DIRECTORATE OF EDUCATION
Govt. of NCT, Delhi

SUPPORT MATERIAL
(2024-2025)

BIOLOGY
Class : XI

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सत्यमेव जयते

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DE.5\228\Exam\Message/SM\2018\555
Dated: 01/07/2024

MESSAGE

In the profound words of Dr. Sarvepalli Radhakrishnan, **"The true teachers are those who help us think for ourselves."**

Every year, our teams of subject experts shoulder the responsibility of updating the Support Material to synchronize it with the latest changes introduced by CBSE. This continuous effort is aimed at empowering students with innovative approaches and techniques, thereby fostering their problem-solving skills and critical thinking abilities.

I am confident that this year will be no exception, and the Support Material will greatly contribute to our students' academic success.

The development of the support material is a testament to the unwavering dedication of our team of subject experts. It has been designed with the firm belief that its thoughtful and intelligent utilization will undoubtedly elevate the standards of learning and continue to empower our students to excel in their examinations.

I wish to extend my heartfelt congratulations to the entire team for their invaluable contribution in creating this immensely helpful resource for our students.

Wishing all our students a promising and bright future brimming with success.

(ASHOK KUMAR)

R.N. SHARMA, IAS
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DE·5/228/Exam/Message/SM/2018/576
Dated· 04/07/2024

MESSAGE

It brings me great pleasure to present the support material specifically designed for students of classes IX to XII by our dedicated team of subject experts. The Directorate of Education remains resolute in its commitment to empower educators and students alike, extending these invaluable resources at no cost to students attending Government and Government-Aided schools in Delhi.

The support material epitomizes a commendable endeavour towards harmonizing content with the latest CBSE patterns, serving as a facilitative tool for comprehending, acquiring and honing essential skills and competencies stipulated within the curriculum.

Embedded within this initiative is a structured framework conducive to nurturing an analytical approach to learning and problem-solving. It is intended to prompt educators to reflect upon their pedagogical methodologies, forging an interactive conduit between students and academic content.

In the insightful words of Rabindranath Tagore, **"Don't limit a child to your own learning, for he was born in another time."**

Every child is unique, with their own interests, abilities and potential. By allowing children to learn beyond the scope of our own experiences, we support their individual growth and development, helping them to reach their full potential in their own right.

May every student embrace the joy of learning and be empowered with the tools and confidence to navigate and shape the future.

(R. N. SHARMA)

Dr. RITA SHARMA
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(School/Exam)

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D.O. No. DE.5/228/Exam/Message/SM/2018/570
Dated: 02/07/2024

MESSAGE

"Children are not things to be molded, but are people to be unfolded." - Jess Lair

In line with this insightful quote, the Directorate of Education, Delhi, has always made persistent efforts to nurture and unfold the inherent potential within each student. This support material is a testimony to this commitment.

The support material serves as a comprehensive tool to facilitate a deeper understanding of the curriculum. It is crafted to help students not only grasp essential concepts but also apply them effectively in their examinations. We believe that the thoughtful and intelligent utilization of these resources will significantly enhance the learning experience and academic performance of our students.

Our expert faculty members have dedicated themselves to the support material to reflect the latest CBSE guidelines and changes. This continuous effort aims to empower students with innovative approaches, fostering their problem-solving skills and critical thinking abilities.

I extend my heartfelt congratulations to the entire team for their invaluable contribution to creating a highly beneficial and practical support material. Their commitment to excellence ensures that our students are well-prepared to meet the challenges of the CBSE examinations and beyond.

Wishing you all success and fulfilment in your educational journey.

(Dr. Rita Sharma)

DIRECTORATE OF EDUCATION

Govt. of NCT, Delhi

SUPPORT MATERIAL
(2024-2025)

BIOLOGY

Class : XI

NOT FOR SALE

PUBLISHED BY : DELHI BUREAU OF TEXTBOOKS

भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक [1][**संपूर्ण प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य**] बनाने के लिए, तथा उसके समस्त नागरिकों को :

सामाजिक, आर्थिक और राजनैतिक **न्याय,**

विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की **स्वतंत्रता,**

प्रतिष्ठा और अवसर की **समता**

प्राप्त कराने के लिए,

तथा उन **सब में**

व्यक्ति की गरिमा और [2][**राष्ट्र की एकता और अखंडता**] सुनिश्चित करने वाली **बंधुता**

बढ़ाने के लिए

दृढ़संकल्प होकर **अपनी इस संविधान सभा में** आज तारीख 26 नवंबर, 1949 ई. को **एतद्द्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।**

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1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977 से) "प्रभुत्व-संपन्न लोकतंत्रात्मक गणराज्य" के स्थान पर प्रतिस्थापित।
2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 की धारा 2 द्वारा (3.1.1977 से) "राष्ट्र की एकता" के स्थान पर प्रतिस्थापित।

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1]**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2][unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

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1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

भारत का संविधान

भाग 4क

नागरिकों के मूल कर्तव्य

अनुच्छेद 51 क

मूल कर्तव्य – भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह –

(क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वज और राष्ट्रगान का आदर करे;

(ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;

(ग) भारत की संप्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण बनाए रखे;

(घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;

(ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभावों से परे हो, ऐसी प्रथाओं का त्याग करे जो महिलाओं के सम्मान के विरुद्ध हों;

(च) हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिरक्षण करे;

(छ) प्राकृतिक पर्यावरण की, जिसके अंतर्गत वन, झील, नदी और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणिमात्र के प्रति दयाभाव रखे;

(ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;

(झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;

(ञ) व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत् प्रयास करे, जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई ऊँचाइयों को छू सके; और

(ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य को शिक्षा के अवसर प्रदान करे।

Constitution of India

Part IV A (Article 51 A)

Fundamental Duties

It shall be the duty of every citizen of India —

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wildlife and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

*(k) who is a parent or guardian, to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

Note: The Article 51A containing Fundamental Duties was inserted by the Constitution (42nd Amendment) Act, 1976 (with effect from 3 January 1977).

*(k) was inserted by the Constitution (86th Amendment) Act, 2002 (with effect from 1 April 2010).

BIOLOGY

CLASS-XI

Members of Review Committee

S.No.	Name	Designation	School
1.	Ms. Sarita Singh	Vice Principal	Dr. B.R. Ambedkar SOSE, Sector-18, Rohini, Delhi
2.	Ms. Iqbal Kaur	Lecturer	RPVV, Shalimar Bagh, Delhi
3.	Ms. Shikha Khatri	Lecturer	GGSSS, AP-Block, Shalimar Bagh, Delhi
4.	Ms. Leena Saxena	Lecturer	SKV, H-Block, Ashok Vihar, Phase-1, New Delhi
5.	Ms. Pooja Verma	Lecturer	School of Excellence, Dwarka, New Delhi

SYLLABUS
SESSION (2024-25)
CLASS - XI
SUBJECT : BIOLOGY

Orientation and Recapitulation

Discussion on importance of biology, scope of biology and other topics of interest.

Unit–I Diversity of Living Organisms — Marks : 15

Chapter–1 : The Living World

Biodiversity; Need for classification; three domains of life ; taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature.

Chapter–2 : Biological Classification

Five kingdom classification; Salient features and classification of Monera, Protista and Fungi into major groups; Lichens,Viruses and Viroids.

Chapter–3 : Plant Kingdom

Classification of plants into major groups; Salient and distinguishing features and a few examples of Algae, Bryophyta, Pteriodophyta, Gymnospermae (Topics excluded - Angiosperms, Plant Life Cycle and Alternation of Generations)

Chapter–4 : Animal Kingdom

Salient features and classification of animals non-chordates upto phyla level and chordates up to class level (Salient features and at least two examples of each category).

(No live animals or specimen should be displayed).

PRACTICALS

1. Study of the parts of a compound microscope. (Spotting)

2. Study of the specimens/slides/models and identification with reasons. Bacteria, *Oscillatoria*, *Spirogyara, Rhizopus*, Mushroom, Yeast, Liverwort, Moss, Fern, Pine, One monocotyledonous plant, One dicotyledonous plant, One lichen. (Spotting)

3. Virtual specimens/slides/models and identifying features of - *Amoeba*, *Hydra*, Liverfluke, *Ascaris*, Leech, Earthworm, Prawn, Silkworm, Honey bee, Snai, Starfish, Shark, Rohu, Frog, Lizard, Pigeon and Rabit. (Spotting)

Unit–II Structural Organisation in Animals and Plants **Marks : 10**

Chapter–5 : Morphology of Flowering Plants

Morphology of different plants of flowering plants : root, stem, leaf, inflorescence, flower, fruit and seed. Description of family Solanaceae.

Chapter–6 : Anatomy of Flowering Plants

Anatomy and functions of tissues systems in dicots and monocots.

Chapter–7 : Structural Organisation in Animals

Morphology, Anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of frog.

PRACTICALS

4. Study and describe locally available common flowering plants, from family Solanaceae (Poaceae, Asteraceae or Brassicaceare can be substituted in case of particular geographical location) including dissection and display of floral whorls, anther and ovary to show number of chambers (floral formula and floral diagrams), type of root (tap and adventitious); type of stem (herbaceous and woody); leaf (arrangement, shape, venation, simple and compound)

5. Preparation and study of T.S. of dicot and monocot roots and stems (primary). (Core)

6. Different types of inflorescence (cymose and racemose) (Spotting).

Unit–III Cell : Structure and Function — Marks : 15

Chapter–8 : Cell-The Unit of Life

Cell theory and cell as the basic unit of life : Structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles–structure and function; endomembrane system, endoplasmic reticulum, golgi bodies, lysosomes, vacoules ; mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus.

Chapter–9 : Biomolecules

Chemical constituents of living cells : Biomolecules, structure and function of proteins, carbohydrates, lipids, nucleic acids, Enzymes– types, properties, enzymes action. (Topics excluded: Nature of Bond Linking Monomers in a Polymer, Dynamic State of Body Constituents - Concept of Metabolism, Metabolic Basis of Living, The Living State)

Chapter–10 : Cell Cycle and Cell Division

Cell cycle, mitosis, meiosis and their significance.

PRACTICALS

7. Tissues and diversity in shape and size of animal cells (squamous epitheliu, smooth, skeletal and cardiac muscle fibers and mammalian blood smear) through temporary/permanent slides. (Spotting)

8. Mitosis in onion root tip cells and animal cells (grasshopper) from permanent slides. (Spotting)

9. Test for the presence of sugar, starch, proteins and fats in suitable plant and animal materials. (Core)

Unit–IV Plant Physiology — Marks : 12

Chapter–13 : Photosynthesis in Higher Plants

Photosynthesis as a mean of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and

biosynthetic phases of photosynthesis, cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C3 and C4 pathways; factors affecting photosynthesis.

Chapter–14 : Respiration in Plants

Exchange of gases; cellular respiration–glycolysis, fermentation (anaerobic), TCA cycle and Electron Transport System (aerobic); energy relations–number of ATP molecules generated; amphibolic pathways; respiratory quotient.

Chapter–15 : Plant–Growth and Development

Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation;' sequence of developmental processes in a plant cell; growth regulators–auxin, gibberellin, cytokinin, ethylene, ABA.

PRACTICALS

10. Study of osmosis by potato osmometer. (Core)
11. Study of plasmolysis in epidermal peels (e.g. *Rhoeo*/lily leaves or fleshy scale leaves of onion bulb). (Core)
12. Separation of plant pigments, through paper chromatography. (Core)
13. Study of distribution of stomata in the upper and lower surface of leaves. (Core)
14. Study of the rate of respiration in flower buds/leaf tissue and germinating seeds. (Core)

Unit–V Human Physiology — Marks : 18

Chapter–17 : Breathing and Exchange of Gases

Respiratory organs in animals (recall only); Respiratory system in human; mechanism of breathing and its regulation in humans–exchange of gases, transport of gases and regulation of respiration, respiratory volume; disorders related to respiration–asthma, emphysema, occupational respiratory disorders.

Chapter–18 : Body Fluids and Circulation

Composition of blood, blood groups, coagulation of blood; composition of lymph and its function; human circulatory system–structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system–hypertension, coronary artery disease, angina pectoris, heart failure.

Chapter–19 : Excretory Products and Their Elimination

Modes of excretion–ammonotelism, ureotelism, uricotelism; human excretory system–structure and function; urine formation, osmoregulation of kidney function–renin–angiotensin, atrial natriuretic factor (ANF), ADH and diabetes insipidus; role of other organs in excretion;' disorders– uraemia, renal failure, calculi, nephritis; dialysis, artificial kidney and kidney transplant.

Chapter–20 : Locomotion and Movement

Types of movement–Ciliary, flagellar, muscular; skeletal muscle, contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal system–myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.

Chapter–21 : Neural Control and Coordination

Neuron and nerves; Nervous system in humans–central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse.

Chapter–22 : Chemical Coordination and Integration

Endocrine glands and hormones; human endocrine system–hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo–and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goitre, diabetes, Addison's disease.

Note : Diseases related to all the human physiological systems to be taught in brief.

PRACTICALS

15. Test for presence of urea in urine. (Core)

16. Test for presence of sugar in urine. (Core)

17. Test for presence of albumin in urine. (Core)

18. Test for presence of bile salts in urine. (Core)

19. Human skeleton and different types of joints with the help of virtual images/models only. (Spotting)

- Investigatory project and its submission
- REVISION of whole syllabus and Final Practical Exam.
- COMMON ANNUAL SCHOOL EXAMINATION-2024.

BIOLOGY – XI
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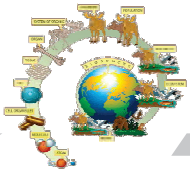


Chapter - 1

The Living World

Points to Remember

1. Organism (Microorganism, plant and animals) who posseses life is living.
2. Life is a complex organisation expressing itself through chemical reactions and exhibit characteristics of living organisms.
3. **Characteristics of Living Organisms :** Growth, reproduction, metabolism, cellular organisation, consciousness, self-replication and self regulation.
   - Reproduction and growth are NOT defining properties.
   - Metabolism (catabolism + anabolism), cellular organisation and consciousness are defining properties.
   - Living organisms are self-replicating, evolving, self-regulating and interactive systems capable of responding to external stimuli.
4. **Biodiversity :** The term used to refer to the variety of microorganisms, plants and animals on earth.
5. **Need for classification :** To organise the vast number of microorganisms, plants and animals into categories that could be named, remembered, studied and understood.
6. **Taxonomy :** Study of principles and procedures of identification, nomenclature and classification.
7. **Systematics :** It deals with classification of organisms based on their diversities and relationships among them. The term was proposed by Carolus Linnaeus who wrote *'Systema Naturae'*.
8. **Concept of Species :** Group of organisms that can interbreed naturally among themselves and can produce fertile offsprings are the members of same species. This is the biological concept of species proposed by Mayr.
9. **Taxa :** Each category (*i.e.,* unit) of classification is called as a taxon.
10. **Taxonomic Hierarchy :** Classification of organisms in a definite sequence of taxon or category or rank in a descending order.

    Kingdom → Phylum /Division → Class → Order → Family → Genus → Species.

11. **Binomial Nomenclature :** Given by Carolus Linnaeus. Each scientific name has two components-Generic name + Specific epithet.
12. **ICBN :** International Code for Botanical Nomenclature (for giving scientific name to plants.)
13. **ICZN :** International Code of Zoological Nomenclature (for giving scientific name to animals.)
14. **Rule for Nomenclature :**
    - Latinised names are used.
    - First word is genus, second word is species name.
    - Printed in italics; if handwritten then underlined separately.
    - First word of Genus starts with capital letter while species name starts with small letter.
15. - **Scientific names of some organisms :**

Man	—	*Homo sapiens*
Housefly	—	*Musca domestica*
Mango	—	*Mangifera indica*
Wheat	—	*Triticum aestivum*

16. Taxonomical aids are the tools for study of taxonomy.
17. Museums in educational institutes (school and colleges) have collection of skeletons of animals, stuffed and preserved specimens of organisms for study and reference.
18. Zoological Parks (Places where wild animals are kept in protected environment under human care) Example : National Zoological Park, Delhi.
19. **Herbarium :** Store house of dried, pressed and preserved plant specimen on sheets, kept systematically according to a widely accepted system of classification, for future use.
20. **Botanical Garden :** Collection of living plants for reference.

    Example : Royal Botanical garden Kew (England), National Botanical Research Institute (Lucknow), Indian Botanical Garden (Howrah, Kolkata).
21. **Keys :** Used for identification of plants and animals on the basis of similarities and dissimilarities two types : Indented key, Bracketed key.
22. **Couplet :** the two alternate characteristic statement used in key to identify organisation.
23. Each Statement of the key is called a *lead*.
24. - Flora Index to plant species found in a particular area.

25. ● Manuals Provide information for identification of name of species in an area. It is a handy book.

26. ● Monographs Contain information on any one taxon.

Question

(SRT) Select Response Type Question (1 mark each)

1. Which of the following botanical garden is the home for great banyan tree?
   (a) Acharya Jagadish Chandra Bose Indian Botanical Garden
   (b) Narendra Narayan Park
   (c) Jawaharlal Nehru Tropical Botanic Garden and Research Institute
   (d) Agri Horticultural Society of India
2. Study about different kinds of organisms and their diversities along with the relationships among them, is called .....
   (a) Nomenclature (b) Systematics
   (c) Taxonomic hierarchy (d) Classification
3. Which of the following is not a taxon?
   (a) Genus (b) Order
   (c) Taxonomic key (d) Family

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. Define species.
5. Define Life.
6. Name two genus belonging to family Felidae.
7. **Assertion:** In planaria larva, a fragmented organism regenerates the lost body part of its body and becomes, a new organism.

   Reason: Reproduction is defining feature of life forms.

   (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Short Answer Question-I (2 marks each)

8. What are the basis of modern taxonomical studies ?
9. Why growth and reproduction cannot be taken as defining property of all living organisms ?
10. How are museum different from zoological parks?
11. Discuss the advantages of assigning a scientific name to living organism.
12. How systematics is different from taxonomy?
13. Write two significances of taxonomical aids.
14. Explain the concept of species given by Ernst Mayr.

Short Answer Question-II (3 marks each)

15. What is the difference between Botanical Garden and Herbarium ?
16. Keys are analytical in nature and are helpful in identification and classification of organisms. How ?
17. Define : (a) Genus (b) Family (c) Order
18. Write the taxonomic categories showing hierarchal arrangement in ascending order.
19. What are botanical gardens? Mention names of three famous botanical gardens.
20. Write a short note on flora, manual, monograph and catalogue.

Long Answer Questions (5 marks each)

21. What are the universal rules of nomenclature ? What does 'Linn.' refer to in *Mangifera indica* Linn ?
22. Illustrate taxonomical hierarchy with suitable examples from plant and animal species.
23. Define classification. What is the significance of classification ?
24. What is herbarium? How is it prepared? Mention the information that a label of herbarium sheet carry. What is the advantage of herbarium sheets?

Answers

(SRT) Select Response Type Question (1 mark each)

1. (a) 2. (b) 3. (c)

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 marks each)

4. Group of organisms that can interbreed naturally to produce fertile offspring.
5. Life is unique, complete complex functioning of metabolic activities to exhibit characteristics of living organisms.
6. *Felis* and *Panthera*.
7. (c)

Short Answers-I (2 marks each)

8. External and internal structure, structure of cell, development process and ecological information.
9. - Non-living things can also increase in mass by accumulation of material on surface (accretion.)
   - Many organisms do not reproduce (*e.g.,* mules, sterile worker bees.)
10. Refer point to remember on page no. 2.
11. The scientific name ensures that each organism has only one name. Description of any organism should enable the people to arrive at the same name. They also ensure that such a name has not been used for any other known organism.
12. Refer to point to remember on page no. 1.
13. They help in correct classification and identification of organisms. These are fundamental to studies and essential for training in systematics.
14. Refer to point to remember on page 2.

Short Answers-II (3 marks each)

15. Botanical Garden : Collection of living plants.

Herbarium : Collection of dried, pressed and prerserved plant specimens on sheets.

16. Key is a list of alternate characters arranged in such a manner that by acceptance and rejection one can easily identify an organisms as to its name and position. Keys are generally analytical in nature.

17. (a) Genus : Group of related species;

    (b) Family : Group of related genera;

    (c) Order : Group of related families.

18. Species, genus, family, order, class, phylum/division, kingdom.

19. Refer to points on page 2.

20. Refer to points on page 3.

(CRT) Long Answers (5 marks each)

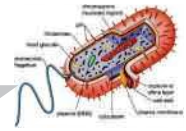
21. Refer to points to remember.

    'Linn.' indicates that the species was first described by Linnaeus.

22. Refer table 1.1, page no. 11, NCERT, Text Book of Biology for Class XI.

23. Grouping organisms on the basis of their similarities and differences. Significance : – Aids in study, better understanding, predicting the features of the group known.

24. Refer page no. 11, NCERT, Text book of Biology class XI.



Chapter - 2

Biological Classification

Points to Remember

Systems of Classification :

- Earliest classification was given by Aristotle.

  Divided plants into herbs, shrubs and trees.

  Animals into those with red blood and those who do not have it.
- **Two kingdom classification :** Given by Carolus Linneaeus–Kingdom–plantae and kingdom–Animalia.
- **Five kingdom classification :** By R.H. Whittaker, Monera, Protista, Fungi, Plantae and Animalia are the five kingdoms.
- The main criteria for classification of organisms into five kingdoms include cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships.
- **Three Domains of Life** : Proposed by Carl Woese in 1990, who also proposed the six kingdom classification for living organisms. The three Domains of life are Archaea, Bacteria and Eukarya.

	1	Archaea	→ 1. Archaebacteria	Kingdom
	2	Bacteria	→ 2. Eubacteria	Prokaryotic organisms in extreme conditions
Domains of life	3	Eukarya	→ 3. Protista	Eukaryotic Organisms
			→ 4. Fungi	
			→ 5. Plantae	
			→ 6. Animalia	

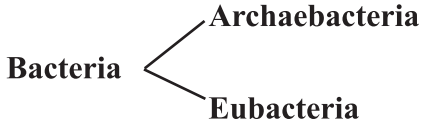
1. **Artificial System of Classification**
    1. It utilise one or two morphological traits.
    2. Homology is never standard.
    3. The system does not employ characters from anatomy, cytology, biochemistry, genetics, etc. for grouping of organisms.
2. **Natural System of Classification**
    1. The system employs several morphological character for grouping of organisms.
    2. It studies homology in all characters including morphology, anatomy, etc.
    3. This system gives information about both natural relationship and phylogeny.
3. **Phylogenetic System of Classification**

    It was proposed by Engler and Prantl. They arranged flowering plants according to increasing complexity of their floral morphology.

    It was based on possible evolution of different traits.
4. **Objections to two kingdom system**
    1. Lichen with dual mode.
    2. Fungi remain fixed but nutrition saprophytic.
    3. No distribution of unicellular and multicellular organism.
    4. No distribution of prokaryotic and eukaryotic organisation.
    5. Euglena can move as well as can do photosynthesis.

Kingdom Monera :

- Has bacteria as sole members.
- Cell wall made up of peptidoglycan.
- Bacteria can have shapes like : Coccus (spherical), Bacillus (rod-shaped), Vibrium (comma shaped) and Spirillum (spiral shaped).
- Bacteria found almost everywhere and can be Photosynthetic autotrophs, Chemosynthetic autotrophs or Heterotrophs.



- Archaebacteria
- Halophiles (salt-loving)
- Thermoacidophiles (in hot springs)
- Methanogens (in marsh and in gut of ruminant animals. Produce methane gas.)
- Eubacteria
- Photosynthetic autotrophs:

  1. Cyanobacteria (Blue-green algae). Some like *Anabaena* and *Nostoc* have specialized cells called heterocysts for nitrogen fixation.
  2. *Algae bloom* is rich growth of blue green algae over the surface of polluted water bodies.

  Algae bloom releases neurotoxins, deplete oxygen and makes water unfit for use.

- **Chemosynthetic autotrophs :** Oxidise various inorganic substances like nitrates/nitrites, ammonia and use released energy for their ATP production. They helps in nutrients recycling of N, P, Fe and S.
- **Heterotrophic bacteria :** Decomposers help in making curd, production of antibiotic, N_2 fixation, casuse diseases like cholera, typhoid, tetanus and citrus canker.

  Mycoplasmas : Completely lack cell wall. Smallest living cells. Can survive without oxygen. Pathogenic in animals and plants.

Kingdom PROTISTA

(Comprises of all single celled eukaryotes)

- Forms a link between plants, animals and fungi.

(i) **Chrysophytes** (Has diatoms and golden algae/desmids)

Fresh water/marine, photosynthetic, microscopic plankton.

- Chief producers in Ocean.
- Cell walls have silica, which makes it indestructible and cell walls overlap to fit together like a soap box.
- Their accumulation forms “Diatomaceous Earth” (gritty soil)
- Used in polishing, filtration of oils and syrups.

(ii) **Dinoflagellates :**

- Marine, photosynthetic, cell wall has stiff cellulose plates.
- Two flagella–one longitudinal and other transverse in a furrow between wall plates.
- **Example :** *Gonyaulax* multiples rapidly, make sea appear red (red tides) and produce toxins to kill marine animals.

(iii) **Euglenoids :**

- Found in stagnant fresh water.

  Have protein rich layer 'pellicle' which makes body flexible.
- Photosynthetic in presence of sunlight but become heterotrophs if they do not get sunlight. (Mixotrophic nutrition)
- **Example :** *Euglena*

(iv) **Slime Moulds :**

- Saprophytic protists
- Under suitable conditions form an aggregates called plasmodium, grows on decaying twigs and leaves.
- During unfavourable conditions, plasmodium differentiates and forms fruiting bodies bearing spores at their tips.
- Spores have true walls which are extremely resistant and survive for many years and dispersed by air currents.

(v) **Protozoans :** Are heterotrops and live as parasites. Have four major groups.

Amoeboid : Catch prey using pseudopodia, *e.g., Amoeba, Entamoeba* which are parasite.

Flagellated : Have one or more flagella. Cause disease like Sleeping Sickness *e.g., Trypanosoma.*

Ciliated : Have cilia to move food into gullet and help in locomotion. *e.g., Paramoecium.*

Sporozoans : Have infective spore like stage in life cycle, *e.g., Plasmodium* which causes malaria.

Kingdom Fungi

1. Heterotrophic organisms
2. Non chlorpohyllous hyphae
3. Network of hyphae called mycelium
4. Hyphae which have multinucleated cytoplasm are called coenocytic hyphae
5. Cell wall of chitin and polysaccharides
6. Cosmopolitan. Grow in warm and humid places.
7. Saprophytic, parasitic, symbiotic (Lichen and Mycorrhiza) *e.g.,* ***Puccinia,*** (wheat rust disease), ***Penicillium,*** Yeast (unicellular fungus).
8. Reproduction can take place by vegetative means fragmentation, fission and budding. Asexual reproduction by spores–conidia, sporangiospores or zoospores. Sexual reproduction by oospores, ascospores and basidiospores–produced in fruiting bodies.
9. **Sexual cycle involves 3 steps :**
   (i) Plasmogamy (fusion of Protoplasms.)
   (ii) Karyogamy (fusion of two nuclei.)
   (iii) Meiosis in zygote resulting in haploid spores.
10. Dikaryophase is a condition of having dikaryon in an intervening dikaryotic stage (n + n *i.e.,* two nuclei per cell) between plasmogamy and karyogamy in fungi like ascomycetes and basidiomycetes.

Classes of Fungi

(i) Phycomycetes :

- grow on decaying wood or as obligate parasites on plants
- Mycelium aseptate and coenocytic
- Spores produced endogenously in sporangium.
- Asexual reproduction by Zoospores or Aplanospores
- Zygospores are formed by the fusion of gametes.

  e.g., ***Rhizopus, Albugo, Mucor***

(ii) Ascomycetes :

- Also known as 'sac fungi'
- Are saprophytic, decomposers, parasitic or coprophilous (growing on dung).
- Mycelium branched and septate
- Asexual spores are called conidia produced exogenously on the conidiophores.

  Sexual spores are called ascospores produced endogenously in ascus, produced inside fruiting body called Ascocarp.

  e.g., ***Aspergillus, Neurospora, Saccharomyces*** **(Unicellular fungi),** ***Claviceps,*** **morels, truffles**

(iii) Basidiomycetes :

- Mycelium septate and branched.
- Generally asexual spores are not found.
- Vegetative reproduction by fragmentation.
- Sexual reproduction by fusion of vegetative or somatic cells to form basidium produced in basidiocarp.
- Basidium produces four basidiospores exogenously after meiosis.

  e.g., ***Agaricus, Ustilago, Puccinia***

(iv) Deuteromycetes :

Taxnomic of Fungi	Hypha	Type of Reproduction	Characteristic spore	Origin of Spore	Examples of Fungi
Phycomycetes	Aseptate Coenocytic	Asexually Sexually	Sporangiospore Zoospore Aplanospore Zygospore or oospore	Sporangiophore Fusion of nuclei of gametes	Nuisance fungi including genera *Albugo*, *Mucor*, and *Rhizopus*

Ascomycetes	Septate branched	Asexually	Blastospore Conidium/ conidia	Budding Exoge-neously on Conidio-phore	*Penicillium* *Aspergillus* *Clavicep* *Neurospora*
		Sexually	Ascospore	Ascus in Ascocarp	*Sacchaaro-myces* (perfect yeast)
Basidiomy-cetes	Septate branched	Sexually	Basidiospore	Basidium	Mushrooms, smuts and rusts
Deuteromy-cetes (fungi imperfecti)	Septate branched	Asexually	Thallospore Conidium	Thallus (hypha) Conidio-phore	Most sapro-phytes and pathogens encountered in medical mycology (Imperfect mould)

- Called as 'Fungi Imperfecti' as sexual form (perfect stage) is not known for them.
- Once sexual form is discovered the member is moved to Ascomycetes or Basidiomycetes.
- Mycelium is septate and branched.
- Are saprophytic parasitic or decomposers.

  e.g., ***Alternaria, Colletotrichum, Trichoderma.***

Viruses :

- They did not find a place in biological classification.
- Not truly living.

- Non-cellular organisms which take over the machinery of host cell on entering it and become living but as such they have inert crystalline structure appear non-living. So, difficult to call them living or non-living.
- Virus means venom or poisonous fluid. Pasteur gave the term 'virus'.
- D.J. Ivanowsky found out that certain microbes caused Tobacco Mosaic Disease in tobacco plant.
- M.W. Beijerinek called fluid as '*Contagium vivum fluidum*' as extracts of infected plants of tobacco could cause infection in healthy plants.
- W.M. Stanely showed viruses could be crystallized to form crystals of protein which are inert outside their specific host.
- Viruses are obligate parasites.

Structure of Virus :

- It is a nucleoprotein made up of protein coat called Capsid. Capsid is made up of capsomeres arranged in helical or polyhedral-geometric forms. Have either DNA or RNA as genetic material which may be single or double stranded.
- Usually plant viruses have single stranded RNA; bacteriophages have double stranded DNA and animal viruses have single or double stranded RNA or double stranded DNA.

Diseases caused in humans :

Mumps, small pox, herpes, influenza and AIDS etc.

In plants, symptoms can be mosaic formation, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth.

Viroids :

- Infectious agent, free RNA (lack protein coat)
- RNA is of low molecular weight.
- Causes potato spindle tuber disease.
- Discovered by T.O. Diener.

Prions

- They are highly resistant glycoproteins molecule which function as infectious agent.

Lichens :

- Symbiotic association between algal component (Phycobiont) and fungal component (Mycobiont). Algae provides food via photosynthesis. Fungi provides shelter and absorb nutrients and water for alga.
- Good pollution indicators as they do not grow in polluted areas. (SO_2 rich areas)

Questions

(SRT) Select Response Type Question (1 mark each)

1. There are specialised cells called heterocysts in *Nostoc* and *Anabena*. The function of heteocyst is to

   (a) To absorb nutrients from thin water film over the body of the organisms

   (b) To fix carbon-di-oxide into carbohydrates

   (c) To synthesise protein from absorbed nitrogen

   (d) To fix nitrogen into products such as ammonia

2. One of following Ascomycetes is called model organisms and is used extensively in genetic research.

   (a) *Neurospora* (b) *Saccharomyces*

   (c) *Penicillium* (d) *Aspergillus*

3. Archaebacteria and eubacteria differ in

   (a) Eubacteria live in harsh environments

   (b) Eubacteria have rigid cell wall

   (c) Cell wall is absent in eubacteria

   (d) Eubacteria are autotrophs only

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Question (1 mark each)

4. Which group comprises of single celled eukaryotes only ?

5. Which organisms are the chief producers in oceans ?
6. Name the fungus which causes disease in wheat (i) rust (ii) smut.
7. What is the principle underlying the use of cyanobacteria in agriculture ?
8. Define dikaryon stage. Where do you observe this stage?
9. Differentiate between zoospore and zygospore?

Short Answer Question-I (2 marks each)

10. How are bacteria classified on the basis of their shapes ?
11. What is the mode of reproduction in bacteria ?
12. Why are red tides caused and why are they harmful ?
13. Viruses and viroids differ in structure and the diseases they cause. How ?
14. Which class of kingdom fungi has both unicellular as well as multicellular member ? When is a fungus called coprophilous ?
15. Why two kingdom classification was not sufficient? Explain with the help of two examples.
16. How flexibility is maintained in the body of Euglena?

Short Answer Question-II (3 marks each)

17. Who gave five kingdom classification ? What was the criteria used for such classification ?
18. What are the modes of nutrition in fungi ?
19. Some symbiotic organisms are very good pollution indicators and composed of a chlorophyllous and a non-chlorophyllous member. Describe them.
20. Who gave two kingdom classification? Write its draw backs?
21. Explain how reproduction takes place in phycomycetes?
22. Differentiate between mode of sexual reproduction in ascomycete and basidiomycetes.

Long Answer Questions (5 mark each)

23. Some primitive relatives of animals live as predators or parasites and are divided into four major groups. Elaborate.
24. Differentiate between various classes of kingdom Fungi on the basis of their (i) Mycelium, (ii) Types of spores and (iii) Types of fruiting body. Also give two examples for each class.
25. Describe sexual reproduction in fungi.
26. Draw a labelled diagram of bacteriophage. Write its characters also.
27. Discuss how the system of biological classification has been evolved in past?

Answers

Select Response Type Question (1 mark each)

1. (d) To fix nitrogen into products such as ammonia
2. (a) Neurospora
3. (b) Eubacteria have rigid cell wall

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Kingdom Protista.
5. Diatoms
6. (i) *Puccinia,* (ii) *Ustilago*
7. Capability of nitrogen fixation
8. Refer to point to remember on page 11.
9. Motile asexual spores of class phycomycetes are known as zoospores whereas zygospores are formed by fusion of two gametes.

Short Answers-I (2 marks each)

10. Bacillus (rod-shaped), Coccus (spherical), Vibrio (comma shaped) and Spirillum (spiral shaped).

11. Mainly by fission; Production of spores in unfavourable conditions. Sexual reproduction by DNA transfer.

12. Rapid multiplication of dinoflagellates like *Gonyaulax*. Harmful as they release toxins which kill marine animals.

13. Refer 'Points to Remember'.

14. Ascomycetes : Yeast (Unicellular), *Penicillum* (Multicellular), Coprophilous, means fungi which grow on dung.

15. Refer 'Points to Remember'.

16. Instead of cell wall, they have a protein rich layer called pellicle which makes their body flexible.

Short Answers-II (3 marks each)

17. R.H. Whittaker, Criteria for classification : Cell structure, thallus organisation, mode of nutrition, reproduction and phylogenetic relationships.

18. Saprophytes, Parasites, Symbionts-Lichens and Mycorrhiza.

19. Lichens, Refer 'Points to Remember'.

20. Carolous Linnaeus. Refer 'Points to Remember'.

21. Refer 'Points to Remember'.

22. Refer page no. 23 and 24, NCERT, Text Book Biology class XI.

Long Answers (5 marks each)

23. Protozoans. Refer for class 10.

24. Refer points to remember table on page 10.

25. The steps are :

    (i) Plasmogamy : fusion of protoplasm of two motile or non-motile gametes.

    (ii) Karyogamy : fusion of two nuclei.

    (iii) Zygotic Meiosis to form haploid spores.

(iv) Dikaryophase in ascomycetes and basidiomycetes where before karyogamy two nuclei per cell (dikaryon) are found.

26. NCERT page no. 26 Fig 2.6 (b), for characters refer Page 14 of points to remember.

27. Refer to point to remember on page 6, 7 and 8.

28. Refer point to remember on page 7.

29. Refer point to remember on page 7.

Case Study (4 Mark each)

Corona viruses are a broad family of viruses that cause illnesses ranging from the common cold to many serious respiratory disorders. SARS-CoV 19 is a novel Corona Virus strain that has never been found in humans before. Corona viruses spread from animals to humans. Fever, cough, shortness of breath, and breathing difficulties are all common symptoms of infection. Infection can lead to pneumonia, severe acute respiratory syndrome, kidney failure, and even death in more severe cases. Hand washing, coughing with your mouth and nose covered, are all standard advice for preventing infection spread. Close contact with anyone who has respiratory symptoms like coughing or sneezing should be avoided.

1. Novel corona virus belongs to the category of viruses having :

   (a) DNA as genetic material

   (b) Double stranded RNA as genetic material

   (c) Single stranded DNA as genetic material

   (d) Single stand RNA as genetic material

Ans.: (d)

2. **Assertion:** An effective antibiotic should be used to prevent the disease

caused by Novel corona virus.

Reason : Effective antibiotic will reduce the chance of getting infection from viruses including Novel corona virus.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Ans.: (d)

3. Read the following statements :

Statement I : The new coronavirus can be transmitted through mosquito bites

Statement II : The COVID-19 virus does not transmit through water while swimming.

Choose from below the correct alternative.

(a) Only I is true. (b) I and II true.

(c) I is true but II is false. (d) I is false but II is true.

Ans.: (d)

4. Which of the following methods should not be used to prevent infection from Novel corona virus?

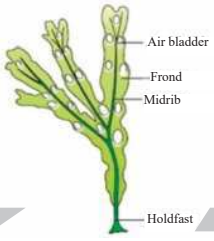
(a) Regular hand washing.

(b) Covering mouth and nose when coughing and sneezing.

(c) Thorough cooking of meat and eggs.

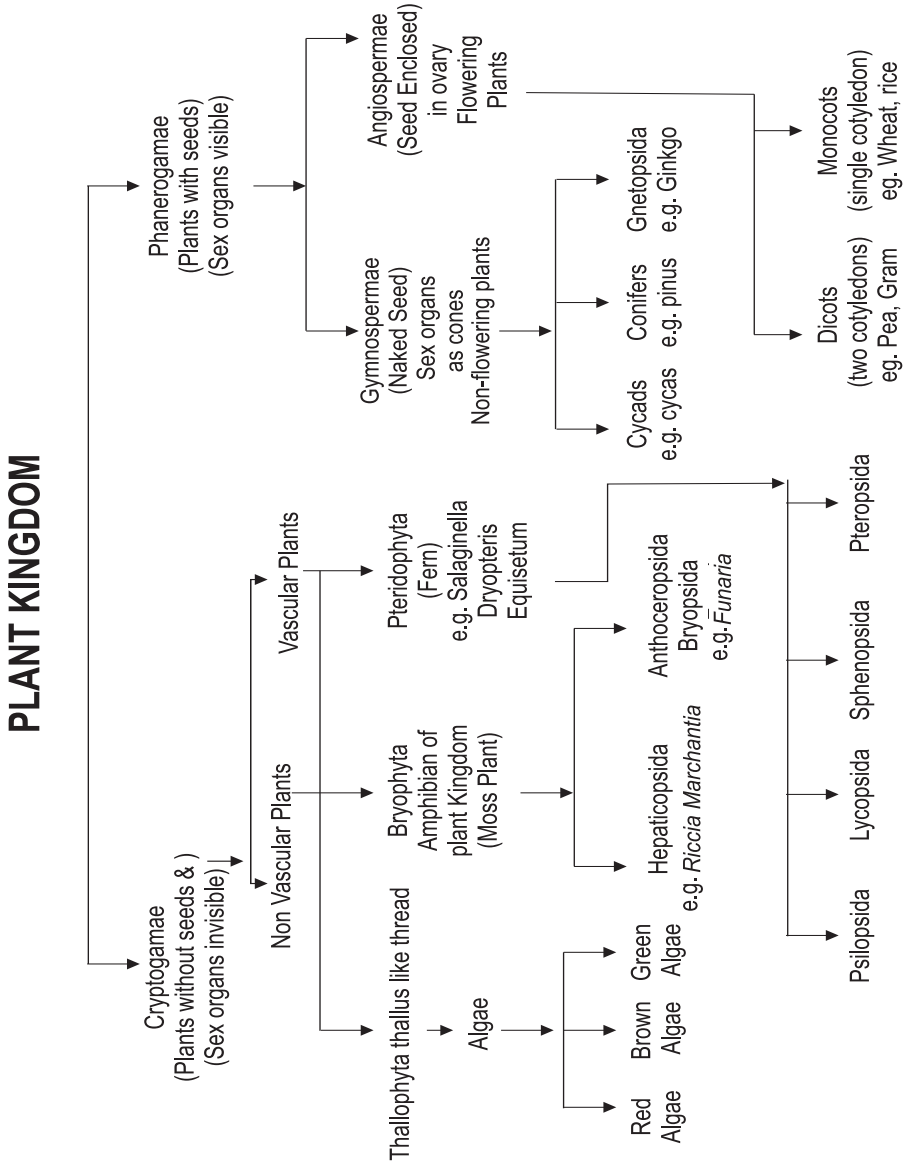
(d) Use of Hand dryers

Ans.: (d)



Chapter - 3

Plant Kingdom



Points to Remember

Classification :

- **Artificial System of Classification**
  - By Carolus Linnaeus, based on androecium structure and vegetative characters.
- **Natural System of Classification**
  - Based on natural affinities among organisms
  - Included external as well as *internal features*
  - By Geroge Bentham and J.D. Hooker
- **Phylogenetic System of Classification**
  - Based on evolutionary relationships between the various organisms
  - By Engler and Prantl
  - Later on By Hutchinson

Numerical Taxonomy :

- Carried out using computers
- Based on all observable characteristics
- Data processed after assigning number and codes to all the characters.

  Advantages : Each character gets equal importance and a number of characters can be considered.

Cytotaxonomy :

- Based on *cytological informations.*
- Gives importance to chromosome number, structure and behaviour.

Chemotaxonomy :

- Based on Chemical constituents of the plants.

Algae :

- Chlorophyll bearing, simple, thalloid, autotrophic and largely aquatic organisms.

Importance of Algae :

- Help in carbon dioxide fixation by carrying out photosynthesis and have immense economic importance.
- At least half of the total carbon dioxide fixation on earth is carried out by them.
- Increases dissolved oxygen level in their environment.
- Many species like ***Laminaria, Sargassum, Porphyra*** etc. are used as food.
- ***Agar*** obtained from ***Gelidium*** and ***Gracilaria*** which is used in ice-creams and jellies and to grow microbes.
- ***Algin*** obtained from brown algae and ***Carrageen*** from red algae used commercially as ***hydrocolloids.***
- ***Chlorella*** and ***Spirullina*** are unicellular algae, rich in protein and used even by space travellers.
- Algae are unicellular like ***Chlamydomonas***, colonial like ***Volvox*** or filamentous like ***Spirogyra*** and ***Ulothrix.*** Occur in water, soil, wood moist stones etc.

Algae are divided into 3 classes.

(i) Chlorophyceae

- Green algae, Main pigment is chlorophyll 'a' and 'b'.
- Cell wall has inner layer of cellulose and outer layer of pectose.
- Has pyrenoids made up of starch and proteins.
- Pigment and pyrenoids are located in ***Chloroplast***.

e.g., ***Chlamydomonas, Volvox, Spirogyra, Ulothrix, Chara.***

(ii) Phaeophyceae

- Brown algae are brown coloured due to main pigments chlorophyll 'a', 'c' and fucoxanthin (xanthophyll)
- Cell wall has cellulose with gelatinous coating of algin.

- Has mannitol and laminarin (complex carbohydrate) as reserve food material.
- Body divisible into holdfast, stipe and frond.
- *e.g.,* ***Ectocarpus, Fucus, Laminaria, Dictyota, Sargassum***

(iii) Rhodophyceae

- Red algae are red coloured due to pigments chlorophyll 'a', 'd' and r-phycoerythrin.
- Found on surface as well great depths in oceans.
- Cell wall has cellulose.
- Reserve food material is floridean starch.

e.g., ***Polysiphonia, Porphyra, Gelidium,Gracilaria.***

Reproduction in Algae

Vegetative reproduction : by fragmentation

Asexual Reproduction : Flagellated zoospores in Chlorophyceae, Biflagellated zoospores in Phaeophyceae, By non-motile spores in Rhodophyceae.

Sexual Reproduction : Isogamous, anisogamous or oogamous in chlorophyceae and Phaeophyceae.

By non-motile gametes and oogamous in Rhodophyceae.

Bryophytes :

- 'Amphibians of plant kingdom'.
- Occur in damp, humid and shaded places.
- Lack true roots, stem or leaves.
- Main plant body is haploid and thallus like (prostrate or erect)
- **Economic Importance :** Food for herbaceous animals.

Sphagnum in from of peat is used as fuel and also used as packing material for trans-shipment of living material, as it has water holding capacity.

Prevents soil erosion, alongwith lichens are first colonizers on barren rock.

- Is divided into two classes ***Liverworts*** (thalloid body, dorsiventral, *e.g.,*

Marchantia) and ***Mosses*** (have two stages in gametophyte–creeping, green, branched, filamentous ***protonema stage*** and the ***leafy stage*** having spirally arranged leaves *e.g.,* ***Funaria, Polytrichum and Sphagnum***).

Reproduction in Bryophytes

- Vegetative reproduction by fragmentation.
- Asexual reproduction by gemmae formed in gemma cups.
- Sexual reproduction : Main plant body is haploid, produces gametes and so called ***Gametophyte***. By fusion of antherozoids produced in antheridium and egg cell produced in archegonium, results in formation of zygote which develops into sporophytic structure differentiated into foot, seta and capsule. ***Spores*** produced in a capsule germinate to from free-living gametophyte (Protonema). ***Sporophyte*** is not free living but attached to photosynthetic gametophyte from which it derives nutrition.

Pteridophytes :

- First terrestrial plants.
- Prefer cool, damp and shady places to grow.
- Grown as ornamentals.
- Used for medicinal purpose, as soil binder.
- Main plant body is sporophyte which is differentiated into true root, stem and leaves.
- Leaves may be small as in ***Selaginella*** or large as in ferms.
- Sporangia having spores are subtended by leaf-like appendages called sporophylls. (Sporphylls may be arranged to form strobili or cones.)
- In Sporangia, the spore mother cells give to spores after meiosis.
- Spores germinate to form haploid gametophytic structure called **prothallus** which is free living, small, unicellular and photosynthetic.
- Prothallus bears antheridia and archegonia which bear antherozoids and egg cell respectively which on fertilisation from zygote. Zygote produces multicellular, well differentiated sporophyte.

- The four classes are : Psilopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*).

Heterospory : Two kinds of spores *i.e.,* large (macro) and small (micro) spores are produced. *e.g.,Selaginella* and *Salvinia.*

Seed Habit : The development of zygote into young embryos takes place within the female gametophyte which is retained on parent sporophyte. This event is precursor to seed habit and this is an important step in evolution and is found ***Selaginella*** and ***Salvinia*** among the pteridophytes.

Gymnosperms :

- Have naked seeds as the ovules are not enclosed by any ovary wall and remain exposed.
- Includes shrubs and trees (medium and tall sized).
- Have generally tap roots, stem may be unbranched (***Cycas***) or branched (***Pinus, Cedrus***), leaves–needle like (***Pinus***) and pinnate (***Cycas***).
- Roots of ***Pinus*** have fungal association in the form of mycorrhiza.
- Cycas have small specialized roots called ***coralloid root*** which are associated with N_2 fixing cyanobacteria.
- Heterosporous–Produce haploid microspores and megaspores.
- Male cone has microsporophylls which bear microsporangia having microspores which develop into reduced gametophyte called pollengrain.
- Female cone has megasporophylls which bear megasporongia having megaspores which are enclosed within the megasporangium (Nucellus). One megaspore develops into female gametophyte bearing two or more archegonia.
- Pollen grains carried in air currents reach ovules, form pollen tube which reach archegonia and release male gametes which fertilise egg cell and form zygote which produce embryos. Ovules develop into seeds which are not covered.

Angiosperms :

- Called flowering plants and have seeds enclosed in fruits.

- Divided into two classes–Dicotyledons (have two cotyledons) and Monocotyledons (have one cotyledon).
- **Smallest angiosperm :** *Wolfia*
- Stamen has filament and anther. Anthers bear pollen grains. Pollen grains have two male gametes.
- Pistil has stigma, style and ovary. Ovary has ovule in which female gametophyt (embryo sac) develops.
- Embryo sac has 7 cells and 8 nuclei.One egg cell 2 synergids, 3 antipodals and two polar nuclei which fuse to form secondary nucleus.
- Pollen grain is carried by wind, water, insects and other agents reaches to stigma and produces pollen tube which enters embryo sac.
- **Double fertilisation :** One male gamete fuses with egg cell (Syngamy) to form zygote which develops into embryo.

Other male gamete fuses with secondary nucleus (triple fusion) which forms triploid primary endosperm nucleus (PEN). PEN develops into endosperm which nourishes the developing embryo.

- Ovules develop into seeds and ovaries into fruits.

Questions

Select Response Type Question (1 mark each)

1. Proteinaceous bodies which are usally surrounded by starch is found in green algae. What are such bodies called and what is their function?

   (a) Pyrenoid body, nitrogen fixation

   (b) Pyrenoid body, carbon-di-oxide fixation

   (c) Pyretic body, nitrogen fixation

   (d) Pyretic body, carbon-di-oxide fixation

2. Peat, a partial decomposed substance used as fuel, leaves/plant used for trans-shipment of living matrial. Name the plant which serves the mentioned purpose.

(a) Marchantia (b) Funaria

(c) Sphagnum (d) Anthoceros

3. Which of the following is not an aquatic pteridophyte?

(a) Salvinia, water moss

(b) Marsilea, water fern

(c) Azolla, mosquito fern

(d) Lycopodium, foot fern

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Question (1 mark each)

4. Define gemma.
5. Which group of plants is regarded as first terrestrial plants ? Why ?
6. Which organism is regarded as one of the tallest tree species ?
7. The gametes and spores of phaeophyceae have a distinct morphology. Give its name.
8. Which substance has structural similarity to floridean starch ?
9. Name the organism which exhibit heterospory and seed habit.

Short Answer Question-I (2 marks each)

10. Gymnosperms can show polyembryony. Why do you think so ?
11. How is leafy stage formed in mosses ? How is it different from protonema?

Short Answer Question-II (3 marks each)

12. The leaves in gymnosperms are adapted to withstand xerophytic conditions. Justify.
13. The gametophytes of bryophytes and pteridophytes are different from that of gymnosperms. How ?
14. Roots in some gymnosperms have fungal or algal association. Give examples, their names and role in the plants.
15. Why is presence of water a must for fertilisation in pteridophytes ?
16. Draw a neatly labelled diagram of *Funaria*?

17. Differentiate between three classes of algae.
18. Mention any three economic importance of algae.
19. Differentiate between isogamous, anisogamous and oogamous reproduction in algae.
20. Explain the life cycle of bryophytes.

Long Answer Questions (5 marks each)

21. Explain various classes of Algae.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) Pyrenoid body, carbon-di-oxide fixation
2. (c) Sphagnum
3. (d) Lycopodium, foot fern

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Gemma are green, multicullular, asexual buds which develop in receptacles called as gemma cups.
5. Pteriodphytes. As they possess vascular tissues–xylem and phloem.
6. *Sequoia*
7. Pyriform (pear-shaped), bear two laterally attached flagella.
8. Amylopectin and glycogen.
9. *Selaginella* and *Salvinia.*

Short Answers-I (2 marks each)

10. Have two or more archegonia, so polyembryony can occur.
11. Leafy stage develops from secondary protonema as a lateral bud. Protonema is creeping, green, branched frequently filamentous stage whereas leafy stage is upright with spirally arranged leaves.

Short Answers-II (3 marks each)

12. Gymnosperms like conifers have : needle shaped leaves to reduce surface area, thick cuticle and sunken stomata to reduce water loss.
13. Male and female gametophyte have free existence in bryophytes and pteridophytes but not in Gymnosperms. They remain within sporangia retained on sporophytes.
14. *Pinus* has fungal association to form mycorrhiza which helps in absorption of water and minerals. Cycas has algal association in coralloid roots which are associated with N_2 fixing cyanobacteria.
15. The antheridia produces male gametes, antherozoids which swim in water to reach archegonia, bearing non-motile egg. Thus fertilisation can occur only when water is present in the surrounding medium.
16. Refer page no. 34, NCERT, Text book of Biology class XI.
17. Refer page no. 33, NCERT, Text book of Biology class XI table 3.1.
18. Refer to point to remember on page 23.
19. Refer page no. 30, NCERT, Text book of Biology class XI.
20. Refer page no. 33, NCERT, Text book of Biology class XI.

Long Answers (5 mark each)

21. Rhodophycae/Phoeophyceqe and chlorophyceae with correct explanation. Refer page no. 33 NCERT XI.

Case Based Question

Case 1: Bryophytes, or plant amphibians, can be found growing on a variety of surfaces including rocks, dirt, tree trunks, bones, and rotting wood. These plants have the ability to live on bare rocks and soil, and so play a crucial role in xeric plant succession. Mosses are one of the most pollutant-sensitive components of the plant, and they can be sensitive to both acidity and nitrogen, which dominate today's human deposition. Many mosses, like lichens, have become extinct in urban/industrial settings. Too much nitrogen can alter morphology, resulting in sparser mats that are more susceptible to desiccation and less effective in suppressing rivals. Mosses are crucial in nutrient cycling and nitrogen immobilization in a few ecosystems.

1. Bryophytes are called amphibian of plant kingdom because.

   (a) They live in damp and shady places

   (b) They can hop like amphibians

   (c) They require water to complete the process of sexual reproduction

   (d) They can survive on bare cork.

Ans.: (c)

2. Mosses show sensitivity towards

   (a) Soil acidity

   (b) Level of nitrogen

   (c) Both acidity and Nitrogen

   (d) Carbon dioxide level increase in air

Ans.: (c)

3. Assertion : Like lichens, many mosses have become extinct from urban/ industrial environments

   Reason : Mosses are among the most sensitive group to both acidity and Nitrogen

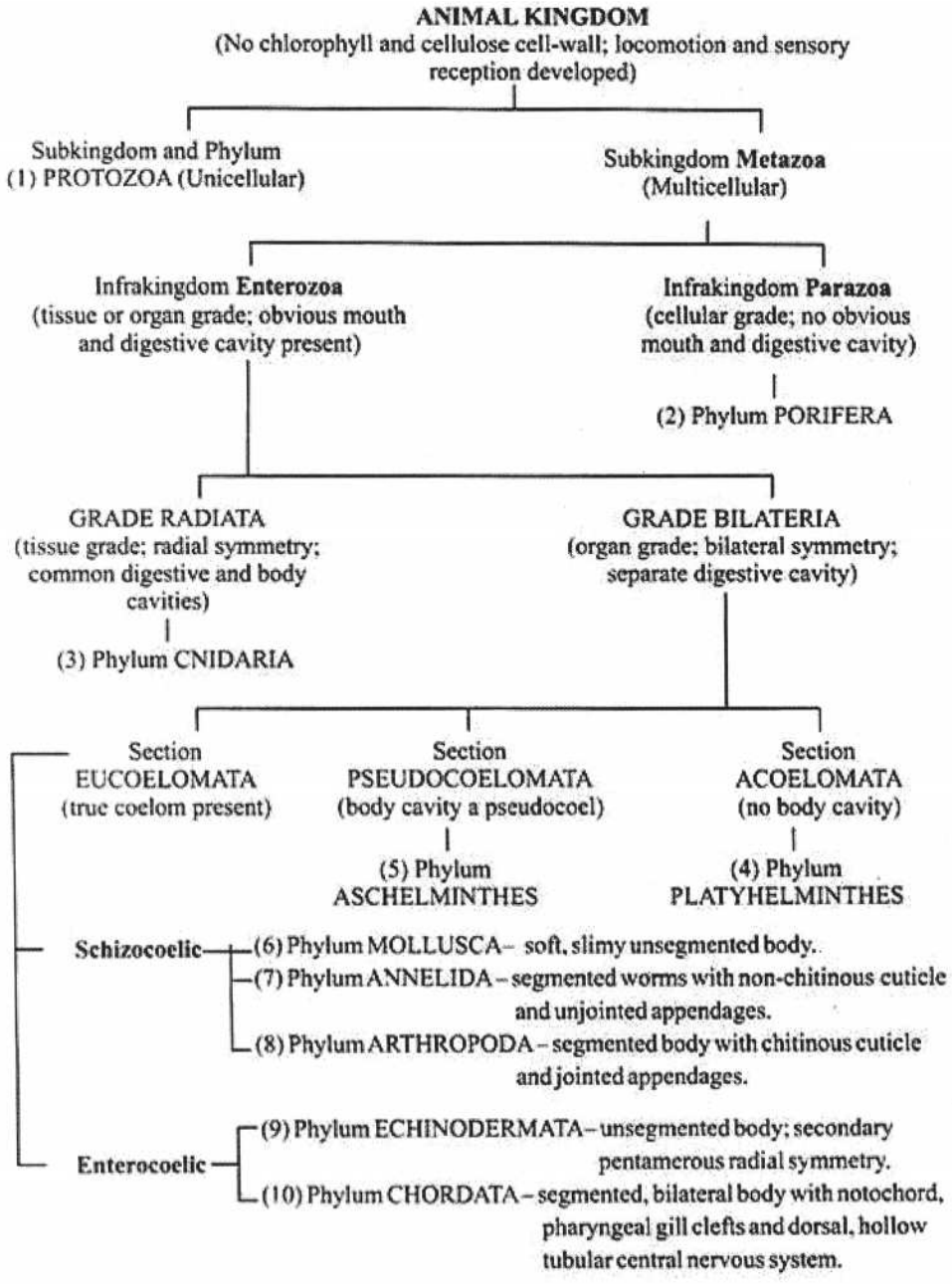
   (a) Both assertion and reason are true, and the reason is the correct explanation of the assertion

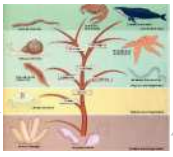
   (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion

   (c) Assertion is true but reason is false

   (d) Both assertion and reason are false

Ans.: (a)


ANIMAL KINGDOM
(No chlorophyll and cellulose cell-wall; locomotion and sensory reception developed)
Subkingdom and Phylum
(1) PROTOZOA (Unicellular)
Subkingdom Metazoa
(Multicellular)
Infrakingdom Enterozoa
(tissue or organ grade; obvious mouth and digestive cavity present)
Infrakingdom Parazoa
(cellular grade; no obvious mouth and digestive cavity)
(2) Phylum PORIFERA
GRADE RADIATA
(tissue grade; radial symmetry; common digestive and body cavities)
(3) Phylum CNIDARIA
GRADE BILATERIA
(organ grade; bilateral symmetry; separate digestive cavity)
Section
EUCOELOMATA
(true coelom present)
Section
PSEUDOCOELOMATA
(body cavity a pseudocoel)
(5) Phylum
ASCHELMINTHES
Section
ACOELOMATA
(no body cavity)
(4) Phylum
PLATYHELMINTHES
Schizocoelic
(6) Phylum MOLLUSCA– soft, slimy unsegmented body.
(7) Phylum ANNELIDA – segmented worms with non-chitinous cuticle and unjointed appendages.
(8) Phylum ARTHROPODA – segmented body with chitinous cuticle and jointed appendages.
Enterocoelic
(9) Phylum ECHINODERMATA– unsegmented body; secondary pentamerous radial symmetry.
(10) Phylum CHORDATA – segmented, bilateral body with notochord, pharyngeal gill clefts and dorsal, hollow tubular central nervous system.



Chapter - 4

Animal Kingdom

Point to Remember

Basis of Classification :

Animals are classified on the basis of following few fundamental features—

1. **Levels of Organisation :**
   (1) Cellular level : Cells are arranged as loose cell aggregates, *e.g.,* sponges.
   (2) Tissue level : The cells performing the same function are arranged into tissues, *e.g.,* Coelenterates.
   (3) Organ level : Tissues are grouped together to form organs, each specialised for a particular function. *e.g.,* platyhelminthes.
   (4) Organ system level : organs are associated to form functional systems *e.g.,* Annelids, Arthropods, Molluscs, Echinoderms and Chordates.
   Example : Circulatory System.

   Open type : Blood pumped out through heart. Not confined to blood vessels. Cells and tissues are directly bathed in it.

   Closed types : Blood is circulated through blood vessels (arteries,veins and capillaries)
2. **Symmetry :**
   - **Asymmetrical :** Cannot be divided into equal halves through median plane *e.g.,* Sponges.
   - **Radial symmetry :** Any plane passing through central axis can divide organism into identical halves. *e.g.,* coelentrates,Ctenophores and echinoderms.
   - **Bilateral symmetry :** Only one plane can divide the organism into two identical left and right halves *e.g.,* Annelids and Arthropods.
3. **Germinal Layers :**

   Diploblastic : Cells arranged in two embryonic layers *i.e.,* external ectoderm and internal endoderm. (Mesoglea may be present in between ectoderm and endoderm) *e.g.,* porifers and Coelentrates. (Cnidarians)

   Triploblastic : Three layers present in developing embryo *i.e.,* ectoderm, mesoderm and endoderm. *e.g.,* Platyhelminthes to Chordates.

4. **Coelom** (Body cavity which is lined by mesoderm)

   Coelomates : Have coelom *e.g.,* Annelids, Arthropods, molluscs, Echinoderms, Chordates etc.

   Pseudocoelomates : No true coelem as mesoderm is present in scattered pouches between ectoderm and endoderm. *e.,g.,* Aschelminthes.

   Acoelomates : Body cavity is absent *e.g.,* Platyhelminthes.

5. **Segmentation Metamerism :** If body is externally and internally divided into segments (metameres) with serial repetition of atleast some organs, then phenomenon is called metamerism *e.g.,* Earthworm.

   (A) True Metamerism : Found in Annelida, Arthropoda, Chordata :

   - Segmentation is external as well as a internal in Annelids.
   - Segmentation is external in Arthropods.
   - Segmentation is internal in chordates.

   (B) Pseudometamerism : Found in tapeworm. The proglottids (segments of tapeworm) budded off from neck not embryonic in origin.

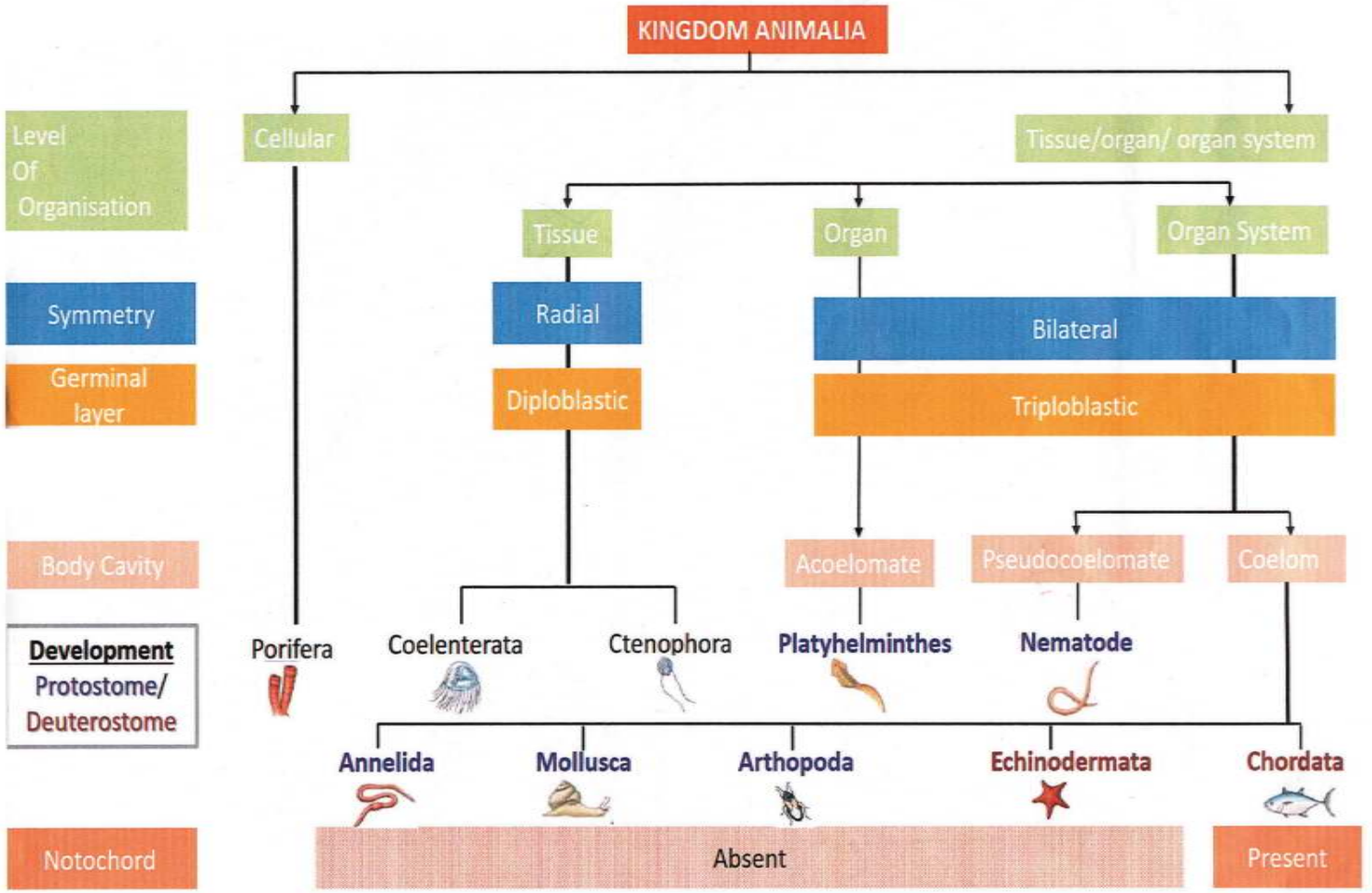
6. **Notochord :**
   - Rod-like structure formed during embryonic development on the dorsal side. It is mesodermally derived *e.g.,* Chordates.
   - Non-chordates do not have notochord .*e.g.,* porifera to echinoderms.

Phylum Porifera :

- Also called sponges.
- Are usually marine and asymmetrical.
- Have cellular level of organisation and diploblastic animals.
- Food gathering, respiratory exchange and removal of wastes occur through water canal system. Digestion intracellular.
- Ostia (minute pores on body), spongocoel (body cavity) and osculum help in water transport. They are lined by choanocytes (collar cells).
- *Body wall* has skeleton of spicules or spongin fibres.
- Animals are hermaphrodite. Fertilisation internal. Development is indirect (*i.e.,* has a larval stage distinct from adult stage) *e.g.,* ***Sycon, Euspongia. Spongilla*** (Fresh water sponge)

Phylum Coelenterata :

- Also called Cnidarians.
- Are usually marine and radially symmetrical.
- Sessile or free swimming.
- Have tissue level of organisation.


KINGDOM ANIMALIA
Level Of Organisation
Cellular
Tissue/organ/ organ system
Tissue
Organ
Organ System
Symmetry
Radial
Bilateral
Germinal layer
Diploblastic
Triploblastic
Body Cavity
Acoelomate
Pseudocoelomate
Coelom
Development
Protostome/
Deuterostome
Porifera
Coelenterata
Ctenophora
Platyhelminthes
Nematode
Annelida
Mollusca
Arthopoda
Echinodermata
Chordata
Notochord
Absent
Present

- Are diploblastic (with mesogloea)
- Capture of prey, anchorage and defence occurs through cnidoblasts/cnidocytes (have stinging capsules nematocytes) present on tentacles.
- Digestion extracellular and intracellular.
- Have a central gastro-vascular cavity and an opening, hypostome.
- Body wall of some composed of calcium carbonate. e.g. corals.
- exhibit two body forms : polyp and medusa *e.g.,* ***Hydra, Aurelia.***
- Alternation of generation between body forms called **metagenesis** ocurs in ***Obelia*** where :

Medusa (free swimming & umbrella shaped) $\underset{\text{Asexually}}{\overset{\text{sexually}}{\rightleftharpoons}}$ Polyp. (Sessile and cylindrical)

- *e.g.,* ***Physalia, Adamsia, Pennatula, Gorgonia,Meandrina.***

Phylum Ctenophora :

- Also called as sea walnuts or comb jellies.
- Are exclusively marine, radially symmetrical.
- Have tissue level organisation, are diploblastic.
- Digestion both extra and intracellular.
- Body has eight external rows of ciliated comb plates for locomotion.
- Show Bioluminescence (Property of living organisms to emit light).
- Hermaphrodite (sexes are not separate).
- Only sexual reproduction occurs. Exernal fertilization. Indirect development.
  e.g., ***Ctenoplana, Pleurobrachia.***

Phylum Plathyhelminthes :

- Also called as 'flat worms'.
- Have dorsoventrally flattened body. Are mostly endoparasites in animals.
- Are bilaterally symmetrical, triploblastic, acoelomate,with organ level of orgnisation.
- Absorb nutrients through body surface.
- Parasitic forms have hooks and suckers.
- 'Flame cells' help in osmoregulation and excretion.
- Sexes not separate.

- Fertilisation internal. Many larval stages present. ***Planaria*** has high regeneration capacity. *e.g.,* ***Taenia, Fasciola.***

Phylum Aschelminthes :

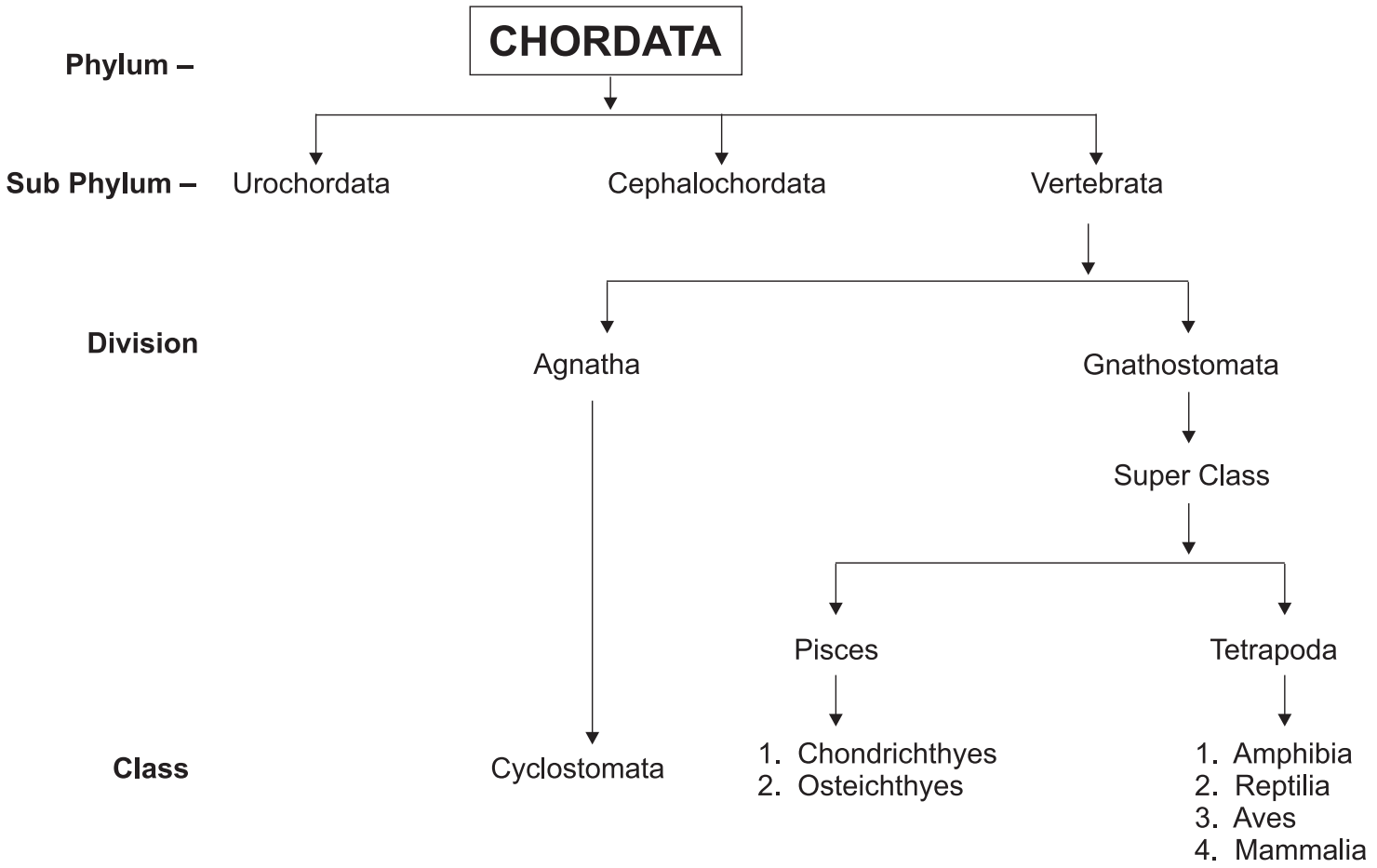
- Also called 'round worms'.
- May be free living, parasitic, aquatic or terrestrial.
- Are bilaterally symmetrical, triploblastic, pseudocoelomate.
- Alimentary canal complete (has muscular pharynx), wastes removed through excretory pore.
- Sexes separate. (dioecious)
- Females longer than males.
- Fertilisation internal. Development direct or indirect. *e.g.,* ***Ascaris, Wuchereria, Ancylostoma.***

Phyum Annelida :

- Are aquatic or terrestrial, free-living or parasitic.
- Are bilaterally symmetrical, triploblastic, organ-system level of organisation and metamerically segmented body.
- Are coelomate animals.
- Have longitudinal and circular muscles for locomation.
- Have closed circulatory system.
- ***Nereis*** (dioecious and aquatic annelid) has lateral appendages called parapodia for swimming.
- Have nephridia for osmoregulation and excretion.
- Neural system consists of paired gangila connected by lateral nerves to a double ventral nerve cord.
- Reproduction is sexual.
- *e.g.,* Earthworm (*Pheretima*) and Leech (*Hirudinaria*) which are hermaph rodites **(*i.e.,* monoecious)**.

Phylum Arthropoda :

- Largest phylum of Animalia.
- Are bilaterally symmetrical, triplobastic, segmented externally and organ system level of organisation, coelomate.
- Body divisible into head, thorax, abdomen and has a chitinous exoskeleton. Jointed appendages are present.
- Respiration by gills, book gills, book lungs or tracheal system. Excretion


Phylum –
CHORDATA
Sub Phylum –
Urochordata
Cephalochordata
Vertebrata
Division
Agnatha
Gnathostomata
Super Class
Pisces
Tetrapoda
Class
Cyclostomata
1. Chondrichthyes
2. Osteichthyes
1. Amphibia
2. Reptilia
3. Aves
4. Mammalia

through **malpighian tubules**.

- Sensory organs : Antennae, eyes; Organs of balance : ***Statocysts.***
- Fertilisation usually internal. Development is indirect or direct. Are mostly oviparous.

  e.g., ***Apis, Bombyx, Laccifer, Anopheles, Culex, Aedes, Locusta, Limulus.***

Phulum Mollusca :

- Second largest phylum of Animalia.
- Terrestrial or aquatic
- Are bilaterally symmetrical, triplobastic and organ system level of organisation, coelomate.
- Body divisible into ***head, muscular foot*** **and** ***visceral hump*** and is covered by calcareous shell and is unsegmented.
- ***Mantle*** : Soft and spongy layer of skin; *Mantle cavity* : Space between visceral hump and mantle.
- Respiration and excretion by feather like gills in mantle cavity.
- Head has sensory tentacles. Radula a rasping organ for feeding in mouth.
- Are oviparous, dioecious, have indirect development.

  e.g., ***Plia, Pinctada, Octopus, Sepia, Loligo, Aplysia, Dentalium, Chaetopleura.***

Phylum Echinodermata :

- Are spiny bodied organisms with endoskeleton of calcareous ossicles.
- Are exclusively marine, **radially symmetrical** in **adult** but **bilaterally symmetrical in larval stage.** Organ system level of organisation.
- Triploblastic and coelomate.
- Digestive system complete. Mouth ventral, Anus on dorsal side.
- Food gathering, respiration, locomotion carried out by ***water vascular system.***
- Excretory system is absent.
- Reproduction–sexual, sexes are separate.
- Fertilisation external. Development indirect (free swimming larva)
- *e.g.,* ***Asterias, Cucumaria, Antedon, Echinus, ophiura.***

Phylum Hemichordata :

- Represents small group of worm-like organisms.
- Was earlier placed as sub-phylum of Phyum Chordata.
- Bilaterally symmetrical, triploblastic and coelomate with organ system level

of organisation.

- Body cylindrical, has proboscis, collar and trunk.
- Circulatory System–open.
- Respiration by gills, excretion by proboscis gland.
- Sexes separate, external fertilisation, indirect development.

e.g, ***Balanoglossus, Saccoglossus.***

Phylum Chordata :

- Presence of ***Notochord.***
- Have **dorsal hollow nerve cord.**
- Have **paired pharyngeal gill slits.**
- Bilaterally symmetrical, triploblastic, coelomate, organ system level of organisation.
- Heart is ventral.
- Post anal tail present, closed circulatory system.

(i) Sub-Phyla Urochordata /Tunicata

- Notocohord present only in larval tail.

e.g., ***Ascidia, Salpa, Doliolum***

(ii) Sub-phyla Cephalochordata

- Notochord extends from head to tail (Persistent)

e.g., ***Amphioxus.***

(iii) Sub-Phyla Vertebrata

- Have notochord only during embryonic period.
- Notochord gets replaced by bony or cartilaginous vertebral column.
- Have ventral muscular heart, kidneys for excretion and osmoregulation, paired appendages (fins or limbs)

Vertebrata have two Division :

(a) Agnatha (Lacks Jaw) : Class : Cyclostomata

- Live as ectoparasites on some fishes.
- Have sucking and circular mouth without jaws.
- Have 6-15 paris of gill slits for respiration.
- No scales, no paired fins.
- Cranium and vertebral column is cartilagenous.
- Marine, Migrate to fresh water for spawning and die after spawning.

- Larva returns to ocean after metamorphosis.

  e.g., ***Petromyzon, Myxine***

(b) Gnathostomata (Bear Jaws)–divides into two super classes :

Super-class : Pisces

1. Class : Chondrichthyes :

- Have cartilagenous endoskeleton, are marine with streamlined body.
- Mouth ventral.
- Gill slits without operculum (gill cover).
- Skin has placoid scales; jaws–very powerful.
- No air bladder, so swim constantly to avoid sinking.
- Teeth are backwardly directed, modified placoid scales.
- Notochord is persistent throughout life.
- Two chambered heart; poikilotherms (cold-blooded)
- Sexes separate; males have ***claspers*** on pelvic fins.
- Internal fertilisation; viviparous.

  e.g., **Torpedo, Trygon, Scoliodon, *Pristis, Carcharodon***

2. Class : Osteichthyes

- Have bony endoskeleton, Aquatic
- Mouth is usually terminal. Body-Streamlined
- Four pairs of gill slits covered by operculum, heart two chambered, cold blooded.
- Skin has cycloid/ctenoid scales.
- Have air bladder which regulates buoyancy.
- Sexes separate.
- Usually oviparous, fertilisation external.
- Development direct.
- *e.g.,* ***Hippocampus, Labeo, Catla, Betla, Clarias, Exocoetus***

Sub-Phylum Vertebrata : Gnathostomata

Super Class : Tetrapoda

1. Class : Amphibia

- Can live in aquatic as well as terrestrial habitats.
- Body divisible into head and trunk, paired limbs.
- Skin moist. No scales.

- Tympanum represents ear. Eyes have eyelids.
- Cloaca is the common chamber where alimentary canal, urinary and reproductive tracts open.
- Respiration by gills, lungs or skin.
- Heart is 3-chambered; cold-blooded; Sexes separate; fertilisation external.
- Oviparous. Indirect development.
- *e.g.,* ***Bufo, Rana, Hyla, Salamandra, Ichthyophis***

2. Class : Reptilia

- Creep or crawl to locomote. Mostly terrestrial.
- Body has dry and cornified skin and epideremal ***scales or scutes.***
- Tympanum represents ear.
- Limbs, when present, are two pairs
- Snakes and lizards shed scales as ***skin cast***.
- Heart 3-chambered but 4-chambered in crocodiles.
- Sexes Separate; fertilisation internal.
- Oviparous. Direct development.
- *e.g.,* ***Testudo, Naja, Vipera, Calotes, Crocodilus, Hemidactylus***

3. Class : Aves

- Presence of feathers except flightless birds and beak (modified jaws) without teeth.
- Forelimbs are modified into wings.
- Hind limbs have scales, modified for walking, swimmng or clasping.
- Skin is dry as no glands on skin except oil gland at base of tail.
- Endoskeleton bony with air cavities (pneumatic) and hollow bones to assist in flight.
- Crop and Gizzard—Additional chamber in digestive tract.
- Air sacs are connected to lungs to supplement respiration.
- Warm blooded (homoiothermous), Heart–Four chambered.
- Sexes separate, fertilization internal
- Oviparous. Direct development.
- *e.g.,* ***Columba, Struthio, Pavo, Corvus, Neophron, Pstittacula, Aptenodytes.***

4. Class : Mammalia

- Have mammary glands to nourish young ones.
- Have two pairs of limbs, adapted to perform special work.
- Skin has hairs.

- External ears or, pinna present.
- Different types of teeth in jaw.
- Homoiothermous; Heart–Four chambered, Lungs for respiration.
- Sexes are separate, fertilisation internal.
- Viviparous. Direct development.
- *e.g.,* ***Rattus, Canis, Elephas, Equus.*** Oviparous mammal is ***Ornithorhynchus.***

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which of the following organisms exhibit cellular level of organisation
   (a) Sycon (b) Hydra
   (c) Obelia (d) Ganyaulax
2. In which of the following organism the indirect development does not occur
   (a) Cockroach (b) Saw-fish
   (c) Tapeworm (d) Starfish
3. What are the characteristic features of the skin of the members belonging to class amphibia?
   (a) Skin is dry cornified and have scales
   (b) The skin is dry without scales
   (c) Skin is moist and is without scales
   (d) The skin is with scales but moist

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. What is mesogloea ? Where is it found.
5. When is the development of an organism called as 'Indirect' ?
6. Why are corals important ?
7. Name the arthropod which is a (i) Living fossil, (ii) Gregarious pest.
8. Which organ helps in excretion in (i) Arthropods, (ii) Hemichordates ?
9. Why the segmentation in flatworms referred as pseudo-segmentations?

Short Answer Questions-I (2 marks each)

10. Distinguish between poikilothermous and homoiothermous organisms.
11. Define metagenesis with a suitable example.
12. List the characteristic features of class Mammalia.
13. How will you distinguish between male and female round worms?
14. How the water vascular system of echinoderms is different from porifearans?

Short Answer Questions-II (3 marks each)

15. What is the difference between organisms on the basis of the coelom ? Give examples for each.
16. What are the feature of class Aves which help them in flying ?
17. Write any three adaptations observed in Aves.

Long Answer Questions (5 marks each)

19. Distinguish between the chordates and non-chordates.
20. Differentiate between class Chondrichthyes and class Osteichthyes.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (a) *Sycon* 2. (b) Saw-fish
3. (c) Skin is moist and is without scales

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Undifferentiated layer present between ectoderm and endoderm. It is found in Coelenterates.
5. Have a larval stage morphologically distinct from adult.
6. Have skeleton composed of calcium carbonatge which gets deposited and can lead to formation of land forms, *e.g.,* Lakshadweep (a coral island).
7. (*i*) ***Limulus*** (King crab), (ii) ***Locusta*** (Locust)
8. (*i*) Malpighian tubules, (ii) Proboscis gland.
9. Refer to point to remember on page 34.

Short Answers-I (2 marks each)

10. **Poikilothermous** (cold blooded); Lack ability to regulate their body temperature.
Homoiothermous (Warm) : Can regulate body temperature.

11. Refer 'Points to Remember' on page 36.

12. Refer 'Points to Remember' on page 42, 43.

13. Refer 'Points to Remember' on page 37.

14. Refer page no 50 and 54, NCERT, Text book of Biology class XI.

Short Answers-II (3 marks each)

15. Refer 'Points to Remember" on page 34.

16. Refer 'Points to Remember, NCERT, Text Book of Biology for Class XI.

17. Wings, bones long and hollow with air cavities, air sacs connected to lungs to supplement respiration.

18. Refer to point to remember on page 36.

Long Answers (5 marks each)

19. Refer Table 4.1, page 55, NCERT, Text Book of Biology for Class XI.

20. Refer 'Points to Remember' on page 41.

21. **Based Questions**

Case 1: Coral reefs are very beautiful, brightly colored backgrounds for serene snorkelling experiences. The lovely colors in corals come from a marine alga referred to as zooxanthellae, which stayinner them. These algae do photosynthesis for the corals in order that the corals get power to develop and reproduce. When corals get environmental stresses like warmness or pollutants, they react via way of means of expelling those algae, leaving a ghostly, obvious skeleton behind. This is understood as 'coral bleaching'. Without zooxanthellae most corals starve and might die. At least 1/4 of the sector's marine life desires coral reels round the sector are disappearing fast. Water pollutants, overfishing and coastal improvement are taking their tool on coral reefs. At international level, carbon pollutants are warming our oceans and inflicting corals releases carbon pollutants into the air, that is heating our planet and warming our oceans. If we keep to polluting the air and the ocean with carbon emissions at our excessive rate, coral reefs round the sector will face a catastrophic future in coming decades in our lifetime.

1. To which of the following phylum coral reefs belong?

   (a) Echinodermata (b) Platyhelminthes

   (c) Cnidaria (d) Porifera

Ans.: (c)

2. Corals are made by deposition of

   (a) Endoskeleton made up of silica

   (b) Exoskeleton made of protein fibre

   (c) Exoskeleton made up of calcium carbonate

   (d) Endoskeleton made up of protein fibres

Ans.: (c)

3. Which one of the following could not be a possible reason for coral bleaching?

   (a) Water pollution

   (b) Carbon pollution

   (c) Soil pollution

   (d) Overfishing and coastal development

Ans. : (c)

4. Assertion : Coral reefs are very beautiful, brightly coloured backgrounds for serene snorkelling experiences

   Reason: A marine algae zooxanthellae live inside them and do photosynthesis

   (a) Both assertion and reason are correct and reason is correct explanation of assertion

   (b) The assertion is incorrect, but the reason is correct

   (c) Both assertion and reason are incorrect

   (d) The assertion is correct, but the reason is incorrect

Ans.: (a)

Case II: In 2020, India has battled its worst locust outbreak in decades. The swarms of desert locusts, known for feeding on green leaves and caused extensive damage to vegetation.

Locust is a large, tropical grasshopper, with strong powers of flight and it migrates in vast swarms causing widespread crop loss. Locusts are not dangerous till the time they are individual hoppers/moths or small isolated groups of insects, in what is called the "solitary phase". When the locust population increases to huge numbers – the behavioural changes are induced by crowding and they ultimately transformed into a "gregarious" phase. Achieving gregarious phase, they start forming swarms. A single swarm contains up to forty to eighty million adults in one square km and these can

travel up to one hundred and fifty km in one day. Locusts are safe to eat insects. Throughout the world, in many cultures people consume insects and locusts are also considered a delicacy.

1. Locust belongs to which phyla of animal kingdom :
   (a) Insecta
   (b) Arthropoda
   (c) Mollusca
   (d) Cnidaria

Ans.: (b)

2. **Assertion :** Locust are gregarious pests
   Reason : A single swarm contains up to 40-80 million adults in one square km
   (a) Both assertion and reason are correct and reason is correct explanation of assertion
   (b) The assertion is incorrect, but the reason is correct
   (c) Both assertion and reason are incorrect
   (d) The assertion is correct, but the reason is incorrect

Ans.: (a)

3. Read the following statement

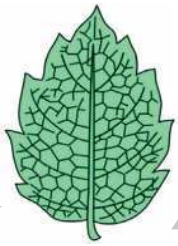
Statement I : The swarms of desert locusts, known for feeding on green leaves and caused extensive damage to vegetation

Statement II : Locust are not always dangerous and do not usually attack human
   (a) Only I if true
   (b) I and II are true
   (c) I is true but II is false
   (d) I is false but II is true

Ans. : (b)

4. Which of the following statement about locust is not true.
   (a) Locusts are not edible insects
   (b) Locust form swarm
   (c) Locust are not harmful in its solitary phase
   (d) Locust is a large, mainly tropical grasshopper

Ans. : (a)



Chapter - 5

Morphology of Flowering Plants

Points to Remember

Morphology : The study of various features, forms and relative position of different organs of the organism is known as morphology. It may be further divided into internal and external morphology. It deals with external forms like shape, size, colour, structure and relative position of different organs.

Anatomy : It deals with the study of internal structure exposed after dissection and opening of various parts of an organ.

Histology : The study of tissues, their composition and structure.

Adaptation : Any alteration in the structure or function of an organism or any of its part that results from natural selection and by which the organism becomes better fitted to survive and multiply in its environment.

The Root

The root is underground part of the plant and develops from elongation of radicle of the embryo.

Characteristics : It is inside the soil, chlorophyll is absent, absence of nodes, internodes, leaves and buds; positive geotropic and hydrotropic and negative phototropic.

Main functions of root system :

1. Absorption of water and minerals from the soil.
2. Provides anchorage to plant parts.
3. Stores reserve food material and synthesises plant growth regulators (cytokinins)

Various types of root

↓

Tap root	Fibrous root	Adventitious root
↓	↓	↓
Originates from radical Dicotyledonous plants, e.g., gram, pea, mango, mustard.	Originates from base of the stem Monocotyledonous plants, e.g., wheat, paddy, grasses.	Originates from parts of the plant other than radicle Banyan tree (Prop roots) Maize (stilt roots) Rhizophora (Respiratory roots)

Regions of Roots

Root Cap : The root is covered at the apex by the thimble-like structure which protect the tender apical part.

Region of meristematic activity : Cells of this region have the capability to divide; cells are small, thin walled with dense protoplasm.

Region of elongation : Cell of this region are elongated and enlarged. This region is responsible for the growth of root in length.

Region of Maturation : This region has differentiated and matured cells. Some epidermal cells form very fine and delicate thread like structures called root hairs.

Modifications of Root : Roots are modified for support, storage of food, respiration.

- **For support :** Prop roots in banyan tree, stilt roots in maize and sugarcane.
- **For respiration :** Pneumatophores in Rhizophora (Mangrove).
- **For storage of food :** Fusiform (radish), Napiform (turnip), Conical (carrot), Fasiculated fleshy roots (Asparagus).

The Stem

Stem is the aerial part of the plant and develops from plumule of the embryo. It bears nodes and internodes.

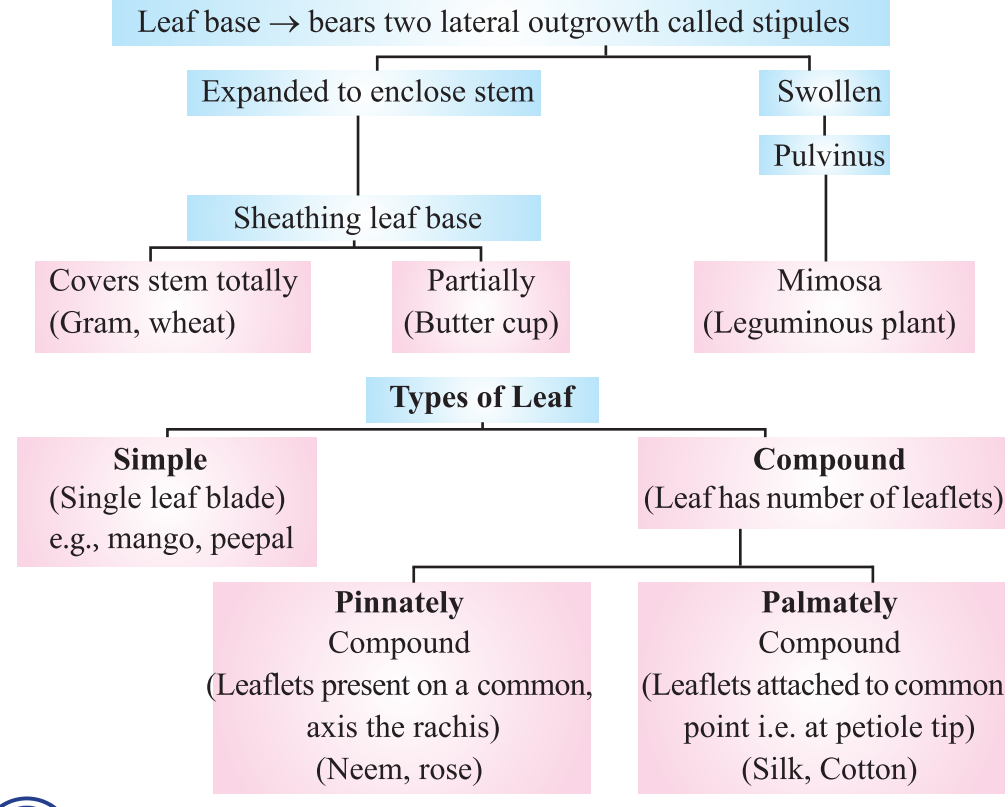
Functions of stem : Exposure of leaves, conduction of water and minerals, translocation of food, exposure of flowers and fruits.

Modifications of Stem :

In some plants the stems are modified to perform the function of storage of food, support, protection and vegetative propagation.

- **For food storage :** Rhizome (ginger, turmeric), Tuber (potato), Bulb (onion), Corm (Colocasia, Amorphophallus/Zamin-kand)
- **For support :** Stem tendrils of watermelon, grapevine, cucumber, pumpkins.
- **For protection :** Axilliary buds of stem of Citrus, Bougainvillea get modified into pointed thorns. They protect the plants from animals.
- **For vegetative propagation :** Underground stems of grass (runner), strawberry (stolons), lateral branches of mint and jasmine, Eichhornia (offsets).
- **For assimilation of food :** Flattened stem of *Opuntia* and cylindrical stem of *Euphorbia* contains chlorophyll and performs photosynthesis.

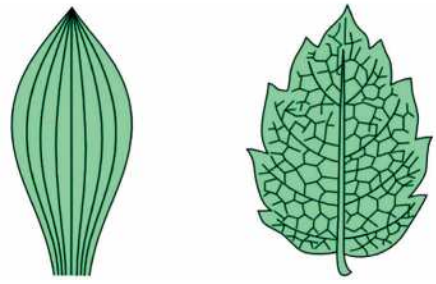
The Leaf : Develops from shoot apical meristem, flattened, green structure acropetally arranged manufacture the food by photosynthesis. It has bud in axil. A typical leaf has leaf base, petiole and lamina (leaf blade). In some leguminous plants the leaf base may become swollen which is called as pulvinus.



Venation : The arrangement of veins and veinlets in the lamina of leaf.

Types of Venation :

1. **Reticulate :** Veinlets form a network as in leaves of dicotyledonous plants (China rose, peepal).
2. **Parallel :** Veins are parallel to each other as in leaves of monocotyledonous plants (grass, maize,sugarcane).



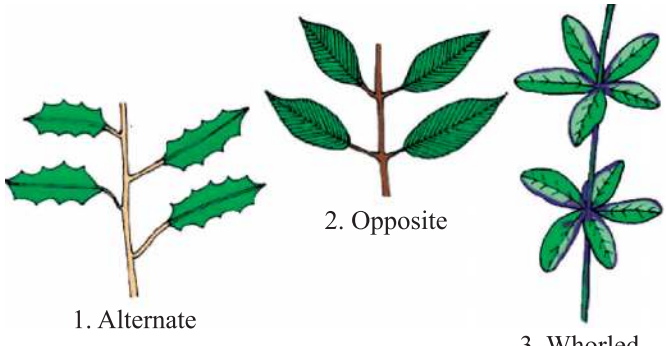
1. Reticulate 2. Parallel

Types of Venation

Phyllotaxy : The pattern of arrangement of leaves on the stem or branch.

Types of phyllotaxy

Alternate	Opposite	Whorled
(Single leaf at a node)in alternate manner e.g., China rose Mustard,	(Two leaves at a node) in opposite manner e.g., Calotropis, guava	(More than two leaves in a whorl at a node) e.g., Nerium, Alstonia



1. Alternate 2. Opposite 3. Whorled

Types of Phyllotaxy

Functions of Leaf

photosynthesis, gaseous exchange, transpiration.

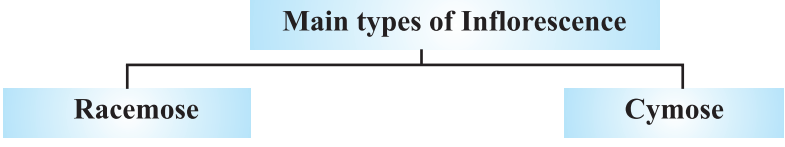
Modifications of Leaves :

Type		Function		Example
● Tendrils	:	(Climbing)	—	Sweet Pea, Pea
● Spines	:	(Protection)	—	Aloe, Opuntia, Argemone
● Pitcher	:	(Nutrition)	—	Nepenthes
● Hook	:	(Support)	—	Cat's nail
● Fleshy Leaves	:	(Storaged food)	—	Onion and Garlic

Inflorescene

The arrangement of flowers on the floral axis (Peduncle)

Main types of Inflorescence



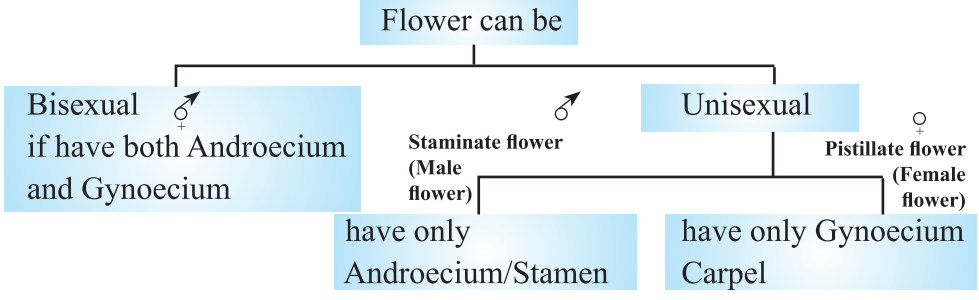
1. It is indefinite inflorescence
2. Main axis continues to grow and flowers borne in acropetal succession e.g. : Radish, Mustard, Amaranthus

1. It is definite inflorescence
2. Main axis terminates in flowers and the flowers borne in basipetal succession e.g. : Cotton, Jasmine, Calotropis

Mnemonic : RU = Racemose unlimited growth CL = Cymose limited growth

Special Inflorescence type— *Ficus, Salvia, Euphorbia,* Sunflower

Flower—Modified shoot meant for reproduction



On the basis of symmetry flower can be :

Actinomorphic ⊕ (Radial symmetry)	Zygomorphic % (Bilateral symmetry)	Asymmetric (Irregular)
Flower can be divided into two equal halves in any radial plane passing through centre eg : Mustard, Datura, Chilli	Flower can be divided into two similar halves only in one plane eg : Pea, bean, Gulmohar, Cassia	Flower cannot be divided in two similar halves by any vertical plane passing through centre eg : Canna

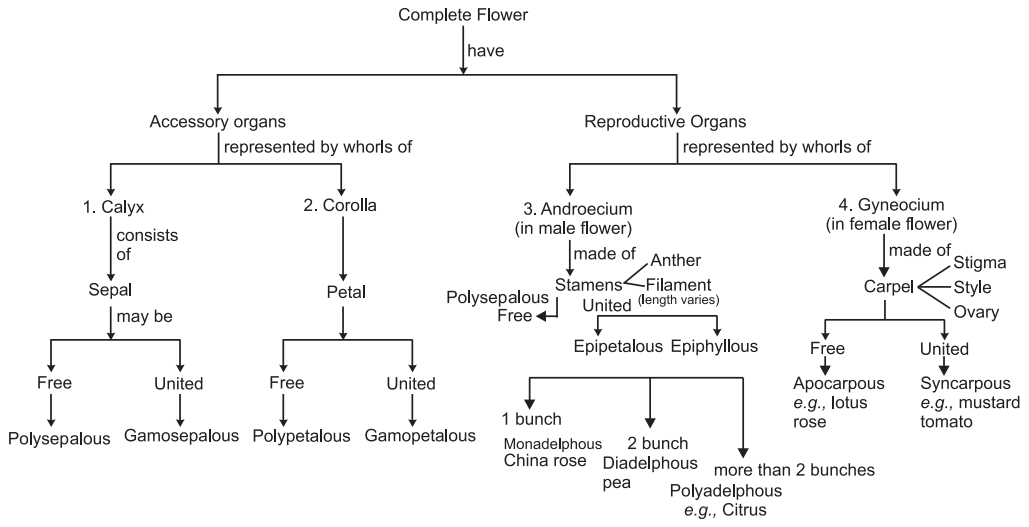
On the basis of floral appendages flower can be :

Trimerous (multiples of 3)	Tetramerous (multiples of 4)	Pentamerous (multiples of 5)

Thalamus/Receptacle : Swollen end of flower stalk (pedicel) which bears four whorls of flower viz., Calyx (K), Corolla (C), Androecium (A) and Gynoecium (G).

On the basis of position of Calyx, corolla and androecium with respect to ovary, flower can be:

Hypogynous (Superior Ovary)	Perigynous (Half inferior ovary)	Epigynous (inferior ovary)
$\underline{G}$ above, K, C, A Mustard, China rose, Brinjal	G at par/same level as K, C, A Plum, Rose, Peach	$\overline{G}$ below K, C, A Guava, Cucumber ray florets (sun flower)



Bract—Reduced leaf base found at the base of pedicel. Flowers with bracts are called bracteale and without bracts are called ebracteate.

Perianth : If calyx and corolla are not distinguishable, they are called perianth.

Example : Lily

Aestivation: The mode of arrangement of sepals or petals in floral bud.

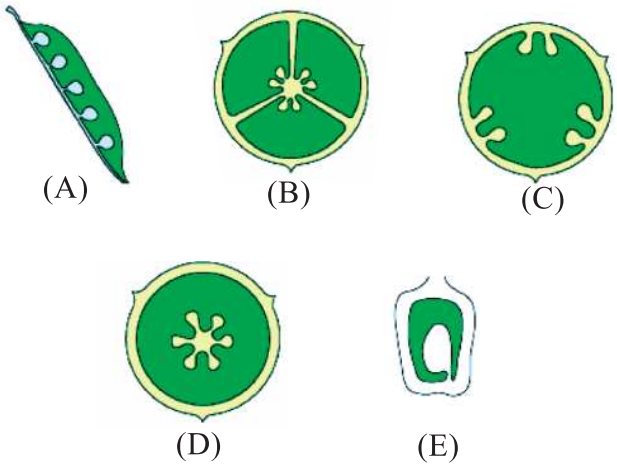
Types of aestivation :

1. **Valvate :** Sepals or petals just touch one another at the margin, without overlapping. e.g., Calotropis
2. **Twisted :** Sepals or petals overlap the next sepal or petal e.g., China rose, Cotton, ladyfinger.
3. **Imbricate :** The margins of sepals or petals overlap one another but not in any definite direction, e.g., Cassia, Gulmohar.
4. **Vexillary :** The largest petal (standard) overlaps the two lateral petals (wings) which in turn overlap two smallest anterior petals (keel) e.g., Bean, Pea.

Placentation : The arrangement of ovules within the ovary.

Types of Placentation :

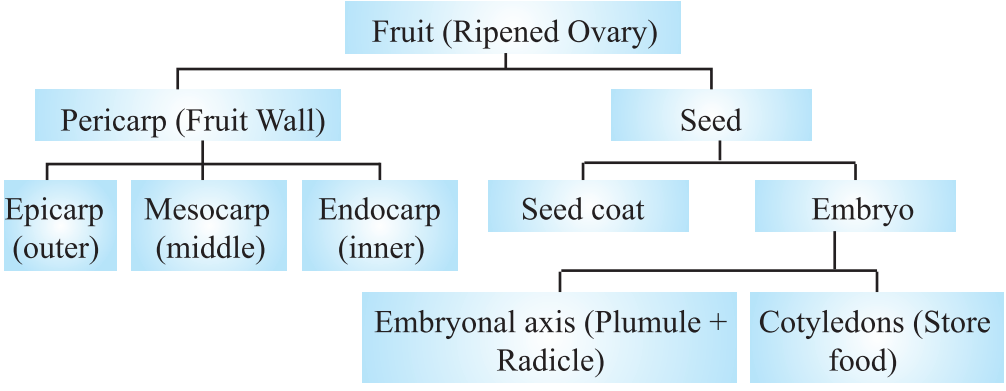
A. **Marginal :** Placenta forms a ridge along the ventral suture of ovary, e.g., Pea.
B. **Axile :** Margins of carpels fuse to form central axis, e.g., China rose, Tomato, Lemon
C. **Perietal :** Ovules develop on inner wall of ovary, e.g., Mustard, Argemone
D. **Free central :** Ovules borne on central axis, lacking septa, e.g., Dianthus, Primrose



E. Basal : Placenta develop at the base of ovary, e.g., Sunflower, Marigold

Placenta : Parenchymatous flattened cushion inside ovary where ovules are borne.

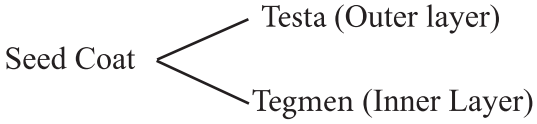
The fruit : After fertilisation, the mature ovary develops into fruit. The parthenocarpic fruits are formed from ovary without fertilisation (seedless fruit-Banana)

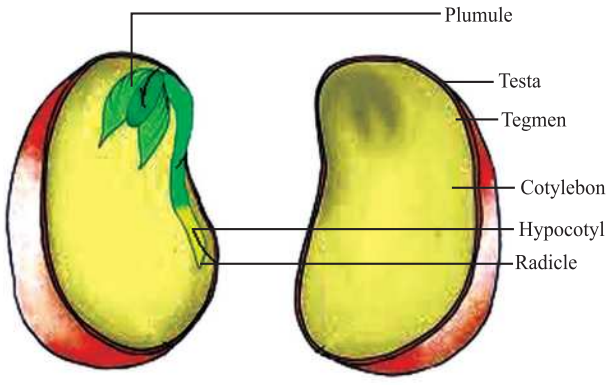


Monocotyledonous seed—Endosperm bulky and stores food, covered by proteinaceous Aleurone layer. Seed has single large cotyledon–scutellum.

Plumule is enclosed in Coleoptile and Radicle is enclosed in Coleorrhiza.

Dicotyledonous Seed—





Hilum —is a scar on the seed coat through which seeds attached to the fruit.
Micropyle—small pore, above hilum
Cotyledons—two; fleshy, full of reserve food materials
Embryonal axis—Radicle and plumule.

Endospermous seed—endosperm present in mature seed. eg. castor

Non-endospermous seed—endosperm not present in mature seeds, eg. bean,

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which part of Opuntia is modified to form spines?
   (a) Root (b) Leaf (c) Flower (d) Stem
2. Which group of plants given below, show pinnately compound leaves?
   (a) Silk Cotton, Maple (b) Tulip, Neem
   (c) Maple, Acacia (d) Neem, Rose, Acacia
3. Which parts in Ginger and Onion are edible respectively?
   (a) Corm & Tuber (b) Bulb & Tuber
   (c) Rhizome & Bulb (d) Corm & Rhizome

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Question (1 mark each)

4. In mangroves, pneumatophores are the modified adventitious roots. How are these roots helpful to the plant ?
5. Why do various plants have different type of phyllotaxy ?

6. State the main function of leaf tendril.
7. Which plant family represent the following floral formula :

$$\oplus \; \overset{\nearrow}{\underset{+}{\mathrm{O}}} \; \mathrm{K}_{(5)} \; \overline{\mathrm{C}_{(5)} \; \mathrm{A}_{5}} \; \underline{\mathrm{G}}_{(2)}$$

8. The endosperm is formed as a result of double fertilisation (triple fusion). What is its function ?
9. Which type of venation do you observe in dicot leaf ?
10. In pea flower, the aestivation in corolla is known as vexillary. Give reason.
11. What is the name given to the cotyledon in case of Monocots.
12. Name the part modified for food storage in the following (a) carrot (b) Radish (c) Potato (d) Dahlia (e) Turmeric (f) Sweet potato

Short Answer Questions-I (2 marks each)

13. Flower is a modified shoot Justify.
14. Name the type of root of the following :
    (a) Roots performing the function of photosynthesis.
    (b) Roots coming above the surface of the soil to absorb air.
    (c) The pillar like roots developed from lateral branches for providing mechanical support.
    (d) Roots coming out of the lower nodes of the stem to provide the support to the plant.
15. Identify the type of tendrils found in the following plants—
    (a) Cucumber (b) Pea (c) Grape vines (d) Water Melon
16. Fill up the blank spaces (a), (b), (c) and (d) in the table given below :

Type of flower	Position of calyx, corolla and respect of the ovary on thalamus	Type of ovary
Hypogynous	..... (a)	Superior
Perigynous	On the rim of the thalamus almost at the same level of ovary.	.....(b).....
..... (c)	..... (d)	Inferior

17. Provide the scientific terms for the following :
    (i) The leaf without a petiole (stalk).
    (ii) The flat and expanded portion of a leaf.
    (iii) Orderly arrangement of leaves on the node.
    (iv) Lateral appendages on either side of the leaf.

18. Differentiate between peduncle and Pedicel

Short Answer Question-II (3 marks each)

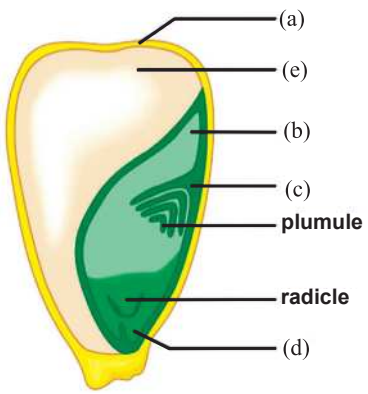
19. Observe the given figure showing various types of placentration. Identify the type of placentation. Give one example of each.

(a) (b) (c)

20. 'Potato is a stem and sweet potato is a root.' Justify the statement on the basis of external features.
21. Define aestivation. Which type of aestivation is found in China rose, Calotropis Gulmohar and Pea?
22. Give two example of each type of phyllotaxy.
23. Differentiate between :
    (a) Actinomorphic flower and Zygomorphic flower
    (b) Apocarpous ovary and Syncarpous ovary
    (c) Racemose inflorescence and Cymose inflorescence
24. Read & observe the following to answer the questions given below

    Seeds either may be monocotyledonous/dicotyledonous. They may vary in shape, size and period of viability.

    (i) In the given structure of a Monocotyledonous seed label the parts a, b, c,d,e. Give the function of part "a"



    (ii) Maize grain is usually called as a fruit and not a seed. Why ?

Long Answer Questions (5 marks each)

25. Describe various stem modifications associated with food storage, climbing and protection.

Assertion and Reason Based

Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A).

(b) If both (A) and (R) are true, but (R) is not the correct explanation of (A).

(c) If (A) is true but (R) is false.

(d) If both (A) and (R) are false.

26. Assertion: Underground parts of a plant are not always roots.
Reason: Underground stems of potato are modified to store food.

27. Assertion: Calyx can be gamosepalous or polysepalous
Reason: Corolla is composed of petals.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) Leaves
2. (d) Neem, Rose, Acacia
3. (c) Rhizome & Bulb

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Pneumatophores in mangroves help in respiration.
5. For proper exposure of leaves to get sunlight.
6. The leaf tendrils help the plant for climbing.
7. Solanaceae
8. Endosperm stores the food.
9. Reticulate venation.
10. In peas, there are five petals. The largest one (standard) overlaps the two lateral petals (wings) which in turn overlap the two smallest anterior petals (keel).
11. Scutellum.
12. (a) Fleshy tap root (b) Fleshy tap root (c) Stem tuber (d) root tuber (e) Rhizome (f) Fleshy root tuber

Short Answers-I (2 marks each)

13. The flower is considered to be a modified shoot because the internodes in flower are highly condensed and the appendages such as sepals, petals, stamens and carpels(pistil) are generally large in number.
14. (a) Assimilatory roots (b) Respiratory roots/Pneumatophores
    (c) Prop roots (d) Stilt roots
15. (a), (c) and (d) stem tendrils
    (b) leaf tendril
16. (a) Floral parts are situated below the ovary.
    (b) Half inferior
    (c) Epigynous
    (d) Floral parts are situated above the ovary.
17. (i) Sessile (ii) Lamina
    (iii) Phyllotaxy (iv) Stipules
18. **Peduncle** is the axis of inflorescence which generally bears a number of flowers.

    Pedicel is the stalk of the flower which bears a single flower.

Short Answers SA-II (3 marks each)

19. (a) Marginal placentation — Pea
    (b) Parietal placentation — Mustard, Argemone
    (c) Free central placentation — Dianthus, Primrose
20. Potato is the swollen tip of an underground stem branch. It has nodes (eyes) which consist of one or more buds subtended by a leaf scar. Adventitious roots also arise during sprouting. On the other hand sweet potato is a swollen adventitious root (tuberous root). It has no nodes, internodes and buds like a stem, but has root hairs.
21. The mode of arrangement of sepals or petals in a floral bud is known as aestivation.

    China rose – twisted Calotropis – valvate

    Gulmohar – imbricate Pea – vexillary

22.

Type of phyllotaxy	Examples
(i) Alternate	China rose, mustard
(ii) Opposite	Calotropis, guava
(iii) Whorled	Nerium, Alstonia

23. **(a)**

Actinomorphic Flower	Zygomorphic flower
(1) Two equal halves are formed by any vertical division passing through the centre.	(1) Two equal havles are produced only by one vertical division
(2) It has a radial symmetry.	(2) It has a bilateral symmetry.

(b)

Apocarpous Ovary	Syncarpous Ovary
(1) The flower has several free free carpels (ovary).	(1) The flower has fused carpels.
(2) On maturity it forms fruitlet of aggregate type.	(2) On maturity it forms a single fruit.

(c)

Racemose inflorescence	Cymose inflorescence
(1) The main axis has unlimited growth.	(1) The main axis has a limited growth.
(2) Flowers are arranged acropetally i.e., the lower flower are younger	(2) Flowers are arranged basipetally i.e., the lower flowers are older

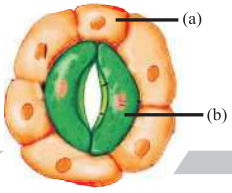
24. (i) (a) Endosperm (b) Scutellum
(c) Coleoptile (d) Coleorrhiza
(e) Aleurone layer
Function of (a)—Provide nutrition.

(ii) Maize grain is a single seeded fruit in which the seed covering or testa is fused with pericarp or fruit wall. A micropyle is not found but base of style is present.

Long Answers (5 marks each)

25. **Stem Modification :**
- **For food storage :** Ginger (Rhizome), Potato (Tuber), Onion (Bulb), Colocasia (Corm).
- **For climbing (support) :** Sterm tendril (cucumber,grapevine,watermelon)
- **For protection :** Thorn (Bougainvillea, Citrus, Duranta) Refer NCERT, Text Book of Biology for Class XI for description.

26. (b) 27. (b)



Chapter - 6

Anatomy of Flowering Plants

Points to Remember

Anatomy : Anatomy is the study of internal structure of organisms. Plant anatomy includes organisation and structure of tissues.

Tissue is a group of cells having a common origin and usually performing a common function.

There are two types of tissues (i) Meristematic (ii) Permanent

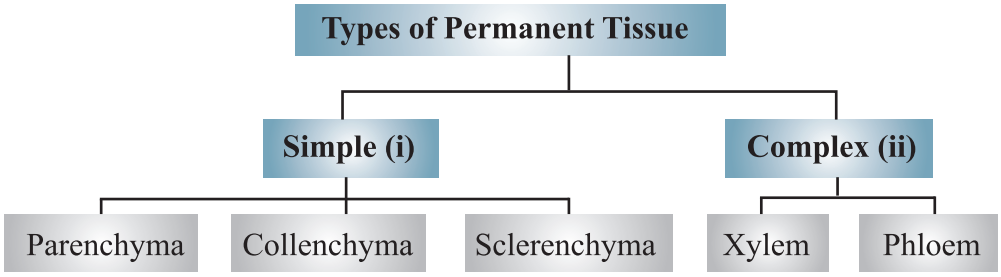
Meristematic tissues : The meristematic tissue is made up of the cells which have the capability to divide. Meristems in plants are restricted to specialised regions and responsible to the growth of plants.

Meristems

Apical meristem	Intercalary meristem	Lateral Meristem
• Occurs at the tips of roots and shoots	• Occurs between mature tissue	• Occurs in the mature region of roots and shoots
• Primary meristem	• Primary meristem	• Secondary meristem
• Increase the length of plant	• Occur in grasses and regenerate parts removed by grazers	• Appears later than primary meristem and responsible for secondary growth

Axillary bud : The buds which are present in the axils of leaves (Consist of cells left behind from shoot apical meristem) and are responsible for forming branches of flowers.

Permanent tissues : The permanent tissues are derived from meristematic tissue, are composed of cells, which have lost the ability to divide and have become structurally and functionally specialised.



Parenchyma : Living, thin walled isodiametric cells, with interceullar spaces, cell wall is made up of cellulose. It performs the functions like photosynthesis, storage, secretion.

Collenchyma : It is formed of living, closely packed cells. Its cells are thicknened at the corners due to depositon of celluose and pectin. It provide mechanical support to the growing parts of the plant. It is either found in homogenous layer or patches.

Sclerenchyma : It is formed of dead cells with thick and lignified walls. Provide mechanical support to organs. They have two types of cells : fibres and sclereids.

(a) Fibers—are thick walled,elongated and pointed cells.

(b) Sclereids—are spherical, oval or cylindrical, highly thickened dead cells with narrow lumen. Found in walls of nut, pulp of fruits like guava, seed coat of legumes and leaves of tea.

Xylem : Xylem consists of tracheids vessels, xylem fibres and xylem parenchyma. It conducts water and minerals from roots to other parts of plant.

(a) Tracheids—Tube like cells with thick and lignified walls and tapering ends; dead, without protoplasm.

(b) Vessel—long cylindrical structure made up of many cells with large central cavity, devoid of protoplasm. Present in angiosperms.

(c) Xylem fibres—highly thickened walls; with obliterated lumens; septate or aseptate.

(d) Xylem parenchyma—living and thin walled; cell walls made up cellulose, store food material in form of starch or fat.

Radial conduction of water takes place by ray parenchymatous cells

Protoxylem : The first formed primary xylem elements.

Metaxylem : The later formed primary xylem.

Endarch : Protoxylem lies towards the centre and metaxylem towards the periphery of the organ; in stem

Exarch : Protoxylem toward periphery and metaxylem towards centre; in roots.

Phloem : Phloem consists of sieve tube elements, companion cells, phloem fibres and phloem parenchyma; Phloem transports the food material from leaves to various parts of the plant.

(a) Sieve tube elements :

- long tube like structures arranged longitudinally.
- associated with companion cells.
- end walls are perforated to form sieve plates.
- functions of sieve tubes are controlled by the nucleus of companion cells.

(b) Companion cells

- Specialised parenchymatous cells associated with sieve tube elements
- Connected with sieve tube elements by pit fields present between their common longitudinal walls
- Help to maintain pressure gradient in sieve tubes.

(c) Phloem Parenchyma

- made up of elongated, tapering cylindrical cells with dense cytoplasm and nucleus.
- cell wall made of cellulose with pits through which plasmodesmatal connections exist between cells.
- store food material.

(d) Phloem fibers (bast fibers)

- are sclerenchymatous; absent in primary phloem but present in secondary phloem.
- elongated, unbranched pointed, needle like apices with thick cell walls.

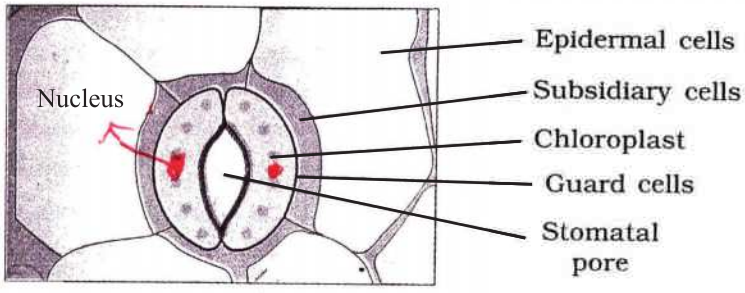
Protophloem : First formed phloem with narrow sieve tubes.

Metaphloem : Later formed phloem with bigger sieve tubes.

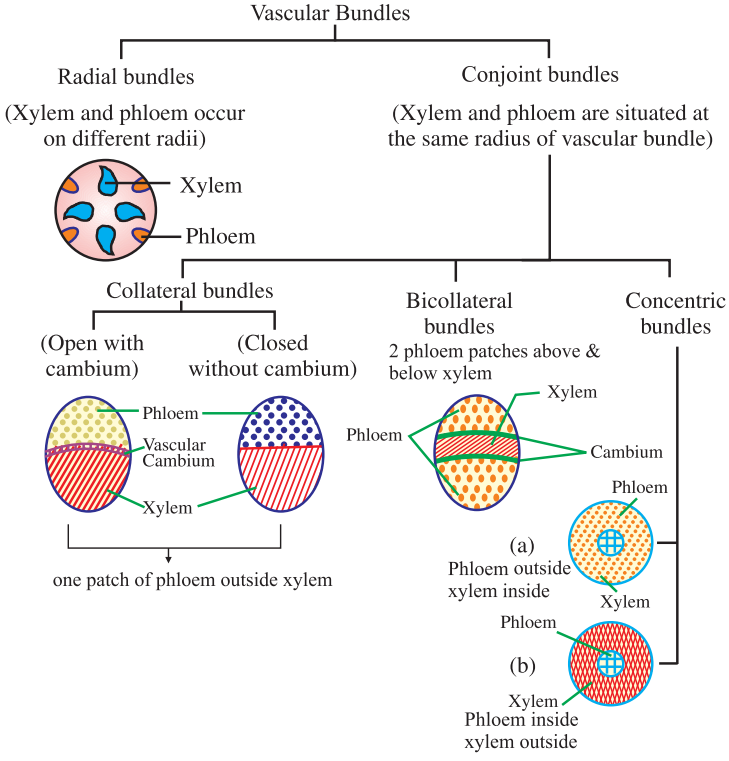
The Tissue System :

1. **Epidermal tissue system :** It includes:
   (a) Cuticle—Waxy thick layer outside epidermis, prevents the loss of water.
   (b) Epidermis : Outer most layer of primary plant body.
   (c) Epidermal hair : help in absorbing water and mineral from soil.
   (d) Trichomes : help in preventing water loss due to transpiration.
   (e) Stomata : Regulate process of transpiration and gaseous exchange.

Stomatal apparatus : The stomatal aperture, guard cells and surrounding subsidiary cells are together called stomatal apparatus.



2. **The ground tissue system :** It is made up of parenchyma, collenchyma, sclerenchyma. In dicot stems and both dicot and monocot roots the ground tissue is divided into hypodermis, cortex, endodermis, pericycle, medullary rays and pith.
3. **The vascular tissue system :** It includes vascular bundles which are made up of xylem and phloem.



Anatomy of Root

Dicot Root	Monocot Root
1. Cortex is comparatively narrow. 2. Endodermis is less thickened casparian strips are more prominent. 3. The xylem and phloem bundles varies from 2 to 5. 4. Pith is absent or very small. 5. Secondary growth takes place with the help of vascular cambium and cork cambium.	1. Cortex is very wide. 2. Endodermal cells are highly thickened casparian strips are visible only in young roots. 3. Xylem and phloem are more than 6 (polyarch). 4. Well developed pith is present. 5. Secondary growth is absent.

Casparian Strips—The tangential as well as radial walls of endodermal cells of dicot roots have deposition of, water impermeable, waxy material, suberin in the form of casparian strips.

Anatomy of Stem

Dicot Stem	Monocot Stem
1. The ground tissue is differentiated into cortex, endodermis, pericycle and pitch. 2. The vascular bundles are arranged in a ring. 3. Vascular bundles are open, without bundle sheath and wedge-shaped outline. 4. The stem shows secondary growth due to presence of cambium between xylem and phloem.	1. The ground tissue is made up of similar cells. 2. The vascular bundles are scattered throughout the ground tissue. 3. Vascular bundles are closed, surrounded by sclerenchymatous bundle sheath, oval or rounded in shape. 4. Secondary growth is absent.

Secondary growth dicot stem—An increase in the girth (diameter) in plants, vascular cambium and cork cambium (lateral meristems) are involved in secondary growth.

1. Formation of cambial ring : Intrafascicular cambium + interfascicular cambium.
2. Formation of secondary xylem and secondary phloem from cambial ring.
3. Formation of spring wood and autumn wood.
4. Development of cork cambium(phellogen)

Cork Cambium (Phellogen) — Cork (phellem) – From outer cells
Sec. cortex (phelloderm) – from inner cells

(Phellogen + Phellem + Phelloderm) = Periderm

Secondary growth in dicot roots : Secondary growth in dicot roots occur with the activity of secondary meristems (vascular cambium). This cambium is produced in the stele and cortex, and results in increasing the girth of dicot roots.

Anatomy of Leaf

Dorsiverntral (Dicot) Leaf	Isobilateral (monocot) Leaf
1. Stomata are absent or less abundant on the upper side.	1. The stomtata are equally distributed on both sides.
2. Mesophyll is differentiated into two parts upper palisade parenchyma and lower spongy parenchyma.	2. Mesophyll is undifferentiated.
3. Bundle sheath is single layered and formed of colourless cells.	3. Bundle sheath may be single or double layered.
4. Hypodermis of the mid-rib region, is collenchymatous.	4. Hypodermis of the mid-rib region is sclerenchymatous.
5. Stomata have kidney shaped guard cells.	5. Stomata have dumb bell shaped guard cells.

Spring Wood	Autumn Wood
1. Also called early wood.	1. Also called late wood
2. Cambium is active	2. Cambium less active
3. Xylary elements more	3. Xylary elements less
4. Vessels with wide cavities	4. Vessels narrow
5. Light in colour, low density	5. Dark, high denisty

Heartwood	Sapwood
1. Central or innermost region of stem which is hard, durable and resistant to attack of microorganisms and insects.	1. Peripheral region stem, light in colour
2. Not involved in conduction of water, gives mechanical support to stem	2. Involved in conduction of water and mineral

Lenticels—Produced when phellogen cuts off parchymatous cells on outer side. These cells rupture the epidermis forming lens shaped opening called lenticels.

Function—Permit exchange of gases.

Bulliform Cells—Large, empty, colourless adaxial cells with vein in leaves which maintain turgidity of leaves.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Name the tissue represented by the jute fibers used for making ropes.
   (a) Parenchyma (b) Meristematic
   (c) Sclerenchyma (d) Aerenchyma
2. Which kind of wood is called early wood?
   (a) Spring wood (b) Autumn wood
   (c) Late wood (d) Delicate wood
3. Open vascular bundle is made of
   (a) Xylem & phloem (b) Xylem, cambium & phloem
   (c) Phloem only (d) Xylem only

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Question (1 mark each)

4. State the role of pith in stem.
5. Where are bulliform cells found in leaves ?
6. Why are xylem and phloem called complex tissues ?
7. Which meristem is responsible for longitudinal growth in plants ?

8. What forms' the cambial ring in a dicot stem during the secondary growth?
9. Name the anatomical layer in the root from which the lateral branches of root originate.
10. Which tissue of the leaf contains chloroplast ?
11. A plant tissue when stained, showed the presence of hemicellulose and pectin in cell wall of its cells. Name the tissue.
12. Write the function of phloem parenchyma.
13. Name the cells which make the leaves curl in plants during water stress.
14. Give the function of lenticels.
15. The vascular bundles are surrounded by a thick layer of cells in leaves. What is the name of cells ?
16. Mention the signfiicance of casparian strips. Where do you find them ?
17. Give the function of companion cells.

Short Answer Questions (SA-I) (2 marks each)

18. Why is cambium considered to be lateral meristem ?
19. Give any four differences between tracheids and vessels.
20. How are open vascular bundles differ from closed vascular bundles ?
21. What are trichomes ? State their functions.
22. Given below are the various types of tissue and their functions. Which out of these is not a matching pair and why;

(a) Collenchyma :	provides mechanical support to the growing parts of plant.
(b) Sclerenchyma :	photosynthesis, storage and secretion.
(c) Chlorenchyma :	perform the function of photosynthesis
(d) Xylem :	conduction of water and minerals.

23. In which part of the plant you would see the following :

(a) Radial vascular bundle (b) Well developed pith

Short Answer Question (SA-II) (3 marks each)

24. Give the points of difference between lenticels and stomata.
25. Even being a monocotyledonous plant the Palm increases in girth. Why and how does it take place ?

26. Differentiate between endarch and exarch conditions.
27. If you are provided with microscopic preparation of transverse section of a meristemic tissue and permanent tissue, how would you distinguish them ?
28. Differentiate between aerenchyma and collenchyma on the basis of their structure and function.
29. Are there any tissue elements in phloem which are comparable to those of xylem ? Explain.
30. **Case Based**

Read and observe the following to answer questions given

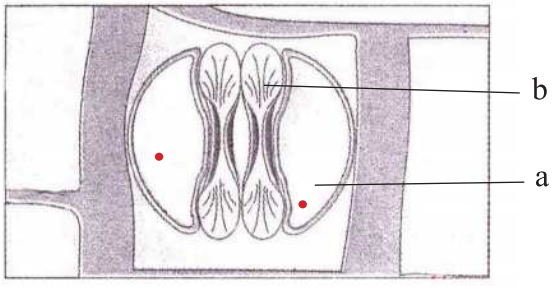
Stomata are present in the epidermis of leaves, to regulate transpirationo also are responsible for gas exchage. The can be dumb bell or kidney shaped stomatal appratus is made of stomatal aperature, guard cells and surrounding subsidiary cells.

Observe the figure and answer the following questions :

(i) Name parts (a) and (b).

(ii) Are these types of stomata observed in monocot or in dicot plants ?

(iii) Which parts shown in figure constitute the stomatal apparatus ?



Long Answer Questions (5 marks each)

31. (i) What are meristems ?

(ii) Name the various kinds of meristems in plants.

(iii) State the location and functions of meristems.

Assertion and Reason Based

DIRECTIONS: In the following questions, a statement of assertion(A) is followed by a statement of the reason(R). mark the correct choice as :

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A).

(b) If both (A) and R are true, but (R(is not the correct explanation of (A).

(c) If (A) is true but (R) is false.

(d) If both (A) and (R) are false.

32. Assertion : Apical meristem of the root is subterminal.
Reason : At the terminal end of the root, the root cap is present.
33. Assertion : Aerenchyma helps to maintain buoyancy in hydrophyte plants.
Reason : The large air chambers are present in aerenchyma.
34. Assertion : A simple tissue is made of a single type of cells.
Reason : Various simple tissues are parenchyma, collenchyma and sclerenchyma.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (c) Sclerenchyma 2. (a) Springwood
3. (b) Xylem combium & phloem

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Pith stores the food material.
5. Bulliform cells are found in the upper epidermis of monocot leaves.
6. As they are made up of more than one kind of cells.
7. Primary meristem.
8. Fascicular and intrafascicular strips of meristem.
9. Pericycle of mature zone.
10. Mesophyll tissue.
11. Collenchyma.
12. Lateral conduction of food and supply of water from xylem.
13. Bulliform or motor cells.
14. Permit exchange of gases.
15. Bundle sheath cells.
16. Casparian strips are found in endodermis and make them water impermeable.
17. Maintain pressure gradient in sieve tubes.

Short Answers (SA-I) (2 marks each)

18. The cambium is considered as a lateral meristem because it occurs along the lateral sides of the stem and roots and appears later than primary meristem. Cells of this meristem divide periodically and increase the thickness of the plant body.

19.

Tracheid	Vessels
1. A tracheid is formed from a single cell.	1. A vessel is made of a number of cells.
2. The ends are oblique or tapering.	2. The ends are rounded and transverse.
3. They are comparatively narrower.	3. They are comparatively wider
4. The lumen is narrower.	4. The lumen is wide.
5. Septa remain intact	5. Septa lacking

20. **Open Vascular bundles :** These vascular bundles contain a strip of cambium in between phloem and xylem. Open vascular bundles are collateral and bicollateral.

    Closed Vascular bundles : Intrafascicular cambium is absent. Closed vascular bundles can be collateral or concentric.

21. Trichomes are multicellular epidermal hairs on the stem, seeds or fruits. Trichomes help in protection, dispersal of fruits and seeds and reduction in water loss.

22. (b) Sclerenchyma : photosynthesis, storage and secretion is not a matching pair. The function of sclerenchyma is to provide mechanical support to organs.

23. (a) Root (b) Monocot root

Short Answers (SA-II) (3 marks each)

24. **Lenticels :** Opening that are found in old stems and roots in the cork tissues containing a number of complimentary cells and they are permanently opened pores.

    Stomata : Opening that are found in leaves and young stems in the epidermis and have two guard cells. They open and close in response to turgidity of their guard cells.

25. Palms possess residual meristem below their leaf primordial, which adds ground parenchyma and vascular bundles. The ground parenchyma can also undergo further divisions even after the completion of elongation.

26.

Endarch condition	Exarch condition
1. Protoxylem towards pith and metaxylem towards periphery 2. Found in Stem	1. Protoxylem towards periphery and metaxylem towards pith 2. Found in root.

27. **Meristematic tissues** are composed of cells that have the capability to divide. These cells exist in different shapes without intercellular space. Cells are thin walled, rich in protoplasm, without vacuoles.

Permanent tissues are derived from meristematic tissue and are composed of cells with definite shape, size and function. These cells may be thin walled (living) or thick walled (dead).

28.

Aerenchyma	Collenchyma
(a) Parenchymatous tissue containing large air space. (b) Thin walled cells, isodiametric in in shape with intercellular space. (c) Provides buoyancy to the plant.	(a) Tissue contains deposits of cellulose and large pectin at the corner of cells. (b) Consists of oval and polygonal cells without intercellular space. (c) Provides elasticity and mechanical strength.

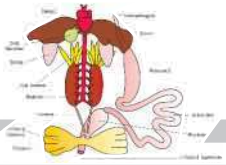
29. (a) The sieve elements of phloem is comparable to the vessel of the xylem because both lack nucleus.
(b) Pholem fibre is similar to the xylem fibre because both provide tensile strength to the tissue.
(c) Phloem parenchyma and xylem parenchyma is the living components of phloem and xylem respectively.

30. (i) a : epidermal cell b : guard cell
(ii) In monocot plants.
(iii) The stomatal apparatus includes the stomatal aperture, guard cells and the surrounding subsidiary cells.

Long Answers (5 mark each)

31. (i), (ii) and (iii) : Refer 'Points to remember'

32. (a) 33. (c) 34. (b)



Chapter - 7

Structural Organisation

Points to Remember

Types of Fundamental Animal Tissues

S.No.	Type	Location	Functions
1.	Epithelial Tissues	Free Surfaces	Protection, Secretion, Excretion, Absorption, Sensory and reproduction
2.	Connective Tissues	All internal, organs in between other tissues, below skin and nervous system.	Holding or binding, support, transport and circulation, protection and storage.
3.	Muscular Tissues	Inside movable parts	Movement and locomotion
4.	Nervous Tissues	Central Nervous System & every organ Peripheral Nervous System.	Communication and control

Animal Tissues

Epithelial | Connective | Muscular | Neural

Epithelial Tissue

(A) Simple : ● Composed of single layer of cells.

● Functions as lining for body cavities, ducts and tubes.

1. Squamous
   - ● single thin layer of flattened cells.
   - ● found in walls of blood vessels, air sacs of lungs.
2. Cuboidal
   - ● single layer of cube like cells.

- found in ducts of glands and tubular parts of nephron.

3. Columnar
   - single layer of tall and slender cells.
   - free surface may have microvilli.
   - found in lining of stomach and intestine
4. Ciliated
   - columnar or cubolidal cells with cilia.
   - move particles or mucus in specific direction, in bronchioles, fallopian tubes.

- Made up of more than one layer of cells.
- Provide protection against chemical and mechanical stresses.
- Cover dry surface of skin, moist cavity, pharynx, inner lining of ducts of salivary glands and pancreatic ducts.

Glandular epithelium

Exocrine glands	**Endocrine glands**
• secrete mucus, saliva, oil, milk digestive enzymes	• secrete hormones.
• products released through ducts.	• secrete directly into the fluid bathing the gland.

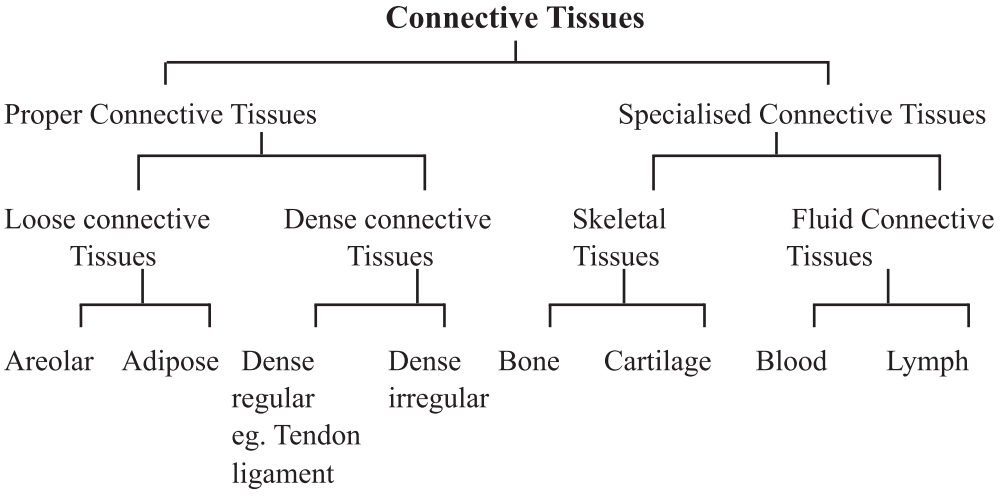
(B) Compound :

Cell junctions—In nearly all animal tissues, specialised junction provide structural and functional links between its individual cells.

Three Types of Cell junctions—

1. **Tight junctions :** Plasma membranes of adjacent cells are fused at intervals. They help to stop substances from leaking across a tissue.
2. **Adhering junctions :** Perform cementing function to keep neighbouring cells together.
3. **Gap junction :** Facilitate the cells to communicate with each other by connecting the cytoplasm of adjoining cells for rapid transfer of ions, small molecules and sometimes big molecules.

Connective tissue : Link and support other tissues/organs of the body.



Loose Connective Tissue

(has cells and fibres loosely arranged in semi-fluid ground substance)

(i) Areolar Tissue :

- present beneath the skin.
- contains fibroblasts, macrophages and mast cells.
- serves as a support framework for epithelium

(ii) Adipose Tissue :

- located beneath the skin.
- cells are specialised to store fats.

Dense Connective Tissue

Fibres and fibroblasts are compactly packed.

(i) Dense Regular

- Collagen fibres present in rows.
- Tendons attach skeletal muscle to bone.
- Ligaments attach bone to bone.

(ii) Dense Irregular

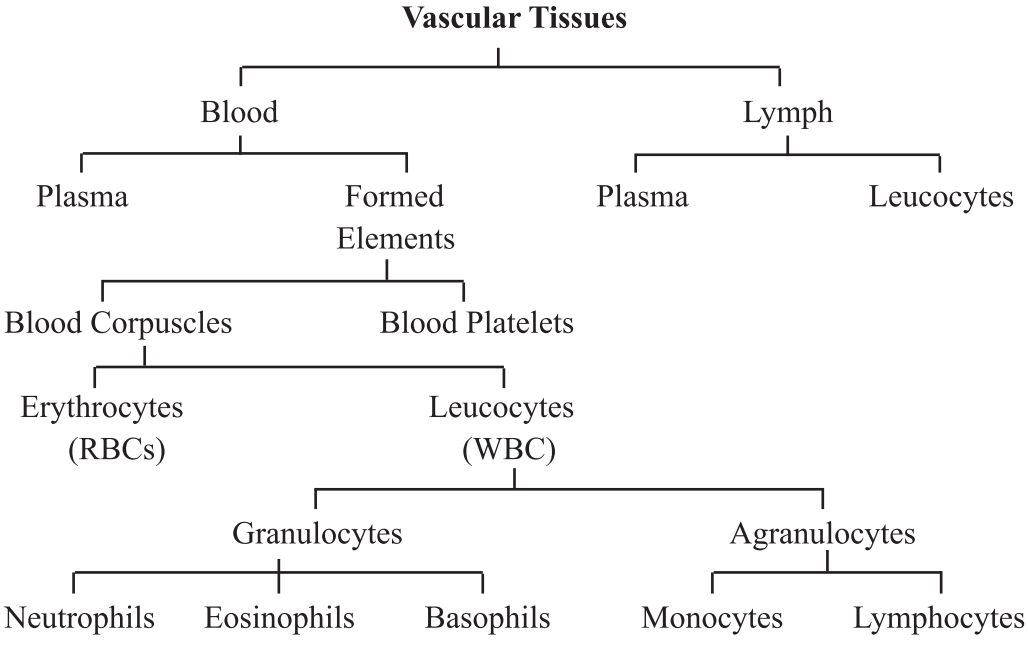
- Has collagen fibres and fibroblasts oriented differently.
- This tissue is present in the skin.

Specialised Connective Tissues

(i) Cartilage : made up of chondrocytes and collagen fibres; inter cellular material is solid and resists compression. Present in tip of nose outer ear joints, etc.

(ii) Bones : Ground substance is rich in calcium salts, collagen fibres and Osteocytes are present in lacunae. Bones support and protect softer tissues and organs. They interact with skeletal muscles to bring about movements. Bone marrow in some bones is the site of blood cell formation.

(iii) Blood : Fluid connective tissue, consists of plasma and blood cells.



MUSCULAR TISSUES

(long, contractile cells called fibres, bring about movement and locomotion)

Skeletal Muscle	Smooth Muscle	Cardiac Muscle
• Striated	• Non-striated	• Striated with intercalated disc for communication
• Closely attached to sekeletal bones.	• Forms wall of Internal Organs like blood vessels stomach, intestine	• Occurs in heart only
• long cylindrical multinucleated fibres	• Spindle like uninucleated fibres.	• Short cyclindrical uninucleated fibres

Neural Tissues

- Neurons are the functional unit and are excitable cells.
- Neurogila cells make up more than half the volume of neural tissue.

They protect and support neurons.

Cockroach— *Periplaneta americana* (Phylum-Arthropoda, Class-Insecta)

Habitat : Cockroach is a terrestrial, nocturnal, ominivorous, unisexual, oviparous insect. Body convered by a chitinous, hard exoskeleton of hard plates called sclerites.

Morphology :

Head : Triangular, formed by fusion of 6 segments. Bears a pair of antennae, compound eyes. Mouth parts consists of labrum (upper lip), a pair of mandibles, a pair of maxillae,labium (lower lip), hypopharynx (acts as tongue).

Thorax : 3 segments; prothorax, mesothorax and metathorax.

Bears 2 pairs of wings :

Forewings : tegmina (mesothoracic).

Hindwings : transparent, membranous (metathoracic)

3 pairs of legs in thoracic segments. (one pair in each thoracic segment.)

Abdomen : 10 segments. Bears a pair of long, segmented **anal cerci** in both sexes and a pair of short, unjoined **anal styles** in males only 7th segment is boat shaped.

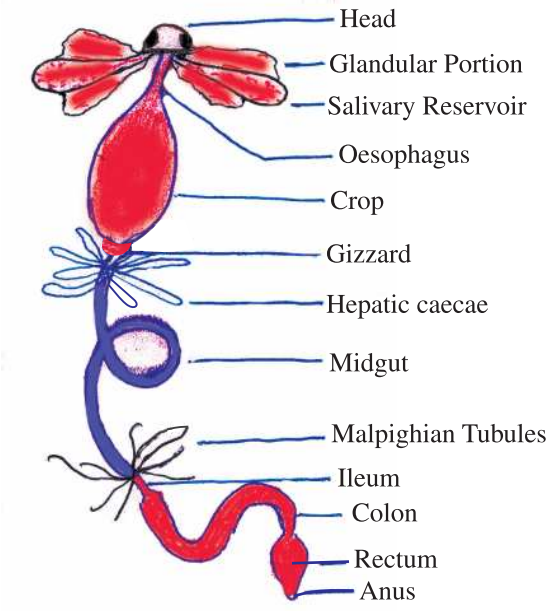
Also has anus and genital aperture at the hind end. Genital aperture surrouonded by external genitalia called **gonapophysis or phallomere.**

Male Cockroach	Female Cockroach
1. Abdomen long and narrow	1. Abdomen short and broad
2. All nine sterna visible	2. Seven sterna visible. (7th sternum fused with 8th and 9th sterna)
3. Anal style present	3. Anal style absent

Anatomy : Study of the morphology of internal organs.

Alimentary canal : Divided into foregut, midgut and hindgut.

Mouth → Pharynx → Oesophagus → Crop (stores food) → Gizzard (grinding of food) → Hepatic caecae (at junction of fore and midgut; secretes digestive juice) → Hindgut (ileum, colon, rectum) → Anus.



Alimentary Canal of Cockroach

Female reproductive system :

A pair of ovaries (with 8 ovarian tubules) → Oviduct → Genital chamber. Sperms transferred through spermatophores female produces 9–10 Ootheca. Fertilised eggs encased in capsules called oothecae (contains 14-16 eggs on an average) development of *P. americana* paurometabolous incompleted metamorphosis). Nymph grows by moulting 13 times to reach adult form.

Interaction with man

- Destroy food and contaminate it. (Pest)
- Can transmit a variety of bacterial diseases (Vector).

Blood vascular system : Open type, visceral organs bathed in haemolymph (colourless plasma and haemocytes).

Heart consists of enlongated muscular tube and differentiated into funnel shaped chambers with ostia on either side. Blood from sinuses enters heart through ostia and is pumped anteriorly to sinuses again. Blood is colourless (haemolymph).

Repiratory system : Network of trachea which open through 10 pairs of spiracles. Spiracles regulated by sphincters. Oxygen delivered directly to cells.

Excretion and osmoregulation : By malpighian tubules; uricotelic (Uric acid as excretory proudct).

Nervous system : Consists of series of fused segmentally arranged ganglia joined by paired longitudinally connectives on the ventral side. Three ganglia in thorax, six in abdomen. Brain represented by supra-oesophageal ganglion. Each eye consist s of 200 hexagonal ommatidia.

Reproductive system :

Male reproductive system : Pair of testes (4th-6th segments) → vas deferens → ejaculatory duct → male gonophore.

Glands–Seminal vesicle (stores sperms), mushroom shaped gland (6th-7th segment).

Frog : *Rana tigrina* (Class : Amphibia)

Cold blooded or poikilotherms. Camouflage with surrounding, undergo summer sleep (aestivation) and winter sleep (hibernation).

Morphology

The body is divided into head and trunk.

Head : A pair of nostrils above mouth is present, bulged eyes covered with nictitating membrane (protect eye in water), membranous tympanum on either side of eyes.

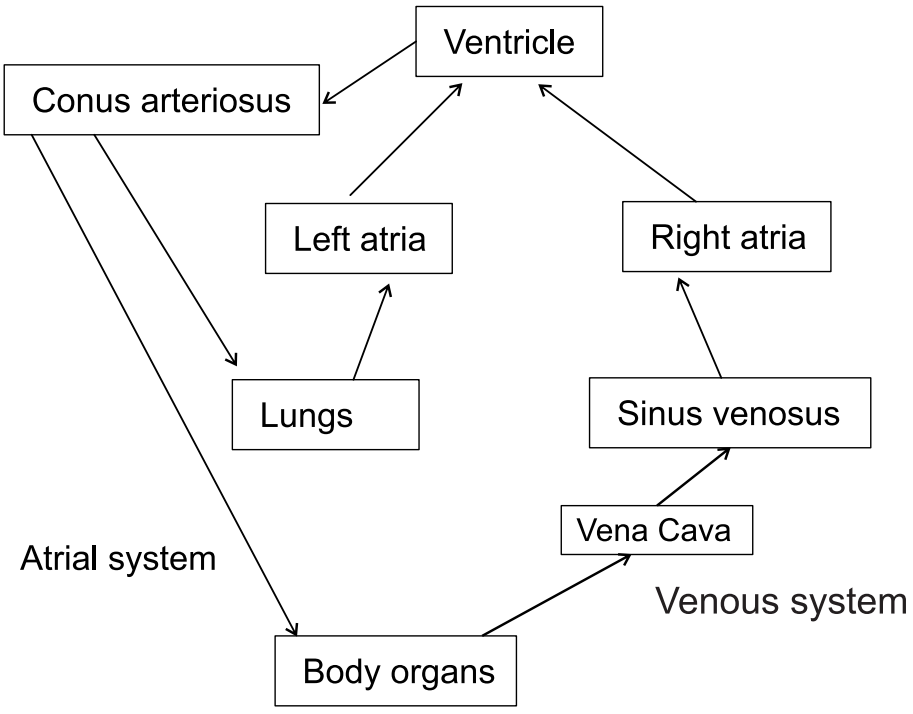
Trunk : Hind legs are large and muscular than forelimb and end in five digits, Forelimb end in four digits.

Male frog	Female frog
Vocal sac present	No vocal sac present
Copulatory pad on the first digit of forelimb	No copulatory pad present

Anatomy

Digestive system : Mouth → buccal cavity → pharynx → esophagus → stomach → intestine → rectum → rectum opens into cloaca

Stomach secreted HCl and digestive juices for digestion and convert food into chyme. Duodenum receives chyme from stomach, Pancreatic juice (from pancreas) and bile (from gall bladder) through common bile duct that help in digestion. Final digestion and absorption (through microvilli) take place in small intestine.



Respiratory system : Frogs respire both on land and in water.

In Water : through skin via diffusion (cutaneous)

On Land : Air → Nostrils → Buccal cavity → Lungs (A pair of elongated pink colored sac like structure)

Blood vascular system : Closed type, Heart three chambered (two atria and one ventricle covered with pericardium), blood contains plasma and cells (nucleated RBC with hemoglobin, WBC and platelets)

Hepatic and renal portal system exists along with lymphatic system. Hepatic portal system = venous connection between liver and intestine. (venous connection between kidney and lower body part)

Excretion and osmoregulation : Ureotelic

Excretory waste though blood reaches to a pair of kidney, then to cloaca via two ureters and finally reaches urinary bladder (stores urine) Urine is released via cloacal aperture.

Control and coordination

Chemical coordination

Achieved through hormones secreted by endocrine glands e.g., endocrine glands found in frog are pituitary, thyroid, parathyroid, thymus, pineal body, pancreatic islets, adrenals and gonads.

Nervous coordination

Nervous system : consists of central nervous system (Brain and spinal cord), peripheral nervous system (cranial and spinal nerves) and autonomic nervous system (sympathetic and parasympathetic).

Brain : Enclosed in brain box (cranium), divided into fore-brain, mid-brain and hind brain. 10 cranial nerves arise from brain.

Forebrain includes olfactory lobes, paired cerebral hemispheres and unpaired diencephalon.

Midbrain is characterised by a pair of optic lobes.

Hind-brain consists of cerebellum and medulla oblongata. The medulla oblongata passes out through the foramen magnum and continues into spinal cord, which is enclosed in the vertebral column.

Sense organ : different types of sense organs, namely organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears) present.

Reproductive system :

Male reproductive system : A pair of yellowish ovoid testes → Vasa efferentia (10-12 in number) → Enters into kidneys on their side → Open into Bidder's canal → Urinogenital duct → Cloaca

Female reproductive system : A pair of ovaries → A pair of oviduct → Cloaca

A mature female can lay 2500 to 3000 ova (eggs) at time. Fertilisation is external and takes place in water. Development involves a larval stage called tadpole. Development is indirect as tadpole undergoes metamorphosis to form the adult.

Benefits of frog for mankind :

- They eat insects and protect the crop.
- Maintain ecological balance because these serve as an important link of food chain and food web in the ecosystem.
- In some countries the muscular legs of frog are used as food by man.

Questions

(SRT) Select Response Type Questions (1 mark each)

1. Name the tissue which contains Haversian canals.
   (a) Epithelial tissue (b) Areolar tissue
   (c) Cartitilage (d) Mammalian Bone
2. Mention any two properties of nervous tissue.
   (a) Excitability & conductivity (b) contraction & relaxation
   (c) lining & packaging (d) Excitablity & movement
3. Name the large cells present in adipose tissue.
   (a) Adipocytes (b) Mast cells
   (c) Collagen (d) Fibroblasts

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. Name the cells responsible for clotting of blood.
5. What are exocrine glands ?
6. Differentiate between tendon and ligament.
7. Where are RBC's formed ?
8. A muscular fiber having no striations and tapers at both ends. Name it.
9. Mention the site,where sclerite is present in cockroach.
10. Name the mouth part of cockroach which is comparable to our tongue.
11. "Sexual dimorphism is found in cockroach". Explain the statement.

Short Answer Questions–I (2 marks each)

12. What is the function of ciliated epithelium ? Where do we find this epithelium ?

13. What are the two types of fibres of connective tissues ? Distinguish between the two.
14. To which tissue do the following belong to :
    (a) Osteocytes (b) Chondrocytes
    (c) Neuroglia (d) Intercalated discs
15. Give the location of hepatic caecae in cockroach ? What is their function ?
16. Name the locomotory appendages of cockroach on the basis of external morphology.
17. Differentiate between Male and Female frog.

Short Answer Questions–II (3 marks each)

18. Differentiate between skeletal and smooth muscles.
19. Differentiate between male and female cockroach on the basis of external morphology.
20. (a) What is open circulatory system ?
    (b) Explain the respiratory system of cockroach.
21. (a) Give the common name of *Periplaneta americana* & *Rana tigrina*
    (b) How many spermathecae found in cockroach ?
    (c) What is the position of ovaries in cockroach ?
    (d) How many segments are present in the abdomen of cockroach ?
    (e) Where do you find malpighian tubules ?
    (f) What is mosaic vision ?
22. Name the different cell junctions found in tissues.
23. Mention the special features of eye in cockroach.
24. Write the appropriate type of tissue in column B accounting to the functions mentioned is column A.

	Column A	Column B
a.	Linking and supporting frame work	.....
b.	Protective covering	.....
c.	Secretion and absorption	.....

25. Diagrammatically represent the blood flow pathway in frog.
26. Explain the mechanism of respiration in frog.
27. What are the benefits of frog for mankind?
28. Neatly draw the labelled diagram of male reproductive system of frog.
29. Why frogs are not seen during peak summer and winters?

Long Answer Questions (5 marks each)

30. (a) What is compound epithelium ? What are their main function ?
    (b) Where do we find areolar tissue ?
    (c) How is adhering junction different from gap junction ?
31. Make a neat and well labelled diagram showing alimentary canal of cockroach.
32. Assign a term for following :
    (a) Animal that secretes urea
    (b) Winter sleep.
    (c) Camouflaging with environment.
    (d) Summer sleep.
    (e) the process that tadpole undergoes to become adult.
    (f) A small, median chamber passes faecal matter, urine and sperms to the exterior in frog.

Case Based/Source Based

Read and observe the following, to answer the questions given below

The common Indian frog leads and amphibious life. It can live both on land and water. Female frogs always lay 2500-3000 eggs in water, the fertilization is external. They are cold blooded animals, with a three chambered heart.

Direction in the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A).
(b) If both (A) and (R) are true, but (R) is not the correct explanation of (A).
(c) If (A) is true but (R) is false.
(d) If both (A) and (R) are false.

33. Assertion: Frog is a ureotelic animal.
    Reason: Frog excretes urea.
34. Assertion: Eyes of frog are covered with nictitating membrane
    Reason: On either side of the eyes, the membranous tympanum receives sound signals.

Answers

(SRT) Select Response Type Questions (1 mark each)

1. (d) Mammalian bone.
2. (a) Excitability and conductivity.
3. (a) Adipocytes.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Blood platelets.
5. Glands which discharge their secretions into ducts.
6.

Tendon	**Ligament**
Attach skeletal muscles to bones	Attach bone to bone

7. Bone narrow
8. Smooth or non striated muscle fibre.
9. In the exoskeleton all over the body.
10. Hypopharynx
11. Male and female cockroaches show morphological differences.

Short Answers–I (2 marks each)

12. Refer 'Points to Remember'.
13. White and yellow fibres. White fibres are thin, unbranched, inelastic, occur in bundles and formed of protein collagen. Yellow fibres are thick, straight, elastic, branched, occuring singly, formed of protein elastin.
14. (a) Bone tissue (b) Cartilage
    (c) Neural tissue (d) Cardiac muscle
15. Refer 'Points to Remember'.

16. Three pairs of legs and two pairs of wings.
17. Refer 'Points to Remember'.

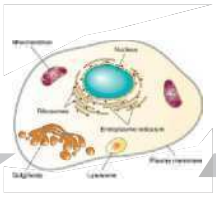
Short Answers-II (3 marks each)

18. Refer 'Points to Remember'.
19. Refer 'Points to Remember'.
20. Refer 'Points to Remember'.
21. (a) American Cockroach & Frog
    (b) One pair, present in 6th segment.
    (c) Between 2nd and 6th abdominal terga.
    (d) 10 segments.
    (e) At the beginning of ileum in cockroach.
    (f) Vision where several images of an object are formed by compound eye. Helps to detect movement of objects very efficiently.
22. (i) Gap junctions
    (ii) Tight junctions
    (iii) Adhering junctions
23. See text in NCERT at
    (i) Situated at dorsal surface of head.
    (ii) Each eye consists of about 2000 hexagon ommatidia.
    (iii) It can receive several images of an object.
    (iv) This kind of vision is known as mosaic vision.
    (v) It has high sensitivity but has less resolution.
24. (a) Connective tissues
    (b) Stratified epithelium
    (c) Columnar epithelium
25. Refers 'Points to Remember'.
26. Refers 'Points to Remember'.
27. Refers 'Points to Remember'.
28. Refer to NCERT

29. Frog are not seen during peak summer and winter. During this period, they take shelter in deep burrows to protect themselves from extreme heat and cold. This is known as summer sleep (aestivation) and winter sleep (hibernation) respectively.

Long Answers (5 marks each)

30. Refer 'Points to Remember'.
31. Refer NCERT Text Book of Biology class-XI.
32. A. Ureotelic, B. Hibernation, C. Mimicry, D. Aestivation, E. Metamorphosis, F. Cloaca.
33. (a)
34. (b)



Chapter - 8

Cell : The Unit of Life

Cell : The unit of life

Basic Unit of Life ← **CELL** → Two Types

- Prokaryotic → No nuclear membrane and no membrane bound cell organelles. Eg. bacteria
- Eukaryotic → With nuclear membrane and membrane bound cell organelles. Eg. human cell

Cell wall (plant cell)	**Cell Membrane**	**Cytoplarm**	**Nucleus**	**Vacuoles (Plant Cell)**
Outermost covering of plant cell, made up of cellulose	Made of phospholipid bilayer and proteins	Fluid present between Nucleus and Cell membrane	Consists of nucleoplasm and nuclear membrane	Store house of water, nutrients mineral salts, waste

Contains cell organelles

Endo membrane System	Mitochondria	Plastids	Ribosomes	Cytoskeleten	Cillia and Flegella	Centrosome Centriole
ER, golgi apparatus, lysosomes and vacuoles have co-ordinated function so form endo membrane system	Double membranous structure, produce energy in the form of ATP, divides by fission, has its own DNA and ribosomes	Found in plant cell & euglenoids contain pigments & classified as chloroplasts and chromoplasts leucoplasts has DNA & ribosomes	Granular structures, made of DNA and protein, acts as protein factories	Proteinaceous structures made of microtubule, microfilaments & intermediate filaments, provide mechanical support, motility and maintain shape of cell	Cilia are smaller hair like out growths and flagella are larger both help in locomotion	Form basal body of cilia and flagella, and spindle fibers during cell division of animal cells

- ER – Network of tiny tubular structures scattered in cytoplasm, which divide intracellular space into two compartments. They are of two types-SER and RER
- Golgibodies – Flat disc shaped sacs or cisternae, stacked parallel to each other, near nucleus.
- Lysosomes – Membrane bound vescicles formed by packaging in Golgi apparatus

Points to Remember

Cell Theory : Cell Theory was formulated by Schleiden and Schwann, and was modified by Rudolf Virchow. Cell theory states that :

(A) All living organisms are composed of cells and products of cells.

(B) All cells arise from pre-existing cells.

Cell : Cell is the structural and functional unit of life.

Prokaryotic Cell

- Generally small sized (1–10 μm)
- Well defined nucleus absent
- Membrane bound cell organelles absent
- DNA without histone protein e.g., Bacteria, Mycoplasma, Blue green Algae

Eukaryotic Cells

- Generally large sized (5–10 μm)
- Well defined nucleus present
- Membrane bounded cell organelles present
- DNA with histone protein e.g., Amoeba, *Euglena* and other higher organism

Gram Positive Bacteria

- Bacteria that take up gram Stain. e.g., *Bacillus*

Gram Negative Bacteria

- Bacteria do not take up gram stain e.g., *Escherichia coli*

PROKARYOTIC CELL :

Modification of cell envelope

- Cell envelope consists of tightly bound 3 layered structure – Outermost Glycocalyx followed by cell well and plasma membrane
- Glycocalyx in form of loose sheath, is called slime layer
- Glycocalyx in form of thick and tough sheath, is called capsule

- Mesosomes : Extension of plasma membrane. These can be in the form of vesicles, tubules and lamellae.

  Functions : Cell wall formation, DNA replication and distribution to daughter cells, respiration, secretion processes, to increase surface area of plasma membrane and enzyme content.
- Flagella : Extension from cell wall. It is composed of three structures – filament, hook and basal body. It help in motility of bacteria.
- Fimbriae and Pili : Surface structure of some bacteria which attaches them to rocks in streams; to host tissues, and conjugating partners respectively.

Genetic Material : It is not covered by nuclear envelope. In addition to the genomic DNA (the single chromosome/circular DNA), many bacteria have small circular self replicating, double stranded DNA which is called as plasmid, plasmid contain genes like antibiotic resistance.

Ribosomes : Associated with plasma membrane of prokaryatic cell, site of protein synthesis. Several ribosomes may attach to a single mRNA and form a chain called polyribosomes or polysomes. They translate mRNA into Proteins.

Inclusion Bodies : Stores reserve material, lie freely in cytoplasm not bound by any membrane. e.g. phosphate granules, cyanophycean granules and glycogen granules.

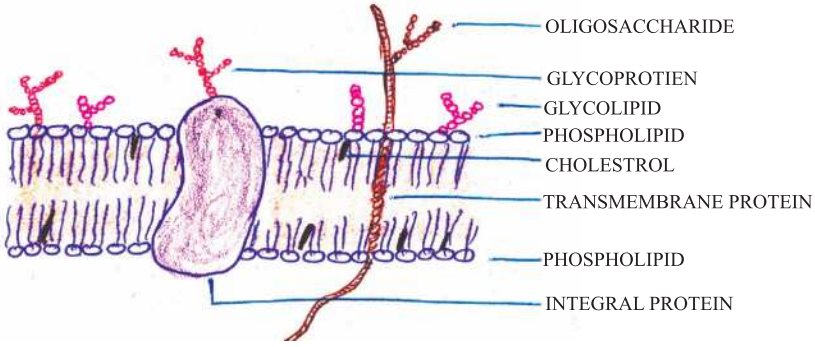
Eukaryotic cells

Possess an oragnized nucleus with nuclear envelope and have a variety of complex locomotory and cytoskeletal structures.

Cell Membrane — Singer and Nicolson (1972) gave 'fluid mosaic model'. According to this the quasi-fluid nature of lipid enables lateral movement of proteins within the overall bilayer; two types of proteins (Peripheral and integral proteins) with cholesterol, glycolipids and glycoporteins. Erythrocyte membrane has 52% protein and 40% lipids.

Function—It is selectively permeable and helps in transport of molecule across it.

Passive transport	Active transport
• Transport of molecules from higher to lower concentration.	• Transport of molecules from lower to higher concentration
• It does not utilise energy (ATP). e.g., diffusion	• It utilises energy (ATP) e.g., Na^+/K^+ ATPase Pump.



Fluid Mosaic Model of Plasma Membrane

Cell Wall is non-living rigid structure which gives shape to the cell and protects cell from mechanical damage and infection, helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.

Cell wall of algae is made of cellulose, galactans, mannans and minerals like calcium carbonate. Plant cell wall consists of cellulose, hemicellulose, pectins and proteins.

Middle lamella is made of calcium pectate which holds neighbouring cells together.

Plasmodesmata connect the cytoplasm of neighbouring cells.

Endoplasmic Reticulum (ER)

Consists of network of tiny tubular structure. ER divides the intracellular space into two distinct compartments–luminal (inside ER) and extra luminal (cytoplasm).

(i) Rough Endoplasmic Reticulum (RER) :

- Ribosomes attached to outer surface.

Function : ● Involved in protein synthesis and secretion.

(ii) Smooth Endoplasmic Reticulum (SER) : ● Lack ribosomes.

Function ● Site for synthesis of lipid.

Golgi apparatus : First observed by Camillo Golgi (in 1898)

Consist of cisternae stacked parallel to each other. Two faces of the organelle are convex/cis or forming face and concave/**trans** or maturing face but inter connected.

Functions : Performs packaging of materials, to be delivered either to the intra-cellular targets or secreted outside the cell. Important site of formation of glycoproteins and glycolipids.

Lysosomes :

Membrane bound vesicular structures formed by the process of packaging in the golgi apparatus. Contain hydrolysing enzymes (lipases, proteases, carbohydrases) which are optimally active at acidic pH. Also called 'Suicidal Bag'.

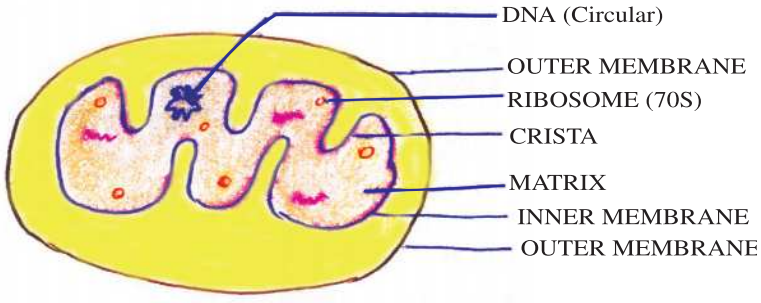
Function : Intracellular digestion.

Vacuoles : Membrane bound space found in the cytoplasm. Contain water, sap, excretory product, etc. In plant cell, vacoule occupies 90% of space.

Function : In plants **tonoplast** (single membrane of vacuole) faciliates transport of ions and other substances.

Contractile vacuole for excretion in ***Amoeba*** and food vacuoles formed in protists for digestion of food.

Mitochondria : Double membranous structure. Outer membrane smooth and inner membrane forms a number of infoldings called cristae The inner compartment is called matrix. The cristae increase the surface area.



Mitochondria

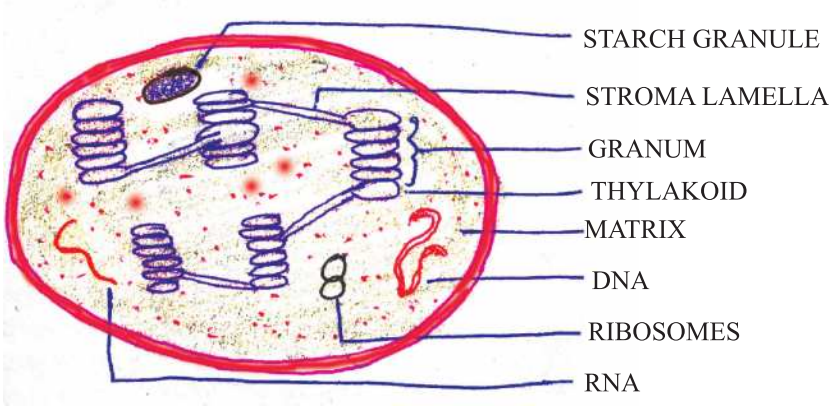
Function : Sites of aerobic respiration. Called 'power houses' of cell as produce cellular energy in the form of ATP. Matrix possesses single circular DNA molecule, a few RNA molecules, ribsomes (70S). It divides by binary fission.

Plastids : Found in plant cells and in euglenoides. Chloroplasts, chromoplasts and leucoplasts are 3 types of plastids depending on pigments contained.

Types of Plastids

Chloroplast (Green coloured plastids)	**Chromoplast**	**Leucoplast** (Colourless plastids)
• Contain chlorophyll, and carotenoids double stranded DNA and 70S ribosomes. • Trap light energy for photosynthesis	• Carotenoid pigments (fat souble) like Carotene, Xanthophylls and Others. • Gives the part of plant a yellow orange and red colour	• Amyloplast (Starch) • Elaioplasts (oil + fat) • Aleuroplast (store proteins)

Function : Site of photosynthesis, and imparts colours to fruits and flowers.



Chloroplast

Ribosomes

Composed of RNA and proteins; without membrane. Eukaryotic ribosomes are 80S. S = Svedberg's unit)

Function : Site of protein synthesis.

Cytoskeleton : Network of filaments.

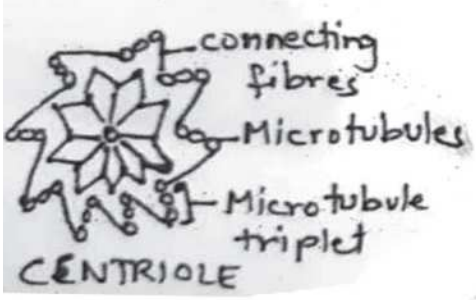
Proteinaceous structure in cytoplasm made up of microtubules and micro filaments.

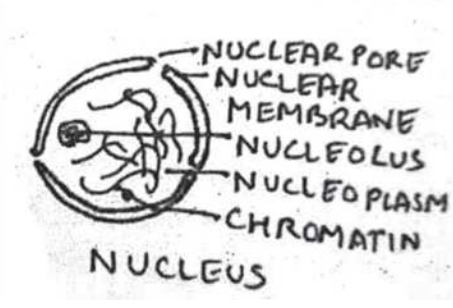
Function : Mechanical support, motility, maintenance of the shape of the cell.

Cilia and Flagella

Cilia are small structures which work like oars which help in movement.

Flagella are longer and responsible for cell movement. They are covered with a plasma membrane. Core is called **axoneme** which has 9 + 2 arrangement of axonemal microtubules.





Centrosome and Centrioles

Centrosome contains two cylindrical structures called centrioles. Surrounded by amorphous pericentriolar material. Made up of nine evenly spaced peripheral

fibrils of tubulin protein (9+0). Centrioles form the basal body of cilia or flagella and spindle fibres for cell division in animal cells. They produces spindle apparatus during cell divison.

Nucleus : Double membranous with perinuclear space and nuclear pores; has Chromatin, nuclear matrix and nucleoli (site for rRNA synthesis). (Named by Robert Brown – 1831) Perinuclear space : Space between two parallel membrains of nuclear envelope.

Chromatin DNA + nonhistone proteins. (Named by Fleming)

Nucleoplasm – Nucleolus + Chromatin

Nulear membrane—It is with perinuclear space and nucleopores.

Chromosomes—DNA/RNA + Histone protein/Nonhistone protein.

Centromere : Primary constriction in every chromosome

Kinetochores : Disc shaped structure on the sides of centsomere.

No nucleus in Erythrocytes (RBC) of mammals and sieve tubes in vascular plants.

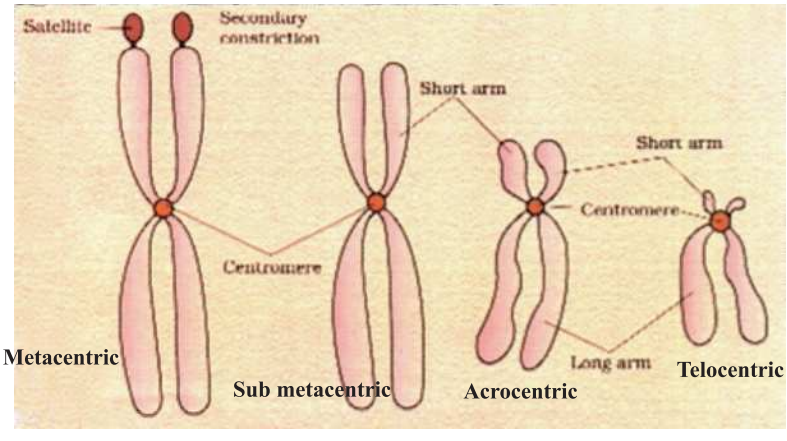
Chromosomes (on basis of position of centromere) :

Metacentric : Middle centromere.

Sub-metacentric : Centromere nearer to one end of chromosomes.

Acrocentric : Centromere situated close to its end.

Telocentric : Has terminal centromere.



Satellite : Some chromosomes have non-staining secondary constrictions at a constant location, which gives the appearance of small fragment called satellite.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Name the parts of bacterials flagella.
   (a) Filament, hook, basal body
   (b) Basal body, nucleus, hook
   (c) Filament, hook, cytoplasm
   (d) Hook, microtubule, axoneme
2. Name the nutrients stored in elaiopiasts & aleuroplasts respectively.
   (a) Fats and oils & proteins (b) Fats & proteins
   (c) Proteins & Fats and oil (d) Starch & proteins
3. Name the scientist, who first saw and described a living cell.
   (a) Anton Von Leeuwenhoek (b) Robert Brown
   (c) Robert Hooke (d) Singer Nicolson

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. What are plasmids ?
5. Name the scientist who first explained that new cells arose from pre-existing cells (Omnis cellula-e-cellula)
6. What is the composition of plasma membrane of human erythrocyte.
7. Eukayotic ribosomes are 80S. What does 'S' stand for ?
8. Write the function of cytoskeleton in a cell ?

Short Answer Questions–I (2 marks each)

9. What are nuclear pores ? State their function.
10. State the cell theory.
11. Differentiate between active and passive transport.
12. Differentiate between RER and SER.
13. List two functions of golgi apparatus.

14. List two functions of mesosome.
15. Differentiate between the electron microscopic structure of cilia/flagella and centriole.
16. Give the specific terms for the following :
    (a) Cluster of ribosomes found in cytoplasm
    (b) Extensive infolding in the inner membrane of mitochondria
    (c) Stacks of closely packed thylakoids
    (d) Stalked particles on the inner membrane of mitochondria
17. (a) Write the function of inclusion bodies in prokaryotic cells ?
    (b) Where are they present ?
    (c) Give two examples of inclusion bodies.

Short Answer Questions–II (3 marks each)

18. With the help of labelled diagram explain the 'fluid mosaic model' structure of cell membrane.
19. Differentiate between a prokaryotic and eukaryotic cell.
20. What are lysosomes ? How are they formed ? Write their functions.
21. Give the structural details of an eukaryotic nucleus along with its diagram.
22. The ribosomes of prokaryoters are of 70 S type ribosomes and while of eukaryotes are of 80 S type as well as 70 S types.
    (a) Give the composition of 70 S type ribosomes and 80 S type ribosome (two sub units, from each of them are made of)
    (b) Name two cell organelles of eukaryotic cells which have their own independent ribosomes of 70 S type

Long Answer Questions (5 marks each)

23. (a) Give the structural details of mitochondria.
    (b) Draw its diagram.
    (c) Why is it called 'powerhouse of the cell' ?
24. (a) Diagrammatically represent the types of chromosomes based on the position of centromere.
    (b) What does chromatin contain ?
    (c) What is perinuclear space ?

Answers

(SRT) Select Response Type Question (1 mark each)

1. (a) Filament, hook, basal body.
2. (a) Elaioplasts : fats and oils.
   Aleuroplasts : proteins.
3. (a) Anton Von Leeuwenhoek

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. The small circular DNA, outside the genomic DNA of bacteria.
5. Rudolf Virchow.
6. 52% proteins, 40% lipids.
7. Sedimentation coefficient (Svedberg unit)
8. Mechanical support, motility, maintenance of shape of cell.

Short Answers–I (2 marks each)

9. Minute pores present in the nuclear envelope; provide passage for movement of RNA and proteins between nucleus and cytoplasm.
10. Refer 'Points to Remember'.
11. Refer 'Points to Remember'.
12. Refer 'Points to Remember'.
13. Refer 'Points to Remember'.
14. Refer 'Points to Remember'.
15.

	Flegella/Cilia		Centriole
(i)	Possess (9 + 2) pattern of axoneme microtubules enclosed by a membrane	:	Possess (9 + 0) pattern, membrane less organelle
(ii)	Each tubule is doublet	:	Each tubule is a triplet

16. (a) Polyribosome/Polysome (b) Cristae
    (c) Grana (d) Fo–F_1 particles
17. (a) Reserve materials are stored,

(b) They are free in the cytoplasm

(c) e.g.,Phosphate granules, cyanophycean granules, glycogen granules.

Short Answers–II (3 marks each)

18. Refer 'Point to remember'.
19. Differences in nucleus/chromosomes/mesosome/membrane bound cell organelles/ribosomes/compartments in cell.
20. Refer 'Point to remember'.
21. Refer 'Point to remember'.
22. (a) 70 S ribosomes have 50 S and 30 S sub units; 80S ribosomes have 60 S and 40 S sub units.

    (b) Mitochondria and chloropolast.

Long Answers (5 marks each)

23. Points to remember.
24. Points to remember.

Case Based :

25. Read the following and answer the question given below:

    It is thought that life originated on earth around 4 billion years ago. The endosymbiotic theory states that some of the organelles in today's Eukaryotic cells were once prokaryotic microbes. In this theory the first eukaryotic cell was probably an *Amoeba* like cell which ingested prokaryotic cells which survived within these amoeba host cells. Both organisms established symbiotic relationship. Mitochondria is formed when bacteria capable of aerobic respiration were ingested, chloroplast formed when photosynthetic bacteria were ingested. They eventually lost their cell wall and much of their DNA.

Some evidences which support this theory are :

- Mitochondria and chloroplast have their own circular DNA, just like prokaryotes.

- Both have 70s type of ribosomes.
- Both are of the same size as prokaryotic cells and divide by binary fission.
- Both are covered by double layered and contain respiratory enzymes on their inner surface.

Mitochondria and chloroplasts are semiautonomous organelles as they have their own DNA and ribosomes. They can synthesise some of their proteins on their own.

(i) Which feature have the prokaryotes lost during their evolution into mitochondria and chloroplast?

(a) Cytoplasm (b) Nucleus

(c) ER (d) Cell wall

(ii) Theory of endosymbiosis explains the :

(a) origin of organelles in eukaryotes

(b) how bacteria live

(c) how species evolve

(d) origin of multicellular life

(iii) Host cell received _____ from its endosymbiont and endosymbiont received _____ from its host :

(a) Energy & shelter (b) Shelter and energy

(c) Motility and reproduction (d) Reproduction and motility

(iv) Which of the following evidence support endosymbiotic theory. Select all that which applies :

(A) Chloroplasts and mitochondria have their own small circular DNA like prokaryotes

(B) They divide by binary fission

(C) 70s type of ribosomes in tem

(D) Respiratory enzymes on their inner surface

(a) A & B (b) A, B & C

(c) A, B, C & D (d) B, C, & D

Assertion and Reason type Questions (1 mark each)

In each of the following questions, two statements are given, one is Assertion and other is Reason. Mark the correct answer as :

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both the assertion & reason are false.

26. **Assertion :** Specialization of cells is useful for organisms.

Reason : It increases the operational efficiency of an organism.

27. **Assertion :** Eukaryotic cells contain membrane bound organelles.

Reason : Prokaryotic cells do not contain membrane bound organelles.

28. **Assertion :** Mitochondria and chloroplast are semi autonomous organelles.

Reason : They are formed by the division of preexisting organelles as well as contain their own DNA but lack protein synthesizing machinery.

Answers:

Ans. 25. (i) (d) Cell wall

(ii) (a) Origin of organelles in eukaryotes

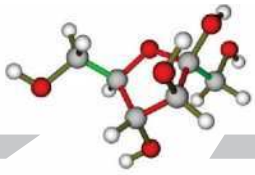
(iii) (a) energy and shelter

(iv) (c) A, B, C and D

Ans. 26. (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

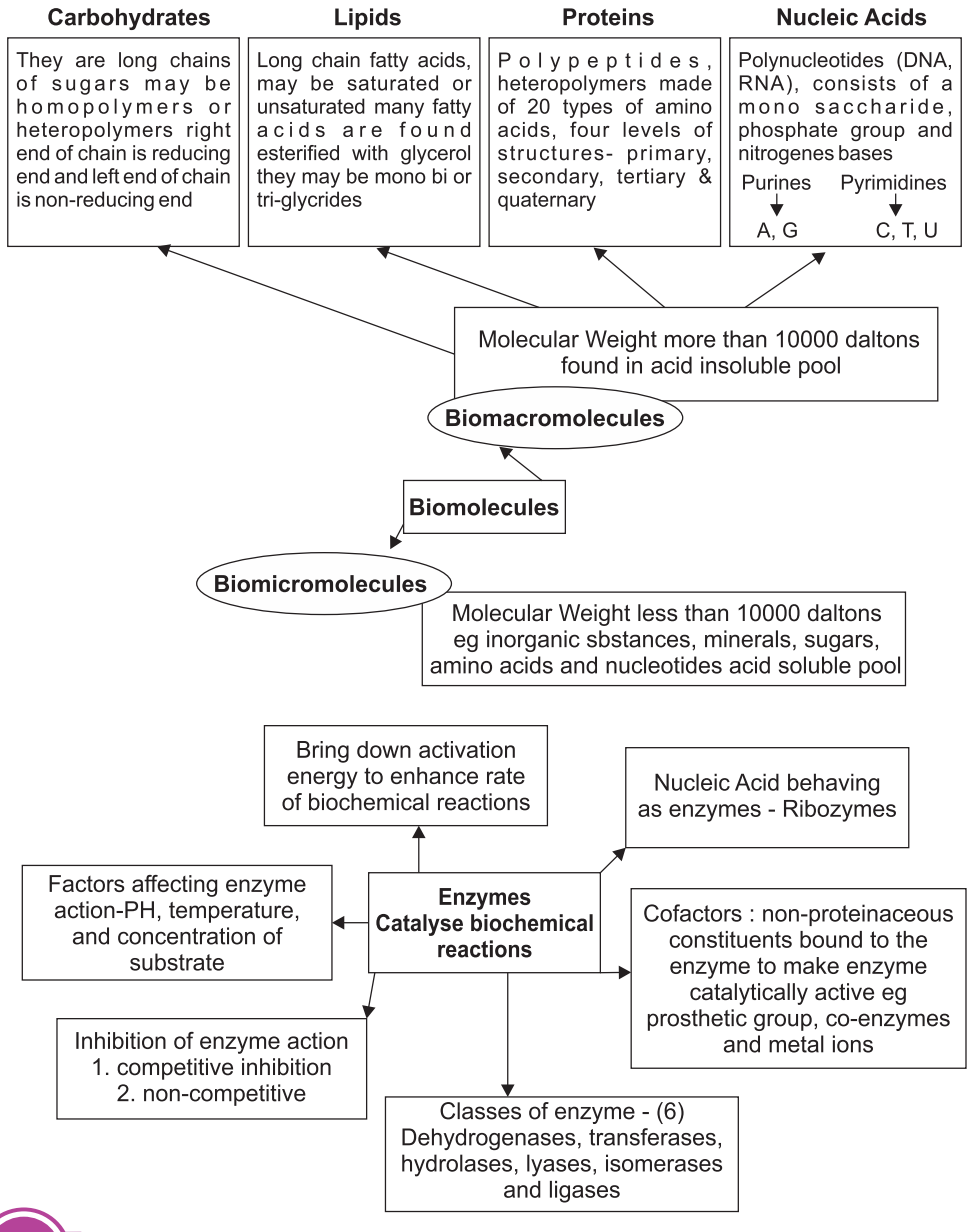
Ans. 27. (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

Ans. 28. (c) Assertion in true but reason is false.



Chapter - 9

Biomolecules



Points to Remember

Biomolecules : All the carbon compounds that we get from living tissues.

Biomicromolecules : Molecules which have molecular weights less than one thousand dalton. They are also known as monomers. They are found in acid soluble fraction.

Biomacromolecules : A biomolecule with molecular weight in the range of ten thousand daltons and above; found in acid insoluble fraction. e.g. polysaccharides, nucleic acids, proteins and lipids.

How to analyse chemical composition of living tissues?

Living tissue + Trichloroacetic acid ⟶ Grinding ⟶ Thick Slurry

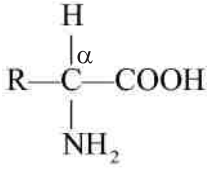
⟶ Filter through cheese cloth ⟶ Filterate (Acid soluble)

Retentate (Acid insoluble)

Primary and secondary metabolites :

- Primary metabolites have identifiable functions and play important roles in normal physiological process eg. Amino acids, nitrogenous bases, proteins and nucleic acid.
- Secondary metabolites are product of certain metabolic pathways from primary metabolites, eg. carotenoids, drugs, alkaloids, essential oils, rubber, gum, cellulose and resins etc.

Amino acids : Organic compounds containing an amino group and one carboxyl group (acid group) and both these groups are attached to the same carbon atom called α carbon and so they are called α amino acids.



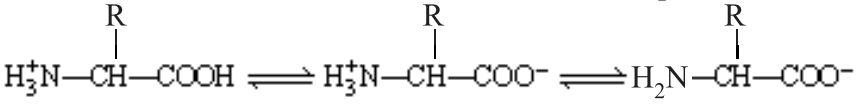
e.g. (1) In Glycine R = H

(2) In alanine R = CH_3

(3) In serine R = CH_2 – OH

- Twenty types of amino acids.

  Amino acid exists in Zwitterionic form at different pHs.



(A) (B) (C)

(Zwitterionic form)

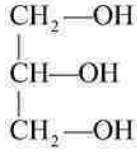
- Based on the type of side chains number of amino and carboxyl groups, amino acids can be :
  - (i) **Aromatic** – Tryptophan, phenylalanine and Tyrosine are aromatic (give smell) amino acids.
  - (ii) **Acidic Amino Acids** – (aspartic acid, glutamic acid).
  - (iii) **Basic amino acid** (Arginine).
  - (iv) **Neutral amino Acids** (valine, Proline).

Lipids :

Lipids are not strictly macromolecules as their molecular weight do not exceed 800 Da but form a part of the acid insoluble pool.

- Water insoluble, containing C, H, O.
- Fats on hydrolysis yield fatty acids.
- Fatty acid has a carboxyl group attached to an R group (contains 1 to 19 carbons).
- **Fatty Acids : Saturated :** With single bonds in carbon chain, *e.g.,* Palmitic acid, butyric acid.

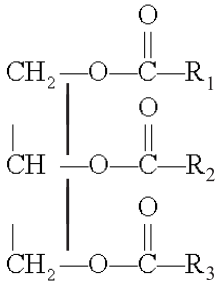
  Unsaturated : With one or more double bonds, *e.g.,* oleic acid, linoleic acid.
- **Glycerol :** A simple lipid, is trihydroxy propane.



- Some lipid have fatty acids esterified with glycerol.

  Example of fatty acid (Palmitic acid) $(CH_3—(CH_2)_{14}—COOH)$
- They can be monoglycerides, diglycerides and triglycerides.

Triglyceride,



R_1, R_2, R_3 are alkyl groups in fatty acids

- **Phospholipids** are compound lipids with phosphorus and a phosphorylated organic compound *e.g.,* Lecithin.
  Phospholipids (Lecithin) found in cell membrane and lipids made complex structure in neural tissue.

Nitrogen bases

(Carbon compounds with heterocyclic rings)

Purine : Adenine, Guanine, **Pyrimidine :** Cytosine, Uracil, Thymine.

Nucleoside : Nitrogenous base + Sugar e.g. Adenosine, guanosine.

Nucleotide : Nitrogenous base + Sugar + Phosphate group. e.g. Adenylic acid, Guanylic acid. Thymidylic acid.

Nucleic acids : Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

DNA structure (Watson and Crick Model) :

1. DNA is a right handed, double helix of two polynucleotide chains, having a major and minor groove.

2. The two chains are antiparallel, and held together by hydrogen bonds (two between A and T and three between C and G).

3. The backbone is formed by sugar-phosphate-sugar chain.

4. The nitrogen bases are projected more or less perpendicular to this, backbone and face inside.

5. The pitch is 34A°. At each step of ascent, the strand turns 36°. The rise per base pair is 3.4°A, so one full turn involves ten base pairs.

Protein : proteins are polypeptides.

- They are polymers of aminoacids linked by peptide bond.
- Is a heteropolymer (different monomers repeating 'n' number of times).
- Functions : Intercellular ground substance (collagen), as enzyme (Trypsin) as hormone (Insulin), to fight infections (Antibodies), as sensery receptors, and to enable glucose transport in cells (GLUT-4)

Structure of Proteins

(a) Primary structure : Is found in the form of linear sequence of amino acids. First amino acid is called N-terminal amino acid and last amino acid is called C-terminal amino acid.

(b) Secondary structure : Polypeptide chain undergoes folding or coiling which is stabilized-by hydrogen bonding. Right handed helices are observed; *e.g.,* fibrous protein in hair, nails.

(c) **Tertiary structure :** Long protein chain is folded upon itself like a hollow woollen ball. Gives a 3-dimensional view of protein, *e.g.,* myosin.

(d) **Quaternary structure :** Two or more polypeptides with their foldings and coilings are arranged with respect to each other, *e.g.,* Human haemoglobin molecule has 4 peptide chains - 2 α and 2 β Subunits.

Monosaccharides are joined by glycosidic bond, right end is reducing and left end is non reducing

Polysaccharides : Are long chain polymers of monosaccharides.

(a) **Starch :** Store house of energy in plant tissues. Forms helical secondary structures, made of only glucose monomers.

(b) **Cellulose :** Homopolymer of glucose. It does not contain complex helices. Cotton fibre is cellulose.

(c) **Glycogen :** Is a branched homopolymer, found as storage polysaccharide in animals.

(d) **Inulin :** Is a polymer of fructose.

(e) **Chitin :** Chemically modified sugar (amino-sugars) N-acetyl glucosamine form exoskeleton of arthropods; homopolymer.

Metabolic Pathways :

(a) **Anabolic pathways :** Lead to formation of more complex structure from a simpler structure with the consumption of energy, *e.g.,* Protein from amino acids., also known as biosynthetic pathways.

(b) **Catabolic pathway :** Lead to formation of simpler structure from a complex structure, *e.g.,* Glucose $\rightarrow$ Lactic Acid + energy

The most important energy currency in living systems is ATP (adenosine tri – phosphate).

"There is no uncatalysed metabolic conversion in living system"

The living state is a non-equilibrium steady state to be able to perform work. Without metabolism, there cannot be a living state.

Bonds linking monomers in a polymer

Peptide bond—formed between the carboxyl (–COOH) group of one amino acid, and the amino ($-NH_2$) group of the next amino with the elimination of water moiety, (dehydration).

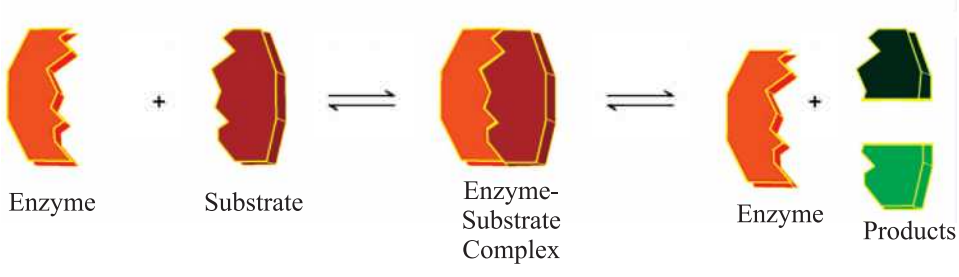
Glycosidic bond—bond formed between two carbon atoms of two adjacent monosaccharides., by dehydration.

Phosphodiester bond—bond formed in nucleic acids where in a phosphate

moiety links the 3⁻carbon of one sugar of one nucleotide to the 5⁻carbon of the sugar of the succeeding nucleotide. (The bond between phosphate group and hydroxyl group of sugar)

Enzymes : Are biocatalyst.

- Almost all enzymes are proteins.
- Ribozymes–Nucleic acid that behave like enzymes.
- Has primary, secondary and tertiary structure.
- Active site of an enzyme is a crevice or pocket into which substrate fits.
- Enzymes get damaged at high temperatures.
- Enzymes isolated from thermophilic organisms (live under high temperatures) are thermostable.
- Enzymes accelerate the rate of reactions many folds.
- Enzymes lower the activation energy of reactions. (Fig. 9.6, Page no. 156, NCERT Text Book of Biology for Class XI).
- $E + S \rightleftharpoons ES \rightarrow EP \rightarrow E + P$
  where E = Enzymes, S = Substrate, P = Product



Steps of Enzyme Action

Factors affecting enzyme activity :

(a) Temperature : Show highest activity at optimum temperature. Activity declines above and below the optimum value.

(b) pH : Enzymes function in a narrow range of pH. Highest activity at optimum pH. (Fig. 9.7, NCERT, Text Book of Biology for Class XI).

(c) Concentration of substrate : The velocity of enzymatic reaction rises with increases in substrate concentration till it reaches maximum velocity (V_{max}). Further increase of substrate does not increase the rate of reaction as no free enzyme molecules are available to bind with additional substrate.

Enzyme inhibition : When the binding of a chemical shuts off enzyme activity, the process is called inhibition and chemical is called **inhibitor.**

Competitive inhibition : Inhibitor closely resembles the substrate in its molecular structure and inhibits the enzyme activity. E.g., inhibition of succinic dehydrogenase by malonate. (Actual substrate is succinic acid).

Classification of enzymes :

1. **Oxidoreductase/dehydrogenases :** Catalyse oxidoreduction between 2 substrates. S reduced + S′ oxidised → S oxidised + S′ reduced.
2. **Transferases :** Catalyse transfer of a group between a pair of substrates.

   S – G + S′ → S + S′ – G
3. **Hydrolases :** Catalyse hydrolysis of ester, ether, peptide, glycosidic, C–C, P-N bonds.
4. **Lyases :** Catalyse removal of groups from substrates by mechanisms other than hydrolysis. leaving double bonds.
5. **Isomerases :** Catalyse inter-conversion of optical, geometrical or positional isomers.
6. **Ligases :** Catalyse linking together of 2 compounds.

   C–O, C–S, C–N, P–O

Co-factors : Enzymes becomes catalytically active when it binds to non protein constituent called co-factors. Protein portion of enzyme is called apoenzyme.

- **Prosthetic group :** These are organic compound which tightly bound to the apoenzyme.

  e. g., Haem is prosthetic group in peroxidase and catalase.
- **Coenzyme :** These are organic compounds whose association with the apoenzyme is only transient, usually occurring during the course of catalysis.

  e.g., Coenzyme Nicotinamide adenine dinucleotide (NAD) and NADP contain vitamin niacin.
- **Metal ions :** Metal ions form coordination bond with side chains at the active site and at the same time form one or more coordination bond with substrate.

  e.g. zinc in enzyme carboxy peptidase.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Purine bases are...
   (a) Adenosine & Guanosine (b) Adenine only
   (c) Guanine only (d) Adenine & Guanine
2. Bond between two monosaccharides is...
   (a) Glycosidic bond (d) Phosphodiester linkage
   (c) Peptide bond (d) Coordinate bond
3. Name an element found in protein but not in lipids & carbohydrates.
   (a) Hydrogen (b) Carbon
   (c) Nitrogen (d) Chlorine

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. What does an enzyme do in terms of energy requirement of a reaction ?
5. What is the function of ATP in cell metabolism ?
6. Name the protein which form the intercellular ground substance.
7. What are biomacromolecules ?
8. Why enzymes are called bio-catalysts ?

Short Answer Questions-I (2 marks each)

9. Differentiate between prosthetic group and coenzyme ?
10. What are glycosidic bonds and peptide bonds ?
11. Why are aminoacids also known as substituted methane?
12. Amino acids exist as zwitter ions. Give its structure. Why is it formed ?
13. Why do starch give blue black colour with iodine ?
14. Why are starch and glycogen more suitable than glucose as a storage product ?

15. What would happen when salivary amylase which acts on starch in mouth enter in stomach ?
16. Differentiate between homo polysaccharides and hetero poly saccharides.
17. Why do physicians recommend vegetable oils rich in polyunsaturated fat for persons suffering from cardiovascular diseases ?
18. Why does the shelf life of fruits and vegetables increase in a refrigerator ?

Short Answer Questions-II (3 mark each)

19. Differentiate between primary and secondary metabolites with examples ?
20. List out some major proteins and their function ?
21. Explain the structure of proteins.
22. Explain Watson-Crick model on DNA structure.
23. Explain peptide bond, glycosidic bond and phospodiester fond.
24. Explain competitive inhibition along with an example.

Long Answer Questions (5 marks each)

25. List the 6 classes of enzymes along with their functions.

Answers

(SRT) Select Resonse Type Question (1 mark each)

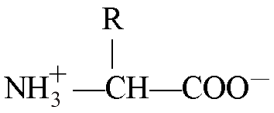
1. (d) Adenine & Guanine
2. (a) Glycosidic bond
3. (c) Nitrogen

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer (1 marks each)

4. Lowers the activation energy of reaction.
5. ATP is energy currency of cell.
6. Collagen.
7. Refer point to remember.
8. Enzymes are proteins that catalyze metabolic/chemical reactions inside the living being. That's why they are called biocatalysts.

Short Answer-I (2 marks each)

9. Refer 'Points to remember'.
10. Refer, 'Points to remembers'.
11. The α-carbon has 4 substituted groups occupying the 4 valency positions : H, — COOH, — NH_2 and — R group.
12. 

    Due to ionizable nature of — NH_2 and — COOH groups.
13. Starch form helical secondary structure which can hold I_2.
14. Occupy lesser space as less bulky and can be hydrolysed to glucose when required.
15. In mouth, salivary amylase changes starch into maltose. Action of amylase stops in stomach as it cannot act in an acidic medium.
16.

	Homopolysaccharides	Heteropolysaccharides
(a)	Constituted of single type of monosaccharide units	Constituted by two or more type of monosaccharide unit and their derivatives
(b)	*e.g.,* starch, glycogen, cellulose	*e.g.,* Peptidoglycans, chitin

17. Polyunsaturated oils contain fatty acids having one or more double bonds which does not clog arteries due to high proportion of polyunsaturated fatty acids.
18. Low temperature prevents growth of food spoiling micro organisms and also inhibits the action of enzymes present in the food, because, enzymes are inactivated at low temperature.

Short Answers-I (3 marks each)

19. **Secondary metabolites**—The metabolites like alkaloids lectins drugs, pigments, spices and scents etc. which are useful to human welfare and have ecological importance, are products of certain metabolic pathways.

    Primary metabolites—The metabolites having identifiable functions and play important role in normal physiological processes, *e.g.,* sugars, amino acids, fats and oils and nucleotides, etc.

20. Refer Table 9.5, NCERT, text book of biology class XI.

21. Refer 'Points to remember'.

22. Refer 'Points to remember'.

23. Refer 'Points to remember'.

24. Refer 'Points to remember'.

Long Answers (5 marks each)

25. Refer 'Points to remember'.

Case study based question (4 marks each)

26. Read the following and answer the question given below:

Enzymes are proteins that act as biological catalysts (biocatalyst). Almost all enzymes are proteins. Some Nucleic acid behaves like enzymes. They are called ribozymes. Enzymes have tertiary structure and many crevices called 'active sites'. Enzymes act upon substrate and change them into products. Substrate binds to the active sites of enzymes.

26. (i) Which enzyme is used by the biscuit manufactures to lower the protein level of flour?

(a) Amylases (b) Proteases

(c) Cellulases (d) Xylases

26. (ii) Which of the following statement is/are correct about enzymes?

(a) An enzyme is a protein which acts as a biocatalyst to accelerate the rate of reaction.

(b) Life would not exist without the presence of enzymes in cells

(c) Enzymes participate in various cellular metabolic processes

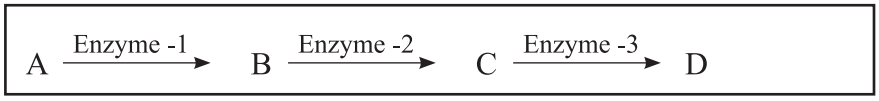
(d) All the above

26. (iii) A protein having both structural and enzymatic properties is :

(a) Collagen (b) Trypsin

(c) Myosin (d) Actin

26. (iv) The diagram shows a metabolic pathway :



What would happen to the rate of production of 'D', if enzyme 1 was not present?

(a) It would stop

(b) It would be increased

(c) It would be decreased

(d) No effect

Assertion and Reason Type Questions (1 mark each)

In each of the following questions, two statements are given, one is Assertion and other is Reason. Mark the correct answer as :

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both the assertion and reason are false.

27. **Assertion :** A coenzyme or metal ion tightly bound to enzyme protein is called prosthetic group.

Reason : A complete catalytically active enzyme together with its bound prosthetic group is called apoenzyme.

28. **Assertion :** Secondary metabolites are produced in small quantities and their extraction from the plant is difficult and expensive.

Reason : Secondary metabolites can be commercially produced by using tissue culture technique.

29. **Assertion :** All enzymes are not proteins.

Reason : RNA molecules that possess catalytic activity are called ribozymes.

Answers :

Ans. 26 (i) (b) Proteases

Ans. 26 (ii) (d) All the above

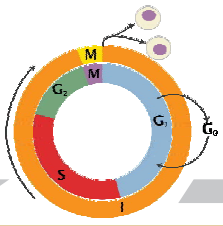
Ans. 26 (iii) (c) Myosin

Ans. 26 (iv) (a) It would stop

Ans. 27 (c) Assertion is true but reason is false.

Ans. 28 (b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

Ans. 29. (a) Both assertion and reason are true, but the reason is the correct explanation of the assertion.



Chapter - 10

Cell Cycle and Cell Division

Points To Remember

Cell cycle : The sequence of events by which a cell duplicates its genome, synthesises the other constituents of the cell and eventually divides into two daughter cells.

Phases of cell cycle
- Interphase (G_1 phase + S phase + G_2 Phase)
- M Phase (Mitosis phases)
  - Karyokinesis (division of nucleus)
  - Cytokinesis (division of cytoplasm)

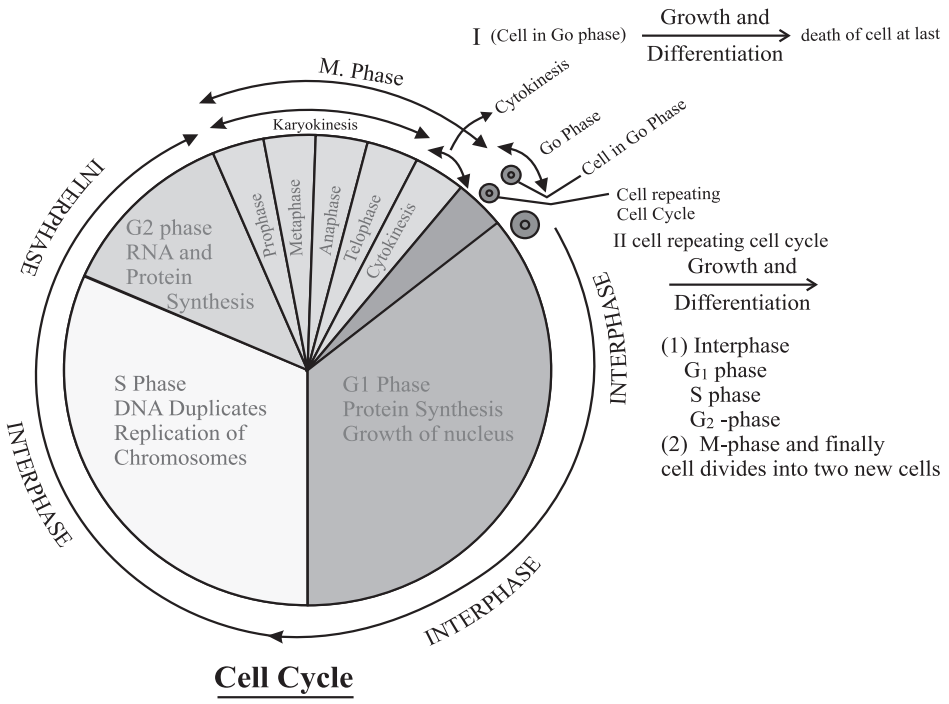
Interphase : (Resting Phase)

- **G_1 Phase :** Cell metabolically active and grows continuously but does not replicate DNA
- **S Phase :** DNA synthesis occurs, DNA content increases from 2C to 4C, but the number of chromosomes remains same *i.e.,* 2*n*.
- **G_2 Phase :** Proteins are synthesised in preparation for mitosis while cell growth continues.

M Phase (Mitosis Phase) : Starts with nuclear division, corresponding to separation of daughter chromosomes (karyokinesis) and usually ends with division of cytoplasm, (cytokinesis).

Quiescent stage (G_0) In adult animal cells that do not divide and exit G_1 phase to enter an inactive stage called G_0. Cells at this stage remain metabolically active but do not proliferate.

e.g., Heart cells

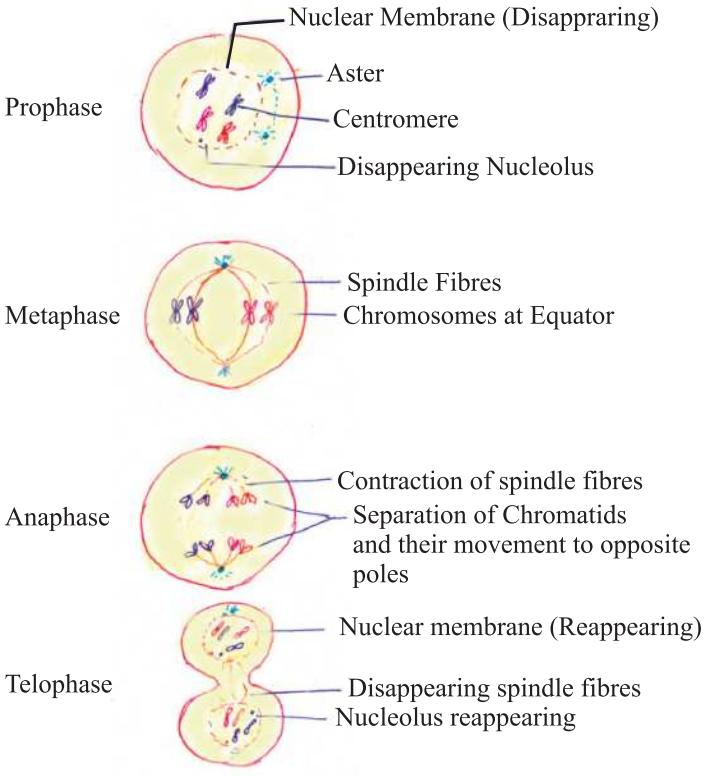


Cell Cycle

Mitosis

Since the number of chromosomes in the parent and progeny cells is the same, it is called as equational division. Mitosis is divided into four sub stages.

1. **Prophase :** (i) Replicated chromosomes, each consisting of 2 chromatids, condense and become visible.
   (i) Microtubules are assembled into mitotic spindle.
   (iii) Nucleolus and nuclear envelope disappear.
   (iv) Centriole moves to opposite poles.
2. **Metaphase :** (i) Spindle fibres attached to kinetochores (small disc-shaped structures at the surface of centromere) of chromosomes.
   (ii) Chromosomes line up at the equator of the spindle to form metaphase plate.
3. **Anaphase :** (i) Centromeres split and chromatids separate.
   (ii) Chromatids move to opposite poles due to shortening of spindle fibres.
4. **Telophase :** (i) Chromosomes cluster at opposite poles.
   (ii) Nuclear envelope assembles around chromosomes clusters'.
   (iii) Nucleolus, Golgi Complex, E.R. reappear.



Stages of Mitosis

Cytokinesis : The division of protoplast of a cell into two daughter cells after karyokinesis (nuclear division)

Animal Cytokinesis :

Appearance of furrow in plasma membrane which deepens and joins in the centre, dividing cell cytoplasm into two.

Plant cytokinesis : Formation of new cell wall begins with the formation of a simple precursor — **cell plate** which represents the middle lamella between the walls of two adjacent cells.

- When karyokinesis is not followed by cytokinesis, a multinucleated condition arises. This is called **syncytium.**

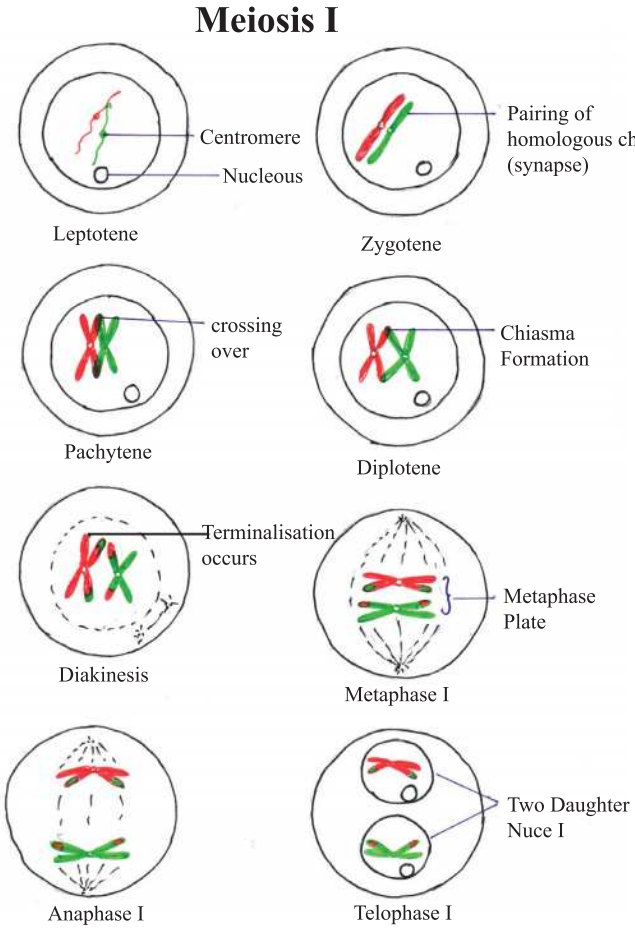
Significance of Mitosis :

1. Growth/addition of cells.
2. Maintenance of surface/volume ratio. Maintain Nucleo–cytoplasmic ratio.
3. Maintenance of chromosomes number.
4. Regeneration.

5. Reproduction in unicellular organisms, lower plants and some insects.
6. Repair and wound healing.
7. Vegetative reproduction in plants takes place by mitosis.

Meiosis :

- Specialised kind of cell division that reduces the chromosomes number by half. Hence it is called reductional division.
- Occurs during gametogenesis in plants and animals.
- Involves two sequential cycles of nuclear and cell division called Meiosis I and Meiosis II.
- It results in 4 haploid daughter cells.
- Interphase occurs prior to meiosis which is similar to interphase of mitosis except the S phase is prolonged.



Meiosis I

Prophase I : Subdivided into 5 phases.

(i) Leptotene :

- Chromosomes make their appearance as single stranded structures.
- Compaction of chromosomes continues.

(ii) Zygotene :

- Homologous chromosomes start pairing and this process of association is called synapsis.
- Chromosomal synapsis is accompanied by formation of Synaptonemal complex.
- Complex formed by a pair of synapsed homologous chromosomes is called bivalent or tetrad.

(iii) Pachytene : Crossing over occurs between non-sister chromatids of homologous chromosomes. The enzymes involved in the process is 'recombinase'. Recombination between homologous chromosomes is completed. Exchange of genetic material.

(iv) Diplotene : Dissolution of synaptonemal complex occurs and the recombined chromosomes separate from each other except at the sites of crossing over. These X-shaped structures are called **Chiasmata.** In oocytes of some vertebrates diplotene can last for month or years.

(v) Diakinesis : Terminalisation of chiasmata.

- Chromosomes are fully condensed and meiotic spindles assembled.
- Nucleolus disappear and nuclear envelope breaks down.

Metaphase I : Bivalent chromosomes align on the equatorial plate.

- Microtubules from opposite poles of the spindle attach to the pair of homologous chromosomes.

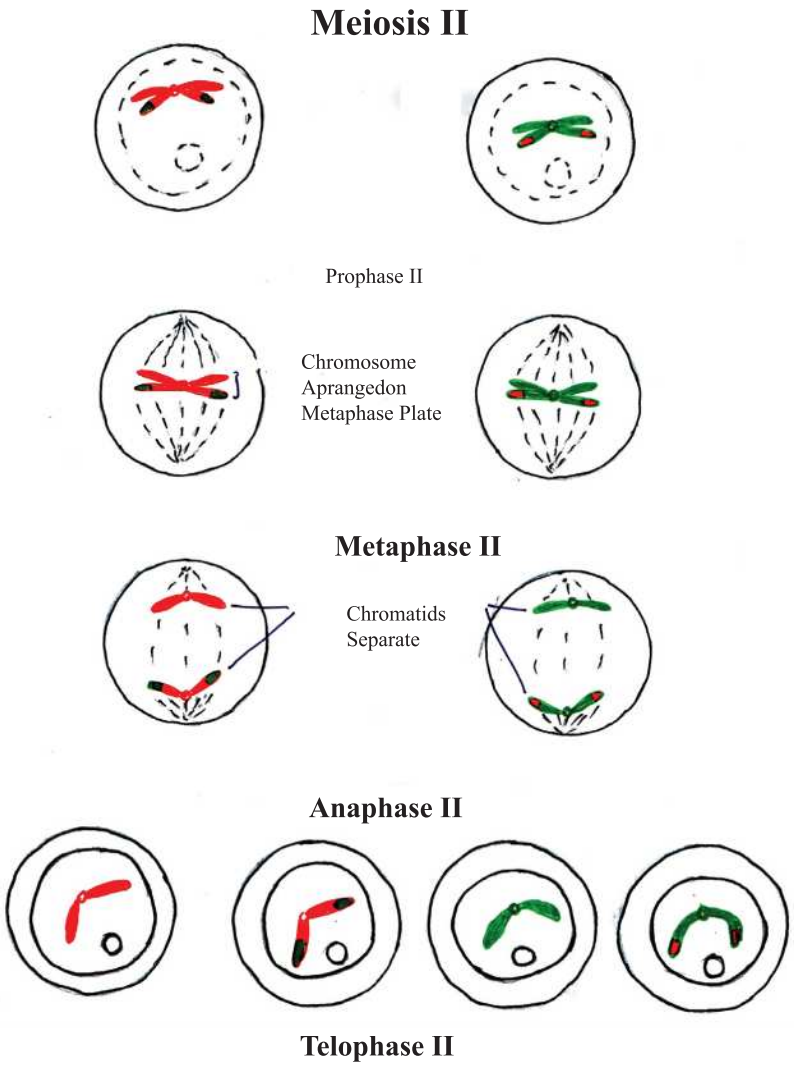
Anaphase I : Homologous chromosomes, separate while chromatids remain associated at their centromeres.

Telophase I :

- Nuclear membrane and nucleus reappear.
- Cytokinesis follows (dyad of cells).

Interkinesis : Stage between two meiotic divisions, (meiosis I and meiosis II) generally short lived, No replication of DNA during this.

Meiosis II: (It resembles the normal mitosis).



Prophase II

- Nuclear membrane disappears.
- Chromosomes again become compact.

Metapahse II

- Chromosomes align at the equator.
- Microtubules from opposite poles of spindle get attached to kinetochores of sister chromatids.

Anaphase II

- Simultaneous splitting of the centromere of each chromosome, allowing them to move towards opposite poles of the cell, by shortening of microtubules attached to kinetochores.

Telophase II

- Two groups of chromosomes get enclosed by a nuclear envelope.
- Cytokinesis follows resulting in the formation of tetrad of cells *i.e.,* 4 haploid cells.

Significance of Meiosis

1. **Formation of gametes :** In sexually reproducing organisms.
2. **Genetic variability : Variations are very important for evolution.**
3. **Maintenance of chromosomal number :** By reducing the chromosome number in gametes. Chromosomal number is restored by fertilisation of gametes.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Karyokinesis is the division of
   (a) nucleus (b) chromosome
   (c) cytoplasm (d) protoplasm
2. Cytokinesis is the division of
   (a) nucleus (b) chromosome
   (c) cytoplasm (d) protoplasm
3. Pairing of homologous chromosomes occurs during
   (a) zygotene (b) diplotene
   (c) diakinesis (d) metaphase

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. Name the stage of meiosis during which synaptonemal complex is formed.
5. What is Go phase of cell cycle ?
6. Where does mitosis take place in plants and animals ?

Short Answer Questions-I (2 marks each)

7. Differentiate between cytokinesis of plant and animal cell.
8. What is Chiasmata ? State its significance.
9. Differentiate between chromatin and chromatid.

10. Give the terms for the following :
    (a) The period between 2 successive mitotic divisions.
    (b) Cell division in which chromosome number is halved.
    (c) Phase in cell cycle where DNA is synthesised.
    (d) Division of nuclear material.
11. What happens during S phase of interphase ?
12. Distinguish between metaphase of mitosis and metaphase I of meiosis.
13. What will be the DNA content of a cell at G_1 after S and G_2 if the content after M phase is 2C.

Short Answer Questions-II (3 marks each)

14. Differentiate between mitosis and meiosis.
15. List the significance of mitosis.
16. Describe the following :
    (a) Synapse (b) Bivalent (c) Leptotene

Long Answer Questions (5 marks each)

17. With the help of labelled diagram, explain the following :
    (a) Diplotene (b) Anaphase of mitosis
    (c) Prophase I of meiosis
18. What is cell cycle ? Explain the events occurring in this cycle.
19. With the help of labelled diagrams, explain various stages of mitosis cell division.
20. (a) Write a note on significance of meiosis.
    (b) Differentiate between anaphase 1 of meiosis and Anaphase of mitosis.
    (c) In which phase of interphase duplication of DNA will occur ?

Answers

(SRT) Select Response Type Question (1 mark each)

1. (a) Nucleus 2. (b) cytoplasm 3. (a) zygotene

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Zygotene.
5. Cells which enter a stage where they are metabolically active but no longer proliferate.

6. Plant – Meristematic tissue; Animals–somatic cells.

Short Answers-I (2 marks each)

7. Refer 'Points to Remember'.
8. Refer 'Points to Remember'.
9. **Chromatin Chromatid :**
   (a) Diffuse, deep staining hereditary material longitudinally split half of a chromosome, light staining hereditary material.
   (b) Metabolically inert Metabolically active.
10. (a) Interphase
    (b) Meiosis
    (c) S phase
    (d) Karyokinesis
11. Refer 'Points to Remember' :
12.

Metaphase	Metaphase I
(a) Chromosome align along the equator of the cell	(a) Bivalent chromosomes arrange along the equatorial plane.
(b) Figure from points to remember	(b) Figure from points to remember

13. $G_1 - 2C$, $S_1 - 4C$, $G_2 - 4C$

Short Answers-II (3 marks each)

14.

Mitosis	Meiosis
(a) Occurs in Somatic cells	(a) Occurs in germ cells
(b) Number of chromosomes remain same in daughter cells	(b) Number of chromosomes reduces to half in daughter cells.
(c) No exchange of genetic material	(c) Exchange of genetic material occurs due to crossing over
(d) Involve single division	(d) Involve two successive division

15. Refer 'Points to Remember'.
16. Refer 'Points to Remember'.

Long Answer (5 marks each)

17. Refer 'Points of Remember'.
18. Refer 'Points of Remember'.

19. Refer 'Points of Remember'.

20. (a) Refer 'Points of Remember'

(b) Refer 'Points of Remember'.

(c) During S phase or synthesis phase.

Case Study based Question (4 marks each)

21. Read the following and answer any four questions from 21 (i) to 21 (v) given below :

The sequence of events by which a cell duplicates its genome, synthesizes the other constituents of the cell and eventually divides into two daughter cells is termed cell cycle. Cell cycle is divided into interphase and M Phase. Interphase is divided into three phases- G_1 phase, S phase and G_2 phase. In G_1 phase, cell prepares proteins and enzymes. In S phase, DNA replication and centrioles duplication takes place. After S phase, chromosome number of the cell does not change but amount of DNA becomes double (4C). In G_2 phase synthesis of protein especially tubulin, which is used in the formation of spindle fibres, occurs.

21. (i) How many chromosomes and DNA content will the onion cell have in G1 phase, after completing S phase and after M phase respectively, if onion plant possess 14 chromosomes initially?

(a) 14 / 2C, 28 / 4C and 14 / 4C

(b) 14 / 2C, 14 / 4C and 14 / 2C

(c) 14 / 2C, 14 / 2C and 14 / 2C

(d) 28 / 4C, 28 / 4C and 14 / 2C

21. (ii) Choose the correct option for a human cell before it enters prophase?

	Number of Chromatids	Number of Chromosomes
(a)	46	92
(b)	46	46
(c)	92	46
(d)	92	92

21. (iii) Non-dividing cells like muscles, neurons are in _____ phase

(a) G_1 (b) G_2

(c) G_0 (d) M Phase

21. (iv) How many mitotic divisions are required to form 128 cells from a single onion root tip cell (mitosis)?

(a) 14 (b) 21

(c) 6 (d) 7

Assertion and Reason Type Questions (1 mark each)

In each of the following questions, two statements are given, one is Assertion and other is Reason. Mark the correct answer as :

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true but the reason it not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both the assertion and reason are false.

22. **Assertion :** Daughter somatic cells formed by mitosis are genetically similar to parental cell.

Reason : Chromosomes do not undergo crossing over in mitosis.

23. **Assertion :** Meiosis–II is similar to mitosis.

Reason : Meiosis–I cannot occur in haploid cells.

24. **Assertion :** Interphase is called resting stage.

Reason : In interphase the cell is metabolically inactive.

Answers :

Ans. 21 (i) (b) 14 / 2C, 14 / 4C and 14 / 2C

Ans. 21 (ii) (c) 92, 46

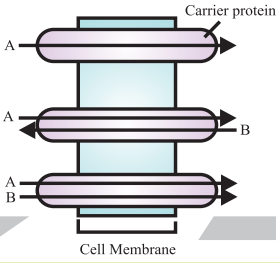
Ans. 21 (iii) (c) G_0 phase

Ans. 21 (iv) (d) 7

Ans. 22 (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

Ans. 23. (b) Both assertion and reason are true but the reason it not the correct explanation of the assertion.

Ans. 24 (c) Assertion is true but reason is false.



Chapter - 11

Transport In Plants

Active transport-: Movement of substances from their lower conc. to higher conc. through selectively permeable membrane using energy.

Facilitated transport : Movement of substances from higher conc. to lower conc. with the help of transport proteins.

It may be symport antiport or uniport.

Diffusion- Movement of substances from higher conc. to lower conc. without involving transport protein.

Means of transport

Pressure Potential :- Magnitude ofi ncrease in water potential when it measures greater than atmospheric pressure, is applied to pure water.

Solution potential :- Magnitude ofl owering of water potential when solute is added to water.

Water potential :- It is the measure of conc. of water or kinetic energy of water in a system. It is zero for pure water.

Plant water relations

Osmosis :- Movement of solvent from their higher chemical potential to their lower chemical potential through selectively permeable membrane.

Plasmolysis- : Shrinkage of protoplasm away from the cell wall due to exosmosis in hypertonic solution.

Imbibition :- Absorption of water by solid particles of an adsorbent resulting in increase in volume.

Transpiration- : Removal of water in the form of water vapours through stomata ofl eaves.

Guttation :- Removal of water droplets through hydathodes.

Some important reactions

TRANSPORT OF SUBSTANCES IN PLANTS
(source to sink)

Uptake and transport of mineral nutrients and food

Xylem Transport-: Uptake and transport of mineral nutrients through xylem. It occurs by active or passive absorption and moves along with water.

Phloem Transport : Movement of sugar, hormones and amino acids by pressure flow or mass flow hypothesis.

Absorption of sugar takes place actively.

Features involved in water movement upward

SURFACE TENSION

Cohesion-Tension - Transpiration pull theory-: Forces of adhesion and cohesion maintain water column and transpiration pull is major force driving water upward.

Root pressure theory :– A hydrostatic pressure existing in roots which pushes the water up in xylem vessels upto certain height in herbaceous plants.

Methods of water absorptions and movement to root xylem

Apoplastic Pathway : Movement through inter cellular spaces or cell wall movement is fast and most of water enters through this way.

Symplastic Pathway : – Water enters the cell through cell membrane and travel through cytoplasm and plasmodesmata; movement is slow.

At casparian strips region, water moves through symplast only.

Points To Remember

Translocation (Long distance transport) : Transport of substances in plants over longer distances through the vascular tissue (Xylem and Phloem) The transport of water and mineral in Xylem is unidirectional while transport of organic and mineral nutrients in phloem is multi-directional.

Means of transport (Short distance transport) : The transport of material into and out of the cells is carried out by a number of methods. These are diffusion, facilitated diffusion and active transport.

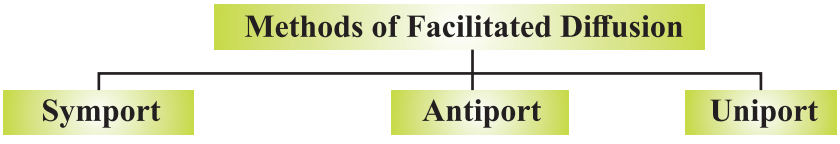
(i) **Diffusion :** Diffusion occurs from region of higher concentration to region of lower concentration. It is passive and slow process. No energy expenditure takes place. No membrane required

Factors affecting diffusion : Permeability of membrane, Temperature, pressure, gradient of concentration and the size of substances.

(ii) **Facilitated diffusion :** The diffusion of hydrophilic substances along the concentration gradient through fixed membrane transport protein without involving energy expenditure. For this the membrane possess aquaporins and ion channels. No ATP energy is utilized in this process.

Porins—The proteins that form huge pores in the outer membranes of the plastids, mitochondria and some bacteria which allow the small size molecules to pass through.

Aquaporins—Proteins that facilitate diffusion of water molecules through/ across the plasma membrane of cell.



(Two molecules cross the membrane in the same direction at the same time.)	(Two molecules move in opposite direction at the same time.)	(Single molecule moves across membrane indpendent of other molecules.)

Transport Proteins—They are present in the membrane. They allow the passage of substances through membrane.

(i) **Carrier Proteins**—They bind to the particular solute particle to be transported and deliver these to other side of membrane.

(ii) **Channel Proteins—Ion Channel**—They are specific for different ions like

$$K^+, Cl^-, NO_3^-, PO_4^{3-}, Mg^{2+}$$

Water Channel—Surrounded by eight proteins called Aquaporins and allow passage of water or water soluble substance.

(iii) **Active transport :** Active transport is carried by the mobile carrier proteins (known as protein pumps) of membrane. Active transport uses energy to pump molecules against a concentration gradient from a low concentration to high concentration (uphill-transport). It is faster than passive transport.

Different Transport Mechanisms

S. No.	Property	Simple Diffusion	Faciliated Transport	Active Transport
1.	Required Special membrane protein	No	Yes	Yes
2.	Uphill transport	No	No	Yes
3.	Requires ATP Energy	No	No	No

- **Water potential**—(ψ_w)–Greater the concentration of water in a system, greater is its kinetic energy and greater is the water potential. It is measured in pascal (Pa) or mega pascal.
- If two systems are in contact, then there is movement of water from the solution with higher potential to lower water potential.
- **Solute potential**—(ψ_s)–Magnitude of lowering of water potential, when a solute is added to the water.
- **Pressure Potential**—(ψ_p)—Magnitude of increase of water potential, when pressure greater than atmospheric pressure is applied to pure water or a solution.
- Water potential of pure water is zero (0).
- Solute potential is always negative (–) and pressure potential is always positive (+).

$$\Psi_w = \Psi_s + \Psi_p$$

- **Osmotic Pressure**—External pressure applied to prevent the diffusion of water. It depends upon solute concentration.
- Numerically, osmotic pressure is equal to osmotic potential. Osmotic pressure has positive (+) sign. Osmotic potential has negative (–) sign.

Turgor Pressure—Due to osmotic entry of water, the protoplasm of a plant cell presses the cell wall towards the outside with a force, it is called Turgor Pressure.

Diffusion Pressure—The pressure exerted by the tendency of the particles to diffuse from the area of higher concentration to lower concentration. It is directly proportional to the concentration of particles of diffusing substance.

Osmosis : Osmosis is movement of solvent or water molecules from the region of their higher chemical potential to the region of their lower potential across a semipermeable membrane.

Water molecules move from higher water potential to lower water potential until equilibrium is reached.

Plasmolysis : Process of shrinkage of protoplasm away from its cell wall due to exosmosis in hypertonic solution. If a plasmolysed cell is placed in water or a hypotonic solution it becomes turgid.

Hypotonic solution : The external solution which is more dilute than the cytoplasm. Cell kept in hypotonic solution become turgid.

Hypertonic solution : The external solution, which is more concentrated than the cytoplasm. Cell kept in hypertonic solution get plamolysed

Isotonic solution : When the external solution balances the osmotic pressure of the cytoplasm. Cell kept in isotonic solution become flaccid.

Casparian strip : It is the tangential as well as radial walls of endodermal cells having the deposition of water impermeable suberin.

Imbibition : Imbibition is the phenomenon of absorption of water by the solid particles of an adsorbent causing it to enormously increase in volume without forming a solution.

Some examples of Imbibition :

(i) If a dry piece of wood is placed in water, it swells and increases in its volume.
(ii) If dry gum or pieces of agar-agar are placed in water, they swell and their volume increases.
(iii) When seeds are placed in water they swell up.
(iv) Swelling of wooden door during rainy season.

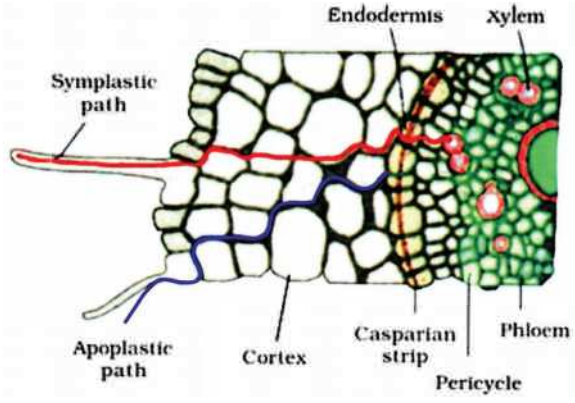
Conditions essential for imbibition

1. Water potential gradient between the surface of the adsorbent and the imbibed liquid, is essential.
2. Affinity between the adsorbent and the imbibed liquid.

Transport of water in plants : Water is absorbed by root hairs by diffusion. Then water moves upto xylem by two pathways–apoplast and symplast pathway.

Apoplast Pathway—Movement occurs through the intercellular spaces or walls of the cell, without entering the cytoplasm. This movement is fast. In roots, movement of water occurs via apoplast except at the carparian strip, most of water enters through apoplast.

Symplast Pathway—Water enters the cell through cell membrane and travels intercellularly through plasmodesmata. This movement is slow. At casparian strip region water moves only through symplast.



Apoplastic And Symplastic Pathways of Water Transport

Ascent of Sap—Upward movement of water in the form of dilute solution of mineral ions from roots to the top aerial parts of plants through tracheary elements of xylem against the gravitational force is called ascent of sap. It involves two theories—

(i) **Cohesion–Tension-**Transpirtation pull theory.

(ii) **Root pressure theory.**

(1) **Cohesion-Tension-Transpiration pull theory**—

(i) **Continuity of water column**—The transport of water to the top of trees occurs through xylem vessels. The forces of adhesion and cohesion maintain a thin and unbroken column of water in the capillaries of xylem vessels through which it travels which is travels upward. Water is mainly pulled by transpiration from leaves.

(ii) **Transpiration Pull**—Transpiration accounts for loss of 99% of water in the form of water vapours from the surface of leaves. The loss is mainly through stomata.

- Pull of water as a result of tension created by transpiration is the major diving force of water movement upward in a plant. This movement is called ascent of sap.

Three physical properties of water which affect the ascent of xylem sap due to transpiration pull.

(iii) **Cohesion force or Tensile strength of water**—

- **Cohesion**—Mutual attraction between water molecules.
- **Adhesion**—Attraction of water molecules to polar surface.
- **Surface tension**—Attraction of water to each other in liquid phase to a greater extent than to water in gaseous phase.

(2) **Root pressure Theory :** A hydrostatic pressure existing in roots which pushes the water up in xylem vessels upto certain height to herbaceons plant.

Guttation : The water loss in its liquid phase in the form of water droplets at night and early morning through special openings of vein near the tip of leaves. These opening are called hydathodes.

Transpiration : The loss of water through stomata of leaves and other aerial parts of plants in form of water vapours.

Factors affecting transpiration : Temperature, light, relative humidity, wind speed, number and distribution of stomata, water status of plant, canopy structure.

Significance of transpiration—Advantages—Helps in ascent of sap, removal of excess water, cooling effect, distribution of mineral salts, supply water for photosynthesis.

Disadvantages—May cause reduced growth, wilting (loss of turgidity), reduced yield and waste of energy.

Since there are advantages as well as disadvantages of transpiration so—'Transpiration is called a necessary evil'.

Opening and closing of stomata—Opening and closing of stomata happens due to following two reasons—

(i) Change in the turgidity of guard cells.

(ii) Orientation of cellulose microfibrils in the cell wall of guard cells.

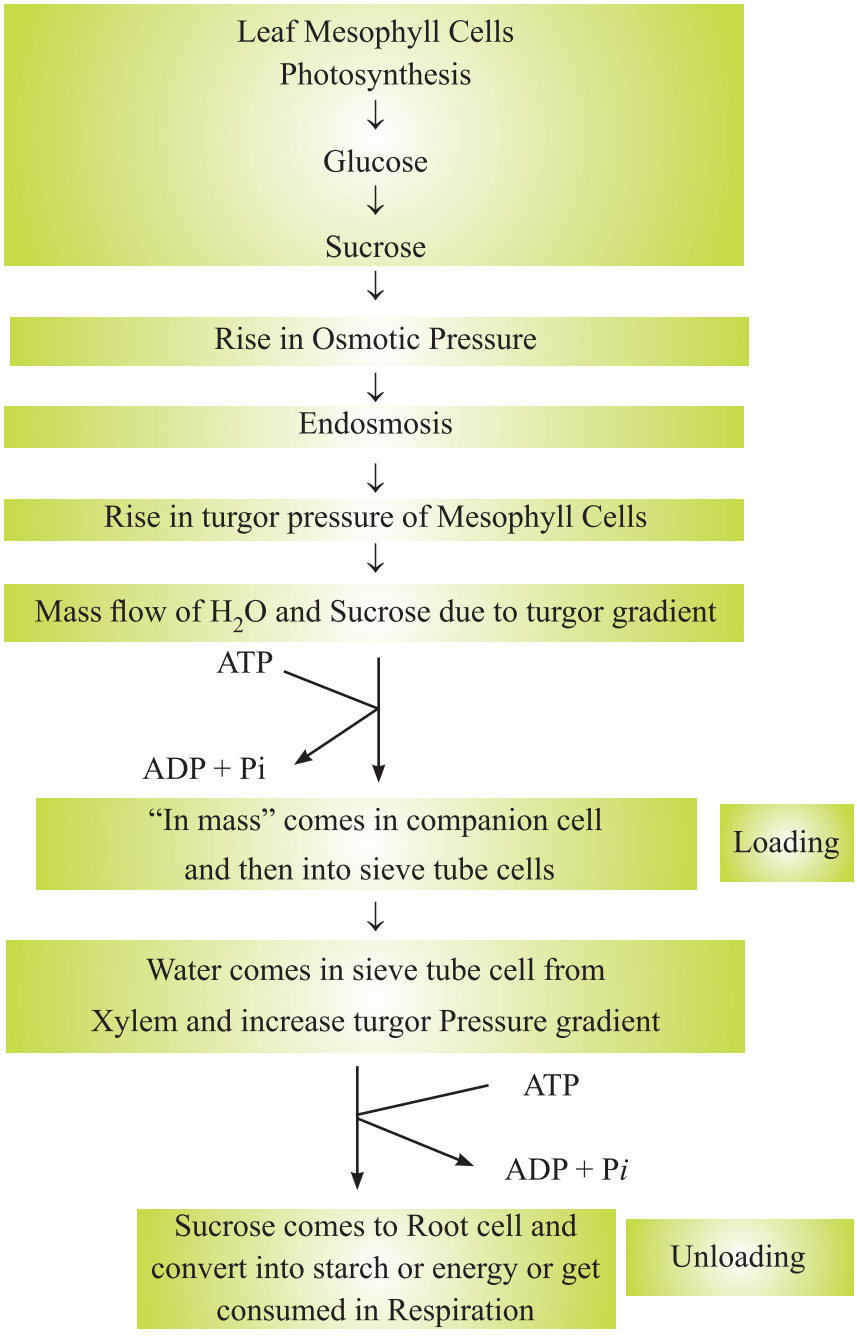
Endosmosis—When a cell is placed in water or hypotonic solution, water enters into the cell. This in called endosmosis. Due to it the volume of cell increases and it creates turgor pressure.

Exosmosis—When a cell is placed in hypertonic solution, water comes out of the cell, this is called exosmosis. It decreases volume of the cell.

Uptake and transport of mineral nutrients—Ions are absorbed by the roots by passive and active transport. The active uptake of ions require ATP energy. Specific proteins in membranes of root hair cells activity pump ions from the soil into the cytoplasm of epidermal cells and then xylem. The further transport of ions to all parts of the plant is carried through the water stream. Older dying leaves export much of their mineral content to younger leaves. Elements phosphorus, sulphur, nitrogen and potassium are most readily mobilised. Structural components such as calcium are not remobilised.

Mass flow : Mass flow is the movement of substances (water, minerals and food) in bulk from one point to another as a result of pressure differences between two points.

The pressure or mass flow Hypothesis :



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Decrease in osmotic pressure of Root Cells

↓

Water moves to Root Xylem

Mycorrhiza—A mycorrhiza is a symbiotic association of a fungus with a root system. The fungal hyphae absorb mineral ions (phosphorous) and water from the soil, and provide them to the roots of plant, in turn the roots provide sugars and nitrogen containing compounds to the mycorrhizae.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which part of the root is related with the absorption of water ?
   (a) root tip (b) terminal root
   (c) root hair (d) leaf
2. What makes the raisins to swell up when kept in water ?
   (a) Endasomonis (b) diffusion
   (c) Exosmosis (d) Guttation
3. Casparian strip is made of a substance which is impervious to water. Name this substance.
   (a) Lignin (b) cellular
   (c) Subenin (d) Pectin

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. What will happen to water potential when a solute is added to water ?
5. A plant cell when kept in a solution got plasmolysed. What was the nature of the solution.
6. Mention two ways of absorption of water by root hairs in plants.
7. Which form of sugar is transported through phloem ?
8. Give one example of imbibition.
9. A flowering plant is planted in an earthen pot and irrigated. Urea is added to make the plant grow faster, but after some time the plant dies. Give its possible reason.

10. Why is energy required to develop root pressure ?
11. Correct the statements :
    (a) Imbibition is a special type of diffusion when water is absorbed by living cell.
    (b) Most of water flow in the roots occurs via symplast.
    (c) Cells shrink in hypotonic solution and swell in hypertonic solution.

Short Answer Questions-I (2 marks each)

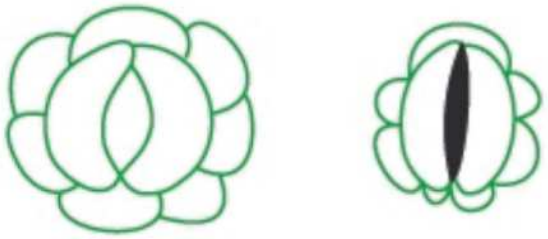
12. A well watered potted herbaceous plant shows wilting in the afternoon of a dry sunny day. Give reason.
13. Do different species of plants growing in the same soil show the same rate of transpiration at a particular time ? Justify your answer.
14. What is casparian strip ? Write its significance in plants.
15. Xylem transport is unidirectional and phloem transport bi-directional why ?
16. How is transpiration different from guttation ? Give two points.
17. Suggest two methods to increase the life of cut plants in a vase.
18. Write the chemical composition of xylem and phloem sap.
19. Transpiration is a necessary evil in plants. Explain.

Short Answer Questions-II (3 marks each)

20. Why is solute potential always negative ? Explain.

$$\psi_w = \psi_s + \psi_p$$

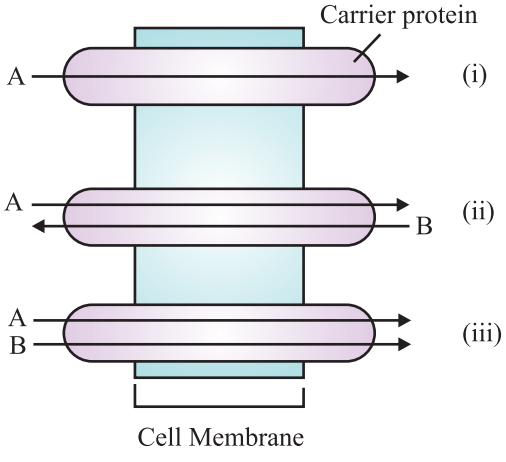
21. Water has a very important role in sustaining the life list properties of water which make it useful for all biological processes on earth.
22. When any dry plant material or seeds is/are kept in water, they swell up.
    (a) Name the phenomenon involved in this change.
    (b) Define this phenomenon.
    (c) Give two conditions essential for the phenomenon to occur.
23. Differentiate between temporary and permanent wilting. Do any of them indicate the water status of the soil ?
24. Observe the diagram and answer the following :



(a) (b)

(a) Which of these guard cells show a higher water content, A or B ?
(b) Are these types of guard cells found in monocots or dicots ?
(c) Name the element which play an important role in the opening and closing of stomata.

25. What is mycorrhiza ? How is the mycorrhizal association helpful in absorption of water and minerals in plants ?
26. Observe the given figure and give the answers of the following :
    (a) Identify the process occurring in (I), (II) and (III).
    (b) Differentiate between the process II and III.
    (c) How many types of aquaporins form the water channels in the cell membrane.



27. Give scientific term for the following statements/processes :
    (a) Movement of water in roots exclusively, through the cell wall
    (b) The positive hydrostatic pressure developed inside the cell or cell wall.
    (c) A solution having relatively less concentration.
    (d) Loss of water vapour from the aerial parts of the plants in the form of water vapours.

(e) Movement of a molecule across a membrane independent of other molecule.

(f) Water loss in its liquid phase through the special opening of veins near the tip of leaves of many herbaceous plants.

Long Answer Questions (5 marks each)

28. Minerals are present in the soil in sufficient amount. Do plants need to adjust the types of solutes that reach the xylem ? Which molecules help to adjust this? How do plants regulate the type and quantity of solutes that reach xylem.
29. How do plants absorb water ? Explain transpiration pull model in this regard.
30. (a) Describe the pressure flow hypothesis of translocation of sugar in plants.
    (b) Explain the mechanism of closing and opening of stomata.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (a) root tip 2. (a) Endosmosis 3. (a) Suberin

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer (1 mark each)

4. Water potential will decrease.
5. Hypertonic.
6. Apoplast and symplast pathway.
7. Sucrose.
8. Swelling of seed when put in water/moist soil.
9. Due to exosmosis *i.e.,* water comes out the plant.
10. Every activity requires energy. Root pressure develops due to activity of living cell.
11. (a) Osmosis is a special type, of diffusion when water is absorbed by living cells.
    (b) Most of the water flows in the roots occurs via the apoplast.
    (c) Cells shrink in hypertonic, solution and swell in a hypotonic solution.

Short Answers-I (2 marks each)

12. During noon, the rate of transpiration becomes higher than the rate of water absorption by plant. It causes loss of turgidity and leads to wilting.

13. Rate of transpiration is not same because transpiration is affected by numbers and distribution of stomata, and their opening.
14. Band of suberised matrix on the inner side of endodermis water molecule are unable to panetrate it.
15. In xylem movement of water is always from roots to leaves. In phloem movement of food is from source to sink and vice versa.

16.

Transpiration	Guttation
(i) Loss of water by a plant in form of vapours.	(i) The loss of water in the form of liquid droplets from the plant.
(ii) Occurs through the general surface of leaves (stomata) and the young stems.	(ii) Occurs at the margins and the tips of the leaves.

17. (a) By adding cytokinin into water of the vase.
    (b) Preventing entry of air in the cut plants by immediately immersing the cut end in water.
18. Xylem Sap-Water, traces of all minerals.

    Phloem sap-5-10% sucrose, 1% amino acids, traces of bound mineral, hormones, other organic substances and rest is water.
19. Refer to 'Points of Remember' (Significance and disadvantages of Transpiration)

Short Answers-II (3 marks each)

20. Refer to 'Points of Remember'. (Solute Potential, Pressure Potential and Water potential)
21. Refer to 'Points of Remember', (Cohesion, Adhesion and surface tension)
22. (a) Imbibition.
    (b) Refer to 'Points to Remember.'
    (c) Condition necessary to imbibition.
        (i) Water potential between the absorbent and the liquid imbibed.
        (ii) Affinity between the adsorbent and the liquid imbibed.

23.

Temporary wilting	Permanent wilting
(i) Plant recovers from temporary wilting after sometimes.	(i) Automatic recovery is not possible. It may recover if water is provided soon.
(ii) Much damage is not caused.	(ii) Much damage is caused.
(iii) It commonly occurs during mid-day only.	(iii) It occurs throughout day and night.

When wilting is permanent, water present in soil is largely in unavailable form. The soil contains 10-15% water depending, upon its texture.

24. (a) A (b) Dicots
(c) K^+ (Potassium ions)

25. Refer points to remember.

26. (a) (i) Uniport (ii) Antiport (iii) Symport
(b) Refer 'Points to Remember'.
(c) 8 types of aquaporins.

27. (a) Apoplast pathway (b) Turgor pressure
(c) Hypotonic (d) Transpiration
(e) Uniport (f) Guttation

Long Answers (5 marks each)

28. Refer 'Points to remember'.

29. Refer 'Points to remember'.

30. (a) Refer points to remember.
(b) Refer 'Points to remember'.

Assertion Reasoning

The following question consists of 2 statements- Assertion (A) and Reason (R). Answer the question by selecting the appropriate option below :

(a) Both A and R are true and the reason is a correct explanation of the assertion

(b) The assertion is true but the reason is false

(c) Both the assertion and reason are false

(d) The assertion if false but the reason is true

31. **Assertion (A)** : Facilitated diffusion occurs due to channel proteins.
Reason (R) : The proteins are of extrinsic type.

32. **Assertion (A)** : Transpiration is considered as a necessary evil.
Reason (R) : Ascent of sap occurs due to three physical properties of water

SOLUTIONS

Assertion Reasoning

31. (b) 32. (b)

Source-based/Case-based/Passage-based/Integrated Assessment questions

Read the following and answer questions from given below :

33. Translocation in plants occurs by mass flow. This was a hypothesis first given by Munch and then was elaborated by Crafts. According to this theory, organic solutes are translocated 'en masse' through the sieve tubes from the source to the sink. The hypothesis fails to explain the bidirectional movement of metabolites which is common in plants. Munch and Crafts could not explain how osmotic pressure is maintained in and balanced in mesophyll cells and that of root hair. This hypothesis placed sieve tube and protoplasm in a secondary role of mass flow whereas xylem and movement of water plays important role in maintaining turgor pressure for the mass flow. Turgor pressure gradient is established across the protoplasm between the cells of the source and the cells of the sink.

(i) What are the source and sink referred to?

(ii) Why does water move from the xylem into the lumen of sieve tubes and causes turgor pressure gradient?

(iii) The movement of sugars at the sink is removed by _____ (active/ passive transport). Choose the correct option.

(iv) Food prepared in leaves is moved from higher concentration to lower concentration. (T/F).

(v) Bidirectional movement occurs in which part of the transporting tissue(s) present in plants?

SOLUTIONS

Source-based/Case-based/Passage-based/Integrated Assessment questions

33. Solution

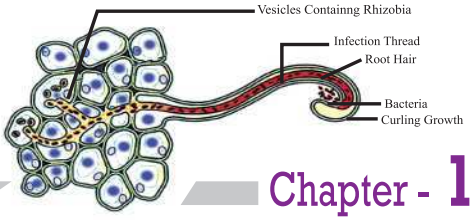
(i) Source is leaves, sink is the storage organs such fruits, or other parts of the plant.

(ii) As the solute concentration increase, the water from xylem moves into the lumen of sieve tubes due to osmosis and causes turgor pressure gradient.

(iii) Active transport

(iv) True

(v) Phloem



Chapter - 12

Mineral Nutrition

Based on functions :-

- Components of bio molecules of C, H, O, N
- components of energy related chemicals e.g. Mg, P
- Activator/Inhibitor of enzymes e.g. Zn^{2+}, Mo
- Alter osmotic potential of cell e.g. K, Na, Cl

Types of essential elements :-
(based on quantity)

Macronutrients :- Present in plant tissue in excess of 10 mole/kg of dry matter. e.g. C, H, O, N. P, S, K Ca, Mg

Micronutrients :-

Present in plant tissue less than 10 mole/kg of dry matter.

e.g. Fe, Mn, Cu, Mo, 2n, B, Cl, Ni

Criteria for Essentiality :-

- must be absolutely necessary for supporting normal growth and reproduction.
- requirement must be specific, not replaceable.
- must be directly involved in metabolism of the plant.

★ There are 17 essential elements.

MINERAL NUTRITION

Deficiency symptoms :-

Chlorosis:-Lossof chlorophyll, caused by deficiency of N, Mg, S. Fe, Mn, Zn & Mo

Necrosis -: Death of tissue caused by deficiency of Ca, Mg, Cu, K

Inhibition of cell division:- due to deficiency of N, K, S, Mo.

Delayed flowering : Caused Due to deficiency of N, K, S, Mo.

Toxicity of micro-nutrients : Moderate increase in micro-nutrient. Causes toxicity e.g Mn toxicity causes appearance of brown spots surrounded by chlorotic veins. Excess Mn induce deficiency of Fe, Mg, Ca.

Minerals are absorbed as ions :-

- Nitrogen as $No_3/NO^{2-}/NH^{4+}$
- Phosphorous as $H_2PO_4^-/HPO_4^{2-}$
- Potassium as K^+
- Calcium as Ca^{2+}
- Magnesium as Mg^{2+}
- Sulphur as SO_4^{2-}
- Iron as Fe^{3+}
- Manganese as Mn^{2+}
- Zinc as $2N^{2+}$
- Copper as Cu^{2+}
- Boron as Bo_3^{3-} or $B_4O_7^{2-}$
- Molybdenum as MoO_2^{2+}
- Chlorine as Cl^-

Points To Remember

Biological nitrogen fixation: Conversion of atmospheric nitrogen into organic compounds by living organisms.

Flux : The movement of ions is called flux. Influx is inward movement of ions into the cells and efflux is the outward movement of ions.

Necrosis : Death of tissues particularly leaf tissue due to deficiency of Ca, Mg, Cu, K.

Mineral Nutrition : Plants require mineral elements for their growth and development. The utilization of various absorbed ions by a plant for growth and development is called mineral nutrition of the plant.

Hydroponics : Soil-less culture of plants, where roots are immersed in nutrient solution (without soil) is called hydroponics. The result obtained from hydroponics may be used to determine deficiency symptoms of essential elements.

Passive Transport : Absorption of minerals with concentration gradient by the process of diffusion without the expense of metabolic energy.

Essential Elements There are 17 essential elements

In addition to the 17 essential elements, Na, Si, Co and Si are required by some higher plants.

Criteria for essentiality specificity, irreplaceable, direct involvement :

Role of Minerals Elements in Plants

MACRO NUTRIENTS

Element	Obtained as	Functions	Deficiency symptoms
Nitrogen (N)	Mainly as NO_3^- some as NO_2 or NH_4^+	Constituent of proteins, nucleic acids, vitamins and hormones.	Stunted growth Chlorosis, dormancy of apical causal buds.
Phosphorus (P)	Phosphate ions ($H_2PO_4^-$ or HPO_4^{2-})	Constituent of cell membrane. Required for the synthesis of nucleic acids, nucleotides, ATP NAD and NADP for phosphory-lation reactions.	Poor growth of plant. Leaves dull green, delay in seed germination purple or red spots on leaves, premature leaf fall.

Potasium (K)	K^+	Helps to maintain an anion-cation balance in cells. Involved in protein synthesis, in opening and closing of stomata; activation of enzymes; maintenance of turgidity of cells.	Stunted growth; yellow leaves of mottled appearance of leaves. Premature death.
Calcium (Ca)	Ca^{2+}	Required in formation of mitotic spindle; involved in normal functioning of cell membranes; activates certain enzymes; as calcium pectate in middle lamella of the cell wall.	Stunted growth, chlorosis of young leaves.
Magnesium (Mg)	Mg^{2+}	Activates enzymes in phosphate metabolism, constituent of chlorophyll; maintains ribosome structure.	Chlorosis between the leaf veins, necrosis, purple colours spots on older leaves.
Sulphur (S)	SO_4^{2-}	Constituent of two amino-acids-Cysteine and methionine and proteins, coenzymes, vitamins and ferredoxin.	Chlorosis of younger leaves, stunted growth

MICRO NUTRIENTS

Element	Obtained as	Functions	Deficiency symptoms
Iron (Fe)	Fe^{3+}	Constituent of Ferredoxin and cytochrome; needed for synthesis of chlorophyll.	Chlorosis of leaves
Manganese (Mn)	Mn^{2+}	Activates certain enzymes involved in photosynthesis, respiration and nitrogen metabolism.	Chlorosis, grey spots on leaves.

Zinc (Zn)	Zn^{2+}	Activates various enzymes like carboxylases. Required for synthesis of auxins.	Malformation of leaves
Copper (Cu)	Cu^{2+}	Activates certain enzymes. Essential for overall metabolism	Stunted growth, inter-veinal chlorosis in leaves. Necrosis of the tip of young leaves, drybark of shoot.
Boron (B)	BO_3^{3-}, $B_4O_7^{2-}$	Required for uptake of water and Ca, for membrane functioning, pollen germination, cell elongation carbohydrate translocation.	Death of stem and root apex, loss of apical dominance, abscission of flowers, small size of fruits
Molybdenum (Mo)	MoO_2^{2+} (molybdate ions)	Activates certain metabolism.	Nitrogen deficiency inter-veinal chlorosis retardation of growth
Chlorine (Cl)	Cl^-	Maintains solute concentration along with Na+ & K+; maintain anion-cation balance in cells; essential for oxygen evolution in photosynthesis.	Wilted leaves; stunted root growth and reduced fruiting.

Critical Concentration : The concentration of the essential element below which plant growth is retarted. The element is said to be deficient when present below the critical concentration.

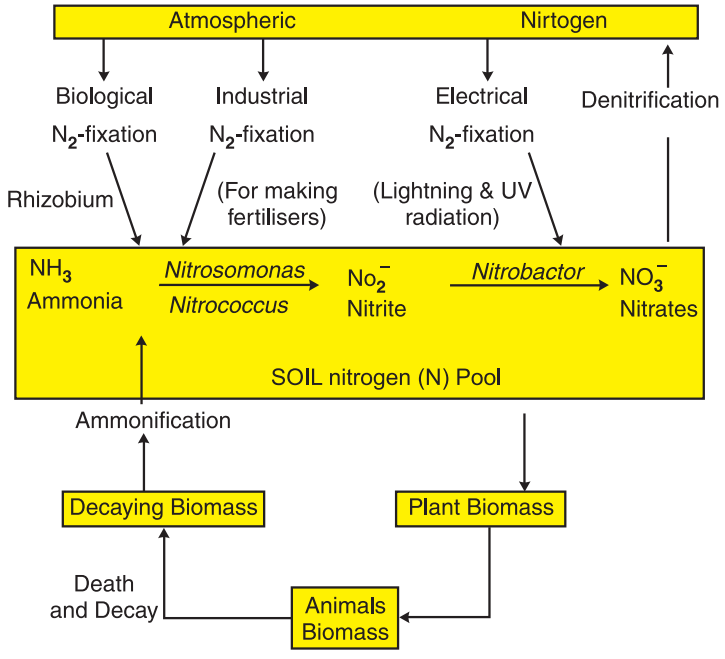
Deficiency symptoms : Chlorosis, necrosis, stunted growth, premature fall of leaves and buds and inhibition of cell division.

Toxicity of micronutrient : Any mineral ion concentration in tissues that reduces the dry weight of tissues by 10% is considered toxic. Toxicity of one element may lead to deficiency of other element since the former may inhibit the uptake of latter., e.g., Mn competes with Fe, Mg for uptake and also inhibits Ca translocation to shoot apex. Therefore Mn toxicity symptoms are actually same as deficiency symptoms of Fe, Mg and Ca.

Role of microbes in nitrogen cycle :

- *Rhizobium, Azotobacter, Rhodospirillum;* Fix atmospheric nitrogen
- *Nitrosomonas and/or Nitrococcus* : Conversion of ammonia to nitrite
- *Nitrobacter :* Conversion of nitrite into nitrate.
- *Pseudomonas* and *Thiobacillus* : reduce nitrate into nitrogen.

Nitrogen Cycle:



Nitrogen Cycle

Nitrogen fixation— (N_2) into ammonia.

Ammonification—The process of decomposition of organic nitrogen of plants and animals (proteins) into ammonia.

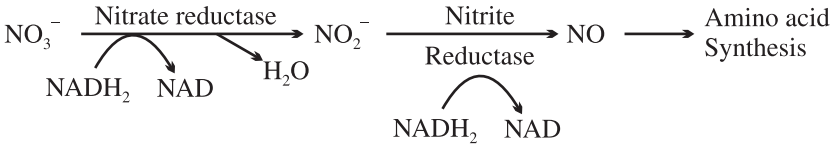
$$\text{Protien in Dead Plants and Animals} \xrightarrow[\text{Bacteria}]{\text{Ammonifying}} NH_3$$

Nitrification—The ammonia so formed may volatilise and re-enter the atmosphere, or some of the ammonia may be converted first into nitrite and then into nitrate by soil bacteria

$$2NH_3 + 3O_2 \xrightarrow{\textit{Nitrosomonas}} 2NO_2^- + 2H_2O + 2H^+$$

$$2NO_2^- + O_2 \xrightarrow{\textit{Nitrobactor}} 2NO_3^-$$

The Nitrate so formed can be easily absorbed by the plants and transported to leaves. In leaves, nitrate is reduced to ammonia to form amino-acids, because nitrate can not used by plants as such.



Denitrification—Process of reduction of the nitrate present in soil to nitrogen. It is carried out by bacteria like *Pseudomonas* and *Thiobacillus*.

Nitrogen fixation = $N_2 \rightarrow NH_3$

Biological Nitrogen Fixation—Reduction of nitrogen to ammonia by living organisms. Certain prokaryotes are able to fix nitrogen because of presence of 'nitrogenase' enzyme in them.

Nitrogen fixing microbes may be

(a) Free living—(i) Aerobic—*Azotobacter*

(ii) Anaerobic—*Rhodospirillum*

(b) Cyanobacteria—*Nostoc, Anabaena*

(c) Symbiotic—(i) With leguminous plants—*Rhizobium*

(ii) With non-leguminous plants—*Frankia*

Enzyme nitrogenase—The enzyme nitrogenase is Mo-Fe protein and catalysis the conversion of atmospheric nitrogen to ammonia (First stable product of nitrogen fixation)

Leg-hemoglobin—A pink colour pigment, similar to hemoglobin of vertebrates and functions as an oxygen scavenger and protects nitrogenase from oxygen.

Steps of nodule formation :

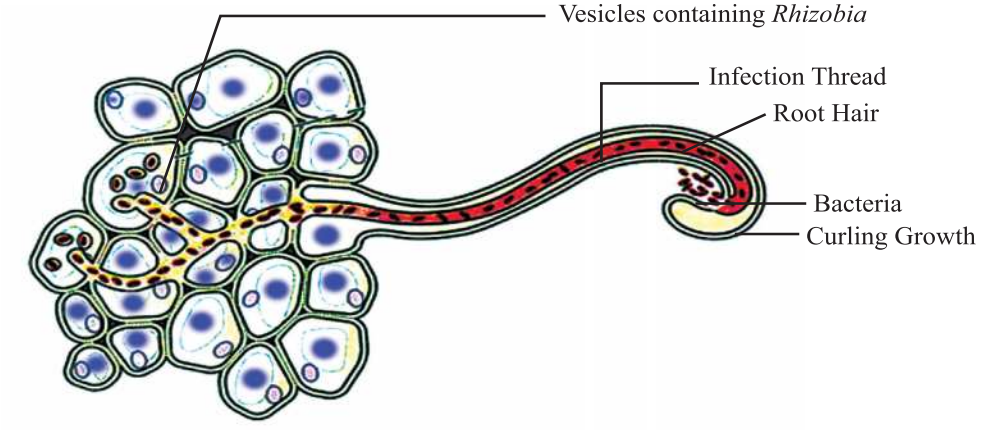
(a) *Rhizobium* bacteria present in soil contact a susceptible root hair.

(b) Infection of the root hair cause it to curve and deformed due to chemical secretion.

(c) An infection thread is produced carrying the bacteria into the cortex of the root.

(d) The bacteria get modified into rod-shaped bacteroids and cause inner cortical and pericycle cells to divide Plant produces cytokinin and auxin to stimulate cell division and enlarges to form nodules.

(e) Division and growth of cortical and pericycle cells lead to nodule formation.



Nodule Formation in Roots of Leguminous Plants

Mechanisms of N_2 fixation

It require 4 components—

(a) A strong reducing agent like $FADH_2$, $NADPH_2$

(b) Nitrogenase enzyme

(c) ATP (as energy service)

(d) Nitrogen gas molecule (as substrate)

$$N_2 + 8e^- + 8H^+ + 16\ ATP \longrightarrow 2NH_3 + H_2 + 16\ ADP + 16Pi$$

Fate of Ammonia :- At physiological pH, the ammonia is protonated to form NH^{4+}, which is quite toxic to plants and hence can not accumulate in them. It is used by plants in following ways–

(a) **Reductive amination :-** α – ketoglutaric acid + NH_4^+ + NADP

$$\xrightarrow[\text{Dehydrogenase}]{\text{glutamate}} \text{glutamate} + H_2O + NADP$$

(b) **Transamination :-** Transfer of amino group from one amino acid to the keto group of a keto acid to form amino acid with the help of enzyme transaminase.

(c) **Formation of Amides :-** The hydroxyl part of the acid is replaced by another amino radicle to form amides. e.g. asparagine and glutamine are formed from aspartic acid and glutamic acid.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Name one symblotic nitrogen fixing bacteria.
   (a) *Rhizobium* (b) *E. coli*
   (c) *Pseudomones* (d) *Nitrosomonas*
2. .... & .... are examples of macronutriesnt.
   (a) S & Ca (b) Zn & Ca
   (c) Fe & B (d) C & A
3. Death of tissue, due to deficiency of Ca, Mg, Cu, K is....
   (a) Chlorosis (b) Wilting
   (c) Plasmolysis (d) Necrosis

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. Which substance impart pink colour to the root nodule of a leguminous plant and also mention its role ?
5. What is the term used for mineral deficiency symptom in plants in which leaves become yellow in different pattern ?
6. Define hydroponics.
7. Give the name of an insectivorous angiosperm plant.
8. Give the name of one non-symbiotic nitrogen fixing prokaryote.
9. Name the green house gas produced in rice fields.
10. Name the element which is essential for the photolysis of water during photosynthesis.
11. Why do deficiency symptoms appear in older leaves first?

Short Answer Questions-I (2 marks each)

12. Differentiate between two types of absorption of minerals in plants from soil.

13. Name the following :
    (a) Bacteria which converts ammonia into nitrite.
    (b) Bacteria which oxidises nitrite into nitrate.
14. How does Leghemoglobin protect the enzyme nitrogenase ?
15. Name the enzyme found in root modules for N_2 fixation ? Name the pink coloured pigment required for its functioning.

Short Answer Questions-II (3 marks each)

16. Write the deficiency symptoms of the following three elements :
    (a) Phosphorus
    (b) Magnesium
    (c) Potassium
17. Describe the following three deficiency symptoms and co-relate them with concerned mineral deficiency :
    (a) Phosphorus
    (b) Magnesium
    (c) Potassium
18. Explain in brief the steps involved in biological nitrogen fixation.
19. Describe the two main processes of synthesis of amino acids from Ammonium ion (NH_4^+) in plants.
20. Define critical concentration, also mention four deficiency symptoms of nutrients in plants.
21. Write a short note on toxicity of micronutrient. Give an example which show toxicity of one element may lead to deficiency of other element.

Long Answers (5 marks each)

22. Describe all the steps of nitrogen cycle in nature.
23. Describe with diagrams how root nodules are formed in leguminous plants.
24. Explain adaptations in leguminous root nodules for N_2 fixation.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (a) *Rhizobium* 2. (a) S & Ca
3. (d) Necrosis

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Leghemoglobin. It is an oxygen scavenger, which protects the enzyme nitrogenase.
5. Necrosis.
6. The technique of growing plants in a nutrient solution without soil is called hydroponics.
7. *Nepenthes* (Pitcher plant)
8. *Azotobacter*
9. Methane (CH_4)
10. Calcium
11. It happens because the elements are mobilized to the younger parts of the plant from older leaves.

Short Answers-I (2 marks each)

12. Refer 'Points to Remember'.
13. (i) Nitrifying Bacteria—*Nitrosomonas*.
    (ii) Nitrifying Bacteria—*Nitrobacter*
14. Refer to page no. 203.
15. Enzyme-Nitrogenase
    Pink coloured pigment-Leghaemoglobin

Short Answers-II (3 marks each)

16. Refer to 'Points to Remember'.
17. Refer to 'Points to Remember'.

18. Refer to 'Points to Remember'.
19. Refer to 'Points to Remember' (Fate of Ammonia)
20. Refer to 'Points to Remember'.
21. Refer to 'Points to Remember'.

Long Answers (5 marks each)

22. Refer to 'Points to Remember'.
23. Refer to 'Points to Remember'.
24. Refer to 'Points to Remember'.

Assertion Reasoning (1 mark each)

The following question consists of 2 statements - Assertion (A) and Reason (R). Answer the question by selecting the appropriate option below :

(a) Both A and R are true and the reason is a correct explanation of the assertion

(b) The assertion is true but the reason is false

(c) Both the assertion and reason are false

(d) The assertion is false but the reason is true

25. **Assertion (A) :** Leguminous plants are grown alternatively with grain crops to replenish nitrogen in the soil.

    Reason (R) : Rhizobium is a symbiotic bacterium that can fix nitrogen while living in the roots of leguminous plants

26. **Assertion (A) :** If any mineral concentration in tissues that reduces the dry weight of tissues by about 10 percent is considered toxic.

    Reason (R) : It is difficult to analyse the symptoms of mineral toxicity

27. **Assertion (A) :** Calcium is required by meristematic and differentiating tissues.

    Reason (R) : It is essential fo rthe formation of the mitotic spindle and cell wall formation.

28. **Assertion (A) :** Hydroponic is a soil-less method to grow plants.

    Reason (R) : Commercial production of vegetable such as tomato, seedless cucumber and lettuce is done only with the help of hydroponics.

29. **Assertion (A) :** Influx of nutrients always occurs via facilitated diffusion.
Reason (R) : Energy is always required when there is an influx.

Solution

Assertion Reasoning

25. (a)
26. (b)
27. (a)
28. (b)
29. (d)

Source-based/Case-based/Passage-based/Integrated assessment questions (4 marks each)

Read the following and answer any four questions from (i) to (v) given below :

30. Soil is the reservoir of nutrients and the properties of soil depend upon the type of minerals present. In addition to essential mineral elements, there are some other minerals too that are grouped according to their biochemical behaviour and physiological functions in plants metabolism. Biogeochemical cycles replenish mineral nutrients in the soil. One of such important nutrients is nitrogen, plants cannot use nitrogen directly from the atmosphere. Many microbes play an important role in the absorption and recycling of nitrogen in an ecosystem. As plants use minerals, the soil becomes deficient in some nutrients. They are either added artificially or are enhanced using biofertilizers. These biofertilizers help plants to absorb certain minerals either symbiotically or non-symbiotically.

(i) Which of the following is a micronutrient?
   (a) Carbon
   (b) Nitrogen
   (c) Iron
   (d) Oxygen

(ii) What will happen if one of the micronutrients is available in the plant in excess?

(iii) In which of the following forms nitrogen is absorbed by the plants?
   (a) Nitrates and dimeric nitrogen
   (b) Nitrates and nitrites

(c) Nitrites and ammonia

(d) Dimeric nitrogen and ammonia

(iv) Name any two symbiotic nitrogen-fixing microbes.

(v) Deficiency of _____ leads to premature fall of leaves and they turn dark green in colour.

(a) Phosphorous

(b) Iron

(c) Nitrogen

(d) Potassium

Solution

Source-based/Case-based/Passage-based/Integrated assessment questions

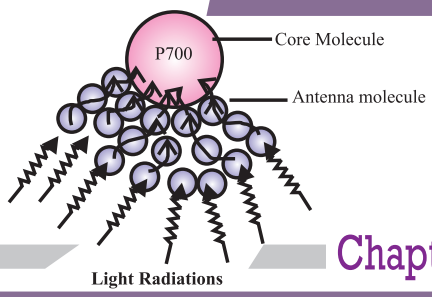
(i) (c) Iron

(ii) It will cause mineral toxicity and will interfere with the metabolism of other micronutrients.

(iii) (b) Nitrates and nitrites

(iv) *Frankia, Rhizobium*

(v) Phosphorous



Chapter - 13

Photosynthesis in Higher Plants

Photosynthesis
Formation of glucose from CO_2 and water in presence of sunlight and chlorophyll.

Factors affecting photosynthesis
- **External factors**: Light, CO_2 conc., temperature, water, O_2 etc.
- **Internal factors**: Chlorophyll conc., leaf age, phytohormones etc.

Site of photosynthesis
Photosynthesis occurs in double membrane bound chloroplasts that consist of stroma, grana stacks, thylakoids and stroma lamellae. Thylakoids contain photosynthetic pigments.

Photosynthetic pigments
They include chlorophylls, carotenes and phycobilins. Chlorophylls are the major pigments while other two are accessory ones. They may be of various types and form two major pigment systems.
- **PS I**: Includes P_{700} as photocentre and LHC (light harvesing complex) with electron carriers.
- **PS II**: Includes P_{680} as photocentre and LHC.

Photosynthetic mechanism
An enzymatic anabolic reaction involving many intermediates.

Photochemical Phase
Light dependent phase occurring in thylakoids.
- **Photolysis**: Water molecule is broken down into O and H by absorbing light energy. It produces e^-.
- **Photophosphorylation**: Electrons released in photolysis of water are used for production of ATP through photophosphorylation. It may be of two types:
  - **Cyclic**: Involves only PS I and produces only ATP.
  - **Non-cyclic**: Involves both PS I and PS II and produces both ATP and NADPH.

Biosynthetic Phase
Light dependent reaction that occurs in stroma. It can be of three types.
- **C_3 cycle**: CO_2 combines with RuBP and produces glucose *via* many intermediate steps. Also called as Calvin cycle. 3C-phosphoglyceric acid is first stable product.
- **C_4 cycle**: Glucose is formed by CO_2 fixation but initial acceptor is PEP in mesophyll cells and first stable product is 4C compound oxaloacetic acid. C_4 plants have kranz anatomy and are more efficient than C_3 plants.
- **CAM cycle**: In xerophytes, CAM cycle is observed where CO_2 is fixed at night. Similar to C_4 plants, but two steps are separated by time (day and night) not in space. It helps in reducing transpiration.

Photorespiration
Light dependent oxygenation of RuBP and release of CO_2 in photosynthetic cells of plant. It involves chloroplasts, peroxisomes and mitochondria. It consumes energy and wastes the work of photosynthesis.

Points To Remember

Photosynthesis : Photosynthesis is an enzyme regulated anabolic process to manufacture organic compounds inside the chlorophyll containing cells from carbon dioxide and water with the help of sunlight as a source of energy.

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll + enzymes}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2 \uparrow$$

Historical Perspective

Josheph Priestley (1770) : Showed that plants have the ability to take up CO_2 from atmosphere and release O_2. (Candle with bell jar and mouse expt.)

Jan Ingenhousz (1779) : Release of O_2 by plants was possible only in sunlight and only by the green parts of plants. (Expt. with aquatic plant in light & dark)

Theodore de Saussure (1804) : Water is an essential requirement for photosynthesis to occur.

Julius Von Sachs (1854) : Green parts in plant produce glucose which is stored as starch.

T.W. Engelmann (1888) : The effect of different wavelength of light on photosynthesis and plotted the first action spectrum of photosynthesis.

C.B. Van Niel (1931) : Photosynthesis is essentially a light dependent reaction in which hydrogen from an oxidisable compound reduces CO_2 to form sugar. He gave a simplified chemical equation of photosynthesis.

$$2H_2A + CO_2 \xrightarrow{\text{Sunlight}} 2A + CH_2O + H_2O$$

Hill (1937) : Evolution of oxygen occurs in light reaction.

Calvin (1954-55) : Traced the pathway of carbon fixation.

Hatch and Slack (1965) : Discovered C_4 pathway of CO_2 fixation.

Site for photosynthesis : Photosynthesis takes place only in green parts of the plant, mostly in leaves. Within a leaf, photosynthesis occurs in mesophyll cells which contain the chloroplasts. Chloroplasts are the actual sites for photosynthesis. The thylakoids in chloroplast contain most of pigments required for capturing solar energy to initiate photosynthesis : The membrane system (grana) is responsible for trapping the light energy and for the synthesis of ATP and NADPH. Biosynthetic phase (dark reaction) is carried in stroma.

Importance of Photosynthesis—(1) Synthesis of organic compounds (2) Change of radiant energy into chemical energy (3) Useful products are obtained from plants gums, oils timber fire wood, resins rubber, fibers and drugs, etc. (4) Balance the percentage of O_2 and CO_2 in atmosphere (5) Fossil fuels like coal, natural gas and petroleum have been formed inside the earth indirectly as a product of photosynthesis.

Pigments involved in photosynthesis :

Chlorophyll a : (Bright or blue green in chromatograph). Major pigment, act as reaction centre, involved in trapping and converting light into chemical energy. It is called universal photo-synthetic pigment.

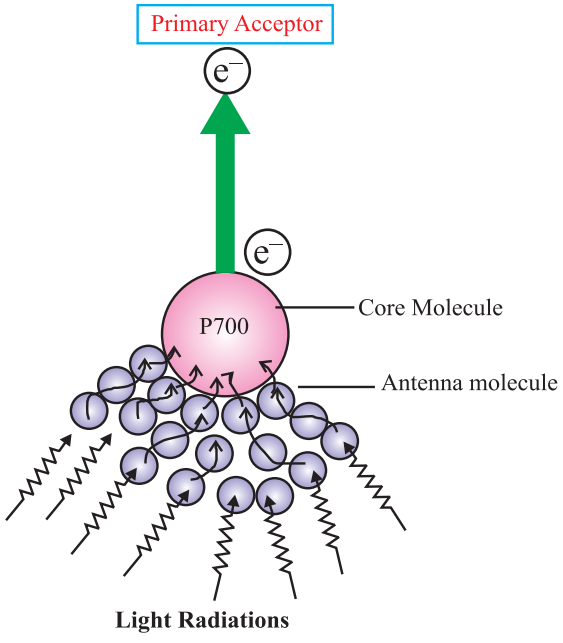
Chlorophyll b : Yellow green

Xanthophylls : Yellow

Carotenoids : Yellow to yellow-orange

- In the blue and red regions of spectrum shows higher rate of photosynthesis.

Light Harvesting Complexes (LHC) : The light harvesting complexes are made up of hundreds of pigment molecules bound to protein within the photosystem I (PS-I) and photosystem II (PS-II). Each photosystem has all the pigments (except one molecule of chlorophyll 'a') forming a light harvesting system (antennae). The reaction centre (chlorophyll a) is different in both the photosystems.



Light Harvesting Complex

Photosystem I (PS-I) : Chlorophyll 'a' has an absorption peak at 700 nm (P700).

Photosystem II (PS-II) : Chlorophyll 'a' has absorption peak at 680 nm (P680),

Process of photosynthesis : It includes two phases-Photochemical phase and biosynthetic phase. (Formerly known as Light reaction and dark reaction)

(i) **Photochemical phase (Light reaction) :** This phase includes-light absorption, splitting of water, oxygen release and formation of ATP and NADPH. It occurs in grana region of chloroplast.

(ii) **Biosynthetic phase (Dark reaction) :** It is light independent phase, synthesis of food material (sugars). (Calvin cycle). It occurs in stroma region of chloroplast.

Photophosphorylation : The process of formation of high-energy chemicals (ATP and NADPH) in presence of light.

Non-Cyclic photophosphorylation : Two photosystems work in series–First PSII and then PSI. These two photosystems are connected through an electron transport chain (Z. Scheme). Both ATP and NADPH + H^+ are synthesised by this process. PSI and PSII are found in lamellae of grana, hence this process is carried here.

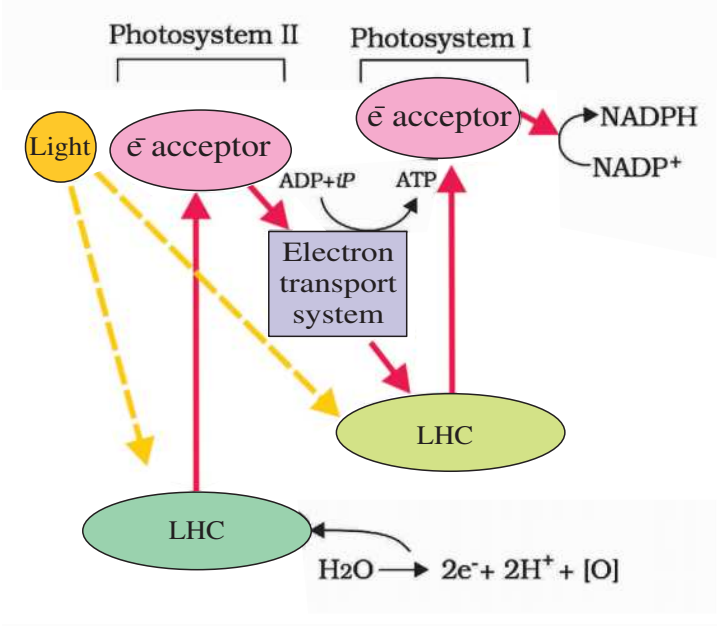


Figure 13.5 Z scheme of light reaction

The electron transport (Z-Scheme) : In PS II, reaction centre (chlorophyll a) absorbs 680 nm wavelength of red light which make the electrons to become excited. These electrons are taken up by the electron acceptor that passes them to an electron transport system (ETS) consisting of cytochromes. The movement of electron is down hill. Then, the electron pass to PS I and move down hill further to $NADP^+$. $NADP^+$ in then reduced to $NADPH + H^+$.

The splitting of water : It is linked to PS II. Water splits into H^+, [O] and electrons. $2H_2O \longrightarrow 4H^+ + O_2 + 4e^-$

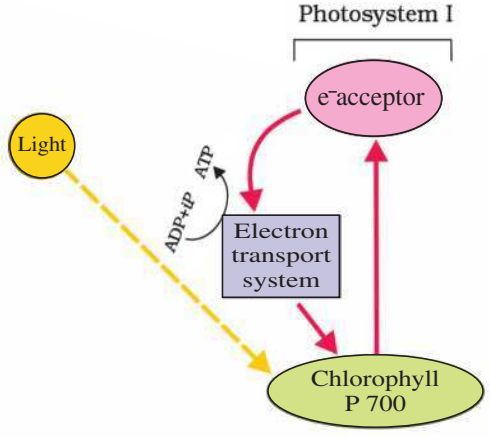
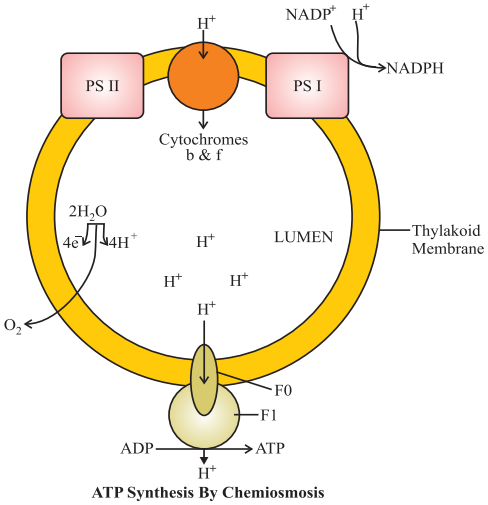


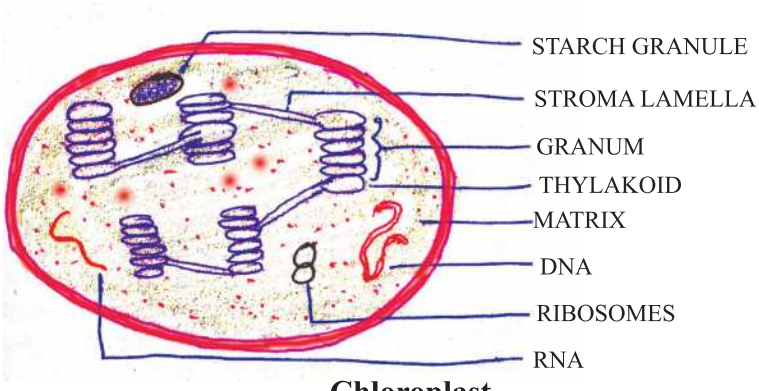
Figure 13.6 Cyclic photophosphorylation

Cyclic photophosphorylation : Only PS-I works, the electron circulates within the photosystem. It happens in the stroma lamellae (possible location) because in this region PSII and NADP reductase enzyme are absent. Hence only ATP molecules are synthesised. It occurs when only light of wavelengths beyond 680 nm are available for excitation.

Chemiosmotic Hypothesis : Chemiosmotic hypothesis explain the mechanism of ATP synthesis in chloroplast. In photosynthesis, ATP synthesis is linked to development of a proton gradient across a membrane. The protons are accumulated inside of membrane of thylakoids (in lumen). ATPase enzyme has a channel of that allow diffusion of protons back across the membrane. This release energy to activate ATPase enzyme that catalyses the formation of ATP.



ATP Synthesis By Chemiosmosis



Chloroplast

Biosynthesis phase in C_3 plants :

ATP and NADPH, the products of light reaction are used in synthesis of food. The first CO_2 fixation product in C_3 plant is 3-phosphoglyceric acid or PGA. The CO_2 acceptor molecule is RuBP (ribulose bisphosphate). The cyclic path of sugar formation is called Calvin cycle on the name of Melvin Calvin, the discover of this pathway. **Calvin cycle** proceeds in three stages.

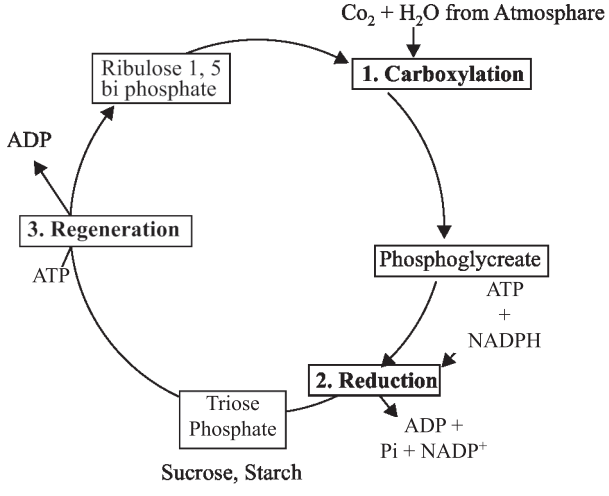
(1) Carboxylation : CO_2 combines with ribulose 1, 5-bisphosphate to form 3 PGA in the presence of RuBisCo enzyme (present in stroma)

(2) Reduction : Carbohydrate is formed at the expense of ATP and NADPH.

It involves 2ATP for phsophorylation and 2NADPH for reduction per CO_2 molecule fixed.

(3) Regeneration : The CO_2 acceptor ribulose 1, 5-bisphosphate is formed again.

6 turns of Calvin cycles and 18 ATP molecules are required to synthesize one molecule of glucose.



$$6CO_2 + 6\,RuBP + 18ATP + 12NADPH \longrightarrow C_6H_{12}O_6 + 6RuBP + 18ADP + 18P\boldsymbol{i} + 12NADP$$

Input	Output
$6CO_2$	One Glucose
18 ATP	18 ADP
18NADPH	12 NADP

The C4 pathway : C_4 plants such as maize, sorghum, sugarcane have a four carbon compound special type, of leaf anatomy, they tolerate higher temperatures. In this pathway, oxaloacetic acid (OAA) is the first stable product formed. It is 4 carbon atoms compound, hence called C_4 pathway (Hatch and Slack Cycle). The leaf has two types of cells : mesophyll cells and bundle sheath cells (Kranz anatomy). Initially CO_2 is taken up by phosphoenol pyruvate (PEP) in mesophyll cell and changed to oxaloacetic acid (OAA) in the presence of PEP carboxylase. Oxaloacetate is reduced to maltate/asparate that reach into bundle sheath cells.

The decarboxylation of maltate/asparate occurs with the release of CO_2 and formation of pyruvate (3C). In high CO_2 concentration RuBisCO behaves as carboxylase and not as oxygenase, hence the photosynthetic losses are prevented. RuBP operates now under Calvin cycle and pyruvate transported back to mesophyll cells and changed into phosphoenol pyruvate (PEP) to keep the cycle continue.

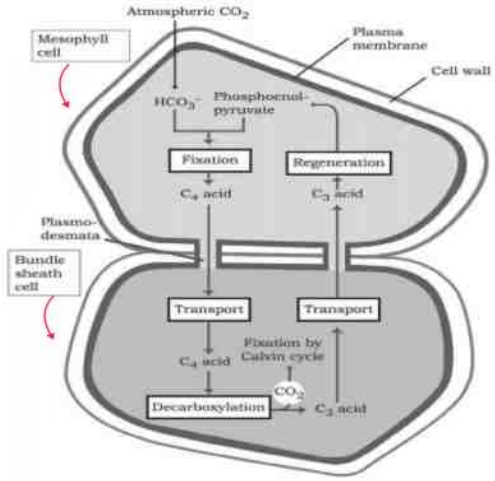


Figure 13.9 diagrammatic representation of the Hatch and Slack Pathway

Photorespiration : The light induced respiration in green plants is called photorespiration. In C_3 plants some O_2 binds with RuBisCO and hence CO_2 fixation is decreased. In this process RuBP instead of being converted to 2 molecules of PGA binds with O_2 to form one molecule of PGA and phosphoglycolate.

$$RuBP + O_2 \xrightarrow{RuBP} PGA + Phosphoglycolate$$

There is neither synthesis of ATP nor $NADPH_2$ or sugar. Rather it results in release of CO_2 with utilisation of ATP. The biological function of photorespiration is not known yet.

C_4 Plants :

(1) Lack Photorespiration

(2) Show response to high light intensities

(3) Have greater productivity of biomass.

Adaptations in C_4 Plants :

(i) Kranz Anatomy

(ii) Occurrence of two types of cells

(iii) Dimorphic chloroplast

(iv) Presence of RuBisCO in Bundle Sheath cells and PEPcase in mesophyll cells.

(v) Mechanism to increase CO_2 concen-tration near RuBisCO in Bundle Sheath cells.

CAM (Crassulacean Acid Metabolism) Plants—Stomata open at night. *e.g.,* Cacti, Bryophyllum, Pineapple.

Law of Limiting Factors : If a chemical process is affected by more than one factor, then its rate will be determined by the factor which is nearest to its minimal value. It is the factor which directly affects the process if its quantity is changed. Factors affecting photosynthesis :

1. **Light :** Rate of photo-synthesis increases at low light intensities. At high intensities of light beyond a point the rate of CO_2 fixation decreases. Longer hours of light duration favour more photosynthesis rate.
2. **Carbon dioxide :** Increase in CO_2 concentration causes increases in CO_2 fixation. It is the major limiting factor for photosynthesis.
3. **Temperature :** The rate of photosynthesis at optimum temperature is, high. It is 20°C-25°C For C_3 plants and 30-45°C for C_4 plants.
4. **Water :** Water is one of the reactant in photosynthesis, but it effects the rate of CO_2 fixation. Low water content causes the stomata to close and reduces the CO_2 availability.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which of the following pathway is following by Pineapples in order to fix carbon-di-oxide efficiently?
   (a) TCA cycle (b) CA cycle
   (c) CAM pathway (d) C3 cycle
2. How many molecules of ATP are required for synthesis of one molecules of glucose in C3 and C4 pathway?
   (a) 12 and 18 respectively (b) 30 and 18 respectively
   (c) 16 and 30 respectively (d) 18 and 30 respectively
3. As the light intensity increases, the rate of photosynthesis increases. During high light intensities the rate of photosynthesis decreases due to
   (a) Increase incident light beyond a point causes the breakdown of chlorophyll
   (b) Increase incident light beyond a point causes less absorption of minerals
   (c) Increase incident light beyond a point will block xylem vessels
   (d) Increase incident light beyond a point will use carbon-di-oxide and will not be available for photosynthesis.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 marks each)

4. Which one of the photosystems can carry on photophosphorylation independently ?
5. Name two photosynthetic pigments belonging to carotenoids.
6. Name the most abundant enzyme found in the world.
7. Name the scientist who proposed the C_4 pathway. Name one such plants.
8. Where does carbon fixation occur in chloroplast ?
9. Which compound acts as CO_2 acceptor in Calvin cycle ?
10. Name the end products of light reaction.
11. Does the photosynthesis occur in moon light ? Why ?
12. Which part of sunlight is most suitable for photosynthesis.

Short Answer Questions-I (2 marks each)

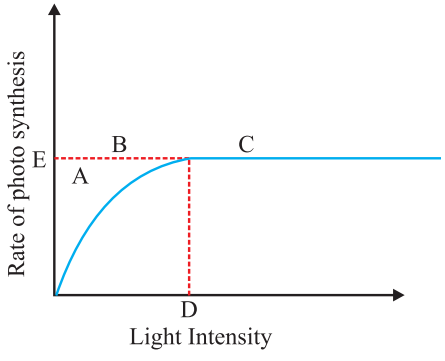
13. Why does the rate of photosynthesis decline in the presence of continuous light ?
14. Why do green plants start evolving carbon dioxide instead of oxygen on a hot sunny day ?
15. Fill in the space, left blank in the given table to bring the difference between C_3 and C_4 plants :

S.No.	Characteristics	C_3 plants	C_4 plants
1.	Cell type	mesophyll	...(a)... and mesophyll
2.	CO_2 acceptor	...(b)...	Phosphoenol pyruvate (PEP)
3.	First CO_2 fixation product	3-PGA	...(c)...
4.	Optimum temperature	...(d)...	30° C to 45° C

16. State two functions of accessory pigments, found in thylakoids.
17. Why do C_4 plants are more expensive (in energy requirement) than C_3 plants ?
18. What is limiting factor ? State the law of limiting factors.

Short Answer Questions-II (3 marks each)

19. The figure shows the effect of light on the rate of photosynthesis. Based on the graph, answer the following questions :
    (i) At which point(s) A, B or C in the curve, light is a limiting factor ?
    (ii) What could be the limiting factor(s) in region A ?
    (iii) What do region C and D represent on the curve ?

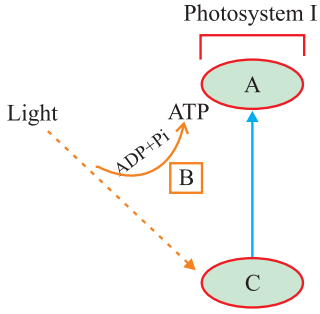


20. When and why does photorespiration take place in plants ? How does this process result in a loss to the plant ?

21. What are the steps that are common to C_3 and C_4 photosynthesis ?

22. Two potted plants were kept in an oxygen free environment in transparent containers, one in total darkness and the other in sunlight. Which one of the two is likely to survive more ? Justify your answer by giving the reason.

23. (a) In the diagram shown below, label A, B and C. What type of phosphorylation is possible in this ?



(b) Give any two points of difference between cyclic and non-cyclic photophosphorylation.

24. Name the pigment found in tomato, carrots, chillies etc. which gives red colour to them. Is it a photosynthetic pigment ?

25. Chloroplast and mitochondria are believed to be semi-autonomous organelles. Justify the statement.

26. Mention the conditions under which the C_4 plants are superior to C_3 plants.

Long Answer Questions (5 marks each)

27. Describe C_4 pathway in a paddy plant. How is this pathway an adaptive advantage to the plant ?

28. Explain, the process, of biosynthetic plase of photosynthesis occurring in chloroplast.

29. (a) Give steps to ATP synthesis in chloroplasts through chemiosmosis.
(b) Schematically represent non-cyclic photophosphoryation in plants.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (c) CAM pathway

2. (d) 18 and 30 respectively
3. (a) Increase incident light beyond a point causes the breakdown of chlorophyll

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer (1 mark each)

4. PS-I.
5. Carotene and xanthophylls.
6. RuBisCO.
7. Hatch and Slack. Maize and Sorghum.
8. Carbon fixation takes place in stroma.
9. Ribulose 1, 5 bisphosphate.
10. ATP, NADPH and O_2.
11. No, the moonlight is unable to perform light reactions of photosynthesis (ATP-NADPH Synthesis as it is 1/50,000 the intensity of sunlight and not strong enough to enable plants to photsynthesise.
12. Blue and Red regious of light spectrum.

Short Answers-I (2 marks each)

13. Increase incident light beyond a point causes the breakdown of chlorophyll.
14. On a hot suny day, enzyme RuBP carboxylase becomes active and its affinity for CO_2 decreases and for O_2 increases. Consequently more and more photosynthetically fixed carbon is lost by photorespiration.
15. (a) Bundle sheath
    (b) RuBP
    (c) OAA (oxaloacetic acid)
    (d) 20°C-25°C
16. (a) Absorption of light and transfer of energy to chlorophyll 'a'.
    (b) Protect chlorophyll 'a' from photo oxidation.
17. Because they require more energy (30 ATPs) in synthesizing one glucose molecule as compared to C_3—(18ATPs).

18. Limiting Factor—A factor which is deficient to such an extent that increase in its concentration directly increase the rate of the process.

(For the law of limiting factors see text in NCERT Book.) Page 222

Short Answers-II (3 marks each)

19. (i) 'B'

(ii) CO_2 and temperature

(iii) 'C' represents to constant rate of photosynthesis, 'D' is the light saturation intensify at which rate of photosynthesis is maximum.

20. Refer NCERT, Text Book Biology for class XI.

21. **Hints :**

(a) Photolysis of H_2O and photophosphorylation occurs in both C_3 and C_4 plants.

(b) In both, dark reaction occurs in stroma.

(c) Calvin cycle results in the formation of starch in both the plants.

(d) During dark reaction both types of plants undergo the phases of carboxylation and regeneration :

22. **Hints :**

- The plant in sunlight will survive for longer period.
- Light is essential for photosynthesis.

23. (a) (A) e^- acceptor

(B) Electron transport system

(C) Chlorophyll P700

(b) NCERT Text Book of Biology for Class XI.

24. **Carotenoid :** It is an accessory photosynthetic pigment which takes part in harvesting light energy only if chlorophyll is present.

25. Mitochondria and chloroplast both contain DNA and can reproduce independently of the cell and chloroplasts even have a built in feeding mechanism both have their own ribosomes of 70S type and capable of synthesising their own kind of proteins.

26. C_4 Plant grow in regions with high temperatures and intense light. The rate of transpiration in C_4 plant is 25% of a C_3 plant, thus they conserve water and have greater photosynthetic rate gives greater rate of growth in intense sunshine and high temperature.

Long Answers (5 marks each)

27. NCERT Text Book of Biology for Class XI.

28. Refer Points to Remember.

    Hints : Three stages of Calvin cycle : Carboxylation, Reduction and Regeneration.

29. (a) Chemiosmotic Hypothesis, NCERT Text Book of Biology for Class XI.

    (b) Z-Scheme of light reaction, NCERT Text Book of Biology for Class XI.

Assertion Reasoning (1 mark each)

The following question consists of 2 statements - Assertion (A) and Reason (R). answer the question by selecting the appropriate option below :

(a) Both A and R are true and the reason is a correct explanation of the assertion

(b) Both A and R are true and the reason is not a correct explanation of the assertion

(c) The assertion is true but the reason is false

(d) Both the assertion and reason are false

(e) The assertion is false but the reason is true

30. **Assertion (A) :** C4 cycle is found in CAM plants.

    Reason (R) : Photorespiration does not occur in C4 plants.

31. **Assertion (A) :** Higher the concentration of O_2 in the atmosphere, lower is the photosynthesis are.

    Reason (R) : Lower respiration rate is due to oxidation of RuBisCo.

32. **Assertion (A) :** For the formation of one molecule of glucose, 6 molecules of CO_2 and 12 molecules of $NADPH^+ + H^+$ and 18 ATP are used.

Reason (R) : In light reaction ATP and $NADPH_2$ are formed.

Solution:

Assertion Reasoning

30. (e)

31. (a)

32. (b)

Source-based/Case-based/Passage-based/Integrated assessment question (4 marks each)

Read the following and answer any four questions from (i) to (v) given below :

33. Photosystems are of two types, PS I and PS II, and are found in thylakoid membranes. Each photosystem consists of a light harvesting complex and each LHC is made up of hundreds of pigment molecules bound to proteins. Each photosystem has all the pigments complexes except one molecule of chlorophyll a.,a single chlorophyll forms a reaction centre. Each photosystem absorbs different wavelengths of light. In PS I the reaction centre chlorophyll a has an absorption peak at 700 nm, hence is called P700, while in PS II it has absorption maxima at 680 nm, and is called P680. It was named PSII because it was discovered after PSI was discovered. Only light reaction takes place in these systems. PSII is the first system which traps light and the most important function is splitting of water and molecular oxygen. The electron is released while the splitting of water. These electrons are passed through PSII and PSI before ending up in NADPH as they move down in the electron transport chain. NADPH, thus produced is used in the dark reaction of photosynthesis.

(i) Photosystem I and II respectively are found in _____

(a) Inner and outer surface of thylakoid in mitochondria

(b) Outer and inner surface of thylakoid in mitochondria

(c) Inner and outer surface of thylakoid in chloroplast

(d) Outer and inner surface of thylakoid in chloroplast

(ii) Will photolysis of water occur in PSI? (Yes/No)

(iii) What is the correct sequence?

I. Antenna molecule 700

II. NADPH

III. PSI

IV. PSII

V. Thylakoid membrane

(a) I, II, III, IV, V

(b) II, III, IV, I, V

(c) V, IV, III, I, II

(d) V, III, IV, I, II

(iv) The dark reaction cannot take place during the day. (True/False)

(v) Which one of the following is not true about the light reaction in photosynthesis?

(a) Photosystems are arrangements of chlorophyll and other pigments packed into thylakoids

(b) Photolysis of water occurs in PSI

(c) NADP is reduced

(d) Magnesium ions are required for the formation of chlorophyll

Solution:

Source-based/Case-based/Passage-based/Integrated assessment questions

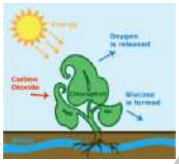
33. (i) (d) Outer and inner surface of thylakoid in chloroplast

(ii) No

(iii) (c) V, IV, III, I, II

(iv) False (dark reaction takes place both during the day and the night)

(v) (b) Photolysis of water occurs in PSI



Chapter - 14

Respiration in Plants

Points To Remember

Aerobic respiration : Complete oxidation of organic food in presence of oxygen thereby producing CO_2, water and energy.

Anaerobic respiration : Incomplete breakdown of organic food to liberate energy in the absence of oxygen.

ATP Synthetase : An enzyme complex that catalysis synthesis of ATP during oxidative phosphorylation.

Biological oxidation : Oxidation in a series of reaction inside a cell.

Cytochromes : A group of iron containing compounds of electron transport system present in inner wall of mitochondria.

Dehydrogenase : Enzyme that catalyses removal of H^+ atom from the substrate.

Electron acceptor : Organic compound which receive electrons produced during oxidation-reduction reactions.

Electron transport : Movement of electron from substrate to oxygen through respiratory chain during respiration.

Fermentation : Breakdown of organic substance that takes place in certain microbe like yeast under anaerobic condition with the production of CO_2 and ethanol.

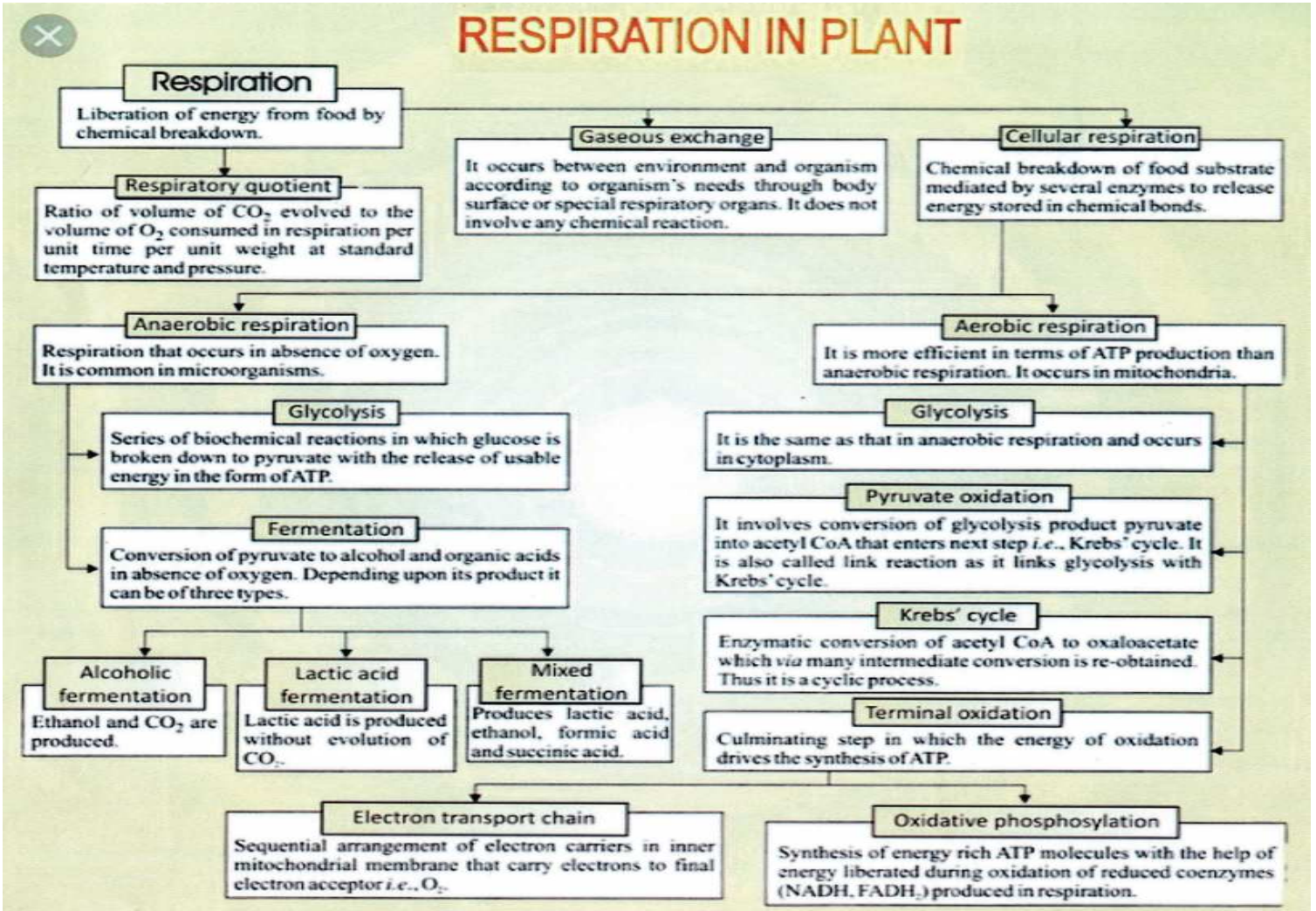
Glycolysis : Enzymatic breakdown of glucose into pyruvic acid that occurs in the cytoplasm.

Oxidative phosphorylation : Process of formation of ATP from ADP and P*i* (Inorganic phosphate) using the energy from proton gradient.

Respiration : Biochemical oxidation food to release energy.

Respiratory Quotient : The ratio of the volume of CO_2 produced to the volume of oxygen consumed.

Proton gradient : Difference in proton concentration across the tissue membrane.


RESPIRATION IN PLANT
Respiration
Liberation of energy from food by chemical breakdown.
Respiratory quotient
Ratio of volume of CO_2 evolved to the volume of O_2 consumed in respiration per unit time per unit weight at standard temperature and pressure.
Gaseous exchange
It occurs between environment and organism according to organism's needs through body surface or special respiratory organs. It does not involve any chemical reaction.
Cellular respiration
Chemical breakdown of food substrate mediated by several enzymes to release energy stored in chemical bonds.
Anaerobic respiration
Respiration that occurs in absence of oxygen. It is common in microorganisms.
Glycolysis
Series of biochemical reactions in which glucose is broken down to pyruvate with the release of usable energy in the form of ATP.
Fermentation
Conversion of pyruvate to alcohol and organic acids in absence of oxygen. Depending upon its product it can be of three types.
Alcoholic fermentation
Ethanol and CO_2 are produced.
Lactic acid fermentation
Lactic acid is produced without evolution of CO_2.
Mixed fermentation
Produces lactic acid, ethanol, formic acid and succinic acid.
Aerobic respiration
It is more efficient in terms of ATP production than anaerobic respiration. It occurs in mitochondria.
Glycolysis
It is the same as that in anaerobic respiration and occurs in cytoplasm.
Pyruvate oxidation
It involves conversion of glycolysis product pyruvate into acetyl CoA that enters next step i.e., Krebs' cycle. It is also called link reaction as it links glycolysis with Krebs' cycle.
Krebs' cycle
Enzymatic conversion of acetyl CoA to oxaloacetate which via many intermediate conversion is re-obtained. Thus it is a cyclic process.
Terminal oxidation
Culminating step in which the energy of oxidation drives the synthesis of ATP.
Electron transport chain
Sequential arrangement of electron carriers in inner mitochondrial membrane that carry electrons to final electron acceptor i.e., O_2.
Oxidative phosphosylation
Synthesis of energy rich ATP molecules with the help of energy liberated during oxidation of reduced coenzymes ($NADH, FADH_2$) produced in respiration.

Mitochondrial matrix : The ground material of mitochondria in which pyruvic acid undergoes aerobic oxidation through Kreb's cycle.

Electron Transport Chains (ETC)—A series of co-enzymes and electron/ carriers where electrons can pass along increasing redox potential losing a bit of energy at every step of transfer.

Abbreviations

ATP	—	Adenosine-tri-phosphate
ADP	—	Adenosine-di-phosphate
NAD	—	Nicotinamide Adenine dinucleotide
NADP	—	Nicotinamide Adenine dinucleotide Phosphate
NADH	—	Reduced Nicotinamide Adenine dinucleotide
PGA	—	Phosphoglyceric acid
PGAL	—	Phospho glyceraldehyde
FAD	—	Flavin adenine dinucleotide
ETS	—	Electron transport system
ETC	—	Electron transport chain
TCA	—	Tricarboxylic acid
OAA	—	Oxalo acetic acid
FMN	—	Flavin mono nucleotide
PPP	—	Pentose phosphate pathway

Cellular Respiration—The process of oxidation/breakdown of food materials within the cell to release energy. Respiratory substrate to be oxidized during respiration is usually glucose, but these can also be proteins, fats or organic acids. In plants, respiratory gaseous exchange occurs through stomata and lenticels :

Overall cellular respiration is :

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Energy (36ATPs)}$$

Aerobic Respiration

Overall mechanism of aerobic respiration can be studied under the following steps :

(A) Glycolysis (EMP pathway) in cytoplasm

(B) Oxidative Decarboxylation—(Gateway Reaction)—in Mitochondrial matrix

(C) Kreb's cycle (TCA—cycle)—Matrix of mitochondria

(D) Oxidative phosphorylation

A. Glycolysis : The term has originated from the Greek word, *glycos* = glucose, *lysis* = splitting, or breakdown means breakdown of glucose molecule to pyruvic acid. It was given by Embden Meyerhof and Parnas. It is a chain of 10 reactions to convert glucose into pyruvate. It is common for aerobic and anaerobic respiration.

Steps for Glycolysis—(EMP Pathway)

1. Phosphorylation of Glucose into Glucose-6-phosphate (ATP used)
2. Isomerisation of Glucose-6-Phosphate into fructose-6-phosphate
3. Second phosphorylation in which Fructose-6-phosphate changes into Fructose-1, 6-biphosphate (ATP used)
4. Splitting of Fructose-1, 6-biphosphate into DHAP (dihydroxy acetone phosphate) and PGAL
5. Isomerisation of DHAP into PGAL
6. Oxidation of PGAL into 1, 3-biphosphosphoglycerate (NADH Produced)
7. Synthesis of ATP and converssion of 1, 3-biphosphoglycerate into 3-phospholycerate
8. Isomerisation of 3-phosphoglycerate into 2-phospholycerate
9. Dehydration of 2-phosphoglycerate into PEP (Removal of water)
10. Substrate level ATP synthesis and formation of Pyruvic Acid.

- It is also called Embden—Meyerhof—Paranas pathway. (EMP pathway)
- It is common in both aerobic and anaerobic respiration.
- It takes place outside the mitochondria, in the cytoplasm.
- One molecule of glucose (Hexose sugar) ultimately produces two molecules of pyruvic acid through glycolysis.
- During this process 4 molecules of ATP are produced while 2 molecules ATP are utilised. Thus net gain of ATP is of 2 molecules.

Input and Output of glycolysis

S. No.	Input	Output
1.	Glucose, (6—C), 1 molecule	Pyruvate, (3—C), 2 molecules
2.	2 ATP	2 ADP
3.	4 ADP + 2 P*i*	4 ADP + $2H_2O$
4.	2 NAD^+	2 NADH (H^+)

Net out put ..... 2 Pyruvate + 2ATP + 2NADH (+ H^+) OR 2 Pyruvate + 8 ATP

The pyruvate, so produced, may under go (i) Lactic acid fermentation, (ii) Alcoholic fermentation (iii) Aerobic Respiration (Krebs Cycle)

B. Oxidative decarboxylation : Pyruvic acid is converted into Acetyl CoA in presence of pyruvate dehydrogenase complex.

$$\text{Pyruvic acid} + \text{CoA} + \text{NAD}^+ \xrightarrow[\text{pyruvate dehydrogenase}]{Mg_2} \text{Acetyl CoA} + CO_2 + \text{NADH} + H^+$$

$$\xrightarrow[\text{pyruvate dehydrogenase}]{Mg^{2+}} \text{The Acetyl CoA enters in TCA cycle.}$$

C. Tri Carboxylic Acid Cycle (Kereb's cycle) or Citric acid Cycle : This cycle starts with condensation of acetyl group with oxaloacitic acid and water to yield citric acid which under goes a series of reactions.

- It is aerobic and takes a place in mitochondrial matrix.
- Each pyruvic acid molecule produces 4 NADH + H^+, one $FADH_2$, one ATP.
- One glucose molecule has been broken down to release CO_2 and eight molecules of NADH + H^+, two molecules of $FADH_2$ and 2 molecules of ATP.

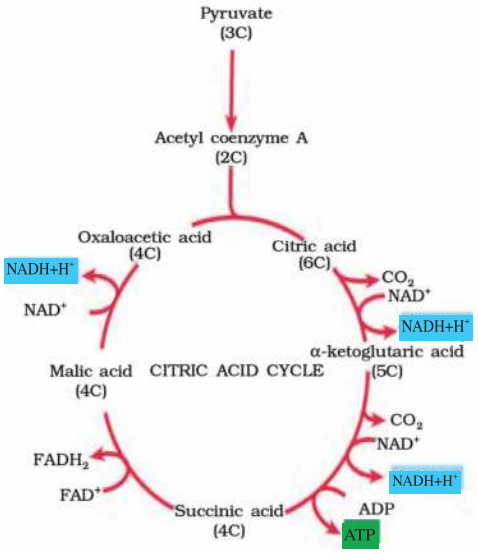


Figure 14.3 The Citric acid cycle

Compensation Point : It is the value of a factor at which the rate of photosynthesis controlled by it is just equal to the rate of respiration and photorespiration so that there is not net exchange of gases between the phtosynthetic organ and the environment.

At compensation point the photosynthetic tissue manufacture only such amount of food which of sufficient for it to remain alive. No food is supplied to rest of the plant. Therefore, net photosynthesis is zero.

(D) Oxidative Phosphorylation

The synthesis of ATP from ADP and inorganic phosphate using energy from proton gradient is called oxidative phosphorylation. This takes place in elementry particles present on the inner membrane of cristae of mitochondria.

This process in mitochondria is catalysed by ATP synthestase (complex V). This complex has two major components F_0 and and F_1- F_0 acts a channel for proton and F_1 acts as an ATP synthetase.

Electron Transport System and Oxidative Phosphorylation

Name of Complex	Components of ETS
Complex I	FMN and FeS are prosthetic groups and NADH dehydrogenase
Complex II	$FADH_2$ dehydrogenase (succinate dehydrogenase), FeS, UQ
Complex III	Cytochrome bc, complex–cytochrome b, cytochrome C, FeS, UQ
Complex IV	Cytochrome oxidase–Cytochrome a_1, cytochrome a_3 which posses two copper centres.
Complex V	F_0–F_1 particles, Flow of protein through F_0 channel induces F_1 partcile to function as ATP synthetase.

Respiratory Balance Sheet :

$$\text{Glucose} + 6O_2 + 36ADP + 36Pi \rightarrow 6CO_2 + 6H_2O + 36\ ATP$$

Total ATP Production

	Process	Total ATP produced
1.	Glycolysis	$2ATP + 2NADH_2$ (6ATP) = 8ATP
2.	Oxidative decarboxylation	$2NADH_2$ (6ATP) = 6ATP
3.	Kreb's Cycle	$2GTP$ (2ATP) + $6NADH_2$ (18ATP) + $2FADH_2$ (4ATP) = 24 ATP

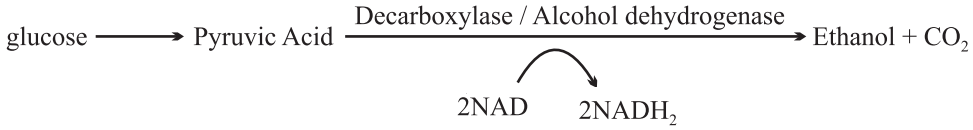
Energy production in prokaryotes during aerobic respiration = 38 ATP

Energy poroduction in eukaryotes during aerobic respiration = 38 – 2 = 36 ATP

In eukaryotes 2 ATP are used in transporting 2 molucules of NADH + H^+ formed in glycolysis from cytoplasm to mitochandria for oxidation through ETS shuttle.

(2) **Anaerobic Respiration**—In anaerobic respiration, Glycolysis is followed by formation of ethanol or lactic acid in the cytoplasm.

Fermentation : It is the process of anaerobic respiration which occurs in yeast and some bacteria. Fermentation involves incomplete oxidation of food into enthanol and carbon-dio-oxide. It results in the production of 2 ATP molcules.



(i) Conversion of Acetyl CoA into fatty acid and PGA.

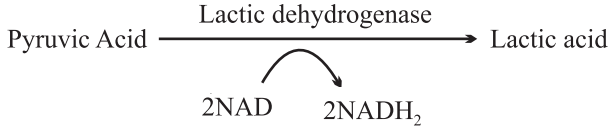
(ii) Synthesis of chlorophyll and cytochromes from Succinyl CoA

(iii) Synthesis of Amino acids from OAA and α-ketoglutaric acid

(iv) Synthesis of Alkaloid from OAA.

Enzymes involved-Pyruvic acid decarboxylase, Alcohol dehydrogenase

Anaerobic respiration in muslces : During vigrous exercise a person feels pain and fatigue in his muscles. This is due to accumulation of lactic acid in muscles. When oxygen is inadequate pyruvic acid is reduced to lactic acid in presence of enzyne-lactic dehydrogenase.



During rest lactic acid is reconverted to pyruvic acid.

Amphibolic Pathway :

During the process of cellular respiration Carbohydrates, fats and proteins are broken down to release energy and hence respiration is a catabolic process/ catabolic pathway. From this pathway many compound are withdrawn for synthesis of substrates. Some anabolic processes are formation of pyruvic acid from amino acids, and formation of Acetyl CoA from Fatty acid. Thus, Respiratory pathway is involved in both catabolism and anabolism, it is better to consider the respiratory pathway as an amphibolic pathway.

RQ (Respiratory quotient)

(a) RQ = 1 (When carbohydrate is used as substrate)

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6\ H_2O$ + Energy

(b) RQ is less than 1 (*i.e.,* < 1) (When fats are used as substrate)

$2C_{51}H_{98}O_6 + 145O_2 \rightarrow 102CO_2 + 98\ H_2O$ + Energy

Tripalmitin

R.Q. $\Rightarrow \frac{102\ CO_2}{145\ O_2} = 0.7$

(c) RQ is 0.9 for proteins.

(d) RQ is more than 1 (*i.e.,* > 1) for organic acids.

(e) RQ is inifinite in case of anerobic respiration, because CO_2 is evolved but O_2 is not consumed.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which of the following is the terminal acceptor of electrons?
   (a) Cytochrome-b (b) Carbon-di-oxide
   (c) Hydrogen (d) Oxygen
2. Which of the following is correct name of the molecule which acts as the acceptor and substrate entrant in Kreb cycle?
   (a) Oxaloacetate and acetyl Co-A
   (b) Acetyl Co-A and Oxaloacetate
   (c) Citric acid and malic acid
   (d) Pyruvic acid and Acetyl Co-A
3. Respiratory quotient is ..... and RQ of fats and proteins is ..... and ..... respectively.
   (a) Ratio between the volume of oxygen consumed to the volume of carbon-di-oxide evolved, 0.5, 0.9
   (b) Ratio between the volume of carbon-di-oxide consumed to the volume of oxygen evolved, 0.5, 0.9
   (c) Ratio between the volume of oxygen consumed to the volume of carbon-di-oxide evolved, 0.9, 0.5
   (d) Ratio between the volume of carbon-di-oxide consumed to the volume of oxygen evolved 0.9, 0.5

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Question (1 mark each)

4. How many ATP molecules are produced from a molecule of glucose on it complete oxidation in eukaryotes ?
5. Where does ETC found in eukaryotic cell ?
6. Name the enzyme which convert sugar into glucose and fructose.
7. How many molecules of ATP are produced by the oxidation of one molecule of $FADH_2$?
8. Why do the person with sufficient white fibres get fatigued in a short period ?
9. Write the name of end product of glycolysis.
10. Name the first product formed in Kreb's cycle.
11. Which intermediate undergoes lysis in glycolysis ?
12. Write the other two names of Krebs cycle.
13. Name the first chemical produced in Krebs cycle.
14. What is Electron Transport Chain ? (ETC).
15. F_0–F_1 Protein complexes participate in the synthesis of .....

Short Answer Questions-I (2 mark each)

16. Differentiate between aerobic respiration and anerobic respiration.
17. Mention two steps of glycolysis in which ATP is utilised.
18. Why does anaeriobic respiration produces less energy than aerobic respiration?
19. Distinguish between glycolysis and fermentation.
20. What are respiratory substrates ? Name the most common respiratory substrate.

Short Answer Questions-II (3 marks each)

21. Pyruvic acid is the end product of glycolysis. What are the three metabolic fates of pyruvic acid under aerobic and anaerobic conditions ?

22. Give the schematic representation of an overall view of TCA cycle.
23. Where does electron transport system operative in mitochondria ? Explain the system giving the role of oxygen ?
24. Give a brief account of ATP molecules produced in aerobic respiration in eukaryotes.
25. Discuss the respiratory pathway is an amphibolic pathway.
26. Exapnd ETC., ETS and TCA.

Long Answer Questions (5 marks each)

27. What is glycolysis ? Where does glycolysis takes place in a cell ? Give schematic representation of glycolysis.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (d) Oxygen
2. (a) Oxaloacetate and acetyl Co-A
3. (a) Ratio between the volume of oxygen consumed to the volume of carbon-di-oxide evolved, 0.5, 0.9

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. 36 ATP.
5. Mitochondrial membrance.
6. Invertase.
7. 2 ATP molecules.
8. due to formation of Lactic acid.
9. Pyruvic acid.
10. Citric acid.
11. Fructose, 6-bisphosphate.

12. (i) Citric acid cycle (ii) Tricarboxylic acid cycle.
13. Citrate
14. See text (Points to remember)
15. ATP

Short Answers-I (2 mark each)

16. Refer NCERT Text Book.
17. (i) Phosphorylation of Glucose into Glucose-6-phosphate.

    (ii) Phosphorylation of Fructose-6-phosphate into Fructose-1,6-biphosphate.
18. Refer NCERT Text Book.
19. Refer NCERT Text Book.
20. Refer NCERT Text Book.

Short Answers-II (3 marks each)

21. (i) Aerobic conditions–$CO_2 + H_2O$ + Energy

    (ii) Anaerobic conditions–(fermentation)

    (a) In muscles – Lactic acid + Energy

    (b) Yeast-Ehtanol + CO_2 + Energy
22. Refer NCERT Text Book.
23. Refer NCERT Text Book.
24. Refer notes.
25. Refer NCERT Text Book.
26. Seet text (abbreviations).

Long Answers (5 mark each)

27. Refer NCERT Text Book.

Assertion Reasoning (1 mark each)

The following question consists of 2 statements - Assertion (A) and Reason (R). answer the question by selecting the appropriate option below :

(a) Both A and R are true and the reason is a correct explanation of the assertion

(b) Both A and R are true and the reason is not a correct explanation of the assertion

(c) The assertion is true but the reason is false

(d) Both the assertion and reason are false

(e) The assertion is false but the reason is true

28. **Assertion (A) :** More ATPs are produced during aerobic respiration than anaerobic respiration.
Reason (R) : Site for aerobic respiration is mitochondria and that of anaerobic respiration is cytoplasm.

29. **Assertion (A) :** Respiration is called an amphibolic pathway.
Reason (R) : In respiration both anabolism and catabolism occur on many substrates.

30. **Assertion (A) :** During carbon-di-oxide fixation, the acetyl-coA comes from glycolysis.
Reason (R) : Acetyl-coA gives energy for the formation of glucose.

Solution:

Assertion Reasoning

28. (b)

29. (a)

30. (d)

Source-based/Case-based/Passage-based/Integrated assessment question
(4 marks each)

Read the following and answer any four questions from (i) to (v) given below :

31. Electron transport chain is the final stage of aerobic respiration which is located on the mitochondrial membrane. There are two mitochondrial membranes, outer and inner. All proton pumps are located on the inner mitochondrial membrane which is arranged into folds called cristae. These folds increase the surface area available for the transport chain. Electron

transport chain is the series of redox reactions in which there is transfer of electrons from electron donors to electron acceptors. The energy is released and stored within the reduced hydrogen carriers which are then used to synthesise ATP. This is called oxidative phosphorylation. Oxidative phosphorylation occurs in distinct steps. First, the proton pumps create an electrochemical gradient called as proton motive force, second, ATP synthase uses the subsequent diffusions of protons, this step is called chemiosmosis. ATP is synthesised in this step. Third and final, oxygen accepts electrons and protons to form water.

(i) The correct series of electron acceptors present in mitochondrial membrane is

(a) Cyt c, b, a, a3

(b) Cyt b, c, a, a3

(c) Cyt a, a, b, c

(d) Cyt b, c, a3, a

(ii) How may ATPs will be produced from three molecules of NADPH and two molecules of $PADH_2$?

(a) 5

(b) 9

(c) 13

(d) 18

(iii) In amphibolic pathway fatty acids will produce

(a) Glucose-6-phosphate

(b) Glucose-1-6-phosphate

(c) Pyruvate

(d) Acetyl coA

(iv) The F_0-F_1 complex acts as a site for ATP synthesis when protons enter inner membrane space. (T/F)

(v) Ubiquinone (UQ) transfers its electrons to

(a) Cytochrome b in complex III

(b) Cytochrome a in complex IV

(c) FAD in Complex II

(d) Mitochondrial matrix

Solution:

Source-based/Case-based/Passage-based/Integrated assessment questions

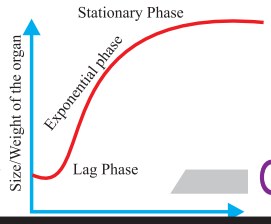
31. (i) (b) Cyt b, c, a, a3

(ii) (c) 13

(iii) (d) Pyruvate

(iv) False, F_0-F_1 complex is acts as site for ATP synthesis when protons leave inner membrane space.

(v) (a) Cytochrome b in complex III



Chapter - 15

Plant Growth and Development

Plant Growth Regulators

Growth

An irreversible permanent increase in size of an organ or its parts or a cell

Growth is indeterminate and measurable. It is accompanied by metabolic process.

Phases of Growth

Meristematic : constantly dividing cells.

Elongation : Increased vacuolation, cell enlargement, new cell wall depositions.

Maturation : Cells attain maximum size in terms of well thickening & protoplasmic modifications.

Growth Rates

Arithmetic Growth : Linear curve on ploting length of organ against time $L_t = L_o + rt$.

Geometric Growth Rate : Shows leg phase, exponential phase and stationary phase in growth.

$W_1 = Woe^{rt}$

Important Processes

Differentiation

Dedifferentiation

Redifferentiation

Conditions of Growth

Need water, oxygen, nutrients, optimum temperature, light.

Development

Include all the changes that an organism goes during its life cycle.

Growth Promoters

Auxins: IAA, IBA, NAA & 2, 4-D. isolated by F W Went from tips of coleoptiles of oat seedling.

Main role apical dominance, initiate rooting for plant propagation, promote flowering, induce parthenocarpy.

Giberellins: GA_1 GA_2 G_3 Aetc isolated by E. Kurosawa, 1926.

Role : Increase in stem height, delay senescence, speed up malting process, promote bolting.

Cytokinins : Skoog & miller.

Role Rapid cell division, over come apical dominance, promote nutrient mobilisation delay leaf senescence.

Growth Inhibitors

Abscisic Acid : ABA discovered by F. T. Addicott.

Role Intibit sead germination, induce dormancy, closure of stomata, increase tolerance to stressful conditions.

Ethylene - neither promoter nor inhibitor stristly

Discovered by H. H. Cousins (1910), only gaseous PGR.

Role Ripening of fruits, apical hook formation in dicot seeding, promote senescence and abscission, break seed and bud dormancy, promote root growth and root hair formation, initate germination in peanut seeds, and sprouting of potato tubers.

Rate of light & temperature in flowering

Response of plants to period of day/night is called photoperiodism.

Plants can be LDP, SDP and DNL.

Vernalisation

Promotion of lowering by a period of low temperature. It affect flowring quantitatively or qualitatively.

Seed Dormancy

The period in which a seed fail to germinate even when external conditions are favourable.

Causes of seed dormancy.

Impermeable & hard seed coat, immature embryos' presence of chemical inhibitors like ABA, Phenelic Acid, Para- ascorbic acid.

Means to break seed dormancy:

- By mechanical abrasions.
- Microbial action as passing through digestive tract of animals.
- Subjecting to chilling conditions.
- Applying GA and nitrates.
- Changing environmental conditions like light & temperature.

Points To Remember

Seed Germination : The seed germinates only when favourable conditions for growth exists in the environment. In absence of favourable conditions it goes into a period of suspended growth or rest, called dormancy.

Abscission : Shedding of plant organs like leaves, flowers and fruits etc. from the mature plant.

Apical dominance : Suppression of the growth of lateral buds in presence of apical bud.

Dormancy : A period of suspended activity and growth usually associated with low metabolic rate. Some, seeds undergo a period of dormancy and can germinate only after dormancy period gets over.

Phytochrome : A pigment, found in plants which control the light dependent developmental process.

Phytohormone : Chemicals secreted by plants in minute quantities which influence the physiological activities.

Senescene : The last phase of growth when metabolic activities decrease.

Vernalisation : A method of promoting flowering by exposing the young plant to low temperature.

Growth : An irreversible permanent increase in size, volume and weight of an organ or its parts or even of an individual cell.

Quiescence : Non-germination of a viable seed due to non-availability of proper environmental conditions.

Vivipary : It is the germination of seed while it is still attached to the parent plant and is nourished by it. *e.g., Rhizophora* and *Sonneratia*. As the germinating seed forms a seedling. It fall down into the mud due to increase in weights. In the mud, lateral roots develops for anchorage.

Heterophylly : Occurrence of more than one type of leaves in plants *e.g.,* larkspur, coriander leaves of juvenile plant are different in shape from mature plant.

Bolting : Elongation of internodes prior to flowering in plants like cabbage.

Photoperiodism : Response of Plants to relative periods of day/night to induce flowering.

According to duration of exposure of plants to light, plants are divided in 3 categories :

1. **Long Day Plants (LDP)—**Plants which need exposure to light for period exceeding critical duration *e.g.,* wheat, rice, cucumber.

2. **Short Day Plants (SDP)**—Plants which need exposure to light for period less than the critical length *e.g.,* Cabbage.
3. **Day Neutral Plants (DNP)**—There is no correlation between exposure to light duration & induction of flowering *e.g.,* Tomato.

Abbreviations

IAA	Indole acetic acid
NAA	Napththalene acetic acid
ABA	Abscisic acid
IBA	Indole-3 butyric acid
2,4-D	2,4 dichlorophenoxy acetic acid
PGR	Plant growth regulator

Seed Dormancy	Quiescence
It is the condition of seed when it is unable to germinate in spite of the availability of all environmental conditions suitable for germination. It can be due to immature embryo or pressure of growth inhibitors.	The condition of a seed when it is unable to germinate because the conditions for germination are not available, such as moisture, temperature etc.

Measurement of growth : Plant growth can be measured by a variety of parameters like increase in fresh weight, dry weight, length, area, volume and cell number.

Phases of growth : The period of growth is generally divided into three phases, namely, meristematic, elongation and maturation.

(i) **Meristematic :** New cell produced by mitotic division at root-tip and shoot-tip thereby show increase in size. Cells are rich in protoplasm and nuclei.

(ii) **Elongation :** Zone of elongation lies just behind the meristematic zone of roots and concerned with enlargement of cells.

(iii) **Maturation :** The portion lies proximal to the zone of elongation in roots. The cells of this zone attain their maximum size in terms of wall thickning and protoplasmic modification.

Growth rate : The increased growth per unit time is termed as growth rate. The growth rate shows an increase that may be arithmetic or geometrical.

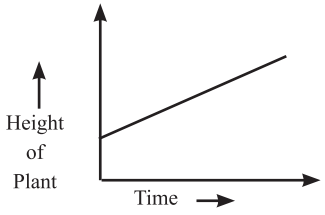


Fig. Linear growth curve

Growth	Mathematical expression	Curve
In Arithmetic growth : Only one daughter cell continues to divide mitotically while other differentiate and matures.	$L_1 = L_0 + rt$ L_1 = Length at time t L_0 = Length at time zero r = growth rate	Linear curve

Sigmoid Growth Curve

Geometrical growth	Formula	Shape of curve
The initial growth is slow (lag phase) and increase rapidly there-after at an exponential rate (log phase) In both, the progeny cells divide mitotically and continue to do so. However, with limited nutrient supply, the growth slow down leading to stationary phase.	$W_1 = W_0 e^{rt}$ W_0 = Initial size W_1 = Final Size r = growth rate t = time of growth e = base of natural logarithms	Sigmoid or S-curve

Sigmoid growth curve

Lag phase : Growth is slow in initial stage.

Exponential phase : Period of maximum growth

Stationary phase : When the nutrients become limiting, growth slows down.

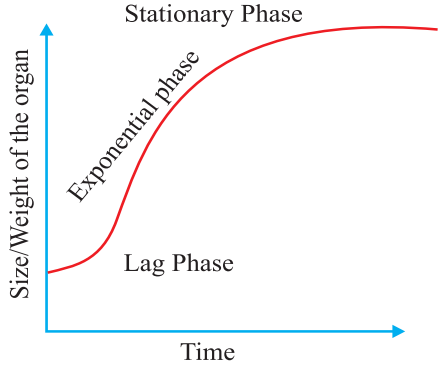


Fig. Sigmoid growth curve

Relative Growth : The growth per unit time as percentage of initial size

$$\text{RGR} = \frac{\text{Growth per unit time}}{\text{Initial size}} \times 100$$

Differentiation : A biochemical or morphological change in meristemic cell (at root apex and shoot apex) to differentiate into permanent cell is called differentiation. e.g. loss of protoplasm by tracheary elements.

Dedifferentiation : The phenomenon of regeneration of permanent tissue to become meristematic is called dedifferentiation. eg. formation of interfascicular cambium and cork combium from parenchymatous cells.

Redifferentiation : Meristems/tissue are able to produces new cells that once again lose the capacity to divide but nature to perform specific functions. e.g. secondary cortex, secondary xylem etc.

Conditions or factors influencing Growth

1. Nutrition 2. Availability of water 3. Temperature 4. Oxygen 5. Light 6. Gravity 7. Stress factors like minerals, water or temperature etc.

Phytohormone or Plant Growth-Regulator

Growth promoting hormones : These are involved in growth promoting activities such as cell division, cell enlargement, flowering, fruiting and seed formation. *e.g.,* Auxin, gibberellins, cytokinins.

Growth inhibitor : Involved in growth inhibiting activities such as dormancy and abscission. *e.g.,* Abscisic acid and Ethylene.

Hormones	Functions
1. Auxins (Growth Promoters) e.g. Indole 3-Acetic Acid, 2, 4-D and 2, 4, 5,-T etc.	1. Apical dominance, cell elongation, Promote flowering prevent premature leaf and fruit falling, initiate rooting in stem cutting, as weedicide, induce parthenocarpy.
2. Gibberellins $GA_3 (C_{19}H_{22}O_6)$ e.g, GA_4, GA_7, GA_{19} and GA_{20} etc.	2. Delay senescence, speed up malting process, increase in length of axis (grape stalk), increase in length of stem (sugarcane), bolting in beet, cabbages and many plants with rosette habit.

3. Cytokinins (Growth Promoters) *e.g.* Zeatin (trans 6-purine) DMAA-Dimethylalyl adenine and Isopentyl adenine (IP) etc.	3. Promote cell division, induce cell enlargement, reduce apical dominance, induce growth in auxiliary bud, chlorophyll preservation, lateral shoot growth, adventitious root formation.
4. [Ethylene ($H_2C = CH_2$) A gaseous PGR which acts as growth promoters as well growth inhibitor (mainly as growth inhibitor)	4. Promotes senescence and abscission of leaf and fruits, promotes ripening of fruits, break seed and bud domancy, initiate germination in peanut, sprouting of potato tuber, promotes root growth and root hair formation.
5. Abscisic acid (ABA) eg. (Abscisin II, Dormin)	5. Inhibit seed germination, stimulate closer of stomata, increase tolerance to various stress, induce dormancy in seed and bud, promotes ageing of leaf (senescence). Can delay the ripening of stored fruits as it absorbs the ethylene.

Vernalisation : The phenomenon in which flowering is either quantitatively or qulitatively dependent on exposure to low temperature. eg wheat, barley, rye, bi-ennial plants like sugarbeet cabbage, carrots. It prevents precocious reproductive development late in the growing season and enables the plant to have sufficient time to reach maturity

Questions

(SRT) Select Response Type Question (1 mark each)

1. The cause of 'BAKANE' disease of rice
   (a) Gracilaria (b) Gibberella fujikuroi
   (c) Geledium (d) Anabena
2. Which plant hormone was first isolated from human urine.
   (a) Ethylene (b) ABA
   (c) Auxin (d) Cytokinin

3. The only gaseous plant hormone is

(a) Gibberllins (b) Dormin

(c) Zeatin (d) Ethylene

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Question (1 mark each)

4. How does abscisic acid acts as stress hormone in drought condition ?
5. A farmer observed some broad-leaved weeds in a wheat crop farm. Which plant hormone would you suggest remove them ?
6. Name the plant growth regulators you should use to (a) Increase the yield of sugarcane (b) Promote lateral growth (c) Cause sprouting of potato tuber (d) Inhibit seed germination.
7. Why do lateral buds start developing into branches when apical bud is removed ?
8. Flowering in certain plant occur only when they are exposed to low temperature for a few weeks. Name this phenomenon.
9. A hormone released by an over ripe apple in a wooden box will cause ripening of all other apples too. Name the hormone, and to which class it belongs to?

Short Answer Question-I (2 marks each)

10. How will you induce lateral branching in a plant which normally does not produce them ? Give reason.
11. What induces ethylene formation in plants ? Give any two different action of ethylene on plants.
12. What is meant by abscission ? Name phytohormone involved in it.
13. What is meant by apical dominance ? Which hormone control it ?
14. Differentiate between photoperiodism and vernalization.
15. Name a hormone which is :

    (a) gaseous in nature (b) responsible for phototropism (c) used for killing dicot weeds (d) Induces flowering in long day plants.

Short Answer Questions-II (3 marks each)

16. A primary root grows from 5 cm to 19 cm in a week. Calculate the growth rate and relative growth over the period.

17. Where are the following hormones synthesised in plants (a) IAA (b) gibberellins (c) cytokinins.
18. What would be expected to happen if :
    (a) GA_3 is applied to rice seedling?
    (b) a rotten fruit get mixed with unripe fruits?
    (c) you forget to add cytokinin to the culture medium?
19. Which growth hormone is responsible for the following :
    (a) induce rooting in a twig
    (b) quick ripening of a fruit
    (c) delay leaf senescence
    (d) 'bolt' a rosette plant
    (e) induce immediate stomatal closure in leaves
    (f) Induce growth in axillary buds.
20. Define differentiation, dedifferentiation and redifferentiation.
21. Where are auxins generally produced in a plant ? Name any one naturally occurring plant auxin and any one synthetic auxin.
22. Define growth rate. Name two types of growth. Draw the growth curves for these two types.
23. Mention various parameters taken into consideration for measuring the growth.

Long Answer Question (5 marks each)

24. Enlist the five categories of phytohormone. Write atleast two uses of each.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) *Gibberella fujikuroi.*
2. (c) Auxin.
3. (d) Ethylene.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer (1 mark each)

4. ABA cause rapid closure of stomata, preventing loss of water by transpiration.
5. 2.4-D.
6. (a) Gibberellin (b) Cytokinin
   (c) Ethylene (d) Abscisic acid
7. Due to inhibition of the activity of auxin the apical dominance is removed.
8. Vernalisation.
9. Ethylene, plant growth inhibitor.

Short Answers-I (2 marks each)

10. When apical bud is removed, lateral branches are produced. Du to removal of apical bud, the auxin is destroyed, thus inducing the lateral buds to grow rapidly.
11. Refer NCERT Book
12. - Premature fall of leaf and fruit is called abscission.
    - Abscisic acid
13. Refer NCERT Book
14. Refer NCERT Book
15. (a) Ethylene C_2H_2 (b) Auxin (c) 2, 4-D (d) Gibberellin

Short Answers-II (3 marks each)

16. (a) Growth = 19 – 5 = 14 cm, Period = 7 days

    Growth rate = $\frac{14}{7}$ = 2cm/day

    (b) Inititial growth = $\frac{7}{5}$ cm

    Growth rate per day $\frac{19-5}{7}$ = 2 cm

    Relative growth rate = $\frac{2}{5} \times 100 = 40\%$

17. (a) IAA = Shoot apex

    (b) Gibberellin – young leaves of buds, root tips

    (c) Cytokinins – Root apical meristan

18. (a) Hyper elongation of internodes of rice seedlings will occur.

    (b) Unripe fruits will lead to early ripening and ultimately it will result in rottening.

    (c) Shoot but formation will not occur.

19. Refer Points to Remember of Support Material

20. Refer Points to Remember of Support Material

21. Refer Points to Remember of Support Material

22. Refer Points to Remember of Support Material

23. Refer Points to Remember of Support Material

Long Answers (5 marks each)

24. Refer NCERT Text Book.

Assertion Reasoning (1 mark each)

The following question consists of 2 statements - Assertion (A) and Reason (R). Answer the question by selecting the appropriate option below :

(a) Both A and R are true and the reason is a correct explanation of the assertion

(b) Both A and R are true and the reason is not a correct explanation of the assertion

(c) The assertion A is true but the reason R is false

(d) Both the assertion A and reason R are false

(e) The assertion A is false but the reason R is true

25. **Assertion (A) :** Plant growth regulators are phytohormones, they are required for various metabolic activities for growth in plants.

    Reason (R) : Auxins, if applied on *Pinus*, will not induce flowering.

26. **Assertion (A) :** Plant growth is measurable.

    Reason (R) : Growth only means addition of dry weight in the plant.

(a) Both A and R are true and the reason is a correct explanation of the assertion

27. **Assertion (A) :** 'r' in logistic growth means exponential growth.

Reason (R) : It is also known as the efficiency index.

28. **Assertion (A) :** Heterophylly in larkspur is due to dedifferentiation.

Reason (R) : There is no role of environment in plasticity.

29. **Assertion (A) :** Cytokinin is produced in actively dividing cells.

Reason (R) : It helps in producing new leaves and shoots in plants.

Solution:

Assertion Reasoning

25. (b) (Plant growth regulators regulate growth but will not induce flowering)
26. (c) (Growth is measured by a variety of parameters some of which are: increase in fresh weight, dry weight, length, area, volume and cell number)
27. (e) ('r' is relative growth rate)
28. (d)
29. (a)

Source-based/Case-based/Passage-based/Integrated assessment questions

(4 marks each)

Read the following and answer any **four** questions from (i) to (v) given below :

30. The process by which prolonged exposure to cold temperatures. 4°C or less, promotes flowering is called vernalisation. It was first studied in 1918 by Gassner. It is believed that due to prolonged cold treatment, a hypothetical hormone like substance vernalin is produced in meristematic regions which induce flowering. Some monocarpic plants, which die when they flower, require vernalisn to flower, mostly requiring two seasons to complete the life cycle. Such plants are biennials or winter annuals. Cold exposure is a most for such plants to flower. Some monocarpic plants that are annuals but they do not require any cold treatment for flowering, such plants are called summer annuals. Many perennial such as stone fruit plants also require cold treatment to flower. Winter cereals such as autumn wheat also require cold

treatment to flower. If such wheat is grown in spring, it will continue growing vegetatively and will flower only after the upcoming winter season. Vernalisation can be reversed. It is done for sowing seeds of onions which are stored in cold storage for long. Applying plant growth regulators which cause bakanae disease can also help some seeds to germinate and skip prolonged cold periods.

(i) Which hypothetical precursor hormone is believed to be produced in meristematic regions of plants after vernalisation?

(a) Photolin (b) Vernalin

(c) florigen (d) morphactin

(ii) The plants which die after flowering are called _____?

(a) Polycarpic plants (b) Bicarpic plants

(c) Monocarpic plants (d) Plietesialic plants

(iii) Spring wheat does not require prolonged cold treatment for flowering. (T/F)

(iv) Name any two monocarpic plants that require vernalisation.

(v) Which of the following plant growth regulators can replace vernalisation?

(a) Gibberellin

(b) Auxin

(c) Cytokinin

(d) Ethylene

Solutions:

Source-based/Case-based/Passage-based/Integrated assessment questions

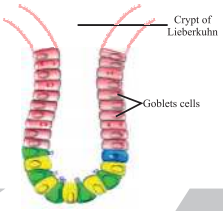
30. (i) (b) Vernalin

(ii) (c) Monocarpic plants

(iii) True

(iv) Sugarbeet, cabbage, carrots (any two)

(v) (a) Gibberellin



Intestinal gland showing crypts of lieberkuhn

Chapter - 16

Digestion and Absorption

Points To Remember

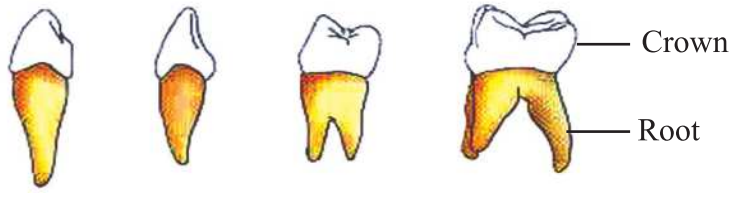
Digestion : The process in alimentary canal by which the complex food is converted mechanically and biochemically into simple substances suitable for absorption and assimilation in the body of animals/organisms.

Food : A substance which is taken and digested in the body to provide material for growth, repair & energy for reproduction and resistance from disease or regulation of body processes.

Thecodont : The teeth embedded in the sockets of the jaw bone, *e.g.,* in mammals.

Diphyodont : The teeth formed twice in life time *e.g.,* in mammals.

Heterodont : Different types of teeth. An adult human has 32 permanent teeth which are of four different types.



Incisor	Canine	Premolar	Molar
(for tearing)	(cutting)	(grinding)	(churning & grinding)

Different Types of Teeth

DENTAL FORMULA OF HYMANS

Milk Teeth

I C PM M.

$$\left.\begin{matrix} 2\ 1\ 2\ \ 0 \text{] x } 2 = 10 \\ 2\ 1\ 2\ \ 0 \text{] x } 2 = 10 \end{matrix}\right] = 20$$

Upper half jaw

Lower half jaw

Permanent Teeth

I C PM M.

$$\left.\begin{matrix} 2\ 1\ 2\ \ 3 \text{] x } 2 = 16 \\ 2\ 1\ 2\ \ 3 \text{] x } 2 = 16 \end{matrix}\right] = 32$$

Peristalsis : The involuntary movement of the gut by which the food bolus is pushed forward.

Deglutition : The process of swallowing of food bolus. It is partly voluntary and partly involuntary.

Ruminants : The herbivours animals (*e.g.,* cow, buffalo etc.) which have symbiotic bacteria in the rumen of their stomach, which synthesize enzymes to hydrolyse cellulose into monosaccharides.

Diarrhoea : The abnormal frequent discharge of semisolid or fluid faecal matter from the bowel.

Vomiting : The ejection of stomach contents through the mouth, caused by antiperistalsis.

Dysentery : Frequent watery stools often with blood and mucus, along with pain and fever. Loss of water causes dehydration.

Chyme : The semifluid mass, into which food is converted by gastric secretion, which passes from the stomach into the small intestine.

Gastric : Anything associated with stomach is given a prefix 'gastric'.

Proenzyme : The inactive forms of enzymes.

Sphincter : A flap like structure at various junctions of the alimentary canal which facilitates one way traffic (movement of material) in the alimentary canal.

Bolus : The masticated food mixed with saliva.

Hepatic : Anything associated with liver is given a prefix 'hepatic'.

Goblet cells : The cells of intestinal mucosal epithelium which secrete mucus.

Glisson's capsule : The connective tissue sheath which covers the hepatic lobules of liver.

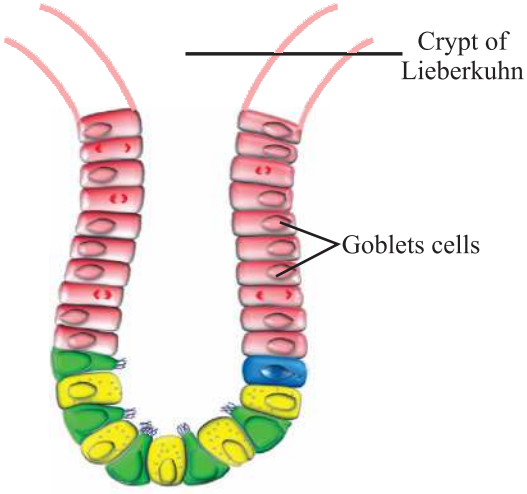
Hepatic lobules : The structural and functional units of liver containing hepatic cells which are arranged in the form of cords.

Sphincter of Oddi : The sphincter which guard the opening of common hepatopancreatic duct.

Villi : The small finger-like folding in the small intestine which increase the surface area for absorption of digested food.

Crypts of Lieberkuhn–pits of intestine/tubular intestinal glands.

Succus entericus—Intestinal juices, secreted in small intestine.



Intestinal gland showing crypts of lieberkuhn

Basic Steps of Holozoic Nutrition :

(1) Ingestion : Intake of food.

(2) Digestion : Breaking down of complex organic food materials into simpler, smaller water soluble molecules.

(3) Absorption and assimilation : Absorption of digested food into blood or lymph and its use in the body cells for synthesis of complex components.

(4) Egestion : Elimination of undigested food as faeces :

Digestive glands : (A) Salivary gland—3 types are (i) Parotids (cheek)

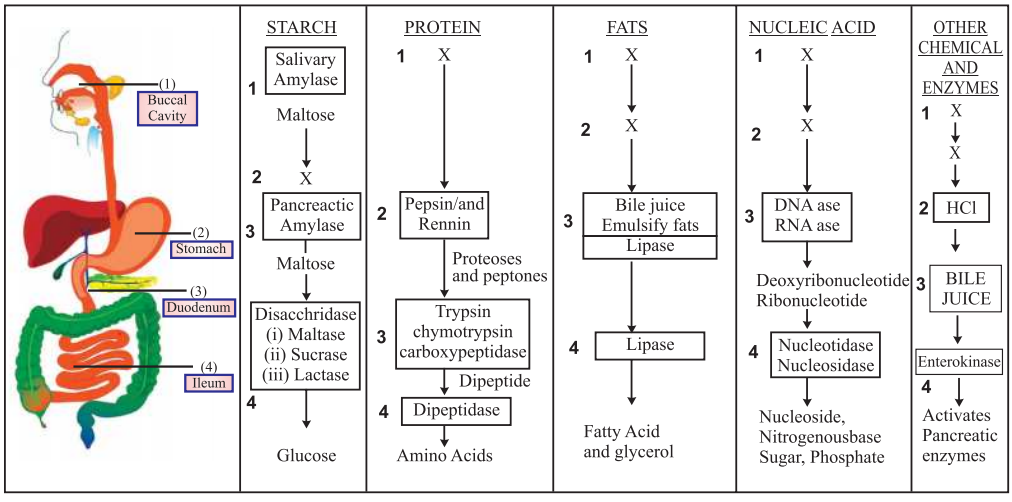
(ii) Sublinguals (Below the tongue) (iii) Submaxillary or submandibular (lower jaw) Secrete saliva which contains ptyalin (Salivary Amylase).

(B) Pancreas : A dual gland that secretes pancreatic juice and also secretes Hormones. Located between limbs of U shaped duodenum.

(C) Liver : In abdominal cavity (1.2–1.5 kg.)

2 lobed → Hepatic lobules → Hepatic cells (arranged as cords) → Secrete bile → Goes to hepatic ducts → bile stored in gall bladder.

COMPLETE PROCESS OF DIGESTION



ABSORPTION OF FATS

- Fatty acids and monoglycerides and Glycerol (insoluble).
- Micelles (tiny spheres with hydrophilic ends) formed.
- Absorbed by epithelial cells of small intestine (simple diffusion)
- They are reformed into very small protein coated fat globules called chylomicrons.
- Chylomicrons transported into lymph vessels (lacteals) in the villi.
- Lymph vessels release the absorbed substances into bloodstream
- **Malnutrition**—When a person is not getting enough food or getting unbalanced diet.

PEM—Protein Energy Malnutrition

Kwashiorkar	Marasmus
The word means 'rejected child'	Word marasmus means wasting away
• It is a disorder found in children 1-5 years of age, where child is weaned off mother's milk very early.	• Child remaining under-nourished suffer from marasmus. Usually found in children below the age of 1 year.
• Children get low protein and low carbohydrate diet are affected.	• It is caused by deficiency of protein & carbohydrate & fat.

DIGESTION AND ABSORPTION					
Part of alimentary canal	Name of glands	Enzymes/ secretion	Substrate	End Products	pH
Buccal cavity	Salivary glands	Salivary amylase	Starch	Maltose	Slightly acidic
oesophagus	–	–	–	–	–
Stomach	Gastric glands (mucosal)	Gastric Juice HCL	Activates pepsinogen	Pepsin	Highly Acidic
		Pepsin	Protein	Peptone	
		Renin (in calves & infants)	caesin (milk protein)	Ca++ & paracaesinate	
		Mucus (protects stomach walls)			
Small intestine. (duodenum)	Liver (through duct)	Bile Juice	Fats	Emulsify fats	Alkaline
	Pancreas (through duct)	Pancreatic Juice			Alkaline
		Trypsin	Proteins	Peptones/ polypeptides	
		Carboxypeptidase	Milk proteins/ peptides	Dipeptides or amino acids	
		Amylase	Starch	Glucose	
		Lipase	Lipids	Fatty acids & Glycerol	
		Nucleases	RNA, DNA	nucleotides	
	Intestinal mucosa	Succus entericus			Alkaline
		Enterokinase	Trypsinogen	Trypsin	
		Dipeptidase	Dipeptides	Amino acids	
		Lipase	Lipids	Fatty acids + Glycerol	
		Maltase/sucrase/ lactase	Maltose/ sucrose/lactose	Glucose/ Fructose/ Galactose	
		Nucleotidase/ Nucleosidase	Nucleotides/ Nucleosides	Nucleoside/free base	
Small Intestine (lleum)	ABSORPTION OF DIGESTED FOOD				
	Passive diffusion	Active Diffusion		Facilitated Diffusion	
	Movement of molecules as per conc. gradient	against concen. gradient		Diffusion of some ions and polar molecules	
	No ATP utilised	ATP used		membrane proteins required	
	glucose, amino acids, chloride ions	amioacids, glucose, sodium		Fructose and some amino acids	

Symptoms

Kwashiorkar	Marasmus
1. Stunted growth	1. Low body weight
2. Dry & scaly skin	2. Wasting of muscles
3. Odema (retention of water in tissues)	3. Prominent ribs
4. Match stick legs	4. Sunken eyes
5. Protrude Belly	5. Lean body with thin limbs
	6. Mental retardation

Cure

Feeding the child with protein rich diet including milk, soyabean, egg etc.	Child should be given protein diet with enough quantity of carbohydrates & fats.

Calorific Value : Amount of heat energy released by 1 gm of substrate after complete oxidation.

Calorific value of Carbohydrates is 4.1 k.cal/g = 17.1 kj/g

Protein is 5.6 kcal/g = 23.4 kj/gm

Fats is 9.4 kcal/g (app.) = 39.2 kj/gm

Questions

(SRT) Select Response Type Question (1 mark each)

1. The hardest substance in the body is:
   (a) Keratin (b) Enamel
   (c) Collagen (d) Fibrin
2. Choose the correct option for lacteal and its function
   (a) Lymph vessel of villi, absorption of protein
   (b) Lymph vessel of stomach of protein
   (c) Lymph vessel of villi, absorption of vitamin
   (d) Lymph vessel of villi, absorption of fats
3. Smallest projection of tongue is:

(a) Goblet cells
(b) Serosa
(c) Papillae
(d) Appendix

Very Short Answer Questions (1 mark each)

4. Mention the function of epiglottis.
5. Write the names of major parts of stomach.
6. Name the enzyme that digest fats. Mention the end products of fat digestion.
7. In which part of alimentary canal absorption of water, simple sugars and takes place ?
8. Why are proteases generally released in inactive form ?
9. Trypsinogen is an inactive enzyme of pancreatic juice. An enzyme, enterokinase, activates it. Which tissue/cell secrete this enzyme ? How is it activated ?
10. What is the role of insulin ?
11. Name any one country where children affected from PEM are found more.

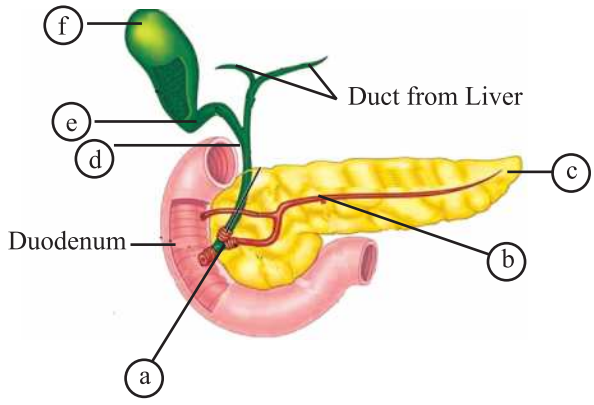
CONSTRUCTED RESPONSE TYPE (CRT)

Short Answer Questions-I (2 marks each)

12. What is emulsification ? Where and how does it occur ?
13. Name three parts of large intestine. Which vestigial organ arises from the first part of it ?
14. Name the digestive gland which acts as both exocrine and endocrine. Also name the products which are secreted by it.
15. The wall of alimentary canal is made up of four layers. Give the names of these four layers.
16. Hydrochloric acid is found in our stomach. What purpose does it serve in alimentary canal ?
17. In which part of the digestive system the absorption of following substances takes place ?
    (a) Certain drugs
    (b) Glucose, fructose and fatty acids
    (c) Water, some minerals and drugs
    (d) Simple sugar and alcohol
18. Differentiate between chylomicron and micelles.

Short Answer Question-II (3 mark each)

19. In the following diagram of duct system of liver, gallbladder and pancreas, label a, b, c, d, e and f :



20. Give a diagrammatic representation of transverse section of gut.
21. Draw the sketch of anatomical regions of human stomach and label any four parts in it.
22. How does the nervous system control the activities of gastro-intestinal tract ?

Long Answer Question (5 marks each)

23. Draw a labelled figure of digestive system of human.
24. Give a summary of cause and symptoms of following disorders of digestive system :
    (a) Jaundice (b) Vomiting
    (c) Diarrhoea (d) Constipation
    (e) Indigestion

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) Enamel
2. (d) Lymph vessel of villi, absorption of fats
3. (c) Papillae, Some Papillae have taste buds.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer (1 mark each)

4. Prevent the entry of food into the glottis.
5. Cardiac, fundic, pyloric.
6. Lipase, fatty acids and glycerol.
7. Large intestine, small intestine and stomach respectively.
8. If released in active form, without the presence of food they will start digesting the membranes and muscular walls of the alimentary canal.
9. Intestinal Mucosa.

$$\underset{\text{(In active)}}{\text{Trypsinogen}} \xrightarrow{\text{Enterokinase}} \underset{\text{(Active)}}{\text{Trypsin}} \rightarrow \text{Proteins} \rightarrow \text{Peptides}$$

10. Metabolism of sugar.
11. African countries– Somalia & others.

Short Answer Questions–I (2 marks each)

12. The process of breakdown of large fat droplets into smaller ones. It occurs in duodenum of small intestine. It is brought about by bile salts through reduction of surface tension of large fat droplets.
13. Caecum, colon and rectum. Vermiform appendix.
14. Pancreas. Exocrine secretion is pancreatic juice containing enzymes and endocrine secretions are hormones : Insulin and glucagon.
15. Serosa, muscularis, submucosa and mucosa.
16. (i) Killing of germs present in food
    (ii) Conversion of inactive pepsinogen into active form pepsin.
17. (a) Mouth & large intestine (b) Small intestine
    (c) Large intestine
    (d) Stomach
18.

Chylomicron	Micelles
1. Protein coated water soluble fat droplets released into the lymph.	Formed by combination of fatty acid, monoglycerides and bile salts.
2. In this form fats lipids are put into circulation	In this form digested fats are absorbed in intestinal cells in alimentary canal.

Short Answers Questions–II (3 marks each)

19. NCERT Text Book, XI Biology.
20. NCERT Text Book, XI Biology.
21. NCERT Text Book, XI Biology.
22. (a) Sight/smell of food → secretion of saliva.
    (b) Neural signal → gastric intestinal secretion.
    (c) CNS and local control over muscular movement.

Long Answers (5 marks each)

23. NCERT Text Book, Class XI Biology.
24. NCERT Text Book, Class XI Biology.

Case-based/Value based questions :

26. When I do not sleep... then the metabolic activities of my body get affected badly. Various food components once ingested, voluntarily by me are passed on to my oesophagus. This proces now is an involuntary action which is now called peristalsis. My stomach works hard to grind the food which was chewed up by my mouth, it also secretes HCl to make surroundings acidic, so as to help in protein digestion. My liver gets filled up by the toxicity from the proteins (ammonia), which were completely digested in the small intestine. My hard working liver also converts fats into an energy source for the body. My intestines look forward to the much-needed rest they need, after their villi have absorbed the final products of digestion and passed it over to my blood. My pancreas screams for help as the Insulin secreted by it, unable to control the increase of the glucose in my blood.. My brain starts getting electrocuted by constantly responding to the huge variety of stimuli being fed into my system continuously... thus increasing my stress. So dear eyes close yourself on time and sleep peacefully. This much needed sleep on time, provides the much-needed rejuvenation to the metabolism of our body!

1. What is the end product of the digestion of proteins in the intestines, which is passed on to the blood?
   (a) Monosaccharides (b) Amino acids
   (c) Fatty acids (d) Nucleosides
2. Define metabolism.
   (a) Sum total of catabolic processes

(b) Sum total of anabolic processes
(c) Sum total of catabolic and anabolic processes.
(d) None of the above

3. Which hormone is secreted by the pancreas?
   (a) Salivary amylase
   (b) Insulin
   (c) Glucagon
   (d) Insulin and glucagon
4. Why sleeping on time is essential for the body?
   (a) To have a perfect circadian rhythm
   (b) To rejuvenate metabolism
   (c) To pass time
   (d) Both (a) & (b)

Assertion reasoning questions: Select Response Type-II Question (1 Mark each)

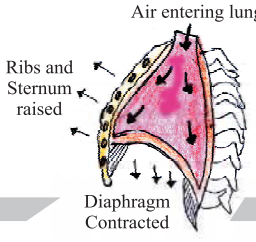
DIRECTIONS, a statement of assertion (A) is followed by a statement of the reason (R). Mark the correct choice as :

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A)
(b) If both (A) and (R) true, but (R) is not the correct explanation of (A)
(c) If (A) is true but (R) is false
(d) If both (A) and (R) are false

27. **Assertion :** The innermost layer lining the lumen of the small intestine is mucosa and is called villi.
    Reason : It increases the surface area of the small intestine.
28. **Assertion :** The teeth help in the mastication of food.
    Reason : The hard chewing surface of the teeth is made up of enamel.

Solutions :

26. 1. (b)
    2. (c)
    3. (d)
    4. (d)
27. (a)
28. (a)



Chapter - 17 Breathing and Exchange of Gases

Points To Remember

Breathing : (External respiration) The process of exchange of O_2 from the atmosphere with CO_2 produced by the cells.

Carbamino haemoglobin : Compound formed in RBCs when CO_2 combine with haemoglobin.

Inspiration : Oxygen from fresh air taken in by lungs and diffused into the blood.

Expiration : CO_2 given up by venous blood in the lungs is sent out to exterior.

Respiration : The sum total of physical and chemical processes by which oxygen and carbohydrates (main food nutrient) etc are assimilated into the system and the oxidation products like carbon dioxide and water are given off.

Diaphragm : A muscular, membranous partition separating the thoracic cavity from the abdominal cavity.

Hypoxia—Shortage of oxygen in tissues.

Partial Pressure—The pressure contributed by an individual gas in a mixture of gases. It is represented as pO_2 for oxygen and pCO_2 for carbondioxide.

Pharynx : The tube or cavity which connects the mouth and nasal passages with oesophagus. It has three parts (i) Nasopharynx (anterior part) (ii) Oropharynx (middle part) and (iii) Laryngopharynx (posterior part which continues to larynx)

Adam's Apple : The projection formed by the thyroid cartilage and surrounds the larynx at the front of the neck.

Tidal volume (TV) : Volume of air taken in/given out during normal respiration (500 mL.)

Inspiratory Reserve Volume (IRV) : Additional volume of air inspired by a forcible inspiration. 2500mL to 3000mL.

Expiratory Reserve Volume (ERV) : Additional volume of air, a person can expire by a forcible expiration.

Residual volume (RV) : Volume of air remaining in the lungs even after a forcible expiration (1100 mL to 1200 mL)

PULMONARY CAPACITIES : Use in clinical diagnosis.

Inspiratory capacity (IC) = (TV + IRV) Total volume of air a person can inspire after a normal expiration.

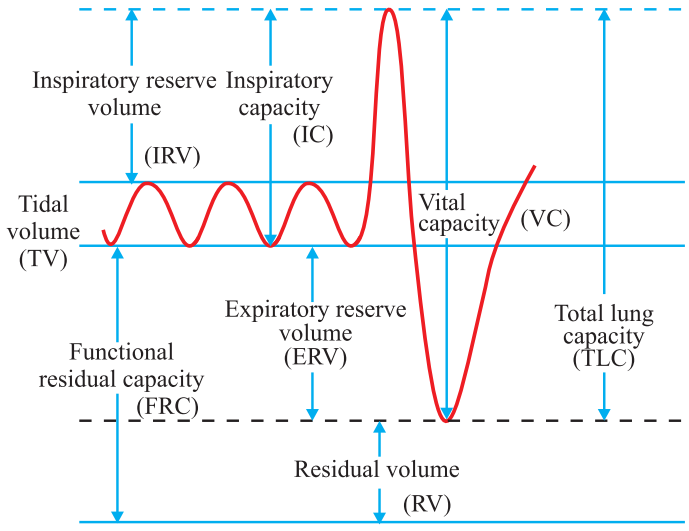
Expiratory Capacity—Total Volume of air a parson can expire after a normal inspiration E.C. = TV + ERV

Functional Residual Capacity—Volume of air that will remain in lungs after a normal expiration (FRC) = (ERV + RV)

Vital Capacity (VC) = (ERV + TV + IRV) or the maximum volume of air a person can breath out after a forced inspiration.

Total Lung Capacity : It includes RV, ERV, TV and IRV or vital capacity + residual volume.

Pulmonary—Anything associated with the lungs is given the prefix 'pulmonary'



Various pulmonary air volumes

Steps involved in respiration—

(i) Breathing or pulmonary ventilation (intake of atmospheric air and releasing out CO_2 rich alveolar air)

(ii) Diffusion of gases (O_2 and CO_2) across alveolar membrane & blood vessel (capillaries).

(iii) Transport of gases by the blood.

(iv) Diffusion of O_2 and CO_2 between blood and tissues.

(v) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2.

Respiratory organs in animals :

(i) Protozoans, annelids Frogs—**Body surface**

(ii) Fishes, tadpole stage of frog and many other aquatic animals—**Gills** (Branchial Respiration)

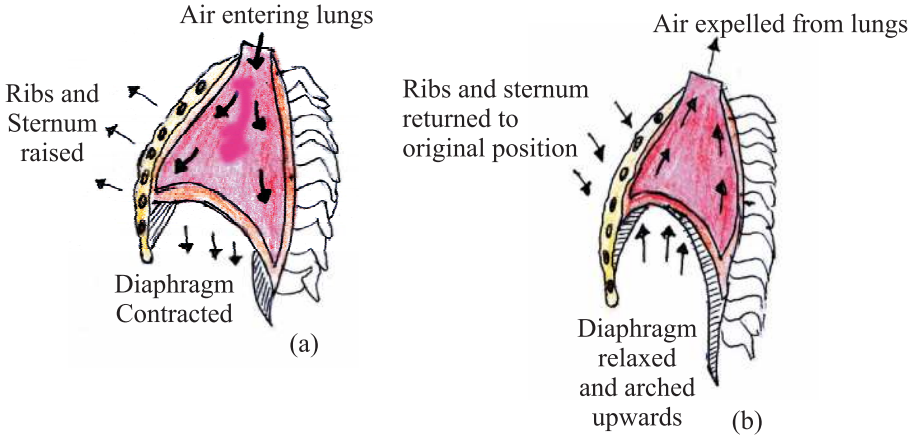
(iii) Insects and a few other arthropods—**Tracheal tubes**

(iv) All land vertebrates (amphibians, reptiles, aves and mammal)—**Lungs.** (Pulmonary Respiration)

Conditions required for (cutaneous respiration)

Skin should be moist and thin. It should be highly vascularised.

Mechanism of Breathing



Mechanism of breathing showing (a) Inspiration (b) Expiration

Inspiration	Expiration
Contraction of diaphragm and external intercostal muscles	Relaxation of diaphragm and sternum
↓	↓
Increase in the volume of thoracic chamber	Decrease in the volume of thoracic chamber
↓	↓
Lungs expand	Lungs contract
↓	↓
Pressure inside the lungs fall	Pressure inside the lungs increase
↓	↓
Air rushes into lungs from Atmosphere	Air rushes out from lungs in to Atmosphere

Human Respiratory Tract :

A pair of external nostrils → nasal chamber through nasal passage → pharynx → glottis → larynx → trachea → Left and right primary bronchi → secondary and tertiary bronchi → bronchioles → vascularised bag like structures (alveoli) or air-sacs. Each lung is covered with double layered membrane known as pleura with pleural fluid between them.

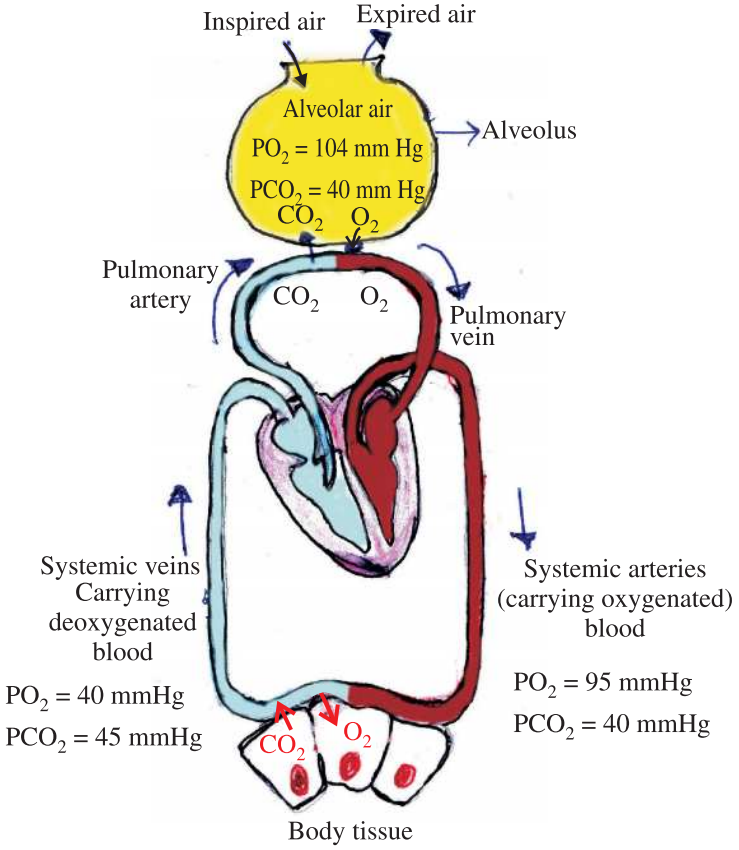
Physiology of Respiration :

(a) Exchange of gases—Diffusion of gases takes place from the region of higher partial pressure to lower (lesser) partial pressure)

(i) pO_2 in alveolar air = 104 mm Hg.

(ii) pO_2 in venous blood = 40 mm Hg.
O_2 diffuses from alveoli to venous blood.

(iii) pCO_2 in venous blood = 45 mm Hg.
pCO_2 in alveolar air = 40 mm Hg.
CO_2 diffuses from venous blood to alveoli



(b) Transport of O_2 by the blood — (i) About 3% of O_2 in dissolved state through plasma.

(ii) As oxyhaemoglobin : 97% of O_2 diffuses from plasma into RBCs. Haemoglobin carry 1-4 molecules of O_2.

$$Hb_4 + 4O2 \underset{\text{TISSUE}}{\overset{\text{LUNGS}}{\rightleftharpoons}} Hb_4\,O_8$$
Oxyhaemoglobin

Oxygen dissociation curve

- A sigmoid curve showing relationship between the % of saturation of haemoglobin with oxygen in blood and pO_2 of the blood.
- Fully saturated each gram of haemoglobin combines with nearly 1.34 ml of oxygen.
- H^+ concn., CO_2 tension, temperature affect the curve. Increase in their concentration decreases the affinity of hemoglobin for oxygen.

(c) Transport of CO_2

(i) As solution – 7% of CO_2 dissolves and carried by the plasma.

(ii) As Bicarbonate – 70% of CO_2 in RBCs combines with water form carbonic acid. Carbonic acid dissociates into bicarbonate ions and H^+, Carbonic anhydrase enzyme help in these reactions.

$$CO_2 + H2O \underset{\text{anhydrase}}{\overset{\text{Carbonic}}{\rightleftharpoons}} H_2CO_3 \underset{\text{anhydrase}}{\overset{\text{Carbonic}}{\rightleftharpoons}} HCO^-_3 + H^+$$

(iii) As carbaminohaemoglobin – 23% CO_2 combines in RBC with amino group of haemoglobin, form carbaminohaemoglobin.

Regulation of Respiration

- Respiratory rhythm centre in medulla of brain responsible for this regulation.
- Pneumotaxic centre in pons region moderates function of respiratory rhythm centre.
- Chemosensitive area adjacent to rhythm centre is highly sensitive to CO_2 and H^+ ions.

- Increase in CO_2 and H^+ ions activates this centre, which in turn signal the rhythm centre to make necessary adjustments and respiratory process by which these substances can be eliminated.

Disorders of Respiratory System

- Emphysema– chronic disorder in which alveolar walls damaged due to cigarette smoking
- Asthma–difficulty in breathing due to inflammation of bronchi or bronchioles,
- Occupational disorders– people working in stone grinding or breaking industries, the dust produced damage the defence system of body leading to servere lung damage.

Questions

(SRT) Select Response Type Question (1 mark each)

1. The organ in human respiratory system producing sound is
   (a) Pharynax (b) Alveoli
   (c) Larynx (d) Ear drum
2. One Haemoglobin molecule carries
   (a) 2 oxygen molecule (b) 3 oxygen molecule
   (c) six oxygen molecule (d) oxygen moelcule
3. The double membranous layer which surround the lung is
   (a) Mucosa (b) Muscularis
   (c) Pleura (d) Serosa

Very Short Answer Questions (1 mark each)

4. Which organ of our respiratory system acts as primary site of exchange of gases ?
5. Cigarette smoking causes emphysema. Give reason.
6. Name the principle or process of exchange of gases.
7. What is the role of oxyhaemoglobin after releasing molecular oxygen in the tissues ?
8. Name the muscles which facilitate breathing.
9. How is the entry of food prevented in the respiratory tract?

10. About 97% of O_2 is transported by RBCs in the blood. How does the remaining 3% of O_2 transported ?

Short Answer Questions (2 marks each)

11. Draw a labelled diagram of a section of an alveolus with a pulmonary capillary.
12. Following is the table showing partial pressure (in mm Hg) of oxygen and carbondioxide) at different parts involved in diffusion in comparison to those in atmosphere. Fill in the blank – a, b, c and d.

Respiratory gases	Atmospheric air	Alveoli	Blood (Deoxygenated)	Blood (Oxygenated)	Tissue
O_2	(a)	104	40	(d)	40
CO_2	0.3	(b)	(c)	40	45

13. Name the organs of respiration in the organisms.
    (a) Flatworms (b) Birds (c) Frog (d) Cockroach
14. What are occupational respiratory disorders ? What are their harmful effects ? What precautions should a person take to prevent such disorders ?
15. How is respiration different from breathing ?

Short Answer Questions-II (3 marks each)

16. Explain the role of neural system in regulation of respiration is human.
17. How is carbon dioxide transported in blood?

Long Answer Questions (5 marks each)

18. With the help of labelled diagram explain the structure of human respiratory system.
19. Explain the mechanism of breathing with the help of labelled diagram involving both stages—inspiration and expiration.
20. Explain the process of exchange of gases with the help of a diagrammatic representation in human respiratory system.

Case Based/Source/Competency focussed Question

(4 Marks each)

21. Breathing is a physical phenomenon where oxygen from the atmosphere is exchanged with the carbon dioxide produced by the cells. Various organisms

have different mechanisms for breathing depending upon their needs and habitat. For example, lower invertebrates like sponges exchange gases by simple diffusion while earthworms use cuticle and insects have a network of tubes to transport atmospheric air within the body. Special vascularized structures called gills are used by aquatic arthropods and molluscs whereas vascularised bags called lungs are used by terrestrial forms for the exchange of gases. Fishes use gills while birds and mammals have lungs and amphibians use their moist skin to exchange gases.

1. **Assertion (A) :** Breathing is different from respiration.

   Reason (R) : Breathing is physical and respiration is biochemical.

   (a) If both (A) and (R) are correct and (R) is the correct explanation of (A)

   (b) If both (A) and (R) are true, but (R) is not the explanation of (A)

   (c) If (A) is true but (R) is false

   (d) If both (A) and (R) are false

2. Why is the mechanism of breathing different for different organisms?

   (a) To meet their needs

   (b) To help them adapt to their environment

   (c) To suit their mode of life

   (d) All of the above

3. What special name is given to the vascularised bags of terrestrial animals and vascularised structures of aquatic arthropods and molluscs?

   (a) Gills and lungs respectively

   (b) Lungs and trachea respectively

   (c) Lungs and gills respectively

   (d) Gills and trachea respectively

4. How do lower invertebrates like sponges exchanges gases?

   (a) Diffusion

(b) Osmosis

(c) Breathing

(d) Cuticle exchange

5. **Assertion :** The larynx is called the sound box.

   Reason : The larynx is a cartilaginous box that helps in sound production.

   (a) If both (A) and (R) are correct and (R) is the correct explanation of (A)

   (b) If both (A) and (R) are true, but (R) is not the explanation of (A)

   (c) If (A) is true but (R) is false

   (d) If both (A) and (R) are false

(Select Response Type) Assertion reasoning type questions : (1 marks each)

DIRECTIONS : In the following questions, a statement of assertion (A) is followed by a statement of the reason (R). Mark the correct choice as :

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A)

(b) If both (A) and (R) are true, but (R) is not the explanation of (A)

(c) If (A) is true but (R) is false

(d) If both (A) and (R) are false

22. **Assertion :** Most fishes, when out of water die of suffocation.

    Reason : Atmospheric air contains far less oxygen content then the dissolved oxygen in water.

23. **Assertion :** Aerobic animals are not truly aerobic.

    Reason : They produce lactic acid anaerobically.

24. **Assertion :** During inspiration pressure of air falls in the thorax.

    Reason : There is a rise in the volume of the thorax during inspiration.

25. **Assertion :** Symptoms of emphysema develops when a person living on planes ascends and stays on a mountain.

Reason : Air pressure and partial pressure of oxygen increases with the rise in altitude.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (c) Larynx (Sound box)
2. (d) Four molecules of O_2.
3. (c) Pleura. It reduces the friction and the two pleura together protect the lungs.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Alveoli of lungs.
5. Cigarette smoking damages alveolar walls due to alveolar sacs abnormal distension, leading to decreased respiratory surface for exchange of gases.
6. Diffusion.
7. Amino group of reduced haemoglobin combines with CO_2 forming carbaminohaemoglobin to transport CO_2.
8. External and internal intercostals muscles, situated between ribs.
9. During swallowing a cartilaginous flap like structure called epiglottis covers the glottis and prevents the entry of food into respiratory tract.
10. In simple solution form through plasma.

Short Answers-I (2 marks each)

11. NCERT Text Book Class XI Biology.
12. NCERT Text Book Class XI Biology.
13. (a) Body surface (b) lungs (c) skin and lungs (d) Network of trachea
14. NCERT Text Book Class XI Biology.

15. Slow oxidation of food to release energy is called respiration while breathing is a biophysical process which is the first step of respiration.

Short Answers-II (3 marks each)

16. Refer Support Material Points to remember.

17. Refer Support Material Points to remember.

Long Answers-II (5 marks each)

18. Refer Support Material Points to remember.

19. Refer Support Material Points to remember.

20. Refer Support material 'Points to remember' of this chapter.

21. 1. (a)
    2. (d)
    3. (c)
    4. (a)
    5. (a)

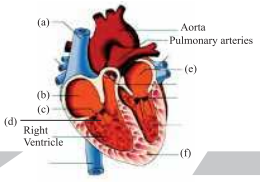
Short Answers-II (3 marks each)

22. (c)

23. (a)

24. (a)

25. (d)



Chapter - 18

Body Fluids and Circulation

Points To Remember

Blood : A special connective tissue that circulates in principal vascular system of man and other vertebrates consisting of fluid matrix, plasma and formed elements (Blood = Plasma + All blood cells).

Plasma : (Blood – All blood cells = Plasma) The liquid part of blood which is straw coloured, viscous fluid and contains about 90-92% of water and 6-8% proteins.

Lymph : A clear yellowish, slightly alkaline, coagulable tissue fluid, containing white blood cells (Only lymphocytes), a liquid resembling blood plasma.

Serum : Blood plasma from which fibrinogen and other clotting factors have been removed. [Plasma– (fibrinogen & other clotting factor)] = blood serum.

Heart Beat : The rhythmic contraction and relaxation of the heart, which includes one systole (contraction phase) and one diastole (relaxation phase) of the heart. Heart beat count of healthy person is 72 times per minute.

Stroke Volume : The volume of blood pumped out by the heart during a systole. It is approximately 70 ml.

Cardiac output : The amount of blood pumped by heart per minute is called cardiac or heart output. The value of cardiac output of a normal person is about $72 \times 70 = 5040$ mL or about 5L per minutes.

Cardiac Cycle : The rhythmic contraction and dilation of different parts of heart in one beat.

Systole : Contraction of heart muscles.

Diastole : Relaxation of heart muscles

Formed Elements : Erythrocytes, leukocytes and platelets are called blood corpuscles or formed elements.

TYPES OF BLOOD CELLS THEIR NUMBER, STRUCTURE & FUNCTIONS

Name and Number/ Percentage	Structure	Life Span and Formation	Function
(A) Erythrocytes RBCs - 4.5 to 5.5 million per cubic millimetre of blood	Red colour Circular, biconcave denucleated, elastic lack of cell organelles like ER, ribosomes, mitochondria etc.	Formed from birth onward by red bone marrow Life-120 days excess RBCs are stored in spleen	Transport of oxygen and some amount of carbon dioxide through haemoglobin
(B) Leucocytes (WBCs) 6000-8000 per cubic mm of blood	Colourless rounded or irregular, nucleated 12 to 20mm wide	Formed in red bone marrow, Lymph nodes, spleen and thymus, life-1-4 days	Acts as soldiers scavenger and some help in healing
(i) Agranulocytes (a) Lymphocytes 20-45% of leucocytes (B and T)	Large rounded nucleus, 6-10 mm	Lymph nodes, spleen, thymus red bone marrow, life few days to months or even years	Non Phagocytic secrete antibodies
(b) Monocytes 6-8% of leucocytes,	Largest of all (12-15 mm) bean shaped nucleus	Red Bone marrow, life 10-20 hours	phagocytic, very motiles engulf germs
(ii) Granulocytes (a) Eosinophils 2-3% of leucocytes	bilobed nucleus, granules in cytoplasm	Red Bone marrow, life 4 to 8 hrs. in blood	Resist infectious and allergic reactious
(b) Basophils 0-5% of leucocytes	Three lobed nucleus (s-shaped)	Red Bone marrow, life 4 to 8 hours in blood	release heparin and histamine
(c) Neutrophils 60-65% of leucocytes	Many lobed nucleus fine granules	Red Bone marrow, life 4 to 8 hours in blood	phagocytic, engulf germ and dead cells
(C) Platelets thrombocytes 1,50,000-3,50,000 per cubic mm of blood	Colourless, rounded or oval, or irregular non-nucleated fragments	Red Bone marrow worn out ones phagocytized in blood	help in blood clotting

Blood Pressure—The resistance offered by the lumen of the artery to the flow of Blood.

Hypertension : The condition when blood pressure is higher than normal (120/80 mmHg)

Electrocardiograph : (ECG) the machine used to record electrocardiogram.

Electrocardiogram ECG : The print out of pattern of heart beat taken on a graph paper from Electrocardiograph. (ECG machine)

Lymph (Tissue Fluid)

The colourless mobile fluid connective tissue drains into the lymphatic capillaries from the intercellular spaces. It is formed by squeezing of blood through capillaries, within tissues. Its flow is unidirectional *i.e.,* from tissues to heart.

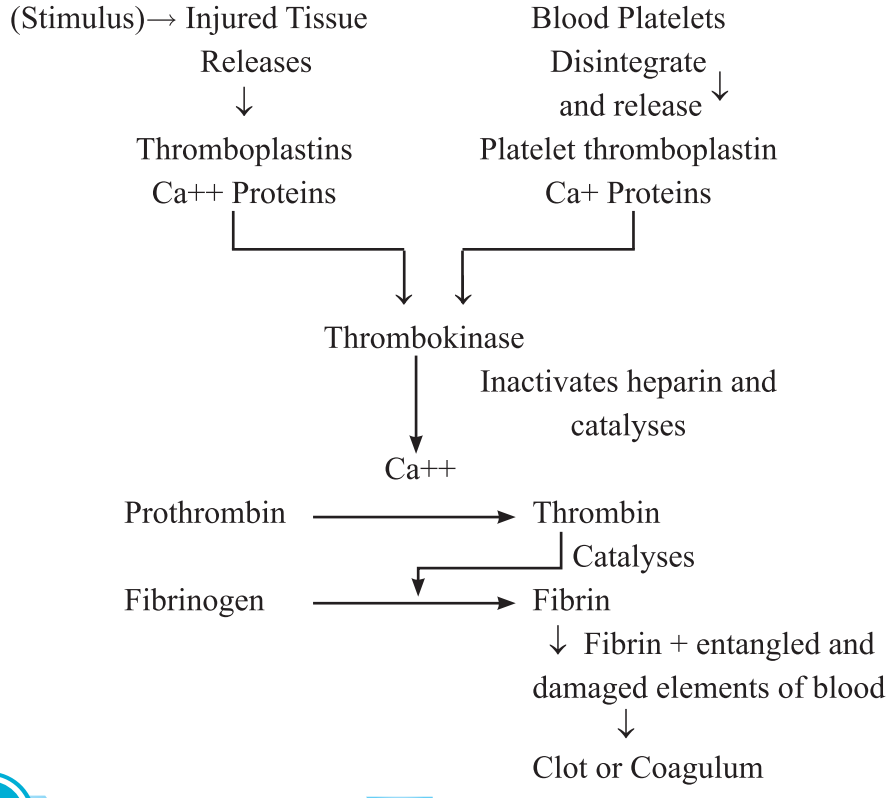
Composition : It is composed of fluid matrix, plasma having only lymphocytes of white blood corpuscles or leucocytes.

Functions : (i) It drains excess of tissue fluid from extra cellular spaces back into the blood.

(ii) It contain lymphocytes and antibodies.

(iii) It transport digested fats.

Blood Clotting : Coagulation of Blood : (Cascade process)



Functions of Blood

Transport, of food, respiratory gases (O_2 and CO_2), hormones, metabolic intermediates, waste products, supply of raw materials, regulation of water balance, regulation of pH and body temperature, and provides immunity.

Blood Groups : Based on presence of Antigens and Antibodies in blood.

Blood Group	Antigen (on the Surface of R.B.Cs)	Anti body : (in plasma)	Possible recipients having blood group	Possible donors having blood group	Remarks
A	A	Anti B	A, AB	O, A	—
B	B	Anti A	B, AB	O, B,	—
AB	A and B	None	AB	O, A, B, AB	Universal recipient
O	None	Anti A and Anti B	O, A, B, AB	O	Universal Donor

Rh (Rhesus) Group :

- Rh positive (Rh + ve) – Rh antigen similar one present in rhesus monkey. Observed on the surface of RBCs (nearly 80% of humans)
- Rh negative (Rh–ve) – those in whom this antigen is absent.
- Compatibility is crucial during transfusion and pregnancy because if Rh -ve person is exposed to Rh +ve blood it forms specific antibodies against Rh antigens.

Rh incompatibility in pregnancy

1st PREGNANCY

Rh+ve (Father)
Rh-ve (Mother)
Rh+ve (Foetus)

→ No mixing of two bloods due to placenta
Foetal maternal blood mixes during delivery

First newborn Rh +ve (safe)
But mother (Rh-ve) prepares antibodies against Rh factor

2nd PREGNANCY

Rh+ve (Father)
Rh-ve (Mother)
Rh+ve (Foetus)

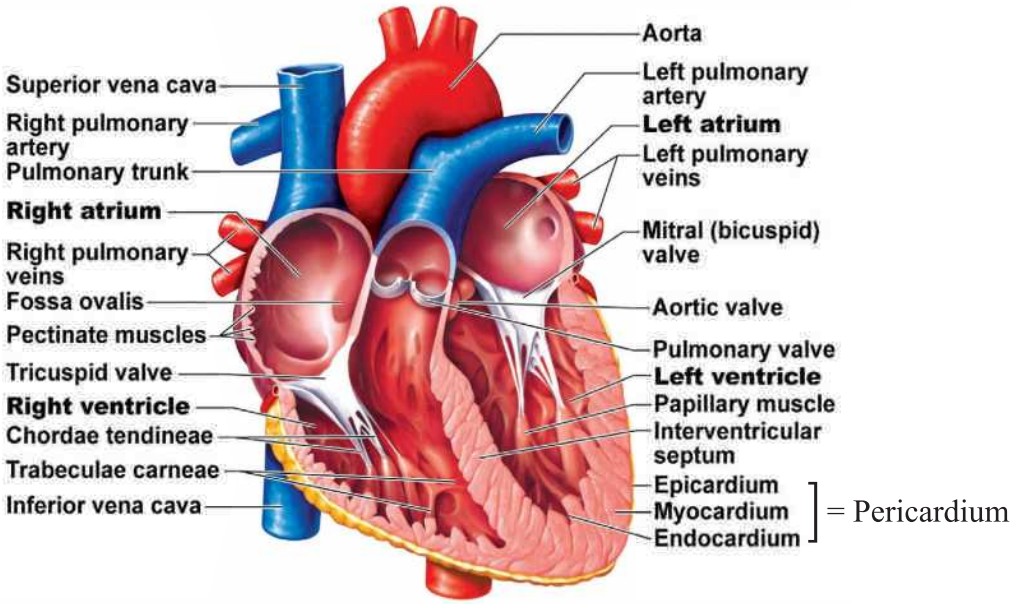
→ Antibodies leak into the blood of foetus

Destroy foetal RBCs
Leads to erythroblastosis foetalis

→ **SAN (Sino-atrial node) :** A patch of tissues present in the right upper corner of the right atrium, acts as pacemaker due to having a unique property of self excitation.

→ **AVN (Atrio Ventricular Node) :** A mass of tissues seen in the lower left corner of the right atrium close to the atrio-ventricular septum. Fresh wave of contraction generated here, passes over both the ventricles simultaneously along the bundle of HIS.

Human Heart



Human Heart

- It is the mesodermally derived organ situated in thoracic cavity in between the two lungs. Protected by a double membrane covering called Pericardium.
- Four chambers–two (left and right) atria, and two ventricles (left and right)
- Inter-atrial septum separates the two atria and inter ventricular septum separates the two ventricles, while the atria and ventricles are separated by atrioventricular septum.
- The valves between right atrium and right ventricle is tricuspid while between left atrium and left ventricle is bicuspid or mitral value.
- The opening of the right ventricle into the pulmonary artery and the opening of left ventricle in to aorta are guarded by semilunar values.

- The valves allow the flow of blood only in one direction, *i.e.,* from atria to ventricles and from ventricles to pulmonary artery or aorta.

Heart Valves

Tricuspid Valve : The valves formed of three muscular flaps or cups, which guard the opening between the right atrium and the right ventricle.

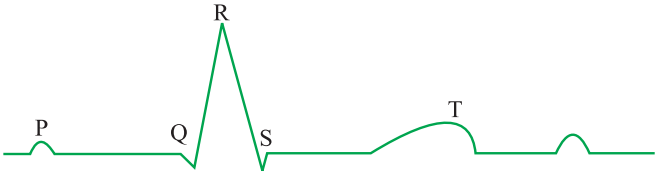
Bicuspid Valve (Mitral Valve) : The valves which guard the opening between the left atrium and the left ventricle, made up of two flaps.

Semilunar Valves : The valves present at the opening of the right and the left ventricles and allow the entry of blood into pulmonary artery and the aorta respectively.

ECG

Electrocardiogram ECG : The graphic record of the electric current produced by the excitation of the cardiac muscles. It is composed of a 'P' wave, 'QRS' wave. (complex) and 'T' wave.

Standard ECG and Reading of ECG : 'P' Wave represents the electrical excitation (or depolarisation) of the atria and leads to the contraction of both the atria.

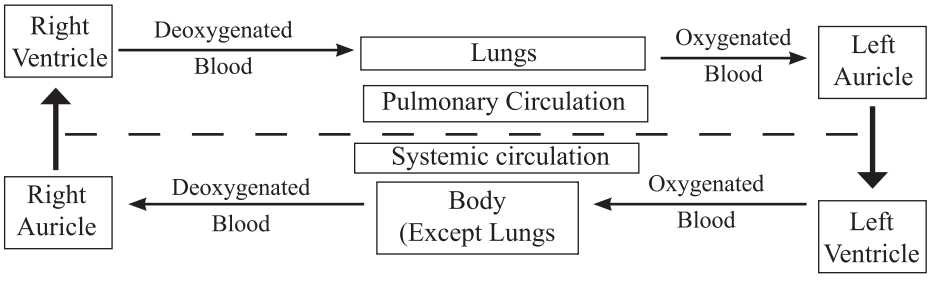


Diagrammatic presentation of a standard ECG.

'QRS' complex : represents the depolarisation of the ventricles, which initiates the ventricular contraction.

'T' Wave : represents the return of the ventricles from excited to normal state (repolarisation). The end of T-wave marks the end of sytole.

Double circulation :



CARDIAC CYCLE : The rhythmic contraction and dilation of different parts of heart in one beat.

Systole : contraction of heart muscles.

Diastole : relaxation of heart muscles.

- ❑ Joint diastole :-All chambers of heart in relaxed state.
  - Tricuspid and bicuspid valves– open
  - Blood from pulmonary vein and vena cava flows into left and right atrium respectively.
- ❑ Atrial systole :- contraction of atrias
  - SAN generates action potential to stimulate atrias to contract simultaneously
  - Blood flows to respective ventricles
- ❑ Ventricular systole : contraction of ventricles
  - AV node and AV bundle conduct the wave of contraction to the ventricles via bundle of HIS.
  - Ventricles contract as a closed chamber (as AV valves and semilunar valves are close).
  - Pressure of blood opens the semilunar valves and blood flows to respective arteries.
- ❑ Joint diastole : Relaxation of all chambers.

HEART SOUNDS

- Closure of bicuspid and tricuspid valves produces first heart sound 'lub'
- Closure of semilunar valves produces second heart sound 'dub'

Disorders of circulatory System

Hypertension (High blood Pressure) : It results from narrowing of arterial lumen and reduced elasticity of arterial walls in old age. It can cause rupturing of capillaries. It is a silent killer.

Coronary Artery Disease : (CAD) Atherosclerosis. The supply of the blood to heart muscles is affected. It is caused by deposits of Calcium, fat, cholesterol and fibrous tissues to make the lumen of arteries narrower.

Angina Pectoris : Caused due to arteriosclerosis, when not enough oxygen is reaching the heart muscle due to which the person experiences acute chest pain.

Heart attack : Caused when the heart muscle is suddenly damaged by an inadequate blood supply.

Cardiac arrest : The state in which the heart stops beating.

Arteriosclerosis : The state of hardening of arteries and arterioles due to thickening of the fibrous tissue and consequent loss of elasticity. It causes hypertension.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which instrument is used to measure blood pressure?
   (a) Barometer (b) Sphygmomanometer
   (c) BOD meter (d) none of these
2. State true or false
   "A lymph node is specialized structure in lymphatic vessel concerned with filtration of foreign bodies by the lymphocytes."
3. QRS complex of Electron cardio gram represents
   (a) Ventricular systole (b) Joint diastole
   (c) Joint systole (d) Ventricular diastole
4. The carbonic acid in RBCs is synthesised by the enzyme
   (a) RUBISCO (b) Lipase
   (b) Carbonic anhydrase (d) Acetyl co transferase.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

5. What is systemic circulation ?
6. Give two examples of extra-cellular fluids.
7. What name is given to the blood vessels which generally bring blood to an organ ?
8. Which adrenal hormone accelerates heart beat under normal conditions ?

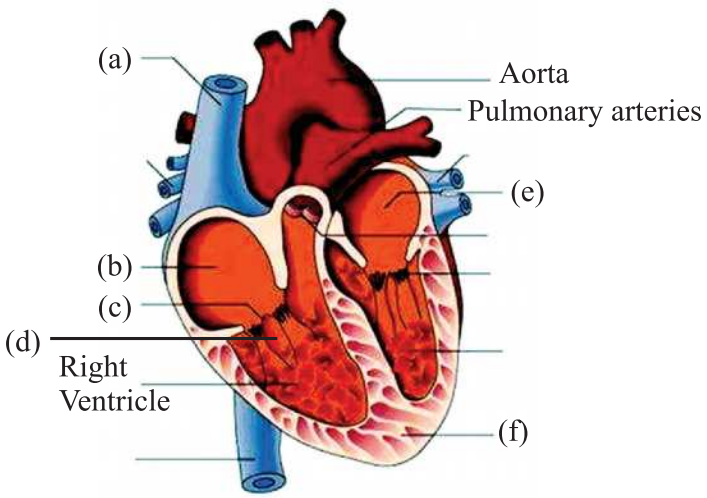
9. Name the blood vessel that carries blood from the intestine to liver.
10. Define cardiac cycle.
11. Name the protein found in RBCs.
12. What happens to a person suffering from hemophilia ?

Short Answer Questions-I (2 marks each)

13. Explain when and how the two sounds of heart are produced.
14. Define joint diastole. What are constituents of the conducting system of human heart ?
15. Give the names of various types of formed elements present in the blood.

Short Answer Questions-II (3 marks each)

16. Why is the SA node called pacemaker of the heart ? Write its full from.
17. Draw a diagram showing schematic plan of blood circulation in human.
18. In the following diagram of section of a human heart, label a, b, c, d, e and f.



19. What is lymph ? Describe its circulation in brief.
20. What is stroke volume ? What is its relation with cardiac output ?
21. A person suffering from fever is advised to take blood test. What may happen to his WBC count and why ?

Long Answer Questions (5 marks each)

22. Neena is having blood group A-ve while her husband's blood group is O +ve. Their first child is having blood gp. A +ve. Her second child was born with severe anemia and jaundice. What could be the reason ? How this situation could have been avoided ?
23. Draw a diagram to show the internal structure of human heart. Lable any two heart chambers, any two heart valves and chordae tendinae in it.
24. Describe the structure of human heart.
25. What is cardiac cycle ? Describe the event that occur during it.
26. Explain Rh grouping and its incompatibility in humans.

Case Based/Competency Based Questions (5 marks each)

27. Blood is a fluid connective tissue made up of fluid matrix plasma, and formed elements, Red blood cells, (erythrocytes) white blood cells (leukocytes), and platelets (thrombocytes) constitute the formed elements. The blood of humans is grouped into A, B, AB and O systems based on the presence or absence of two surface antigens A, B on the RBCs. Another blood grouping is also done based on the presence or absence of another antigen called Rhesus factor (Rh) on the surface of RBCs. The spaces between cells in the tissues contain a fluid derived from the blood called tissue fluid this fluid called lymph is almost similar to blood except for the protein content and the formed elements.

1. Why is blood called a fluid connective tissue?
   (a) Because of fluid matrix plasma
   (b) Because of osteocytes
   (c) Because of the solid matrix
   (d) None of the above
2. Name the formed elements of blood.
   (a) RBCs, WBCs only (b) Platelets only
   (c) Plasma only (d) RBCs, WBCs and Platelets
3. Which blood group is considered a universal donor and why?
   (a) A (b) B
   (c) AB (d) O

4. Name the complication which arises when a Rh+foetus is developing the womb of a Rh-mother.
   (a) Erythroblastosis foetalis
   (b) Angina
   (c) Cardiac arrest
   (d) None of the above
5. Give the basic difference between tissue fluid and blood.
   (a) Tissue fluid has no proteins
   (b) Tissue fluid has no RBCs
   (c) Tissue fluid has no WBCs and platelets
   (d) All of the above

Assertion & Reason Question (SRT) (1 marks each)

DIRECTIONS : In the following questions, a statement of assertion (A) is followed by a statement of the reason (R). Mark the correct choice as :

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A)

(b) If both (A) and (R) true, but (R) is not the correct explanation of (A)

(c) If (A) is true but (R) is false

(d) If both (A) and (R) are false

28. **Assertion :** Blood coagulates in uninjured blood vessels.

    Reason : Uninjured Blood vessels release an anticoagulant Heparin.

29. **Assertion :** Left atrium possess the thickest muscles.

    Reason : Left atrium receives blood from the lungs.

30. **Assertion :** In the human heart there is no mixing of oxygenated and deoxygenated blood.

    Reason : The presence of valves in the heart allows the movement of blood in one direction.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) Sphygmomanometer.
2. True

3. (a) QRS waves denotes ventricular systole.
4. (c) Carbonic anhydrase.

Very Short Answer (1 mark each)

5. The kind of blood circulation that is concerned with the supply of oxygenated blood from the left ventrical to all body parts and return of deoxygenated blood to the right atrium of heart.
6. Interstitial fluid and blood plasma.
7. Afferent blood vessel.
8. Noradrenalin.
9. Hepatic portal vein.
10. A regular sequence of three events (i) Joint diastole during the completion of one heart beat (ii) auricular systole and (iii) ventricular systole.
11. Haemoglobin.
12. The person suffering from haemophilia lacks clotting factors in blood, which result the defective clotting mechanism. In case of injury the person is at a risk of blood loss.

Short Answer-I (2 mark each)

13. (i) 'Lubb' the first sound which is low pitched, is caused by the closure of bicuspid and tricuspid valves.
    (ii) 'Dub' the second sound which is high pitched, is caused by the closure or semilunar valves.
14. In a cardiac cycle when both atria and ventricles are in a diastole and are relaxed simultaneously is called a joint diastole.
    Conducting system constitutes : SA node → AV node → Bundle of His → Purkinje fibres.
15. Erythrocytes, lymphocytes, (monocytes, neutrophils, eosinophils, basophils), and platelets.

Short Answer-II (3 marks each)

16. SA node being self excitatory initiate a wave of contraction in the heart.
    SA node — Sino–Atrial Node.
17. Refer Support material Points to remember.

18. Refer Support material Points to remember.
19. Refer Points to remember of support material.
20. During one cardiac cycle or one heart beat the volume of blood pumped by the heart is called stroke volume. This is normally 70 mL.

    In one minute the heart beats about 72 times and the amount of blood pumped per minute is called cardiac output. This is usually 4900 mL. or 5 litres.
21. The WBC count of this person may show an increase from the normal range. As pathogens may be present in his body, so the body is producing more WBCs to fight against those pathogens. WBC count is a good tool to asses the presence of infection in a sick person.

Long Answer (5 marks each)

22. During her first pregnancy after exposure with blood of her first Rh +ve child, her body prepared antibodies against Rh antigen in her blood. In second pregnancy these Rh antibodies from mother leaked into the blood of foetus (Rh +ve) and destroyed foetus RBCs. It could cause of severe anemia and Jaundice could be fetal to the foetus.

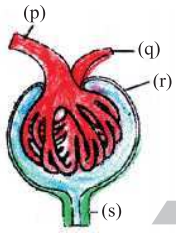
    This situation could have been avoided if she had got herself administered anti Rh antibodies, immediately after first delivery to kill Rh antibodies entered in mother's blood from foetus.
23. Refer Points to remember.
24. Refer Points to remember.
25. Refer Points to remember.
26. Refer Points to remember.

Case Based Question (4 marks each)

27. 1. (a) 2. (d) 3. (d)
    4. (a) 5. (d)

Assertion & Reason Question (SRT) (1 marks each)

28. (d)
29. (c)
30. (b)



Chapter - 19

Excretory products and Their Elimination

Points To Remember

Excretory Products : Ammonia (most harmful) it needs large amount of water for excretion. Urea (less harmful) and Uric acid (least harmful) needs least amount of water for excretion.

MODE OF EXCRETION

(*On the basis of type of excretory end products*)

Ammonotelism	Ureotelism	Uricotelism
• Excretion of ammonia • Bony Fishes, Aquatic Amphibians & Aquatic Insects.	• Excretion of urea • Mammals, Many Terrestrial Amphibians & Marine Fishes	• Excretion of Uric acid • Snails, Reptiles, Birds & Insects.

Human Excretory System:

Pair of kidney, pair of Ureter, Urinary bladder and Urethra.

Nephron And Its Structure:

The structural and functional unit of kidney is nephron. Each kidney contains about one million of nephrons. A nephron consist of glomerulus (tuft of capillaries-JGA juxtra glomerulus apparatus), and renal tubule. Renal tubule consist of bowman's capsule, proximal convulated tubule (PCT), loop of henle, distal convulated tubule (DCT) and collecting Duct.

Structure of Kidney :

Size 10-12 cm in length, 5-7 cm in width, 2-3 cm thick, average weight about 120-170 g.

- The blood vessels, ureters and nerves enter the kidney through hilum (a notch).
- The outer layer of kidney is a tough capsule.
- The outer zone of kidney is cortex and the inner is medulla.
- The medulla is divided into few conical masses (medullary pyramids) projecting into calyces.

- The cortex extends between medullary pyramids called columns of Bertini.

Glomerular Filtration :

The filtration of blood in glomerulus, about 1100-1200 ml of blood is filtered by the kidney per minute.

Glomerular Filtration Rate (GFR) :

The amount of filtrate formed by the kidney per minute is called GFR. In a healthy individual it is about, 125 ml/minute, i.e. 180 litres per day.

Types of Nephrons :

(i) Juxtamedullary Nephron—About 15% of total nephrons, Glomeruli are found in inner region of cortex, large in size, long loop of Henle and found deep in medulla, associated with vasa recta control plasma volume when water supply is short.

(ii) Cortical Nephron—About 85% of total nephron mainly lie in renal cortex, glomeruli found in outer cortex, short loop of Henle, extends very little in medulla. They do not have vasa recta or vasa recta is highly reduced.

Functions of Tubules :

(i) PCT—absorption of all essential nutrients and 70-80% of electrolytes and water, helps to maintain the pH and ionic balance of body fluids by selective secretion of H^+, ammonia and K^+ into filtrate.

(ii) Henele's Loop—reabsorption in this segment is minimum, it plays a significant role in maintenance of higher molarity of medullary interstitial fluid.

(iii) DCT—conditional reabsorption of Na^+ and water takes place here, reabsorption of HCO_3^- and selective secretion of H^+ and K^+ and ammonia to maintain the pH and sodium-potassium balance in blood.

(iv) Collecting duct—Large amount of water is absorbed from this region to produce concentrated urine, it plays a role in maintenance of pH and ionic balance of blood by selective secretion of H^+ and K^+ ions.

Steps of Urine Formation

1. **Glomerular Filtration**—Blood is filtered by glomerulus through three membranes i.e., endothelium of blood vessel, filtration slits of Bowman's capsule and basement membrane between these two layers. This filtration is called ultrafiltration as all constituents of plasma comes into filterate except proteins.

2. **Reabsorption**—99% of filtrate is reabsorbed by the renal tubules by active or passive mechanism.

   It is evident by the fact that out of 180L of filtrate formed per day only 1.5 L of urine released.

3. **Secretion**—Tubular cells secrete H^+, K^+, ammonia into the urine. It maintains acid-base balance of body fluids.

Mechanism of concentration of the Filtrate (Countercurrent Mechanism) :

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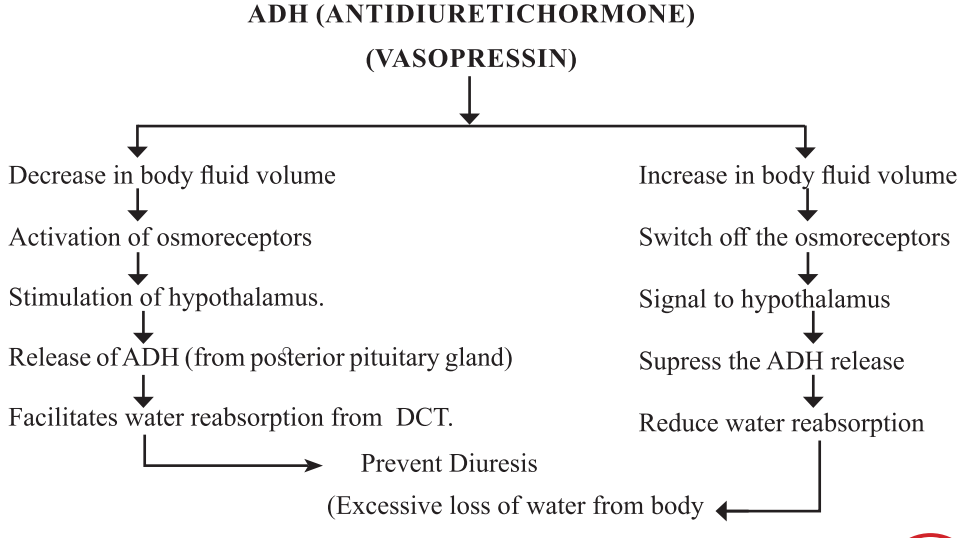
- This mechanism is said to be countercurrent mechanism because the out flow (in the ascending limb) runs parallel to and in the opposite direction of the inflow (in the descending limb).
- NaCl is transported by the ascending limb of Henle's loop which is exchanged with the descending limb of vasa-recta. (Capillaries running parallel to loop of Henle)
- NaCl is returned to the interstitium by the ascending portion of **vasa recta.**
- Henle's loop and vasa recta as well as the counter current in them help to maintain an increasing osmolarity towards the inner medullary interstitium i.e., from 300 mosmol/L in cortex to about 1200 mosmol/L in inner medulla.
- Small amount of urea enter, the thin segment of ascending limb of Henle's loop which is transported back to the interstitium by the collecting tubule.
- This mechanism helps to maintain a concentration gradient in the medullary tubule interstitium.



- It helps in an easy passage of water from the collecting tubule to concentrate the filtrate i.e. urine.

Renin Angiotensin System

Fall in GFR

↓ Renin from JG cells

Angiotensinogen → Angiotensin I → Angiotensin II

↓ Acts on

Adrenal Cortex

↓ Secretes aldosterone

Reabsorption of Na+ and water from DCT

↓

Increase in GFR

Atrial natriuretic factor (ANF)

- Increase in blood flow to Atria of heart release of ANF.
- Causes vasodilation and thus decrease blood pressure.
- ANF acts as a check on renin-angiotensin mechanism.

Micturition :

The expulsion of urine from the urinary bladder is called micturition. It is a reflex process but can be controlled voluntarily up to some extent in grown up children and adults.

- The CNS (Central Nervous System) sends the signal which cause the stretching of the urinary bladder when it gets filled with urine.
- In response, the stretch receptors on the walls of the bladder sends signals to the CNS.
- The CNS passes on motor message to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.

  Urine is slightly acidic in pH 6.0 and yellow in colour due to urochrome pigment derived from breakdown of haemoglobin from worm out RBCs.
- An adult human excretes on an average 1 to 1.5 Litres of urine per day.
- On an average 25-30 gram of urea is excreted out per day.

Role of other organs in excretion :

- **Lungs**—removes CO_2 (18L/day) and water.
- **Liver**—secretes bilirubin, biliverdin etc. helps to eliminate these substances along. with cholesterol, vitamins, drugs and degraded steroid hormones through digesive wastes.
- **Sweat and sebaceous glands**—These glands of skin help to eliminate small amount of urea, NaCl and lactic acid etc. through sweat while sebaceous glands help to eliminate some substances like steroids, hydrocarbons and waxes through sebum.
- **Saliva**—It can help to eliminate small amount of nitrogenous wastes.

Disorders of Excretory system :

- **Uremia**—The accumulation of urea in blood due to malfunctioning of kidney.

  Hemodialysis—The process of removal of urea from the blood artificially. In this process the blood from an artery is passed into dialysing unit after adding an anticoagulant like heparin. The blood passes through coiled cellophane tube, surrounded by dialysing fluid. The nitrogenous wastes form the concentration gradient and the blood becomes clear. This blood is pumped back to the body through vein after adding anti-heparin to it.
- **Renal calculi**—The formation of insoluble mass of crystallised salts (oxalates or phosphates of calcium).
- **Glomerulonephritis**—Inflammation of glomeruli of kidney.

Kidney Transplantation

- Kidney transplantation is done in a patient in which both the kidneys fail to work i.e. at total failure of kidney. Kidney transplantation is the ultimate method for treatment of renal failure. In case of kidney transplantation both the damaged kidneys of patient are removed by surgery. And a functional kidney from a healthy donar preferably from close relative is taken and transplanted in the body of patient. After successful transplantation the patient and donar can survive on one kidney.

Precautions taken for successful transplantation of Kidney :

1. Kidney should be taken from a healthy donor preferably from close relative.
2. Matching of blood group and other factor and compatibility should be done carefully before transplantation.

3. The patient (recipient) has to take some prescribed medicines immunosuppressants through out the life to suppress the immune system.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which gland secrete sebum?
   (a) lacrymal (b) Adrenal
   (c) sebaceous gland (d) Thymus
2. A part of Henle's Loop is impermeable to water that is
   (a) decending limb (b) ascending limb
3. State true or false:
   Sodium chloride, lactic acid, glucose are the constituent of the human sweat beside water.

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 marks each)

1. Explain the function of vasa recta.
2. Name two types of nephrons found in human kidney.
3. Define GFR (Glomerular Filtration Rate).
4. The mechanism of concentration of filtrate is also known as counter current mechanism. Justify the statement.
5. What is micturition ?
6. Write the function of hormone 'renin' produced by kidney.
7. Name the excretory product of (i) reptiles (ii) Prawns (iii) Tapeworm (iv) Marine fish (v) Insects (vi) Birds.
8. What is vasa recta ?

Short Answer Questions-I (2 marks each)

12. Mark the odd ones in each of the following—
    (a) Renal pelvis, medullary pyramid, renal cortex, ureter.
    (b) Afferent arteriole, Henle's loop, vasa recta, efferent arteriole.
    (c) Glomerular filtration, antidiuretic hormone, hypertonic urine, collecting duct.
    (d) Proximal convoluted tubule, distal convoluted tubule, Henle's loop renal corpuscle.

13. In the following diagram of longitudinal section of kidney (Fig.–i) identify and label a, b, c and d respectively.

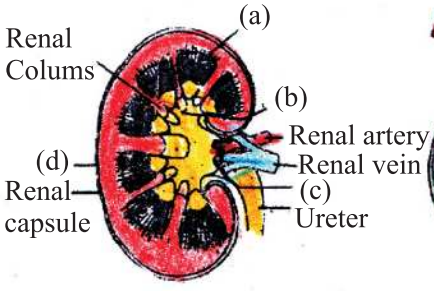


fig. (i)

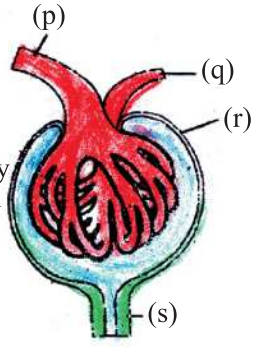
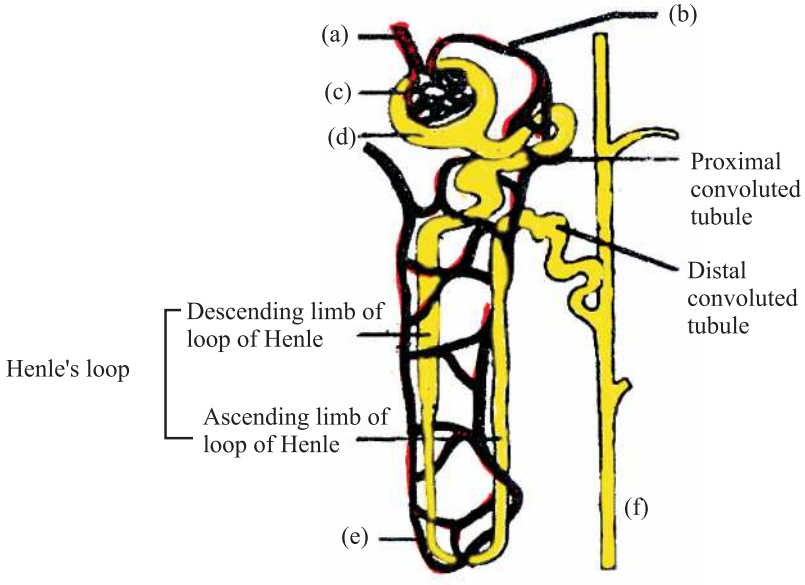


fig. (ii)

14. In the diagram (Fig.-ii) showing malpighian body (renal corpuscle) identify and label p, q, r, s.
15. Name two metabolic disorder which can be diagnosed by analysis of urine.

Short Answer Questions-II (3 marks each)

16. In the following diagram (Fig.-3) showing structure of a nephron label a, b, c, d, e and f.



17. Describe the hormonal feed back circuit in controlling the renal functions.
18. Give three points of difference between Rennin and Renin.

19. What are ammonotelic, ureotelic and uricotelic animals ? Give an example of each type of these.
20. Why is urine formation less during summers ?

Long Answer Questions (5 marks each)

21. Draw a labelled diagram of human urinary system and write one function each of adrenal gland, ureter, urinary bladder, kidney and urethra.
22. Describe how urine is formed in the nephron through filtration reabsorption and secretion.

OR

Explain the steps involved in the process of urine formation.

23. Distinguish between (i) Uricotelism and Ureotelism (ii) Sebum and sweat (iii) Proximal and distal convoluted tubules (iv) Ascending and descending limbs of Henle's loop (v) Cortical and Medullary nephrons.
24. Explain the process of reabsorption and secretion of major substances at different parts of nephron with the help of schematic diagram.

Case Based/Competency Based Question (4 marks)

25. For the regulation of glomerular filtration rate (GFR) the kidneys have a built-in mechanism. One such efficient mechanism is known as renin-angiotensinogen system and is carried out by the distal convoluted tubule and the afferent arteriole at the location of their contacts. Fall in GFR can stimulate the JG cells to release renin which can stimulate the glomerular blood flow and thereby bring the GFR back to normal. An increase in blood flow in the atria of the heart can cause the release of the Atrial natriuretic factor (ANF). This causes vasodilation of blood vessels and thereby decreases the blood pressure. ANF mechanism, therefor, acts as a check on renin-angiotensin mechanism.

1. Why is GFR called ultrafiltration?

   (a) As it is very efficient

   (b) As it is using ultraviolet rays of filtration

   (c) As all constituent of plasma come into filtrate except proteins

   (d) All of the above

2. Where is JGA located?

   (a) Below renal corpuscle

   (b) At Henle's loop

   (c) At the contact region between distal convoluted tubule and afferent arteriole.

   (d) Below glomerulus

3. Give the causes of the release of ANF.

   (a) Decrease in blood flow to the atria of the heart

   (b) Increase in blood flow to the atria of the heart

   (c) Decrease in blood flow to the ventricle of the heart

   (d) Increase in blood flow to the ventricle of the heart

4. Which mechanism can act as a check on renin-angiotensin mechanism?

   (a) Self-check and control

   (b) Atrial natriuretic factor

   (c) Parasympathetic system

   (d) Vasopressin factor

5. What do JG cells release to control GFR?

   (a) Renin

   (b) Rennin

   (c) Angiotensin

   (d) Antidiuretic hormone

(SRT) Assertion reasoning type questions-II **(1 marks each)**

DIRECTIONS : In the following questions, a statement of assertion (A) is followed by a statement of the reason (R). Mark the correct choice as :

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A)

(b) If both (A) and (R) true, but (R) is not the correct explanation of (A)

(c) If (A) is true but (R) is false

(d) If both (A) and (R) are false

26. **Assertion :** In cortical nephrons vasa recta is absent or highly reduced.

Reason : Cortical nephrons are mainly concerned with the concentration of urine.

27. **Assertion :** Compared to uric acid, urea is a more toxic excretory substance.

Reason : Birds and insects are uricotelic animals.

28. **Assertion :** Vasopressin increases the water permeability of the distal convoluted tubule.

Reason : In absence of ADH, water reabsorption is considerably reduced.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (c) Sebaceous glands (wax-glands)
2. (b) Ascending limb
3. True

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer (1 mark each)

4. It helps to retain reabsorbed ions and urea in the interstitial fluid of the medulla, to maintain its high osmotic pressure.
5. (i) Juxta medullary nephron (ii) Cortical nephron
6. The amount of filtrate formed by the kidney per minute.
7. In the ascending limb, the outflow runs parallel to and in the opposite direction of the inflow in the descending limb.
8. The act of passing out urine from urinary bladder.
9. Renin is used to convert angiotensinogen to angiotensin.

10. (i) Uric acid (ii) Ammonia (iii) Ammonia (iv) Urea (v) Uric Acid (vi) Uric acid.

11. Capillary network running parallel to loop of Henle is known as Vasa recta.

Short Answer-I (2 marks each)

12. (a) Ureter (b) Henle's loop (c) Glomerular filtration (d) Renal Corpuscle.

13. Refer fig. 19.2, page 292 (NCERT Class XI-Biology)

14. Refer fig. 19.4 page 293 (NCERT class XI-Biology)

15. Glycosuria, Ketonuria

Short Answer-II (3 marks each)

16. Refer fig. 19.3, page 292, (NCERT class XI-Biology)

17. Refer content 19.5, page 297 (NCERT class XI-Biology).

18.

Rennin	Renin
(i) It is a proteolytic enzyme.	(i) It is a hormone that acts as an enzyme.
(ii) It helps in the digestion of milk protein.	(ii) It converts the protein angiotensinogen into angiotensin
(iii) It is secreted as an inactive form Prorennin which is activiated to rennin by HC1.	(iii) It is secreted as renin.
(iv) Its secretion is stimulated by food.	(iv) It secretion is stimulated by a reduction of Na^+ level in tissue fluid.

19. Refer content given in the beginning of the chapters of NCERT Text Book page 290 class XI-Biology or Points to remember of this support material.

20. Due to sweating in summers blood volume is decreased. ADH is secreted from hypothalamus which increase reabsorption from D.C. tubules thus amount of urine is decreased.

Long Answer (5 mark each)

21. Support Material Points to Remember.

22. Refer content points to remember of this support material.

23. Refer the content given in Points to remember of this chapter of support material.

24. Refer Support material points of remember.

25. 1. (c) 2. (c)

    3. (b) 4. (b)

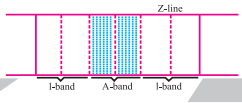
    5. (a)

SRT Questions II Answers.

26. (c)

27. (b)

28. (b)



Chapter - 20

Locomotion and Movement

Points To Remember

Arthritis : an inflammatory joint disease characterised by inflammation of joints.

Coccyx : tail bone formed by fusion of four coccygeal vertebrae in man.

Dicondylic Skull : A Skull with two occipital condyles.

Endo Skeleton : A skeleton present in side the body.

Fascicle : Bundles of muscles fibres held together by connective tissue.

Fascia : Collagenous connective tissue layer that surrounds muscle bundles.

Floating ribs : The ribs that remain free anteriorly, **(last 2 pairs)**

False ribs : 8th, 9th and 10th pair of ribs not directly joins the sternum but to seventh pair of ribs, hence called pseudoribs.

Myoglobin : A red colored pigment present in sarcoplasm of muscle.

Sarcomere : A portion of myofibril between two successive 'Z' lines.

Sarcolema : The plasma membrane of a muscle.

Gout : Inflammation of joints due to accumulation of uric acid crystal.

Suture : immovable joints between skull bones.

Synovial joints : Freely movable joints between limb bones.

Patella : A seasmoid bone acting as kneecap.

Intervertebral disc : Fibro cartilaginous pad present between the vertebrae that act as shock absorbers.

Tendon—Connective tissue made of yellow fibrous tissue which connect muscle to bone. It is not flexible.

Ligament—Connective tissue made of white fibrous tissue which joins two bones. It is flexible.

LMM : Light meromyosin

HMM : Heavy meromyosin

Types of Movement :

1. **Amoeboid movement :** These movements takes place in phagocytes where leucocytes and macrophages migrate through tissue. It is affected by pseudepodia formed by the streaming of protoplasm (as in amoeba)
2. **Ciliary movement :** This movement occurs in internal organs which are lined by ciliary epithelium.
3. **Muscular Movement :** This movement involves the muscle fibers, which have the ability to contract and relax.

Properties of Muscle : (i) Excitability (ii) Contractility (iii) Extensibility (iv) Elasticity

Types of Muscles :

(a) Skeletal muscles or striated muscles—These are involved in locomotion and change of body postures. These are also known as voluntary muscles.

(b) Visceral muscles or smooth muscles—These are located in inner walls of hollow visceral organs, smooth in appearance and their activity are not under control of voluntary nervous system. They are called involuntary muscles.

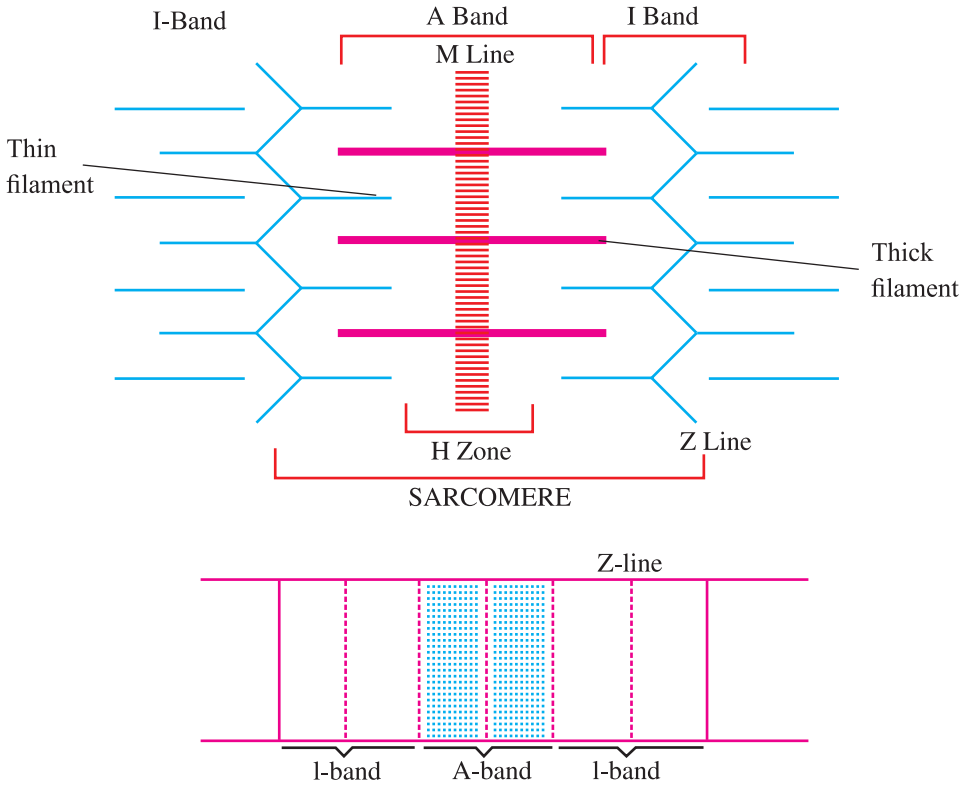
(c) Cardiac muscles—The muscles of heart, involuntary in nature, striated and branched, These are uninucleated.

Characteristic	Skeletal Muscle	Smooth Muscle	Cardiac Muscle
Location	Muscles attached with skeletal components	muscles found in the inner walls of hollow visceral organs	Muscles found only in heart.
Appearance	Striated having light and dark bands. Multi-nucleated	unstriped, smooth in appearance with tapering ends. Uninucleated	Striated in appearance and branched, uninucleated
Control	They are controlled by our will hence called voluntary muscles.	They are not under the control of our will hence called involuntary muscles.	not under the direct control of nervous system.

Structure of myofibril :

- Each myofibril consist of alternate dark and light band.
- Dark band—contain myosin protein and is called A-band or Anisotroic band.
- Light band—Contain actin protein and is called I Band or Isotropic band.
- I Band is bisected by an elastic fiber called 'Z' line. Actin filament (thin filament) are firmly attached to the 'Z' lines.
- Myosin filament (thick filament) in the 'A' Band are also held together in the middle of T Band by thin fibrous membrane called 'M' line.
- The portion between two successive 'Z' lines is considered as functional unit of contraction and is called a sarcomere.

Structure of Actin and Myosin Filament



1. **Actin filament :** An actin filament is made of two 'F' actins which are helically wound to each other. Two filaments of tropomyosin protein also run close to 'F' actins throughout its length. A complex protein Troponin is distributed at regular intervals on tropomyosin which mask the actin binding site for myosin.
2. **Myosin filament :** Each myosin filament is a polymer of meromyosin. Each meromyosin has two components—a globular head with a short arm and a tail. Head is made of heavy meromyosin while tail is made of light meromyosin. The head with its short arm project outward at regular distance and angle from each other and is known as cross arm. The head has an active site for actin and binding site for ATP.

Red muscle fibres :

— These are red in colour due to presence of high content of myoglobin.
— These contain plenty of mitochondria.
— Sarcoplasmic reticulum is less in these fibres.
— Show slow but sustained contractions for longer periods.

White muscle fibres

— These are pale or whitish due to presence of less content of myoglobin.

— These contain fewer mitochondria

— Sarcoplasmic reticulum is more/high

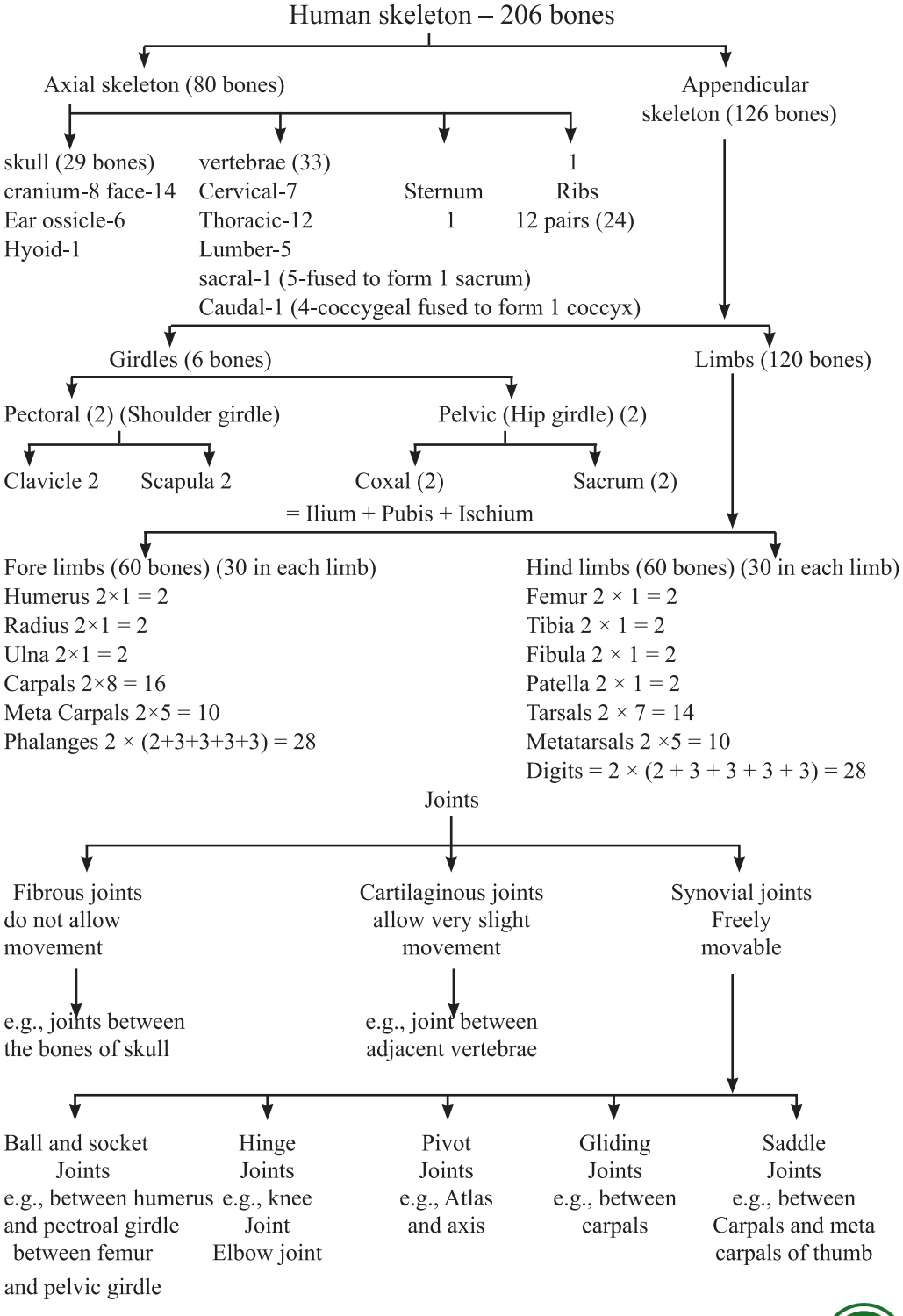
— During sternous exercise, lactic acid accumulates in large quantity so muscle fatigues

Mechanism or Muscle contraction : Sliding filament theory

The contraction of muscle fiber takes place by the sliding of actin (thin filament) on myosin (thick filament)

- Muscle contraction is initiated by a signal sent by the CNS via a motor neuron.
- Impulse from motor nerve stimulates a muscle fiber at neuro muscular junctions.
- Neurotransmitter releases here which generates an action potential in sarcolema.
- This causes release of Ca^{++} into sarcoplasm. These Ca^{++} binds with troponin, thereby remove masking of active site for myosin.
- Myosin head binds to exposed active site on actin to form a cross bridge, utilising energy from ATP hydrolysis.
- This pulls the actin filament towards the centre of 'A' band.
- 'Z' lines also pulled inward thereby causing a shortening of sarcomere i.e. contraction.
- I band get reduced, whereas the 'A' band retain the length.
- During relaxation, the cross bridge between the actin and myosin break. Ca^{++} pumped back to sarcoplasmic cisternae. Actin filament slide out of 'A' band and length of I band increase. This returns the muscle to its original state.

Vertebral formulae of man $C_7T_{12}L_5S_{(5)}C_{(4)} = 33$



Questions

(SRT) Select Response Type Question (1 mark each)

1. What is the total number of bones present in the left pectoral girdle and left arm respectively. In human beings?
   (a) 4, 30 (b) 2, 30
   (c) 4, 30 (d) 2, 32
2. Skeletal muscles show striation because of
   (a) Pattern of troponin and tropomyosin
   (b) pattern of actin and kinetin
   (c) pattern of actin and myosin
   (d) none of these
3. Which pair of ribs are called floating ribs
   (a) 9th and 10th (b) 11th and 12th
   (c) 7th and 6th (d) 10th and 11th

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. Name the proteins making up dark and light bands of myofibrils.
5. Write the name of chemical that causes fatigue in the muscles.
6. What lubricates the freely movable joints at the shoulder ?
7. Name the longest bone of human body.
8. Give the name of first vertebra.
9. Define a sarcomere.
10. Name the cup shaped bone that constitutes the knee cap.
11. Which muscle fibre work during long flight of eagle ?
12. Name the cavity in the girdle into which the head of femur fits ?

Short Answer Questions-I (2 marks each)

13. Write any two difference between cardiac muscle and skeletal muscle.
14. Distinguish between red fibre and white fibre.
15. Name the two types of girdles found in human body and write their role.
16. State the role of calcium ions and ATP in muscle contraction.
17. Name the bones of fore limb (hand) of human body. Give their number in each limb.

Short Answer Questions-II (3 marks each)

18. What makes the synovial joints freely movable ? List any four types of synovial joints.
19. Name the category of bones forming the ribcage. How are these articulated to each other to form the cage ?
20. How are actin and myosin filament arranged in a muscle fibre ?
21. Mention the factor which is responsible for the following :

    (i) Tetany (ii) Gout (iii) Osteoporosis

Long Answer Questions (5 mark each)

22. Explain the important steps of sliding filament theory of muscle contraction.

Case Based/Competency based/Value based question (4 mark each)

23. The muscle fiber is a syncytium. A characteristics features of the muscle fiber is the presence of a large number of parallelly arranged filaments in the sarcoplasm called myofilaments or myofibril. Each myofibril has alternate dark and light bands on it. Visceral muscles are located in the inner walls of hollow visceral organs of the body. They do not have any striation and are smooth in appearance. Many cardiac muscle cells assemble in a branching pattern to form cardiac muscle.

(i) Why is muscle fiber called a syncytium?

(a) As it is aseptate

(b) As it has more than one nuclei

(c) As it has more than one sarcoplasm

(d) As it has dark and light bands

(ii) Give a characteristic feature of muscle fiber.

(a) Presence of myofilaments

(b) Absence of myofilaments

(c) Presence of branching pattern

(d) Spindle shaped appearance

(iii) Name some visceral organs of the human body.

(a) Femur, legs, arms

(b) Oesophagus

(c) Stomach

(d) Both (b) & (c)

(iv) Which type of muscle are located in the inner walls of hollow visceral organs?

(a) Skeletal muscles

(b) Smooth muscles

(c) Cardiac muscles

(d) Smooth muscles & cardiac muscles

(v) Skeletal muscles and smooth muscles are .....

(a) Involuntary and voluntary respectively

(b) Voluntary and involuntary respectively

(c) Both involuntary

(d) Both voluntary

(SRT) Assertion reasoning type questions-II:

DIRECTIONS : In the following questions, a statement of assertion (A) is followed by a statement of the reason (R). Mark the correct choice as :

(a) If both (A) and (R) are correct and (R) is the correct explanation of (A)

(b) If both (A) and (R) true, but (R) is not the correct explanation of (A)

(c) If (A) is true but (R) is false

(d) If both (A) and (R) are false

24. **Assertion :** Fatigue is the inability of muscles to relax.

Reason : It is due to lactic acid accumulation by repeated contractions.

25. **Assertion :** Rapid spasm in the muscle is termed as tetany.

Reason : Tetany is caused by an increase in the blood calcium level.

26. **Assertion :** Radius is shorter than the ulna.

Reason : It has a large olecranon process.

27. **Assertion :** First seven pairs of ribs are called true ribs.

Reason : These ribs are not connected ventrally to the sternum.

28. **Assertion :** Inflammation of a skeletal joint may immobilize the movement of joints.

Reason : Uric acid crystals in the joint cavity and ossification of articular cartilage leads to this condition.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) Left pectoral girdle has 2 bones. Left Arm has 30 bones.
2. (c) Due to distribution pattern of actin and myosin protein.
3. (b) These ribs are not ventrally attached to sternum

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Myosin and Actin

5. Lactic acid
6. Synovial fluid
7. Femur
8. Atlas
9. A portion of myofibril between two successive 'Z' lines.
10. Patella
11. Red muscle fibre
12. Acetabulum

Short Answers-I (2 marks each)

13. Refer Points to remember of support material.
14. Refer Points to remember
15. Pectoral and Pelvic girdle bones help in articulation of the upper and lower limbs respectively with the axial skeleton.
16. Calcium (Ca^{++}) ions binds with troponin, thereby remove masking sites. ATP hydrolysis gives energy to Myosin head to bind with active site of actin.
17. Refer Points to remember

Short Answers-II (3 marks each)

18. Refer content points to Remember of support
19. Refer content points to Remember of support
20. Refer content points to Remember of support
21. Refer content points to Remember of support

Long Answer (5 marks each)

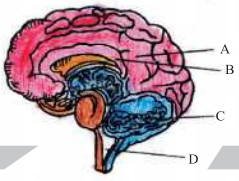
22. Refer Points to remember
23. (i) (b)
    (ii) (a)
    (iii) (d)

(iv) (b)

(v) (b)

(SRT) Assertion Reason II Answers

24. (a)
25. (c)
26. (b)
27. (c)
28. (a)



Chapter - 21 Neural Control and Coordination

Points To Remember

Coordination : Process through which two or more organs interact and complement the functions of one another surrounding the brain.

Action potential : A sudden change in the electrical charges in the plasma membrane of a nerve fibre.

Aqueous humour : The thin watery fluid that occupy space between lens and cornea in eye.

Blind spot : A spot on retina which is free from rods and cones and lack the ability for vision.

Cerebrospinal fluid : An alkaline fluid present in between inner two layers of meninges, surrounding the brain and spinal cord.

Cerebellum : A part of hind brain that controls the balance and posture of the body.

Cochlea : A spirally coiled part of internal ear which is responsible for hearing.

Corpus callosum : A curved thick bundle of nerve fibres that joins two cerebral hemisphere.

Depolarisation : A condition when polarity of the plasma membrane of nerve fibre is reversed.

Endolymph : The fluid filled within membranous labyrinth.

Eustachian Tube : A tube which connect ear cavity with the pharynx.

Fovea : An area of highest vision on the retina which contain only cones.

Meninges : Three sheets of covering of connective tissue wrapping the brain.

Gray Matter : This is the area of processing : Contains cell bodies and their dendrites (of neurons)

White matter : It provides communication between the grey matter and the rest of the body. Consists of bundles of axons.

Medula oblongata : Posterior most part of the brain which is continuous with spinal cord and control respiration, heart rate,swallowing,vomiting.

Pons : Thick bundles of fibres on the ventral side of brain below cerebellum.

Foramen magnum : A big aperture in the skull posteriorly through which spinal cord emerges out.

Spinal cord : A tubular structure connected with medulla oblongata of brain and situated in the neural canal of the vertebral column, covered by meninges.

Synaptic cleft : A narrow fluid filled space which separates two membranes of the two neurons at the synapse.

Synaptic vesicles : These are membrane bound vesicles in the axoplasm of the axon terminal and they store neurotransmitter.

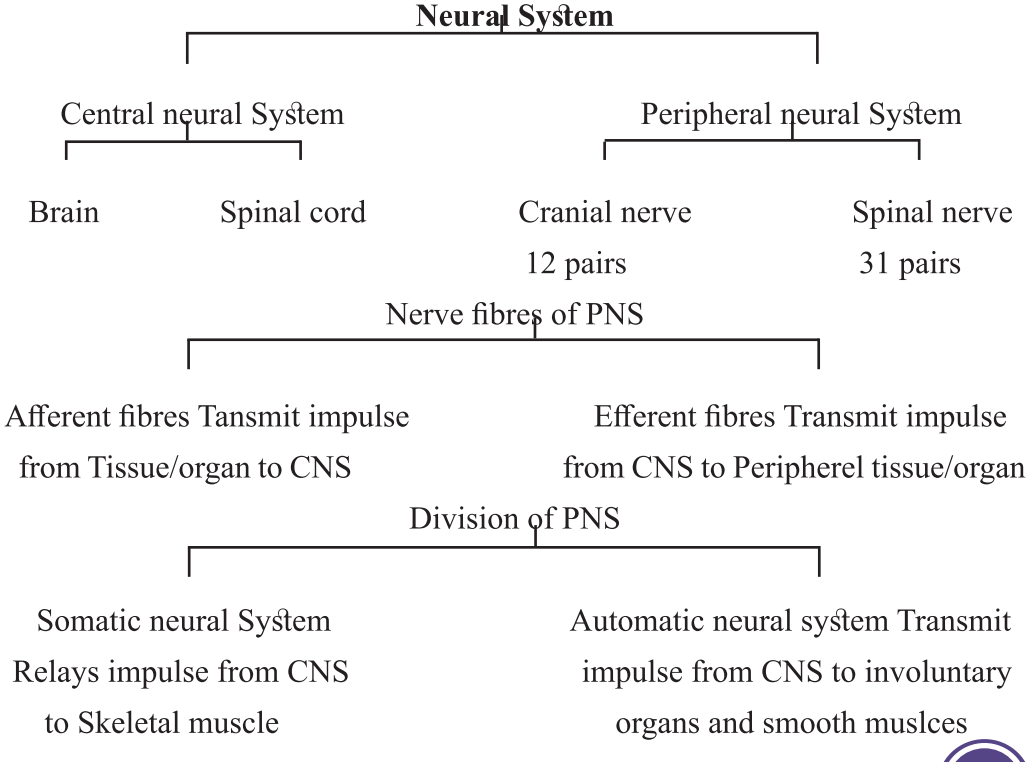
Neurotransmitter : These are chemicals stored in synaptic vesicles, diffuse to reach the membrane of next neuron for its stimulation.

Synapse : A physiological junction between axon of one neuron and dendrite of next neuron.

CNS—Central neural system

PNS—Peripheral neural system

ANS—Autonomic neural system



Visceral Nervous System : whole complex of nerves, fibres, ganglia and plexuses by which impulses travel from CNS to the viscera and from viscera to CNS

Parts of Neuron
- Cell body = Cytoplasm with nucleus, cell organelles and Nissl's granules
- Dendrites = Short fibres which branch rapidly and project out of cell
- Axon = Single, long fibre, branched at distal end

(Refer fig. 21.1, page 317, NCERT - Biology, Class-XI)

Neuron
- Multipolar = : One axon and two or more dentrites
  : Found in cerebral Cortex
- Bipolar = : One axon and one dendrite
  : Found in retina of eye
- Unipolar = : Cell body with axon only
  : Found usually in the embryonic stage

Conduction of Nerve Impulse

Polarization : Resting potential

- Before stimulation axoplasm contain –vely high concentration of K+ and low concentration of Na+ Inner surface is –vely charged.
- Fluid outside axon – low concentration of K+ and high concentration of Na+. Outside the membrane is + vely charged.
- Most membrane channels are closed.

Depolarization: Action potential

- Stimulation of nerve.
- Permeability of membrane to Na+ increases.
- Na+ channels opens allowing Na+ to diffuse into the cell quickly.
- As a result inside become +ve and outside -ve.

Repolarization : Normalising

- K+ gates open in order to allow K+ to diffuse out of the axon. This restores the membrane. (+ve outside -ve inside)

Transmission of Impulses at Synapse

(i) **At electrical synapses :** Here the membrane of pre and post-synaptic neuron are in very close proximity. Electric current can flow directly from one neuron into other across these synapses, like impule conduction along a single axon.

(ii) **At chemical synapses :** Here the membrane of pre and post-syneptic neuron are separated by fluid filled space called synaptic cleft. Neurotransmitter are involved here.

When an impulse arrives at the axon terminal, it stimulates the movement of the synaptic vesicles towards membrane and they fuse with the plsama membrane and release their neurotransmitter in the synaptic cleft. These chemicals bind to specific receptors, present on the post-syneptic membrane. Their binding opens ion channels and allow the entry of ion which generate new potential in post synaptic neuron.

Human brain : Human brain is the major portion of central neural system. Which is well protected by the skull.

The brain is surrounded by three cranial meninges—

(i) Duramater—outer layer

(ii) Arachnoid—middle layer

(iii) Piamater—Inner layer-remain incontact with brain

Parts of Brain

Fore brain	Mid brain	Hind brain
(a) Cerebrum		(a) Cerebellum
(b) Thalamus		(b) Pons
(c) Hypothalamus		(c) Medulla oblongata

Functions of pars of brain :

Cerebrum : Centre of intelligence, memory and imagination, reasoning, judgement, expression of will power.

Thalamus : Acts as relay centre to receive and transmit general sensation of pain, touch and temperature.

Hypothalamus : Centre for regulation of body temperature, urge for eating and drinking.

Midbrain : Responsible to coordinate visual reflexes and auditory reflexes.

Cerebellum : Maintains posture and equilibrium of the body as well as coordinates and regulates voluntary movement.

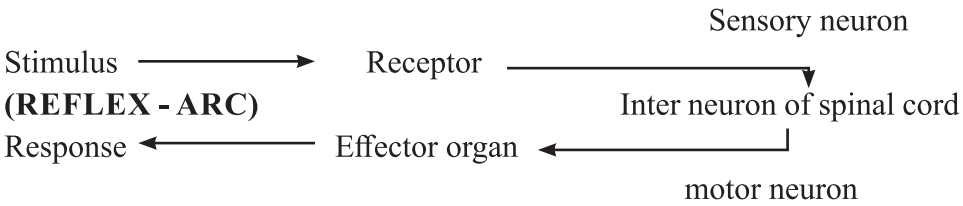
Pons : Relays impulses between medulla oblongata and cerebral hemisphere and between the hemisphere of cerebrum and cerebellum. It also heps to regulate breathing.

Medulla oblongata : Centre that control heart beat, breathing, swallowing, salivation, sneezing, vomitting and coughing.

Reflex action : It is spontaneous, autonomic and mechanical response to a stimulus that occurs at the level of spinal cord, without involvement of brain.

Reflex arc : The flow of nerve impulse along the specific, path during reflex action. It consist of—

(a) A receptor
(b) An Afferent neuron (sensory neuron)
(c) An inter neuron
(d) An efferent neuron (motor neuron)
(e) An effector organ



Organ of Sight-Eye

Layer	Component	Function
1. External layer	Sclera	Protects and maintain shape of the eye ball
	Cornea	Outermost transparent portion of eye which allows light to enter
2. Middle layer	Choroid	Absorb light and prevent light from being reflected within the eye ball.
	Ciliary body	Holds lens, regulate shape of the lens.
	Iris	Control amount of light entering.
3. Inner layer	Retina	Vision in dim light, colour vision, vision in bright light. Sends the image to brain through optical nerves.

(Refer-Fig. 21.6, Page 323 NCERT-Biology, Class XI)

Organ of Hearing–Ear

Portion of the ear	Component	Function
1. External ear	Pinna	Collect sound waves
	External auditory canal	Direct sound waves towards ear drum, ear wax prevents the entry of foreign bodies.
2. Middle ear	Tympanic membrane	Acts as resonator that reproduces the vibration of sound.
	Ear ossicles	Transmit sound waves to internal ear.
	Eustachian tube	Helps in equalising the pressure on either side of ear drum.
3. Internal ear	Cochlea	Hearing organ.
	Vestibular apparatus	Balancing of body.

(Refer Fig. 21.7, page 325-NCERT-Biology, Class XI)

Organ to smell – Nose (Factor Organ)

NOSE

Olfactory Epithelium

Olfactory Receptors – Receives sense of smell (air/chemicals)

(mucus coated)

↓

Olfactory Neurons

↓

Olfactor bulbs (limbic system of brain)

Organ to Taste – Tongue (Gustatory Organ)

TONGUE

Papillae

↓

Taste buds

↓

Gustatory Nerves

↓

Brain (integrates the differential inputs from taste buds).

Questions

(SRT) Select Response Type Question (1 mark each)

1. Name the fluid present in the membranous Labyrinth
   (a) hemolymph (b) endolymph
   (c) myolymph (d) peri lymph
2. Name the area of retina where only cones are densely packed
   (a) Sclera (b) choroid
   (c) fovea (d) iris
3. Name the innermost meninges of the brain?
   (a) duramater (b) arachnoid
   (c) piamater (d) pieuron

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. To which part of the brain communication and memory are associated ?
5. Name the bundle of fibres that connect two cerebral hemisphere in human being.
6. Name the photo pigment present in the rod cells.
7. Why do impulses flow only in one direction ?
8. Where is hypothalamus located in the brain ?
9. Which cells are responsible for scotopic vision?

Short Answer Questions-I (2 marks each)

10. Distinguish between electrical synapses and chemical synapses.
11. What is iris ? Give the function of iris.
12. What is organ of corti ? Where is it located ?
13. Differentiate between cerebrum and cerebellum.
14. What is synapse ? Name its two types.

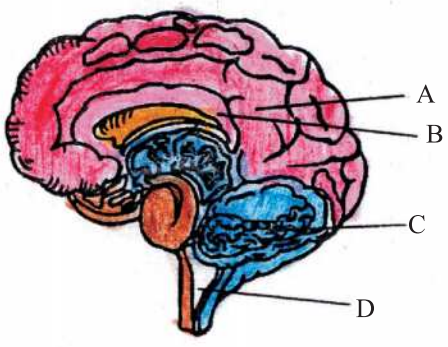
15. Fill in the blanks in the different columns A to D :

Part/Organ	Function
Pinna	.....(A).....
.....(B).....	Equalise the pressure on either side of ear drum.
Cone cells	.....(C).....
.....(D).....	regulate amount of light to pass into the eye.

16. Why are grey matter and white matter contained in human nervous system named so ?

Short Answer Questions-II (3 marks each)

17. Observe the diagram given below and answer the following questions :



(i) Label the parts A, B, C & D.

(ii) Give the function of C and D.

(iii) Name the layers which wrap this organ.

18. What is a synapse ? How does the nerve impulse cross the chemical synapse ?

19. Give the function of the following :

(i) Cerebrum (ii) Hypothalamus (iii) Mid brain

20. What is meant by reflex action ? Name the components of a reflex arc in correct sequence from receptor upto effector. Support your answer by a diagram.

21. Draw a diagram of V.S. of human eye and label the following :

Iris, Retina, Cornea, Blind spot, Ciliary body and Vitreous chamber.

Long Answer Questions (5 mark each)

22. Describe in detail, how conduction of nerve impulse takes place through a nerve fibre.

Case Study based questions :

23. Read the following and answer any four questions from 23 (i) to 23 (v) given below :

Ajinomoto, the most popular ingredients commonly used in Chinese dishes as a taste enhancer is otherwise known as mono sodium glutamate (MGS). Excessive consumption of Ajinomoto can cause various harmful effects such as hypertension, effect on Brain and nerves, nausea, headache, sleeping disorders and cancer. As glutamate can serve as a neurotransmitter, high intake of MSG can adversely affect the brain and nerves. In our body neurotransmitters are involved in carrying nerve impulses across a chemical synapse. Common neurotransmitters are epinephrine, adrenaline, acetylcholine, dopamine and GABA. When an impulse arrives at the axon terminal, it stimulates the movement of synaptic vesicles towards the presynaptic membrane, where they fuse and release their neurotransmitters in the synaptic cleft. Now these neurotransmitters bind to their specific receptors present on the postsynaptic membrane, which opens ion channels. Thus signal is transmitted across the synapse. In electrical synapse signal can flow directly from one neuron to another.

(i) Identify the harmful effects of excessive consumption of ajinomoto :

(a) Hypertension

(b) Headache

(c) Effects nerves

(d) All of them

(ii) Ajinomoto serves as a _____ neurotransmitter :

(a) Glutamate

(b) GABA

(c) Dopamine

(d) Acetyl choline

(iii) Interaction between neurons occurs commonly across junctions called :

(a) Action potential (b) Synapse

(c) Axon terminal (d) Juxtaposition

(iv) Receptor site for neurotransmitters are present on :

(a) Presynaptic membrane

(b) Tips of axons

(c) Postsynaptic membrane

(d) Membrances of synaptic vesicles

(v) **Assertion :** Transmission of nerve impulse across a synapse is accomplished by neurotransmitters.

Reason : Transmission across a chemical synapse usually requires neurotransmitters because there is a small space, synaptic cleft that separates one neuron from another.

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false

(d) Both the assertion and reason are false

(SRT) Assertion and Reason type Questions-II : (1 mark each)

In each of the following questions, two statements are given, one is Assertion and other is Reason. Mark the correct answer as :

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false

(d) Both the assertion and reason are false

24. **Assertion :** The space between the cornea and the lens is called the vitreous chamber.

Reason : The space between the lens and retina is called the aqueous chamber.

25. **Assertion :** The Eustachian tube helps in equalizing the pressure on either side of the ear drum.

Reason : The Eustachian tube connects the middle ear cavity with the pharynx.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (b) Endolymph
2. (c) Fovea
3. (c) Piameter

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answers (1 mark each)

4. Cerebrum
5. Corpus callosum
6. Rhodopsin
7. Because each synapse allows impulse to cross it in a single direction.
8. At the base of thalamus.
9. Rods

Short Answers-I (2 marks each)

10. Refer Point to remember of support material.
11. Refer Point to remember of support material.
12. Refer Point to remember of support material.
13. Refer Point to remember of support material.
14. Junction between two nerves Chemical synapse and electrical synapse
15. (A) To collect sound waves (B) Eustachina tube
    (C) Colour vision (D) Iris
16. Refer Point to remember of support material.

Short Answers-II (3 marks each)

17. (i) A : Cerebrum C : Cerebellum

B : Corpus callosum D : Medulla oblongata

(ii) C : Balancing of body and maintain posture

D : Vomiting , coughing, breathing, salivation or any other correct answer (anyone).

(iii) Pia mater, arachnoid and dura mater.

18. Refer Point to remember of support material.

19. Refer Point to remember of support material.

20. Refer Point to remember of support material.

21. Refer Point to remember of support material.

Long Answer (5 marks)

22. Refer Point to remember of support material.

23. (i) (d) All of them

(ii) (a) Glutamate

(iii) (b) synapse

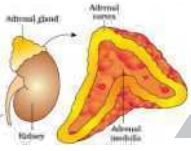
(iv) (c) post synaptic membrane

(v) (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion

Assertion Reason Type II Answer.

24. (d) Both the assertion and reason are false

25. (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.



Chapter - 22 Chemical Coordination and Integration

Points To Remember

Endocrine glands : These are ductless glands which secrete hormones directly into the blood stream.

Hormones : Non-nutrient chemicals synthesised in trace amount by Endocrine glands, that act as intracellular messengers and are specific in their action which are transported by blood from site of production to site of action.

Hypothalamus :

- It is basal part of diencephalon.
- Has neurosecretory cells called nuclei which produce hormones to regulate the synthesis and secretion of pituitary gland hormones.
- Two types of hormones released are :

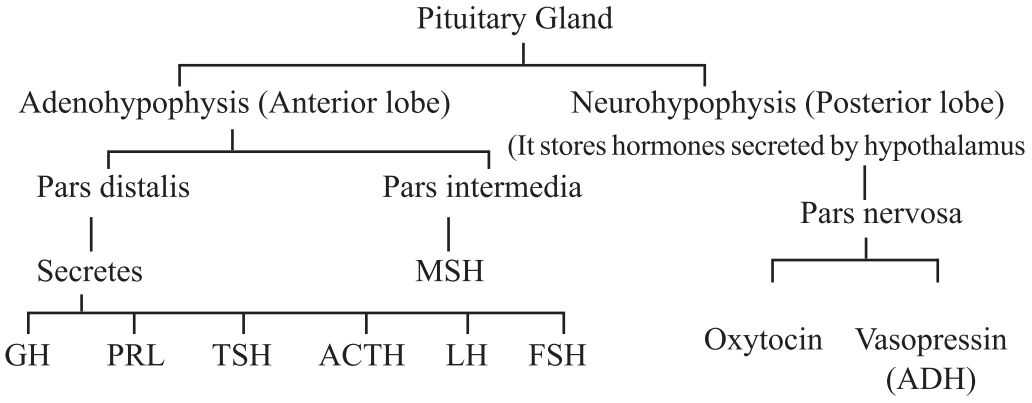
  Releasing hormones : Stimulate secretion of pituitary hormones, *e.g.,* *Gonadotrophin* releasing hormone stimulates pituitary gland to synthesise gonadotrophins.

  Inhibiting hormones : Inhibit secretions of pituitary hormones, *e.g.,* Somatostatin inhibits secretion of growth hormone.

Pituitary Gland :

- Located in bony cavity called as sella tursica.
- Attached to hypothalamus by a stalk.
- Divided anatomically into : Adenohypophysis (Anterior lobe) and Neurohypophysis (Posterior lobe).
- Hormones released from hypothalamic neurons reach anterior pituitary through portal system and through neurons in Posterior pitutary.
- Posterior pituitary is under neural control of hypothalamus.

1. Pituitary Gland



Adenohypophysis : (Anterior lobe of Pituitary)

- **Growth hormone (GH) :** Oversecretion leads to gigantism and low secretion causes dwarfism and Proper secretion leads to proper growth of body.
- **Prolactin (PRL) :** Growth of mammary gland and formation of milk in them.
- **Thyroid stimulating hormone (TSH) :** Stimulates synthesis and secretion of thyroid hormones from thyroid gland.
- **Adrenocorticotrophic hormone (ACTH) :** Stimulates synthesis and secretion of steroid hormones called glucocorticoids from adrenal cortex.
- **Luteinizing hormone (LH) :** Synthesis and secretion of hormones called androgens in males, and helps in ovulation and maintenance of corpus luteum in females.
- **Follicle stimulating hormone (FSH) :** Regulate spermatogenesis in males, and growth and development of ovarian follicles in females.

Neurohypo physis (Posterior lobe of Pituitary)

- **Oxytocin** helps in contraction of uterus during child birth and milk ejection from mammary gland in females.
- **Vasopressin :** Acts on kidney and stimulates reabsorption of water and electrolytes by distal tubules to reduce water loss through urine. It is also called as Anti Diuretic Hormone (ADH).

Diabetes insipidus : Impairment of synthesis of ADH

(i) Diminished ability of kidney to conserve water.

(ii) Water loss and dehydration.

(iii) Can be overcome by taking more water.

Excessive Secretion of Growth Hormone

- **Acromegaly :** It is a condition when the pituitary gland makes too much growth hormone. It is due to a tumour in pituitary gland. Person suffering from acromegaly (acro means tip and megaly means enlargement) may gradually develop a long face with protruding lower jaw, enlarged nose and wider spacing between teeth and enlarged hands and feet.

2. Pineal Gland :

- Located on dorsal side of forebrain.
- Secretes Melatonin for regulation of 24-hours rhythm, sleep-wake cycle, menstrual cycle, pigmentation etc.

3. Thyroid Gland :

- Has two lobes on either side of trachea interconnected by isthmus (connective tissue).
- Composed of follicles and stromal tissues.
- Follicular cells synthesise thyroxine (T_4) and tri-iodothyronine (T_3).
- Iodine is necessary for normal functioning of thyroid.
- **Goitre (Hypothyroidism) :** Enlargement of thyroid gland; Hypothyroidism may lead to mental retardation and stunted growth (cretinism) Deaf-mutism in the baby if it occurs during pregnancy.
- **Hyperthyroidism :** Occurs due to cancer or due to development of nodules in thyroid glands, affects body physiology as abnormally high levels of thyroid hormones is synthesised. Basic metabolic rate increases.
- **Exophthalmic goitre :** It is a form of hyperthyroidism, characterised by enlargement of thyroid gland, protrusion of eye balls and increased BMR
- Thyroid hormone controls carbohydrates, proteins & fats metabolism.
- Also secretes a protein hormone called Thyrocalcitonin (TCT) which regulates blood calcium level.

4. Parathyroid Gland :

- Present on back side of thyroid gland. Each lobe of thyroid gland has its one pair.
- Secrete peptide hormone called parathyroid hormone (PTH) which increases calcium levels in blood so called **hypercalcemic** hormone.
- PTH stimulates bone resorption, and reabsorption of calcium from blood and reabsorption of calcium by renal tubules, thus increasing blood Ca^{++} level.

5. Thymus Gland

- Located on dorsal side of heart and aorta.
- Secrete peptide hormones called Thymosins which play role in differentiation of T-lymphocytes (help in cell mediated immunity.)
- Thymosins also produce antibodies and provide humoral immunity.
- Immunity of old people usually becomes weak as thymus gets degenerated with age.

6. Adrenal Gland

- Located at anterior part of each kidney.
- Has centrally located adrenal medulla and at periphery in adrenal cortex.
- **Adrenal medulla.**

1. **Adrenal medulla secretes** adrenaline (epinephrine) and nor adrenaline (norepinephrine), commonly called as catecholamines or emergency hormones or hormones of fight or flight.
2. These hormones increase heart beat, rate of respiration, breakdown of glycogen thus increase blood glucose level, breakdown of lipids and protein, alertness, raising of hairs, sweating etc.

- Adrenal Cortex-(3 layers) : Zona reticularis (inner layer)
  Zona fasciculata (middle layer)
  Zona glomerulosa (outer layer)
- **Adrenal cortex secretes :**

1. Androgenic steroids : (Secreted by Zona reticularis)

- Secreted in small amounts.
- Play role in growth of axial pubic and facial hair during puberty.

2. Glucocorticoids : (Secreted by fasciculata)

- Involved in carbohydrate metabolism.
- Stimulates gluconeogenesis, lipolysis and proteolysis.
- *e.g.,* Cortisol which is also involved in cardio-vascular and kidney functions.
- It also suppresses immune response and stimulates RBC production.

3. Mineralocorticoids : (Secreted Zona glomerulosa)

- Regulate balance of water and electrolytes in body.
- *e.g.,* Aldosterone which also helps in reabsorption of Na^+ and water. Excretion of K^+ and phosphates ions from renal tubules.

- When adrenal cortex is damaged, it does not produce enough cortisols (which regulate body's reaction to stressful situations) and aldosterone.
- It result in **Addison's disease**. Symptons of addison's disease are weak muscles, extreme fatigue, increased skin pigmentation, weight loss, sores in mouth and depression.

Two major adrenal insufficiency

- Primary adrenal insufficiency where our immune system mistakes adrenal for an antigen and tries to damage it.
- Secondary adrenal insufficiency-when pituitary gland can't produce ACTH

7. Pancreas : It is called composite/dual gland. As it acts as Exocrine and endocrine gland i.e. has both exocrine and endocrine function.

- Contains about 1-2 million islets of Langerhans which has glucagon secreting α-cells and insulin secreting β-cell.
- **Glucagon :** Peptide hormone, stimulates glycogenolysis by acting on liver cells. Also, stimulates gluconeogenesis. Hence called hyperglycemic hormone.
- **Insulin :** Peptide hormone, acts on hepatocytes and adipocytes to enhance cellular glucose uptake, stimulates conversion of glucose to glycogen (glycogenesis), so decrease blood glucose level. Hence called hypoglycemic hormone.
- Deficiency of insulin causes diabetes mellitus in which loss of glucose occurs through urine. Excessive hunger and thirst (polydipsia) are other symptoms of Diabetes.
- Insulin and glucagon are antagonistic hormones i.e. play opposite role.

  Glycogenolysis : Breaking of glycogen into glucose.

  Gluconeogenesis : Formation of glucose from substances other than glycogen.

  Glycogenesis : Conversion of glucose into glycogen.

8. Testis :

- A pair of testis composed of seminiferous tubules and interstitial cells is present in the scrotal sac of males.
- Leydig cells (interstitial cells) produce androgens (mainly testosterone) which regulate development and maturation of male accessory sex organs, formation of secondary sex characters and play stimulatory role in spermatogenesis. Male sexual behaviour (libido) is influenced by androgens.

9. **Ovary :** A pair of ovaries which produce one ovum in each menstrual cycle are present in abdomen in females.

- Ovary composed of ovarian follicles and stromal tissue.
- Estrogen synthesised by growing ovarian follicles helps in stimulation of growth of female secondary sex organs, female behaviour, mammary gland development and female secondary sex characters.
- Ruptured follicle form corpus luteum which secretes progesterone. Progesterone supports pregnancy and stimulates alveoli formation and milk secretion in mammary glands.

Hormones secreted by tissues which are not endocrine glands :

(a) Heart : Atrial wall secrets Atrial Natriuretic factor (ANF) which decreases blood pressure by dilation of the blood vessels.

(b) Kidney : Juxtaglomerular cells secretes erythropoietin which stimulates erythropoiesis (RBC formation).

(c) Gastro-intestinal tract : It secretes four peptide hormones.

- **Gastrin :** Acts on gastric glands and stimulates secretion of hydrochloric acid and pepsinogen.
- **Secretin :** Acts on pancreas and stimulates secretion of water and bicarbonate ion.
- **Cholecystokinin (CCK) :** Act on pancreas and gall bladder to stimulate secretion of pancreatic juice and bile juice respectively.

Gastric inhibitory peptide (GIP) : Inhibits gastric secretion and motility.

Mechanism of hormone action : By hormone receptors of two kinds, *i.e.*,

(a) Located on membrane of target cell

- These are membrane bound receptors.
- Form hormone receptor complex.

↓

Leads to biochemical changes in tissue.

↓

Release of second messengers like (cyclic AMP, IP_3, Ca^{2+} etc.) which regulate cellular metabolism.

(b) Located inside the target cell

- These are intra cellular receptors.
- Hormones (steroid hormones iodothyronines etc.) interact with them and cause physiological and developmental effects of regulating gene expression.

Questions

(SRT) Select Response Type Question (1 mark each)

1. Which to system coordinate and regulate physiological function of our body?
   (a) muscular system and endocrine system
   (b) neural system and muscular system
   (c) neural system, and endocrine system
   (d) endocrine system and reproductive system
2. What is the role of melanocyte stimulating hormone?
   (a) act on hepatic cells
   (b) act on melanocytes and regulate pigmentation of skin
   (c) act on ovarian follicles
   (d) act on osteocytes
3. Name the hormone which act antagonistically in order to regulate calcium level in blood?
   (a) Glucocorticoid and adrenocortical
   (b) Thyrocalcitonin and parathyroid hormone
   (c) Mineralocorticoid and Thyrocalcitonin
   (d) Parathyroid hormone and glucocorticoid

CONSTRUCTED RESPONSE TYPE (CRT)

Very Short Answer Questions (1 mark each)

4. Give the names of any one glucocorticoid and one mineralocorticoid.
5. How does Atrial natriuretic factor decrease blood pressure ?

6. Which structure is formed from ruptured follicle in females ? What is its role ?

7. Immunity of old persons becomes very week. Give reason.

Short Answer Questions-I (2 marks each)

8. What happens if a person suffers from prolonged hyperglycemia ?

9. What are the two modes through which the hypothalamus causes the release of hormones by pituitary gland ?

10. Androgen regulates the development, maturation and other important functions in human male. List them.

11. Mr. Akshay notices that his shoe size has progressively increased. He also observes that shape of his face is gradually changing with protruding lower jaw. What can be the cause for all changes. Name the disorder.

Short Answer Questions-II (3 marks each)

12. Define hormone and classify them on basis of their chemical nature.

13. How do oxytocin, progesterone and estrogen differ from each other ?

14. What are the disorders caused and the effects produced due to malfunctioning/ improper secretion from thyroid gland ?

15. Name the disease/disorder caused by :

    (a) Excessive secretion of Thyroid hormone in adults.

    (b) Insufficient amount of insulin secreted by pancreas.

    (c) Damage of adrenal cortex.

Long Answer Questions (5 mark each)

16. 'The master gland regulates a number of physiological functions in our body.' Give reasons and explain.

Answers

(SRT) Select Response Type Question (1 mark each)

1. (c) Nerual system and endocrine system.
2. (b) Acts on melanocytes and regulates pigmentation of skin.
3. (b) Thyrocalcitonin (TCT) and parathyroid hormone (PTH).

Very Short Answers (1 mark each)

4. Glucocorticoid—Cortisol; Mineralocorticoid—aldosterone.
5. By dilation of the blood vessels.
6. Corpus luteum which secrets progesterone.
7. Thymus gland degenerates with age.

Short Answer Questions-I (2 marks each)

8. Gets affected by diabetes mellitus which causes loss of glucose through urine and formation of harmful ketone bodies.
9. Anterior pituitary receives signals (hormones) from hypothamus via portal system and posterior pituitary receives signals directly from nerve endings of hypotatamus to which runs tell posterior pituitary.
10. Refer Points to Remember.
11. Increased secretion of growth hormone Acromegaly

Short Answers Questions-II (3 marks each)

12. Refer Points to Remember of this support material
13. Oxytocin causes milk ejection and contraction of uterus at time of child birth.

    Progesterone–causes milk secretion and maintains pregnancy.

    Estrogen : Refer Points to Remember.
14. Refer Points to Remember.
15. (a) Exophthalmic goitre (b) Diabetes

(c) Addison's disease

Long Answers Questions-II (3 mark each)

16. Explain the role of pituitary gland + Refer Points to Remember.

Case Study based question :

17. Read the following and answer any four questions from 17 (i) to 17 (v) given below :

Xenoestrogens are found in a variety of everyday items. Its sources are plastic, pesticides, insecticides, beauty products etc. Many of us don't think twice about the make up we wear, container we use to pack a lunch. Unfortunately this may be altering the way our body works naturally because they all contain endocrine disruptors called Xenoestrogens. Xenoestrogens are a subcategory of endocrine disruptor that specifically has estrogen like effects. Estrogen is a natural hormone synthesized by the growing ovarian follicles in females. It helps in the growth of female secondary sex organs and female secondary sex characters. It is also important for bone growth and reproduction in men and women. When xenoestrogen enter the body they increase the total amount of estrogen in the body resulting in a phenomenon called estrogen dominance. As they are not biodegradable they are stored in our fat cells. This leads to breast cancer, prostate cancer, obesity, infertility, miscarriages and diabetes.

(i) Xenoestrogen mimics the action of _____ and its excess causes_____.

(a) Progesterone, bone and prostate cancer

(b) Estrogen, breast and prostate cancer

(c) Cortisol, brain and blood cancer

(d) Thyrocalcitonin, bone and lung cancer

(ii) Estrogen is secreted mainly by :

(a) GI tract

(b) Pancreas

(c) Growing ovarian follicles

(d) Thymus

(iii) Select the function/functions performed by estrogen in females :

(a) Growth of female secondary sex organs

(b) Bone growth

(c) Female secondary sex-characters

(d) All of these

(iv) What measures, as an individual you would take to reduce your exposure to these harmful exenoestrogens?

(a) Eat local and organic food

(b) Use beauty products made from natural ingredients

(c) Do not use plastic lunch box and water bottles

(d) All of these

(v) **Assertion :** Estrogen belongs to the class of steroid hormones.

Reason : Cholesterol is the precursor used in synthesizing estrogen hormone.

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false

(d) Both the assertion and reason are false

(SRT) Assertion and Reason type Questions-II : (1 mark each)

In each of the following questions, two statements are given, one is Assertion and other is Reason. Mark the correct answer as :

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false

(d) Both the assertion and reason are false

18. **Assertion :** Hormone thyrocalcitonion has antagonistic effect to that of parathyroid hormone (PTH).

Reason : Thyrocalcitonin decreases the blood calcium level while parathyroid hormone increases blood calcium level.

19. **Assertion :** Immunity of old person becomes weak.

Reason : Thymus degenerates in old individuals.

Answers :

17. (i) (b) Estrogen, breast and prostate cancer

(ii) (c) Growing ovarian follicles

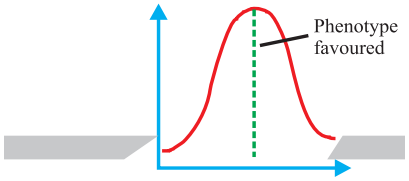
(iii) (d) All of these

(iv) (d) All of these

(v) (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion

18. (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

19. (a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.



Practice Paper

Solved Sample Paper

Subject : BIOLOGY (044) (Theory)

Class : XI

Time : 3 Hrs.] **[MM : 70**

INSTRUCTION :

- Section - A contains 16 questions of 1 mark each.
- Section - B contains 5 questions of two marks each.
- Section - C contains 7 questions of three marks each.
- Section -D contains 2 questions of four marks each.
- Section-E contains 3 questions of 5 marks each.
- There is no overall choice. However, internal choice has been provided in some questions. Attempt only one of the alternatives in such questions.
- Wherever necessary, neat and properly labelled diagram should be drawn.

Section -A

Question 1 to 12 is Selected Response type questions.

1. As we go from species to Kingdom in a taxonomical hierarchy, the number of common characteristics

(a) will decrease (b) will increase

(c) remain same (d) may increase or decrease

2. The given statement describes a group of organisms.

(i) Instead of a cell wall they have a protein rich pellicle making a body flexible.

(ii) They have two flagella a short and a long one

(iii) They show mixotrophic nutrition

(iv) They are connecting link between plants and animals.

Which of the following group is referred here?

(a) Dinoflagellates (b) Slime moulds

(c) desmids (d) Euglenoids

3. Isogamous condition with non-flagellated gametes is found in

(a) Chlamydomonas (b) Volvox

(c) Spirogyra (d) Fucus

4. Flame cells are the excretory structures for

(a) Annelids (b) Coelenterates

(c) platyhelminthes (d) Echinoderms

5. In a flower if all the sepals are united then the condition is said to be

(a) Gamosepalous (b) gamopetal JUS

(c) polypetalous (d) polysepalous

6. Stomatal apparatus is made of and

(a) Stomatal aperture, guard cells and subsidiary cells.

(b) Slomatal aperture and guard cells only

(c) Guard cells and subsidiary cells only

(d) Stomatal aperture and subsidiary cells only

7. Which is the common opening for passing out fecal matter, urine and sperms to the exterior in frogs?

(a) Anus (b) cloaca

(c) urethra (d) ostia

8. Select the incorrect statement regarding S- phase of interphase.

(a) occurs between Gl and G2

(b) DNA replicates in the nucleus

(c) Centrioles duplicate in the cytoplasm

(d) As DNA is doubled number of chromosome also doubles

9. Keratin present in hairs show secondary structure known as

(a) Parallel beta sheet (b) antiparallel beta sheet

(c) Alpha helix (d) none of these

10. Frogs respire through

(a) Moist skin (b) lungs

(c) Gills in larval stage (d) All three

11. Renal corpuscle or Malphigian body is-

(a) Glomerulus only

(b) only Bowman's capsule

(c) Glomerulus along with Bowman's capsule

(d) Glomerulus with afferent arteriole

12. Multipolar neuron has

(a) One Dendron and one axon

(b) Many dendrons and one axon

(c) one Dendron and many axons

(d) many dendrons and no axon

Question No 13 to 16 consists of two statements- Assertion and Reason. Answer these questions selecting the appropriate options given below:

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion & reason are false.

13. Assertion: Two kingdom Classification was insufficient.

    Reason: Majority of organisms failed to fall into either of the categories in two kingdom classification.

14. Assertion: Only red algae are able to flourish at the great depths of sea.

    Reason: Red algae have the pigments r-phycoerythrin and r-phycocyanin.

15. Assertion: In alternate phyilotaxy the arrangement of leaves is such that a single leaf arises at each node in alternate manner.

    Reason: Alternate phyilotaxy is seen in China rose and mustard plant.

16. Assertion: Collenchymatous cells show thickening of hemicellulose and pectin at the corners.

    Reason: Collenchyma is thick walled dead tissue.

Section -B

17. With respect to ribcage explain the following:

    (a) True ribs (b) Floating ribs

18. (i) Name the four main components of xylem.

    (ii) Which of these is most suitable for carrying water?

OR

How open vascular bundles differ from closed vascular bundles?

19. Identify and name the following:

(i) Unit membrane which bounds a vacuole.

(ii) Animal cell that loses nucleus at maturity.

20. What is the difference between a virus and viriods?

21. Draw a well labelled diagram of Funaria.

OR

Tabulate 4 major differences between liverworts and mosses.

Section -C

22. Answer the following:

(i) What is radula?

(ii) Name the excretory organs of insects.

(iii) What is bioluminescence?

OR

Give an example for each of the following:

(i) A fish possessing electric organ

(ii) An oviparous mammal

(iii) Animal which exhibits alternation of generation

(iv) An animal with Cnidoblasts

(v) An animal having canal system and spicules

(vi) An organ, which regulates buoyancy in fishes

23. Comment on the "9 + 2" arrangement of a flagellum with the help of suitable diagran

24. Give 3 reasons why plants can survive without respiratory organs.

OR

(i) What is oxidative phosphorylation? Where does it occur inside the mitochondria?

(ii) Explain the role of oxygen in ETS.

25. Draw a well labelled diagram of a human nephron. Label any 6 parts.

26. Explain the following terms

(a) Turn over number (b) Denaturation

(c) Activation Energy.

27. Describe the arrangement of floral members in relation to their insertion on thalamus.

28. Draw a diagram to show the structure of a neuron and label any 6 parts in it.

Section - D

29. Jetlag is a temporary sleep problem that can affect anyone who quickly travels across several time zones. Your body has its own internal clock, called circadian rhythms. They signal to your body when to stay awake and when to sleep. You will be surprised to know that our internal body clock is regulated by melatonin hormone which is produced by Pineal gland. When light is low during night time, the hypothalamus signals the pineal gland to release melatonin. When people are exposed to blue light coming from their mobiles and laptops at night, it delays/ stops the release of melatonin which makes it hard for them to sleep.

(i) What is the location of Pineal Gland in our body?

(ii) List 4 functions of melatonin hormone.

(iii) Is Pineal an endocrine gland or exocrine Gland? Give reason.

30. Fruits are one of the best natural food usually consumed raw. Natural fruit ripening is a physiological process which makes fruit edible and nutritious. Unfortunately, nowa¬days artificial fruit ripening is done using Calcium Carbide (CaCz) which is popularly known as "masala", its use is banned under Food safety and Standards Regulations, 2011. When calcium carbide reacts with water it produces acetylene gas (also called carbide gas) which quickens the ripening process. It is said to have the same effect as ethylene the natural ripening hormone. Calcium carbide contains traces of arsenic and phosphorus and thus not good for our health.

(i) Name the plant growth regulator (PGR) which performs natural fruit ripening.

(ii) Write a short note on discovery, 2 physiological functions performed by this PGR.

Section -E

31. (i) Write a short note on "Kranz anatomy".

(ii) Which group of plants possesses Kranz anatomy?

(iii) Does this group of plants show photorespiration9 If no, explain how is it possible?

OR

Describe Z scheme of light reaction in plants. Why this process is called so? Also mention the location where it occurs?

32. (i) How does cytokinesis in plant cells differ from that in animal cells?

(ii) The plant cell cannot undergo cytokinesis by an invaginating cleavage furrow. Why?

OR

(i) Name and explain the three stages of cell cycle associated with interphase.

(ii) Why Meiosis-II is necessary? Explain.

33. (i) What is basis of ABO blood grouping in humans?

(ii) Rh factor plays a crucial role in child's birth born out of a marriage between Rh-woman and Rh+ man. Explain how?

OR

Answer the following:

(i) Name 2 leucocytes which show phagocytic action.

(ii) Name the ions and type of blood cells involved in blood clotting.

(iii) One can determine the heart beat rate by counting the number of i n an ECG.

(iv) Name the leucocytes which have coarse granules, bilobed nucleus and take acidic stain.

(v) Name the organ which acts as graveyard of RBC's.

17. (iii) False ribs- last 2 pairs (11* and 12*) which are not connected \ entrally. 1 -1 I8.(i) Vessels, tracheids. xylem fibres and xylem parenchyma

(iii) Vessels 1X

OR

Refer NCERT Textbook Page No 901 X

7 = 1

1 = 2

20. Refer NCERT Textbook Page No 25 and 26. 2 = 2

21. Refer Fig No 32 (c) in NCERT Textbook Page No 34 X 4 = 2

OR

X4 = 2

1 X 1 X

Vz

	Liverworts	Mosses
1.	Plani bodv is dorsiventral is ihallus like.	Plant body has radial symmetry Plant body is foliose.
3.	Lizoids	Multicellular rhizoids
4.	Example- Marchantia	Example - Fun aria

22. (i) (ii)

Section- C

Physiological Functions - Refer NCERT Textbook Page No 250 2

Section -E

31. (i) Bundle sheath cells form a 'wreath' around vascular bundles. 1

(ii) It is found in C-4 plants. 1

(iii) Refer NCERT Textbook Page No 220 (4th para in photorespiration). 3

OR

(i) Refer NCERT Textbook Page No 212 for explanation of Z scheme light reaction. 3

(ii) It is called so because the diagram, when first drawn, was in the form of letter 'Z'.

(iii) Location - Membrane of thylakoid 1

32. (i) Refer NCERT Textbook Page No 166 under the heading cytokinesis. 3

(ii) The plant cell cannot undergo cytokinesis by an invaginating cleavage furrow due to the presence of rigid cell wall made up of cellulose. 2

OR

(i) Explain Gi, S and G2 phase of cell cycle, Refer to NCERT Textbook Page No 163.(3)

(ii) Meiosis - II separates sister chromatids. Meiosis -II resembles mitosis but it is very important as it serves to increase the number of daughter cells from two to four and also reduces the amount of DNA to half. 2

33. (i) ABO grouping is based on the presence or absence of two surface antigens on the RBCs namely A and B. 2

(iii) Refer NCERT Textbook Page No 281 under the heading Rh grouping. 3

OR

(i) Neutrophils and Monocytes 5 = 5

(ii) Calcium ions and Platelets

(iii) QRS Complexes

(iv) Eosinophil or Acidophil

(v) Spleen

(iii) The property of a living onanism to emit light. Example -Phylum Ctenophora 1 × 3 = 3

OR

(i) Torpedo

(ii) Echidna

(iii) Obelia

(iv) Hydra

(v) Euspongia

(vi) Air bladder '/2 x 6 = 3

23. Refer Fig 8.10(b) in NCERT Textbook Page No 137(diagram -1, explanation -2 Marks) 3

24. (i) Each plant part takes care of its own gas-exchange needs.

(ii) They do not present great demand for gas exchange as leaves produce oxygen.

(iii) Distance that gases must diffuse is not great. 1×3 = 3

OR

Refer NCERT Textbook Page No 233 2 +1

25. Refer Fig 19.3 in NCERT Textbook Page No 292. Vi x 6 = 3

26. (i) Turnover- Number of substrate molecules transformed per minute by a single enzyme into products.

(ii) Denaturation- implies destruction of the tertiary structure of a protein molecule and the formation of random polypeptide chains.

(iii) Activation Energy- is the difference in average energy content of'substrate' from that of transition state. 1 × 3 = 3

27. Explain Epigynous, Hypogynous and perigynous condition.

1 + 1+1

28. Refer Fig 21.1 in NCERT Textbook Page No 317 >/2 x 6 = 3

Section- D

29. (i) Pineal gland is located on the dorsal side of forebrain. 1

(ii) Melatonin regulates 24- hours' diurnal (circadian) rhythm, sleep wake cycle, metabolism, pigmentation, menstrual cycle and defense capability. (Write any 4) 2

(iii) As pineal lacks duct, thus it is ductless or endocrine gland. 1

30. (i) Ethylene hormone is responsible for natural fruit ripening. 1

(ii) Discovery of ethylene- Refer NCERT Textbook Page No 248 (4th paragraph) 1

Unsolved Sample Paper

Subject : BIOLOGY (044) (Theory)

Class : XI

Time : 3 Hrs.] **[MM : 70**

INSTRUCTION :

- Section - A contains 16 questions of 1 mark each.
- Section - B contains 5 questions of two marks each.
- Section - C contains 7 questions of three marks each.
- Section -D contains 2 questions of four marks each.
- Section-E contains 3 questions of 5 marks each.
- There is no overall choice. However, internal choice has been provided in some questions. Attempt only one of the alternatives in such questions.
- Wherever necessary, neat and properly labelled diagram should be drawn.

Section -A

Question 1 to 12 is Selected Response type questions.

1. Growth occur ..... in plants and ..... in animals.
   (a) Continuously, only upto a certain age
   (b) Only upto a certain age, continuously
   (c) Continuously, continuously
   (d) Twice, never
2. Which of the following are autotrophs?
   (a) Photosynthetic bacteria (c) both a and b
   (b) chemosynthetic bacteria (d) None of them

3. Phylogenelic system of classification is based on

(a) Morphological features (b) Anatomical features

(c) Floral characters (d) Evolutionary relationships

4. Which of the following feature of bony fish is missing in cartilaginous fishes?

(a) Placoid scales (c) cold blooded

(b) Operculum (d) unpaired fins

5. Vexillary aestivation is characteristic of the family

(a) Fabaceae (c) Poaceae

(b) Asteraceae (d) Solanaceae

6. Fibres and sclereids are the types of

(a) Collenchyma (c) Parenchyma

(b) Sclerenchyma (d) Aerenchyma

7. In frog, a triangular structure calledjoins the right

(a) Conus arteriosus, ventricle (c) Conus arteriosus, auricle

(b) Sinus venosus, auricle (d) Sinus vcnosus, ventricle

8. Lipid gets precipitated under acid insoluble fraction during analysis of chemical composition of tissues due to

(a) Its high molecular weight

(b) Its low molecular weight

(c) Its polymeric nature

(d) on grinding, it is broken into pieces and form vesicles

9. The exchange of genetic material between non-sister chromatids of homologous chromosomes occurs during

(a) Anaphase -I (b) Mctaphase-1

(c) Prophase-I (d) Telophase -I

10. Urea is

(a) More toxic than uric acid
(c) more toxic than ammonia
(b) Equally toxic to ammonia
(d) Non-toxic

11. Sodium- Potassium exchange pump

I. needs ATP to workII. Expels 3 Na+ ions for every 2 K+ imported

III. Works against concentration gradient

IV. Maintains resting potential

(a) Only I. and II. are correct

(b) Only I., III. And IV. are correct

(c) Only II. and IV. are correct

(d) All are correct

12. The majority of CO2 is transported as-

(a) Carbaminohaemoglobin
(b) Carbonates
(c) Bicarbonates
(d) Dissolved state in blood

Question No 13 to 16 consists of two statements- Assertion and Reason SRT. Answer these questions selecting the appropriate options given below:

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion & reason are false.

13. Assertion: Both words are separately underlined in binomial nomenclature.

Reason: Underlining indicates their Latin origin.

14. Assertion: Chlorella is utilised to keep the air pure in space vehicles.
Reason: The space travelers feed on chlorella soup.

15. Assertion: Monoadelphous stamens are found in pea.

    Reason: Dialdelphous stamens are found in China rose.

16. Assertion: Frog has short alimentary canal.

    Reason: Frogs are carnivores.

Section -B

17. List 2 roles of fungi in our daily lives.

    OR

    What are the characteristics of euglenoids? (Write any 4)

18. Draw a well labelled diagram of T.S. of monocot stem.

19. What role does Ca2" ions play in the contraction of muscles?

    OR

    Differentiate between red and white muscle fibres.

20. List 2 ways which prove that Sphagnum is economically important for us.

21. Why are lysosome called "suicidal bags of the cell"?

Section-C

22. (a) List 2 similarities between Chondrichthyes and Osteichthyes.

    (b) Also tabulate 4 differences between them.

23. Describe various stem modifications associated with food storage, climbing and protection.

24. (a) How many types of plastids are present in a plant cell on the basis of pigments present in them?

    (b) Are these different types of plastids interchangeable? If yes, give an example where they are getting converted from one type to another.

OR

Justify the statement."Mitochondria are powerhouses of the cell".

25. Draw a graph depicting relationship between substrate concentration and velocity of reaction. Define Km value. What is the correlation between Km and efficiency of enzyme?

OR

What is competitive inhibition? Explain its application in the Pharmaceutical sector.

26. Give the schematic representation of glycolysis. Also give a brief account of total ATP produced in it.

27. Describe the 3 steps involved in the formation of urine.

28. Explain the process of polarization of the membrane of a nerve fibre.

Section - D

29. Agent Orange is a chemical herbicide and defoliant which was used by U.S. military during the Vietnam War from 1961 to 1971. Jt is a mixture of 2, 4, 5-T and 2, 4-D. The government of Vietnam says that upto three million people have suffered illness because of exposure to Agent Orange.

    (a) Expand 2. 4-D.

    (b) To which group of plant growth regulators does 2, 4-D belongs?

    (c) Write a note on 2 physiological functions performed by this group of plant growth regulators.

30. Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide. India too, is no exception. Four main thyroid diseases are - hypothyroidism, hyperthyroidism, Goiter and Hashimoto's disease. Hypothyroidism affects approximately 11% of the population

of India. Any irregularity with the thyroid can lead to various health problems in the long run.

(a) How does hypothyroidism during pregnancy affects the foetus?

(b) Mention 2 functions performed by thyroid hormones in humans?

(c) Mention the 2 forms in which thyroid hormone are secreted in our blood

Section -E

31. (i) Draw flowchart of C-4 Cycle.

(ii) Rubisco is an enzyme that acts both as a carboxylase and oxygenase. Why do you think Rubisco carries out more carboxylation in C-4 plants?

32. Draw a well labeled diagram to show the internal structure of human heart and label any 8 parts in it.

OR

Answer the following questions:

(i) SA Node is called 'pacemaker of human heart'.

(ii) Name the 2 Heart sounds. How are they produced?

(iii) Why human heart is considered myogenic?

33. Why mitosis is called equational division? Explain its four phases with suitable well-labelled diagram.

OR

(i) Comment on the statement - Telophase is reverse of prophase.

(ii) Comment on the statement - Meiosis enables the conservation of specific chromosome number of each species even though the process per se, results in a reduction of chromosome number.

Unsolved Practice Paper-II

Subject : BIOLOGY (044) (Theory)

Class : XI

Time : 3 Hrs.] **[MM : 70**

INSTRUCTION :

(i) All questions are compulsory.

(ii) The question paper has 5 sections and 33 questions. Section–A, Section–B, Section–C, Section–D & Section-E.

(iii) Section-A contains 16 questions of 1 mark each.

(iv) Section-B contains 5 questions of 2 marks each.

(v) Section-C contains 7 questions of 3 marks each.

(vi) Section-D contains 2 case based questions of 4 marks each.

(vii) Section-E contains 3 questions of 5 marks each.

(viii) There is no overall choice. However, internal choice has been provided in some questions. Attempt only one of the alternatives in such questions.

(ix) Wherever necessary, neat and properly labelled diagrams should be drawn.

Section-A

Question 1 to 12 is Selected Response type questions.

1. Match the column (Kingdom and cell wall) and select the correct option.

Kingdom	**Cell Wall**
(A) Monera	(1) Peptidoglycan
(B) Protista	(2) Cellulose
(C) Fungi	(3) Pellicle
(D) Plantae	(4) Chitin

(a) Al B2 C3 D4 (b) Al B3 C4 D2

(c) A4 B3 C2D1 (d) A3Bl C4 D2

2. In mitochondria, protons accumulate in

(a) Outer membrane (b) Inner membrane

(c) Matrix (d) Peri-Mitochondrial space

3. Which one is stress hormone?

(a) C_2H_4 (b) GA3

(c) IAA (d) ABA

4. Serum differs from blood in

(a) Lacking clotting factors (b) Lacking antibodies

(d) Lacking albumins (d) Lacking globulins (d)

5. Which of the following is correct?

(a) CNS includes brain and spinal cord

(b) CNS is the site of information, processing and control

(c) PNS comprises of all the nerves of the body associated with CNS

(d) All three

6. Enzyme amylase belongs to-

(a) Oxidoreductases (b) transferase

(c) Hydrolases (d) Isomerases

7. Incomplete double circulation is found in-

(a) Mammals (b) Non-ehordates

(c) Amphibians and reptiles (d) Birds

8. Electrical potential difference across the depolarized membrane is called

(a) Resting potential (b) Action potential

(c) Solute potential (d) Osmotic potential

9. Which stage is marked by terminalisation of chiasmata?

(a) Zygotene (b) Pachytene

(c) Diplotcnc (d) Diakinesis

10. Different cells have different sizes. Arrange the following cells in an ascending order according to their size and select the correct option

(1) Mycoplasma (2) Ostrich egg

(3) Human RBC (4) Bacteria

(a) 1,4,3,2 (b) 2,1,3,4

(c) 1,2,3,4 (d) 3,2,1,4

11. Bryophytes are not characterised by

(a) Well developed root system and vascular tissue

(b) Rhizoids

(c) Alternation of generation

(d) Presence of chlorophyll

12. Common characteristics between flatworms, roundworms and earthworms is

(a) Parasitism (b) acoelomate nature

(c) Triploblastic (d) Pseudocoelomate

Question No 13 to 16 consists of two statements- Assertion and Reason. Answer these questions selecting the appropriate options given below:

(a) Both assertion & reason are true, and the reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion & reason are false.

13. **Reason:** To maintain unequal distribution ol Na' and K' ions, neurons use electrical energy.

Reason: To maintain unequal distribution of Na' and K* ions, neurons us.

14. **Assertion:** Left atrium possesses ihe thickest muscles.

Reason: Left atrium receives blood from the superior and inferior vena cava.

15. **Assertion:** A cell membrane shows fluid behaviour.

Reason: A membrane is a mosaic of lipids and proteins.

16. **Assertion:** Bryophytes exist in 2 phases - gametophyte and sporophyte.

    Reason: Sporophyte in bryophytes is nutritionally independent.

Section-B

17. What is the correct way of writing a scientific binomial name? Illustrate with an example.
18. List 4 peculiar features that are present in parasitic platyhelminthes.

OR

How do earthworm and Ascaris differ with respect to coelom?

19. "Inspiration in humans is a negative pressure phenomenon". Justify.

OR

"In mammals, the lungs replace the skin very effectively as respiratory organs". Explain giving any 2 reasons.

20. The digestive system of frog is made of following parts. Arrange them in an order beginning from mouth.

    Mouth, oesophagus, buccal cavity, stomach, cloaca, intestine, rectum, cloacal aperture

21. Which are chiasmaia? State their significance.

Section-C

22. Tabulate 6 differences between Kingdom Monera and Kingdom Protista.
23. (i) Define Placentaiion.

    (ii) How can you differentiate between free central and axile placentaiion.

24. Briefly describe the life cycle of bryophytes with the help of a flowchart.
25. Answer the following:

    (i) Mention the (>pc of ribosome* found in mitochondria and p last ids

    (ii) Would our expect the cells that form hairs lo contain more ribosomes than the cells vesica itore lais? Why?

OR

How do neutral solutes move across the plasma membrane? Can the polar molecules also move across it in the same way? If not, then how are these transported across the membrane?

26. (i) What are the end products of light reaction?

    (ii) Chlorophyll 'a' is the primary pigment for light reaction. What are accessory pigments? What is their role in photosynthesis?

27. "Auxin and cytokinin show synergistic as well as antagonistic action in plants". Justify the statement with the help of an example.

28. Give reason for the following statements:

    (i) Steroid hormones act within the cells.

    (ii) Hormones released by posterior Pitutary are not its own products.

    (iii) Adrenals are called 'glands of emergency'.

OR

Name the 2 pancreatic hormones responsible for maintaining sugar level in the human body. How do they maintain sugar level in the blood?

Section-D

29. Fermentation occurs in yeast cells, bacteria and in the muscles of animals under anaerobic condition. Cellular respiration begins with glycolysis where a 3-C compound, pyruvic acid is formed as the end product. There are 2 main types of fermentation. In lactic acid fermentation sugar is converted into lactic acid by lactobacillus and muscle cells. Lactobacillus is used in setting curd due to its unique property. In alcoholic fermentation, pyruvate is broken down into ethyl alcohol and carbon dioxide by yeast.

    Due to this properly, yeast is used in making bread and wine.

    (i) Lactic acid fermentation occurs in:

        (a) Muscles under anaerobic condition

        (b) Some bacteria

        (c) Aerobes

        (d) Both (a) and (b)

(ii) Differentiate between alcoholic fermentation and lactic acid fermentation (write any 3 points).

OR

Only 2 ATPs molecule are formed from one glucose molecule during fermentation. Explain how is it possible?

30. Around 10% of the Indian population suffers from chronic kidney disease and every year 1 lakh cases of kidney failure are being reported. Most common causes of kidney-failure are diabetes, high blood pressure, recurrent dehydration, renal infection etc. With the help of a machine called dialysis machine, blood can be filtered and purified. It assists in maintaining balance of electrolytes and fluids, removing nitrogenous waste from blood when kidney fails to perform and carry out its functions.

(i) What is the composition of the membrane that is used in dialysis machine?

(ii) What happens to the plasma proteins during haemodialysis?

(iii) What is a dialysis machine? When is it needed?

Section-E

31. (i) Why are xylem and phloem called "complex tissue"?

(ii) Name the 4 major components of phloem.

(iii) From which part of the plant Jute, hemp and flex fibres are obtained.

OR

(i) Explain the 3 types of meristem present in plants.

(ii) What is the difference between fibres and sclereids? Give one example of each.

32. (i) List 4 features of DNA structure.

(ii) A DNA fragment has total 1,000 nucleotides, out of which 240 are adenine containing nucleotides. How many pyrimidine bases this DNA possesses?

OR

Explain any 5 classes of enzymes with suitable example.

33. Explain in detail the mechanism of muscle contraction as given by Sliding filament theory.

OR

(i) What are the 3 types of muscles? Write 2 characteristic features about the structure and function of each of them.

(ii) Name the cells/ tissue in the human body which-

(a) Exhibit amoeboid movement

(b) Exhibit ciliary movement

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