) Skull bones – 26 |
| v) Vertebral column – 29 | vi) Facial bones – 12 |
| vii) Ribs – 14 | viii) Girdle bones – 2 |
- Five
 - Four
 - Six
 - Seven
11. Diagrammatic view of human skull is given below. Select the option with **correct** identification of bones.



- A-Sphenoid, F-Temporal, H-Zygomatic, E-Frontal
- E-Frontal, F-Temporal, B-Parietal, H-Maxilla
- G-Maxilla, D-Parietal, G-Mandible, A-Zygomatic
- B-Occipital, J-Lacrymal, F-Temporal, L-Nasal

12. How many of the following statements concerning vertebral column are correct?
- a) It is a long curved bony rod with two curves
 - b) Each vertebra has a neural canal through which the spinal cord passes
 - c) Lumbar and coccygeal vertebrae are fused ones
 - d) Thoracic vertebrae serve as the point of attachment for the ribs and musculature of the back
 - e) Sacrum has facets for the attachment of ilia of hip girdle
- 1) Two 2) Three 3) Four 4) Five
13. Which of these statements concerning the ribs is true?
- 1) The head of the ribs are attached to the manubrium of sternum.
 - 2) Floating ribs are not attached to the vertebrae
 - 3) True ribs are attached directly to the sternum with costal cartilage
 - 4) False ribs are attached ventrally to the xiphoid process of sternum
14. Number of bones in each forelimb from proximal to distal region are:
- 1) 2-4-16-10-28
 - 2) 28-10-16-4-2
 - 3) 14-5-8-2-1
 - 4) 1-2-8-5-14
15. Identify the **incorrect** statement regarding girdles
- 1) Scapula has a slightly elevated ridge called spine
 - 2) Collar bone articulates with acromion process and manubrium of sternum
 - 3) Acetabulum of coxal bone provides place for articulation of thigh bone
 - 4) Coxal bones of hip girdle meet dorsally to form pubic symphysis
16. In the pelvic girdle of man A, B, C, D and E respectively represents



- 1) A-pubis, B- acetabulum, C-ilium, D-ischium, E-pubic symphysis
- 2) A-ilium, B-acetabulum, C-pubis, D-ischium, E-pubic symphysis
- 3) A-ischium, B-acetabulum, C-pubis, D-ilium, E-pubic symphysis
- 4) A-ilium, B-pubis, C-acetabulum, D-pubic symphysis, E- ischium

17. Which is **incorrect** regarding each joint and its two examples?

 - 1) Pivot joint
 - a. between atlas and axls
 - b. between radius and ulna
 - 2) Hinge joint
 - a. elbow joint, knee joint
 - b. interphalangial joint
 - 3) Gliding / Sliding joint
 - a. between carpals in the wrist
 - b. between tarsals in the ankle
 - 4) Saddle joint
 - a. metacarpophalangeal joint
 - b. carpometacarpal joint of thumb

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 discs - Cartilaginous joint, between two adjacent vertebrae of vertebral column
 - 4) Pubic symphysis - Fibrous joint, between right and left pubic bones of vertebral column

19. Match the following

	Column I		Column II
a	Gout	1	Decrease the density of bone after menopause in females
b	Tetany	2	Progressive degeneration of skeletal muscle
c	Myasthenia gravis	3	Accumulation of uric acid crystals in joints
d	Muscular dystrophy	4	Wild contraction of muscle due to low blood calcium
e	Osteoporosis	5	An autoimmune disorder, affects neuro muscular junction

- 1) a-3; b-4; c-5; d-2; e-1 2) a-4; b-5; c-1; d-3; e-2

2) a-1; b-5; c-4; d-3; e-2 4) a-2; b-4; c-3; d-5; e-1

20. How many of the following statements are correct?

 - i) Muscle bundles are held together by a white fibrous connective tissue layer called fascicle
 - ii) Hyoid bone lies at the roof of buccal cavity is also included in the skull
 - iii) Mandible is the movable bone in the cranium
 - iv) Obturator foramen is found in pelvic girdle
 - v) Hypocalcemia leads to hyperexcitation / rapid spasm of muscle.
 - vi) Force generated by the muscles is used to carry out movement through fulcrum.

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

CHAPTER - 09

NEURAL CONTROL AND CO-ORDINATION

Teaching Points

- Neural system in various phyla
- Components of human neural system. Mention CNS, PNS , afferent and efferent nerves , ANS-sympathetic and parasympathetic nerves and their functions, visceral neural system.

NEURAL TISSUE—

- Neurons – Structure ,types of neurons and unique features of neurons.
- Neuroglia – Types of neuroglia cells with their functions.

GENERATION AND CONDUCTION OF IMPULSES

- Explain – Resting potential , Depolarisation ,Action potential , Repolarisation etc.
- Na and K-ion pumps, Na^+ and K^+ channels

Electrical and chemical synapses

- Explain mechanism of synaptic transmissions with the help of diagram in NCERT.

CNS — BRAIN AND SPINALCORD

- Meninges
- Brain – structure with the labelled figure in NCERT.

FORE BRAIN- Cerebrum, Thalamus and Hypothalamus

Cerebrum – Cortex - Grey matter, Medulla-white matter

- Sulci and Gyri , cerebral hemispheres , Different lobes and sensory areas in cerebral cortex and their roles.
- Limbic system — amygdala and hippocampus—functions.

Diencephalon –

- Thalamus , hypothalamus , diocoel(3rd ventricle) — functions

MID BRAIN

- Corpora quadrigemina , cerebral peduncles , cerebral aqueduct

HIND BRAIN — Cerebellum , Pons varolii and Medulla oblongata.

- **Pons varolii** - pneumotaxic centre - function.
- **Medulla oblongata** - Controlling centre of involuntary organs .

Controlling centers such as Respiratory centre , cardiac centre and centres of peristalsis , salivation , micturition, vomiting etc.

VENTRICLES AND CAVITIES OF BRAIN

- Mention - Paracoels /Lateral ventricles , diocoel / 3rd ventricle , cerebral aqueduct/ Iter /aqueduct of Sylvius , Myocoel / 4th ventricle.

SPINAL CORD - Structure, Neural canal, Central canal.

PNS -

- Cranial nerves - 12 pairs
- Spinal nerves - 31 pairs
- Sympathetic and parasympathetic nerves ,their functions.

Reflex action - Figure –NCERT , Reflex arc , Types of reflex actions.

SENSE ORGANS

EYE :- Mention photoreceptors , ocular muscles ,eye glands etc.

- Structure of eye -Labelled diagram (NCERT). With all parts.
- Explain - Eye wall layers such as sclera , choroid and retina.
- Structure of retina , flow chart of light rays in retinal layers.
- Flow chart of light rays in eyes and mechanism of vision.

EAR :- **Functions – hearing and balancing.**

- Structure of ear - Labelled diagram(NCERT)
- **External ear** - Pinna , Auditory meatus and Tympanic membrane.
- **Middle ear** :- Ear ossicles , Eustachian tube, Oval and Round windows.
- **Internal ear** :- Vestibular apparatus for balancing and cochlea for hearing.
- Structure of cochlea, T.S of cochlea and ‘Organ of Corti’
- Flow chart of sound waves and mechanism of hearing.

Nose :- Olfactory epithelium, olfactory receptor cells ,olfactory bulb, Bowman’s glands etc.

QUESTIONS

LEVEL - I

1. A sprinting athlete experiences all the following except
 - 1) an increase in cardiac output
 - 2) an increase in GFR
 - 3) an increase in peristalsis
 - 4) an increase in rate of respiration
2. Efferent nerve fibres transmit impulses from
 - 1) CNS to voluntary and involuntary muscles
 - 2) CNS to receptor cells
 - 3) CNS to skeletal muscles only
 - 4) tissues or organs to CNS
3. All the following are major parts of a neuron except
 - 1) Axon
 - 2) Cell body
 - 3) Nodes of Ranvier
 - 4) Dendrites
4. Myelin sheath is formed by
 - 1) Ranvier cells
 - 2) Purkinje cells
 - 3) Schwann cells
 - 4) Neurilemma
5. A nerve fibre during resting stage is
 - 1) more permeable to K^+
 - 2) nearly impermeable to Na^+
 - 3) impermeable to proteins
 - 4) all of the above
6. Which of the following is incorrect?
 - 1) Resting membrane potential is +30mV and action potential is -70mV.
 - 2) For a synapse, presynaptic membrane is the part of axon and post synaptic membrane is the part of dendrite
 - 3) Depolarisation is due to influx of Na^+
 - 4) Neurotransmitters are produced by Nissl bodies
7. Of the three layers of meninges, the middle layer is
 - 1) pia mater
 - 2) dura mater
 - 3) arachnoid
 - 4) CSF filled layer
8. Corpus callosum connects
 - 1) Cerebral hemispheres
 - 2) Cerebellar hemispheres
 - 3) IIIrd and IVth ventricles
 - 4) forebrain and hindbrain

9. Find the correct match regarding brain parts and their location

	Brain parts		Location
1	Corpora quadrigemina	p	between midbrain and medulla oblongata
2	Thalamus	q	occipital lobe of cortex
3	Pons varolii	r	part of forebrain above midbrain
4	Visual area	s	dorsal part of midbrain

1) 1-s, 2-p, 3-q, 4-r 2) 1-s, 2-r, 3-p, 4-q

3) 1-q, 2-s, 3-r, 4-p 4) 1-s, 2-q, 3-p, 4-r

10. The second biggest part of brain is

1) Cerebrum 2) Midbrain 3) Little brain 4) Medulla oblongata

11. The respiratory and cardiac centres are located in:

1) Cerebrum 2) Thalamus 3) Cerebellum 4) Medulla oblongata

12. Brain stem is formed of

- 1) Midbrain, Cerebellum and pons
- 2) Midbrain, Pons and Medulla oblongata
- 3) Medulla oblongata, Cerebellum and midbrain
- 4) Cerebrum, Midbrain and hindbrain

13. The reflex centre of knee jerk reflex is

1) Brain 2) Spinal cord 3) Receptor 4) Dorsal ganglion

14. Retina is most sensitive at

1) Yellow spot 2) Macula lutea 3) Fovea 4) Optic disc

15. The correct path of flow of photon to retina is

- 1) Lens → Vitreous humour → Aqueous humour → Retina
- 2) Cornea → Vitreous humour → Lens → Aqueous humor → Retina
- 3) Cornea → Aqueous humour → Lens → Vitreous humour → Retina
- 4) Conjunctiva → Aqueous humour → Vitreous humour → Lens → Retina

16. The point of mammalian eye from where optic nerve leave the eye ball and blood vessels enter and leave the eye ball is

1) yellow spot 2) blind spot
3) canal of Schlemm 4) optic chiasma

17. The parts of ear converting sound energy into vibrations is

1) pinna 2) ear drum 3) cochlea 4) ear ossicles

18. Find the matching set

	Column I		Column II
1	Eustachian tube	a	connect ear drum and oval window
2	Ear ossicles	b	maintains dynamic equilibrium
3	Organ of Corti	c	equalises air pressure on both sides of ear drum
4	Cristae	d	units of hearing

- 1) 1-c, 2-d, 3-a, 4-b 2) 1-c, 2-b, 3-b, 4-a
 3) 1-d, 2-b, 3-a, 4-c 4) 1-c, 2-a, 3-d, 4-b

19. Find the false statement

- 1) Tectorial membrane is non-sensory, while basilar membrane is sensory membrane
 2) Ceruminous glands of auditory canal produce ear wax
 3) The ear is in frontal bone
 4) Olfactory cells are located in nasal equilibrium

20. The vestibular apparatus is composed of

- 1) three ear ossicles of middle ear
 2) three semicircular canals of inner ear
 3) cochlea and the organ of corti
 4) cristae of semicircular canals and maculae of saccule and utricle

LEVEL - II

1. Nissl bodies are characteristic cell organelles of neurons and are mainly composed of
 1) DNA and RNA 2) proteins and glycolipids
 3) immunoglobulins and SER 4) free ribosomes and RER
2. Which of the following is incorrect?
 1) Somatic neural system relays impulses from CNS to skeletal muscles
 2) Visceral nervous system is part of PNS
 3) ANS transmits impulses from CNS to voluntary organs
 4) PNS comprises of afferent and efferent fibres
3. The correct direction of impulse flow through a neuron is
 1) cyton → dendron → axon
 2) dendrite → cell body → axon
 3) synaptic vesicle → synaptic cleft → post synaptic neuron
 4) axon → cell body → dendrite

4. Receptor sites for neurotransmitters are present on
 1) pre-synaptic membrane
 2) post-synaptic membrane
 3) membrane of synaptic knobs
 4) membrane of synaptic vesicles
5. Around a resting nerve fibre, the most abundant cation is
 1) K⁺ 2) Na⁺ 3) Protein 4) Ca²⁺
6. How many of the following statements are incorrect?
 a) Using an ATP, the Na⁺- K⁺ pump transports 2Na⁺ outwards for 3K⁺ into the cell
 b) The axoplasmic side of axolemma of a resting nerve fiber is +55mV
 c) A resting axonal membrane is more permeable to K⁺
 d) Neurons with one axon and one dendrite are found in the retina of eye
 1) 1 2) 2 3) 3 4) 4
7. The main event in depolarisation is
 1) efflux of Na⁺ 2) efflux of K⁺ 3) influx of Na⁺ 4) influx of K⁺
8. Find the wrong match
 1) Arachnoid mater - middle layer of meninges
 2) Synaptic cleft - gap between pre and post synaptic membranes
 3) Resting potential - electrical potential difference across a resting plasma membrane
 4) Nodes of Ranvier - electrically inactive gaps between 2 adjacent myelin sheaths
9. Which of the following is not a part of hindbrain?
 1) Cerebellum 2) Pons varoli
 3) Medulla oblongata 4) Corpora quadrigemina
10. Find the matching set

	Column I		Column II
a	Hypothalamus	i	Inter connects different parts of brain
b	Pons varoli	ii	Integrates impulses from vestibular system
c	Association area	iii	Appetite centre and thermostat
d	Cerebellum	iv	Intersensory association and memory

- 1) a-iii, b-ii, c-i, d-iv 2) a-iii, b-i, c-iv, d-ii
 3) a-ii, b-i, c-iv, d-iii 4) a-i, b-ii, c-iv, d-iii
11. Limbic system consists of
 1) Cerebrum, thalamus and hypothalamus 2) amygdala, hippocampus and hypothalamus
 3) pons, cerebellum and medulla oblongata 4) midbrain, pons and medulla oblongata

12. Which of the following is not the name for the canal of connecting IIIrd and IVth ventricles of brain?
- 1) central canal
 - 2) Iter
 - 3) aqueduct of sylvius
 - 4) cerebral aqueduct
13. Match the following columns and select the correct option

	Column I		Column II
a	Organ of corti	i	connects middle ear and pharynx
b	Eustachian tube	ii	adjusts the focal length of eye lens
c	Blind spot	iii	on basilar membrane of cochlear duct
d	Ciliary apparatus	iv	rods and cones are absent

	a	b	c	d
1	i	ii	iv	iii
2	iii	iv	i	ii
3	iii	i	iv	ii
4	ii	i	iii	iv

14. Which of the following is not true of fovea centralis?
- 1) Concave central part of macula lutea
 - 2) Point of retina with greatest visual acuity
 - 3) Thickest part of retina
 - 4) Contains only cones and no rods
15. Which one of the following is incorrect?
- 1) Corneal transplant is almost never rejected because cornea is avascular
 - 2) Iris muscles are for altering the size of pupil
 - 3) Chemical senses of gustation and olfaction are functionally similar and interrelated
 - 4) Iris, the pigmented and opaque structure, is the anterior part of retina

16. 2 membranes divide cochlea into 3 longitudinal canals. The membranes are
 - 1) tectorial membrane and basilar membrane
 - 2) basilar membrane and Reissner's membrane
 - 3) tympanic membrane and Schneiderian membrane
 - 4) conjunctiva and basilar membrane
17. The middle layer of eye wall is
 - 1) bipolar layer
 - 2) incus
 - 3) choroid
 - 4) scala media
18. Medulla oblongata controls
 - 1) respiration , cardiovascular reflexes and gastric secretion
 - 2) voluntary movements, intelligent activities
 - 3) circadian rhythms of the body
 - 4) sexual behaviour, emotions and motivations
19. Scala tympani terminates at
 - 1) oval window
 - 2) round window
 - 3) ear drum
 - 4) pharynx
20. Mark the incorrect statement
 - 1) The nerve impulse is transmitted as a wave of depolarisation
 - 2) Limbic system is concerned with olfaction and autonomic responses
 - 3) Rods are for daylight vision
 - 4) The image formed on retina is diminished, inverted and real

CHAPTER - 10

CHEMICAL COORDINATION AND INTEGRATION

Key Elements

- ◆ Endocrinology - Study of endocrine glands, hormones, related disorders etc.
- ◆ Dr. Thomas Addison - Father of endocrinology
- ◆ Hormones - Secretions of endocrine glands
- ◆ Hormone - Word origin - Greek-means set in motion/to excite etc.
- ◆ Hormones are released into the blood and transported to target organs
- ◆ Endocrine glands have no ducts (ductless glands)
- ◆ Hormones are non nutrient chemicals which act as intercellular messengers and are produced in trace amounts
- ◆ The neural system and endocrine system jointly coordinate and regulate the physiological functions of the body.
- ◆ The neural co-ordination is fast but short lived whereas chemical coordination is slow and long lasting
- ◆ Nerve fibres do not innervate all cells of the body (innervate = supply with nerves)
- ◆ Secretin - First hormone discovered
- ◆ Secretin acts on exocrine pancreas and stimulates the secretion of water and bicarbonate ions
- ◆ Invertebrates show simple endocrine systems
- ◆ Vertebrates show complex endocrine systems
- ◆ Major endocrine glands located in different parts of human body are
 - 1) Head -3**
 - i) Hypothalamus
 - ii) Pituitary gland
 - iii) Pineal gland
 - 2) Neck-2**
 - i) Thyroid gland
 - ii) Parathyroid gland
 - 3) Thorax : i)** Thymus gland

4) Abdomen : 3

- i) Adrenal gland
- ii) Pancreas, iii) Ovaries/Testis (extra abdominal)

Placenta : hCG, hPL, Relaxin, estrogen, progesterone etc are produced by placenta

- ◆ In addition to organised endocrine glands, hormones are also produced from different tissues/cells in our body.
 - eg :
 - 1) gastrointestinal tract → gastrin, secretin, CCK, GIP etc
 - 2) JG cells of kidney → Renin
 - 3) Atrial wall of heart → ANF

HYPOTHALAMUS

- ◆ Located at the basal part of diencephalon (caudal region of forebrain)
- ◆ Contains several groups of neurosecretory cells called nuclei which produce hormones (neurohormones)
- ◆ Hypothalamus regulates the synthesis and secretion of pituitary hormones through releasing hormones and inhibiting hormones. Hypothalamus is known as master clock.
- ◆ **Releasing hormones of hypothalamus**
 - eg i) GHRH (Growth hormone Releasing hormone)
 - ii) GnRH (Gonadotropin releasing hormone)
 - iii) TRH (Thyrotropin Releasing Hormone), also known as TSH -RH/Thyroid Stimulating hormone - Releasing Hormone.
 - iv) PRH (Prolactin Releasing Hormone)
 - v) CRH (Corticotropin Releasing Hormone, also known as ACTH-RH/Adrenocorticotropic Hormone - Releasing Hormone)
 - vi) MSH - RH (Melanocyte Stimulating Hormone - Releasing Hormone).

Inhibiting Hormones of hypothalamus

- eg :
- i) GHIH (Growth Hormone Inhibiting Hormone), also known as somatostatin
- ii) PIH (Prolactin Inhibitory Hormone)
- iii) MSH - IH (Melanocyte stimulating Hormone Inhibiting Hormone)

The target organ of releasing hormones and inhibiting hormones of hypothalamus is anterior pituitary/ adenohypophysis.

These hormone are transported to anterior pituitary through hypophyseal portal circulation.

Hypophyseal portal system starts from hypothalamus and ends in adenohypophysis.

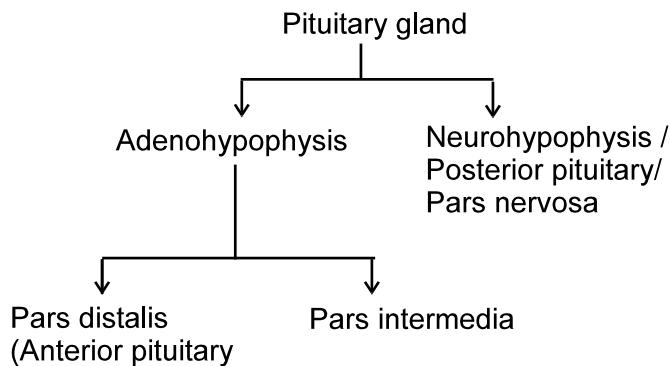
Apart from releasing and inhibiting hormone, hypothalamic nuclei also produce vasopressin/ADH and oxytocin/OT.

Vasopressin/ADH and OT are transported axonally to posterior pituitary/neurohypophysis.

Posterior pituitary is under the direct neural regulation of hypothalamus.

Pituitary gland/ Hypophysis

- ◆ Formerly known as master gland
- ◆ It is located in a bony cavity called sella turcica present in sphenoid bone (a cranial bone).
- ◆ It is connected to hypothalamus by a stalk called infundibulum.



- ◆ In humans, the pars intermedia is almost merged with pars distalis

Hormones of Anterior Pituitary

1) Growth Hormone/ GH

2) Somatotrophin

3) TSH

4) Prolactin/PRL

5) FSH

6) LH

7) MSH (from Pars intermedia)

- ◆ Hypersecretion of growth hormone in children creates pituitary dwarfism

- ◆ Hypersecretion of growth hormone in adults creates acromegaly

- ◆ Acromegaly is hard to diagnose in the early stages

Posterior pituitary - Stores and releases two neuro hormones of hypothalamus-OT and ADH

- ◆ Oxytocin/OT acts on the smooth muscles of the body and stimulates their contraction. It stimulates child birth and milk ejection. So OT is also known as birth hormone and milk ejecting hormone.

- ◆ Synthetic oxytocin is called pitocin.

- ◆ Pitocin injection speeds up childbirth.

Anti Diuretic Hormone/ADH/Vasopressin - acts mainly at the kidney tubules and stimulates the reabsorption of water and electrolytes.

- ◆ Hyposecretion of ADH creates diuresis (excess urination) and the disorder is known as diabetes insipidus.

- ◆ More ADH → Less urination, Less ADH → More urination.

Pineal gland/ Pineal body/ Epiphysis cerebri

- ◆ Biological clock
- ◆ Located on the dorsal side of forebrain
- ◆ Secretes hormone melatonin. It helps to keep sleep wake cycle (circadian rhythm) body temperature, metabolism, menstrual cycle, defense capability, destroys free radicles etc.
- ◆ Melatonin is secreted in response to darkness
It delays sexual development

Thyroid gland

- ◆ Largest endocrine gland. Bilobed gland located on either side of trachea
- ◆ Both lobes of thyroid gland are interconnected by thin connective tissue flap.
- ◆ Thyroid gland is composed of thyroid follicles (follicular cells, para follicular cells) and stromal tissue.
- ◆ Stroma is the connective tissue present below the surface of an organ and it helps to hold the other parts of the organ.
- ◆ Follicular cells synthesise two hormones
 - i) tetraiodothyronine (thyroxine/T₄)
 - ii) triiodothyronine (T₃), (Iodine is essential for thyroxine synthesis)
- ◆ Iodothyronines are the derivatives of amino acid tyrosine
- ◆ Deficiency of iodine results in hypothyroidism and enlargement of the thyroid gland, known as simple goitre.
- ◆ Hypothyroidism during pregnancy creates cretinism in foetus and myxoedema/ Gull's disease in mother.
- ◆ Cretin means stupid person. Cretinism is characterised by mental retardation, stunted growth, low IQ, deaf -mutism, etc.
- ◆ Thyroid gland can store and release its hormone
- ◆ Hyperthyroidism creates exophthalmic goitre/ Grave's disease. Hashimoto's thyroiditis is an autoimmune disease.
- ◆ Thyroid hormones help to regulate basal metabolic rate(BMR), erythropoiesis, water electrolyte balance, metabolism of carbohydrates , protein and lipids.
- ◆ Skipping of menstrual cycles in adult women may occur due to hypothyroidism.
- ◆ Para follicular cells (para = beside) of thyroid gland secrete thyrocalcitonin\TCT\ Calcitonin/Hypocalcemic hormone.
- ◆ It lowers the blood calcium level. (Hypocalcemic hormone).
- ◆ It is a protein hormone, not an iodothyronine.

Parathyroid gland (para = beside)

- ◆ Four parathyroid glands (one pair in each lobe of thyroid gland).

- ◆ Secretes Parathyroid hormone/PTH/Parathormone/Collips hormone/Hypercalcemic hormone.
- ◆ PTH is regulated by blood calcium level.
- ◆ A peptide hormone.
- ◆ PTH increases calcium level by stimulating i) demineralisation or resorption/dissolution of bones, ii) reabsorption Ca^{2+} from renal tubules, iii) digested food in intestine
- ◆ Hyper secretion of PTH creates tetany (hypocalcemic tetany). PTH and TCT are antagonistic in function.

Thymus gland

- ◆ Located beneath the sternum near the heart (ventral side of aorta)
- ◆ Thymus is quite large at the time of birth but keeps reducing in size with age and by the time of puberty is attained it reduces to a small size.
- ◆ Thymosin hormone is a peptide hormone
- ◆ Thymosin has a major role in immunity especially differentiation of T - lymphocytes. (T stands for Thymus).
- ◆ Immunity of elderly peoples become weak due to the atrophy/degeneration of thymus gland

Adrenal glands/Supra renal glands

- ◆ One pair of adrenal glands, one at the anterior part of each kidney
- ◆ Each adrenal gland shows a peripheral cortex (mesoderm derivative) and an inner medulla (ectoderm derivative)
- ◆ Steroid hormones of adrenal cortex are collectively known as corticoids.
- ◆ Steroid hormones are cholesterol derivatives.
- ◆ Adrenal cortex shows three layers
 - i) Zona glomerulosa (outer layer)
 - ii) zona fasciculata (middle layer) and
 - iii) zona reticularis (inner layer)
- ◆ Hormones of zona glomerulosa are collectively called mineralocorticoids. eg Aldosterone/ salt retaining hormone. Its production is under the direct monitoring of JG cells of kidney.
- ◆ Aldosterone acts mainly at the renal tubules and stimulates the reabsorption of Na^+ and water and secretion of K^+ and phosphate ions. It helps in the maintenance of electrolytes, body fluid volume, osmotic pressure etc.
- ◆ Zona fasciculata secretes glucocorticoids eg: cortisol.
- ◆ Cortisol stimulates gluconeogenesis, lipolysis and proteolysis.
- ◆ Gluconeogenesis means formation of glucose from non carbohydrate sources like lipids and proteins etc.
- ◆ Cortisol inhibits cellular uptake and utilisation of amino acids. It is also involved in maintaining cardio-

vascular function and kidney function. It suppresses immune response and produces anti-inflammatory reactions. Cortisol is a stress fighter. It also stimulates erythropoiesis.

- ◆ Synthetic cortisol is called cortisone
- ◆ Zona reticularis secretes sex corticoids. These androgenic steroids promote the growth of axial hair, pubic hair and facial hair during puberty

Adrenal medulla : Secretes two hormones

- i) Adrenaline/epinephrine
- ii) Noradrenaline/Norepinephrine

- ◆ They are commonly called catecholamines / emergency hormones/ hormones of fight or flight or fright.
- ◆ These hormones prepare our body to face emergency situations.
- ◆ They are the derivatives of amino acid tyrosine. Adrenaline and Acetylcholine are antagonistic in function
- ◆ An injury to cortex is not likely to affect the secretion of emergency hormones.
- ◆ Catecholamines increase alertness, pupillary dilation, piloerection, sweating, strength of heart contraction, rate of respiration and glucose level in blood.
- ◆ Action of catecholamines is similar to that of sympathetic nervous system.

Pancreas : Mixocrine gland/ Composite gland/ Heterocrine gland

- ◆ Endocrine pancreatic part is called Islets of Langerhans (about 1-2% pancreatic tissue. Hormones are glucagon, insulin, somatostatin etc.
- ◆ 98% pancreatic tissue is exocrine and produces digestive enzymes.

Glucagon

α – cells of Islets of Langerhans (about 20% cells) secrete glucagon. It helps in maintaining normal blood glucose level. Glucagon acts mainly on the liver cells and promotes glycogenolysis. It also promotes gluconeogenesis.

- ◆ Glucagon reduces cellular glucose uptake and utilisation. Glucagon is a peptide hormone
- ◆ Also called hyperglycemic hormone

Insulin

Beta cells (about 70% cells) of pancreatic Islets secrete insulin. It acts mainly on hepatocytes and adipocytes and promotes cellular glucose uptake and utilisation.

- ◆ Insulin stimulates glycogenesis (conversion of glucose to glycogen)
- ◆ Insulin decreases blood glucose level, hence known as hypoglycemic hormone.
- ◆ Insulin and glucagon are antagonistic hormones.
- ◆ Insulin is a peptide hormone. Insulin and glucagon are antagonistic in function
- ◆ Diabetes mellitus ; Prolonged hyperglycemia due to the hyposecretion of insulin causes this disorder.
- ◆ Glycosuria and ketonuria are indicative of diabetes mellitus. Diabetes patient shows excessive thirst. (Needs more water to remove the excess blood sugar through urine)

- ◆ Glycosuria-presence of glucose in urine, ketonuria - presence of ketone bodies in urine.
- ◆ Somatostatin : Delta cells (about 5 to 10%) of Islets of Langerhans secrete somatostatin. It inhibits the secretion of insulin and glucagon. Thus inhibits growth.
- ◆ **Testis** : Primary sex organ of male. It produces both gametes and sex hormones (androgens).
- ◆ Testis shows seminiferous tubules and stromal tissue/interstitial tissue.
- ◆ Interstitial cells/Leydig cells secrete androgens (testosterone is the main androgen) . Androgens are steroid hormones.
- ◆ Androgens play a major role in the development of epididymis, vas deference, seminal vesicles, prostate gland, urethra etc.
- ◆ Androgen promotes muscular growth, facial and axillary hair, aggressiveness, low pitch voice, spermatogenesis, libido/ sexual urge.
- ◆ Androgens produce anabolic/synthetic effects on protein and carbohydrate metabolism.

Ovary

Primary sex organ of female. Produces both gametes and sex hormones (estrogen and progesterone). They are steroid hormones.

- ◆ Ovary is composed of ovarian follicles and stromal tissue.
- ◆ Growing ovarian follicles secrete estrogen
- ◆ Estrogen promotes the development of secondary sex organs, ovarian follicles, appearance of secondary sex characters like high pitch voice, mammary gland development, libido etc.
- ◆ Estradiol, Estrone, Estriol, Esterol etc are the main naturally occurring estrogens.
- ◆ After ovulation the ruptured Graafian follicle is converted into a temporary endocrine gland called corpus luteum. It mainly produces progesterone, also estrogen.
- ◆ Progesterone is called pregnancy hormone
- ◆ Progesterone stimulates the formation of mammary alveoli and lactation
- ◆ Progesterone meaning → substance which favours gestation
- ◆ Progestin is a synthetic form of progesterone
- ◆ Progestogen is a naturally occurring or synthetic form of progesterone.
- ◆ Levonorgestrel (LNG) is a synthetic progestogen/progestin. LNG-20 releases 20 μ g of levonorgestrel per day into the uterine cavity. (An example for hormone releasing intra uterine contraceptive device).

Hormones of heart, kidney and gastrointestinal tract

Heart : ANF (Atrial Natriuretic Factor), secreted from the atrial wall of heart. ANF promotes the urinary elimination of sodium (Blood pressure lowering hormone and vasodilator hormone.) ANF opposes Renin-Angiotensin mechanism. ANF stops the secretion of Renin and aldosterone. ANF is a peptide hormone.

Kidney : JG cells of kidney secretes erythropoietin. It promotes erythropoiesis. It is a peptide hormone.

Gastrointestinal tract hormones

- i) Gastrin : Stimulates the secretion of gastric juice (HCl and pepsinogen).
- ii) Secretin : Stimulates the secretion of water and bicarbonate ions from exocrine pancreas
- iii) Cholecytokinin(CCK) : Releases bile from gall bladder and stimulates the secretion of pancreatic enzymes (cholecyst - gall bladder)
- iv) Gastric Inhibitory Peptide / GIP: It inhibits gastric juice secretion and motility movement of food. The function of enterogasterone hormone is almost same as GIP.
- v) Enterocrinin - Promotes the secretion of intestinal juice
- v) Duocrinin - Stimulates Brunners' glands to release mucus.

PLACENTAL HORMONES:

- i) hCG/Human Chorionic Gonadotropin

It stimulates corpus luteum to secrete progesterone and estrogen. Presence of hCG is considered as an indication of pregnancy.

- ii) hPL - (Human Placental Lactogen)

It has lactogenic and growth stimulating effects. It helps to free up glucose for the foetus and shows anti insulin properties too.

- iii) Relaxin : Both placenta and ovary (corpus luteum) produce relaxin. Relaxin relaxes the ligaments in the pelvis, softens cervix and pubis symphysis during child birth.

Growth Factors : Non endocrine tissues secrete growth factors. They are essential for the normal growth of tissues and their repair/regeneration. eg : IgF/ Insulin like growth factor. It acts as an intermediate in the stimulation of tissue growth.

Prostaglandins

They are the derivatives of complex fatty acids. They act as local tissue hormones. During childbirth, prostaglandins help in the dilation of cervix and contractions to occur.

Mechanism of hormone action

- ◆ Hormones are receptor specific.
- ◆ Hormone receptors are located either on the cell membrane of the target cells (membrane bound receptors) or inside the target cells (intracellular receptors/mostly present in the nucleus).
- ◆ Binding of a hormone to its receptor leads to the formation of hormone receptor complex
- ◆ Each receptor is specific to one hormone only.

- ◆ So if the hormone receptor is removed from its target tissue, then the target tissue will not all respond to the hormone.
- ◆ Hormone -receptor complex formation leads to certain biochemical changes in the target tissue metabolism and physiological functions.
- ◆ Hormones which interact with membrane bound receptors normally do not enter the target cell, but generate second messengers like cyclic adenosine monophosphate (cAMP), Inositol triphosphate (IP_3), Ca^{++} etc.
- ◆ Through the messengers the hormone regulates the metabolism of the target cell. eg : peptide, polypeptide, protein hormones etc.
- ◆ **All hormones except steroid hormones and iodothyronines combine with membrane bound receptors.**

ADH, OT, GHRH, PRH, CRH, TRH, MSHRH, GnRH, GHIH, PIH, MSH-IH, FSH, LH, TSH, ACTH, GH, PRL, Melatonin, TCT, PTH. Thymosin, Insulin, glucagon, epinephrine, norepinephrine, gastrin, secretin, CCK, GIP, ANF, Relaxin, hCG, hPL, erythropoietin etc are examples for hormones which interact with membrane bound receptors. These are water soluble hormones.

- ◆ Hormones which interact with intracellular receptor, mostly regulate gene expression or chromosome function by the interaction of hormone receptor complex with the genome.

Examples : - Steroid hormones and iodothyries. They are lipid soluble hormones

- ◆ Steroid hormones examples
 - 1) **Corticoids**: - i) aldosterone, ii) cortisol, iii) sex corticoids
 - 2) **Sex hormones** : - i) androgens (testosterone), ii) progesterone, iii) estrogen (estradiol)
- ◆ Iodothyronines : examples
 - 1) Tetraiodothyronine (T_4), Triiodothyronine(T_3)

QUESTIONS**LEVEL - I**

1. Read the following statements
 - i) Nerve fibres innervate all cells of human body
 - ii) Hormones are nutrient chemicals which act as intracellular messengers
 - iii) Chemical coordination is fast and long lasting
 - iv) Invertebrates possess very simple endocrine systems with few hormones

Of the above statements

 - 1) only two are true
 - 2) three are true
 - 3) only one is true
 - 4) all are true
2. Select the incorrect statement
 - 1) Pituitary, pineal, thyroid, adrenal, pancreas, parathyroid, thymus and gonads are examples for organised endocrine glands
 - 2) Hypothalamus contains several groups of neurosecretory cells called nuclei, which produce hormones:
 - 3) Somatostatin is also known as growth hormone inhibiting hormone
 - 4) Hypophyseal portal circulatory system ends in hypothalamus
3. Neurohormones produced from hypothalamic nuclei include
 - 1) vasopressin and oxytocin only
 - 2) releasing hormones only
 - 3) inhibiting hormones only
 - 4) all of the above
4. How many of the following statements are false about thyroid gland?
 - i) It is the largest endocrine gland, located on either side of trachea
 - ii) Both lobes of thyroid gland is connected by a thick flap made up of smooth muscles called isthmus
 - iii) Thyroxine, can be stored in thyroid follicles
 - iv) Para follicular cells of thyroid gland secretes thyrocalcitonin, which is a hypocalcemic hormone
 - 1) two are false
 - 2) only one is false
 - 3) three are false
 - 4) all are false
5. Select the mismatch,

1) glycogenesis	- conversion of glucose to glycogen
2) gluconeogenesis	- formation of glucose from non carbohydrate sources
3) glycogenolysis	- conversion of glycogen to glucose
4) glucogenesis	- formation of glucagon from α – cells of Islets of Langerhans

6. Choose the odd one with references to the diseases associated with the hypersecretion of hormones
 - 1) acromegaly
 - 2) Graves' disease
 - 3) gigantism
 - 4) Addison's disease
7. Select the false statement
 - 1) Adenohypophysis of humans consists of pars distalis and pars intermedia
 - 2) Hypophysis is located in a bony cavity called sella turcica, present in sphenoid bone
 - 3) The target organ of gonadotropin releasing hormone is gonads
 - 4) As a result of hypothyroidism, skipping of menstrual cycles may be occurred in adult females
8. Melatonin helps in maintaining
 - 1) metabolism and pigmentation
 - 2) immunity
 - 3) menstrual cycle and diurnal rhythm of our body
 - 4) all of these
9. Hyposecretion of vasopressin results in decreased ability of the kidneys to conserve water, leading to water loss and dehydration. This disorder is known as
 - 1) Addison's disease
 - 2) Diabetes mellitus
 - 3) Diabetes insipidus
 - 4) Cushing's disease
10. Which of the following function is not relevant to catecholamines?
 - 1) sweating and pupillary dilation
 - 2) increased alertness
 - 3) glycogenolysis
 - 4) synthesis of lipids and proteins
11. Select the incorrect statement
 - 1) About 98% pancreatic tissue is exocrine in nature
 - 2) α – cells of Islets of Langerhans secrete hyperglycemic hormone
 - 3) Insulin is also known as hypoglycemic hormone and it reduces cellular glucose uptake and utilisation
 - 4) Pancreas is a composite gland
12. Which of the following groups of hormones are amino acid derivatives?
 - 1) insulin and glucagon
 - 2) adrenaline and noradrenaline
 - 3) cortisol and estradiol
 - 4) oxytocin and vasopressin
13. Read the following statements
 - i) The target organ of MSH is melanocytes present in skin
 - ii) Hyposecretion of GH results in pituitary dwarfism
 - iii) The disease acromegaly is easy to diagnose in the early stages
 - iv) Posterior pituitary does not secrete any hormones, but it stores and releases hypothalamic hormones like ADH and OT

Of the above statements

 - 1) only one is true
 - 2) three are true
 - 3) only two are true
 - 4) all are true

14. Match the columns suitably

Column I	Column II
a) FSH	i) promotes parturition and milk ejection
b) MSH	ii) milk secretion
c) OT	iii) melanin pigment
d) PRL	iv) growth and development of ovarian follicles
1) a-iv, b-i, c-iii, d-ii	2) a-ii, b-i, c-iv, d-iii
3) a-iv, b-iii, c-i, d- ii	4) a-iv, b-iii, c-ii, d-i

15. Deficiency of iodine during pregnancy may create

- 1) cretinism and hypothyroidism in mother
- 2) cretinism in mother and hypothyroidism in foetus
- 3) cretinism in foetus and myxoedema in mother
- 4) myxoedema in foetus and cretinism in mother

16. A person shows increased basal metabolic rate, weight loss, bulging of eye balls etc. This may be due to

- 1) hypoparathyroidism 2) hyperthyroidism 3) hypothyroidism 4) hypothyrocalcitonism

17. Read the following statements

- i) Steroid hormones are cholesterol derivatives
- ii) Triiodothyronine (T_3), tetraiodothyronine (T_4) are examples for iodothyronines
- iii) Thyrocalcitonin is not an iodothyronine
- iv) Cortisol and catecholamines are involved in maintaining the cardiovascular function

Of the above statements

- 1) only two are true 2) only one is true
- 3) only three are true 4) all are true

18. Select the non antagonistic pair of hormones

- 1) gastrin and GIP 2) epineprine and norepinephrine
- 3) glucagon and insulin 4) parathyroid hormone and thyrocalcitonin

19. Which of the following groups of hormones can play a significant role in osteoporosis?

- 1) aldosterone and luteotropin 2) progesterone and aldosterone
- 3) estrogen and parathyroid hormone 4) prolactin and parathyroid hormone

20. Which of the following set of hormones contains only steroid hormones?

- 1) glucocorticoids, mineralocorticoids, sex corticoids, sex hormones
- 2) PRL, GHRH, TSH, GnRH
- 3) glucocorticoids, LH, FSH, GnRH
- 4) Mineralocorticoids, glucocorticoids, GI tract hormones

LEVEL - II

1. The hormone that stimulates the pituitary synthesis and release of gonadotropins is secreted by
 - 1) hypophysis
 - 2) adenohypophysis
 - 3) hypothalamus
 - 4) neurohypophysis
2. Select the mismatch
 - 1) clock of aging - Thymus gland
 - 2) biological clock - Pineal gland
 - 3) master clock - Hypothalamus
 - 4) Master gland - Pineal body
3. In a pregnant woman having prolonged labour pain, if the childbirth has to be hastened, it is to administer a hormone that can
 - 1) stimulate ovary
 - 2) activate the smooth muscles of uterus
 - 3) increase metabolic rate
 - 4) release glucose into blood
4. Malfunctioning of adenohypophysis may badly affect the functions of
 - 1) adrenal medulla
 - 2) thyroid
 - 3) pancreas
 - 4) thymus
5. Identify the hormone, based on the hints given below
 - a) released in response to stress
 - b) increases heart beat and strength of contraction
 - c) increases alertness and pupillary dilation
 - 1) cortisol
 - 2) secretin
 - 3) epinephrine
 - 4) CCK
6. Low level of progesterone and estrogen in blood stimulate the secretion of
 - 1) TSH
 - 2) FSH and LH
 - 3) GH
 - 4) hCG
7. The hormone produced by the zona glomerulosa layer of adrenal cortex will
 - 1) not help in the maintenance of electrolyte balance and blood pressure
 - 2) enhance gluconeogenesis
 - 3) increase glomerular filtration rate
 - 4) not alter carbohydrate metabolism
8. Hyposecretion of aldosterone and cortisol results in
 - 1) Graves' disease
 - 2) Cushing's disease
 - 3) Conn's disease
 - 4) Addison's disease

9. A person shows excess loss of glucose through urine and formation of ketone bodies. This is an indication that the person is suffering from
- 1) diabetes mellitus 2) diabetes insipidus
3) simple goitre 4) Addison's disease
10. How many of the following hormones can increase blood sugar level?
- i) epinephrine
ii) cortisol
iii) glucagon
iv) insulin
v) secretin
- 1) i, ii, iv 2) i, ii, v 3) i, iv, v 4) i, ii, iii
11. Which of the following statement is true about the hormone action in humans?
- 1) Secretion of thymosin is increased with ageing
2) In females FSH first binds with specific receptors present on ovarian cell membrane
3) PTH stimulates the secretion of estrogen
4) Cortisol is a non steroid hormone which regulates glucose metabolism
12. Which of the following groups of hormones shows gonadotropic effects?
- 1) LH and FSH only 2) GHRH, LH and FSH
3) LH , FSH and hCG 4) GHRH, LH, FSH and TCT
13. Which one of the following hormone can interact with intracellular receptors and regulate gene expression or chromosome function by the interaction of hormone receptor complex with the genome?
- 1) Thyrocalcitonin 2) Prolactin
3) GnRH 4) Cortisol
14. A list of hormones are given below. How many of them can promote erythropoiesis?
- i) erythropoietin ii) thyroxine
iii) thyrocalcitonin iv) androgens v) cortisol
- 1) four 2) three only 3) two only 4) all
15. Which of the following is a steroid hormone having antiinsulin effect?
- 1) glucagon 2) thyroxine
3) cortisol 4) aldosterone

16. Match the columns suitably

Column I	Column II
a) Cortisol	i) Sex corticoid
b) Androgen	ii) Mineralocorticoid
c) Aldosterone	iii) Glucocorticoid
d) FSH and LH	iv) Gonadotropins

- 1) a-iv, b-i, c-ii, d-iii 2) a-iii, b-i, c-ii, d-iv 3) a-iii, b-i, c-iv, d-ii 4) a-iv, b-ii, c-i, d-iii

17. If pancreatic duct is fully blocked, then which of the following function of pancreas will not be affected?

- | | |
|----------------------------------|---------------------------|
| 1) Protein digestion | 2) Carbohydrate digestion |
| 3) Blood sugar level maintenance | 4) Lipid digestion |

18. Which of the following disorders are caused by the hypersecretion of hormones?

- 1) Myxoedema, tetany
 - 2) diabetes insipidus, diabetes mellitus
 - 3) Addison's disease, simple goitre
 - 4) gigantism, Graves' disease

19. Which of the following groups of hormones are the examples of those, that all can easily pass through the cell membrane of the target cell and bind to the receptors located inside the target cell?

- 1) insulin, cortisol, glucagon, thymosin
 - 2) testosterone, cortisol, insulin, melatonin
 - 3) LH, FSH, Cortisol, testosterone
 - 4) estradiol, progestogen, testosterone, aldosterone

20. Select the option which shows the correct match of the source gland, with its respective hormone and function

	Source	Hormone	Function
1)	Anterior pituitary	Vasopressin	Induces reabsorption of water from renal tubules
2)	Pars distalis	Oxytocin	Contraction of smooth muscles
3)	Zona fasciculata of adrenal cortex	Cortisol	Inhibits cellular uptake and utilisation of amino acids
4)	β – cells of Islets of Langerhans	glucagon	Reduces cellular glucose uptake and utilisation

21. Which one of the following groups of hormones is one and the same?

- 1) Calcitonin and oxytocin 2) ACTH and PRH
3) GHRH and somatostatin 4) Vasopressin and ADH

WORKBOOK

BOTANY

CHAPTER -01 **MORPHOLOGY OF FLOWERING PLANTS**

QUESTIONS

1. The region of root which is actively involved in the absorption of water and mineral is :
1) Meristematic region 2) Elongation region
3) Maturation region 4) Root cap region
2. The root system having embryonic origin and possess a long lived primary root is the feature of :
1) Tap root system 2) Fibrous root system
3) Adventitious root system 4) 1 and 2
3. Which among the following plant possess adventitious root modified for storage :
1) Carrot 2) Radish 3) Turnip 4) Sweet potato
4. Consider the following statements :
Statement A : In some plants such as Rhizophora growing in swampy areas many roots come out grow and vertically upward, such roots are called prop roots.
Statement B : Leaf is generally green when young and later often become woody and dark brown.
1) Statement A and B are correct 2) Statement A and B are wrong
3) Statement A is correct, B is wrong 4) Statement A is wrong, B is correct
5. Pick up the true statement:
1) In all plants, root system is developed from the radicle.
2) Majority of flowering plants posses underground stems.
3) Photosynthesis is carried out only in leaves.
4) The primary roots and its branches constitute the tap root system, as found in the Mustard plant.
6. When a tendril is present on stem as a stem modification, its position will be:
1) Always apical 2) Always axillary
3) Either apical or axillary 4) Neither apical or axillary
7. Common feature of stems of Potato, Ginger, Turmeric, Zaminkand:
1) Weak 2) Woody
3) Photosynthetic 4) Act as organs of perennation

8. Which among the following plant modify their stems into flattened green structure meant for photosynthesis :
 - 1) Euphorbia
 - 2) Opuntia
 - 3) Ginger
 - 4) Zaminkand
9. The petiole of some plants such as Australian acacia modify into expanded structures meant for :
 - 1) Photosynthesis
 - 2) Storage
 - 3) Trap the insect
 - 4) Climb on support
10. In Nepenthes, pitcher which contains digestive enzymes are the modification of :
 - 1) Leaf base
 - 2) Petiole
 - 3) Lamina
 - 4) Leaf base and Petiole
11. Number of leaf / leaves at a node in the case of alternate and opposite phyllotaxy respectively are :
 - 1) One and two
 - 2) Two and one
 - 3) Two and more than two
 - 4) More than two and two
12. The axis of flower which carries different types of floral leaves is :
 - 1) Pedicel
 - 2) Peduncle
 - 3) Thalamus
 - 4) Bracteole
13. Aestivation is the mode of arrangement of following type of floral leaves :
 - 1) Sepals and Petals only
 - 2) Stamens and carpels
 - 3) Sepals, petals and tepals
 - 4) Sepals, petals, stamens and carpels
14. Which among the following sentence is correct about the structure of leaf :
 - 1) Leaf is an apical generally cylindrical structure borne on the stem
 - 2) Leaves originate from shoot apical meristems and are arranged in a basipetal order
 - 3) Veins provide rigidity to the leaf blade and act as channels of transport of water, minerals and food materials
 - 4) Petiole is the green stalk of leaf with vein and veinlets
15. Common feature of flowers in Salvia and Mustard :
 - 1) Bell shaped corolla and Didynamous stamens
 - 2) Papilionaceous corolla
 - 3) Tetrodynamous stamens
 - 4) Stamens exhibit variation in the length of filaments within a flower
16. In which type of inflorescence, the main axis terminates in a flower :
 - 1) Racemose
 - 2) Cymose
 - 3) Special type
 - 4) Head

17. Identify the missing words (A, B, C and D) and select the correct option :

Family	Inflorescence	Flower	Stamens	Gynoecium
	A	B	C	D
Fabaceae				
Solanaceae	Solitary, axillary or cymose	Actinomorphic	5	Bicarpellary
Liliaceae	Solitary, cymose or racemose	Actinomorphic	3 + 3	Tricarpellary

A	B	C	D
1) Racemose	Zygomorphic	3 + 3	Monocarpellary
2) Racemose	Actinomorphic	5	Bicarpellary
3) Cymose	Zygomorphic	3 + 3	Tricarpellary
4) Racemose	Zygomorphic	(9) + 1	Monocarpellary

18. Which among the following placentation possess only one ovule inside the ovary :

- 1) Basal 2) Marginal 3) Axile 4) Free central

19. The morphological nature of the edible part of Coconut is :

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

20. Which among the following is an endospermic / albuminous seed :

- 1) Castor 2) Orchids 3) Bean 4) Ground nut

21. Scutellum is a part of embryo of certain seeds, it is a :

- 1) Sheath covering radicle 2) Cotyledon
3) Sheath covering plumule 4) Endosperm

22. Medicinal plants belonging to different families are given below. Select the plants belonging the family Solanaceae:

1) Indigofera, Muliathi

2) Belladonna, Ashwagandha

3) Aloe, Asparagus

4) Tulip, Gloriosa

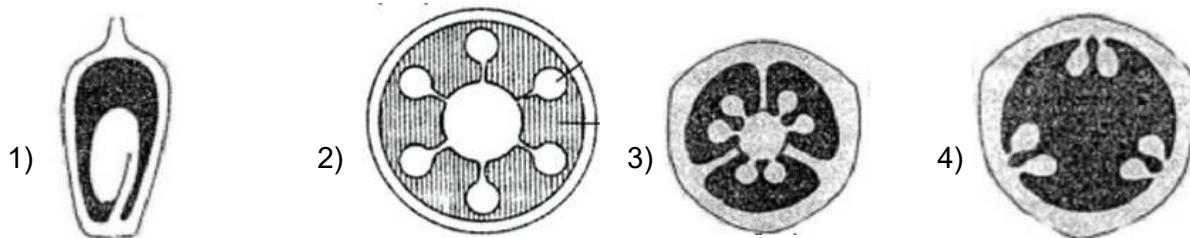
23. In different plants of Liliaceae the accessory organs of flower is described as :

- 1) Calyx and corolla 2) Perianth
3) Androecium and Gynoecium 4) Pistillode

24. The similarity shared by the flowers of China rose, Brinjal, Plum, Rose and Peach is that :

- 1) Superior ovary
2) Inferior ovary
3) Lateral wall of ovary fused with thalamus
4) Lateral wall of ovary free from thalamus

25. One of the following is a common feature of members of Solanaceae and Liliaceae :
- Rotate (Wheel shaped) corolla
 - Trimerous flowers
 - Axile placentation
 - Epiphyllous stamens
26. Which among the following is not a character of Liliaceae :
- Bisexual and monochlamydeous flowers
 - 6 tepals in perianth arranged in two whorls
 - Epipetalous condition
 - Tricarpellary gynoecium with axile placentation
27. Observe the following diagrams of placentations and identify the placentation in Bitter gourd and cucumber :



28. Which among the following is a pulse belongs to the family Fabaceae :
- Glycine max
 - Crotalaria juncea
 - Indigofera tinctoria
 - Atropa belladonna
29. Which among the following floral character cannot be shown in floral diagram :
- Symmetry of flower
 - Number of floral leaves in each whorl
 - Aestivation
 - Position of ovary
30. Identify the group of plants which possesses aerial root meant for mechanical support :
- Carrot, Turnip, Radish
 - Sugarcane, Maize, Banyan tree
 - Asparagus, Dhalia, Tapioca
 - Loranthus, Cuscuta, Vanda
31. Read the statements and identify the correct option :
- Statement A :** All types of root system are originating from radicle of embryo
- Statement B :** Adventitious root system is found in monocots only
- 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

32. Read the following statement and identify the correct option :

Statement A : Leaf is said to be simple, when the lamina is entire or when incised, the incisions do not touch the midrib.

Statement B : In pinnately compound leaf, the leaflets are attached at a common point.

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

33. Which among the following type of aestivation is confined to the corolla of Fabaceae :

- 1) Twisted
- 2) Valvate
- 3) Imbricate
- 4) Vexillary

34. The term epiphyllous describes the connation or fusion between :

- 1) Stamen and Petal
- 2) Stamen and Sepal
- 3) Stamen and Tepal
- 4) Stamen and Leaf

35. How many among the following plants contains multicarpellary apocarpous gynoecium :

Atropa, Solanum, Lotus, Gloriosa, Allium, Rose, Soyabean, Pea, China rose, Withania

- 1) 2
- 2) 4
- 3) 6
- 4) 8

36. Which among the following root is not of adventitious origin :

- 1) Prop root of banyan tree
- 2) Stilt root of pandanus
- 3) Conical root of carrot
- 4) Fasciculated root of Asparagus

37. Plants like Asparagus possess aerial modified stem, modified for :

- 1) Storage
- 2) Photosynthesis
- 3) Mechanical support
- 4) Vegetative propagation

38. Pulvinus, commonly found in the leguminous plant is :

- 1) Swollen petiole
- 2) Swollen leaf base
- 3) Sheathing petiole
- 4) Sheathing leaf base

39. The term venation describes the mode of arrangement of veins and veinlets through the following part of leaf :

- 1) Leaf lamina only
- 2) Lamina and petiole
- 3) Petiole only
- 4) Petiole and leaf base

40. Which among the following term is explaining the stalk of inflorescence :

- 1) Pedicel
- 2) Peduncle
- 3) Rachis
- 4) Petiole

41. Inflorescences are basically grouped into more than one types on the basis of :

- 1) Presence of essential organs of flower
- 2) Branching and modification of peduncle
- 3) Order of maturation of flowers on the peduncle
- 4) Presence of absence of stalk of flower

42. Which among the following description is correct about cymose inflorescence :

- 1) Peduncle is of indefinite growth
- 2) Peduncle always terminates in flower
- 3) Acropetal maturation of flowers on the peduncle
- 4) Oldest flowers are at the base of the peduncle

43. How many among the following plants have epigynous flowers :

Mustard, China rose, Brinjal, Plum, Rose, Peach, Guava, Cucumber

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

44. The aestivation found in the corolla of China rose and lady's finger is :

- 1) Valvate
- 2) Twisted
- 3) Imbricate
- 4) Vexillary

45. Consider the following statements :

Statement A : In plants like Salvia and Mustard there is variation in the length of stamen.

Statement B : Adelphy, syngenesious and synandrous are the different types of fusion in gynoecium

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

46. In Mango and Coconut, the pericarp of fruit is developed from the :

- 1) Thalamus
- 2) Pedicel
- 3) Integument of ovule
- 4) Ovary wall

47. Scutellum is a part of embryo of plant belongs to the following family :

- 1) Potato family
- 2) Pea family
- 3) Lily family
- 4) Grass family

48. Which among the following floral character is not expecting in dicot families :

- 1) Dichlamydeous flower
- 2) Trimerous flower
- 3) Axile placentation
- 4) Unisexual flower

49. The vegetative character shared by the three families ; Fabaceae, Solanaceae and Liliaceae :

- 1) Alternate phyllotaxy
- 2) Reticulate venation
- 3) Pulvinus leaf base
- 4) Root nodules

50. Legume is a dry simple fruit common in the family :

- 1) Solanaceae
- 2) Fabaceae
- 3) Brassicaceae
- 4) Liliaceae

CHAPTER -02

ANATOMY OF FLOWERING PLANTS

QUESTIONS

1. Tissues coming under primary meristems:
 - 1) Intercalary meristem and interfascicular cambium
 - 2) Apical meristems and intercalary meristems
 - 3) Interfascicular cambium and cork-cambium
 - 4) Cylindrical meristems and lateral meristem
2. Meristem which appear early in life of a plant and contribute to the formation of the primary plant body is
 - 1) Primary meristem
 - 2) Intercalary meristem
 - 3) Cylindrical meristems
 - 4) Lateral meristem
3. Sequence of tissues from tip to backwards in root apex
 - 1) Initials of root cap, Root cap , Root apical meristem , Initials of central cylinder
 - 2) Root cap , Initials of central cylinder , Initials of root cap, Root apical meristem
 - 3) Root cap , Initials of root cap, Root apical meristem , Initials of central cylinder
 - 4) Initials of central cylinder , Root apical meristem, Root cap , Initials of root cap.
4. Following divisions of cells in both primary and as well as secondary meristems, the newly formed cells become structurally and functionally specialised and lose the ability to divide. Such cells are termed
 - 1) Dermal tissues, ground tissues and vascular tissues.
 - 2) Ground tissue only
 - 3) Permanent or mature
 - 4) Meristematic
5. With reference to parenchyma, which of the following statement is not correct
 - 1) A simple tissue is made of only one type of cells.
 - 2) Forms the major component within organs.
 - 3) They may be spherical, oval, round, polygonal or elongated in shape.
 - 4) Their walls are thin and made up of suberin

6. Select the mismatch
- 1) Casparyan thickening - Chitin 2) Sclerenchyma – Lignin
3) Collenchyma – pectin 4) Cuticle – Cutin
7. Which of the following tissue consists of long, narrow cells with thick and lignified cell walls having a few or numerous pits. They are usually dead and without protoplasts.
- 1) Sclerenchyma and collenchyma 2) Sclerenchyma
3) Fibres or sclereids. 4) Both 2 and 3
8. The fibres are not
- 1) Thick-walled 2) Spherical or oval 3) Pointed 4) Occuring in groups
9. With reference to features of Tracheids, which of the following statements is not correct ?
- 1) Elongated or tube like cells with thick and lignified walls and tapering ends
2) In flowering plants, tracheids is the main water transporting elements.
3) These are dead and are without protoplasm
4) The inner layers of the cell walls have thickenings which vary in form.
10. Which of the following options best represents the phloem elements in angiosperms?
- 1) Sieve tubes, companion cells , tracheids, parenchyma
2) Sieve tubes, companion cells , vessels, parenchyma
3) Sieve tube elements, companion cells, phloem parenchyma and phloem fibres
4) Sieve tube, sieve cells, companion cells and phloem fibres
11. Which among these is the incorrect combination of phloem elements
- 1) Companion cells– closely associated with sieve tube elements.
2) Sieve tube– lacks a nucleus at maturity
3) Phloem fibres– absent in most of the monocotyledons
4) Phloem parenchyma- elongated, tapering cylindrical cells which have dense cytoplasm and nucleus.
12. Select the false option from the following statements regarding the companion cells
- 1) Specialised parenchymatous cells, which are closely associated with sieve tube elements
2) Help in maintaining the pressure gradient in the sieve tubes.
3) Absent in most of the monocotyledons
4) The sieve tube elements and companion cells are connected by pit fields present between their common longitudinal walls.
13. The epidermal tissue systems are made of
- 1) Epidermal cells and the epidermal appendages only
2) Epidermal cells, stomata and the epidermal appendages
3) Epidermal cells, cuticle and stomata only
4) Epidermis, cuticle and stomata only

14. Which of the following facilitates opening of stomatal aperture ?
- Decrease in turgidity of guard cells
 - Radial orientation of cellulose microfibrils in the cell wall of guard cells
 - Longitudinal orientation of cellulose microfibrils in the cell wall of guard cells
 - Contraction of outer wall of guard cells
15. Ground tissue constitutes
- All tissues except vascular bundles
 - All tissues except stele
 - All tissues except epidermis and vascular bundles
 - All tissues except epidermis and stele
16. Select the wrong one from the following statements :
- Epidermal system comprises epidermal cells, stomata, trichomes and hairs
 - Cuticle is absent in roots
 - In grasses, the guard cells are dumb-bell shaped
 - The stomatal aperture and guard cells together called stomatal apparatus.
17. Function of root hair and trichome respectively
- Absorbtion water and preventing water loss
 - Preventing water loss and absorbtion water
 - Secretory and preventing water loss
 - Secretion and Transpiration
18. Which one of the following statements is not valid for vascular bundles
- In dicotyledonous stems vascular bundles are open
 - Conjoint vascular bundles are common in stems and leaves
 - In root vascular bundles are radial and collateral
 - Vascular bundles are closed in monocotyledonous stems
19. Match the Column I and II, and choose the correct combination with respect to vascular bundles
- | Column I | Column II | | |
|-----------------------|--|-----------------------|-----------------------|
| a. open. | 1) arranged in an alternate manner | | |
| b. radial | 2) xylem and phloem are jointly situated | | |
| c. closed | 3) presence of cambium | | |
| d. conjoint | 4) no cambium | | |
| 1) a-3, b-2, c-4, d-1 | 2) a-4, b-2, c-3, d-1 | 3) a-4, b-1, c-3, d-2 | 4) a-3, b-1, c-4, d-2 |
20. Initiation of lateral roots and vascular cambium during the secondary growth takes place from
- Epiblema
 - Pericycle
 - Medullary rays
 - Pericycle and medullary rays

21. Stele constitutes
 - 1) Endodermis , pericycle, vascular bundles and pith
 - 2) Pericycle, vascular bundles and pith
 - 3) Vascular bundles and pith only
 - 4) Vascular bundles only
22. Cortex constitute the cells arranged in multiple layers
 - 1) Between epidermis and Pericycle
 - 2) Between epidermis and endodermis
 - 3) Between hypodermis and Pericycle
 - 4) Between hypodermis and endodermis
23. Dicot stem is characterized by
 - 1) Conjoint, closed, endarch vascular bundles which are arranged in the form of a ring
 - 2) Conjoint, open, endarch vascular bundles which are arranged in the form of a ring
 - 3) Conjoint, open, endarch and scattered vascular bundles
 - 4) Conjoint, closed, endarch and scattered vascular bundles
24. With reference to bulliform cells, which of the following statements are correct ?
 - a. Large, empty, colourless , adaxial epidermal cells
 - b. They make the leaves curl during water stress
 - c. Prevent water loss through transpiration.
 - d. Primarily seen in grasses.

1) (a), (b) and (c) 2) (a) (c) and (d) 3) (b), (c) and (d) 4) (a) (b) (c) and (d)
25. The secondary growth occurs in
 - 1) Most of the dicotyledonous stems only
 - 2) Most of the dicotyledonous roots and stems only
 - 3) Most of the dicotyledonous roots , stems and in gymnosperm
 - 4) Most of the dicotyledonous roots , stems, gymnosperm and in pteridophytes
26. The tissues involved in secondary growth are
 - 1) Vascular cambium and cork cambium only
 - 2) Fascicular cambium and phellogen only
 - 3) Intra fascicular cambium and interfascicular cambium only
 - 4) Intra fascicular cambium , interfascicular cambium and cork cambium
27. During secondary growth at some places, the cambium forms a narrow band of parenchyma, which passes through the secondary xylem and the secondary phloem in the radial directions. These are the
 - 1) Conjunctive tissue
 - 2) Primary and secondary medullary rays
 - 3) Secondary medullary rays
 - 4) Secondary cortex

28. The tissues get gradually crushed due to the continued formation and accumulation of secondary xylem are
- 1) Primary xylem and primary phloem.
 - 2) Primary and secondary phloem
 - 3) Secondary medullary rays
 - 4) All the above
29. The wood is actually
- 1) Secondary xylem and secondary phloem
 - 2) Secondary xylem ,secondary phloem and vascular cambium
 - 3) Secondary xylem only
 - 4) Secondary xylem ,secondary phloem, vascular cambium and primary xylem
30. The deposition of organic compounds in the heart wood make it
- 1) Hard only
 - 2) Hard and durable only
 - 3) Hard, durable and resistant to the attacks of micro organisms and insects
 - 4) Hard, durable, light coloured and resistant to the attacks of micro organisms and insects
31. Match the Column I and II, and choose the correct combination with respect to vascular bundles
- | Column I | Column II | | |
|-----------------------|-----------------------|-----------------------|-----------------------|
| a. early wood | 1) durable | | |
| b. sapwood | 2) autumn | | |
| c. heartwood | 3) conduction | | |
| d. late wood | 4) spring | | |
| 1) a-4, b-3, c-1, d-2 | 2) a-2, b-1, c-3, d-4 | 3) a-3, b-2, c-4, d-1 | 4) a-1, b-4, c-2, d-3 |
32. Periderm consists of
- 1) Phellogen, phellem and phelloderm
 - 2) Cork , Cork cambium and primary cortex
 - 3) All tissues exterior to the vascular cambium
 - 4) All the above
33. Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following:
- 1) Tyloses in vessels
 - 2) Closure of stomata
 - 3) Flaccidity of bulliform cells
 - 4) Shrinkage of air spaces in spongy mesophyll
34. Phloem in gymnosperms lacks:
- 1) Both sieve tubes and companion cells
 - 2) Albuminous cells and sieve cells
 - 3) Sieve tubes only
 - 4) Companion cell only

35. Which of the statements given below is not true about the formation of Annual Rings in trees?
- 1) Annual rings are not prominent in trees of temperate regions.
 - 2) Annual rings are a combination of spring wood and autumn wood produced in a year.
 - 3) Differential activity of cambium causes light and dark bands of tissue - early and late wood respectively.
 - 4) Activity of cambium depends upon variation in climate.
36. In the dicot root the vascular cambium originates from :
- 1) Tissue located below the phloem bundles and a portion of pericycle tissue above protoxylem.
 - 2) Cortical region
 - 3) Parenchyma between endodermis and pericycle
 - 4) Intrafascicular and interfascicular tissue in a ring
37. Regeneration of damaged growing grass following grazing is largely due to :
- 1) Lateral meristem
 - 2) Apical meristem
 - 3) Intercalary meristem
 - 4) Secondary meristem
38. Identify the incorrect statement.
- 1) Sapwood is involved in conduction of water and minerals from root to leaves
 - 2) Sapwood is the innermost secondary xylem and is lighter in colour
 - 3) Due to deposition of tannins, resins, oils etc., heart wood is dark in colour.
 - 4) Heart wood does not conduct water but gives mechanical support.
39. Guard cells in grass leaf are
- 1) Dumb-bell shaped
 - 2) Kidney shaped
 - 3) Rectangular
 - 4) Barrel shaped
40. Large, empty colorless cells of the adaxial epidermis along the veins of grass leaves are
- | | |
|------------------------|--------------------|
| 1) Lenticels | 2) Guard cells |
| 3) Bundle sheath cells | 4) Bulliform cells |
41. Which of the following statements about cork cambium is incorrect?
- 1) It forms a secondary cortex on its outside
 - 2) It forms a part of periderm
 - 3) It is responsible for the formation of lenticels
 - 4) It is multilayered

42. Match List I with List II

List - I

- (a) Cells with active cell division capacity
- (b) Tissue having all cells similar in structure and function
- (c) Tissue having different types of cells
- (d) Dead cells with highly thickened walls and narrow lumen

List - II

- (i) Vascular tissues
- (ii) Meristematic tissue
- (iii) Sclereids
- (iv) Simple tissue

Select the correct answer from the options given below.

- (a) (b) (c) (d)
- 1) (i) (ii) (iii) (iv)
- 2) (iii) (ii) (iv) (i)
- 3) (ii) (iv) (i) (iii)
- 4) (iv) (iii) (ii) (i)

43. Match List-I with List-II.

List - I

- (a)Lenticels (i) Phellogen
- (b)Cork cambium (ii) Suberin deposition
- (c) Secondary cortex (iii) Exchange of gases
- (d)Cork (iv) Phelloderm

List-I

Choose the correct answer from the options given below.

- (a) (b) (c) (d)
- 1) (ii) (iii) (iv) (i)
- 2) (iv) (ii) (i) (iii)
- 3) (iv) (i) (iii) (ii)
- 4) (iii) (i) (iv) (ii)

44. Select the correct pair.

- 1) Cells of medullary rays that form part of a cambial ring - Interfascicular cambium
- 2) Loose parenchyma cells rupturing the epidermis and forming a lens-shaped opening in the bark - Spongy parenchyma
- 3) Large colorless empty cells in the epidermis of grass leaves - Subsidiary cells
- 4) In dicot leaves, vascular bundles are surrounded by large thick-walled cells - conjunctive tissue

45. Identify the wrong statement in context of heartwood.

- 1) Organic compounds are deposited in it
- 2) it is highly durable
- 3) It conducts water and minerals efficiently
- 4) It comprises dead elements with highly lignified walls

46. Which of the following is made up of dead cells?
- 1) Xylem parenchyma 2) Collenchyma
3) Phellem 4) Phloem
47. The vascular cambium normally gives rise to.
- 1) Phellogen 2) Primary phloem
3) Secondary xylem 4) Periderm
48. Cortex is the region found between
- 1) Epidermis and stele
2) Pericycle and endodermis
3) Endodermis and pith
4) Endodermis and vascular bundle
49. The balloon-shaped structures called tyloses
- 1) Originated in the lumen of vessels
2) Characterise the sapwood
3) Are extensions of xylem parenchyma cells into vessels
4) Are linked to the ascent of sap through xylem vessels
50. Specialised epidermal cells surrounding the guard cells are called ?
- 1) Subsidiary cells 2) Bulliform cells
3) Lenticels 4) Complementary cells

CHAPTER - 03

CELL THE UNIT OF LIFE

QUESTIONS

1. Match the items in column I with those in column II

Column I	Column II		
a. Robert Hooke	1. First one to examine living cells		
b. Robert Brown	2. Omnis cellula e cellula		
c. Leeuwenhoek	3. Discovered cells in cork tissue		
d. Schleiden and Schwann	4. Discovered nucleus in orchid root cells		
e. Rudolf Virchow	5. Proposed cell theory		
1) a-1, b-2, c-3, d-4, e-5	2) a-2, b-3, c-4, d-5, e-1		
3) a-3, b-4, c-1, d-2, e-5	4) a-3, b-4, c-1, d-5, e-2		
2. Scientist who applied cell theory to animals was :			
1) Brown	2) Schleiden		
3) Schwann	4) Leeuwenhoek		
3. The cells lack nucleus are;			
1) Erythrocytes of many mammals	2) Sieve tube cells of vascular plants		
3) Lymphocytes of mammals	4) Both 1 and 2		
4. Every living cell has a :			
1) plasma membrane	2) food vacuole		
3) chloroplast	4) cell wall		
5. An example of enucleated living plant cell is :			
1) RBC	2) Mature sieve tube cell		
3) companion cell	4) xylem parenchyma		
6. The motile bacteria are able to move by :			
1) pili	2) fimbriae	3) flagella	4) cilia
7. Pigment-containing membranous extensions in some cyanobacteria are :			
1) Pneumatophores	2) Chromatophores		
3) Heterocysts	4) Basal bodies		

8. Mesosomes are not involved in
 - 1) DNA replication
 - 2) Respiration
 - 3) Lipid synthesis
 - 4) Cell wall synthesis
9. Which among the following is/are the functions of mesosomes?
 - 1) DNA replication
 - 2) Respiration
 - 3) Cell wall formation
 - 4) All of these
10. Prokaryotic and eukaryotic cells have which of the common features
 - 1) Membrane bound nucleus
 - 2) Cell wall made of cellulose
 - 3) Ribosomes
 - 4) Flagella that contain microtubules
11. Circular DNA is found in
 - 1) Prokaryotic cytoplasm
 - 2) Matrix of mitochondria
 - 3) Stroma of chloroplast
 - 4) 1, 2 & 3
12. Subunits of prokaryotic ribosomes are :
 - 1) 50 S + 50 S
 - 2) 50 S + 30 S
 - 3) 40 S + 30 S
 - 4) 60 S + 40 S
13. Which of the following is absent in a plant cell
 - 1) Cell wall
 - 2) Centrosome
 - 3) Plasmodesmata
 - 4) Plastids
14. Who proposed the fluid mosaic model of the plasma membrane
 - 1) Theodore Schwann
 - 2) Camillo Golgi
 - 3) Singer and Nicolson
 - 4) Shleiden
15. The plasma membrane consists mainly of :
 - 1) Proteins embedded in a carbohydrate bilayer
 - 2) Phospholipids embedded in a protein bilayer
 - 3) Proteins embedded in a phospholipids bilayer
 - 4) Carbohydrates are embedded in a protein bilayer
16. Fluid mosaic model of cell membrane was proposed in :
 - 1) 1831
 - 2) 1838
 - 3) 1855
 - 4) 1972
17. Which of the following statement is incorrect about plasma membrane?
 - 1) The ratio of proteins and lipids varies considerably in different cell types
 - 2) 52% proteins and 40% lipids are in the membrane of human RBC
 - 3) Integral proteins are seen partially or completely buried in phospholipid bilayer
 - 4) Cell membrane of eubacteria and eukaryotes is structurally different
18. Steroid hormones are synthesised in the
 - 1) Smooth ER
 - 2) Rough ER
 - 3) Golgi bodies
 - 4) Lysosomes

19. Which of the following is not part of the endomembrane system
 1) Endoplasmic reticulum 2) Golgi bodies
 3) Lysosomes 4) Mitochondria
20. Lysosomes are rich in which of the following enzymes
 1) Isomerases 2) Transferases
 3) Lyases 4) Hydrolases
21. Tonoplast is the membrane surrounding which organelle
 1) Centriole 2) Glyoxysome
 3) Peroxisome 4) Vacuole
22. Which of the following is a wrong statement
 1) Chloroplast is surrounded by a double membrane
 2) Chloroplast contains membrane structures called thylakoids
 3) Stacks of thylakoids form grana
 4) Light reaction occurs in stroma
23. Colourless plastid storing oil is
 1) Chromoplast 2) Aleuroplast
 3) Proteinoplast 4) Elaioplast
24. Ribosomes are synthesised in
 1) Cytoplasm 2) Mitochondria
 3) Plastids 4) Nucleolus
25. Which one of the following organelle in the figure correctly matches with its function?



- 1) Golgi apparatus, formation of glycolipids
 2) Rough endoplasmic reticulum, protein synthesis
 3) Rough endoplasmic reticulum, formation of glycoproteins
 4) Golgi apparatus, protein synthesis

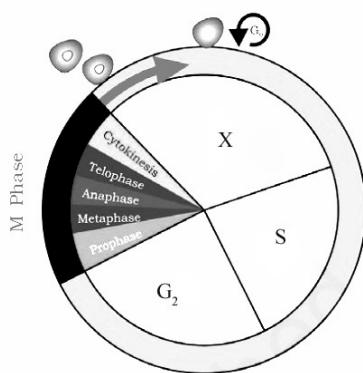
26. Which of the following cell organelles is concerned with photophosphorylation?
- 1) Mitochondria
 - 2) Lysosomes
 - 3) Chloroplast
 - 4) Both 1 & 2
27. Primary lysosomes are formed from
- 1) Golgi bodies
 - 2) ER
 - 3) Mitochondria
 - 4) Vacuole
28. The proteins synthesized on RER are modified, converted and packaged into secretory vesicles by:
- 1) Golgi complex
 - 2) Lysosomes
 - 3) Ribosomes
 - 4) ER
29. Ribosomes are composed of :
- 1) DNA and protein
 - 2) rRNA and protein
 - 3) Proteins only
 - 4) DNA, rRNA and proteins
30. Smallest cell organell in eukaryotic cell :
- 1) Golgi bodies
 - 2) Centriole
 - 3) Nucleolus
 - 4) Ribosome
31. The complex liquid matrix of chloroplast is called :
- 1) Cytosol
 - 2) Nucleoplasm
 - 3) Cytoplasm
 - 4) Stroma
32. Cell organelles with its own genome system and considered to be semiautonomous are :
- 1) chloroplasts and nucleus
 - 2) chloroplast and mitochondria
 - 3) chloroplast only
 - 4) chloroplast, centrioles and mitochondria
33. A large and mature plant cell has :
- 1) many vacuole
 - 2) no vacuole
 - 3) a large vacuole
 - 4) many small vacuoles and a large vacuole
34. Contractile vacuoles help in :
- 1) Excretion only
 - 2) Osmoregulation only
 - 3) Osmoregulation and excretion
 - 4) Digestion
35. DNA does not occur in :
- 1) mitochondria
 - 2) plastids
 - 3) mature RBC, centrioles and ribosomes
 - 4) nucleus, bacteria and viruses
36. Site of protein synthesis is :
- 1) Ribosomes
 - 2) mitochondria
 - 3) nucleus
 - 4) DNA
37. Which among the following is/are the functions of cell wall?
- 1) Protection
 - 2) Cell to cell interaction
 - 3) Provide shape
 - 4) All of these
38. Which of the following cell organelle are included in endomembrane system?
- 1) Lysosome and vacuole
 - 2) ER
 - 3) Golgi complex
 - 4) All the above
39. Large number of RER are found in the cells actively involved in
- 1) Lipid synthesis
 - 2) Protein synthesis
 - 3) Secretion
 - 4) Both 2 and 3

40. Which of the following plastid is coloured and contains carotenoids?
- 1) Aleuroplast 2) Elaioplast 3) Amyloplast 4) Chromoplast
41. Which is incorrect about chloroplast?
- 1) They are double membrane bound
2) They contain ds circular DNA
3) They contain 80 s ribosome
4) Outer membrane is more permeable
42. Ribosomes are discovered by;
- 1) Flemming 2) Rudolf virchow 3) George Palade 4) Schwann
43. Cytoskeleton is a
- 1) Network of cellulose microfilaments
2) Network of protenaceous filaments
3) Network of single membrane bound proton channels
4) Network of calcium pectate
44. Which among the following is not a function of cytoskeleton?
- 1) Mechanical support 2) Motility
3) Keeping organelles in position 4) Intracellular transport
45. Choose the false statement
- 1) Spindle fibers are arising from centriole
2) Centrioles are basically made up of flagellin protein
3) Centrosome is membraneless
4) Centrioles have 9+0 organisation
46. Choose the incorrect pair
- 1) Basal body of eukaryotic cilium - 9+2 arrangement
2) Axoneme - Core of flagellum
3) Basal body of flagella of eukaryotes - centriole like structure
4) Radial spoke - connect central sheath to peripheral doublets
47. Thickness of perinnuclear space is
- 1) 10-50 nm 2) 10-40 nm 3) 20-60 nm 4) 30-80 nm
48. Term 'chromatin' was coined by:
- 1) Schleiden 2) Flemming 3) Robert Hook 4) Robert brown
49. Satellite chromosomes have;
- 1) Primary constriction only 2) Secondary constriction only
3) Tertiary constriction only 4) Both primary and secondary constriction
50. Which of the following chromosome has two equal arms
- 1) Metacentric 2) Acrocentric
3) Submetacentric 4) Telocentric

CHAPTER - 04

CELL CYCLE AND CELL DIVISION

QUESTIONS

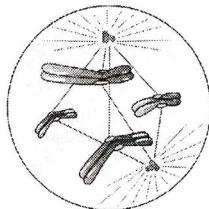


- 1) The cell is metabolically inactive
 - 2) The content of DNA is half in comparison to S-phase
 - 3) The number of chromosomes is half in comparison to S-phase
 - 4) Lasts for more than 95% of the duration of cell cycle

4. G₀ or quiescent stage is:

 - 1) Permanent exit of cell from cell cycle
 - 2) Enter the cell cycle
 - 3) A metabolically inactive stage
 - 4) Suspend the cell cycle

5. During which phase(s) of cell cycle, amount of DNA in a cell remains at 4C level if the initial amount is denoted as 2C?
- 1) G₂ and M
 - 2) G₀ and G₁
 - 3) G₁ and S
 - 4) Only G₂
6. Scientists who first reported mitosis are :
- 1) Farmer and Moore
 - 2) Watson and Crick
 - 3) Strassburger and Fleming
 - 4) Schleiden and Schwann
7. Longest phase of cell cycle is _____
- 1) Post mitotic gap phase
 - 2) Prophase
 - 3) Synthetic phase
 - 4) Diplotene
8. Chromosomes can be clearly observed under the microscope in :
- 1) Prophase
 - 2) Anaphase
 - 3) Metaphase
 - 4) Telophase
9. Chromosomes are arranged along the equator during :
- 1) Prophase
 - 2) Metaphase
 - 3) Anaphase
 - 4) Telophase
10. Choose the correct option for the diagram given below:



	Number of chromosomes	Number of chromatids	Number of centromeres	Number of kinetochores
1)	4	8	8	8
2)	4	4	4	8
3)	4	16	8	4
4)	4	8	4	8

11. Smallest phase of mitosis is :
- 1) Prophase
 - 2) Metaphase
 - 3) Anaphase
 - 4) Telophase
12. Nuclear membrane is formed around the groups of daughter chromosomes during :
- 1) Telophase
 - 2) Prophase
 - 3) Metaphase
 - 4) Interphase
13. Phragmoplast formation involved in
- 1) Spindle fibre formation
 - 2) Separation of homologous pair
 - 3) Cytokinesis in plant cells
 - 4) Check point decision process on cell cycle

23. Match the column I with column II and choose the correct option :

Column-I		Column -II	
A)	Prophase	i)	Spindle fibres gets connected to the kinetochores
B)	Metaphase	ii)	Initiation of condensation of chromosomal material
C)	Anaphase	iii)	Centromeres of chromosomes lie towards pole while arms trail behind
D)	Telophase	iv)	Nucleous, Golgi and ER reform

1) A = (ii), B = (i), C= (iv), D = (iii)

2) A = (i), B= (ii), C= (iii), D = (iv)

3) A = (ii), B = (i), C = (iii), D = (iv)

4) A = (iv), B = (ii), C = (i), D = (iii)

24. Which of the following is true about diakinesis :

1) Chromosomes at pole uncoil and form chromatin reticulum

2) Exchange of chromosome segments between two non-sister chromatids of homologous pair of chromosomes

3) Chromosomes are joined only at their ends

4) Synaptonemal complex starts breaking down

25. Match the following correctly

a) Zygote 1) Endonuclease & ligase

b) Pachytene 2) Dissolution of synaptonemal complex

c) Diplotene 3) Bivalent

d) Diakinesis 4) Terminalisation

1) abcd
1234

2) abcd
2413

3) abcd
3124

4) abcd
4321

26. Homologous chromosomes separates, while the sister chromatids remain attached. This statement is applicable to :

1) Metaphase I

2) Anaphase I

3) Metaphase II

4) Anaphase II

27. What happens in interkinesis ?

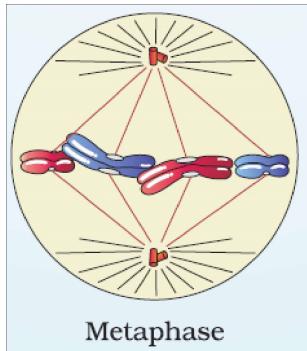
1) Similar to interphase

2) DNA replication

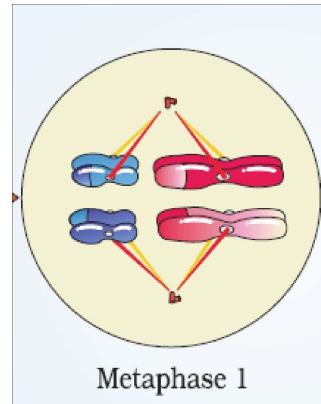
3) Chromosome duplication

4) Preparation of second meiotic division

28. Identify the figures given below.



Metaphase



Metaphase I

- 1) Metaphase II and Metaphase of mitosis
- 2) Metaphase of Mitosis and Metaphase I
- 3) Anaphase I and Metaphase I
- 4) Metaphase and Anaphase

29. Find the mis-matched pair?

- | | | |
|----------------|---|-------------------------------------|
| 1) Amitosis | - | Binary fission |
| 2) Diplotene | - | Dissolution of synaptonemal complex |
| 3) Anaphase II | - | Bivalent disjunction |
| 4) Meiosis | - | Heterotypic division |

30. Which of the two events restore the normal number of chromosomes in life cycle of sexually reproducing organisms :

- 1) Mitosis & Meiosis
- 2) Only meiosis
- 3) Meiosis and Fertilization
- 4) Fertilization and Mitosis

31. Identify the wrong statement about meiosis:

- 1) Pairing of homologous chromosomes
- 2) Four haploid cells are formed
- 3) At the end of meiosis number of chromosomes are reduced to half
- 4) Two cycles of DNA replication occur

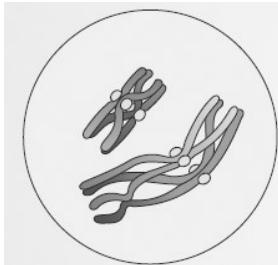
32. The phase which marks the period during which DNA synthesis occurs

- | | |
|-------------------------|-------------------------|
| 1) S phase | 2) M Phase |
| 3) G ₂ phase | 4) G ₁ Phase |

33. All of the following occur during mitosis except :

- | | |
|-------------------------------|----------------------------|
| 1) Chromosome condensation | 2) Spindle fibre formation |
| 3) Disappearance of nucleolus | 4) Synthesis of DNA |

34. In which order, cytokinesis occurs in animal cells :
- 1) Centrifugal
 - 2) Centripetal
 - 3) Equatorial
 - 4) Centre towards the periphery
35. Identify the type of division which leads to coenocytic condition :
- 1) Endomitosis
 - 2) Free - nuclear division
 - 3) Meiosis
 - 4) Mitosis
36. Mitosis differ from meiosis in not having :
- 1) Duplication of DNA
 - 2) Long prophase
 - 3) Interphase
 - 4) Synapsis and crossing over
37. Identify the given figure and process takes place during that stage :



- 1) Prophase I and disjunction
 - 2) Pachytene and plate like arrangement
 - 3) Anaphase I and chiasmata
 - 4) Pachytene and crossing over
38. In which of the following stage of meiosis, crossing over takes place?
- 1) Zygotene
 - 2) Diplotene
 - 3) Pachytene
 - 4) Leptotene
39. Pick out the correct statement :
- a) Synapsis of homologous chromosomes takes place during prophase I of meiosis
 - b) Division of centromere and separation of chromatid takes place during Anaphase I of meiosis
 - c) Anaphase II begins with simultaneous splitting of the centromere of each chromosome
 - d) Nucleolus reappear at telophase I of meiosis
- 1) a only
 - 2) a and c only
 - 3) a and b only
 - 4) a, c and d only
40. Which of the following not occurs in Anaphase - I but occurs in Anaphase II :
- 1) Condensation of chromosomes
 - 2) Bivalent disjunction
 - 3) Contraction of spindle fibres
 - 4) Splitting of chromosome through centromere
41. During meiosis poleward movement of sister chromosome takes place during :
- 1) Prophase I
 - 2) Telophase I
 - 3) Metaphase II
 - 4) Anaphase II

CHAPTER -05

TRANSPORT IN PLANTS

QUESTIONS

1. Movement of substances which are hydrophilic in nature across a membrane according to the concentration gradient by the help of certain protein is called
 - 1) Diffusion
 - 2) Facilitated diffusion
 - 3) Imbibition
 - 4) Active transport
2. The membrane that allows some of solute molecules to pass through it and prevent others is called
 - 1) Permeable membrane
 - 2) Semi permeable membrane
 - 3) Selectively or differentially permeable membrane.
 - 4) Impermeable membrane.
3. Which is incorrect
 - 1) Rate of diffusion is directly proportional to concentration
 - 2) Rate of diffusion is inversely proportional to distance
 - 3) Diffusion is movement of particles from low to high concentration
 - 4) Example of diffusion is opening of ammonia container or perfume bottle in one corner of a room
4. Identify the process of diffusion from the following?
 - 1) Transpiration
 - 2) Absorption of water from soil
 - 3) Exchange of O₂ & CO₂ through stomata
 - 4) All the above
5. Which of the following characters are common to facilitated diffusion and active transport?

A) Highly selective	B) Uphill transport
C) Requires ATP	D) Transport saturates
E) Requires special membrane proteins	

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

6. Choose the correct option based on given statements :

Statement A : Diffusion is the movement of substances from high to low concentration

Statement B : Diffusion is the only means of gaseous exchange within the plant body

1) A is correct and B is wrong

2) A is wrong but B is correct

3) Both A and B correct

4) Both A and B incorrect

7. Find out the value of ψ_w and ψ_p of a flaccid cell, if its OP is 30 :

1) $\psi_w = -15, \psi_p = 15$

2) $\psi_w = 0, \psi_p = 15$

3) $\psi_w = -30, \psi_p = 0$

4) $\psi_w = 30, \psi_p = 30$

8. Which of the following statement is wrong

1) Water potential is chemical potential of water

2) Solute potential is always negative

3) Pressure potential is zero in a flaccid cell

4) Water potential is equals solute potential in a fully turgid cell

9. Identify the mis-matched pair based on membrane permeability :

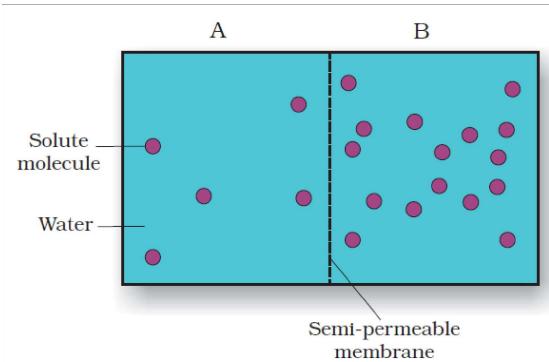
1) Permeable - Allow movement of solvent and solute

2) Impermeable - Allow only solute movement

3) Semipermeable - Allow only solvent movement

4) Selectively permeable - Allow movement of selected molecules

10. Based on figure given below, answer the questions :



A) Which solution has higher water potential

B) Which solution has higher solute potential

C) In which direction will osmosis occur

1) A – A

2) A – A

3) A – B

4) A – B

B – A

B – A

B – B

B – A

C – A → B

C – B → A

C – A → B

C – B → A

11. When solute dissolved in water then :-
- 1) Water potential increases
 - 2) Solute potential became positive
 - 3) Water potential decreases
 - 4) No change in water potential
12. Osmotic pressure of a solution is :-
- 1) Greater than the pure solvent
 - 2) Less than the pure solvent
 - 3) Equal to the pure solvent
 - 4) More or less than the pure solvent
13. Identify the mis-matched pair?
- 1) OP of pure water = 0
 - 2) ψ_s of plasmolysed cell = 0
 - 3) TP of flaccid cell = 0
 - 4) ψ_w of pure water = 0
14. Osmosis can be demonstrated by :
- 1) Thistle - funnel experiment
 - 2) Bell jar method
 - 3) Girdling experiment
 - 4) Mass flow hypothesis
15. Match the following correctly :
- | Column I | Column II |
|-----------------|---------------------|
| A) Isotonic | 1. Plasmolysed cell |
| B) Hypotonic | 2. Flaccid cell |
| C) Hypertonic | 3. Turgid cell |
- 1) $\frac{ABC}{231}$
 - 2) $\frac{ABC}{123}$
 - 3) $\frac{ABC}{321}$
 - 4) $\frac{ABC}{312}$
16. The cell wall exerts an equal and opposite pressure against to protoplast is :
- 1) Turgor pressure
 - 2) Osmotic pressure
 - 3) Wall pressure
 - 4) Diffusion pressure
17. A cell when placed in a solution gets plasmolysed. What is largely present in between the cell wall and the plasmolysed contents
- 1) Water
 - 2) Cell sap
 - 3) Hypotonic solution
 - 4) Hypertonic solution
18. When more chemical fertilizers are given to plants, the soil is to be thoroughly watered otherwise the plants get killed because of
- 1) Toxic effects of chemical (fertilizer) compounds.
 - 2) Exosmosis from plant due to high concentration of fertilizer
 - 3) Failure of physiological process like photosynthesis and respiration
 - 4) Excessive absorption of water

19. During plasmolysis, water moves out from the cell, it is first lost from the :

- 1) Cytoplasm and then from the vacuole
- 2) Vacuole and then from the cytoplasm
- 3) Cytoplasm and then from the nucleus
- 4) Nucleus and then from the cytoplasm

20. Choose the correct option based on given statements :

Statement A : Osmotic pressure is numerically equivalent to the osmotic potential

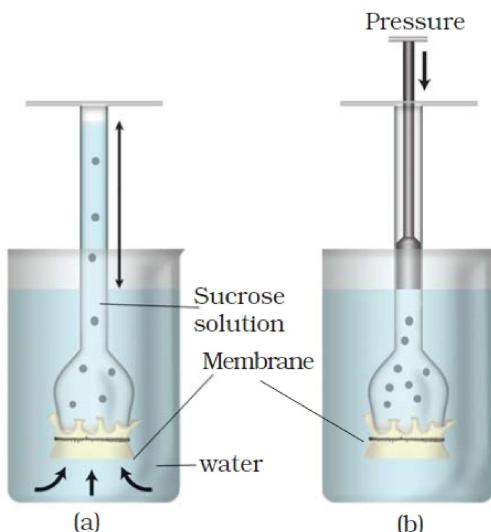
Statement B : Osmotic pressure is the negative pressure applied while osmotic potential is positive

- 1) Statement A is correct and B is wrong
- 2) Statement A is wrong and B is correct
- 3) Both statements A and B are correct
- 4) Both A and B incorrect

21. Bacteria cannot survive in a highly salted pickle because :-

- 1) Salt inhibits reproduction of bacteria
- 2) Enough light is not available for photosynthesis
- 3) They become plasmolysed and death occurs
- 4) Nutrient in the pickle medium cannot support life

22. The pressure shown in the figure is :



- 1) Osmotic pressure
- 2) Osmotic potential
- 3) Turgor pressure
- 4) Suction pressure

23. Identify the incorrect option :
- 1) Cell in hypotonic solution - Plasmolysis
 - 2) Cell in hypertonic solution - Exosmosis
 - 3) Cell in pure water - Endosmosis
 - 4) Cell in isotonic solution - No net water movement
24. What would be the ψ_p of a flaccid cell?
- 1) 0
 - 2) 1
 - 3) -ve
 - 4) Maximum
25. Select the incorrect statement about movement of water across a membrane?
- 1) High OP area to low OP area
 - 2) High ψ_w to low ψ_w area
 - 3) Turgid plant cells to plasmolysed plant cell
 - 4) High DP to low DP area
26. Select the incorrect statement regarding imbibition :
- 1) Imbibition is the phenomenon of adsorption or absorption of water or any other liquid by solids
 - 2) The liquid which is imbibed is called as imbibe
 - 3) There occurs a decrease in volume of imbiant during imbibition
 - 4) Water is absorbed by germinating seeds through imbibition
27. Apoplast is the system of adjacent cell wall that is continuous throughout the plant except at the :
- 1) Plasmodesmata
 - 2) Vessel element
 - 3) Tracheids
 - 4) Caspary strips of endodermis
28. Passage cells are thin-walled cells found in:
- 1) Phloem elements that serve as entry points for substances for transport to other plant parts
 - 2) Endodermis of roots facilitating rapid transport of water from cortex to pericycle
 - 3) Central region of style through which the pollen tube grows towards the ovary
 - 4) Large cells in the upper epidermis of monocot leaves
29. Absorption of water from soil by plant root involves :
- 1) Endosmosis
 - 2) Exosmosis
 - 3) Plasmolysis
 - 4) Both 2 & 3
30. Match the following correctly :
- | Column I | Column II |
|-------------------|---------------------------|
| A) Apoplast | 1. Phosphorous absorption |
| B) Symplast | 2. Suberised endodermis |
| C) Caspary strips | 3. Cytoplasm |
| D) Mycorrhiza | 4. Intercellular space |
- 1) $\frac{ABCD}{3412}$
 - 2) $\frac{ABCD}{2341}$
 - 3) $\frac{ABCD}{1234}$
 - 4) $\frac{ABCD}{4321}$

31. Match the following correctly :

Column I

- A) Xylem
B) Phloem

Column II

1. Unidirectional
2. Bidirectional
3. Water and minerals
4. Sucrose, Hormones

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

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

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

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

32. The main water and food transporting tissue of Angiosperms are :

- 1) Vessels and Sieve tube elements
2) Parenchyma and Fibres
3) Tracheids and Companion cell
4) Root and stem

33. Water absorption takes place rapidly in :-

- 1) Root cap 2) Zone of elongation
3) Root hair zone 4) Meristematic region

34. The oozing out of water from the cut end of a well watered potted plant is due to the

- 1) Diffusion pressure 2) Osmotic pressure
3) Root pressure 4) Suction pressure

35. Passive absorption of water by the root system is the result of

- 1) Tension on the cell sap due to transpiration
2) Increased respiratory activity in root cells
3) Forces created in the cells of the root
4) Osmotic force in the shoot system

36. The rupture and fractionation do not usually occur in the water column in xylem during the ascent of sap because of :

- 1) Lignified thick walls 2) Cohesion and adhesion
3) Transpiration pull 4) Low transpiration rate

37. Due to low atmospheric pressure, the rate of transpiration will :

- 1) Increase 2) Decrease rapidly
3) Remain unaffected 4) No transpiration

38. Which of the following factors involved in ascent of sap?

- 1) Transpiration pull 2) Root pressure
3) Cohesion - adhesion like properties 4) All the above

39. Transpiration pull will be maximum under which of the following conditions :-
- 1) Open stomata, high humid atmosphere and well irrigated soil
 - 2) Open stomata, high humid atmosphere and dry soil
 - 3) Open stomata, dry atmosphere and moist soil
 - 4) Closed stomata, low light intensity and humid atmosphere
40. The stomata open when guard cells become :-
- 1) Turgid
 - 2) Flaccid
 - 3) Plasmolysed
 - 4) Both 1 and 3
41. Select the incorrect events leading to the opening of the stomata
- 1) Decline in guard cell solutes
 - 2) High osmotic pressure of guard cells
 - 3) Rise in potassium levels in guard cells
 - 4) Movement of water from neighboring cells into guard cells
42. In dorsiventral leaf, the number of stomata per unit area are generally
- 1) Same on both the surfaces
 - 2) More on lower surface (Abaxial epidermis)
 - 3) More on upper surface (Adaxial epidermis)
 - 4) Absent on upper surface (Adaxial epidermis)
43. Rate of transpiration is reduced with
- 1) Rise in temperature
 - 2) The absence of light
 - 3) Increase in wind velocity
 - 4) Increase in water uptake
44. Identify the incorrect statement :
- 1) Guard cell, subsidiary cell and stomatal pore together form stomatal apparatus
 - 2) Cellulose microfibrils radially oriented in guard cells
 - 3) In dicots, stomata more on abaxial epidermis and in monocots, more stomata on adaxial side
 - 4) The opening and closing of stomata is controlled by turgidity of guard cells
45. Identify the mis-matched option :
- 1) Tensile strength - Ability to resist pulling force of transpiration
 - 2) Capillarity - Ability to rise in small tubes
 - 3) Surface tension - Attraction of water molecules, more in liquid phase than in gaseous state
 - 4) C₄ plants - High (double) transpiration than C₃ plants
46. The most accepted view explaining the mechanism of transport of food molecules through phloem is
- 1) Transpiration pull concept
 - 2) Pressure flow hypothesis
 - 3) Mass-flow hypothesis
 - 4) 2 and 3

47. A few drops of sap were collected by cutting across a plant stem, which one of the following chemical test result indicates that it is phloem sap
- 1) Low refractive index
 - 2) Absence of sugar
 - 3) Acidic
 - 4) Alkaline
48. Identify the incorrect statement related with phloem transport :
- 1) Glucose prepared in leaf translocated through phloem in the form of sucrose
 - 2) Phloem loading and unloading are active transport
 - 3) Phloem transport is unidirectional
 - 4) Phloem sap contains water, sugar, hormones and amino acids
49. Ringing experiment cannot be performed in monocot plants, because :
- 1) Vascular bundles are radial
 - 2) Vascular bundles are scattered
 - 3) Cambium absent in between xylem and phloem
 - 4) Secondary growth absent in monocots
50. Identify the incorrect option :
- 1) Plant transport substances like water, minerals, sucrose etc.
 - 2) Transporting tissue are xylem and phloem
 - 3) Transporting mechanism is either passive or active
 - 4) The only mechanism of transportation in plant is osmosis

CHAPTER -06

MINERAL NUTRITION

QUESTIONS

1. The technique of hydroponics was first demonstrated by :
1) Joseph Priestly 2) Julius Von Sachs 3) Jan Ingenhousz 4) Cornelius van Neil
 2. Hydroponics has been successfully employed as a technique for the commercial production of vegetables such as :
1) Tomato 2) Seedless Cucumber
3) Lettuce 4) All of these
 3. Which one of the following is group of elements required more than 10m mole kg⁻¹ of dry matter?
1) Mg, Ca, K, S, P, N 2) C, H, O, Cl, Mo, N
3) Mn, Zn, Mg, S, P, C 4) Cu, Zn, B, Ca, O, Cl
 4. Which one of the following group is known as structural elements of cell?
1) Na, Si, Co, Se 2) Au, Cu, Ni, Mo 3) C, H, O, N 4) Cl, Ni, Zn, Mn
 5. Which one of the following is a macro nutrient required by the plant in greatest amount?
1) Mg 2) Ca 3) N 4) P
 6. Which element is required by all parts of the plant, particularly meristematic tissue and metabolically active cells :
1) Fe 2) Mg 3) B 4) N
 7. Which of the following element is responsible for maintaining turgidity of cells?
1) Molybdenum 2) Manganese 3) Potassium 4) Iron
 8. Which element is required in more abundant quantities in the meristematic tissue, buds, leaves and root tips?
1) K 2) Fe 3) S 4) Cu
 9. Which one of the following element is needed during the formation of mitotic spindle?
1) P 2) Ca 3) Mo 4) Zn
 10. The element which accumulates in older leaves is :
1) Ca 2) K 3) P 4) N

11. The element responsible for the ring structure of chlorophyll and maintenance of ribosome structure:
1) Ca 2) S 3) Mg 4) K
12. Which one of the following is not a micronutrient for plants?
1) Molybdenum 2) Magnesium
3) Manganese 4) Boron
13. Which one of the following element is involved in the synthesis of DNA and RNA?
1) N 2) P 3) Mg 4) Mn
14. Which one of the following micro nutrient is required in larger amount, in comparison to other micro nutrients?
1) Cu 2) Zn 3) Mn 4) Fe
15. The element which activates catalase enzyme is :
1) Manganese 2) Iron 3) Calcium 4) Boron
16. Micro nutrients are needed in amount equivalent to :
1) Below 10 m mole kg⁻¹ of dry matter 2) 18 m mole kg⁻¹ of dry matter
3) 32 m mole kg⁻¹ of dry matter 4) 60 m mole kg⁻¹ of dry matter
17. Manganese activates enzymes involved in :
1) Photosynthesis 2) Respiration
3) Nitrogen metabolism 4) All of these
18. Enzymes such as Alcohol dehydrogenase and carboxylases are activated by :
1) Fe 2) S 3) Zn 4) B
19. Which element is needed in the synthesis of auxin?
1) Zn 2) Cu 3) B 4) Mg
20. How many of the following are functions of Boron :
A) Uptake and utilisation of Ca B) Membrane functioning
C) Pollen germination D) Carbohydrate translocation
1) A and C 2) A, B and D 3) D only 4) A, B, C and D
21. Which one of the following element is required for cell elongation and cell differentiation?
1) Mo 2) B 3) Mn 4) Ni
22. One of the following forms of ions are not absorbed by plants :
1) H₂PO₄⁻ 2) HPO₄²⁻ 3) B₄O₇²⁻ 4) B₄O₃²⁻
23. Plants absorb molybdenum in the form of :
1) MoO₂ 2) MoO 3) MoO₂²⁺ 4) MoO₂²⁻
24. The element which is involved in nitrogen metabolism and activator of nitrogenase and nitrate reductase:
1) Mn 2) Mo 3) K 4) S

25. Water splitting reaction in photosynthesis requires the elements :
 1) Zn and Cu 2) Mn and Mg 3) Zn and Cl 4) Mn and Cl
26. Chlorosis is caused by the deficiency of :
 1) Mg, Mn, Mo 2) Zn, S, Fe 3) N, K 4) All of these
27. Inhibition of cell division is caused by the deficiency of :
 1) Ca, Mg, Cu, K 2) N, K, S, Mo 3) C, H, O, N 4) Mo, Zn, Mn, Fe, S
28. One observed that flowering is delayed in a plant, which group of elements concentration is probably decreased in that plant?
 1) N, K, S, Mo 2) Mo, S, N 3) Mg, Mn, Cl, K 4) Na, Si, Co, B
29. Necrosis refers to :
 1) Inhibition of cell division 2) Death of tissue
 3) Delay flowering 4) Yellowing of leaves
30. Deficiency symptoms of elements that are actively mobilised with the plant tends to appear first in :
 1) Older tissue 2) Young tissue 3) Root tip 4) Shoot tip
31. Which one of the following consists of elements that are actively mobilised within the plants and exported to young developing tissue?
 1) N, K, Mg 2) N, K, Ca 3) Ca, Mg, N 4) Ca, K, Mg
32. Which one of the following is an immobile element in plants?
 1) N 2) Mg 3) K 4) Ca
33. Select the correct statement regarding Mn Toxicity :
 1) Prominent symptom of Mn toxicity is the appearance of brown spot surrounded by chlorotic veins
 2) Mn competes with Fe and Mg for uptake
 3) Mn inhibits Ca translocation in shoot apex
 4) All of these
34. Symptoms of Mn toxicity may actually be the deficiency symptoms of :
 1) Mg, Mo, Mn 2) Fe, Mg, Ca 3) Fe, Na, Ca 4) C, H, O, N
35. In the mineral absorption, an initial rapid uptake of ions in to the free space or outer space of the cell is called :
 1) Apoplast pathway 2) Symplast pathway 3) Active absorption 4) Osmosis
36. Which of the following microbes produce nitrogen fixing nodules in non-leguminous plants?
 1) Rhizobium 2) Nostoc
 3) Rhodospirillum 4) Frankia
37. Which of the following bacteria reduce nitrate in soil into Nitrogen?
 1) Nitrobacter 2) Nitrococcus 3) Thiobacillus 4) Nitrosomonas
38. $2\text{NO}_2^- + \text{O}_2 \rightarrow 2\text{NO}_3^-$. This step is carried out by :
 1) Nitrosomonas 2) Nitrococcus 3) Nitrobacter 4) Pseudomonas

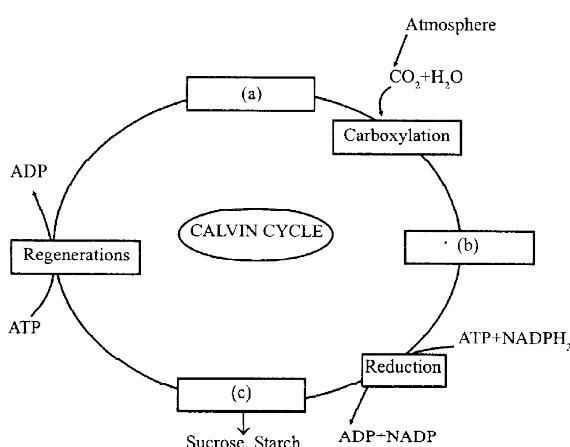
39. Find out the true statements.
- a) Nostoc and Anabaena are capable of fixing nitrogen in free living state also
 - b) Nitrifying bacteria are chemoautotrophs
 - c) Rhizobia live as aerobes under free living condition
 - d) Free living aerobic nitrogen fixing microbes are Azotobacter and Beijernickia
- 1) All
 - 2) a and d only
 - 3) b and c only
 - 4) c and d only
40. Which of the following bacteria is correctly matched with their function?
- A) Nitrosomonas - Nitrite to nitrate
 - B) Thiobacillus - Nitrification
 - C) Nostoc - Free living nitrogen fixer
 - D) Azotobacter - Aerobic nitrogen fixer
- 1) A & B
 - 2) C & D
 - 3) B & C
 - 4) B & D
41. Find the incorrectly matched pair :
- 1) Rhizobium - Leguminous plants
 - 2) Frankia - Alnus
 - 3) Rhodospirillum - Aerobic nitrogen fixer
 - 4) Pseudomonas - Denitrifying bacteria
42. For its action, nitrogenase requires :
- 1) High input of energy
 - 2) Light
 - 3) Oxygen
 - 4) Zn
43. During biological nitrogen fixation, inactivation of nitrogenase by oxygen poisoning is prevented by :
- 1) Carotene
 - 2) Cytochrome
 - 3) Leghaemoglobin
 - 4) Xanthophyll
44. Pigment present in the root nodules of leguminous plant is :
- 1) Carotene
 - 2) Phycoerythrin
 - 3) Leg haemoglobin
 - 4) Fucoxanthin
45. The first stable product of fixation of atmospheric nitrogen in leguminous plant is :
- 1) NO_3^-
 - 2) NO_2^-
 - 3) Glutamate
 - 4) Ammonia
46. In plants amino acids are synthesised by :
- 1) Reductive amination
 - 2) Transamination
 - 3) Both 1 and 2
 - 4) Translocation
47. Reaction of α – ketoglutaric acid with ammonia to form glutamic acid is :
- 1) Nitrification
 - 2) Reductive amination
 - 3) Transamination
 - 4) Ammonification
48. The process of transfer of amino group from one amino acid to the ketogroup of a keto acid is called as:
- 1) Denitrification
 - 2) Transamination
 - 3) Reductive amination
 - 4) Ammonification
49. Asparagine and glutamine are the two most important :
- 1) Amino acids
 - 2) Proteins
 - 3) Amides
 - 4) S containing aminoacids
50. Amides are transported to other parts of the plant via :
- 1) Xylem vessels
 - 2) Sieve tube
 - 3) Companion cells
 - 4) Phloem parenchyma

CHAPTER - 07

PHOTOSYNTHESIS IN HIGHER PLANTS

QUESTIONS

14. Consider the following statements:
- A) NADP found in stroma
 - B) Both cytochrome B₆ and cytochrome f are found in the membrane of both stroma lamellae and grana thylakoid
 - C) Flow of proton from lumen towards the stroma through F₀ channel is facilitated diffusion.
 - D) Plastocyanin is a non-protein found in the outer surface of thylakoid membrane
- 1) C and D are false 2) A, B & C are true
 3) All except B are true 4) All statements are false
15. Identify the most possible location of cyclic electron transport :
- 1) Stroma lamellae 2) Stroma 3) Periplastidial space 4) Both 1 & 2
16. During non-cyclic electron transport, NADP accept protons from :
- 1) Lumen of grana thylakoid
 2) Stroma of chloroplast
 3) In between outer and inner membrane of chloroplast
 4) Cytoplasm of mesophyll cell
17. FNR is associated with :
- 1) Cyclic electron transport 2) Calvin cycle
 3) C₄ cycle 4) Z-scheme
18. Both PS I and PS II are present in :
- 1) Membrane of grana thylakoid 2) Membrane of stroma lamellae
 3) Fret channel 4) Stroma
19. Choose the correct combinations of labelling the carbohydrate molecule involved in the Calvin cycle:



- 1) a - RuBP ; b - Triose phosphate ; c - PGA 2) a - PGA ; b - RuBP ; c - Triose phosphate
 3) a - PGA ; b - Triose phosphate ; c - RuBP 4) a - RuBP ; b - PGA ; c - Triose phosphate

20. Consider the following statements.

Statement I : In C₃ plants, the reactions catalysing the assimilation of CO₂ to carbohydrates take place in the stroma.

Statement II : C₃ pathway is also called Calvin cycle after its discoverer, Melvin Calvin, who received Nobel Prize for discovering this pathway.

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

21. How many ATP molecules are used in the regeneration of RuBP when six CO₂ molecules are entering into Calvin cycle :

- 1) 1
- 2) 2
- 3) 3
- 4) 6

22. Function of RuBisCO in Calvin Cycle :

- 1) Carboxylation of RuBP
- 2) Oxygenation of RuBP
- 3) Both Carboxylation and oxygenation of RuBP
- 4) Accept CO₂ from atmosphere

23. NADP is :

- 1) Electron acceptor only
- 2) Proton acceptor only
- 3) Both proton and electron acceptor
- 4) Proton pumping channel

24. Photolysis takes place in :

- 1) Luminal surface of grana thylakoid
- 2) Lumen of stroma lamellae
- 3) Lumen of frets
- 4) Both 1 & 2

25. The electron deficiency of PS II is compensated by :

- 1) Splitting of H₂O in the stroma and provided electrons to PS II
- 2) Splitting of H₂O in periplastidal space and provided electrons to PS II
- 3) Photolysis of water in the luminal surface of thylakoid and provided electrons to PS II
- 4) Photolysis of water in frets and provided electrons to PS II

26. The primary electron acceptor of photosystem I is located in :

- 1) Inner surface of the thylakoid membrane
- 2) Outer surface of the thylakoid membrane
- 3) Middle portion of the thylakoid membrane
- 4) Luminal surface of the granum

27. Which of the following statement is true regarding non-cyclic electron transport :
- 1) Electrons excited from PS II goes to PS I and then to ferredoxin and there is negligible chance to go to NADP but most probably electrons return back to PS I
 - 2) Electrons from PS II goes to PS I and from PS I to ferredoxin and there is a chance to go to PS I but most probably electron goes to NADP
 - 3) Electrons from PS II goes to PS I and from PS I to ferredoxin and strictly go to NADP and there is no chance to return back to PS I
 - 4) Electrons from PS II goes to PS I and from PS I to ferredoxin and there is equal chance to go to NADP and PS I
28. The most outstanding objective of light phase reactions during photosynthesis :
- I. Evolution of O₂ and purification of atmosphere
 - II. Synthesis of assimilatory powers
 - III. Creating proton gradient
 - IV. Absorption of light up to 700nm
 - V. Absorption of light up to 680 nm
- 1) Both I & II
 - 2) I only
 - 3) II only
 - 4) All except III
29. Which of the following are true regarding proton pump in thylakoid membrane :
- A) Only one type of pump
 - B) More than one type of pump
 - C) Cytochrome b₆ is a pump
 - D) PlastoQuinone B is a pump
- 1) A & D
 - 2) A & C
 - 3) B & C
 - 4) C & D
30. In which of the following device through which the reactions of calvin cycles were discovered:
- 1) Paper chromatography
 - 2) Bell jar experiment
 - 3) Blotting technique
 - 4) Radioactive isotope technique
31. How many major type of cells are involved in the CO₂ fixation process in C₃ plants :
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
32. What are the essential requirements for the synthesis of one molecule of glucose:
- A) 6 molecule of RuBP
 - B) 6 molecule of CO₂
 - C) 6 Calvin cycle
 - D) 18 ATP
 - E) 12 NADPH₂
- 1) All except C
 - 2) D & E only
 - 3) A, D, E only
 - 4) All
33. In C₃ plants, RuBisCO present in :
- 1) Mesophyll cell only
 - 2) Bundlesheath only
 - 3) Spongy parenchyma and bundle sheath
 - 4) Palisade parenchyma and bundlesheath
34. In C₃ cycle, primary CO₂ acceptor is :
- 1) RuBisCO
 - 2) PGA
 - 3) PEP
 - 4) RuBP
35. First stable product of Calvin cycle :
- 1) 2 - carbon compound
 - 2) 3 - carbon compound
 - 3) 4 - carbon compound
 - 4) 5 - carbon compound

36. The isotope of carbon used extensively for studies on photosynthesis is :
- 1) C¹⁴ 2) C¹⁶ 3) C¹³ 4) C¹⁵
37. Connecting link between light phase and dark phase of photosynthesis :
- 1) ATP only 2) NADH₂ only 3) NADPH₂ only 4) ATP & NADPH₂
38. Which of the following plant exhibit dimorphic chloroplast :
- 1) Sorghum 2) Tomato 3) Bell pepper 4) Opuntia
39. How many carboxylations and decarboxylations are required for the synthesis one molecule of glucose in C₄ plants :
- 1) One carboxylation in Mesophyll
One carboxylation in bundle sheath
One decarboxylation in bundle sheath
- 2) One carboxylation in Mesophyll
One carboxylation in bundle sheath
Twelve decarboxylation in bundle sheath
- 3) Six carboxylation in mesophyll
Six carboxylation in bundle sheath
Six decarboxylation in bundle sheath
- 4) One carboxylation in mesophyll
Six carboxylation in bundle sheath
One decarboxylation in bundle sheath
40. Which of the following plants responds to higher temperature :
- I. C₃ plants II. Bell pepper and Tomato
III. Sorghum IV. C₄ plants
- 1) I & II only 2) All 3) II & IV only 4) III & IV only
41. Consider the following statements :
- A) Cyclic photophosphorylation is the only source of energy for Calvin cycle for the synthesis of glucose
B) Both cyclic and non - cyclic photophosphorylation are sources of Calvin cycle for the synthesis of carbohydrate
C) With regards to C₄ plants, primary carboxylation enzyme found only in mesophyll cell
D) Calvin cycle involves only three major stages
E) In C₄ plants, mesophyll cells are arranged with or without intercellular spaces
- Of the above statements
- 1) A and D are false but B, C, E are true 2) All except A are true
3) A,C,E are false 4) Only B and D are false

42. Identify the first stable product and substrate of photorespiration respectively :
- 1) 3 - PGA and 2-phosphoglycolic acid
 - 2) 3 - PGA and glycolic acid
 - 3) 2 - phosphoglycolic acid and glycolic acid
 - 4) Glycolic acid and 3-pGA
43. Regeneration of one molecule of RuBP in Calvin cycle requires :
- 1) 1 ATP
 - 2) 3 ATP
 - 3) 4 ATP
 - 4) 6 ATP
44. Which of the following statements are false:
- I. In C₃ plants, C₃ cycle occur in mesophyll cells
 - II. Primary carboxylation is catalysed by Rubisco in C₄ plants
 - III. C₃ plants, CAM plants and C₄ plants perform Calvin cycle
 - IV. In C₄ photosynthesis, RuBisCO functionally active only in Calvin cycle
- 1) Only II
 - 2) I, II and IV
 - 3) Both III and IV
 - 4) All except I
45. Photosynthetically active radiation (PAR), light most effective for photosynthesis :
- 1) 400 - 500 nm
 - 2) 400 - 700 nm
 - 3) 450 - 550 nm
 - 4) 500 - 600 nm
46. In C₄ photosynthesis, number of C₄ and C₃ cycles are required for the synthesis of one glucose molecule:
- 1) one C₄ cycle and six C₃ cycles
 - 2) one C₄ cycle and one C₃ cycle
 - 3) Six C₄ cycles and six C₃ cycles
 - 4) Twelve C₄ cycles and six C₃ cycles
47. Which of the following is false regarding PEPcase :
- a) Found in both mesophyll and bundle sheath of C₄ plants
 - b) Primary CO₂ acceptor in both C₄ and CAM plants
 - c) Primary carboxylation enzyme present only in C₄ plants
 - d) Found in Sorghum and Maize
- 1) All except b
 - 2) All statements are false
 - 3) a, b and c
 - 4) b, c and d
48. Consider the following statements :
- I. PEPcase is absent in bundlesheath.
 - II. PEPcase is a primary carboxylation enzyme present in maize and sorghum
 - III. Starch is the first visible product of photosynthesis
- Of the above statements :
- 1) All statements are false
 - 2) All statements are true
 - 3) I & II are false but III is true
 - 4) I & III are true but II is false

49. Consider the following statements ;
- A) With regards to C₄ plants, RuBisCO is present in both mesophyll and bundle sheath cells
 - B) In C₄ plants both PEPcase and RuBisCO are found at the same mesophyll cells
 - C) Bundlesheath cells are large sized than mesophyll cells
 - D) Number of chloroplast found maximum in bundlesheath cells than mesophyll.
- Of the above statements :
- 1) A & C are false
 - 2) B & D are false
 - 3) A & B are true
 - 4) C & D are true
50. Identify the function of RuBisCO in photorespiration :
- 1) Carboxylation
 - 2) Oxygenation
 - 3) Reduction
 - 4) Both 1 and 2
51. With regard to C₄ photosynthesis, the transport of both C₄ and C₃ acids from mesophyll to bundlesheath and from bundlesheath to mesophyll occur through :
- 1) Cell wall
 - 2) Plasmodesmata
 - 3) Cell membrane
 - 4) Vacuole
52. With regarding to the following conditions :
- A) Continuous strong light intensity
 - B) High CO₂ concentration
 - C) Temperature 30°C - 40°C
 - D) Low oxygen level
- What will be the possibility on photosynthesis in C₃ plants :
- 1) Denaturation of enzyme
 - 2) Enhances rate of photosynthesis
 - 3) Decreases rate of photosynthesis
 - 4) Both 1 and 3
53. Who postulated the Law of Limiting Factors :
- 1) F.F. Blackman
 - 2) Van Niel
 - 3) Engelmann
 - 4) Priestly
54. Law of limiting factor was proposed in :
- 1) 1805
 - 2) 1850
 - 3) 1905
 - 4) 1950
55. In continuous strong light, the rate of photosynthesis will :
- 1) Increase
 - 2) Decrease
 - 3) Slowly increase
 - 4) Rapidly increase

CHAPTER - 08

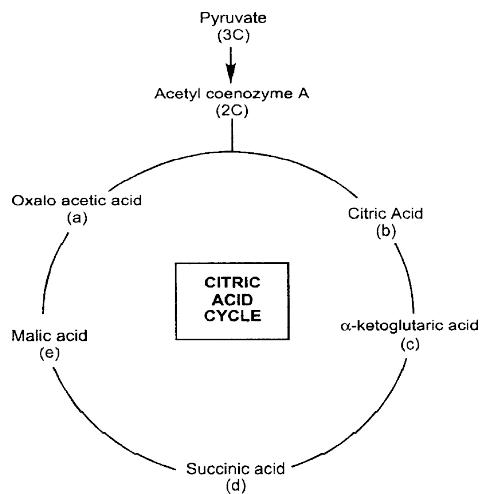
RESPIRATION IN PLANTS

QUESTIONS

10. In which of the following reaction of glycolysis, a molecule of water is removed from the substrate :
- 1) Fructose - 6 - phosphate → Fructose 1,6 - bisphosphate
 - 2) PEP → Pyruvic acid
 - 3) 2 - Phosphoglycerate → PEP
 - 4) Glucose → Glucose 6 - phosphate
11. Which of the following is formed by phosphorylation in Glycolysis?
- | | |
|--------------------------|-------------------------------|
| 1) Pyruvic Acid | 2) PEP |
| 3) Phosphoglyceraldehyde | 4) Fructose 1, 6-bisphosphate |
12. Which is a false statement regarding glycolysis :
- 1) Glycolysis is otherwise called mitochondrial respiration
 - 2) Glycolysis occurs in cytoplasm
 - 3) In this process glucose undergoes partial oxidation to form two molecules of pyruvic acid
 - 4) Pyruvic acid is the key product of glycolysis
13. Net gain of ATP and NADH₂ during glycolysis :
- | | |
|----------------------------------|----------------------------------|
| 1) 4ATP and 2 NADH ₂ | 2) 2 ATP and 2 NADH ₂ |
| 3) 4 ATP and 4 NADH ₂ | 4) 2 ATP and 1 NADH ₂ |
14. Triose phosphates formed by the splitting of fructose-1, 6-bisphosphate during glycolysis :
- | | | | |
|--------------------------------|-----------------------------|------------|------------|
| a) 3-phophoglyceraldehyde | b) 1, 3-bisphosphoglycerate | | |
| c) Dihydroxy acetone phosphate | d) 3-phosphoglyceric acid | | |
| 1) a and d | 2) b and d | 3) a and c | 4) b and c |
15. Which is the connecting link between glycolysis and Krebs cycle?
- | | | | |
|--------|----------------|-----------------|----------------|
| 1) PEP | 2) Acetyl-Co.A | 3) Pyruvic acid | 4) Citric acid |
|--------|----------------|-----------------|----------------|
16. In respiration, the site of Krebs cycle is :
- | | |
|----------------|---------------------------------|
| 1) Cytosol | 2) Inner mitochondrial membrane |
| 3) Chloroplast | 4) Mitochondrial matrix |
17. Identify the activator of pyruvic dehydrogenase enzyme :
- | | | | |
|---------------------|---------------------|---------------------|---------------------|
| 1) Mg ²⁺ | 2) Mn ²⁺ | 3) Zn ²⁺ | 4) Ca ²⁺ |
|---------------------|---------------------|---------------------|---------------------|
18. The enzyme involved in the formation of Acetyl Co. A from pyruvic acid :
- | | |
|---------------------------------|---------------------------|
| 1) Citrate synthetase | 2) Aconitase |
| 3) Isocitric acid dehydrogenase | 4) Pyruvate dehydrogenase |
19. The site of link reaction :
- | | |
|---------------------------------|----------------------------|
| 1) Cytoplasm | 2) Mitochondrial matrix |
| 3) Inner mitochondrial membrane | 4) Perimitochondrial space |

20. NADH₂ is not formed between :
- 1) Isocitric acid and oxalo succinic acid
 - 2) Pyruvic acid and Acetyl Co. A
 - 3) Malic acid and oxaloacetic acid
 - 4) Succinic acid and Fumaric acid
21. Identify the first decarboxylation reaction in respiration :
- 1) Isocitric acid → Oxalosuccinic acid
 - 2) Oxalosuccinic acid → α - ketoglutaric acid
 - 3) α - ketoglutaric acid → Succinyl Co. A
 - 4) Pyruvic acid → Acetyl Co. A
22. Total number of CO₂ evolved during a single turn of Krebs cycle :
- | | | | |
|--------|----------|---------|--------|
| 1) Two | 2) Three | 3) Four | 4) Six |
|--------|----------|---------|--------|
23. How many substrate level phosphorylation occur in a Krebs cycle :
- | | | | |
|--------|--------|----------|---------|
| 1) One | 2) Two | 3) Three | 4) Four |
|--------|--------|----------|---------|
24. How many oxidations are there in a Krebs cycle :
- | | | | |
|--------|---------|--------|-----------|
| 1) Two | 2) Four | 3) Ten | 4) Twelve |
|--------|---------|--------|-----------|
25. Conversion of Succinic acid to Fumaric acid in Krebs cycle takes place by :
- 1) Addition of O₂ to succinic acid
 - 2) Removal of hydrogen from succinic acid
 - 3) Addition of phosphate to succinic acid
 - 4) Removal of phosphate from succinic acid
26. Substrate level phosphorylation in Krebs cycle occurs during conversion of :
- 1) Succinate to Fumaric acid
 - 2) Succinyl Co.A to Succinic acid
 - 3) Malate to Oxaloacetic acid
 - 4) Fumaric acid to Malic acid
27. In Krebs cycle, FADH₂ is formed between :
- | | |
|---|-----------------------------------|
| 1) Isocitric acid and oxalo succinic acid | 2) Pyruvic acid and Acetyl Co. A |
| 3) Malic acid and oxaloacetic acid | 4) Succinic acid and Fumaric acid |
28. Select the step which is not a part of Krebs cycle :
- 1) Citric acid → Cisacconitic acid
 - 2) Pyruvic acid → Acetyl Co. A
 - 3) Fumaric acid → Malic acid
 - 4) Succinyl Co. A → Succinic acid

29. Choose the correct combination of labelling the number of carbon compounds in the substrate molecules, involved in the citric acid cycle



- 1) (a) 4C, (b) 6C, (c) 5C, (d) 4C, (e) 4C
 - 2) (a) 6C, (b) 5C, (c) 4C, (d) 3C, (e) 2C
 - 3) (a) 2C, (b) 3C, (c) 4C, (d) 5C, (e) 6C
 - 4) (a) 4C, (b) 5C, (c) 6C, (d) 4C, (e) 4C
30. In prokaryotic organisms like Bacteria, the part concerned with respiration :
- 1) Peroxisome
 - 2) Mitochondria
 - 3) Mesosome
 - 4) Chloroplast
31. How many decarboxylations are present in respiration when one glucose participate in the reaction :
- 1) One
 - 2) Six
 - 3) Three
 - 4) Four
32. In the first reaction of citric acid cycle, 6-carbon citric acid is formed by the reaction between acetyl CoA and -----
- 1) Malic acid
 - 2) Succinic acid
 - 3) Oxalosuccinic acid
 - 4) Oxaloacetic acid
33. Net ATP yield during the complete oxidation of one molecule of glucose in aerobic respiration :
- 1) 30
 - 2) 32
 - 3) 40
 - 4) 38
34. Direct ATP yield during Krebs cycle per glucose molecule is :
- 1) 2
 - 2) 8
 - 3) 12
 - 4) 22
35. Identify the respiratory entrant in Krebs cycle:
- 1) Acetyl Co A
 - 2) Oxalo acetic acid
 - 3) Pyruvic acid
 - 4) Citric acid

36. Select the mismatched pair :

- 1) Succinyl Co A - 4 carbon
- 2) Oxaloacetic acid - 6 carbon
- 3) Alpha-ketoglutaric acid - 5 carbon
- 4) Acetyl Co A - 2 carbon

37. Identify the correct sequence of events in Kreb's cycle :

- 1) Citric acid → Isocitric acid → Cisaconitic acid → Oxalosuccinic acid → Alpha-ketoglutaric acid → Succinyl CoA → Succinic acid → Fumaric acid → Malic acid → Oxalo acetic acid
- 2) Citric acid → Cisaconitic acid → Isocitric acid → Oxalo acetic acid → Alpha-ketoglutaric acid → Succinyl CoA → Succinic acid → Fumaric acid → Malic acid → Oxalosuccinic acid
- 3) Citric acid → Cisaconitic acid → Isocitric acid → Oxalosuccinic acid → Alpha-ketoglutaric acid → Succinyl CoA → Fumaric acid → Succinic acid → Malic acid → Oxalo acetic acid
- 4) Citric acid → Cisaconitic acid → Isocitric acid → Oxalosuccinic acid → Alpha-ketoglutaric acid → Succinyl CoA → Succinic acid → Fumaric acid → Malic acid → Oxalo acetic acid

38. Turns of Krebs cycle required for complete oxidation of one molecule of glucose are :

- 1) 2
- 2) 3
- 3) 4
- 4) 6

39. Yeasts poison themselves to death when the concentration of alcohol reaches about ----- percent :

- 1) 13
- 2) 30
- 3) 31
- 4) 3

40. Identify complex II from the following :

- | | |
|-----------------------|-------------------------|
| 1) NADH dehydrogenase | 2) Cytochrome c oxidase |
| 3) ATPsynthase | 4) FADH_2 |

41. ETS is present in :

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

42. Final electron donor in ETS :

- 1) Oxygen
- 2) UbiQuinone
- 3) FMN
- 4) Cytochrome a_3

43. How many ATP molecules are formed by oxidative phosphorylation of 1 NADH_2 molecule?

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

44. Which of the following is the final electron acceptor in ETS?

- | | |
|---------------------|-----------------|
| 1) Cytochrome c_1 | 2) Cytochrome c |
| 3) Ubiquinone | 4) Oxygen |

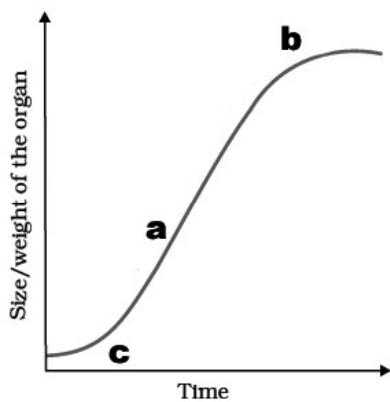
45. Which one is complex V of mitochondrial ETS :
1) NADH dehydrogenase 2) ATP synthase
3) Succinate dehydrogenase 4) Cytochrome c oxidase complex
46. Which of the following is a mobile electron carrier between complex III and IV :
1) Cytochrome c 2) Cytochrome a_3 3) Cytochrome b 4) All
47. The enzyme involved in the formation of Ethanol from Acetaldehyde :
1) Citrate synthetase 2) Pyruvic acid decarboxylase
3) Isocitric acid dehydrogenase 4) Alcohol dehydrogenase
48. Net ATP yield during the complete oxidation of one molecule of glucose in anaerobic respiration :
1) 30 2) 32 3) 2 4) 38
49. End product of lactic acid fermentation :
1) CO_2 only 2) CO_2 and ethanol
3) Lactic acid only 4) CO_2 and lactic acid
50. In alcoholic fermentation, pyruvic acid is converted into _____
1) CO_2 and ethanol 2) Methanol and ethanol
3) CO_2 and H_2O 4) CO_2 only

CHAPTER - 09

PLANT GROWTH & DEVELOPMENT

QUESTIONS

1. The growth of an organism in natural environment follows;
 - 1) J- shaped
 - 2) Hyperbolic curve
 - 3) Sigmoid curve
 - 4) Parabolic curve
2. Growth is maximum in the zone of
 - 1) Cell elongation
 - 2) Cell division
 - 3) Cell maturation
 - 4) All of these
3. Which among the following are products of dedifferentiation?
 - 1) interfascicular cambium
 - 2) Permanent cells
 - 3) cork cambium
 - 4) Both 1 & 3
4. Arithmetic growth is expressed mathematically as :
 - 1) $W_t = W_0 e^{rt}$
 - 2) $W_t = W_0 e^{rt}$
 - 3) $L_t = L_0 + rt$
 - 4) $L_t = L_0 + rt$
5. Label the following sigmoid graph :



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

6. Find out the correct statements from the following :
1. All cells of a plant are descendants of the zygote
 2. Development is the sum of growth and differentiation
 3. Growth is regarded as one of the most fundamental and conspicuous characteristics of a living being
 4. Growth is reversible permanent increase in size of an organ or its parts
- 1) 1 and 2 2) 1, 2 and 3 3) 1, 2 and 4 4) 2 and 3
7. The measure of the ability of the plant to produce new plant material is known as :
- 1) Efficiency index 2) Differentiation
3) Plasticity 4) Dedifferentiation
8. Heterophylly in cotton is an example of :
- 1) Plasticity 2) Differentiation
3) De - differentiation 4) Senescence
9. Choose the false statement concerned with growth:-
- 1) Growth is an irreversible, permanent increase in size of an organ or its parts.
2) Growth is accompanied by metabolic processes, that occur at the expense of energy.
3) Plant growth generally is determinate.
4) In plants, growth is open form
10. Formation of meristems-interfascicular cambium and cork cambium from fully differentiated parenchyma cells is an example for:-
- 1) Differentiation 2) De-differentiation 3) Re-differentiation 4) Maturation
11. Select the term that includes all changes that an organism goes through during its life cycle from germination of the seed to senescence:-
- 1) Growth 2) Differentiation 3) Development 4) Maturation
12. Most commonly occurring natural auxin :
- 1) IBA 2) NAA 3) 2, 4 - D 4) IAA
13. Auxin was isolated by F.W. Went from :
- 1) Corn kernels 2) Tips of coleoptiles of oat seedlings
3) Coleoptiles of tobacco 4) Coconut milk
14. The auxin, widely used to kill dicotyledonous weeds
- 1) IAA 2) IBA 3) NAA 4) 2,4-D
15. Which of the following hormone is used in root formation on stem cuttings ?
- 1) Kinetin 2) GA 3) ABA 4) IBA
16. Which hormone is responsible for apical dominance
- 1) GA 2) Cytokinin 3) Auxin (IAA) 4) Ethylene

17. High concentration of synthetic auxin, 2,4-D is used as a
 1) Vitamin 2) Fertilizer 3) Insecticide 4) Weedicide
18. Which of the following is/are synthetic auxins :
 1) IAA 2) NAA 3) 2, 4 - D 4) 2 & 3
19. Phototropic curvature is the result of uneven distribution of :
 1) Gibberellin 2) Phytochrome 3) Cytokinins 4) Auxin
20. Auxins promote flowering in
 1) Tomatoes 2) Cucumber 3) Apple 4) Pineapple
21. Natural Zeatin is isolated from
 1) Corn kernels 2) Coconut milk 3) Palm oils 4) Both 1 & 2
22. Skoog and Miller are associated with the discovery of :
 1) Ethylene 2) Auxin 3) Cytokinin 4) Gibberellin
23. N⁶ - furfuryl amino purine is :
 1) IAA 2) Kinetin 3) ABA 4) Gibberellic acid
24. The plant hormone which help to overcome the apical dominance and promote nutrient mobilisation in leaves
 1) Auxins 2) Gibberellins 3) Cytokinins 4) Ethylene
25. Kinetin identified first by Skoog and Miller in
 1) Herring egg 2) Herring sperm
 3) Tradescantia pollen 4) Corn Kernal
26. The PGR, which is used to speed up the malting process in brewing industry
 1) GA₃ 2) 2,4-D 3) IAA 4) NAA
27. 'Foolish seedling' is a disease of rice seedlings. It is caused by :
 1) Bacteria 2) Fungus 3) Protozoa 4) Virus
28. Internode elongation just prior to flowering is :
 1) Bolting 2) Rosette formation 3) Plasticity 4) Decapitation
29. The most widely used compound as source of ethylene is :
 1) Ethyl alcohol 2) Ethepron 3) Zeatin 4) Acetylene
30. Cousins, confirmed the release of a volatile substance from ripened oranges that hastened the ripening of stored unripened bananas. Later this volatile substance was identified as:-
 1) Gibberellin 2) Cytokinin 3) Auxin 4) Ethylene
31. Fruit ripening is stimulated by
 1) Auxin 2) Gibberellin 3) Cytokinin 4) Ethylene

32. **Statement I** : Auxin was isolated by F.W Went from the tips of coleoptile of Avena
Statement II : Ethylene delays the senescence
1) Both statement I and statement II are true and the statement II is the correct explanation of statement I .
2) Both statement I and statement II are true but statement II is not the correct explanation of statement I .
3) Statement I is correct, Statement II is wrong
4) Both statement I and statement II are false
33. The PGR, used to initiate flowering and for synchronising fruit set in pine apple is :
1) Auxin 2) Gibberellin 3) Abscisic acid 4) Ethylene
34. In Cucurbita the female flowers can be promoted by the application of:-
1) Zeatin 2) Ethylene 3) Cytokinin 4) Abscisic acid
35. Ethylene is synthesised in large amounts by :
1) meristematic tissues
2) root and shoot apices
3) tissues undergoing senescence and ripening fruits
4) developing leaves and fruits
36. The PGR that stimulate the closure of stomata is :
1) Ethylene 2) ABA 3) IAA 4) IBA
37. Select the plant growth inhibitor from the following:-
1) Auxins 2) Gibberellins 3) Cytokinins 4) Abscisic acid
38. Which of the following statements are correct:-
i) Kinetin occur naturally in plants.
ii) Auxin generally produced by the growing apices of the stems and roots.
iii) Gibberellins cause fruits like apple to elongate and improve its shape.
iv) ABA helps seeds to withstand desiccation.
1) i and ii only 2) ii, iii and iv only 3) ii and iv only 4) iii and iv only
39. Stress hormone is
1) Auxin 2) Gibberellin 3) Cytokinin 4) Abscisic acid
40. Dormancy is induced by
1) Gibberellins 2) Cytokinins 3) Auxin 4) ABA
41. Plants which require an exposure to light for a period greater than critical day length are
1) Long day plants 2) Short day plants
3) Day neutral plants 4) Long night plants

42. Most appropriate temperature for vernalization is :
 1) 0°C 2) $1\text{-}6^{\circ}\text{C}$ 3) -6°C 4) 7°C
43. Vernalisation occurs in response to :
 1) High light intensity 2) Low light intensity 3) High temperature 4) Low temperature
44. Which among the following hormone is a stress hormone :
 1) Ethylene 2) Abscisic acid 3) Auxin 4) Cytokinin
45. One of the following is an intrinsic factor which control the development in plants:-
 1) Light 2) Temperature 3) Oxygen 4) Plant growth regulators
46. Match the columns and choose the correct combination:-

Column - I	Column - II
a) Auxin	i) Fruit ripening
b) Gibberellin	ii) Cell division
c) Cytokinin	iii) Apical dominance
d) Ethylene	iv) Bolting

- 1) a \rightarrow iii, b \rightarrow iv; c \rightarrow i; d \rightarrow ii 2) a \rightarrow iv; b \rightarrow iii; c \rightarrow ii; d \rightarrow i
 3) a \rightarrow iii; b \rightarrow ii; c \rightarrow iv; d \rightarrow i 4) a \rightarrow iii; b \rightarrow iv; c \rightarrow ii; d \rightarrow i
47. Choose the wrong pair:-
 1) Auxein - to grow 2) Gibberellin - Acidic
 3) Cytokinin - Zeatin 4) ABA – Flowering hormone
48. Which of the following statements are true:-
 i) GA₃ is used to speed up the malting process in brewing industry.
 ii) Ethylene breaks seed and bud dormancy.
 iii) ABA plays an important role in seed development, maturation and dormancy.
 iv) Auxin controls xylem differentiation and helps in cell division.
 1) i and iii only 2) ii and iv only 3) i only 4) All statements are true
49. The ability of the plant to detect and respond to the relative length of day and night to which the plant is exposed is called
 1) Photoperiodism 2) Phototropism
 3) Vernalisation 4) Photolysis
50. The meristems that cause the increase in the girth of the organs in which they are active:-
 1) Lateral meristems, vascular cambium and cork-cambium.
 2) Lateral meristems, intercalary meristem and cork cambium.
 3) Apical meristems, vascular cambium and secondary cortex.
 4) Intercalary meristems, cambium and cork-cambium.

WORKBOOK

ZOOLOGY

CHAPTER - 01

STRUCTURAL ORGANIZATION IN ANIMALS (ANIMAL TISSUES)

QUESTIONS

1. The study of the microscopic anatomy of tissues is called
 - 1) Histology
 - 2) Cytology
 - 3) Pathology
 - 4) Morphology
2. The formation of tissues from the primary germ layers such as ectoderm, mesoderm and endoderm is called
 - 1) Herpetology
 - 2) Histogenesis
 - 3) Morphology
 - 4) Cytology
3. The term epithelium means
 - 1) Epithelial tissue
 - 2) Only tissue with basement membrane
 - 3) First tissue evolved
 - 4) The only tissue with variable origin
4. Which of the following tissue is avascular?
 - 1) connective tissue
 - 2) muscular tissue
 - 3) epithelial tissue
 - 4) neural tissue
5. Simple columnar epithelium having microvilli on their free surface, known as brush bordered columnar epithelium is seen
 - 1) in the lining of intestine
 - 2) in the lining of fallopian tube
 - 3) in the lining of bronchioles
 - 4) in the lining of trachea
6. Name the tissue that develops from all germ layers
 - 1) epithelial tissue
 - 2) muscular tissue
 - 3) connective tissue
 - 4) neural tissue
7. Glands which can produce both hormones and enzymes are called
 - 1) endocrine glands
 - 2) exocrine glands
 - 3) heterocrine glands
 - 4) merocrine glands
8. Mammary glands are the modification of
 - 1) sweat glands
 - 2) Sebaceous glands
 - 3) mast cells
 - 4) preen glands
9. Ducted glands are also called as
 - 1) endocrine glands
 - 2) exocrine glands
 - 3) holocrine glands
 - 4) apocrine glands

10. Transitional epithelium, / urothelium is present in
 1) Ureters 2) urinary bladder 3) urethra 4) all
11. Which of the following cover the dry surfaces of skin, the moist surface of buccal cavity, pharynx, inner lining of ducts of salivary glands and of pancreatic ducts?
 1) Compound epithelium 2) Germinal epithelium
 3) Transitional epithelium 4) Urothelium
12. Which of the following cell junction helps to stop substances from leaking across a tissue,
 1) Adhering junction 2) tight junction
 3) gap junction 4) cementing junction
13. Which of the following facilitates the cells to communicate with each other by connecting the cytoplasm of adjoining cells, for rapid transfer of ions, small and sometimes big molecules
 1) Gap junction 2) Adhering junction
 3) Tight junction 4) Zona adherent
14. Mast cells secrete
 1) Histamine, Heparin, Serotonin etc 2) Fibres
 3) Melanin, Serotonin etc 4) Mucus and polysaccharides etc
15. Which type of tissue correctly matches with its location
- | Tissue | Location |
|----------------------------|---------------------|
| 1) transitional epithelium | - tip of nose |
| 2) smooth muscles | - small intestine |
| 3) cuboidal epithelium | - lining of stomach |
| 4) areolar tissue | - tendons |
16. Which of the following is the strongest cartilage
 1) hyaline cartilage 2) fibrous cartilage
 3) elastin cartilage 4) calcified cartilage
17. Haversian canal is a characteristic feature of mammalian bones. They are interconnected by
 1) Eustachian canal 2) Endosteum
 3) Volkman's canal 4) Osteocyte
18. Read the following statements
 i) Muscle fibres are cylindrical and multinucleated
 ii) They contract quickly and easily get fatigued
 iii) They are seen attached to skeleton
 iv) Skeletal muscle fibre is a syncitium
 Of the above statements how many are true about skeletal muscles
 1) only three are true 2) only two are true
 3) four are true 4) only one is true

19. Sprain is caused due to the excessive pulling of
1) tendons 2) ligaments 3) muscles 4) nerves
20. Which of the following has the function of engulfing foreign materials?
1) Mast cells 2) Macrophages
3) Lymphocytes 4) Plasma cells
21. Tendons and ligaments are made up of
1) nerve tissue 2) epithelial tissue
3) muscular tissue 4) fibrous connective tissue
22. Due to the regular, parallel and longitudinal arrangement of yellow fibres, dense elastic cords or bands called ligaments may be formed. It is used for connecting
1) organs to body wall 2) bones to bones
3) organs to organs 4) muscles to bone
23. Choose the correctly matched pairs
1) Tendon - Specialised connective tissue
2) Bone - Dense connective tissue
3) Cartilage - Loose connective tissue
4) Adipocytes - Loose connective tissue
24. The hard and non pliable ground substance of bone is rich in:
1) calcium salts and elastin fibres 2) calcium salts and collagen fibres
3) calcium salts and chondrocytes 4) calcium salt and chondroblast
25. Which of the following contains the largest quantity of extracellular material / intercellular material?
1) stratified epithelium 2) areolar tissue
3) voluntary muscle 4) ependyma
26. Plasma cells produce
1) antibody 2) matrix 3) heparin 4) serotonin
27. Skeletal muscle fibre is a syncitium which means it is
1) made up of many fibres 2) spindle shaped and uninucleated
3) swollen in the middle with tapered ends 4) multinucleated
28. Areolar tissue joins
1) bone with bone 2) bone with muscles
3) integument with muscles 4) fat body with muscles
29. Collagen and elastin are formed from
1) macrophages 2) fibroblasts 3) chondrocytes 4) osteocytes
30. Protein present in cartilage is called
1) Ossein 2) Condroblast 3) Chondrin 4) Perichondrium

31. Softest tissue of body is:
- 1) Blood 2) Bone 3) Cartilage 4) Adipose tissue
32. Which is the most abundant cell of human blood?
- 1) Leucocytes 2) Erythrocytes 3) Thrombocytes 4) Neutrophils
33. Which of the following is a glassy tissue?
- 1) Fibrous cartilage 2) Elastic cartilage
3) Hyaline cartilage 4) Tendons
34. The excess of nutrients which are not used immediately are converted into fat are stored in
- 1) Areolar tissue 2) Dense regular tissue
3) Epithelial tissue 4) Adipose tissue
35. Muscles of the heart are
- 1) striated and voluntary 2) non- striated and voluntary
3) striated , unbranched and involuntary 4) striated, branched and involuntary
36. Whartons jelly present in umbilical cord is an example for
- 1) adipose tissue 2) mucoid connective tissue
3) areolar tissue 4) elastic connective tissue
37. Which one of the following tissues originate exclusively from ectoderm of the embryo?
- 1) Muscular tissue 2) Epithelial tissue
3) Neural tissue 4) Connective tissue
38. Haversian canal is a peculiarity of the long bones of
- 1) Mammalian bones 2) Avian bones
3) Amphibian bones 4) Chondrichthyes
39. Most of the human neurons are
- 1) unipolar 2) bipolar
3) multipolar 4) pseudo-unipolar
40. The tissue which help in control and coordination of the body organ is:
- 1) Neural tissue 2) Epithelial tissue
3) Muscular tissue 4) Connective tissue

CHAPTER - 02

MORPHOLOGY OF ANIMALS (COCKROACH)

QUESTIONS

1. The branch of biology dealing with the study of form or externally visible features of organisms is called
1) Morphology 2) Anatomy 3) Histology 4) Cytology
2. Which of the following is absent in Periplaneta
1) prothorax 2) mesothorax 3) metathorax 4) cephalothorax
3. Among the different mouth parts of cockroach which of the following is considered as lower lip
1) labrum 2) labium 3) mandible 4) maxilla
4. Mandibulate type mouth parts are seen in
1) culex 2) periplaneta 3) apis 4) musca
5. Among the various mouth parts of cockroach which of the following are paired?
1) Mandible only 2) Labium only
3) Mandible and maxilla 4) Labrum only
6. Which of the following is a cephalic appendage of cockroach
1) Tegmina 2) Elytra 3) Labrum 4) Coxa
7. Cockroach shows a pair of compound eyes. Its visual unit is called
1) Coxa 2) Labrum 3) Ommatidium 4) Ocelli
8. Antennae of cockroach have
1) gustatory receptors 2) auditory receptors
3) tactile receptors 4) olfactory receptors
9. Body of cockroach is divided into
1) head and abdomen 2) head thorax and abdomen
3) cephalothorax and abdomen 4) head and trunk
10. Cockroach shows
1) three pairs of legs 2) two pairs of legs
3) three legs 4) four pairs of legs
11. The number of abdominal segments in male and female cockroach is
1) 10 & 11 2) 9 & 10 3) 10 & 10 4) 10 & 12

24. The number of ostia present in each heart chamber of cockroach is
1) two 2) one 3) four 4) three
25. Haemocoel is present in
1) earthworm 2) meandrina 3) scypha 4) periplaneta
26. Which among the following is not involved in excretory organs of cockroach?
1) Nephrocytes 2) fat body
3) uricose gland 4) maxillary palps
27. Gizzard of cockroach helps in grinding food. The number of chitinous teeth like structure present in it is
1) six 2) three 3) eight 4) two
28. The excretory product of cockroach is mainly
1) urea 2) uric acid 3) ammonia 4) amnio acids
29. Which of the following statement is incorrect?
1) A mushroom shaped gland is present in 6th - 7th abdominal segments of male cockroach
2) A pair of spermatheca is present in the 6th segment of female cockroach
3) Female cockroach possesses sixteen ovarioles in the ovaries
4) Cockroach exhibits mosaic vision with less sensitivity and more resolution
30. Which of the following statements is correct regarding a cockroach?
1) Compound eye is also called ocellus
2) Spiracle helps in excretion
3) Phallomeres are present in female cockroach and help in locomotion
4) Shows ventral nerve cord
31. Which sternum is boat shaped in a female cockroach?
1) 7th 2) 8th 3) 9th 4) 10th
32. Alary muscles, in a cockroach are connected with
1) Heart 2) Trachea 3) Legs 4) Alimentary canal
33. Number of segments that constitute thorax of a cockroach is:
1) Six 2) three 3) ten 4) eight
34. The tracheal system in Periplaneta communicate to the exterior through
1) 10 pair of spiracles 2) 8 pairs of spiracles
3) 12 pairs of spiracles 4) 6 pairs of spiracles
35. Ootheca of a cockroach contains
1) 14 to 16 zygotes 2) 8 zygotes only
3) One zygote only 4) 6 zygote only

36. How many moulting are required for the development of wing pads

- 1) 10 2) 13 3) 12 4) 8

37. Which of the following is incorrect about a cockroach

- 1) Ostia have valves which allow blood to pass only into heart from the haemocoel
- 2) Head is formed by the fusion of six segments
- 3) In a cockroach seminal vesicles are used for storing sperms
- 4) Unfertilized eggs are stored in ootheca

38. In cockroach ecdysis is related with

- 1) growth 2) regeneration 3) nutrition 4) excretion

39. Egg case of cockroach is known as

- 1) embryophore 2) phallomere 3) ootheca 4) gonapophysis

40. Match the items of column I with that of column II

Column I

- i) One pair of spermatheca
 - ii) One pair of testes
 - iii) Mushroom shaped gland
 - iv) One of ovaries
- 1) i-c, ii-d, iii-b, iv -a
3) i-c, ii-a, iii-d, iv-b

Column II

- a) 2nd to 6th segments
 - b) 6th to 7th segments
 - c) 6th segment
 - d) 4th to 6th segment
- 2) i-c, ii-b, iii-d, iv-a
4) i-c, ii-d, iii-a, iv-b

CHAPTER - 03

BIOMOLECULES

QUESTIONS

1. The four elements called “Big-Four” which make up 95% of all elements found in the living system are:
1) C, H, O, N 2) C, H, O, P 3) C, H, O, S 4) C, N, O, P
2. Which of the following is not a polymeric?
1) Proteins 2) Fatty acid 3) Nucleic acids 4) Polysaccharides
3. In human, percent of body weight of carbohydrates, lipids and proteins respectively are:
1) 15, 17, 7 2) 1, 15, 17 3) 7, 17, 15 4) 17, 15, 7
4. An amino acid is a/an:
1) Substituted ethane
2) Any acid having amino group
3) Substituted methane
4) Derivatives of indoleactic acid
5. Which of the following is not an amino acid?
1) Lysine 2) Arginine 3) Thymine 4) Tryptophan
6. Glycerol is:
1) Tetrahydroxy propane 2) Trihydroxy propane
3) Trihydroxy butane 4) Tetrahydroxy butane
7. Choose the incorrect statement;
1) N-bases (A, G, C, T, U) have heterocyclic rings
2) In cellular organisms DNA is the genetic material
3) Adenylic acid is nucleoside
4) Cytidine is a nucleoside
8. Which of the following secondary metabolites is a drug
1) Ricin 2) Concavaline A
3) Vinblastin 4) Anthocyanin

9. Match the **column I** with **column II**

Column I	Column II
A) Pigments	i. Concanavaline A
B) Terpenoids	ii. Monoterpenes, Diterpenes
C) Alkaloids	iii. Morphine, Caffeine
D) Lectins	iv. Carotenoids, Anthocyanin
1) A –iv, B – ii, C –iii, D – i	2) A –iv, B – iii, C –ii, D – i
3) A – i, B – iv, C –iii, D – ii	4) A – i, B – iii, C –ii, D – iv

10. Primary structure of protein is due to:

- 1) Peptide bonds 2) Hydrogen bonds 3) Disulfide bond 4) Protein

11. Which of the following is the simplest amino acid?

- 1) Glycine 2) Tyrosine 3) Alanine 4) Asparagine

12. Which of the following statements about the structure of proteins is true?

- 1) The sequence of amino acids in a protein represent the secondary structure
 2) Adult human hemoglobin consists of two subunits.
 3) The left end of a protein is called the C-terminal and the right end is called the N-terminal.
 4) Proteins are heteropolymers containing strings of amino acids.

13. Which of the following is not a constituent of cell membrane?

- 1) Proline 2) Phospholipids 3) Cholesterol 4) Glycolipids

14. Which of the following amino acids can stabilize protein structure by forming disulphide bonds?

- 1) Lysine 2) Alanine 3) Cystine 4) Arginine

15. Which one is the sweetest sugar

- 1) Sucrose 2) Glucose 3) Fructose 4) Maltose

16. Sucrose, a common table sugar is composed of

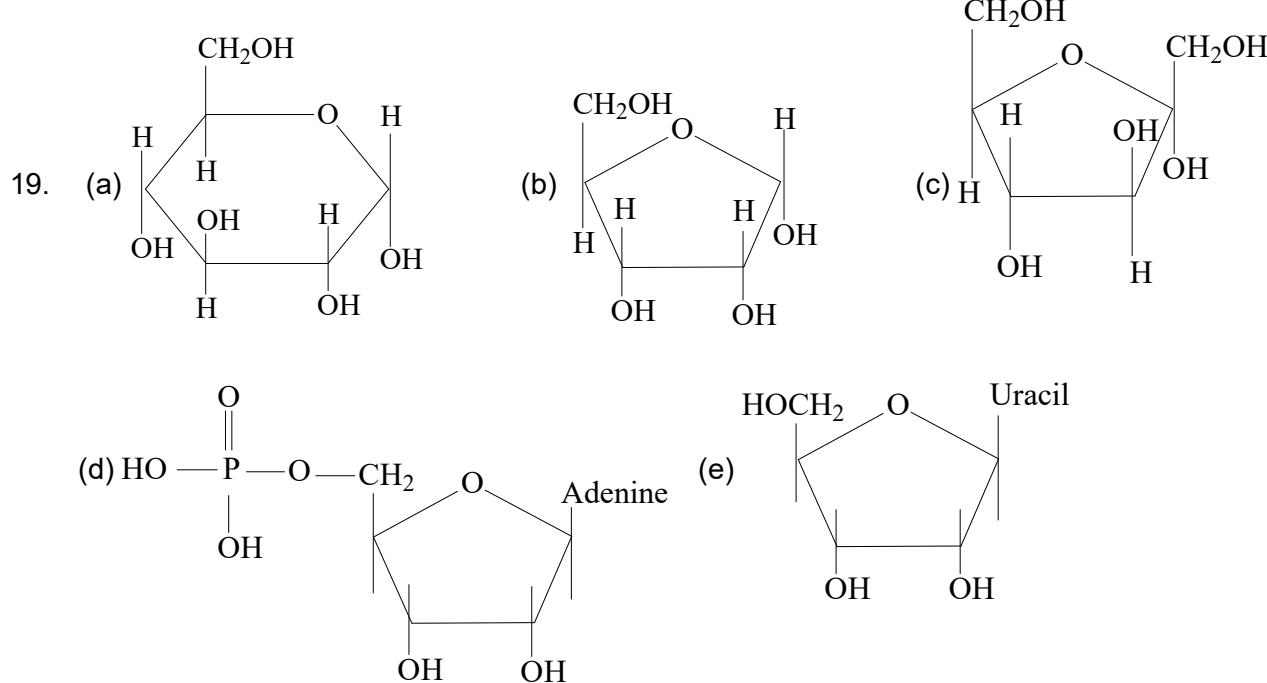
- 1) Glucose + Fructose 2) Glucose + Galactose
 3) Fructose + Galactose 4) None of these

17. Chitin is a:

- 1) Nitrogen containing polysaccharide 2) Sulphur containing polysaccharide
 3) Simple polysaccharide 4) Polymer of fructose

18. Find out the wrongly matched pair:

- 1) Primary metabolite – Ribose 2) Protein – Insulin
 3) Secondary metabolites – Anthocyanin 4) Cellulose - heteropolymer

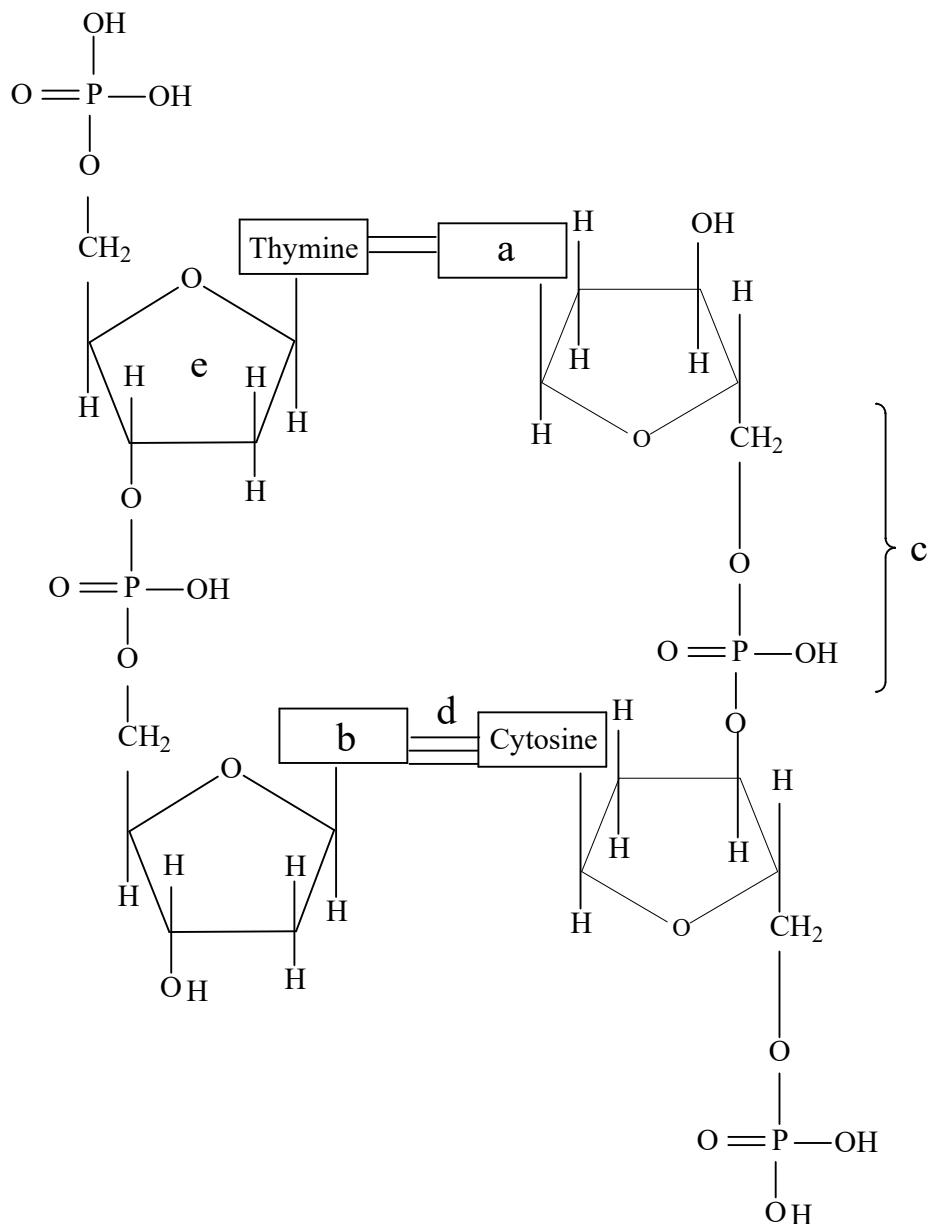


Identify a, b, c, d and e in correct order from the following options;

- 1) Glucose, Ribose, Deoxyribose, Adenosine, Uridine
 - 2) Glucose, Fructose, Galactose, Adenylic acid, Uridylic acid
 - 3) Fructose, Ribose, Glucose Adenylic Acid, Uridylic acid
 - 4) Glucose, Ribose, Fructose, Adenylic acid, Uridine
20. A fatty acid is unsaturated , if it :
- 1) Contains hydrogen
 - 2) Contains double bond
 - 3) Contains an acidic group
 - 4) None of the above
21. Coconut oil and palm oil are more like animal fats than other plant oils, because
- 1) Less saturated
 - 2) Contains less hydrogen
 - 3) Are less soluble in water
 - 4) Contains fewer double bonds
22. Phospholipid is :
- 1) One fatty acid and three glycerol
 - 2) Phosphoric acid, two fatty acids and one glycerol
 - 3) Phosphoric acid, one fatty acid and three glycerol
 - 4) Phosphoric acid, three fatty acids and one glycerol

23. Select the false statement:
- 1) Fevicol is a synthetic resin (Polyvinyl alcohol)
 - 2) Natural silk is a protein
 - 3) Gums are heteropolysaccharides
 - 4) Low K_m value indicates lower substrate affinity
24. Which of the following statements regarding lipids / component of lipids are true?
- 1) Arachidonic acid has 20 carbons excluding the carboxyl carbon.
 - 2) Glycerol is trihydroxy propane.
 - 3) Oils have higher melting points than fats.
 - 4) Palmitic acid has 18 carbons including the carboxyl carbon.
25. Which of the following biomolecules does have a Phosphodiester bond:
- 1) Amino acids in a peptide
 - 2) Fatty acids in a diglyceride.
 - 3) Nucleotides in a nucleic acid
 - 4) Monosaccharides in a polysaccharide.
26. A nucleotide has three components :
- 1) A nitrogen base, a hexose sugar and a phosphate group
 - 2) A nitrogenous base, a pentose sugar and a phosphate group
 - 3) A nitrogenous base, a pentose sugar and biphosphate group
 - 4) A nitrogenous base, a pentose sugar and a triphosphate group.
27. Ribose sugar is present in
- 1) RNA polymerase, RNA and ATP
 - 2) RNA polymerase and ATP
 - 3) RNA and ATP
 - 4) RNA only
28. The information in a genetic nucleic acid resides in the
- 1) Number of nucleic acids
 - 2) Kinds of nucleotides
 - 3) Sequence of nucleosides
 - 4) All of the above

29. From the given figure, identify a, b, c, d and e in correct order;

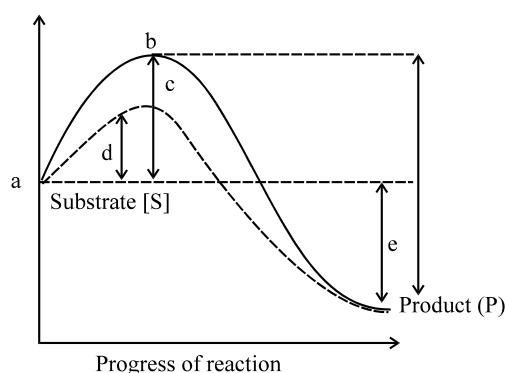


- 1) Cytosine, Adenine, Hydrogen bond, Ester bond, Ribose
- 2) Adenine, Thymine, Ester bond, Hydrogen bond, Deoxyribose
- 3) Adenine, Thymine, Hydrogen bond, Phosphodiester bond, Ribose
- 4) Adenine, Guanine, Phosphodiester bond, Hydrogen bond, Deoxyribose

30. Which of the following classes of biomolecules are known to have catalytic properties?
- 1) Protein and RNA
 - 2) Proteins and lipids
 - 3) Carbohydrates and lipids
 - 4) Proteins and carbohydrates
31. The helical structure of protein is stabilized by:
- 1) Ester bonds
 - 2) Peptide bonds
 - 3) Dipeptide bonds
 - 4) Hydrogen bonds
32. Select the option that correctly identifies the chemical bonds present in the given biomolecules.
Polysaccharides - A, Proteins - B, Lipid - C, Nucleic acid - D
- | A | B | C | D |
|-------------------|----------|----------------|----------------|
| 1) Ester | Peptide | Glycosidic | Phosphodiester |
| 2) Glycosidic | Peptide | Ester | Phosphodiester |
| 3) Glycosidic | Peptide | Phosphodiester | Ester |
| 4) Phosphodiester | Ester | Peptide | Glycosidic |
33. Even after the destruction of all the hydrogen bonds, which structural level of a protein molecule still remains intact:
- 1) Tertiary structure
 - 2) Primary structure
 - 3) Secondary structure
 - 4) Quaternary structure
34. As per the rule of thumb, rate of chemical reactions doubles or decreases by half for every:
- 1) 10 °C change in temperature
 - 2) 20 °C change in temperature
 - 3) 30 °C change in temperature
 - 4) 40 °C change in temperature
35. The process of resynthesis of food materials from simpler food molecule is called:
- 1) Absorption
 - 2) Catabolism
 - 3) Assimilation
 - 4) Biosynthesis
36. Select the **correct** statement from the following:
- A) Biomolecules are in metabolic flux in living state
 B) Living process is a constant effort to prevent falling into equilibrium
 C) Metabolism provides a mechanism for the production of energy
 D) Living state and metabolism is synonymous
- 1) All except (A)
 - 2) All except (B)
 - 3) All except (D)
 - 4) All of these
37. Select the incorrect statement from the following
- 1) Acetic acid becoming cholesterol is an example of biosynthetic or anabolic pathway.
 - 2) Glucose becoming lactic acid in our skeletal muscle is an example of degradation or catabolic pathway.
 - 3) Flow of metabolite through metabolic pathway does not have a definite rate and direction.
 - 4) Anabolic pathway requires energy whereas catabolic pathway releases energy.

38. The essential chemical components of many co-enzymes are:
- 1) Nucleic acids 2) Carbohydrates 3) Vitamins 4) Lecithins
39. The quaternary structure of human hemoglobin is best described as a:
- 1) Dimer of identical subunits 2) Dimer of different subunits
3) Tetramer of four different subunits 4) Tetramer of two different subunits
40. Which of the following is not correct:
- 1) Peptide bond is formed, when R- group of one amino acid reacts with carboxyl (COOH) group of another amino acid.
2) Glycosidic bond is formed by dehydration between two carbon atoms of two adjacent monosaccharides.
3) The bond between the phosphate and hydroxyl group of sugar is ester bond.
4) Nucleic acid exhibit a wide variety of secondary structure.
41. Which one of the following statement is correct with reference to enzymes?
- 1) Holoenzyme = Co- enzyme + Co- factor
2) Apoenzyme = Holoenzyme + Co-enzyme
3) Holoenzyme = Apoenzyme + Co-enzyme
4) Co-enzyme = Apoenzyme + Holoenzyme
42. Which one of the following statement is **incorrect**
- 1) A competitive inhibitor reacts reversibly with the enzyme to form an enzyme –inhibitor complex.
2) In competitive inhibition, the inhibitor molecule is chemically changed by the enzyme.
3) The competitive inhibitor does not affect the rate of breakdown of the enzyme- substrate complex.
4) The presence of the competitive inhibitor decreases the Km value of the enzyme for the substrate.
43. With reference to enzymes, turn over number means:
- 1) The number of substrate molecules that a molecule of an enzyme converts into products per hour.
2) The number of substrate molecules that a molecule of an enzyme converts into products per second.
3) The number of substrate molecules that a molecules of an enzyme converts into products per minute.
4) The number of substrate molecules that a molecule of an enzyme converts into products per day.
44. 'They' block the active site of the enzyme. 'They' referred as:
- 1) Feedback inhibitor 2) Allosteric inhibitor
3) Competitive inhibitor 4) Non-competitive inhibitor.
45. The enzyme that join together two molecules by forming new covalent bond is:
- 1) Lyase 2) Ligase 3) Isomerase 4) Transferase

46. The enzymes enhance the rate of chemical reaction by:
- Increase reaction time
 - Decrease reaction time
 - Reducing activation energy
 - Increasing activation energy
47. An organic substance bound to an enzyme and essential for its activity is called :
- Co- enzyme
 - Apoenzyme
 - Isoenzyme
 - Holoenzyme
48. The enzyme part, which combines with non-protein part to form a functional enzyme is:
- Apoenzyme
 - Holoenzyme
 - Prosthetic group
 - Co-factor
49. A ribozyme is :
- An enzyme that helps in ribose synthesis.
 - An enzyme that joins ribose with adenine.
 - An enzyme associated with ribosome.
 - A catalytic RNA
50. The figure given below shows the conversion of a substrate into product by an enzyme. In which one of the four option (A - 4) the components of reaction labelled as a, b, c, d, e are identified correctly:



	a	b	c	d	e
1)	Activation energy with enzyme	Transition state	Activation energy without enzyme	Potential energy	Energy of reaction
2)	Potential energy	Transition state	Activation energy without enzyme	Activation energy with enzyme	Energy of reaction
3)	Potential energy	Energy of reaction	Transition state	Activation energy without enzyme	Activaiton energy with enzyme
4)	Transition state	Potential energy	Activation energy without enzyme	Activation energy with enzyme	Energy of reaction

CHAPTER - 04

DIGESTION AND ABSORPTION

QUESTIONS

1. Match the two columns and select the right one among option given

Column I

- A. Duodenum
- B. Epiglottis
- C. Glottis
- D. Caecum

- 1) A → i, B → ii, C → iii, D → iv
- 3) A → iii, B → i, C → iv, D → ii

Column II

- i) A cartilaginous flap
- ii) Small blind sac
- iii) 'C' shaped tube
- iv) Opening of wind pipe

- 2) A → iii, B → i, C → ii, D → iv
- 4) A → iii, B → ii, C → i, D → iv

2. Which of the following is the correct sequence of different layers of the wall of alimentary canal from outside to inside?

- 1) Mucosa → Muscularis → Submucosa → Serosa
- 2) Mucosa → Submucosa → Muscularis → Serosa
- 3) Serosa → Muscularis → Submucosa → Mucosa
- 4) Mucosa → Submucosa → Serosa → Muscularis

3. Which among the following is not seen in adult gastric juice?

- 1) Pepsin
- 2) Rennin
- 3) HCl
- 4) Lipase

4. Emulsification of fat is done by

- 1) Sodium bicarbonate
- 2) Bilirubin
- 3) HCl
- 4) Sodium glycocholate

5. Just as hydrochloric acid is to pepsinogen, such as

- 1) Enterokinase to trypsinogen
- 2) Bile juice to fat
- 3) Glucagon to glycogen
- 4) Haemoglobin to oxygen

6. In mammals, the teeth are

- i) Of different types
- ii) Embedded in the cup like sockets of the jaw bone
- iii) Two sets may appear in life

These conditions are referred to as

- 1) Heterodont, Pleurodont, Polyphyodont
- 2) Heterodont, Pleurodont, Diphyodont
- 3) Heterodont, Acrodont, Diphyodont
- 4) Heterodont, Thecodont, Diphyodont

7. Alimentary canal is usually longer in

- 1) Omnivores 2) Carnivores 3) Herbivores 4) Sanguivores

8. Tongue attached to floor of buccal cavity by

- 1) uvula 2) hyoid 3) frenulum 4) epiglottis

9. The smallest salivary gland in human

- 1) Submaxillary gland 2) Parotid gland
- 3) Sublingual gland 4) Submandibular gland

10. Which of the following is not a modification of mucosa?

- 1) Rugae 2) Brunner's glands
- 3) Crypts of Lieberkuhn 4) Both 1 and 3

11. Which of the following would be expected in a child suffering from congenital absence of enterokinase?

- 1) increase glucose intake 2) protein digestion difficulty
- 3) pancreatitis 4) increase in gastric pH

12. Common passage of food and air is

- 1) Buccal cavity 2) Gullet 3) Pharynx 4) Oesophagus

13. All the following are released as proenzyme except

- 1) Pepsin 2) Rennin 3) Nucleosidase 4) Trypsin

14. The cells of the gastric gland that secrete Castle's intrinsic factor are

- 1) Chief cells 2) Peptic cells 3) Parietal cells 4) Zymogen cell

15. Crypts of Lieberkuhn are present in and secrete.....

- 1) Pancreas, Pancreatic juice 2) Small intestine, digestive enzymes
- 3) Stomach, digestive enzyme 4) Liver, Bile

16. Digested food is first absorbed and taken to liver by,

- 1) Renal portal vein 2) Hepatic portal vein
- 3) Hypophyseal portal vein 4) Common Bile duct

17. If for some reason our goblet cells are non-functional this will adversely affect

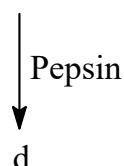
- 1) Production of somatostatin
- 2) Secretion of sebum
- 3) Smooth movement of food downward the intestine
- 4) Digestion of protein

18. Select the option for correct completion

P) Pepsinogen \xrightarrow{a} pepsin

Q) Prorennin \xrightarrow{HCl} b

R) Casein $\xrightarrow{\text{rennin}}$ c $\xrightarrow{\text{Ca}^{2+}}$ Calcium paracaseinate



S) Elastin \xrightarrow{e} dipeptides

- 1) a \rightarrow enterokinase, b \rightarrow rennin, c \rightarrow paracasein, d \rightarrow peptones, e \rightarrow elastase
- 2) a \rightarrow HCl, b \rightarrow rennin, c \rightarrow paracasein, d \rightarrow aminoacids, e \rightarrow dipeptidase
- 3) a \rightarrow HCl, b \rightarrow rennin, c \rightarrow paracasein, d \rightarrow peptones, e \rightarrow elastase
- 4) a \rightarrow HCl, b \rightarrow rennin, c \rightarrow paracasein, d \rightarrow peptones, e \rightarrow elastase

19. Succus entericus is the name given to

- | | |
|------------------------------|---------------------|
| 1) Swelling in the duct | 2) Appendix |
| 3) Castle's intrinsic factor | 4) Intestinal juice |

20. The lacteals are present in

- | | |
|---------------------|------------------------|
| 1) hepatic lobules | 2) mammary glands |
| 3) intestinal villi | 4) alveoli of pancreas |

21. Which of the following is not done by an enzyme of succus entericus?

- 1) Maltose \rightarrow 2 Glucose
- 2) Dipeptides \rightarrow amino acids
- 3) Nucleotides \rightarrow nucleosides
- 4) Peptones \rightarrow dipeptides

22. Trypsin acts on all the following except

- | | |
|--------------------|--------------|
| 1) polysaccharides | 2) proteins |
| 3) peptones | 4) proteoses |

23. Study the table showing gross calorific values and physiologic value of nutrients

	Gross calorific value	Physiologic value
Carbohydrate	A	B
Proteins	C	D
Fats	E	F

B,C and F stand for

- 1) B = 4.1 kcal/g ; C = 4 kcal/g ; F = 9.45 kcal/g
- 2) B = 4 kcal/g : C = 5.65 kcal/g : F = 9 kcal/g
- 3) B = 4 kcal/g: C = 4 kcal/g : F = 9 kcal/g
- 4) B = 4.1 kcal/g : C = 5.65 kcal/g : F = 9.45 kcal/g

24. Lipase is absent in the secretions of

- | | |
|-------------------------|---------------------|
| 1) Gastric glands | 2) Pancreatic acini |
| 3) Crypts of Lieberkuhn | 4) Hepatocytes |

25. Pancreatic enzymes digest

- 1) carbohydrates and proteins only
- 2) vitamins, casein and fats only
- 3) triglycerides, carbohydrates and nucleic acids only
- 4) starch, proteins, nucleic acids and fats

26. How many human teeth appear twice during the life span of an individual?

- | | | | |
|-------|-------|-------|-------|
| 1) 16 | 2) 32 | 3) 22 | 4) 20 |
|-------|-------|-------|-------|

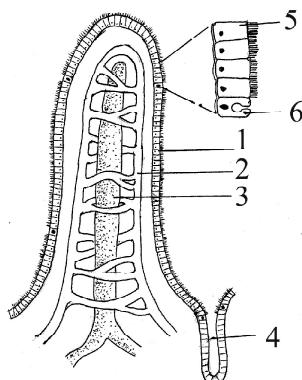
27. Which one of the following does not produce any digestive enzymes?

- 1) Intestinal mucosa
- 2) Gastric mucosa
- 3) Pancreas
- 4) Liver

28. Largest gland present in human body

- | | |
|-------------------|--------------------|
| 1) Salivary gland | 2) Pancreas |
| 3) Liver | 4) Pituitary gland |

29. After a fat rich diet chylomicrons accumulate in



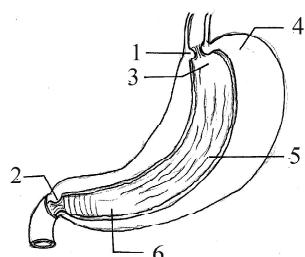
1) 1

2) 2

3) 3

4) 4

30.



Entry of bolus into stomach is regulated by

1) 1

2) 2

3) 3

4) 4

31. Match column I and II and find the correct answer

Column I	Column II
a) Bile	1. amylase
b) starch digestion	2. HCl
c) Bile salts	3. Bilirubin
d) pepsinogen	4. Emulsification of fat

1) abcd
4213

2) abcd
3421

3) abcd
3142

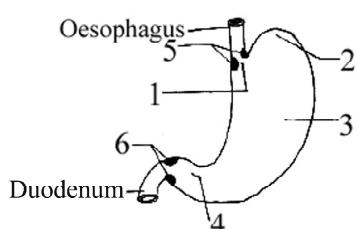
4) abcd
2143

32. Narrow distal end of the stomach is called

1) Cardiac 2) Fundic 3) Pylorus 4) Duodenum

33. The digestive enzymes among the following that is not directly involved in breaking the peptide bonds of macronutrients is

1) Enterokinase 2) Erepsin 3) Chymotrypsin 4) Pepsin

34. **Stomach**

I. Region near to the heart is labelled as.....

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

II. Region labelled commonly filled with air/gas

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

III. Entry of bolus into stomach is regulated by

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

35. Gastric glands and crypts of Lieberkuhn are found in :

- 1) mucosa 2) submucosa 3) muscularis 4) serosa

36. Which of the following is not a function of adult liver?

- | | |
|-----------------------|-----------------------|
| 1) Detoxification | 2) Production of bile |
| 3) Production of urea | 4) Erythropoiesis |

37. Find the false one

- 1) maltose $\xrightarrow{\text{maltase}}$ glucose + glucose
- 2) Nucleosides $\xrightarrow{\text{nucleosidases}}$ N₂ bases + pentose sugar
- 3) Fats $\xrightarrow{\text{bilesalts}}$ glycerol + fatty acids
- 4) Lactose $\xrightarrow{\text{Lactase}}$ glucose + galactose

38. Which of the following is / are the digested forms of carbohydrates?

- | | |
|------------------------------------|--|
| 1) Aminoacids | 2) Fatty acids and glycerol |
| 3) Glucose, galactose and fructose | 4) Glucose, sucrose and monoglycerides |

39. Mark the mismatch

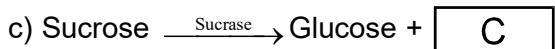
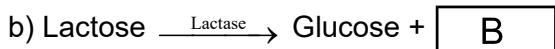
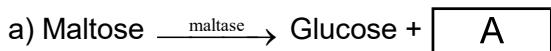
- | | |
|---------------------|--|
| 1) Glottis | - opening of oesophagus |
| 2) Ileum | - coiled tubular part between jejunum and caecum |
| 3) Sigmoid colon | - connects descending colon to rectum |
| 4) Brunner's glands | - submucosal glands of duodenum |

40. Salivary amylase is active in pH

- 1) 1.8 2) 6.8 3) 7.8 4) 10.8

41. Nucleosidase is secreted by
- 1) Gastric glands
 - 2) Pancreas
 - 3) Crypts of Lieberkuhn
 - 4) Brunner's glands

42. Select the option that correctly labels the boxes A, B, C and D



	A	B	C	D
1	Glucose	Fructose	Galactose	Triglycerides
2	Glucose	Galactose	Fructose	Monoglycerides
3	Glucose	Ptyalin	Galactose	Monoglycerides
4	Galactose	Glucose	Fructose	Diglycerides

43. The undigested and unabsorbed substances pass into caecum through
- 1) cardiac sphincter
 - 2) pyloric sphincter
 - 3) ileo-caecal valve
 - 4) sphincter of Oddi
44. 99.5% of saliva contain
- 1) Electrolytes
 - 2) Salivary amylase
 - 3) Water
 - 4) Lysozyme
45. The digested and absorbable form of protein is
- 1) glucose
 - 2) amino acid
 - 3) fatty acid
 - 4) glycerol
46. After a fat rich diet , chylomicrons accumulate in
- 1) intestinal lumen
 - 2) lacteals
 - 3) blood of villi
 - 4) crypts of Lieberkuhn

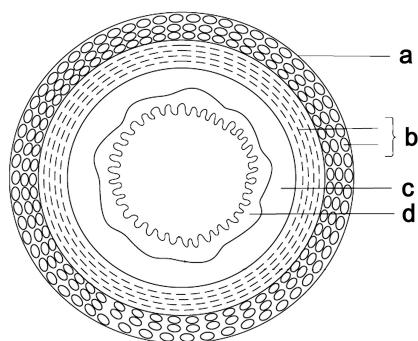
47. Which of the following gastric cells indirectly help in erythropoiesis?

 - 1) Mucous cells
 - 2) Chief cells
 - 3) Parietal cells
 - 4) Goblet cell

48. The part of large intestine that hosts some symbiotic microorganisms is :

 - 1) Caecum
 - 2) Ileum
 - 3) Rectum
 - 4) Vermiform appendix

49. Which layer has goblet cells?



- 1) a 2) b 3) c 4) d

50. Which among the following is not seen in adult gastric juice?

1) Pepsin 2) Rennin
3) HCl 4) lipase

CHAPTER - 05

BREATHING AND EXCHANGE OF GASES

QUESTIONS

1. Anaerobic respiration is seen in
 - 1) Wasp
 - 2) Hydra
 - 3) Cray fish
 - 4) Tape worm
2. Lactic acid fermentation is seen in
 - 1) Aurelia
 - 2) Yeast
 - 3) Euplectella
 - 4) Ascaris
3. Which of the following structures are supported by incomplete cartilaginous rings?
 - a) Trachea
 - b) 1^o bronchi
 - c) 2^o bronchi
 - d) 3^o 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
4. In mammals the body cavity is partitioned into thoracic and abdominal parts by
 - 1) Liver
 - 2) Lungs
 - 3) Ribs
 - 4) Diaphragm
5. The instrument which helps in estimating the volume of air during breathing is
 - 1) Sphygmomanometer
 - 2) Barometer
 - 3) Thermometer
 - 4) Spirometer
6. Number of lobes in right and left lungs of human are:
 - 1) 2, 4
 - 2) 3, 2
 - 3) 4, 2
 - 4) 6, 3
7. When the stretch receptors located on bronchi and bronchioles are stimulated by over stretching it produces
 - 1) Pulmonary ventilation
 - 2) Alveolar ventilation
 - 3) Hering - Breurer's reflex
 - 4) Sleep apnoe syndrome
8. Largest laryngeal cartilage in the form of a broad ring incomplete posteriorly is
 - 1) Thyroid
 - 2) Cricoid
 - 3) Arytenoids
 - 4) Cartilage of Santorini
9. How many alveoli are present in human lungs?
 - 1) 300 millions in each lungs
 - 2) 300 millions in the two lungs
 - 3) 200 millions in each
 - 4) 200 millions in the two lungs

10. Lung alveoli of mammals have a thin wall composed of
 1) Simple cuboidal epithelium 2) Simple squamous epithelium
 3) Stratified cuboidal epithelium 4) Stratified squamous epithelium
11. Which of the following is the primary inspiratory muscle?
 1) External intercostals 2) Internal intercostals
 3) Diaphragm 4) External oblique
12. Glottis is an opening in the floor of –
 1) Mouth 2) Trachea 3) Pharynx 4) Diaphragm
13. Trachea is lined by incomplete rings of –
 1) Fibrous cartilage 2) Calcified cartilage
 3) Elastic cartilage 4) Hyaline cartilage
14. Which of the following is not a structural feature of the left lung?
 1) Superior lobe 2) Cardiac notch 3) Inferior lobe 4) Middle lobe
15. Pleura is a double membrane sac which covers-
 1) Heart 2) Kidney 3) Brain 4) Lungs
16. Match the columns
- | Column I | Column II |
|-----------------|-------------------------|
| (a) Larynx | (p) Elastic cartilage |
| (b) Trachea | (q) Squamous epithelium |
| (c) Alveoli | (r) Vocal cords |
| (d) Epiglottis | (s) Cartilagenous rings |
- 1) a – r, b – s, c – q, d – p 2) a – r, b – q, c – s, d – p
 3) a – r, b – s, c – p, d – q 4) a – s, b – r, c – q, d – p
17. Which of the following statements are true regarding the mechanism of the inspiration?
 I) Diaphragm muscles contract
 II) Diaphragm muscles relax
 III) External intercostal muscles relax and rib cage moves outwards and inwards
 IV) External intercostal muscles contract and rib cage moves outwards and upwards
 1) I and IV only 2) II and III only 3) I and III only 4) I and II only
18. Difficulty in breathing due to inflammation of bronchi and bronchioles causes
 1) Emphysema 2) Pneumonia 3) Wheezing 4) Hypoxia
19. Dead space air is
 1) The amount of air remaining in the alveoli
 2) The amount of air left behind in lungs at the end of deep expiration
 3) The amount of air taken in and out
 4) The air left in the bronchial tree

20. During expiration diaphragm:
- 1) Contracts and attains dome shape 2) Relaxes and attains dome shape
3) Contracts and becomes flattened 4) Relaxes and becomes flattened
21. Read the following statements and choose the correct option
- Statement 1- During inspiration, the volume of thorax increases
Statement 2- Relaxation of diaphragm and inspiratory muscles causes the increase in thoracic volume
- 1) Statement 1 is correct and statement 2 is wrong
2) Both statement 1 and 2 are correct
3) Statement 1 is wrong and statement 2 correct
4) Both statement 1 and 2 are wrong
22. The amount of air inspired by a healthy man approximate to
- 1) 2000 - 3000 ml/minute 2) 6000 - 8000 ml/minute
3) 2500 - 3000 ml/minute 4) 1000 - 1100 ml/minute
23. Arachnids respire with the help of
- 1) Gills 2) Coxal glands 3) Book gills 4) Book lungs
24. Arrange the following in the order of increasing volume?
- a) Residual volume b) Functional residual volume
c) Expiratory reserve volume d) Vital capacity
1) a < b < c < d 2) a < c < d < b 3) c < a < b < d 4) b < c < a < d
25. Whether a child died after normal birth or died before birth can be confirmed by examining:
- 1) Tidal volume 2) Residual volume 3) Weight of the child 4) Vital capacity
26. The amount of oxygen carried by 100 ml of arterial blood is approximately-
- 1) 18 ml 2) 20 ml 3) 16.9 ml 4) 14.9 ml
27. Every 100ml of deoxygenated blood can deliver approximatelyml of CO₂ to the alveoli
- 1) 4ml 2) 15ml 3) 5 ml 4) 20 ml
28. Which among the following is a surfactant to lower the surface pressure of alveoli in lungs:-
- 1) Myoglobin 2) Lecithin 3) Bicarbonates 4) Chloride ions
29. The extra oxygen that must be used in the oxidative energy processes after a period of strenuous exercise is called
- 1) Oxygen credit 2) Hyperoxia 3) Oxygen debit 4) Hypoxia
30. 'C' shaped cartilagenous rings around trachea is made up of-
- 1) Elastic cartilage 2) Fibrous cartilage
3) Hyaline cartilage 4) Calcified cartilage

31. Which of the following factors are essential for dissociation of oxygen from oxyhaemoglobin?
- 1) Low pO_2 , high pCO_2 , high H^+ ion concentration, high temperature
 - 2) Low pO_2 , low pCO_2 , high H^+ ion concentration, high temperature
 - 3) High pO_2 , low pCO_2 , low H^+ ion concentration, lower temperature
 - 4) High pO_2 , low pCO_2 , low H^+ ion concentration, lower temperature
32. In resting person the saturation of haemoglobin with oxygen seen in the blood that leaves the tissue capillaries is approximately:
- 1) 25 %
 - 2) 1.34 %
 - 3) 46%
 - 4) 75%
33. Respiratory centre of brain is sensitive to
- 1) More O_2 conc. in blood
 - 2) More CO_2 conc. in blood
 - 3) Accumulation of blood in brain
 - 4) Less CO_2 in blood
34. Which of the following is an occupational respiratory disorder?
- 1) Emphysema
 - 2) Pneumonia
 - 3) Pleurisy
 - 4) Silicosis
35. Emphysema is
- 1) The hypertrophy of mucous gland of bronchi
 - 2) Proliferation of fibrous connective tissue
 - 3) The damage of alveoli due to cigarette smoking
 - 4) An occupational lung disease
36. The solubility of CO_2 is
- 1) 5 -10 times higher than that of O_2
 - 2) 20-25 times higher than that of O_2
 - 3) 30 - 35 times higher than that if O_2
 - 4) 40-45 times higher than that of O_2
37. What is the common element in haemoglobin and Myoglobin?
- 1) Fe
 - 2) Cu
 - 3) Mn
 - 4) Mg
38. Condition as which the body or a region of the body has inadequate oxygen supply at the tissue level is called-
- 1) Anoxia
 - 2) Apnoea
 - 3) Hypoxia
 - 4) Asphyxia
39. The loss of affinity of O_2 with decreasing pH and high pCO_2 is called
- 1) Hamburger effect
 - 2) Breuer effect
 - 3) Haldane effect
 - 4) Bohr effect
40. Oxygen dissociation curve is dependant on
- 1) PO_2
 - 2) PCO_2
 - 3) pH
 - 4) (1), (2), and (3)
41. The movement of bicarbonate ions from RBC to plasma and chloride ions from plasma to RBC is called
- 1) Hamburger effect
 - 2) Bohr effect
 - 3) Haldane effect
 - 4) Breuer effect

CHAPTER - 06

BODY FLUIDS AND CIRCULATION

QUESTIONS

1. Find the true statement
 - 1) Plasma with the clotting factor are called serum
 - 2) RBC are the least abundant of all the cells in blood
 - 3) Neutrophils are 60 - 65% of total WBCs
 - 4) Leucocytes are non - nucleated and are relatively lesser in number
2. Which of the following is not true about plasma?
 - 1) Plasma of human blood is straw coloured due to dissolved Hb
 - 2) Plasma constitutes 55% of blood
 - 3) 90 - 92% of plasma is water
 - 4) Proteins form 6-8% of plasma
3. Which is correct about leucocytes?

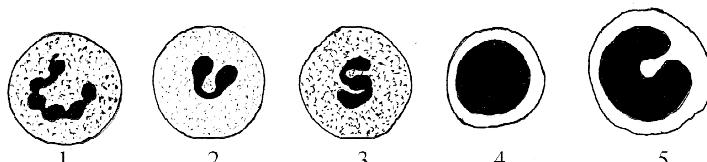
1) They are red coloured	2) They can cross capillaries
3) They are enucleate	4) Decrease in their number causes leukemia
4. Which of the following is not correctly matched?

1) Globulin - Defence mechanism	2) Albumin - Osmotic balance
3) Neutrophils - Phagocytic	4) Annelids - Open circulation
5. Number of RBC/mm³ in healthy adult man is
 - 1) 4.0 - 5.0 million
 - 2) 5.0 -5.5 million
 - 3) 3.5 - 4.0 million
 - 4) 6.5 - 7.0 million
6. Which of the following sequence is correct in terms of abundance in blood
 - 1) RBC > WBC > platelets
 - 2) WBC > RBC > platelets
 - 3) RBC > platelets > WBC
 - 4) RBC < WBC < platelets
7. The important mineral for blood coagulation is
 - 1) Magnesium
 - 2) Calcium
 - 3) Sodium
 - 4) Iron

8. Find out the incorrect statement
 - 1) Thrombocytes are cell fragments produced from megakaryocytes
 - 2) Antibodies are proteins produced in response to antigen
 - 3) In humans Rh antigen is rarely observed on the surface of RBC's
 - 4) 'O' group individuals are called universal donors
9. Which of the following is correct about lymph?
 - 1) Lymph is colourless fluid containing erythrocytes, which are responsible for immune responses of the body
 - 2) Lymph is important carrier for nutrients, hormones etc
 - 3) Lymph is blood minus WBCs and plasma proteins
 - 4) Major WBC present in lymph is Neutrophils
10. Match column I with column II

Column I	Column II
1) Haemolymph	a) Gas transport
2) RBC	b) Cockroach
3) Antibody	c) Coagulation
4) Platelets	d) Contraction
5) Systole	e) Immunity

1) $\frac{12345}{bced}$
2) $\frac{12345}{ceabd}$
3) $\frac{12345}{baecd}$
4) $\frac{12345}{abdce}$
11. Husband and wife should know their Rh factor because the situation can be serious due to biological incompatibility in one of the following cases
 - 1) Rh⁺ husband & Rh⁺ wife
 - 2) Rh⁻ husband & Rh⁻ wife
 - 3) Rh⁻ husband & Rh⁺ wife
 - 4) Rh⁺ husband & Rh⁻ wife
12. Choose the incorrect one
 - 1) Plasma contributes 55% of the total blood volume
 - 2) Chordates and Annelids having closed circulatory system
 - 3) Albumin provides Immunity
 - 4) Normal pH of human blood is 7.4
13. Identify the monocytes from the nuclear shape of various leucocytes given :



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

14. Match the following

Blood group	Donors group
1. O	a. B,O
2. AB	b. A,O
3. A	c.O
4. B	d. AB,A,B,O
1) $\frac{1234}{cbda}$	2) $\frac{1234}{dcba}$
3) $\frac{1234}{cdab}$	4) $\frac{1234}{cdba}$

15. A deficiency of albumin would result in

- 1) increased blood volume
- 2) increased blood osmotic pressure
- 3) decreased blood osmotic pressure
- 4) increased blood pressure

16. Lymph is known as

- 1) Tissue fluid
- 2) Interstitial fluid
- 3) Both 1 and 2
- 4) Plasma

17. The blood protein involved in blood coagulation is

- 1) Heparin
- 2) Prothrombin
- 3) Albumin
- 4) All of these

18. When type B agglutininogen is not present on the surface of RBC of a person, his plasma would contain _____ agglutinins

- 1) Anti-a
- 2) Anti -b
- 3) Both anti-a and anti-Rh
- 4) anti-Rh

19. Read the statements and choose the right option

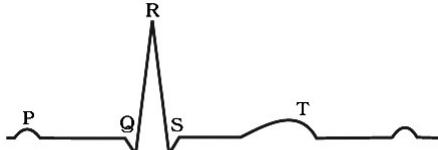
- a) Heart is situated in the thoracic cavity, slightly tilted to the left
- b) It is protected by a double walled membranous bag, enclosing pleural fluid
- c) The atrium and the ventricle of the same side are separated by thin muscular tissue atrio-ventricular septum
- d) Tricuspid and bicuspid valves prevent any backward flow of blood

- 1) All are true
- 2) a,d are true b and c are false
- 3) a,b are true, c and d are true
- 4) a,c are true, b and d are false

20. The inter-atrial septum in the human heart can be best described as

- 1) A thin muscular wall
- 2) A thick muscular wall
- 3) A thin fibrous tissue
- 4) A thick fibrous tissue

21. Correct match about heart chambers and blood vessels attached is
- | | |
|-------------------------------|------------------------------------|
| 1) Right atrium | a) pulmonary veins |
| 2) Right ventricle | b) aorta |
| 3) Left atrium | c) superior and inferior vena cava |
| 4) Left ventricle | d) pulmonary artery |
| 1) 1 - c, 2 - d, 3 - a, 4 - b | 2) 1 - c, 2 - d, 3 - b, 4 - a |
| 3) 1 - d, 2 - c, 3 - a, 4 - b | 4) 1 - d, 2 - c, 3 - b, 4 - a |
22. The various nodal tissues are given below
- | | |
|---------------------------------|---------------------------|
| a. AV bundle | b. Purkinje fibres |
| c. Atrio ventricular node (AVN) | d. Sino-atrial node (SAN) |
- Arrange them in correct order of transmission of cardiac impulse.
- | | |
|------------------|------------------|
| 1) d → a → b → c | 2) d → c → a → b |
| 3) d → a → c → b | 4) b → d → c → a |
23. Blood vessel which brings oxygenated blood to left atrium is
- | | | | |
|------------------|--------------------|--------------------|---------------------|
| 1) Precaval vein | 2) Post caval vein | 3) Pulmonary veins | 4) Pulmonary artery |
|------------------|--------------------|--------------------|---------------------|
24. Select the incorrect statement
- | |
|--|
| 1) Wall of the ventricles is much muscular than atria |
| 2) Atrio-ventricular node is located in the lower right corner of the right atrium, close to the atrioventricular septum |
| 3) Stroke volume is about 70ml |
| 4) First heart sound is produced due to the closure of AV valves |
25. Purkinje fibres are special type of
- | |
|--|
| 1) Muscle fibres located in the wall of ventricles |
| 2) Connective tissue fibres joining one bone to another bone |
| 3) Muscle fibres located throughout the heart wall |
| 4) Nerve fibres located in heart |
26. A complete heartbeat consists of a :
- | | |
|---|---|
| 1) Systole and diastole of both the atria | 2) Systole and diastole of both the ventricles |
| 3) Systole of auricles and ventricles | 4) Systole and diastole of both auricles and ventricles |
27. Find the option showing correct sequence of the given events in cardiac cycle ?
- | | |
|-------------------|--|
| 1. SAN activation | 2. Flow of blood into aorta and pulmonary artery |
| 3. Lub sound | 4. Dup sound |
| 5. Joint diastole | 6. Atrial systole |
- | | |
|--------------------------|--------------------------|
| 1) 1 → 6 → 3 → 2 → 5 → 4 | 2) 3 → 6 → 2 → 3 → 5 → 4 |
| 3) 1 → 6 → 3 → 2 → 4 → 5 | 4) 1 → 6 → 2 → 3 → 4 → 5 |

28. Which is incorrect regarding cardiac cycle?
- 1) It consists of systole and diastole of both the atria and ventricles
 - 2) During a cardiac cycle, each ventricle pumps out approximately 70 ml of blood
 - 3) The AV valves open in ventricular systole
 - 4) Cardiac output is the volume of blood pumped out by each ventricle per minute
29. Cardiac output is
- 1) The product of heart rate and stroke volume
 - 2) The product of auricular and ventricular volume
 - 3) The blood pumped in one minute
 - 4) Both 1 and 3
30. The second heart sound heard during a heart beat resulted from the closure of:-
- 1) AV valves
 - 2) Semilunar valves
 - 3) Bicuspid valve
 - 4) Mitral valve
31. SA node acts as a pacemaker of the heart because of the fact that it
- 1) is capable of generating impulses
 - 2) has rich sympathetic innervation
 - 3) has poor cholinergic innervation
 - 4) generates impulses at the highest rate
32. The volume of blood that each ventricle pumps out during a cardiac cycle is about
- 1) 70 ml
 - 2) 5000 ml
 - 3) 7 L
 - 4) 1200 ml
33. The T of the ECG denotes:-
- 
- 1) Excitation of SA node
 - 2) Beginning of ventricular systole
 - 3) Depolarisation of ventricles
 - 4) Ventricular repolarisation
34. ECG depicts the depolarisation and repolarisation processes during the cardiac cycle. In the ECG of a normal healthy individual one of the following waves is not represented
- 1) Depolarisation of atria
 - 2) Repolarisation of atria
 - 3) Depolarisation of ventricles
 - 4) Repolarisation of ventricles
35. Systemic circulation
- 1) provides food materials to liver
 - 2) supplies nutrients, O₂ and essential substances to tissues
 - 3) brings releasing hormones to adenohypophysis
 - 4) takes deoxygenated blood to lungs

36. Statements,

- i) Sympathetic N.S and adrenal medullary hormones increases the heart beat rate
- ii) 'Dub' is heard at the beginning of atrial systole
- iii) Pulse rate is equal to that of heart beat rate
- iv) Angina pectoris occurs due to insufficient O₂ supply to the heart muscle
- v) A special neural centre moderate cardiac function located in the hypothalamus

From the above statements.

- 1) ii, v are correct, while i, iii, iv are incorrect
- 2) ii, v, iii are correct while i, iv are incorrect
- 3) i, iii, iv are correct, but ii, v are incorrect
- 4) i, iii are correct but ii, iv, v are incorrect

37. During pulmonary circulation heart receives oxygenated blood from _____ (1), through _____ (2). Here (1) and (2) represents

- | | |
|---------------------------------|-----------------------------------|
| 1) 1-Kidney and 2-Renal artery | 2) 1-Lungs and 2-Pulmonary artery |
| 3) 1-Lungs and 2-Systemic aorta | 4) 1-Lungs and 2-Pulmonary vein |

38. In an accident there is great loss of blood and there is no time to analyse the blood group. Which blood can be safely transferred.

- | | |
|-----------------------|-----------------------|
| 1) O and Rh negative | 2) AB and Rh negative |
| 3) AB and Rh positive | 4) A and Rh positive |

39. Name the disease caused by the deposits of calcium, fat, cholesterol and fibrous tissue which makes the lumen of arteries narrower

- | | |
|----------------|------------------------|
| 1)Angina | 2) Atherosclerosis |
| 3)Hypertension | 4) High blood pressure |

40. Given below are four statements (a—d) regarding human blood circulatory system.

- A) Arteries are thick-walled and have narrow lumen as compared to veins.
- B) Angina is acute chest pain when the blood circulation to the brain is reduced.
- C) Person with blood group AB can donate blood to any person with any blood group under ABO system.
- D) Calcium ions play a very important role in blood clotting.

Which of the above statements are correct ,

- | | | | |
|-----------|-----------|------------|------------|
| 1)A and D | 2)A and B | 3) B and C | 4) C and D |
|-----------|-----------|------------|------------|

41. The state of heart when it is not pumping blood effectively enough to meet the needs of the body, is;

- | | | | |
|-----------------|-------------------|--------------------|------------------|
| 1) Heart attack | 2) Cardiac arrest | 3) Angina pectoris | 4) Heart failure |
|-----------------|-------------------|--------------------|------------------|

42. Congestion of lungs is one of the main symptoms in

- | | | | |
|----------------|-----------------|----------|--------|
| 1)Hypertension | 2)Heart failure | 3)Angina | 4) CAD |
|----------------|-----------------|----------|--------|

43. Cardiac activity could be moderated by the autonomous neural system. Choose the right option
- The parasympathetic system stimulates heart rate and stroke volume
 - The sympathetic system stimulates heart rate and stroke volume
 - The parasympathetic system decreases the heart rate and but increases stroke volume
 - The sympathetic system decreases the heart rate but increases stroke volume
44. Select the correctly matching set
- | A | B |
|------------------------------------|---|
| A) Lymphatic system | i) Carries oxygenated blood |
| B) Pulmonary vein | ii) Immune response |
| C) Thrombocytes | iii) To drain back the tissue fluid to the circulatory system |
| D) Lymphocytes | iv) Coagulation of blood |
| 1) A -ii, B - i, C - iii, D - iv | 2) A - iii, B - i, C - iv, D - ii |
| 3) A - iii, B - i, C - iii, D - iv | 4) A - ii, B - i, C - iii, D - iv |
45. Vein is a blood vessel which carries blood
- Away from the heart
 - Towards the heart
 - Has oxygenated blood without exception
 - Carry only deoxygenated blood
46. If the systolic pressure is 130mmHg and diastolic pressure is 90mmHg the pulse pressure is
- 70 mmHg
 - 60 mmHg
 - 40 mmHg
 - 80 mmHg
47. Other term for heart attack is
- Coronary thrombosis
 - Myocardial infarction
 - Cardiac arrest
 - Angina
48. Find the incorrect statement
- AV node is known as Pacemaker
 - Cardiac cycle consists of systole and diastole of both the Atria and Ventricles
 - Hepatic portal vein carries blood from intestine to the liver before it is delivered to the systemic circulation
 - Tunica media is comparatively thin in the veins
49. Which of the following statements regarding ECG is false?
- It can be used to detect heart rate
 - T - wave represents systole
 - P-T segment is characterised by atrial and ventricular systole
 - Number of QRS complex / min is equal to heart rate
50. Identify the wrong statement
- Varicose veins are due to weakened valves
 - Each RBC contains about 280million molecules of haemoglobin
 - Lymph is a coloured fluid tissue
 - Neutrophils and monocytes phagocytose the dead cells to clean the body

CHAPTER - 07

EXCRETORY PRODUCTS AND THEIR ELIMINATION

QUESTIONS

1. Metanephric kidneys found in
 - 1) Reptiles , Salamanders and Birds
 - 2) Amphibia and pisces
 - 3) Cyclostomes and Anamniotes
 - 4) Amniotes.
2. Which of the following nitrogenous substance is least toxic ?
 - 1) Urea
 - 2) Uric acid
 - 3) Ammonia
 - 4) Amino acid.
3. Uricotelism is found in
 - 1) Frogs and toads
 - 2) Bony fishes and amphibians
 - 3) Birds , reptiles and insects
 - 4) Mammals and birds.
4. The land snails are:
 - 1) Ammonotelic
 - 2) Ureotelic
 - 3) Uricotelic
 - 4) Both 1 and 3
5. If the liver is function less, which will increase in the blood ?
 - 1) Urea
 - 2) Water
 - 3) Ammonia
 - 4) Uric acid
6. The ascending order of toxicity among nitrogenous wastes is
 - 1) Urea, Uric acid, Ammonia
 - 2) Ammonia, Urea, Uric acid
 - 3) Uric acid, Ammonia, Urea
 - 4) Uric acid, Urea, Ammonia
7. The basic functional and structural unit of human kidney is:
 - 1) Nephrons
 - 2) Malpighian corpuscles
 - 3) Uriniferous tubules
 - 4) Both 1 and 3
8. An average weight of each kidney is
 - 1) 50—160 gm,
 - 2) 25 – 75 gm,
 - 3) 120 – 170gm,
 - 4) 180 – 210gm
9. Human kidneys are exactly located in between the level of :
 - 1) Second thoracic and third lumbar vertebrae.
 - 2) First thoracic and last lumbar vertebrae.
 - 3) Last thoracic and third lumbar vertebrae.
 - 4) Last thoracic and third sacral vertebrae.

10. Human kidneys have nearly
- 1) 1,00,000 nephrons
 - 2) 1 million nephrons
 - 3) 2 million nephrons
 - 4) 2 billion nephrons
11. In some nephrons, the loop of Henle is very long and runs deep into the medulla
These nephrons are called:
- 1) Cortical nephrons
 - 2) Medullary nephrons
 - 3) Juxtaglomerular nephrons
 - 4) Juxtamedullary nephrons.
12. In kidney ,the cortex that extends between medullary pyramids is:
- 1) Duct of Bellini
 - 2) Calyx
 - 3) Columns of Bertini
 - 4) Pelvis
13. The modified cells present in the visceral layer of Bowman's capsule ;
- 1) Podocytes
 - 2) Chondrocytes
 - 3) Foot cells
 - 4) Both 1 and 3
14. Which one of the following statement is incorrect?
- 1) The medullary zone of kidney is divided into a few conical masses called medullary Pyramids projecting into the calyces.
 - 2) Inside the kidney the cortical region extends in between the medullary pyramids as renal pelvis.
 - 3) Glomerulus along with Bowman's capsule is called renal corpuscle or malpighian body.
 - 4) Renal corpuscle, PCT and DCT of the nephrons are situated in the cortical region.
15. The part not belongs to a single uriniferous tubule is :-
- 1) Peritubular capillaries
 - 2) Convoluted tubules
 - 3) Collecting ducts
 - 4) Glomerulus
16. The blood vessel taking blood away from Bowman's capsule is
- 1) Afferent arteriole
 - 2) Renal vein
 - 3) Efferent arteriole
 - 4) Renal artery
17. Glomerulus along with Bowman's capsule is called :
- 1) Malpighian body
 - 2) Renal capsule
 - 3) Renal tubule
 - 4) Both 1 and 2.
18. Select the correct statement
- 1) The juxta medullary nephrons have reduced Henle's loop.
 - 2) Vasa recta is well developed in cortical nephrons.
 - 3) The PCT and DCT are situated in the medulla of kidney.
 - 4) The ascending limb of Henle's loop extends as DCT
19. Ornithine cycle is related to
- 1) Respiration
 - 2) Nutrition
 - 3) Excretion
 - 4) Digestion
20. In the kidney, glucose is mainly absorbed in
- 1) Loop of Henle
 - 2) Proximal convoluted tubule
 - 3) Distal convoluted tubule
 - 4) Bowman's capsule

21. The number of nephrons in a kidney is equal to
 - 1) The number of Bowman's capsule
 - 2) Sum of Bowman's capsule and glomeruli
 - 3) Double the number of Bowman's capsule
 - 4) Sum of Bowman's capsule and Malpighian corpuscles
22. The glomerular filtrate contains
 - 1) Blood minus cells and proteins
 - 2) Blood minus cells
 - 3) Blood minus proteins
 - 4) Plasma minus cells and proteins.
23. Reabsorption of glucose from the glomerular filtrate in the kidney tubule is carried out by
 - 1) Active transport
 - 2) Osmosis
 - 3) Brownian movement
 - 4) Diffusion
24. Which of the following is secreted from kidney ?
 - 1) AN F
 - 2) Erythropoietin
 - 3) Rennin
 - 4) Aldosterone
25. The projections of renal pelvis are called
 - 1) Medullary pyramids
 - 2) Renal columns
 - 3) Calyces
 - 4) Hilum
26. In man, urea is formed from
 - 1) Carbon dioxide and water in glomerulus.
 - 2) Carbon dioxide and ammonia in liver by Kreb's – Hanseliet cycle.
 - 3) Carbon monoxide and ammonia in liver by orinithine cycle.
 - 4) Carbon dioxide, ammonia and water in hepatocytes.
27. GFR is :
 - 1) The amount of water reabsorbed by kidney per minute.
 - 2) The amount of filtrate formed by kidney per minute.
 - 3) The amount of nitrogenous waste removed by kidney per minute.
 - 4) The amount of water reabsorbed by kidney per minute.
28. The part of nephron impermeable to water is
 - 1) Proximal convoluted tubule
 - 2) Distal convoluted tubule.
 - 3) Ascending limb of Henle's loop
 - 4) Collecting duct.
29. The function of renin is :
 - 1) Activation of angiotensinogen
 - 2) To reduce blood pressure
 - 3) Vasodilation
 - 4) Stimulation of corpus luteum.

30. In which part of the excretory system of mammals you can first use the term urine for the fluid it contains ?
- 1) Bowman's capsule
 - 2) Loop of Henle
 - 3) Collecting tubule
 - 4) Ureter
31. The yellow colour of urine is due the presence of:
- 1) Urea
 - 2) Uric acid
 - 3) Bilirubin
 - 4) Urochrome
32. Volume of urine is regulated by :
- 1) Aldosterone
 - 2) Aldosterone and ADH
 - 3) Aldosterone , ADH and testosterone
 - 4) ADH alone
33. The maximum reabsorption of useful materials back into the blood from filtrate in a nephron occurs in:
- 1) PCT
 - 2) Loop of Henle
 - 3) DCT
 - 4) Collecting duct
34. The DCTs of many nephrons open into a straight tube called
- 1) Renal pelvics
 - 2) Duct of Bellini
 - 3) Columns of Bertini
 - 4) Collecting duct
35. Which one is an important constituent of renin – angiotensin – aldosteron system?
- 1) JGA cells
 - 2) Macula luteal cells
 - 3) Erythropoietin
 - 4) Podocytes.
36. Angiotensinogen is a protein produced and secreted by
- 1) Kidney
 - 2) Atrial wall
 - 3) Hepatocytes
 - 4) JGA cells
37. Which of the following is directly responsible for increasing glomerular blood pressure and hence the GFR ?
- 1) Renin
 - 2) Angiotensin II
 - 3) ANF
 - 4) Aldosterone
38. Maintenance of body potassium levels is primarily by tubular:
- 1) Absorption in PCT
 - 2) Secretion in DCT
 - 3) Absorption in DCT
 - 4) Secretion in PCT
39. Diabetes insipidus results from the hyposecretion of:
- 1) Aldosterone
 - 2) ADH
 - 3) Angiotensin II
 - 4) Renin
40. Haemodialysis is done in the condition when a person is suffering from:
- 1) Ketonuria
 - 2) Diabetes insipidus
 - 3) Glycosuria
 - 4) Uremia
41. In human beings the capsular urine entering the proximal convoluted tubule is
- 1) Hypotonic to blood
 - 2) Hypertonic to blood
 - 3) Isotonic to blood
 - 4) Isotonic to normal urine
42. NaCl is transported by the ascending limb of Henle's loop which is exchanged with :-
- 1) Proximal convoluted tubule
 - 2) Distal convoluted tubule
 - 3) Ascending portion of vasa recta
 - 4) Descending portion of vasa recta.

43. Inflammation of nephrons of kidney is:
- 1) Glomerulonephritis 2) Nephritis
3) Bright's disease 4) Both 2 and 3.
44. Which of the following component of blood does not enter into the nephron ?
- 1) Urea 2) Water 3) Glucose 4) Plasma protein
45. What happens when human urine is allowed to stand?
- 1) It become odourless
2) Urea is degraded by bacteria to NH₃ which accounts for strong smell
3) Protein and ions are precipitated
4) Sugar is crystallised.
46. A person is undergoing prolonged fasting . His urine will be found to contain abnormal quantities of
- 1) Fats 2) Amino acids 3) Glucose 4) Ketones
47. A man has taken large amount of protein through his diet. He will excrete more of
- 1) Urea 2) Uric acid 3) Sugar 4) Salt and water.
48. Accumulation of urea in blood leads to;
- 1) Ketonuria 2) Diabetes insipidus 3) Glycosuria 4) Uremia
49. Regarding haemodialysis, which of the following statement is incorrect?
1. In dialyzing unit, the cellophane membrane is permeable to micromolecules.
 2. The dialysate should be isotonic to the normal blood.
 3. The blood should be cooled to zero degree and treated with heparin before passing to the artificial kidney.
 4. The blood should be warmed to 37 degree and treated with anti-heparin before passing to the body through a suitable artery.
50. Match the following and select the correct option :-
- | | |
|--------------------|---------------------------------|
| A | B |
| A) Nephritis | 1) Uric acid crystals in joints |
| B) Renal calculi | 2) Presence of glucose in urine |
| C) Gouty arthritis | 3) Calcium oxalate crystals |
| D) Podocytes | 4) Bright's disease |
| E) Glycosuria | 5) Bowman's capsule. |
- 1) A - 4; B - 3; C - 1; D - 5; E - 2 2) A- 4; B -2; C -1; D -3; E -5
3) A – 3; B - 2; C - 4; D - 5; E - 1 4) A- 3; B -4; C -5 ; D-2 ; E-1

CHAPTER - 08

LOCOMOTION AND MOVEMENT

QUESTIONS

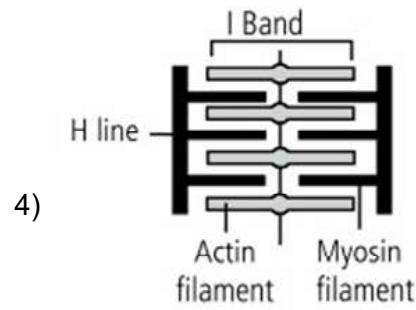
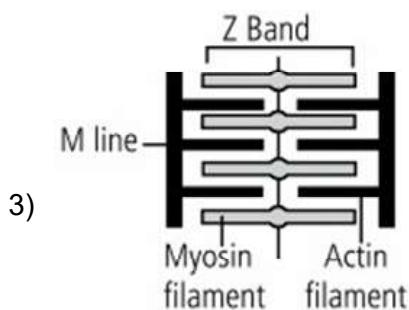
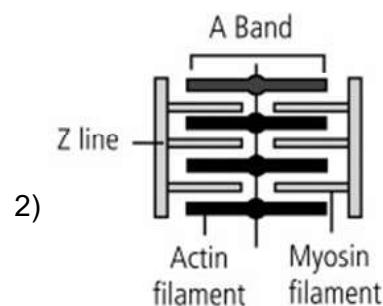
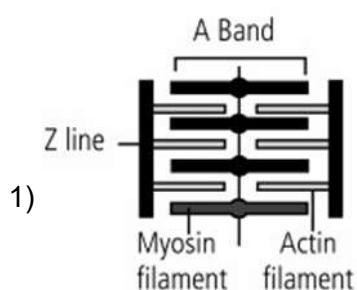
1. Which of the following statements is wrong?
 - 1) Movement is one of the significant feature of living things
 - 2) Streaming of protoplasm in amoeba leads to the formation of pseudopodia.
 - 3) Animals and plants exhibit a wide range of movements
 - 4) Movement of cilia, flagella and tentacles are limited to lower organisms
2. Which of the following statement is incorrect?
 - 1) All movements are locomotions but all locomotions are not movements
 - 2) Structures involved in general movements can also act as locomotory structures
 - 3) Removal of dust from trachea is an example of ciliary movement.
 - 4) Sponges perform certain flagellar movements
3. Match the column.

	Column A		Column B
A	Amoeboid movement	1	Movement of ova in female reproductive tract
B	Ciliary movement	2	Movement of tongue
C	Muscular movement	3	Movement of limbs
		4	Leucocytes
		5	Macrophages

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

4. Find the incorrect statement with respect to type of movement.
 - 1) Choanocytes in porifera perform flagellar movement
 - 2) Oviduct and trachea shows ciliary movement
 - 3) Amoeboid movement is due to protoplasmic streaming
 - 4) WBCs and macrophages exhibit flagellar movement.
5. Methods of locomotion performed by animals vary with their
 - a) habits
 - b) habitats
 - c) level of organisation
 - d) demand of the situation
 - 1) a and c
 - 2) a,b and c
 - 3) b and d
 - 4) b and c
6. Locomotory structure found in asterias:
 - 1) Muscular foot
 - 2) Tubefeet
 - 3) Tentacle
 - 4) Setae
7. Which of the cytoskeletal elements are involved in amoeboid movement?
 - 1) Microfilaments
 - 2) Intermediate filament
 - 3) Microtubules
 - 4) All of these
8. Which of the following statements is incorrect?
 - 1) Smooth muscles are found in urinary bladder
 - 2) A striated muscle fibre is a syncytium
 - 3) The cytoplasm of striated muscle is specifically called endoplasm.
 - 4) The plasma membrane and ER of striated muscles are called sarcolemma and sarcoplasmic reticulum respectively.
9. Involuntary muscles giving striped appearance are located in :
 - 1) stomach
 - 2) colon
 - 3) uterus
 - 4) heart
10. When we lift a heavy object using arms
 - 1) Triceps contracts and biceps relaxes
 - 2) Biceps contracts and triceps relaxes
 - 3) Both biceps and triceps contract
 - 4) Both biceps and triceps relax
11. Skeletal muscle bundles are held together by a common collagenous connective tissue layer called:
 - 1) Perimysium
 - 2) Endomysium
 - 3) Fascia
 - 4) Fascicle
12. Which is a false statement about skeletal muscle structure?
 - 1) A myofibril is composed of multiple muscle fibres.
 - 2) Most skeletal muscles are attached to bones by tendons.
 - 3) Each end of a thick filament is surrounded by six thin filaments.
 - 4) Cross-arm is a portion of the myosin molecule.

13. Which of the following sarcomeres is labelled correctly?



14. Which of the following statements about the striated muscles is incorrect?

- 1) In the centre of each I – band is an elastic fibre (Z-line) which bisects it.
- 2) Thin filaments are firmly attached to the Z-line
- 3) M – line is a fibrous membrane in the middle of A-bands.
- 4) Primary filament is formed of mainly F-actins

15. What is sarcomere?

- 1) Part between two H-lines
- 2) Part between two A-lines
- 3) Part between two I – bands
- 4) Part between two Z – lines

16. A-band is that part of sarcomere in which :

- 1) myosin is present
- 2) only myosin is present
- 3) actin is absent
- 4) only actin is present

17. Part of myofibril with both actin and myosin region is;:

- 1) M-line
- 2) A-band
- 3) H-zone
- 4) I-band

18. H-zone of skeletal muscle is

- 1) Portion of myosin filaments not overlapping with actin filament
- 2) The central gap between myosin filaments in A-band
- 3) The central gap between actin filaments extending through myosin filaments in A-band
- 4) Both (1) & (3)

19. Select the correct option regarding A,B,C



- 1) A- tropomyosin , runs close to F - Actin throughout its length
- 2) B - Troponin - complex protein distributed at regular interval of tropomyosin
- 3) C - F actin - polymer of monomeric G - actin helically bound to each other
- 4) ATP binding site lies in 'A'

20. Read the statements regarding muscle proteins.

- (i) Actin is the secondary filament and is made up of two filamentous actins helically wound to each other
- (ii) The complex protein, tropomyosin is distributed at regular intervals on the troponin.
- (iii) Myosin is a thick filament which is also a polymerized protein.
- (iv) The globular head of meromyosin consists of light meromyosin (LMM).

Of the above statements,

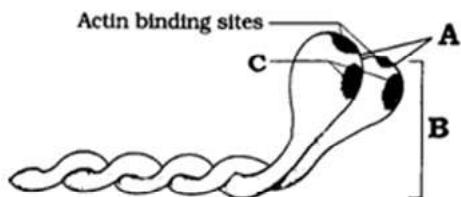
- 1) (i), (ii) and (iii) are correct
- 2) (i), (ii) and (iv) are correct
- 3) (i) and (iii) are correct
- 4) (ii) and (iv) are correct

21. Which of the following are not applicable to actin filament?

- (i) An Actin filament has 2 F-actins
- (ii) G-Actins are polymers of F-Actin
- (iii) Each actin filament is a polymerized protein consisting of F-actin, tropomyosin and troponins
- (iv) Two filamentous proteins, troponins runs close to F-actins
- (v) In the resting state, a subunit of troponin masks the binding site of actin filament

- 1) ii, iii, iv
- 2) iv, v
- 3) ii, iii
- 4) ii, iv

22. The given figure is related with myosin monomer (meromyosin). Identify the parts labelled from A to C and select the correct option.



	A	B	C
1)	Head	Cross arm	GTP binding sites
2)	Cross arm	Head	Ca^{+2} binding sites
3)	Head	Cross arm	ATP binding sites
4)	Cross arm	Head	ATP binding sites

23. Which of the following has ATPase activity?

 - 1) Actin
 - 2) Tropomyosin
 - 3) Head of meromyosin
 - 4) Troponin.

24. Stimulation of a muscle fibre by a motorneuron occurs at:

 - 1) sarcoplasmic reticulum
 - 2) neuro-muscular junction
 - 3) transverse tubules
 - 4) triad

25. Calcium is important in skeletal muscle contraction because it

 - 1) binds to troponin to remove the masking of active sites on actin for myosin
 - 2) activates the myosin ATPase by binding to it
 - 3) detaches the myosin head from the actin filament
 - 4) prevents the formation of bonds between the cross bridge with actin filament

26. Which of the following statements wrongly represents the nature of smooth muscle?

 - 1) These muscle have no striations
 - 2) They are involuntary muscles
 - 3) Communication among the cells is performed by intercalated discs
 - 4) These muscles are present in the wall of blood vessels

27. The action potential that triggers a muscle contraction travels deep within the muscle cell which causes the release of Ca^{2+} from

 - 1) Sarcoplasmic cisternae
 - 2) Transverse tubules
 - 3) Synapse
 - 4) Motor end plates

28. During muscular contraction which of the following events occur?

- a) 'H' zone disappears
- b) 'A' band widens
- c) 'I' band reduces in width
- d) Myosine hydrolyzes ATP, releasing the ADP and Pi
- e) Z-lines attached to actins are pulled inwards

Choose the correct answer from the options given below.

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

29. Match the following and select the correct option.

	Column I		Column II
A.	Fast muscle fibres	i)	Myoglobin
B.	Slow muscle fibres	ii)	Lactic acid
C.	Actin filament	iii)	Contractile unit
D.	Sarcomere	iv	I-band

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

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

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

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

30. Red muscles and white muscles are represented as A and B. Identify the correctly matched option with respect to the features of A and B?

I. Number of mitochondria less.

II. Number of mitochondria more

III. Sarcoplasmic reticulum is abundant

IV. Myoglobin content high

V. Sarcoplasmic reticulum moderate

VI. Aerobic muscles

VII. Depend on anaerobic respiration for energy

VIII. Less myoglobin content

Identify above (I to VIII) traits as characteristic of A and B types of muscles:

1) A - I, III, VII, VIII; B - II, IV, V, VI

2) A - II, IV, V, VI; B - I, III, VII, VIII

3) A - I, III, IV, VII; B - II, V, VI, VIII

4) A - II, V, VI, VIII; B - I, III, IV, VII

31. The sensation of fatigue in muscles after prolonged strenuous physical work is caused by

1) a decrease in the supply of oxygen

2) minor wear and tear of muscle fibres

3) the depletion of glucose

4) the accumulation of lactic acid.

32. Ions needed for muscle contraction

- 1) Na^+ & Cl^-
- 2) Ca^{2+} & Mg^{2+}
- 3) Fe^{2+} & Ca^{2+}
- 4) Ca^{2+} & PO_4^{2-}

33. Choose the incorrect one with respect to the function of skeletal system

- 1) Locomotion
- 2) Erythropoiesis
- 3) Production of body heat
- 4) Storage of minerals

34. Identify the incorrectly matched pair.

Pair of skeletal parts	Category
1) Sternum and ribs	Axial skeleton
2) Clavicle and glenoid cavity	Pelvic girdle
3) Humerus and ulna	Appendicular skeleton
4) Malleus and stapes	Ear ossicles

35. Which of the following bone does not participate in cranium?

- 1) Zygomatic
- 2) Parietal
- 3) Occipital
- 4) Frontal

36. Find out the correct order of number of bones in the parts of skull such as cranial bone, facial bone, hyoid bone and middle ear bones respectively

- 1) 14,8,1 and 3
- 2) 3,8,14 and 1
- 3) 8,14,1 and 6
- 4) 14, 8, 3 and 1

37. Select the correct option about the nature and composition of cartilage

- 1) Very hard due to calcium salts
- 2) Very hard due to chondroitin salts
- 3) Pliable due to calcium salts
- 4) Pliable due to chondroitin salts

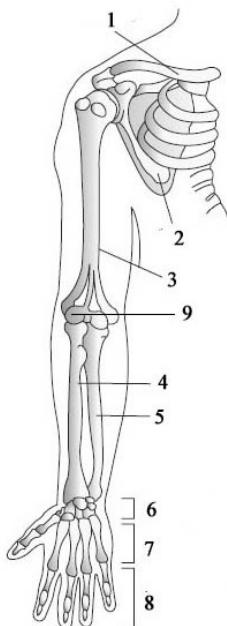
38. Vertebrochondral ribs in human

- 1) attached to vertebrae only
- 2) attached to sternum only
- 3) join the 7th rib
- 4) are 2 pairs only

39. Identify the unpaired bone:

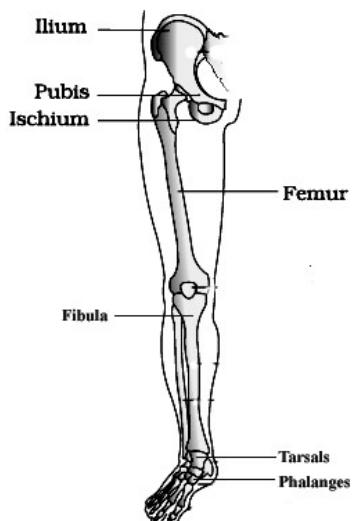
- 1) Zygomatic
- 2) Occipital bone
- 3) Maxilla
- 4) Nasal bone

40. Frontal view of right pectoral girdle and upper arm are given below. Identify the parts labelled 1,2,4 and 6 are respectively as:



- 1) Collar bone – shoulder blade – Ulna – Metacarpals
- 2) Sternum – Clavicle – Radius – Carpals
- 3) Shoulder blade – Collar bone – Radius – Wrist bones
- 4) Clavicle – Scapula – Radius – Carpals

41. Given diagram shows bone of the right human hindlimb as seen from front. It has certain mistakes in labelling. Two of the wrongly labelled bones are



- 1) Pubis and tarsals
- 2) Femur and fibula
- 3) Fibula and phalanges
- 4) Tarsal and femur

42. The collar bone articulates with shoulder blade through

 - 1) Coracoid process
 - 2) Olecranon process
 - 3) Acromion process
 - 4) Odontoid process

43. Glenoid cavity articulates

 - 1) Scapula with acromion
 - 2) Clavicle with scapula
 - 3) Humerus with scapula
 - 4) Femur with pelvic girdle

44. Scapula is a triangular bone situated in the

 - 1) dorsal part of thorax between 2nd and 7th ribs
 - 2) ventral part of thorax between 2nd and 7th ribs
 - 3) medial part of thorax between 2nd and 7th ribs
 - 4) posterior part of thorax between 2nd and 7th ribs.

45. The coxal bone of the pelvic girdle is formed by the fusion of

 - 1) ilium, ischium and pubis
 - 2) ilium and scapula
 - 3) scapula and clavicle
 - 4) ilium, scapula and clavicle

46. The joint without any movement is

 - 1) Hinge joint
 - 2) Fibrous joint
 - 3) Cartilaginous joint
 - 4) Synovial joint

47. Match the following joints with the bones involved

(A) Gliding joint	(i) Between carpal and metacarpal of thumb
(B) Hinge joint	(ii) Between atlas and axis
(C) Pivot joint	(iii) Between the carpal
(D) Saddle joint	(iv) Between humerus and ulna

Select the correct option

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

48. Match List - I with List - II

List I		List II	
a)	Scapula	i)	Cartilaginous joints
b)	Cranium	ii)	Flat bone
c)	Sternum	iii)	Fibrous joints
d)	Vertebral column	iv)	Triangular flat bone

Choose the correct answer from the options given below

	a	b	c	d
1	i	iii	ii	iv
2	ii	iii	iv	iv
3	iv	ii	iii	i
4	iv	iii	ii	i

49. Which of the following type of connective tissue is seen between cranial bones in humans?

- 1) Dense fibrous connective tissue
- 2) Areolar tissue
- 3) Fibrous cartilage
- 4) Hyaline cartilage

50. Select the incorrectly matched muscular disorder from the following

- | | |
|-----------------------|---------------------------------------|
| 1) Myasthenia gravis | - auto immune disease |
| 2) Muscular dystrophy | - genetic disorder |
| 3) Tetany | - low Ca^{2+} in body fluids |
| 4) Osteoporosis | - weakening of skeletal muscle |

CHAPTER - 09

NEURAL CONTROL AND CO-ORDINATION

QUESTIONS

1. When a person is doing a vigorous exercise, all the following activities are increased except
 - 1) Voluntary muscular activity
 - 2) Rate of respiration
 - 3) Rate of peristalsis
 - 4) Cardiac output
2. Find the wrong statement
 - 1) Neurons detect, receive and transmit different kinds of stimuli
 - 2) Platyhelminthes have ladder like CNS
 - 3) Supra - oesophageal ganglion is the brain of insects
 - 4) Echinoderms have most evolved brain among invertebrates
3. Mark the wrong statement.
 - 1) Neurons are the structural and functional units of neural system
 - 2) Neuroglia cells are non-nervous supporting cells of neural system
 - 3) Ganglia are clusters of cytons in peripheral nervous system.
 - 4) Among the invertebrates, echinoderms have the best evolved brain
4. Find the wrong statement
 - 1) CNS has brain and spinal cord
 - 2) PNS contains afferent and efferent fibres
 - 3) ANS innervates involuntary organs
 - 4) Visceral neural system has efferent neurons only
5. Autonomic neural system consists of
 - 1) Brain and spinal cord
 - 2) Somatic and autonomic neural system
 - 3) Sympathetic and parasympathetic NS
 - 4) Afferent and efferent pathways
6. Which of the following is not true of a neuron?
 - 1) The major parts of a neuron are cell body , dendrites and axon
 - 2) Nissl's granules are seen in axoplasm
 - 3) Dendrites transmit impulses towards cyton
 - 4) Synaptic knob is the part of axon in a synapse

7. Match correctly and find the answer

Column I

- 1) Multipolar neurons
- 2) Bipolar neurons
- 3) Unipolar neurons
- 4) Pseudounipolar neurons

$$1) \frac{1234}{nmkp}$$

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

Column II

- k) retina
- m) dorsal ganglia
- n) cerebral cortex
- p) embryos

$$3) \frac{1234}{npmk}$$

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

8. Find the incorrect one

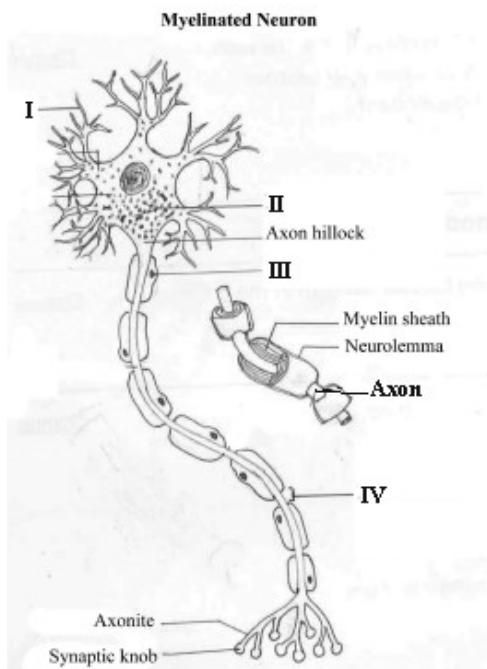
1) CNS $\xleftarrow{\text{Afferent pathway}}$ receptors

2) CNS $\xrightarrow{\text{Somatic NS}}$ skeletal muscles

3) CNS $\xrightarrow{\text{ANS}}$ visceral organs

4) CNS $\xleftarrow{\text{Efferent pathway}}$ peripheral tissues

9. Cell parts labelled II and IV are



- 1) Synaptic knob and myelin sheath
- 3) Nissl granules and nucleus

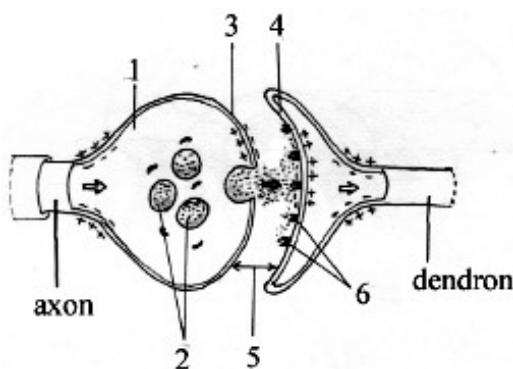
- 2) Nissl bodies and nodes of Ranvier
- 4) Centrioles and Schwann cells

10. Which of the following statement is not true?
- Neurons are excitable cells with polarised membrane.
 - Nodes of Ranvier are electrically active.
 - "Axon → Cyton → dendron" is the impulse flow direction along a neuron
 - Schwann cells are myelin producing cells of PNS.
11. Find the correct match.

	Column I		Column II
1	Saltatory conduction	a.	Neurotransmitters
2	Nissl's bodies	b.	Synaptic vesicles
3	Synaptic knob	c.	Myelinated axon
4)	Nodes of Ranvier	d.	Gaps in myelin sheath

1) $\frac{1234}{cabd}$ 2) $\frac{1234}{cbad}$ 3) $\frac{1234}{dacb}$ 4) $\frac{1234}{dcab}$

12. Which of the following statement is not true of a resting axon?
- Axoplasm has a high concentration of K^+ and low concentration of Na^+
 - $Na^+ - K^+$ pumps are active even in resting state pumping $3Na^+$ out for every $2K^+$ into axoplasm
 - Na^+ channel remain opened and free flow of Na^+ occurs.
 - Resting potential is $-70mV$
13. Mark the true statement
- Depolarisation is due to Na^+ efflux
 - Impulse is, transmitted action potential
 - On depolarisation, the inside of the axon becomes $-ve$
 - Axolemma is freely permeable to Na^+
14. In the given diagram the synapse is formed of parts marked



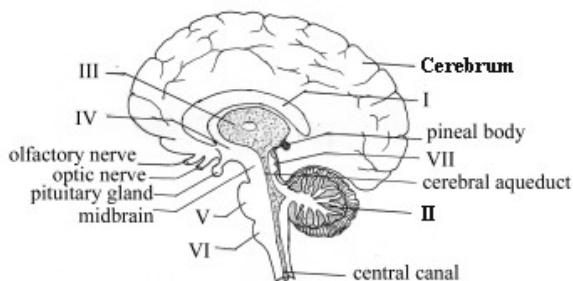
1) 1,2 and 3

2) 3,4 and 5

3) 4,5 and 6

4) 2,3 and 4

15. Mark the false statement
- 1) Myelinated axons conduct impulses faster.
 - 2) Neurotransmitters are employed in transmitting impulses through electrical synapses
 - 3) Ca^{2+} helps in chemical synaptic conduction
 - 4) Neurotransmitters are stored in synaptic vesicles of synaptic knob
16. Find the false statement
- 1) Acetyl choline is the most abundant neurotransmitter in our body.
 - 2) Ca^{2+} ions enter synaptic knob on depolarisation of presynaptic membrane
 - 3) Electrical synaptic conduction is faster
 - 4) Chemical synapses are very few in our body
17. The layer of cranial meninges lining the inside of brain box (cranium) is
- 1) dura mater
 - 2) pia mater
 - 3) arachnoid
 - 4) ependyma
18. Match the following
- | | |
|------------------|--|
| 1) Forebrain | a) Cerebellum, pons, medulla oblongata |
| 2) Hind brain | b) Amygdala, Hippocampus, Hypothalamus |
| 3) Brain stem | c) Cerebrum, thalamus, hypothalamus |
| 4) Limbic system | d) Midbrain, pons, medulla oblongata |
- 1) $\frac{1234}{adbc}$ 2) $\frac{1234}{cabd}$ 3) $\frac{1234}{cadb}$ 4) $\frac{1234}{dabc}$
19. Which of the following is true of association area of cerebral cortex?
- 1) A tract of 200 million myelinated nerve fibres connecting the two cerebral hemispheres.
 - 2) For intersensory association, memory and communication.
 - 3) Controls body temperature, urge for eating and drinking
 - 4) Regulates sexual behaviour, emotional reactions and motivation.
20. Sagittal section of human brain



In the above diagram, part labelled II is

- 1) Controls voluntary functions
- 2) Controls involuntary functions
- 3) Corpora quadrigemina for the relay centre
- 4) Crura cerebri for maintaining balance and equilibrium

21. Find the false statement
- 1) Limbic system has amygdala and hippocampus
 - 2) Cerebellum wraps around thalamus
 - 3) Cerebral medulla is made of white matter.
 - 4) Cerebral cortex contains cell bodies and dendrites
22. The biggest part of hindbrain is
- 1) Pons varoli
 - 2) Medulla oblongata.
 - 3) Cerebellum
 - 4) Arbor vitae
23. Which of the following is on the dorsal part of midbrain?
- 1) Amygdala
 - 2) Hippocampus
 - 3) Cerebral aqueduct
 - 4) Corpora quadrigemina
24. The part of the brain between midbrain and medulla oblongata is
- 1) Pons varolii
 - 2) Thalamus
 - 3) Cerebral aqueduct
 - 4) Medulla oblongata
25. Match the following and select the correct one.
- | Column I | Column II |
|--------------------|-------------------------|
| a) Cerebral cortex | p) Memory centre |
| b) Hypothalamus | q) Fear centre |
| c) Hippocampus | r) Master clock |
| d) Amygdala | s) Voluntary functions. |
- 1) $\frac{abcd}{srpq}$
 - 2) $\frac{abcd}{sprq}$
 - 3) $\frac{abcd}{rsqp}$
 - 4) $\frac{abcd}{srqp}$
26. Visual area of brain, processing impulses from retina, is in the cortex of
- 1) Frontal lobe
 - 2) Parietal lobe
 - 3) Temporal lobe
 - 4) Occipital lobe
27. Frontal and parietal cortices are separated by
- 1) Longitudinal sulcus
 - 2) Central sulcus
 - 3) Lateral sulcus
 - 4) Parieto-occipital sulcus
28. Brain stem is formed of
- 1) Cerebrum, Thalamus and hypothalamus
 - 2) Cerebellum, Pons and medulla oblongata
 - 3) Midbrain, Pons and medulla oblongata
 - 4) Amygdala and hippocampus
29. Which of the following is a mismatch?
- 1) Cerebral cortex - controls voluntary function of the body
 - 2) Thalamus - Centre for sensory and motor signalling
 - 3) Limbic system - Regulates sexual behaviour, emotional reactions and motivations.
 - 4) Corpora quadrigemina - Controls body temperature, urge for eating and drinking.

30. Find the mismatch

- | | |
|-------------------------|------------------------------|
| 1) Corpora quadrigemina | – Audiovisual reflex centre |
| 2) Thalamus | – Respiratory centre |
| 3) Hypothalamus | – Thermostat |
| 4) Brain | – Command and control system |

31 Select the correct match

	Column I		Column II
1	Appetite centre	p.	Limbic lobe
2	Emotional brain	q.	Pons varolii
3	Equilibrium centre	r.	Hypothalamus
4	Pneumotaxic centre	s.	Cerebellar cortex

1) $\frac{1 \ 2 \ 3 \ 4}{r \ p \ q \ s}$

2) $\frac{1 \ 2 \ 3 \ 4}{p \ q \ s \ r}$

3) $\frac{1 \ 2 \ 3 \ 4}{r \ p \ s \ q}$

4) $\frac{1 \ 2 \ 3 \ 4}{q \ r \ s \ p}$

32. The ventricle of thalamus and the ventricle of hind brain are connected by

- 1) Foramen of Monro 2) Cerebral aqueduct 3) Central canal 4) Neural canal

33. Mark the wrong statement regarding reflexes

- 1) Reflexes are involuntary
 2) Reflex impulses begin in receptors and end in effectors.
 3) CNS is the reflex centre
 4) Knee jerk reflex is conditioned reflex

34. In knee jerk reflex, the sensory neuron – motor neuron synapse is in

- 1) Tendons of calf muscle 2) Dorsal ganglion
 3) Spinal cord 4) Thigh muscle

35. Find the matching set.

	Column I		Column II
1	Cranial reflex	p.	I.P.Pavlov
2	Spinal reflex	q.	Winking of eyes
3	Unconditioned reflex	r.	Sneezing
4	Conditioned reflex	s.	Knee jerk reflex

1) $\frac{1234}{spqr}$

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

3) $\frac{1234}{rspq}$

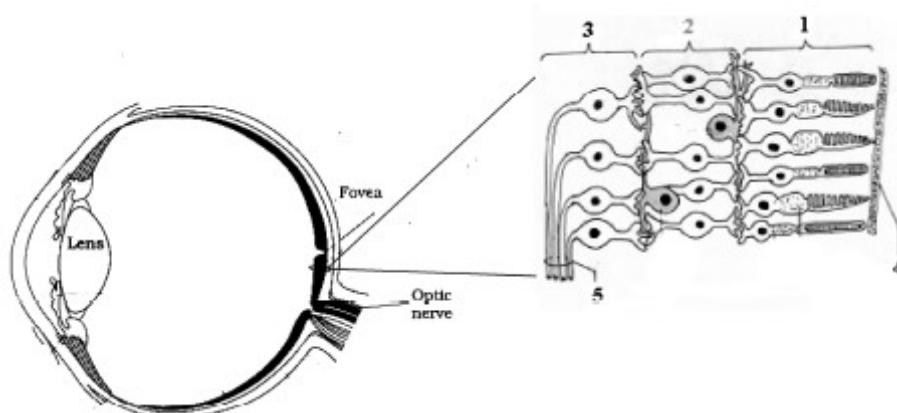
4) $\frac{1234}{qr sq}$

36. Find the mismatch in the following
- 1) Eye wall – Sclera, choroid and retina
 - 2) Retina – Photoreceptor cells, bipolar cells and ganglion cells
 - 3) Ear ossicles – Malleus, incus and stapes
 - 4) Organ of corti - Sensory cells, Otoliths and tectorial membrane
37. The anterior transparent avascular part of sclera is
- 1) Iris
 - 2) Pupil
 - 3) Cornea
 - 4) Conjunctiva
38. The cells of retina near to choroid are
- 1) Ganglion cells
 - 2) Bipolar cells
 - 3) Photoreceptor cells
 - 4) Amacrine cells
39. Dim light breaks rhodopsin into retinal and
- 1) Iodopsin
 - 2) Chloropsin
 - 3) Scotopsin
 - 4) Erythropsin
40. Match the following and select the correct option.

	Column I		Column II
1	Eye wall	p.	Photoreceptor layer, bipolar layer and ganglion cell layer
2	Retina	q.	Semicircular canals, utricle and saccule
3	Vestibular apparatus	r.	Malleus, incus and stapes
4	Ear ossicles	s.	Sclera, choroid and retina

- 1) $\frac{1234}{pqsr}$
- 2) $\frac{1234}{spqr}$
- 3) $\frac{1234}{qsrp}$
- 4) $\frac{1234}{sprq}$

41. Photosensitive pigments are stored in cells of layer labelled.



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

42. Match the following and find the correct option.

	Column I		Column II
1	Ciliary muscles contract	a.	Only cones are present.
2	Radial muscles of iris contract	b.	Due to blocking of canal of schlemm
3	Fovea centralis	c.	Dilation of pupil
4	Glaucoma	d.	Near vision

1) $\frac{1234}{bc\ ad}$

2) $\frac{1234}{dc\ ab}$

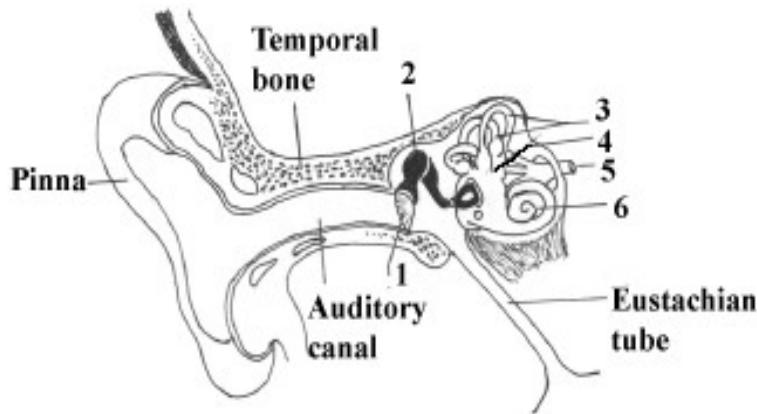
3) $\frac{1234}{cba\ d}$

4) $\frac{1234}{dc\ ba}$

43. Which of the following statement is false?

- 1) Semicircular canals contain cristae for dynamic equilibrium
- 2) Cristae and maculae are sense organs for balance and posture
- 3) Organ of corti has hair cells on basilar membrane
- 4) Cochlear duct is filled with perilymph

44. Organ of corti, units of hearing are located in part labelled.



1) 1

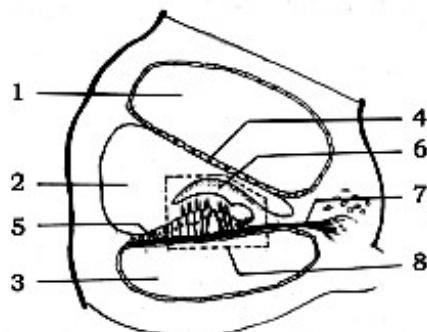
2) 2

3) 4

4) 6

45. Mark the wrong statement

- 1) External ear consists of pinna, auditory canal and eardrum
- 2) Malleus, incus and stapes are the ear ossicles.
- 3) Cochlea contains scala vestibuli, scala media and scala tympani
- 4) Vestibular apparatus is composed of cochlea, utricle and saccule.

46. C. S of Cochlea

The membrane labelled 4 is

- 1) Tectorial membrane
- 2) Basilar membrane
- 3) Reissner's membrane
- 4) Schneiderian membrane

47. Find the correct statement

- 1) Cristae are receptors of static equilibrium
- 2) Basilar membrane is a non-sensory membrane
- 3) Olfactory bulb is the anterior part of limbic system
- 4) Bony labyrinth is filled with endolymph.

48. Which of the following is incorrect?

- 1) $\text{Photons} \rightarrow \text{photoreceptor cells} \rightarrow \text{bipolar cells} \rightarrow \text{Ganglion cells} \rightarrow \text{Optic nerve} \rightarrow \text{Visual cortex} \Rightarrow \text{Vision}$
- 2) $\text{Sound waves} \rightarrow \text{ear drum} \rightarrow \text{Vibrations} \rightarrow \text{Organ of corti} \rightarrow \text{impulses} \rightarrow \text{Auditory cortex} \Rightarrow \text{Hearing}$
- 3) $\text{Statoreceptors} \rightarrow \text{Cerebellar cortex} \rightarrow \text{Thalamus} \rightarrow \text{Motor area} \rightarrow \text{Skeletal muscles} \Rightarrow \text{Balance}$
- 4) $\text{Schneiderian membrane} \rightarrow \text{Olfactory cells} \rightarrow \text{Olfactory area} \rightarrow \text{Olfactory nerve} \rightarrow \text{Olfactory bulb} \Rightarrow \text{Olfaction}$

49. Find the mismatch

- | | |
|-------------------|--------------------------------------|
| 1) Amygdala | - Emotion centre of brain |
| 2) Hippocampus | - Memory and learning centre |
| 3) Reflex arc | - Impulse pathway in a reflex action |
| 4) Sympathetic NS | - Decreases heart rate |

50. Olfactory bulb is the anterior part of

- 1) nasal epithelium
- 2) Bowman's glands
- 3) thalamus
- 4) limbic lobe

CHAPTER - 10

CHEMICAL COORDINATION AND INTEGRATION

QUESTIONS

1. Select the incorrect statement
 - 1) Neurohormones are secreted by hypophysis
 - 2) Hypophyseal portal system starts from hypothalamus and ends in hypophysis
 - 3) Study of endocrine glands and hormones is called endocrinology
 - 4) Hyposecretion of aldosterone and cortisol causes Addison's disease
2. Neurohormones produced by hypothalamic nuclei comprise
 - 1) ADH and oxytocin
 - 2) Releasing hormones
 - 3) Inhibiting hormones
 - 4) All of the above
3. Excess secretion of a particular hormone in human adults, especially in middle age can result in severe disfigurement and may lead to serious complications and premature death if unchecked. Name the hormone and its source?
 - 1) Vasopressin - Pars nervosa
 - 2) Cortisol - Adenohypophysis
 - 3) Melanin - Pineal gland
 - 4) Growth hormone - Adenohypophysis
4. How many organised endocrine bodies/glands are present in the neck and thorax of a human being?
 - 1) four
 - 2) three
 - 3) two
 - 4) five
5. Which one of the following glands is under the direct neural regulation of hypothalamus?
 - 1) Adenohypophysis
 - 2) Pars intermedia
 - 3) Neurohypophysis
 - 4) Pineal gland
6. Over secretion of which of the following causes acromegaly?
 - 1) Cortisol
 - 2) Growth hormone
 - 3) Insulin
 - 4) Androgens
7. Catecholamines are secreted by
 - 1) adrenal medulla
 - 2) adrenal cortex
 - 3) zona glomerulosa
 - 4) zona reticularis

8. Androgenic hormones which play a role in the growth of axial hair, pubic hair and facial hair during puberty are secreted by
- 1) adrenal medulla
 - 2) zona glomerulosa
 - 3) zona reticularis
 - 4) zona fasciculata
9. Select the incorrect statement
- 1) ANF is a blood pressure lowering hormone
 - 2) Erythropoietin from JG cells stimulates erythropoiesis
 - 3) Gastrin stimulates the secretion of hydrochloric acid and pepsinogen from gastric glands
 - 4) Secretin acts on Islets of Langerhans and stimulates the secretion of water and bicarbonate ions
10. Which of the following hormone acts on both pancreas and gall bladder and stimulates the secretion of pancreatic enzymes and bile juice respectively
- 1) gastrin
 - 2) secretin
 - 3) gastric inhibitory peptide
 - 4) cholecystokinin
11. Which of the following hormone acts on mammary glands and stimulates the formation of alveoli and milk secretion?
- 1) progesterone
 - 2) thyroxine
 - 3) cholecystokinin
 - 4) melatonin
12. Match the columns suitably

Column I		Column II	
a	Progesterone	i	milk secreting hormone
b	ANF	ii	glycogenesis
c	Insulin	iii	vasodilation
d	Prolactin	iv	pregnancy hormone

- 1) a-i, b-ii, c-iv, d-iii
 - 2) a-iv, b-ii, c-iii, d-i
 - 3) a-iv, b-iii, c-ii, d-i
 - 4) a- i, b-iii, c-ii, d-iv
13. Pituitary dwarfism is caused by the insufficient secretion of
- 1) TSH
 - 2) ACTH
 - 3) GH
 - 4) ADH
14. Name the steroid hormone responsible for water and electrolyte balance in humans?
- 1) Vasopressin
 - 2) Aldosterone
 - 3) ADH
 - 4) All of these
15. Which of the following groups of hormones, contains only hormones produced by the endocrine cells of GI tract?
- 1) gastrin, secretin, erythropoietin, renin
 - 2) CCK, GIP, gastrin, secretin
 - 3) insulin, glucagon, gastrin, CCK
 - 4) gastric inhibitory peptide, cholecystokinin, catecholamines

16. If the secretion of GHRH is inhibited , then it affects
 - 1) vasopressin secretion
 - 2) growth
 - 3) micturition
 - 4) calcium regulation
17. Which one of the following is a steroid hormone, that regulates glucose metabolism?
 - 1) insulin
 - 2) cortisol
 - 3) glucagon
 - 4) secretin
18. Which of the following hormone is considered as anti abortion hormone?
 - 1) estradiol
 - 2) relaxin
 - 3) thyroxine
 - 4) progesterone
19. Which of the following is/are considered as second messengers for hormones, which interact with membrane bound receptors?
 - 1) cyclic AMP
 - 2) IP₃
 - 3) Ca⁺⁺
 - 4) all
20. Which of the following hormone or hormones can influence menstrual cycles in a human female?
 - 1) thyroxine
 - 2) melatonin
 - 3) estrogen
 - 4) all of these
21. A pregnant female delivers a baby who suffers from stunted growth, mental retardation, low intelligence quotient and abnormal skin. This is due to
 - 1) over secretion of pars distalis
 - 2) deficiency of iodine in diet
 - 3) hyposecretion of growth hormone
 - 4) cancer of thyroid gland
22. Which of the following statements is correct in relation to the endocrine system?
 - 1) Releasing and inhibitory hormones are produced by the pituitary gland
 - 2) Adenohypophysis is under the direct neural regulation of the hypothalamus
 - 3) Pars distalis produces trophic hormones
 - 4) In humans pars intermedia is almost merged with pars nervosa
23. Which of the following pairs of hormones, is not antagonistic?
 - 1) parathormone - calcitonin
 - 2) insulin - glucagon
 - 3) epinephrine - acetylcholine
 - 4) relaxin - inhibin
24. The posterior pituitary gland is not a 'true' endocrine gland because
 - 1) It secretes hormones
 - 2) It is under the regulation of hypothalamus
 - 3) It is provided with a duct
 - 4) It only stores and releases hormones
25. How does steroid hormone influence the cellular activities?
 - 1) Changing the permeability of the cell membrane
 - 2) Binding to DNA and forming a gene-hormone receptor complex
 - 3) Activating cyclic AMP located on the cell membrane
 - 4) Through second messengers

26. Match the following columns suitably

Column I		Column II	
a	hypothalamus	i	Graves' disease
b	thyroid gland	ii	diabetes mellitus
c	adrenal gland	iii	diabetes insipidus
d	pancreas	iv	Addison's disease

- 1) a-iv, b-iii, c-i, d-ii 2) a-iii, b-ii, c-i, d-iv 3) a-iii, b-i, c-iv, d-ii 4) a-ii, b-i, c-iv, d-iii

27. Select the correct statement

- 1) Glucocorticoids stimulates gluconeogenesis
 2) Glucagon is associated with hypoglycemia
 3) Insulin acts on pancreatic cells and adipocytes
 4) Insulin is associated with hyperglycemia

28. Match the following columns and select the correct option

Column I		Column II	
a	ovary	i	human chorionic gonadotropin
b	placenta	ii	estrogen and progesterone
c	corpus luteum	iii	androgens
d	Leydig cells	iv	progesterone

- 1) a-ii, b-i, c-iv, d-iii 2) a-iv, b-iii, c-ii, d-i
 3) a-i, b-ii, c-iii, d-iv 4) a-i, b-iii, c-ii, d-iv

29. Select the incorrect statement

- 1) Triiodothyronine shows more potency than tetraiodothyronine
 2) PTH causes demineralisation
 3) Thymosins play a major role in the differentiation of T-Lymphocytes
 4) Fall in blood calcium level stimulates parathyroid gland to release TCT

30. Which of the following hormone is transported from hypothalamus through hypophyseal portal system?

- 1) PRL 2) ACTH 3) GHRH 4) GH

31. Select the incorrect statement about thymus gland and its hormone
- Thymosin hormone plays a major role in cell-mediated immunity
 - The size of thymus gland is quite small during infancy.
 - Thymosin is a peptide hormone
 - Thymus is located between lungs behind sternum on the ventral side of aorta
32. Select the mismatch
- | | |
|-----------------------|--|
| 1) Tetany | - hyposecretion of parathyroid hormone |
| 2) Graves' disease | - hypersecretion of thyroxine |
| 3) Diabetes mellitus | - hyposecretion of insulin |
| 4) Diabetes insipidus | - hypersecretion of vasopressin |
33. A list of hormones are given below. How many of them interact with membrane bound receptors present on the target organ?
- | | | |
|-------------------|--------------------|------------------------|
| i) ACTH | ii) GH | iii) insulin |
| iv) adrenaline | v) thyrocalcitonin | |
| 1) i, iii, v only | 2) i, ii, iv only | 3) i, ii, iii, iv only |
| | | 4) All of these |
34. Which of the following set of hormones contains only steroid hormones?
- glucocorticoids, mineralocorticoids, sexcorticoids, sex hormones
 - glucocorticoids, ACTH, LH, FSH
 - PRL, GHRH, TSH, GnRH
 - mineralocorticoids, Sex hormones, GI tract hormones
35. Goitre is the swelling of
- | | | | |
|------------|-----------|---------------|------------------|
| 1) trachea | 2) larynx | 3) oesophagus | 4) thyroid gland |
|------------|-----------|---------------|------------------|
36. Blood calcium level is lowered by
- | | |
|--------------------|-------------------------------------|
| 1) thyrocalcitonin | 2) thyroxine |
| 3) parathormone | 4) both calcitonin and parathormone |
37. Select the mismatched pair
- | | |
|---------------------------|---------------|
| 1) Hyperglycemic hormone | - glucagon |
| 2) Hypercalcemic hormone | - PTH |
| 3) Hypoglycemic hormone | - Cortisol |
| 4) Salt retaining hormone | - Aldosterone |
38. Match the columns suitably

Column I		Column II	
a	ANF	i	regulates blood calcium level
b	MSH	ii	decreases blood pressure
c	GIP	iii	pigmentation
d	TCT	iv	inhibits gastric secretion

- 1) a-ii, b-iii, c-iv, d-i 2) a-iv, b-i, c-ii, d-iii 3) a-ii, b-i, c-iv, d-iii 4) a-ii, b-iv, c-iii, d-i

39. Hyposecretion of ADH results in
- 1) diuresis
 - 2) decreased output in urine
 - 3) myxoedema
 - 4) hypertension
40. Statement A : Parathyroid hormone stimulates the process of bone demineralisation
 Statement B : PTH increases the blood calcium levels
- 1) Statement A is correct, whereas statement B is wrong
 - 2) Statement A is wrong, whereas statement B is correct
 - 3) Both statements A and B are correct
 - 4) Both statements A and B are wrong
41. A person shows hyperglycemia and formation of ketone bodies. This may be due to
- 1) hyposecretion of glucagon
 - 2) hypersecretion of insulin
 - 3) hyposecretion of insulin
 - 4) hyposecretion of cortisol
42. Select the mismatch, based on the chemical nature of hormones
- 1) Thymosin - peptide hormone
 - 2) Adrenaline - amino acid derivative hormone
 - 3) Thyrocalcitonin - iodothyronine
 - 4) ANF - peptide hormone
43. Select the mismatched pair

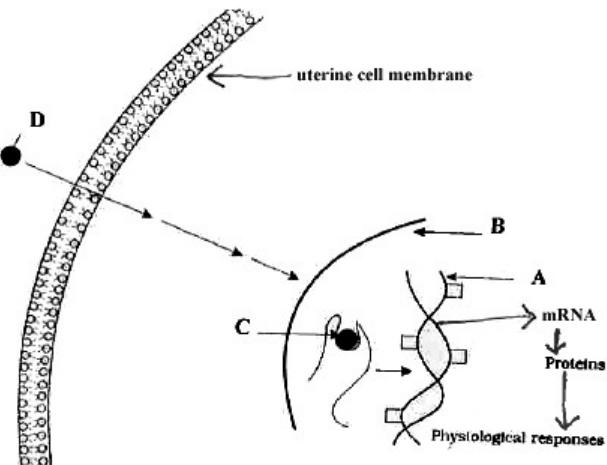
Gland		Location in human body
1	Adrenal gland	Anterior part of kidney
2	Parathyroid	Back side of thyroid gland
3	Pineal gland	Ventral side of forebrain
4	Hypothalamus	Basal part of diencephalon

44. Match the following suitably

a	Progestational hormone	i	atrial natriuretic factor
b	hypercalcemic hormone	ii	insulin
c	hypoglycemic hormone	iii	parathormone
d	hypertension lowering hormone	iv	progesterone

- 1) a-iv, b-i, c-ii, d-iii 2) a-iv, b-iii, c-ii, d-i 3) a-iii, b-iv, c-i, d-ii 4) a-iv, b-ii, c-iii, d-i

45. Select the non steroid hormone
- 1) aldosterone
 - 2) cortisol
 - 3) estradiol
 - 4) LH
46. Which of the following hormone does not enter into the cytoplasm of the target cell?
- 1) progesterone
 - 2) testosterone
 - 3) FSH
 - 4) sex corticoids
47. Which of the following represents the action of insulin?
- 1) Increases blood glucose level by stimulating glucagon production
 - 2) Decreases blood glucose level by forming glycogen
 - 3) Increases blood glucose level by promoting cellular uptake of glucose and utilisation
 - 4) Increases blood glucose level by the hydrolysis of glycogen
48. Diagrammatic representation of the mechanism of hormone action of a particular hormone on uterine cell is given below. Identify the parts marked A,B,C and D.



- 1) A - DNA, B-Nucleus, C- Hormone receptor complex, D- iodothyronine hormone
 - 2) A- Genome. B- Nucleus, C-Hormone receptor complex, D-Steroid hormone
 - 3) A-Genome, B-Nucleus, C- Hormone receptor complex, D-peptide hormone
 - 4) A- DNA, B-Nucleus, C-Hormone receptor complex, D-Protein hormone
49. Which of the following hormone not acts as anti-allergic hormone?
- 1) aldosterone
 - 2) epinephrine
 - 3) cortisol
 - 4) noradrenaline
50. Which one of the following hormones produces anabolic effects on protein and carbohydrate metabolism?
- 1) oxytocin
 - 2) testosterone
 - 3) estrogen
 - 4) progesterone