



**Time Allowed: 3 hours**

**Maximum Marks: 70**

**General Instructions:**

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

**Section A**

1. Which is the topmost taxa in zoology? [1]
  - a) Phylum
  - b) Division
  - c) Order
  - d) Kingdom
2. If kidney tissues are supplied with blood low in oxygen then: [1]
  - a) Both tubular reabsorption and ultrafiltration stops
  - b) Both tubular reabsorption and ultrafiltration continue normally
  - c) Ultrafiltration stops
  - d) Tubular reabsorption stops
3. Amino acids are also known as: [1]
  - a)  $\delta$  - amino acid
  - b)  $\beta$  -amino acid
  - c)  $\gamma$  -amino acid
  - d)  $\alpha$  -amino acid
4. Bulliform or motor cells are present in [1]
  - a) Dorsiventral leaves of dicot
  - b) Isobilateral leaves of monocot
  - c) Unifacial leaves of monocot
  - d) Dorsiventral leaves of monocot
5. It is known that exposure to carbon monoxide is harmful to animals because: [1]
  - a) It increases  $O_2$  transport
  - b) It increases  $CO_2$  transport
  - c) It reduces  $CO_2$  transport
  - d) It reduces  $O_2$  transport
6. Which is the most effective wavelength of light for photosynthesis? [1]
  - a) Yellow
  - b) Violet



- c) Red  
d) Green
7. The condition of accumulation of urea in the blood is termed as: [1]  
a) Glomerulonephritis  
b) Ketonuria  
c) Uremia  
d) Renal Calculi
8. Platelets are formed from the\_\_\_\_\_. [1]  
a) Haemocytes  
b) Microkayocytes  
c) Thrombocytes  
d) Megakaryocytes
9. A farmer grows cucumber plants in his field. He wants to increase the number of female flowers in them. Which plant hormones can be applied to achieve this? [1]  
a) Gibberellins  
b) Auxins  
c) Ethylene  
d) Abscisic acid
10. In mosses, the sex organs arise from: [1]  
a) Foot  
b) Leaf apex  
c) Setae  
d) Capsule
11. The following substances are the excretory products in animals. Choose the least toxic form among them. [1]  
a) Carbon dioxide  
b) Ammonia  
c) Urea  
d) Uric acid
12. Loud snoring and labored breathing are symptoms of: [1]  
a) Peripheral sleep apnea  
b) Obstructive sleep apnea  
c) Bronchitis  
d) Central sleep apnea
13. **Assertion (A):** Hippocrates is known as father of Biology. [1]  
**Reason (R):** Hippocrates gave binomial classification of organisms.  
a) Both A and R are true and R is the correct explanation of A.  
b) Both A and R are true but R is not the correct explanation of A.  
c) A is true but R is false.  
d) Both A and R are false
14. **Assertion (A):** Receptors associated with the aortic arch and carotid artery also can recognize changes in CO<sub>2</sub> and H<sup>+</sup> concentration. [1]  
**Reason (R):** It sends necessary signals to the rhythm centre for remedial actions.  
a) Both A and R are true and R is the correct explanation of A.  
b) Both A and R are true but R is not the correct explanation of A.  
c) A is true but R is false.  
d) A is false but R is true.
15. **Assertion (A):** Enzymes of glycolysis are constitutive enzymes. [1]  
**Reason (R):** They are present over mitochondrial cristae.  
a) Both A and R are true and R is the correct explanation of A.  
b) Both A and R are true but R is not the correct explanation of A.  
c) A is true but R is false.  
d) A is false but R is true.

16. **Assertion (A):** Abdominal muscle is related with respiration in animals. [1]  
**Reason (R):** Relaxation of abdominal muscles draws in air.
- a) Both A and R are true and R is the correct explanation of A.      b) Both A and R are true but R is not the correct explanation of A.  
c) A is true but R is false.      d) A is false but R is true.

**Section B**

17. What is the difference between monocot and dicot leaves? [2]  
18. Draw a well labelled diagram of both ventral and dorsal views of the brain of the frog. [2]  
19. Mention any four activities regulated by the estrogen hormone. [2]  
20. *Eichornia crassipes* is called as an exotic species while *Rauvolfia serpentina* is an endemic species in India. [2]  
What do these terms exotic and endemic refer to?  
21. Why is the colour of a leaf kept in the dark frequently yellow, or pale green? Which pigment do you think is more stable? [2]

OR



Based on the above equation, answer the following questions:

- i. Where does this reaction take place in plants?  
ii. What is the significance of this reaction?

**Section C**

22. Differentiate between the following: [3]  
i. Red algae and brown algae  
ii. Liverworts and moss  
iii. Homosporous and heterosporous pteridophyte
23. Differentiate between: [3]  
i. Acoelomate and pseudocoelomate  
ii. Notochord and nerve cord  
iii. Polyp and medusa
24. What are Lipids? Explain. [3]  
25. Name one synthetic auxin that can be used as a herbicide. Give one more application of the same. [3]  
26. Mention and explain the special properties of muscle. [3]  
27. What is the significance of the time gap in the passage of action potential from the sinoatrial node to the ventricle? [3]

OR

Differentiate between right ventricle and left ventricle.

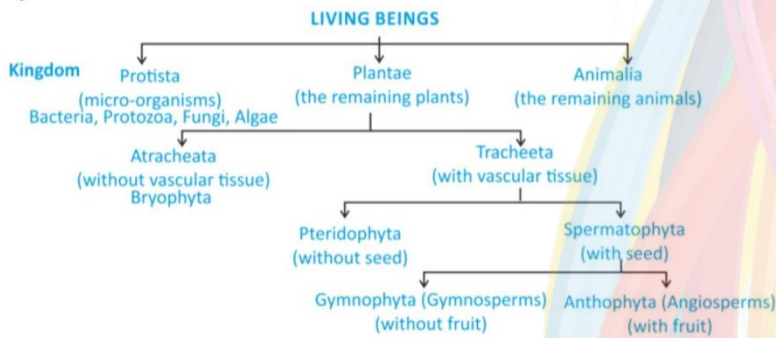
28. How do you call the conduction of impulse along a myelinated nerve fibre? [3]

**Section D**

29. **Read the following text carefully and answer the questions that follow:** [4]

Linnaeus gave two kingdom classification/which consists of kingdom Plantae and kingdom Animalia. This classification was based on the mode of nutrition/ reproduction/ presence or absence of cell wall. However, this system had many drawbacks like there was no distinction between eukaryotes and prokaryotes. Then, came the three-kingdom classification in which single-celled bacteria and protozoans were kept in the kingdom Protista.

This system also failed to classify all living organisms into appropriate categories. Finally a five Kingdom classification was proposed by dividing all the organisms into five kingdom and it will be accepted as modern system of classification.



- i. We know that Haeckel proposed the term Protista for unicellular organisms. Observe the given flowchart and mention what are advantages does the five-kingdom classification have over the two-kingdom classification? (1)
- ii. All eukaryotic unicellular organisms belong to which kingdom? Also, mention its two characteristics. (1)
- iii. What is heterotrophic? Is Euglena heterotrophic? (2)

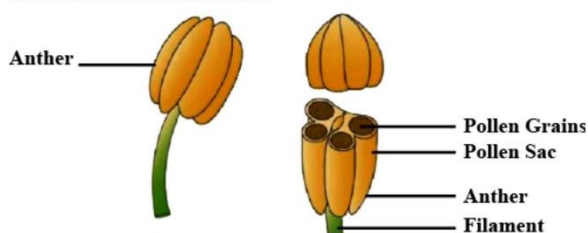
**OR**

Who proposed the five-kingdom classification? And which criteria were used to classify organism in the 5-kingdom system? (2)

30. **Read the following text carefully and answer the questions that follow:**

[4]

The androecium is composed of stamens. Each stamen that represents the male reproductive organ consists of a stalk or a filament and an anther. Each anther is usually bilobed and each lobe has two chambers, the pollen-sacs. Stamens of flowers may be united with other members such as petals or among themselves. The stamens may be epipetalous or epiphyllous. A flower is a modified shoot wherein the shoot apical meristem changes to floral meristem. Internodes do not elongate and the axis gets condensed. The apex produces different kinds of floral appendages laterally at successive nodes instead of leaves. The arrangement of flowers on the floral axis is termed an inflorescence.



- i. Observe the figure and mention what is androecium composed of. (1)
- ii. The pollen grains are produced in pollen-sacs. What is a sterile stamen is called? (1)
- iii. Is salvia and mustard show variation in the length of filaments within a flower? (2)

**OR**

Mention statement justifies that the given figure is racemose inflorescence. (2)



**Section E**

31. Describe the following:

- i. synapsis
- ii. bivalent
- iii. chiasmata

[5]

Draw a diagram to illustrate your answer.

OR

A well-known biologist stated that the life history of an organism can be summed up as gametic fusion, equational division and reductional division. Comment on it.

32. Enumerate the assumptions that we undertake in making the respiratory balance sheet. Are these assumptions valid for a living system? Compare fermentation and aerobic respiration in this context.

[5]

OR

Describe briefly the main steps on glycolysis from triose phosphate onwards. Highlight the reactions which release energy.

33. Is there a species or region specific type of plastids? How does one distinguish one from the other?

[5]

OR

Give the biochemical composition of plasma membrane. How are lipid molecules arranged in the membrane?







Section A

1. (a) Phylum  
**Explanation:** In biology, a phylum is a level of classification or taxonomic rank below kingdom. If we talk only about Zoology phylum is on top.
2. (d) Tubular reabsorption stops  
**Explanation:** If Kidney tissues are supplied with blood having low oxygen in it then tubular reabsorption gets stopped as energy is required for active absorption.
3. (d)  $\alpha$  -amino acid  
**Explanation:** Amino acids share a basic structure, which consists of a central carbon atom, also known as the alpha ( $\alpha$ ) carbon.
4. (b) Isobilateral leaves of monocot  
**Explanation:** Bulliform cells or motor cells are large, bubble-shaped epidermal cells that occur in groups on the upper surface of the leaves of many monocots on the upper surface of the leaf.
5. (d) It reduces  $O_2$  transport  
**Explanation:** Breathing of carbon monoxide is harmful to animals as carbon monoxide binds with haemoglobin to form carboxyhemoglobin due to which oxygen is not released to the tissues.
6. (c) Red  
**Explanation:** Certain red and blue wavelengths of light are the most effective in photosynthesis because they have exactly the right amount of energy to energize, or excite, chlorophyll electrons and boost them out of their orbits to a higher energy level.
7. (c) Uremia  
**Explanation:** Malfunctioning of kidneys can lead to accumulation of urea in blood, a condition called uremia, which is highly harmful and may lead to kidney failure.
8. (d) Megakaryocytes  
**Explanation:** Platelets are a little piece of blood cells that help wound healing and prevent bleeding by forming a blood clot. It is formed from the megakaryocytes.
9. (c) Ethylene  
**Explanation:** Ethylene promotes female flowers in cucumbers thereby increasing the yield.
10. (b) Leaf apex  
**Explanation:** In sexual reproduction, the sex organs antheridia and archegonia are produced at the apex of the leafy shoots.
11. (d) Uric acid  
**Explanation:** Uric acid is being the least toxic excretory products in animals. Hence, it can be removed with a minimum loss of water.
12. (b) Obstructive sleep apnea  
**Explanation:** Loud snoring and labored breathing are the symptoms of obstructive sleep apnea. Obstructive sleep apnea is a sleep disorder in which breathing is briefly and repeatedly interrupted.

13. (d) Both A and R are false  
**Explanation:** Hippocrates is known as the father of medicine. Aristotle is the father of biology. Binomial nomenclature was popularized by Carolus Linnaeus.
14. (a) Both A and R are true and R is the correct explanation of A.  
**Explanation:** Both A and R are true and R is the correct explanation of A.
15. (c) A is true but R is false.  
**Explanation:** Constitutive enzymes are those, which are always present because of their requirement for a vital process, e.g. enzymes of glycolysis. These enzymes are present in the cytoplasm.
16. (a) Both A and R are true and R is the correct explanation of A.  
**Explanation:** In higher group of animals, respiratory process is directly related with abdominal muscles. Relaxation of abdominal muscles draws in air through spiracles, tracheae and tracheole. This air enters the body fluid through terminal opening & tracheoles. It then diffuses through the body fluid to reach the cells. Contraction of abdominal muscles drives air out from the tracheal system through spiracles. This back and forth movement of abdominal muscles regulates the whole respiratory process.

### Section B

#### 17. Monocot Leaf

Symmetry: Isobilateral

Stomata distribution: Amphistomatic i.e., stomata equally distributed on both the surfaces.

Bulliform cells: Present on upper epidermis.

Mesophyll: Only spongy parenchyma is present which has very small intercellular spaces.

Bundle sheath: Made of parenchyma but just above and below the vascular bundles are found sclerenchymatous cells (upto epidermis)

#### Dicot Leaf

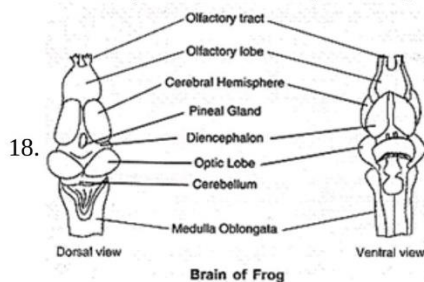
Symmetry: Dorsiventral

Stomata distribution: Hypostomatic i.e., stomata present on lower surface of leaf.

Bulliform cells: Usually absent.

Mesophyll: Made up of two types of tissues: Palisade parenchyma and spongy parenchyma with large intercellular spaces.

Bundle sheath: Made up of parenchyma. Just above and below the vascular bundle some parenchymatous cells or collenchymatous cells are present up to epidermis.



#### 19. Four Activities Regulated by Estrogen Hormone are:

- i. The **stimulation** and **growth** of **secondary sex organs**.
  - ii. The **development** of growing **follicles**.
  - iii. The appearance of **female secondary sexual characteristics** like voice pitch is high, mammary glands development and other features, etc.
  - iv. To **regulate** female **sexual behaviour**.
20. **Exotic species** are introduced into a new area like *E. crassipes* that damages our nature species.  
**Endemic species** are confined to a region and not found anywhere else.
21. In the absence of light, chlorophyll production decreases in leaves, leading to a reduction in the green pigment content. This causes the leaf to appear yellow or pale green. Carotenoids are more stable than chlorophyll.

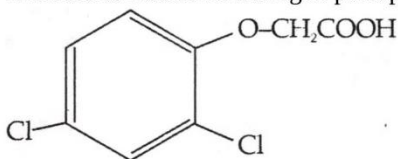
OR

- i. It shows the decomposition of water molecule. It takes place in PS II. It is located on the inner surface of thylakoid membrane.
- ii. Splitting of water continuously provides electrons to the electron transport chain; for further steps of photosynthesis.



**Section C**

22. i. **Red algae:** The pigment phycoerythrin in Rhodophyceae gives it the unique red colour and hence the name red algae.  
**Brown algae:** The pigment fucoxanthin in phaeophyceae gives it the unique brown colour and hence the name brown algae.  
 ii. In liverworts there is no protonema stage, while in moss the life cycle begins with the protonema stage.  
 iii. Majority of pteridophytes are homosporous, while some of them are heterosporous. Selaginella and salvinia are heterosporous. Basically the presence of heterospory in certain pteridophytes is a precursor of seed habits of higher plants, like gymnosperms and angiosperms.
23. i. When the body cavity is absent, the animal is called acoelomate, e.g. platyhelminthes. In some animals; mesoderm is present as scattered pouches between ectoderm and endoderm. Such animals are called pseudocoelomate, e.g. aschelminthes.  
 ii. The notochord is a flexible rod-shaped body found in embryos of all chordates. It is composed of cells derived from the mesoderm and defines the primitive axis of the embryo. The dorsal nerve cord is a hollow cord dorsal to the notochord. It is formed from a part of the ectoderm that rolls, forming the hollow tube. The notochord is replaced by a vertebral column in higher vertebrates. The nerve cord develops into the central nervous system.  
 iii. A polyp is a sessile and cylindrical form whereas medusa is umbrella-shaped and free-living. Polyps produce medusae asexually and medusae from the polyps sexually (e.g. Obelia). Examples of polyps are Hydra and Adamsia whereas of medusa is Aurelia.
24. **Lipids:** They are macro biomolecules. They are organic compounds; insoluble in water but soluble in organic solvents such as chloroform, benzene, and petroleum, ether, etc. They have **long chains of aliphatic hydrocarbons** or a benzene ring. Oil, butter, ghee, waxes, natural rubber, and cholesterol are either lipids or rich in lipids. **Fats** form an important structural component of cell membranes, pigments such as **carotene** and **lycopene**, menthol, hormones, and vitamins A, E and K. Chemically, fats are compounds of C, H, and O.
25. Various types of auxins are used in agriculture for economic gain. Some of the synthetic auxins are used as a herbicide. 2, 4-dichloro phenoxy acetic acid (2, 4-D) is a dicotyledonous weed killer. 2,4-D is used to kill broad-leaved weeds. It is used to induce flowering in pineapple and litchi.



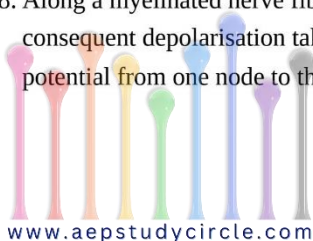
**The chemical formula of 2,4-D**

26. Muscles exhibit various special properties, some of them are as follows:
- Contractibility:** The cells of muscle can be shortened considerably and return to the original relaxed state.
  - Excitability:** It is due to the energy stored in the electrical potential difference across the plasma membrane.
  - Muscles also possess properties of extensibility and elasticity (because of proteins actin and myosin).
27. SA Node has a **resting potential** of approx. -55 to -60 mV. It is a **pacemaker**. Cardiac impulses originate in it and atrial contraction proceeds ventricular contraction. This has the highest degree of self-contraction that is approx. 70-75 times per minute. Cardiac impulses reach A.V. Node app. 0.03 second after their origin from SA Node.

OR

Right ventricle	Left ventricle
It is smaller than the left ventricle.	It is comparatively larger than the right ventricle.
Moderator band pre-sent in it.	Moderator band is lacking in it.
Columnar carneae thicker but less intricate.	Columnar carneae is narrower but more intricate.
Receives and pushes deoxygenated blood.	Receives and pumps oxygenated blood.
Crescent-shaped.	Biconvex in shape.
The wall of the right ventricle is thinner than the left ventricle.	The wall of its is thicker than the right ventricle.

28. Along a myelinated nerve fibre, the conduction of impulse is called saltatory conduction. This is so because the ionic changes and consequent depolarisation taking place only at the nodes of Ranvier free from myelin sheath leading to the jumping of action potential from one node to the next.



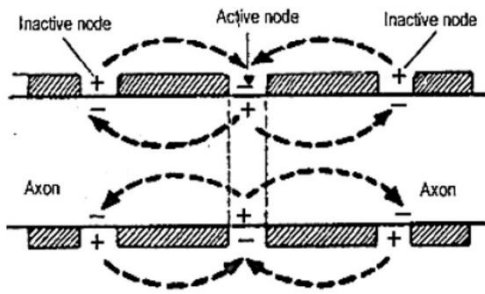


Figure: Saltatory conduction.

#### Section D

29. i. The advantages of five-kingdom classification over two-kingdom classification are as follows:

- It is based on cell structure
- It is based on the body structure
- Nutrition
- Way of living
- Phylogenetic relationship

ii. Protista

#### Characteristic of protists:

- Most of them live in water while some inhabit moist places.
- They have a membrane-bound nucleus and other cellular organelles

iii. Heterotrophs are those organisms that cannot prepare their own food and depend on other organisms (plants and animals) for food.

Yes, Euglena is heterotrophic and also possess chlorophyll like plants to synthesize their food.

**OR**

R. H. Whittaker proposed the five-kingdom classification.

R.H. Whittaker's primary classification criteria include cell structure, body organization, mode of nutrition, reproduction, and phylogenetic relationships.

30. i. An androecium is the male part of the flower which is composed of a long filament and an anther attached to its tip.

ii. Sterile stamen is called staminode.

iii. Yes, salvia and mustard show variation in the length of filaments within a flower.

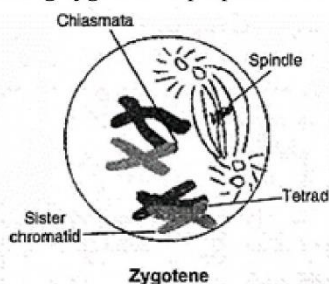
**OR**

a. The main axis continues to grow.

b. The flowers are borne laterally in an acropetal succession.

#### Section E

31. i. During zygotene of prophase I of meiosis homologous chromosomes pair together. This pairing is called synapsis.



ii. **Bivalent:** The complex formed by homologous chromosomes during zygotene is called a bivalent. They are also known as tetrad

iii. **Chiasmata:** During diplotene, the paired chromosomes make a X-shaped structure. This is called chiasmata. It is a site where two non-sister chromatids of homologous chromosomes have crossed over.

**OR**

The statement of the biologist is **correct**. Because the life history of an organism can be summed up as **gametic fusion, equational division, and reductional division**. By the fusion of male and female gametes, the gametic zygote is formed and from the zygote develops the adult. The zygote is formed during sexual reproduction. Half of the chromosome comes from the mother and the other half chromosomes come from the father to bring the character from both the parents. The male and female gametes are formed as a result of meiosis. The body cell divides by **mitosis**. In prophase of meiosis I, the exchange of segments between

the two adjacent non-sister chromatids of the homologous pair at different sites takes place which results in the genetic recombinations.

32. It is possible to make calculations of the net gain of ATP for every glucose molecule oxidized, but in reality, this can remain only a theoretical exercise.

Following assumptions are made while calculating the respiratory balance sheet:

- Respiration involves a sequential and orderly pathway.
- NADH which is synthesized during glycolysis is transferred to mitochondria where it undergoes oxidative phosphorylation.
- None of the other intermediates in the pathway are utilized to synthesize any other compound.
- Only glucose is undergoing oxidation. No other substrate is being utilized at any intermediate stage.

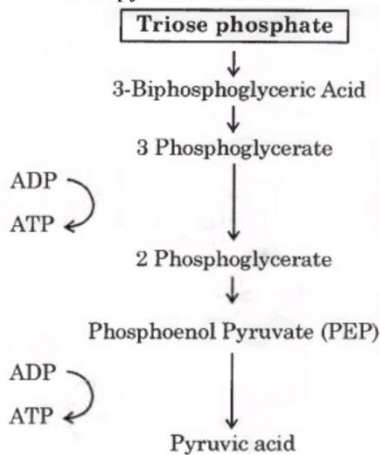
But these assumptions are not valid for a living system. All pathways work simultaneously and they cannot always work one after another, i.e. in sequence. ATP is utilized as and when needed. Glucose is not the only substrate. In spite of the practical limitations, this calculation is quite useful.

Fermentation	Aerobic respiration
(i) Partial breakdown of glucose happens during	(i) Complete breakdown of glucose takes a process into ethanol. place into carbon dioxide.
(ii) There is a net gain of only two ATP molecules.	(ii) There can be a net gain of 36 molecules of ATP.
(iii) Oxidation of NADH to NAD <sup>+</sup> is slow.	(iii) Oxidation of NADH to NAD <sup>+</sup> is very fast.

OR

Two moles of triose phosphate are **interconvertible**. They are dihydroxyacetone phosphate and 3-bi phosphoglyceraldehyde. 3-phosphoglyceraldehyde is converted into 1, 3, bi phosphoglycerate and NAD<sup>+</sup> is reduced to NADH. Phosphoglycerate kinase catalyses the formation of 3-phosphoglycerate and **ATP is produced**. 3-phosphoglycerate is converted into 2-phosphoglycerate and PEP.

PEP makes pyruvate and **releases ATP**.



33. Plastids are both region or species-specific. These are as follows

- Proplastids:** These are colourless, rounded but amoeboid plastid precursors, found in meristematic and newly formed cells of plants. It has a double membrane envelope that surrounds a colourless matrix, containing DNA, ribosomes and reserve food. A few vesicles and lamellae also occur in the matrix.
- Leucoplasts:** These are colourless plastids that occur in non-green plant cells commonly near the nucleus. They are as follows
  - a. **Amyloplasts** These leucoplasts store starch, e.g., the tuber of potato, grain of rice and wheat.
  - b. **Elaioplasts** These store fats, e.g., rose.
  - c. **Aleuroplasts** They are protein storing plastids, e.g., castor endosperm.
- Chromoplasts:** These are non-photosynthetic coloured plastids which synthesise and store carotenoid pigments. They appear, orange, red or yellow in colour. These mostly occur in ripe fruits (tomato and chillies) carrot roots, etc.
- Chloroplasts:** These are photosynthetic plastids, which are green in colour and found in the leaves of all green plants. They have lamellae organised in the form of grana.

OR

Chemically the plasma membrane consists of proteins (20-70%), lipids (20-79%), carbohydrates (1-5%) and water (20%). Nucleic acids (DNA and RNA) are absent in the plasma membrane. The lipids present in the plasma membrane are phospholipids, glycolipids (sugar lipids) and sterols.

Each lipid molecule consists of a three carbon glycerol poles (head) which is hydrophilic (water-loving) in nature and two long tails of fatty acids which are hydrophobic (water-fearing) in nature.

The hydrophilic glycerol poles of lipid are located towards the outside of the lipid bilayer whereas, the hydrophobic fatty acid tails are repelled by water and face towards the inner side of the membrane.

The hydrophilic and hydrophobic forces in lipid molecules cause the membrane to become a bilayer.

