

Class XI Session 2024-25
Subject - Biology
Sample Question Paper - 6

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. Carolus Linnaeus is associated with: [1]
 - a) Law of limiting factor
 - b) Binomial nomenclature
 - c) Origin of species
 - d) Inheritance of acquired character
2. During micturition, the muscles of urinary bladder, and urethral sphincters will: [1]
 - a) Keep expanding
 - b) Show fatigue
 - c) Contract and relax respectively
 - d) Relax and contract respectively
3. The inhibition of enzyme activity by the presence of a chemical that competes with the substrate for binding to the active site of the enzyme is called: [1]
 - a) Substrate analogue
 - b) None-competitive inhibitor
 - c) Irreversible inhibition
 - d) Reversible inhibition
4. The quiescent centre is found in the plant at: [1]
 - a) Root tips
 - b) Leaf tip
 - c) Cambium
 - d) Shoot tips
5. Insect of the family Chironomidae like Chironomous larvae are also known as bloodworms since: [1]
 - a) They contain haemocyanin as their respiratory pigment
 - b) They are blood parasites
 - c) They have only blood
 - d) They contain haemoglobin as their respiratory pigment

- c) A is true but R is false. d) A is false but R is true.

15. **Assertion (A):** Lysozyme of tears is an example of endoenzymes. [1]

Reason (R): Enzymes functional inside living cells are known as endoenzymes.

- 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):** In mammals, complex respiratory system has developed. [1]

Reason (R): Mammalian skin is impermeable to gases.

- 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. Stomata are present on the ventral side of a dicot leaf. What may be the reason? [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. How has the doctrine of evolution influenced systematics? [2]
21. A certain tree is believed to be releasing oxygen during night time. Do you believe in the truthfulness of this statement? Justify your answer by giving the reason. [2]

OR

Suppose there were plants that had a high concentration of Chlorophyll b, but lacked chlorophyll a, would it carry out photosynthesis? Then why do plants have chlorophyll b and other accessory pigments?

Section C

22. Distinguish between Red, Brown and Green Algae. [3]
23. Give general characters of Phylum Arthropoda. [3]
24. Proteins have a primary structure. If you are given a method to know which amino acid is at either of the two termini (ends) of a protein, can you connect this information to purity or homogeneity of a protein? [3]
25. Can you alter the rate of growth in an organism? If so, how? [3]
26. Give the name of the bones present in the lower leg in humans. [3]
27. Write a short note on electrocardiogram (ECG). [3]

OR

Difference between Heartbeat and Pulse.

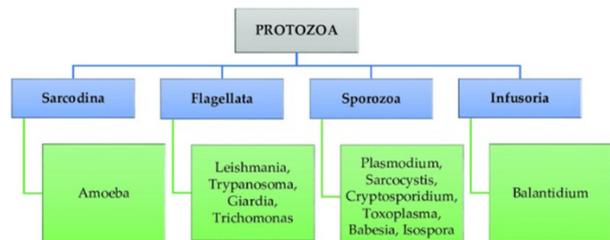
28. Why does the nerve impulse flow more rapidly in myelinated nerve fibres than in the non-myelinated fibres? [3]

Section D

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

Sarcodines are unicellular/jelly-like protozoa found in fresh or sea water and in moist soil. Their body lacks a periplast. Therefore, they may be naked or covered by a calcareous shell. They usually lack flagella and have temporary protoplasmic outgrowths called pseudopodia. These pseudopodia or false feet help in movement and capturing prey. They include free-living forms such as Amoeba or parasitic forms such as Entamoeba. Zoo flagellates ciliates and I sporozoans are other groups of protozoan protists. They are all unicellular and

heterotrophic. They may be holozoic, saprobic or parasitic.



- i. Write two lines about flagellated protozoans and also mention some flagellated protozoans. (1)
- ii. Observe the given protozoan classification and mention what is the basis of protozoan classification. (1)
- iii. Mention some locomotory organs of protozoa. (2)

OR

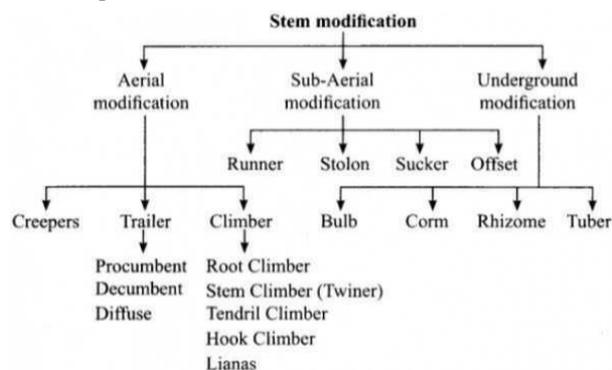
Which protozoan group has two nuclei, macronucleus, and micronucleus? Mention characteristics of it. (2)

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

[4]

Various parts of the plant such as stems, leaves, and even fruits are modified into underground parts to perform various functions such as stems, leaves, and even fruits.

The stems in ginger and banana are underground and swollen due to storage of food. They are called rhizome. Rhizome of ginger is a modification of stem because it bears nodes, internodes, terminal buds, scaly leaves and buds, which give rise to aerial shoots. It is not a root because root does not have nodes and internodes. Also, rhizome does not perform the function of roots i.e. anchorage and absorption, rather it serves as a reservoir for storage of food. Similarly, corm is an underground stem in Colocasia (jimbikand). The tips of the underground stem in potato become swollen due to accumulation of food and form a tuber.



- i. Observe the given flow chart and mention what are the four types of Underground stem modification also mention one example of each. (1)
- ii. Ginger is an underground stem but why is it distinguished from a root? (1)
- iii. Why do the tips of modified stems in potatoes become swollen? (2)

OR

Are all underground parts of a plant roots? (2)

Section E

31. What do you mean by cell cycle? Explain cell cycle and interphase in detail.

[5]

OR

Describe prophase I of meiotic cell division. How is it different from prophase II of meiosis?

32. Describe the pentose phosphate pathway.

[5]

OR

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

33. Eukaryotic cells have organelles which may

[5]

- i. not be bound by a membrane
- ii. bound by a single membrane
- iii. bound by a double membrane

Group the various sub-cellular organelles into these three categories.

OR

What is a centromere? How does the position of centromere form the basis of classification of chromosomes. Support your answer with a diagram showing the position of centromere on different types of chromosomes.

Solution

Section A

1. **(b)** Binomial nomenclature
Explanation: Carolus Linnaeus is associated with Binomial nomenclature in which the name of the organism consists of the genus name and species name.
2. **(c)** Contract and relax respectively
Explanation: The CNS passes on motor messages to initiate the contraction of smooth muscles of the bladder and simultaneous relaxation of the urethral sphincter causing the release of urine.
3. **(a)** Substrate analogue
Explanation: The inhibition of enzyme activity by the presence of a chemical that competes with the substrate for binding to the active site of the enzyme is called substrate analogue.
4. **(a)** Root tips
Explanation: A quiescent centre is a small group of cells with low mitotic activity. It is found at the tips of growing roots in the root meristem.
5. **(d)** They contain haemoglobin as their respiratory pigment
Explanation: Insects of family Chironomidae eg. Chironomus commonly known as the harlequin fly is a species of the non-biting midge. Their larvae are known by the common name of blood worm due to their red colouration. The red colouration is because they contain haemoglobin as their respiratory pigment.
6. **(c)** Sugarcane
Explanation: The efficiency of uncultivated plant life is only about 0.2%. In sugar cane, which is one of the most efficient plants, about 8% of the light absorbed by the plant is preserved as chemical energy. It shows the high efficiency of CO₂ fixation because of the Hatch and Slack cycle.
7. **(d)** Statement (i) and (iii) are correct
Explanation: Apple snail or *Pila globosa* is adapted to lead an amphibious life both on land as well as water. It is both ammonotelic as well as uricotelic can release ammonia and uric acid.
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)** More than 100
Explanation: There are more than 100 gibberellins reported from widely different organisms such as fungi and higher plants. They are denoted as GA₁, GA₂, GA₃, and so on.
10. **(d)** Cryptogams
Explanation: The cryptogams are flowerless and seedless plants. They are simple plants like algae, mosses, and ferns which do not produce flowers, fruits, and seeds. Cryptogams are considered as lower plants.
11. **(a)** Malpighian tubules
Explanation: The excretory organ of cockroach is the malpighian tubules. It is found at the junction of the midgut and hindgut and is about 150 in number. They are fine, yellow coloured and branched threads present in bundles. They lie freely in the haemolymph.

12. (c) Low $p\text{CO}_2$ and low temperature
Explanation: In the alveoli, where there is high $p\text{O}_2$, low $p\text{CO}_2$, lesser H^+ concentration, and lower temperature, the factors are all favourable for the formation of oxyhaemoglobin.
13. (d) Both A and R are false.
Explanation: Balantidium coli is a ciliate protozoan parasite of colon and caecum of man, monkeys, pigs, etc. It causes Balantidial dysentery in these organism.
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. (d) A is false but R is true.
Explanation: Enzymes that function outside the living cell are called exoenzymes. Lysozyme of tears is functional outside the living cells and is an example of exoenzymes. Examples of endoenzymes are trypsin, pepsin, lipase which work in our intestinal tract.
16. (b) Both A and R are true but R is not the correct explanation of A.
Explanation: Mammalian skin is impermeable so that water loss through it, is minimised. But mammals need far more oxygen to maintain their high metabolic rates than lower animals; so they need a more extensive respiratory surface. Thus a complex respiratory system has evolved in mammals to meet this need. The mammalian respiratory system consists of the nasal cavity, nasopharynx, larynx, trachea, bronchi, bronchiole and lungs.

Section B

17. The ventral surface is facing the sun while the dorsal surface is usually away from the sun. Stomata need to be in the direction of sun for facilitating transpiration and absorption of light energy.
18. Frogs are beneficial for mankind in various ways. Some are as follows:
- Frogs eat many insects and pests. Thus, frogs help prevent damage to crops.
 - Frogs are important links in the food chain and thus are important component of the ecosystem for maintaining ecological balance.
 - 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:

- Steroid Hormones
 - Amine Hormones
 - Peptide Hormones
 - Protein Hormones
 - Glycoprotein Hormones
20. Linnaeus considered the species as unchangeable. But with the advance of evolutionary theory, the concept of species is changed. It says that the species are not static but dynamic and are the product of organic evolution.
21. Photosynthesis occurs during the day in the presence of sunlight. Sunlight is trapped by chlorophyll and carbon fixation occurs in dark. O_2 is released as a by-product of this process. Since photosynthesis occurs during the day, no O_2 will be released by the tree during night time.

OR

Plants with a high concentration of chlorophyll b but lacking chlorophyll a would still be able to carry out photosynthesis, albeit less efficiently. Chlorophyll b and other accessory pigments expand the range of light wavelengths that plants can absorb, allowing them to maximize their photosynthetic potential under different environmental conditions.

Section C

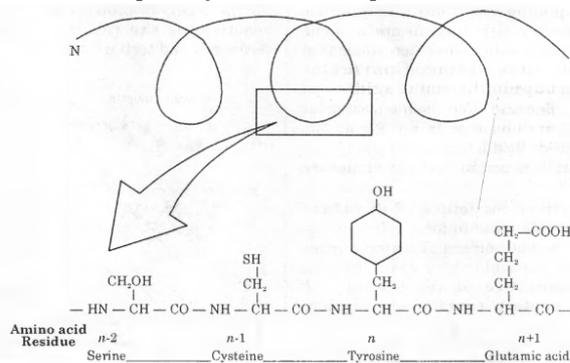
	Red Algae	Brown Algae	Green Algae
22.	Mainly marine.	Marine forms.	Chiefly freshwater.
	Only a few are unicellular.	Unicellular forms do not exist.	Unicellular species are more.

Thylakoids unstacked.	Occur in groups of three.	Stacked in groups of 2-20.
Only chlorophyll-a present.	Chlorophyll 'a' and 'c' present.	Chlorophyll 'a' and 'b' is present
Fucoxanthin present	Fucoxanthin is present.	Fucoxanthin is absent.
Phycobilins present	Absent	Phycobilins absent.
Reserve food is Floridean starch.	Reserve food is Laminarin.	Reserve food is starch.
Motile stages are not observed.	Present.	The motile stage is present.

23. **General characters of Phylum Arthropoda** : (Arthropoda = “jointed foot”). It is the **largest group of animals** comprising of about 900,000 species. The animals of this phylum are found all over the world in all climates and conditions.

Distinguishing characters:

- i. The body is **metamerically segmented**.
 - ii. The body is jointed outwardly and **bilaterally symmetrical**.
 - iii. Typically each segment has a pair of **jointed appendages**.
 - iv. **Coelomata** and **triploblastic**.
 - v. A hard, non-living, exoskeleton is present. It is usually made up of chitin.
 - vi. Body divided into **head, thorax** and **abdomen**.
24. Yes. The sequence of amino acids or positional information in a protein which is a first amino acid, which is second and so on, is known as the primary structure of a protein.



Primary structure of a portion of a hypothetical protein. N and C refer to the two termini of every protein. Single letter codes and three-letter abbreviations for amino acids are also indicated.

The difference in one amino acid will make the protein different from each other. The sequencing of a complete protein by sangers or Edman technique can tell us about the purity of a protein.

25. Yes, we can alter the rate of growth by making variations in the factors affecting growth. These factors are **light** and **temperature**. A plant grows quicker during the night than during the day. During the night the retarding or inhibiting action of light is absent and the rate of growth of a plant gradually increases until dawn while during the day the rate of growth gradually decreases until about sunset.
26. **Hind limb**: It consists of 30 bones. The femur is thigh bone. It is the longest bone of the body. Its upper end is called a head. The head fits into the acetabulum of the pelvic girdle. The patella is a small, sesamoid bone found on the anterior surface of the knee forming **knee cap (patella)**.
Two bones lie in the shank region of the leg
- i. tibia and
 - ii. fibula
- Seven tarsal bones make ankle. The foot possesses 7 tarsals.
Metatarsals: Phalanges are **five** in number. There are only two phalanges in the first digit called **hallux** and **three** in each of the rest toes.
27. It is a graphical representation of the electrical activity of the heart during a single cardiac cycle. The electrocardiogram is obtained by a machine known as an electrocardiograph. The study or the process of recording of the electrocardiogram is called **electrocardiography**.
Einthoven (1903) is known as ‘father of electrocardiography’.
The impulse generated by the SA node causes contraction and relaxation of heart chambers. To obtain an ECG, a patient is connected to the machine with **three electrical leads** (i.e., one to each wrist and one to the left ankle), monitoring the activity of the heart continuously and heart’s functioning is evaluated by attaching multiple leads to the chest region.

OR

Heart beat	Pulse
Alternate systole and diastole of heart chambers.	Alternate contraction and expansion of superficial arteries in the body.
Hormones, autonomic nervous system, exercise and emotions, etc., influence heartbeat.	Related to the rate of heartbeat.
Occurs due to impulses produced by SA and AV nodes.	Rhythmic pumping of oxygenated blood into the arterial system by the left ventricle.
Heartbeat is created by cardiac muscles.	Rhythmic distension of the arteries is related to the smooth muscle fibres.

28. In non-myelinated fibres myelin sheath is absent and **ionic changes** take place all along the length of the nerve fibres. While as in myelinated nerve fibres (fibres which are surrounded by a myelin sheath) **depolarization** of ionic changes takes place only in myelin free areas called **Nodes of Ranvier**; because the myelin sheath insulates the nerve fibres and prevents its depolarization. So action potential jumps from one node to another. This is known as **saltatory conduction**. The nerve impulse flows more rapidly in myelinated nerve fibre than in non-myelinated nerve fibre.

Section D

29. i. Flagellated protozoans are either free-living or parasitic protozoans that have flagella. Sleeping sickness is caused by parasitic versions of the parasite. Trypanosoma is a good example.
- ii.
 - Locomotion
 - Protozoan are eukaryotic having different shapes and sizes. Some are ciliated flagellated or both may be absent.
- iii. a. Cilia
b. Flagella
c. Pseudopodia

OR

Ciliata has two nuclei, macronucleus, and micronucleus.

Ciliates are characterized as organisms propelled by rows of cilia and possessing two types of nuclei. They are a large macronucleus involved in vegetative functions of the organism, and a small micronucleus involved in sexuality.

30. i.
 - Rhizome - Ginger, turmeric, Banana
 - Bulb - Tulips, Lilies, Daffodils, Onion, Garlic
 - Corm - Colocasia, Yam, Saffron
 - Tuber - Potato, Artichokes

ii. It has nodes and internodes. Such nodes and internodes are not found in the roots.

iii. Modified stem in the potato is underground and it becomes swollen because food gets accumulated to form tubers.

OR

No. Many different parts of plants, like the stem, leaves and fruits, get modified to act as underground structures that can perform functions other than those of roots.

Section E

31. Cell Cycle:

The cell cycle is an orderly sequence of events or a set of stages by which a cell duplicates its genome, synthesises the other constituents (important for the cell) of the cell and eventually divides into two daughter cells.

Interphase:

It is the period between the end of one cell division to the beginning of the next cell division, i.e., (between two successive M-phase).

During this phase, the cell prepares itself for both cell growth and DNA replication in an orderly manner. So, it is also known as the **preparation phase**. It lasts for about 90-96%, i.e., more than 95% of the total duration of the cell cycle. In a cell cycle of human cell, only about one hour is taken by the dividing phase out of 24 hours duration of one cell cycle.

Interphase is further divided into following three substages on the basis of various synthetic activities

i. G₁(Gap-1)-phase

It corresponds to the duration between the mitosis (M-phase) and initiation of replication of DNA. The cell becomes

metabolically very active during this period. It grows continuously and prepares itself for DNA replication. Thus synthesising enzymes and proteins needed for this process.

ii. **S (Synthesis)-phase**

It is known to be the phase in which actual synthesis or replication of DNA takes place. The overall amount of DNA doubles per cell, but no increase in chromosome number takes place during this phase. If the initial amount of DNA is 2C, it will become 4C.

In the case of an animal cell, during S-phase DNA replication begins inside the nucleus while the duplication of centrioles takes place in the cytoplasm.

iii. **G₂ (Gap-2)-phase** This phase is also called post-synthetic or pre-mitotic phase. During this stage, the synthesis of DNA stops and proteins required for mitosis are being synthesised while the growth of cell continues. It prepares the cell to undergo division.

OR

Prophase I. Prophase of the first meiotic division is typically longer and more complex. It has been further subdivided into the following five phases based on chromosomal behaviour:

- Leptotene
- Zygotene
- Pachytene
- Diplotene and
- Diakinesis.

Leptotene. During leptotene stage the chromosomes become gradually visible under the light microscope. The compaction of chromosomes continues throughout leptotene.

Zygotene:

- During this stage chromosomes start pairing together and this process of association is called synapses. Such paired chromosomes are called homologous chromosomes.
- The chromosome synapses is accompanied by the formation of complex structure called synaptonemal complex.
- The complex formed by a pair of synapsed homologous chromosomes is called a bivalent or a tetrad.
- The first two stages of prophase I are relatively short-lived compared to the next stage that is pachytene.

Pachytene:

- During this stage bivalent chromosomes now clearly appear as tetrads.
- This stage is characterized by the appearance of recombination nodules, the sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes.
- Crossing over is the exchange of genetic material between two chromosomes. Crossing over is also an enzyme-mediated process and the enzyme involved is called recombinase.
- Crossing over leads to recombination of genetic material on the two chromosomes.
- Recombination between homologous chromosomes is completed by the end of pachytene, leaving the chromosomes linked at the sites of crossing over.

Diplotene. The beginning of diplotene is recognized by the dissolution of the synaptonemal complex and the tendency of the recombined homologous chromosomes of the bivalents to separate from each other except at the sites of crossovers. These X-shaped structures are called chiasmata.

Diakinesis. The final stage of meiotic prophase I is diakinesis. This is marked by terminalisation of chiasmata. During this phase the chromosomes are fully condensed and the meiotic spindle is assembled to prepare the homologous chromosomes for separation. By the end of diakinesis, the nucleolus disappears and the nuclear envelope also breaks down. Diakinesis represents transition to metaphase.

Difference between prophase I and prophase II. During prophase I recombination of genes takes place, while in prophase II no such event happens. Prophase I is longer and more complicated compared to prophase II.

32. **Pentose Phosphate Pathway:** The glucose is broken down into CO₂ and water during aerobic respiration. It is the principal pathway of respiration. Oxidation of glucose also takes place by another pathway called the pentose phosphate pathway. In this pathway, glucose 6-phosphate (6C) produced during the early stages of glycolysis (photosynthates produced during photosynthesis are oxidized to give rise to 6-phosphogluconate). The reaction occurs in the presence of the enzyme called **glucose-6-phosphate dehydrogenase**. It generates NADPH. The 6-phosphogluconate molecule is again oxidized by the enzyme **6-phosphogluconate dehydrogenase**. After this one molecule, each of ribulose-5-phosphate, carbon dioxide, and NADPH are formed. Ribulose-5-phosphate undergoes many changes to produce intermediates like glyceraldehyde-3-phosphate and fructose-6-phosphate. All these reactions occur in the cytoplasm of the cells.

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 O_2 is not a problem in these cells since O_2 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 CO_2 . 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, O_2 is the ultimate acceptor of electrons and it gets reduced to water.

33. i. Ribosome are the organelles which are not bound by a membrane. Rather ribosome is composed of two subunits and lie interspersed in the protoplasm. Ribosomes are also found attached to the surface of the Rough Endoplasmic Reticulum. They are also found in mitochondria and plastids.
- ii. Lysosome is the cell organelle which is bound by a single membrane. It is a small sac-like structure. Lysosomes are found in animal cells but not in prokaryotes. Lysosome play an important role in destroying harmful substances and foreign materials.
- iii. Most of the cell organelles are bound by double membranes. Mitochondria, plastids, nucleus, endoplasmic reticulum are the examples of double-membrane cell organelles. These organelles serve important functions in the cell.

OR

The centromere is a narrow non-stainable area, which joins two similar threads or chromatids of late prophase or metaphase chromosome. The two parts of the chromosome on either side of the centromere are known as an arm. They may be isobrachial (equal) or heterobrachial (unequal in length). Depending upon the position of the centromere, the chromosomes are classified as follows

- Acrocentric chromosome:** The centromere is sub-terminal, at anaphasic stage appear J-shaped.
- Sub-metacentric chromosome:** The centromere is sub-median and the anaphasic chromosome appears L-shaped.
- Metacentric chromosomes:** The centromere is in the middle and the chromosome appears V-shaped in anaphase.
- Telocentric chromosome:** Centromere is terminal, the anaphasic state is I-shaped. Depending upon the number of centromeres a chromosome possess, it may be monocentric, dicentric (two centromeres), polycentric (many centromeres), acentric chromosome (having no centromere).

