

6. Splitting of water is associated with: [1]
- a) Both Photosystem I and II b) Inner surface of thylakoid membrane
- c) Lumen of thylakoid d) Photosystem I
7. What is the average amount of urine produced by a human in a day? [1]
- a) 1.4 litres b) 15 litres
- c) 18 litres d) 180 litres
8. The lymph in frog lacks: [1]
- a) RBC and plasma b) Plasma and WBCs
- c) WBCs and few proteins d) RBCs and few proteins
9. Plant growth regulator that is used in delay in leaf senescence is _____. [1]
- a) Ethylene b) Cytokinin
- c) Auxin d) ABA
10. The yellow or brown spots which have sporangia in fern are called _____. [1]
- a) Capsule b) Sori
- c) Arthropodia d) Archegonia
11. pH of urine under healthy conditions is: [1]
- a) Slightly alkaline b) Slightly acidic
- c) Neutral d) Highly alkaline
12. Pranayama is: [1]
- a) Involuntary and conscious effort to control breathing b) Voluntary and conscious effort to control breathing
- c) Function of respiratory system d) Reflex action
13. **Assertion (A):** Mucor, Rhizopus and Albugo fungi are members of Phycomycetes. [1]
Reason (R): The mycelium is aseptate and coenocytic and sexual reproduction takes place by zoospores or by aplanospores.

- 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.

14. **Assertion (A):** The part starting with the external nostrils up to the terminal bronchioles constitutes the conducting part. [1]

Reason (R): It is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric 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.

15. **Assertion (A):** Souring of milk occurs due to condensation of glucose and galactose. [1]

Reason (R): Condensation of glucose and galactose forms lactose.

- 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):** Alveoli are the primary sites for exchange of gases. [1]

Reason (R): All factors in our body are favourable for diffusion of O_2 from alveoli to tissues and that of CO_2 from tissues to alveoli.

- 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 are the characteristic differences found in vascular tissue of gymnosperms and angiosperms? [2]
18. Frogs are beneficial for mankind, justify the statement. [2]
19. Define hormone and classify them on basis of their chemical nature. [2]
20. List any two difference between anabolism and catabolism. [2]
21. Where is NADP reductase enzyme located in the chloroplasts? What is the role of this enzyme in proton gradient development? [2]

OR

Are the enzymes that catalyze the dark reactions of carbon fixation located inside the thylakoids or outside the thylakoids?

Section C

22. Differentiate between the following: [3]
i. Red algae and brown algae
ii. Liverworts and moss
iii. Homosporous and heterosporous pteridophyte
23. i. Why molluscs are considered advanced over annelids? [3]
ii. Justify that annelids are evolutionary precursors of molluscs.
24. Describe the influence of temperature on enzyme action. [3]
25. Both animals and plants grow. Why do we say that growth and differentiation in plants is open and not so in animals? Does this statement hold true for sponges also? [3]
26. Name the type of joint between the following: [3]
a. atlas/axis
b. carpal/metacarpal of thumb
c. between phalanges
d. femur/acetabulum
e. between cranial bones
f. between pubic bones in the pelvic girdle
27. Distinguish between [3]
i. Small Lymphocytes and Large Lymphocytes.
ii. Renal portal system and hepatic portal system.

OR

What is meant by coronary artery disease?

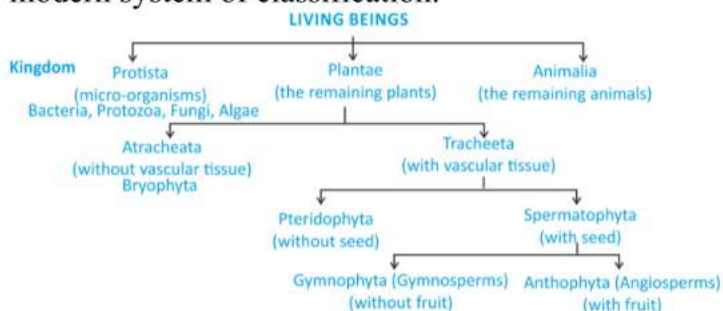
28. Distinguish between [3]
i. Axon and Dendron
ii. Endolymph and Perilymph

Section D

29. **Read the text carefully and answer the questions:** [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?

OR

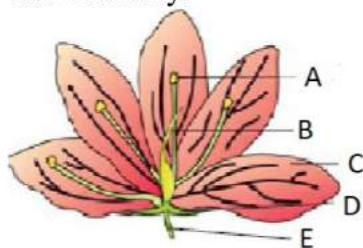
Who proposed the five-kingdom classification? And which criteria were used to classify organism in the 5-kingdom system?

- (ii) All eukaryotic unicellular organisms belong to which kingdom? Also, mention its two characteristics.
- (iii) What is heterotrophic? Is Euglena heterotrophic?

30. **Read the text carefully and answer the questions:**

[4]

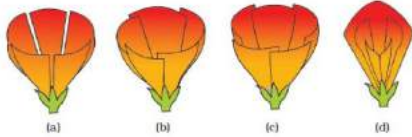
Each flower normally has four floral whorls, viz., calyx, corolla, androecium and gynoecium. The calyx is the outermost whorl of the flower and the members are called sepals. Corolla is composed of petals. Petals are usually brightly coloured to attract insects for pollination. The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation. The main types of aestivation are valvate, twisted, imbricate. The shape and colour of corolla vary greatly in plants. Corolla may be tubular, bell-shaped, funnel-shaped or wheel-shaped and vexillary.



- (i) Observe the given figure mentioned A, B, C and D. Also mention its function.
- (ii) Identify D and mention its example.
Ganosepalous, Ganopetalous, Polysepalous, Polypetalous, Imbricate
- (iii) What is Valvate and twisted aestivation?

OR

Which of the following shows imbricate? Explain imbricate aestivation?



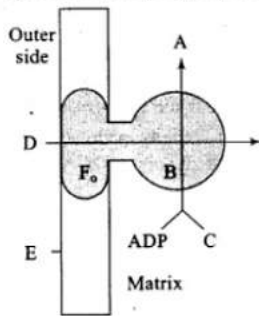
Section E

31. What are homologous chromosomes? What happens to homologous chromosomes during meiosis? [5]

OR

With the help of suitable diagrams describe mitosis.

32. Given below is a diagram showing ATP synthesis during aerobic respiration, replace the symbols A, B, C, D and E by appropriate terms given in the box. [5]



F₁, Particle, Pi, 2H⁺, Inner mitochondrial membrane, ATP, F₀ particle, ADP

OR

How do plants manage the exchange of gases? Give an overview of respiration in plants.

33. Is there a species or region specific type of plastids? How does one distinguish one from the other? [5]

OR

Structure and function are correlatable in living organisms. Can you justify this by taking the plasma membrane as an example?



Solution

Section A

1. (b) Lucknow
Explanation: The national botanical research institute is located in Lucknow (UP). This is one of the largest botanical research institutes in the world housing thousands of plants.
2. (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.
3. (c) G+C/A+T
Explanation: The ratio of the sum of guanine and cytosine to the sum of adenine and thymine is always constant for a species. This is due to the formation of hydrogen bonds between purine and pyrimidine.
4. (c) Open and close stomatal pore
Explanation: Opening and closing of stomatal pore of stomata is the function of guard cells. Change in osmotic potential cause the opening and closing of stomata.
5. (d) Pneumotaxic centre
Explanation: A pneumotaxic centre in the pons region of the brain and a chemosensitive area in the medulla can alter respiratory mechanism.
6. (b) Inner surface of thylakoid membrane
Explanation: The inner surface of the thylakoid membrane splitting of water molecules into hydrogen and oxygen in the illuminated chloroplast is called photolysis of water.
7. (a) 1.4 litres
Explanation: The normal range for 24-hour urine volume is 800 to 2000 milliliters per day (with a normal fluid intake of about 2 liters per day). This is the range.
So average = $\frac{800+2000}{2} = 1400\text{ml} = 1.4 \text{ L}$
8. (d) RBCs and few proteins
Explanation: The lymph is different from the blood. It is known as tissue fluid. Lymph is yellowish in colour as it lacks RBCs and few proteins.
9. (b) Cytokinin
Explanation: Cytokinins help overcome apical dominance. They promote nutrient mobilization which helps in the delay of leaf senescence.
10. (b) Sori



Explanation: The yellow or brown spots which have sporangia in fern are called sori. Spores are produced inside these sporangia to produce haploid gametophyte.

11.

(b) Slightly acidic

Explanation: The pH of urine under healthy conditions is slightly less than 7 so, slightly acidic in nature.

12.

(b) Voluntary and conscious effort to control breathing

Explanation: Pranayama is the control of breath. It is the voluntary and conscious effort to control breathing. It is also a breathing technique of yoga to increase physical activity.

13.

(c) A is true but R is false.

Explanation: Mucor, Rhizopus, and Albugo are examples of Phycomycetes. Their mycelium is aseptate and coenocytic. Asexual reproduction takes place by zoospores (motile) or by aplanospores (non-motile).

14.

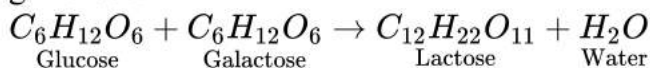
(c) A is true but R is false.

Explanation: A is true but R is false.

15.

(d) A is false but R is true.

Explanation: Souring of milk is due to the conversion of lactose into lactic acid. Lactose or milk sugar is named so because it is found naturally in milk. It is a reducing sugar that is formed inside mammary glands by condensation of two hexose molecules, glucose, and galactose.



16.

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

Explanation: Both A and R are true but R is not the correct explanation of A.

Section B

17. In gymnosperms, vessel elements are not present in xylem, whereas, these are main constituents in angiosperms. In the phloem of gymnosperms, companion cells are not associated with the sieve elements. In angiosperms, companion cells are associated with the sieve elements of phloem.

18. Frogs are beneficial for mankind in various ways. Some are as follows:

- i. Frogs eat many insects and pests. Thus, frogs help prevent damage to crops.
- ii. Frogs are important links in the food chain and thus are important component of the ecosystem for maintaining ecological balance.
- iii. In some countries, the muscular legs of frog are used as food by man.

19. **Hormone:** It is a regulatory substance produced in an organism and transported in tissue fluids such as blood or sap to stimulate specific cells or tissues into action.

Hormones on the basis of chemical nature:

- i. Steroid Hormones
- ii. Amine Hormones

- iii. Peptide Hormones
- iv. Protein Hormones
- v. Glycoprotein Hormones

20. Difference between anabolism and catabolism are:

Anabolism	Catabolism
It is the sum total of constructive processes.	It is the sum total of destructive processes.
Energy is stored.	Energy is released.

21. NADP reductase enzyme is located on the outer/stroma side of the thylakoid membrane. Along with the electrons from the primary acceptor of PS-I, it uses the protons of stroma for the reduction of NADP⁺ to NADPH; this removal of protons from the stroma causes a proton gradient between the lumen of thylakoids and the stroma.

OR

The stroma contains enzymes which are capable of utilizing ATP and NADPH₂ to produce carbohydrate during the dark reaction. The carbon fixation occurs in the stroma by a series of enzymes catalysed steps which are located outside the thylakoids (in stroma) and not inside the thylakoids.

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. The molluscs have advancement over annelids, as they have a distinct head, better sense organs and gills or lungs for respiration.
- ii. Annelids are considered evolutionary precursors of molluscs as they do not have metameric segmentation. However, Neopilina a living fossil shows metameric segmentation. Besides, its trochophore larva, it has structural similarities to annelid trochophore larva.
- These two shreds of evidence suggest that molluscs have descended from annelids.

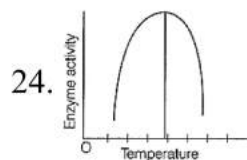


Figure: The influence of temperature on enzyme action.

Enzymes generally function at a narrow range of temperature. The temperature at which the enzyme shows its maximum activity is called its optimum temperature. The enzyme activity decreases at temperatures below and above the optimum temperature.

At low temperatures, the enzyme is inactive, while at high temperature, the enzyme is denatured and so it loses its activity.

25. In animals, once a particular type of tissue is formed it cannot change to any other tissue. Moreover, growth in all the organs stop after a certain age of the animal. On the contrary, growth in the plant is indeterminate because plants retain the capacity for unlimited growth throughout their life. A senescent part is usually replaced in plants. Differentiated cells undergo dedifferentiation in plants if a need arises.

Sponges are exceptions in the animal kingdom. A sponge shows an open type of growth.

26. a. Pivot joint
 b. Saddle joint
 c. Hinge joint
 d. Ball and socket joint
 e. Fibrous joint
 f. Cartilaginous joint

27. i. **Difference between Small Lymphocytes and Large Lymphocytes.**

Small Lymphocytes	Large Lymphocytes
About 10-14 μm in diameter.	App. 7-10 μm diameter.
Abundant cytoplasm and small nucleus.	A thin layer of cytoplasm and big nucleus.

ii. **Difference between Renal portal system and the hepatic portal system.**

Hepatic portal system	Renal portal system
It consists of the vein which collects blood from the digestive tract and gives it to the liver and from the liver it goes to the heart.	It consists of the vein which collects blood from the legs and pelvic region and the open into the kidneys instead of carrying it directly to the heart. It then opens into the heart from the kidneys.

OR

It is the hardening of **arteries** and **arterioles** due to the thickening of the fibres tissue and the consequent loss of elasticity. It is often referred to as **atherosclerosis**. This mainly affects the vessels, which are mainly responsible for supplying blood to the heart muscle. It seems to occur due to deposition of calcium, fat cholesterol, and fibrous tissues, making the lumen of arteries narrower.

28. i. **Difference between Axon and Dendron:**

Axon	Dendron
Axon is a long process originating from the cyton of a nerve cell.	Dendron is an extension from the cell body other than an axon. There is a short process.

ii. **Difference between Endolymph and Perilymph:**

Endolymph	Perilymph

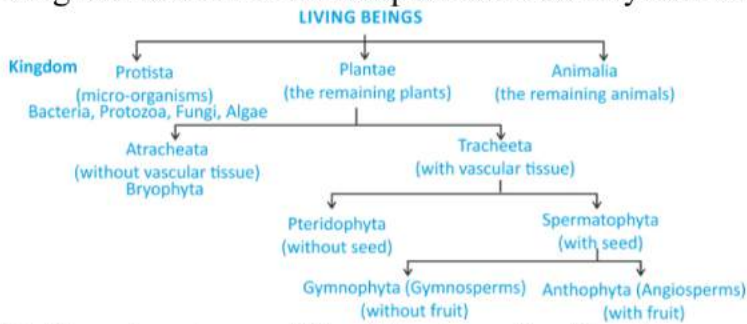
It transmits vibrations to the hair cells of the inner ear to produce acoustic perception.

It protects and nourishes the tissue of the inner ear.

Section D

29. Read the text carefully and answer the questions:

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) 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

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.

(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

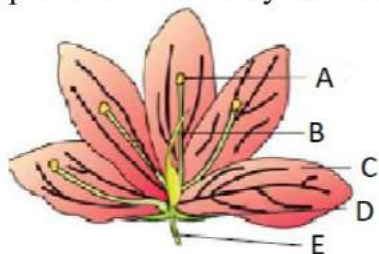
(iii) Heterotrophs are those organisms that cannot prepare their own food and depend on other organisms (plants and animals) for food.

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

30. Read the text carefully and answer the questions:

Each flower normally has four floral whorls, viz., calyx, corolla, androecium and gynoecium. The calyx is the outermost whorl of the flower and the members are called

sepals. Corolla is composed of petals. Petals are usually brightly coloured to attract insects for pollination. The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation. The main types of aestivation are valvate, twisted, imbricate. The shape and colour of corolla vary greatly in plants. Corolla may be tubular, bell-shaped, funnel-shaped or wheel-shaped and vexillary.



(i) **A-androecium, B-gynoecium, C-corolla, D-calyx**

Androecium: It contains pollen grains, which are responsible for reproduction in the male part of the plant.

Gynoecium: It holds ovary, which is transformed into fruit after fertilization.

Corolla: The corolla promotes pollination and protects the reproductive organs.

Calyx: The main function of the calyx is to protect the floral shoot during the bud stage.

- (ii) ■ **Ganosepalous:** Plants with many fused sepals are known as Gamosepalous. Eg, Hibiscus, Periwinkle, etc.
- **Polypetalous:** Polysepalous plants are also categorized based on sepals. Eg, Rose, Southern magnolia, etc.
- (iii) ■ When the margins of the petals are in contact with each other without overlapping, it is called **valvate aestivation**. For example, Calotropis.
- Contoured or **twisted aestivation** occurs when the margin of one petal overlaps the margin of the next. Example - Hibiscus.

OR

Figure (c), Imbricate aestivation occurs when the margins of sepals or petals overlap without a clear direction. There is an irregular overlapping of petals by each other in this type of aestivation.

Section E

31. **Homologous Chromosomes:** These are pairs of similar chromosomes having corresponding genes governing the same set of traits.

During the heterotypic division of **meiosis** in leptotene, chromosomes are thread shaped and coiled. During **zygotene**, the homologous chromosomes start pairing. Here morphologically and genetically chromosomes similar are called homologous chromosomes. In pachytenes, the chromosomes show thickening and shortening.

Diplotene is marked by the **cessation of attraction force** between two homologous chromosomes. Uncoiling of homologous chromosome tends to separate them from each other but remains attached at chiasmata. During **diakinesis**, the separation of homologous chromosomes is complete. Exchange of parts between chromatids of homologous chromosomes may occur.

During **Anaphase I**, the centromere of homologous compounds of bivalents repel each other. After separation of centromeres, the homologous chromosomes begin to move apart

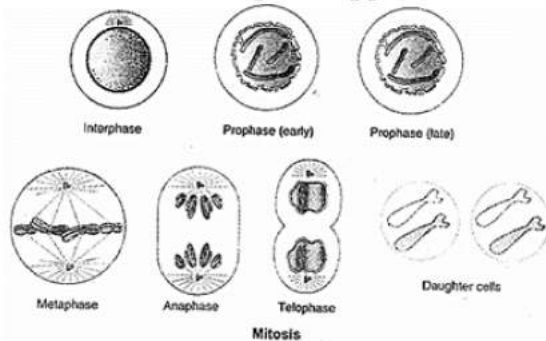
towards the spindle. In telophase I, the chromosomes reach **poles** and become shortened. The two cells have a reduced number of chromosome and then second meiosis begins.

OR

Mitosis is divided into the following four stages:

i. Prophase

- Condensation of chromosomal material starts. The chromosomal material becomes untangled during the process of chromatin condensation.
- The centriole, which had undergone duplication during S phase of interphase now begins to move towards opposite poles of the cell.
- At the end of prophase, Golgi complexes, endoplasmic reticulum, nucleolus and the nuclear envelope disappear.



ii. Metaphase

- The metaphase is characterized by all the chromosomes coming to lie at the equator.
- One chromatid of each chromosome connected by its kinetochore to spindle fibres from one pole and its sister chromatid connected by its kinetochore to spindle fibres from the opposite pole.
- The plane of alignment of the chromosomes at metaphase is referred to as the metaphase plate.

iii. Anaphase

- At the onset of anaphase, each chromosome arranged at the metaphase plate is split simultaneously and make the two daughter chromatids.
- They are now referred to as chromosomes of the future daughter nuclei and begin their migration towards the two opposite poles.
- As each chromosome moves away from the equatorial plate, the centromere of each chromosome is towards the pole and hence at the leading edge, with the arms of the chromosome trailing behind.

iv. Telophase

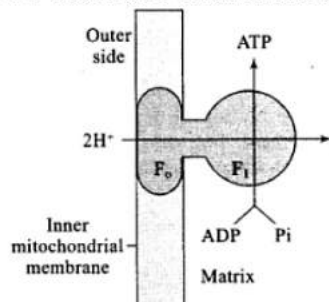
This is the stage which shows the following key events:

- Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements.
- Nuclear envelope assembles around the chromosome clusters.
- Nucleolus, Golgi complex and ER reform.

v. Cytokinesis

Karyokinesis is followed by cell division to form two daughter cells. This process is called cytokinesis at the end of which cell division is complete.

32. The energy released during the electron transport system is utilized in synthesizing ATP with the help of ATP synthase (complex V). This complex consists of two major components, F₁ and F₀. The F₁ headpiece is a peripheral membrane protein complex and contains the site for synthesis of ATP from ADP and inorganic phosphate. F₀ is an integral membrane protein complex that forms the channel through which protons across the inner membrane. The passage of protons through the channel is coupled to the catalytic site of the F₁ component for the production of ATP. For each ATP produced, 2H⁺ passes through F₀ from the intermembrane space to the matrix down the electrochemical proton gradient.



Diagrammatic presentation of ATP synthesis in mitochondria

OR

Plant Respiration

- Plants, unlike animals, have no specialized organs for gaseous exchange but they have stomata and lenticels for this purpose. There are several reasons why plants can get along without respiratory organs.
- Each plant part takes care of its own gas-exchange needs. There is very little transport of gases from one plant part to another.
- Plants do not present great demands for gas exchange. Roots, stems and leaves respire at rates far lower than animals do. Only during photosynthesis are large volumes of gases exchanged and, each leaf is well adapted to take care of its own needs during these periods. When cells photosynthesize, availability of O₂ is not a problem in these cells since O₂ is released within the cell.

Overview of respiration in plants

Plants undergo aerobic respiration. Glucose is broken down into Pyruvic acid during glycolysis. Pyruvic acid is transported into the mitochondria where it is converted into acetyl CoA with the release of CO₂. Acetyl CoA then enters the tricarboxylic acid pathway or Krebs's cycle. NADH + H⁺ and FADH₂ are generated in the Krebs cycle. The energy in these molecules as well as that in the NADH + H⁺ synthesised during glycolysis are used to synthesise ATP. This is accomplished through electron transport system (ETS) located on the inner membrane of the mitochondria of the plant cell. The electrons, as they move through the system, release enough energy that are trapped to synthesise ATP. This is called oxidative phosphorylation. In this process, O₂ is the ultimate acceptor of electrons and it gets reduced to water.

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.

- ii. **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.
- iii. **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.
- iv. **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

This is true that structure and function are correlated in living organisms. The following aspects of the structure and function of the plasma membrane justify this fact.

- i. The plasma membrane provides a boundary to the cell contents. This is made possible because of its ability to segregate the inside of the cell with the external environment.
- ii. The plasma membrane is a semi-permeable membrane. This attribute helps the plasma membrane to allow the exchange of some selected materials between the cell and its external environment.
- iii. We know that the plasma membrane is composed of a lipid bilayer that has protein intersperse in a mosaic-like pattern. The protein molecules serve as channels for those substances which need active transport mechanism to enter or exit a cell.
- iv. The fluid layer of lipid allows those molecules to pass through the membrane which can easily travel through osmosis.

