

1. Taxon is a: [1]
 - a) Group of living organisms
 - b) Group of related species
 - c) Ranking
 - d) Group of related families
2. 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
3. Metal ions required for the functioning of the enzyme is _____. [1]
 - a) Prosthetic group
 - b) Co-factor
 - c) Holoenzyme
 - d) Co-enzyme
4. A conjoint and open vascular bundle will be observed in the transverse section of: [1]
 - a) Dicot root
 - b) Monocot stem
 - c) Dicot stem
 - d) Monocot root
5. Regarding the functions of our respiratory system, mark the wrong entry. [1]
 - a) Exchange of gases
 - b) Humidifies the air
 - c) Cleans up the air
 - d) Warms up the air

6. About 70% of global carbon occurs in: [1]
 - a) Forest
 - b) Agro ecosystem
 - c) Oceans
 - d) Grassland
7. Which of the following symptoms will be shown in a person suffering from diabetes? [1]
 - a) Paruresis
 - b) Anuria
 - c) Haematuria
 - d) Glycosuria
8. The number of nymphs produced from single ootheca of the frog is _____. [1]
 - a) 12
 - b) 16
 - c) 15
 - d) 10
9. Auxin precursor for IAA is: [1]
 - a) Alanine
 - b) Tryptophan
 - c) Buteric acid
 - d) Aspartic acid
10. Which of the following shows no segregation of plant parts? [1]
 - a) Pteridophyta
 - b) Bryophyta
 - c) Algae
 - d) Gymnosperm
11. Which excretory organ is used by cockroaches? [1]
 - a) Malpighian tubules
 - b) Protonephridia
 - c) Kidneys
 - d) Nephridia
12. How is the entry of food prevented in the respiratory tract? [1]
 - a) Oesophagus
 - b) Pyranx
 - c) Epiglottis
 - d) Vocal chords
13. **Assertion (A):** Mycoplasmas are pathogenic in animals and plants. [1]
Reason (R): Mycoplasmas lack a cell wall and can survive without oxygen.
 - 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):** Inspiration is initiated by the contraction of the diaphragm which increases the volume of the thoracic chamber in the antero-posterior axis. [1]

Reason (R): The contraction of external intercostal muscles lifts up the ribs and the sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis.

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):** At high temperatures, proteins are liable to denaturation. [1]

Reason (R): Globular proteins are not coagulated by heat.

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):** More of oxygen is released from oxyhaemoglobin in a more active tissue than in a less active one. [1]

Reason (R): This is because the partial pressure of carbondioxide is very low in an active tissue than in a less active one.

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 stomatal apparatus? Explain the structure of stomata with a labelled diagram. [2]
18. Differentiate between eyes of cockroach and eyes of frog. [2]
19. What are the effects of hypothyroidism (observed during pregnancy) on the development and maturation of a growing baby? [2]
20. What is a taxon? [2]
21. Give comparison between C_3 and C_4 pathways. [2]

OR

Give comparison between cyclic and non-cyclic photophosphorylation.

Section C

22. How far does Selaginella one of the few living members of lycopodiales (pteridophytes) fall short of seed habit? [3]
23. Differentiate between: [3]
 - i. Notochord and nerve cord
 - ii. Polyp and Medusa.
24. Account for the following: Phospholipids form a thin layer on the surface of an aqueous medium. [3]
25. How are gibberellins useful in agriculture to improve productivity. Give any three points in support of your answer. [3]
26. Describe the structure of the human skull. [3]
27. Name the essential components for the synthesis of haemoglobin and maturation of erythrocytes. What happens to old and worn out erythrocytes in the body of humans? [3]

OR

Compare the effect of sympathetic nerves and vagus on the heart.

28. Give a description of the structure of neuron. [3]

Section D

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

OR

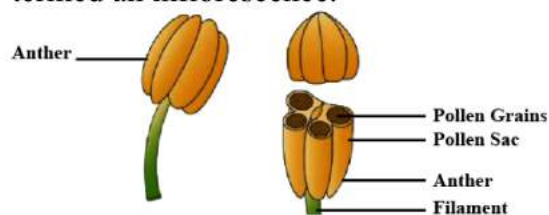
Which protozoan group has two nuclei, macronucleus, and micronucleus? Mention characteristics of it.

- (ii) Observe the given protozoan classification and mention what is the basis of protozoan classification.
- (iii) Mention some locomotory organs of protozoa.

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

[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.
- (ii) The pollen grains are produced in pollen-sacs. What is a sterile stamen called?
- (iii) Is salvia and mustard show variation in the length of filaments within a flower?

OR

Mention statement justifies that the given figure is racemose inflorescence.



Section E

31. Mitosis results in producing two cells that are similar to each other. What would be the consequence if each of the following irregularities occur during mitosis? [5]
- i. Nuclear membrane fails to disintegrate
 - ii. Duplication of DNA does not occur
 - iii. Centromeres do not divide
 - iv. Cytokinesis does not occur.

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. Where is the electron transport system operative in mitochondria? Explain the system highlighting the role of oxygen. [5]

OR

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.

33. What are nuclear pores? State their function. [5]

OR

Write the functions of the following

- i. Centromere
- ii. Cell wall
- iii. Smooth ER
- iv. Golgi Apparatus
- v. Centrioles

Solution

Section A

1.
(c) Ranking
Explanation: Each category in the taxonomic hierarchy represents the rank and is commonly termed as a taxon. Hence, the correct option is Ranking.
2.
(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.
3.
(b) Co-factor
Explanation: A number of enzymes require metal ions for their activity which form coordination bonds with side chains at the active site and at the same time form one or more coordination bonds with the substrate, e.g., zinc is a cofactor for the proteolytic enzyme carboxypeptidase.
4.
(c) Dicot stem
Explanation: In dicot stem, vascular bundle are of equal size, arranged in a ring with cambium present between xylem and phloem.
5.
(c) Cleans up the air
Explanation: Our respiratory system humidifies the air, warms up the air, and helps in the exchange of gases. However, the respiratory system does not clean up the air.
6.
(c) Oceans
Explanation: Carbon is present in all living organisms in the form of carbohydrate, protein, fat, and other organic compounds. About 70% of global carbon occurs in oceans in the form of carbonate and hydrogen carbonate.
7.
(d) Glycosuria
Explanation: Glycosuria is a condition characterized by an excess of sugar in the urine, typically associated with diabetes or kidney disease.
8.
(b) 16
Explanation: Young ones of frogs are called nymphs. When the ootheca ruptures, 16 nymphs come out.
9.
(b) Tryptophan
Explanation: The major precursor of Auxin is most likely the amino acid Tryptophan. However, the tryptophan is possibly derived from the shikimic acid pathway. Numerous

enzymes would be utilized for Auxin alone. the ultimate precursor depends on how far you want to follow the production back.

10.

(c) Algae

Explanation: Algae are chlorophyll-bearing, simple, thalloid, autotrophic plants with the simplest body organization. Their body is thallus like without true root, stem, and leaf differentiation.

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) Epiglottis

Explanation: During swallowing the glottis is covered by a cartilaginous flap called epiglottis. This prevents the entry of food into the respiratory tract.

13.

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

Explanation: Mycoplasmas or mollicutes are the simplest and the smallest of free-living prokaryotes, they can survive without oxygen. Mycoplasmas are heterotrophic in their nutrition. Some of them live as saprophytes but the majority parasitize plants and animals. The parasitic habit is due to the inability of most mycoplasmas to synthesize the required growth factors.

14.

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

Explanation: Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external intercostal muscles lifts up the ribs and the sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis.

15.

(c) A is true but R is false.

Explanation: Bonds maintaining the structure of proteins are easily broken by high temperatures. The phenomenon is called denaturation. Heat coagulability increases with the increase in the size of globular proteins. Small globular proteins are not coagulated by heat, e.g. histone.

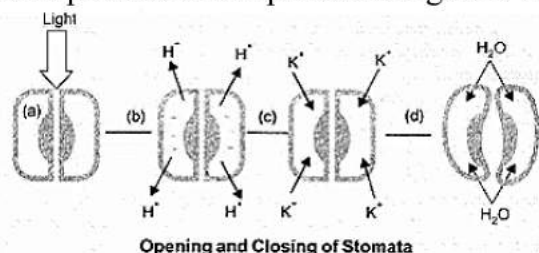
16.

(c) A is true but R is false.

Explanation: Lower partial pressure of oxygens and higher partial pressure of carbon-dioxide in the tissue than in blood effect the dissociation of oxyhaemoglobin to deoxyhemoglobin (reduced haemoglobin) and molecular oxygen. Since the partial pressure, of oxygen is much lower and the partial pressure of carbon-dioxide is much higher in an active tissue than in a less active one therefore, far more oxygen is released from oxyhaemoglobin in a more active tissue than in a less active one.

Section B

17. Stomata are structures present in the epidermis of leaves. Stomata regulate the process of transpiration and gaseous exchange. Each stoma is composed of two bean-shaped cells known as guard cells. In grasses, the guard cells are dumbbell shaped. The outer walls of guard cells are thin and the inner walls are highly thickened. The guard cells possess chloroplast and regulate the opening and closing of stomata.



Opening and Closing of Stomata

Sometimes a few epidermal cells, in the vicinity of the guard cells become specialized in their shape and size and are known as subsidiary cells. The stomatal aperture, guard cells and the surrounding subsidiary cells are together called stomatal apparatus.

18. Differences between eyes of cockroach and eyes of frog

Eyes of Cockroach	Eyes of Frog
1. Compound eyes made of multiple units	1. Simple eyes made of single units
2. Ommatidia comprise eyes.	2. Lens comprise eyes
3. Project mosaic vision with less resolution.	3. Stereoscopic vision with high resolution.

19. Hypothyroidism during pregnancy causes defective development and maturation of the growing baby leading to stunted growth (cretinism), mental retardation, low intelligence, abnormal skin, deaf-mutism, etc.
20. A taxon is a group of (one or more) organisms, which a taxonomist adjudges to be a unit. Usually, a taxon is given a name and a rank, although neither is a requirement. It is a level of hierarchy in biological classification. Example: Family is a taxa.

21. C_3 pathways	C_4 pathways
The primary acceptor of CO_2 is RUBP – a six-carbon compound.	The primary acceptor of CO_2 is phosphoenolpyruvate – a three-carbon compound.
The optimum temperature for photosynthesis is $10^{\circ}C$ - $25^{\circ}C$.	Optimum temperature is $30^{\circ}C$ - $45^{\circ}C$.
It involves C_3 or Calvin cycle.	It involves C_4 or Hatch -Slack cycle.
The first stable product is 3-phosphoglycerate.	The first stable product is oxaloacetic acid.
It occurs only in the mesophyll cells of the leaves.	It occurs in the mesophyll and bundle sheath cells of the leaves.
It is a slower process of carbon fixation and photorespiratory losses are high.	It is a faster process of carbon fixation and photorespiratory losses are low.

OR

Cyclic photo phosphorylation	Non-cyclic photo phosphorylation
Reaction centre P ₇₀₀ is the electron emitter and also electron acceptor.	Reaction centre P ₆₈₀ is the electron emitter and P ₇₀₀ is the electron acceptor.
It synthesises the only ATP.	It forms both ATP and NADPH ₂ .

Section C

22. In case of Selaginella, the development of zygote into embryo takes place within the female gametophyte. This female gametophyte is retained on the parent plant for variable periods. This is considered as a precursor of seed habit because advanced version of this phenomenon is seen in higher plants; like gymnosperms and angiosperms. But unlike seeds in higher plants; the embryo in Selaginella needs to quickly develop to begin the new generation. However, there could be temporary suspension of embryo growth; which is similar to seed dormancy in higher plants.

23. i. **Difference between Notochord and Nerve cord:**

Notochord	Nerve cord
It is the solid and unjoined rod of vacuolated cells found in chordates. It is dorsal but flexible.	The dorsal tubular nerve cord is mostly differentiated into the brain and spinal cord. It is found in chordates.

- ii. **Difference between Polyp and Medusa:**

Polyp	Medusa
Cylindrical in shape. It remains fixed .	It is umbrella-shaped and is free living .
Sense organs lacking in it.	Eight sense organs present in it.
Gonads absent. Feed and protect the colony.	Four gonads present. Bring about sexual reproduction and the dispersal of species.

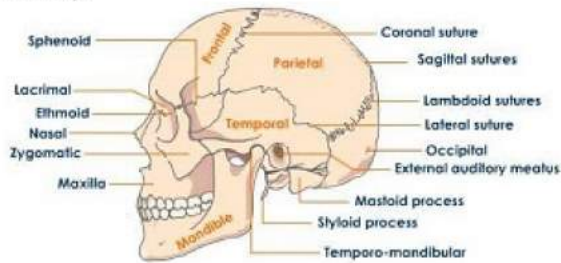
24. The hydrocarbon chains of the two fatty acids function as hydrophobic non-polar tails of the phospholipid molecule. The phosphate and the additional group behave as hydrophilic polar head of the molecule. In the aqueous medium, the phospholipid molecules arrange themselves to form a thin double layer. The polar hydrophilic heads of the molecules form the two surfaces which are in contact with water. The hydrophobic or non-polar tails of the phospholipid molecules are towards the centre of the bilayer.

25. Gibberellins are useful in agriculture in the following ways:

- Application of gibberellins increases the length of the stem and increases the yield of sugar in sugarcane.
- Gibberellins delay senescence and prevent the premature fruits drop.
- It can cause fruits like apple to elongate and improve in shape.

26. The skull is composed of two sets of bones - cranial and facial, that totals to 22 bones. Cranial bones are 8 in number. They form the hard protective outer covering, cranium for the brain. The facial region is made up of 14 skeletal elements which form the front part of the skull. A single U-shaped bone called hyoid is present at the base of the buccal cavity and it is also included in the skull. Each middle ear contains three tiny bones - Malleus, Incus and Stapes, collectively called Ear Ossicles. The skull region articulates with the

superior region of the vertebral column with the help of two occipital condyles (dicondylic skull).



27. Proteins and iron are essential components required for the synthesis of haemoglobin and erythrocytes. Vitamin B₁₂ and folic acid help in their maturation.

The old and worn-out erythrocytes are destroyed by phagocytosis in the blood, liver, and spleen. Their iron content is returned to the bone marrow. The pigment is degraded into bilirubin which is excreted in bile.

OR

Effects of Sympathetic Nerves on Heart: The human heart is myogenic and the impulse of contraction originates itself in the heart. The sympathetic nerve fibres supplying the heart increases the activity of SA-node and thus enhance the cardiac activity.

Effects of Vagus on Heart: It decreases the rate of cardiac impulse formation from the SA-node and thus inhibits the cardiac activity.

28. A neuron is a microscopic structure composed of three major parts, namely, cell body, dendrites and axon.

Cell Body. The cell body contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules.

Dendrites. Short fibres which branch repeatedly and project out of the cell body also contain Nissl's granules and are called dendrites. These fibres transmit impulses towards the cell body.

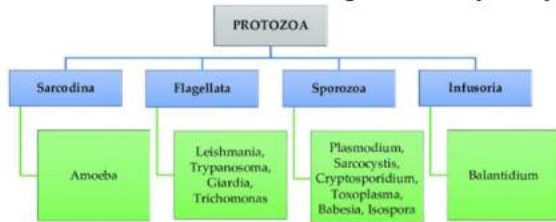
Axon. The axon is a long fibre, the distal end of which is branched. Each branch terminates as a bulb-like structure called synaptic knob which possess synaptic vesicles containing chemicals called neurotransmitters. The axons transmit nerve impulses away from the cell body to a synapse or to a neuro-muscular junction.

Section D

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

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) 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.

OR

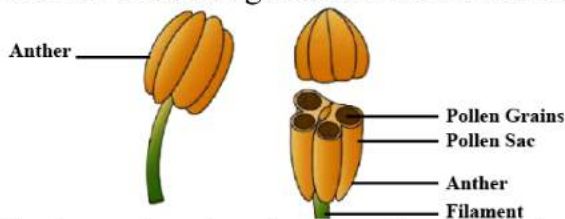
Ciliata has two nuclei, macronucleus, and micronucleus.

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.

- (ii) ■ Locomotion
 ■ Protozoan are eukaryotic having different shapes and sizes. Some are ciliated flagellated or both may be absent.
- (iii) i. Cilia
 ii. Flagella
 iii. Pseudopodia

30. Read the text carefully and answer the questions:

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) 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

- i. The main axis continues to grow.
 ii. The flowers are borne laterally in an acropetal succession.

Section E

31. i. If the nuclear membrane fails to disintegrate, then the spindle fibres would not be able to reach chromosomes. As a result, the chromosomes would not be able to reach the opposite poles of the cell.
- ii. If DNA duplication does not take place, then the cell may not be able to reach the M phase. This will result in the cessation of the cell cycle.
- iii. If the division of centromeres does not take place, then one of the daughter cells will get a complete pair of chromosomes and another daughter cell will get none. This may result in trisomy. Trisomy is a type of the abnormal number of chromosomes, i.e. aneuploidy.
- iv. If cytokinesis does not occur, then a cell with multinucleate condition would be formed.

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. **Electron Transport System (ETS):** The metabolic pathway by which the electrons pass from one carrier to another is known as the **electron transport system**. It is operative in the inner mitochondrial membrane of mitochondria. The electrons from NADH produced in the mitochondrial matrix during the citric acid cycle are oxidised by an **NADH dehydrogenase** (Complex I). Electrons are then transferred to Ubiquinone that receives reducing equivalents via FADH, {generated during oxidation of succinate) by the activity of **Succinic dehydrogenase** (Complex II) in TCA. Reduced ubiquinone is oxidised with the transfer of electrons to cytochrome V via Cytochrome V complex (complex III). Cytochrome V acts as a carrier for transfer of electrons between complex III and complex IV. Complex IV refers to cytochrome c oxidase complex having cytochromes a and α_3 and two copper centres.

OR

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:

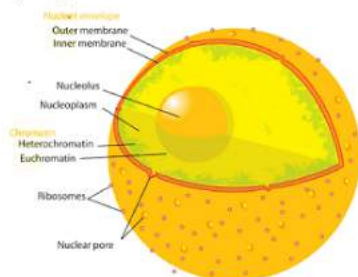
- Respiration involves a sequential and orderly pathway.
- NADH which is synthesized during glycolysis is transferred to mitochondria where it undergoes oxidative phosphorylation.
- None of the other intermediates in the pathway are utilized to synthesize any other compound.
- Only glucose is undergoing 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^+ is slow.	(iii) Oxidation of NADH to NAD^+ is very fast.

33. Nuclear pores are large protein complexes that cross the nuclear envelope, which is the double membrane surrounding the eukaryotic cell nucleus. These are formed by the fusion of its two membranes. These nuclear pores are the passages through which the movement of RNA and protein molecules takes place in both directions between the nucleus and the cytoplasm.



OR

- Facilitates proper segregation of chromosomes.
- It provides structural rigidity to the plant cells. Plants cells need to be rigid because they cannot run for safety in case of any natural stress; unlike animals.
- Smooth ER facilitates the synthesis of lipids, metabolism of carbohydrates, regulation of calcium concentration and drug detoxification.
- Golgi apparatus is involved in the packaging of various substances that are manufactured in the endoplasmic reticulum.
- They form the basal bodies of cilia and flagella and thus play an important role in the motility of certain cells. They also play an important role in cell division by forming asters. The aster as spindle pole during cell division.