



- a) Appressed parts of granal thylakoids                      b) Both Appressed parts of granal thylakoids  
and Stromal thylakoids
- c) Stromal    d) Stromal thylakoids and non-appressed parts  
of granal thylakoids
7. Which of the following is removed from our body by lungs? [1]
- a) CO<sub>2</sub> only    b) Ammonia
- c) CO<sub>2</sub> and H<sub>2</sub>O    d) H<sub>2</sub>O only
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. How many daughter cells are formed after mitotic division in case of arithmetic growth? [1]
- a) 4    b) 3
- c) 2    d) 1
10. Which plant has a fungal association in the form of mycorrhiza? [1]
- a) Pinus    b) Sequoia
- c) Cedrus    d) Cycas
11. The pH of human urine is approximately: [1]
- a) 7    b) 7.5
- c) 6    d) 6.5
12. What is the residual volume of air in a normal human? [1]
- a) 1.4 to 1.6 litre    b) 0.7 to 0.9 litre
- c) 1.0 to 1.2 litre    d) 1.2 to 1.4 litre
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):** Medulla is considered as a respiratory centre in animals. [1]  
**Reason (R):** Rate of breathing is regulated by the medulla because of the changes in the O<sub>2</sub> content of the blood.
- 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):** Potassium is only essential for animals. [1]  
**Reason (R):** Along with sodium is essential for the conduction of impulses in nerve cells.
- a) Both A and R are true and R is the correct                      b) Both A and R are true but R is not the

explanation of A.

correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

16. **Assertion (A):** Tracheae, primary, secondary and tertiary bronchi are supported by incomplete cartilaginous rings. [1]

**Reason (R):** These rings of cartilage make the wall non-collapsible.

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. Name the three basic tissue systems in the flowering plants. Give the tissue names under each system. [2]
18. How does a gap junction facilitate intercellular communication? [2]
19. Distinguish between Hormone and vitamin. [2]
20. Write the proper order of taxonomic categories starting from top to the bottom. [2]
21. What is the chemical equation to express photosynthesis? [2]

OR

The entire process of photosynthesis consists of a number of reactions. Where in the cell do each of these take place?

i. Synthesis of ATP & NADPH \_\_\_\_\_

ii. Photolysis of water \_\_\_\_\_

iii. Fixation of CO<sub>2</sub> \_\_\_\_\_

iv. Synthesis of sugar molecule \_\_\_\_\_

v. Synthesis of starch \_\_\_\_\_

### Section C

22. Each plant or group of plants have some phylogenetic significance in relation to evolution: Cycas, one of the few living members of gymnosperms is called as the 'relic of past'. Can you establish a phylogenetic relationship to Cycas with any other group of plants that justifies the above statement? [3]
23. Distinguish between Shark and Ray. [3]
24. Nucleic acids exhibit secondary structure, justify with example. [3]
25. Explain differentiation by giving one example. [3]
26. How many vertebrae in all do we have? Categorise them on the basis of their location giving the specific number in each category. [3]
27. What is an artificial pacemaker? Explain. [3]

OR

Write the features that distinguish between the two open and closed circulatory system.

28. Give the major anatomical and physiological differences between Sympathetic system and Parasympathetic system. [3]

### Section D

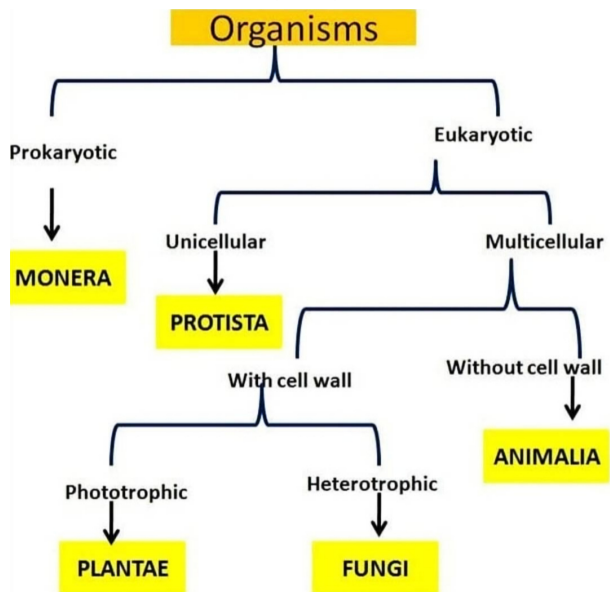
29. **Read the following text carefully and answer the questions that follow:** [4]

R.H. Whittaker proposed a Five Kingdom Classification. The kingdoms defined by him were named Monera, Protista, Fungi, Plantae, and Animalia. The main criteria for classification used by him include cell structure, body organisation, mode of nutrition, reproduction and phylogenetic relationships. The three-domain system has also been proposed that divides the Kingdom Monera into two domains, leaving the remaining eukaryotic



kingdoms in the third domain and there by a six kingdom classification. Earlier classification systems included bacteria, blue-green algae, fungi, mosses, ferns, gymnosperms and the angiosperms under 'Plants'. The character that unified this whole kingdom was that all the organisms included had a cell wall in their cells.

**Robert H. Whittaker (1969)**



- i. Observe Robert H. Whittaker (1969) flow chart of classification and mention what type of organisms were included in Kingdom Animalia? (1)
- ii. Mention two differences between prokaryotic and eukaryotic cells. (1)
- iii. Linnaeus used which kingdom of classification? State two drawbacks of Linnaeus two kingdom classification. (2)

**OR**

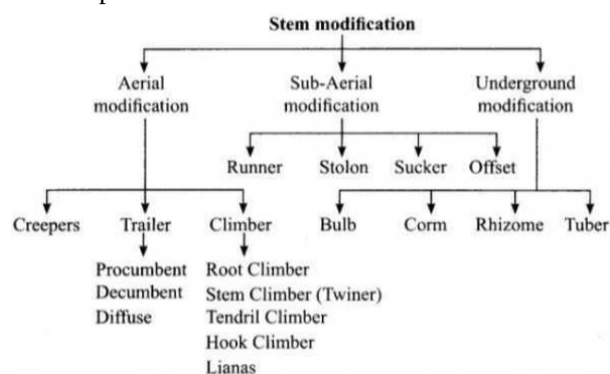
Is Fungi- Autotrophic (Photosynthetic) and Heterotrophic the correct match? Also, Mention the difference between the walls of fungi and green plants. (2)

**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 serve as reservoir for storage of food. Similarly, corm is an underground stem in Colocasia (jimikand) The tips of the underground stem in potato become swollen due to accumulation of food and forms 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 it is 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. With the help of suitable diagrams describe mitosis. [5]

OR

Briefly describe the significance of cell division.

32. Explain the formation of NADH and ATP during glycolysis in aerobic respiration. [5]

OR

Enumerate the assumptions that we have undertaken in making the respiratory balance sheet. Are these assumptions valid for a living system?

33. The cells of a unicellular organism are usually spherical whereas those of multicellular tend to be many-sided. [5]

Why?

OR

Singer and Nicolson proposed the model for membrane. Describe the composition of the membrane.

# Solution

## Section A

1. **(b)** Genus species  
**Explanation:** *Mangifera Indica*. Here, *Mangifera* is a generic name while *Indica* is a specific name. Hence, the correct option is the Genus species.
2. **(d)** Anti Diuretic hormone  
**Explanation:** Anti Diuretic hormone or ADH is also called arginine vasopressin. It's a hormone made by the hypothalamus in the brain and stored in the posterior pituitary gland. It tells your kidneys how much water to conserve. ADH constantly regulates and balances the amount of water in your blood.
3. **(d)** Oxygen  
**Explanation:** By mass, oxygen is the most abundant element in the human body. most of the body consists of water or  $H_2O$ . Oxygen accounts for 61-65% of the mass of the human body. Even though there are many more atoms of hydrogen in your body than oxygen, each oxygen atom is 16 times more massive than a hydrogen atom.
4. **(c)** All tissues except epidermis and vascular tissue  
**Explanation:** The ground tissue of plants includes all tissues that are neither dermal nor vascular. It can be divided into three classes based on the nature of the cell walls.
5. **(c)** Vital capacity  
**Explanation:** Vital capacity is the maximum volume of air that a person can breathe in after forced expiration or the maximum volume of air that a person can breathe out after forced inspiration.
6. **(d)** Stromal thylakoids and non-appressed parts of granal thylakoids  
**Explanation:** The pigment of Photosystem I occurs in stromal thylakoids and non-appressed parts of granal thylakoids. PS-I absorbs light of a wavelength of less than 780 nm.
7. **(c)**  $CO_2$  and  $H_2O$   
**Explanation:** Our lungs remove large amounts of  $CO_2$  (18 litres/day) and also significant quantities of water every day.
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. **(c)** 2  
**Explanation:** There are two types of growth rates - Arithmetic and Geometric. In arithmetic growth rate, out of the two daughter cells produced by the mitotic division of a cell, only one daughter cell continues to divide while the other differentiates and matures.
10. **(a)** Pinus  
**Explanation:** Roots in some genera of gymnosperms have a fungal association in the form of mycorrhizal (Pinus).
11. **(c)** 6  
**Explanation:** The pH of human urine is approximately 6.

12. (c) 1.0 to 1.2 litre  
**Explanation:** Residual volume (RV) is about 1100 ml to 1200 ml which is the volume of air still remaining in the lungs after the expiratory reserve volume is exhaled.
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. (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:** Potassium fluxes govern the movements of stomata and the movement of variations in several plants including Mimosa pudica (Seismonasty) and Oxalis (nyctinasty). Its deficiency in plants affects processes such as respiration, photosynthesis, chlorophyll development, and the water content of leaves.
16. (a) Both A and R are true and R is the correct explanation of A.  
**Explanation:** The cartilage rings are present in the trachea to prevent it from collapsing. This enables the lumen of trachea to stay open during breathing.

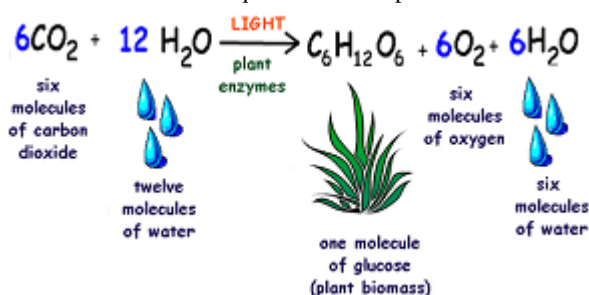
### Section B

17. On the basis of their structure and location, there are three types of tissue systems:
- Epidermal tissue system. Epidermis, stomata.
  - Ground or Fundamental tissue system and: Parenchyma, Sclerenchyma and collenchyma
  - Vascular or conducting tissue system. Phloem and Xylem.
18. Gap junctions are fine hydrophilic channels between two adjacent animal cells. These are formed with the help of two protein cylinders; called connexions. Gap junctions allow small signaling molecules to pass from one cell to another and thus they facilitate intercellular communication. Movement through gap junctions is controlled by pH and  $Ca^{2+}$  concentration.

19.

Hormone	Vitamin
It is synthesized in the animal body.	It is taken mostly in food.
Hormonal disorders are caused by excess and deficiency of hormones. It may be a peptide, amino acid derivative protein or steroid.	Deficiency of vitamin causes deficiency diseases. Excess of the vitamin is excreted out. A vitamin is a simple organic compound.

20. Kingdom, Phylum, Class, Order, Family, Genus and Species.
21. A simple word equation that can be used to describe the process of photosynthesis is  
 Carbon dioxide + Water → Glucose + Oxygen + Water.  
 A balanced chemical equation for the process can be written as



OR

- Synthesis of ATP and NADPH<sub>2</sub> takes place at the outer side of the thylakoid membrane.
- Photolysis of water takes place at the Inner side of thylakoid membrane.
- Fixation of carbon dioxide occurs at the stroma of the chloroplast.
- Synthesis of sugar occurs in chloroplast.
- Synthesis of starch takes place in the cytoplasm

### Section C

22. Cycas is called **living fossil** since it has many characters of extinct pteridophytes and cycads. Cycads have fern-like foliage, leaf bases persistent; secondary growth occurs; dioecious plants have micro and megasporophylls on separate plants; **sporophylls** aggregated to form cones (strobila) (the exception is megasporophyll of Cycas), sperms are motile, plants are xerophytic found in warm weather. Cycads are grown for **ornamental appeal**.

23.	Basis	Shark	Ray
	Form of body	Body laterally compressed.	Body dorsoventrally fiat.
	Gills slits position	Lateral.	Ventral.
	Pectoral fins	Distinct but not fused with the head.	Fused with the head but large sized.
	Spiracle	Present but small and lateral.	Large and dorsal always present.
	Feeding	Surface feeders.	Bottom feeders.
	Swimming pattern	Fast-swimmers.	Slow swimmer.
	Example	Examples are Scoliodon and Zygaena.	Examples are Torpedo, Trygon.

24. For nucleic acids, the building block is a nucleotide. A nucleotide has three chemically distinct components. One is a heterocyclic compound, the second is a monosaccharide and the third is phosphoric acid or phosphate.

The heterocyclic compounds in nucleic acids are the nitrogenous bases named adenine, guanine, uracil, cytosine, and thymine. Adenine and guanine are substituted purines while the rest are substituted pyrimidines.

The skeletal heterocyclic ring is called as purine and pyrimidine, respectively. The sugar found in polynucleotides is either ribose (a monosaccharide pentose) or 2' deoxyribose. A nucleic acid containing deoxyribose is called deoxyribonucleic acid (DNA), while that which contains ribose is called ribonucleic acid (RNA).

25. The process in which the cells or tissues become structurally and functionally different is called **differentiation**.

In the plant body, all the cells are derived from the single-cell zygote. After division, the zygote undergoes some structural and functional changes, which are collectively called '**differentiation**'. Example: In xylem elements, the changes in thickening occurs and perform the function of conduction of water, storage of food, etc.

26. There are 26 (twenty-six) vertebrae in total in our body. On the basis of location, they are the following:

- i. **Cervical vertebrae:** Found in neck region; 7 in number.
- ii. **Thoracic vertebrae:** Found in thoracic region; 12 in number.
- iii. **Lumbar vertebrae:** Present in abdominal region; 5 in number.
- iv. **Sacrum:** In the lowermost region of the vertebral column; 2 fused bones.
- v. **Coccyx:** Lies 0at end of the vertebral column; vestigial tail bone.

27. **Artificial pacemaker:** It is an artificial electronic device. It constantly sends a small amount of electrical charge to maintain rhythmicity of the heart. It is implanted in the upper thoracic region subcutaneously having a connection with the heart. It contains a pulse generator having a cell to produce electrical impulse. The lead in the form of a wire transmits the impulse. An electrode is connected to the portion of the heart where the impulse is transmitted.

OR

	Open circulatory system	Closed circulatory system
	(i) Blood pumped by the heart passes through large vessels into open spaces or body cavities called sinuses.	(i) Blood is pumped by the heart is always circulated through a closed network of blood vessels.
	(ii) The respiratory pigment is absent in most of the cases.	(ii) The respiratory pigment is present in all cases.
	(iii) Present in arthropods and mollusks.	(iii) Present in annelids, some mollusks, and all vertebrates.
28.	Sympathetic system	Parasympathetic system
	It consists of a double chain of ganglia situated on either side of the spinal cord. Each chain consists of 18 ganglia distributed from neck to abdominal region.	The ganglia of the parasympathetic system are also paired but these occur nearer to visceral organs.
	The ganglia of the parasympathetic system are also paired but these occur nearer to visceral organs.	This system has its origin in the brain and the posterior parts of the spinal cord.

Section D



29. i. All organisms are multicellular, eukaryotes with heterotrophic mode of nutrition.

Prokaryotic cell	Eukaryotic cell
Genetic material is not enclosed in a nuclear envelope and is present suspended in the cytoplasm in a region called nucleoid.	Genetic material is enclosed within the nucleus by a nuclear envelope and is not present in direct contact with cytoplasm.
Cell wall is made up of peptidoglycan.	Cell wall is made up of chitin in fungi and cellulose in plants.
Nucleolus is absent.	Nucleolus is present.

iii. Linnaeus used artificial system kingdom of classification.

**Drawbacks of Linnaeus two kingdom classification:**

- Linnaeus developed a Two Kingdom system of classification with Plantae and Animalia kingdoms.
- This system did not distinguish between eukaryotes and prokaryotes, unicellular and multicellular organisms, photosynthetic (green algae) and non-photosynthetic (fungi) organisms.

**OR**

No, Fungi-Autotrophic (Photosynthetic) and Heterotrophic is not correct match. The walls of the fungi were made of chitin, whereas the green plants had a cellulose cell wall.

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**

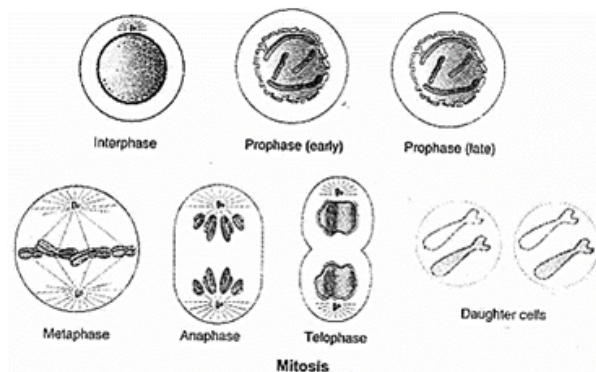
No. Many different parts of plants, like the stem, leaves and fruits, get modified to act as underground structures that can perform functions other than those of roots.

**Section E**

31. 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.

OR

Cell division is significant in the following ways

- Cell multiplication:** Cell division is a means of cell multiplication or the formation of new cells from pre-existing cells.
  - Continuity:** It maintains continuity of living matter generation after generation.
  - Multicellular organisms:** The body of a multicellular organism is formed of innumerable cells. They are formed by repeated divisions of a single cell or zygote. As the number of cells increases, many of them begin to differentiate, form tissues and organisms.
  - Cell size:** Cell division helps in the maintenance of a particular cell size which is essential for efficiency and control of cell activities.
  - Genetic similarity:** The common type of cell division or mitosis maintains the genetic similarity of all the cells in an individual despite being different, i.e., structurally and functionally.
32. **NADH = Nicotinamide Adenine Dinucleotide Hydrogen:** It is formed by the reduction of NAD. NAD plays an important role during glycolysis, where 3-phosphoglyceraldehyde is converted into 1, 3-diphosphoglycerate in the presence of inorganic phosphate and the enzyme glyceraldehyde phosphate dehydrogenase.

**ATP = Adenosine 4riphosphate:** It is a high energy compound present in the living cells. During the formation of ATP, energy is stored and during hydrolysis, energy is released. 2 molecules of ATP are formed from ADP when 1, 3-diphosphoglycerate is converted into 3- phosphoglycerate. Two molecules of ATP are formed from ADP when phosphoenolpyruvate is converted into pyruvic acid at the end of glycolysis. In this way, four molecules of ATP are formed and two molecules are used during the conversion of glucose into glucose-6- phosphate and later fructose-1,6-phosphate. So there is a net gain of two ATP molecules during glycolysis.

OR

**Respiratory Balance Sheet:** Some assumptions in preparing respiratory balance sheet are :

- None of the **intermediates** produced in this pathway is used to make any other compound.
- Only glucose is being respired—no other alternative substrates enter in the pathway at any of intermediary stages in any case.
- There seems to be a **sequential, orderly pathway** that is functioning, with a single **substrate** forming next as well as with glycolysis. Krebs' cycle and ETS pathway following one after the other pathway.
- NADH synthesised in glycolysis** transferred to mitochondria; it undergoes oxidative phosphorylation also.

This assumption is not really valid in a living system since all the pathways work simultaneously; moreover, the substrates enter pathways and also are withdrawn from the pathways as and when required; ATP used when needed and enzymes control the reactions also. It is only useful in the extraction and storing energy; there is a net gain of 36 ATP mols in aerobic respiration for one mol of glucose.

33. It is true that the cells of unicellular organisms tend to be spherical. It is because of the following reasons:

- Surface tension:** Surface tension shapes the spherical way as in the case in air-borne soap bubbles.
- The free-floating cells with thin membranes tend to be spherical as it is the most economical shape that can confine a given mass of protoplasm. The shape and the size of the cell depend upon the place where they are present and the functions they have to perform. In multicellular animals, the cells tend to become faceted as they come in contact with each other in the same way as the spherical soap bubbles become flattened when they are jammed together in a small space.

OR

Nicholson and Singer in 1972 proposed this model. The name of this model was fluid mosaic model.

According to this model, each phospholipid layer is bimolecular and their hydrophilic ends are pointed towards top and bottom

respectively. In this, protein are of two categories :

- i. Peripheral (extrinsic) and
- ii. integral (intrinsic)

The integral proteins are tightly held in place by strong hydrophilic or hydrophobic interactions or both and are difficult to remove from the membranes. The peripheral proteins are superficially arranged on either side and can be easily separated. These proteins have enzymatic properties and also make membranes selectively permeable. These proteins are referred to as permeases. This is a widely accepted model.

