5 The Fundamental Unit of Life

Fastrack Revision

- **Cell:** All living beings are composed of the basic functional unit of life *i.e.*, cell. So, a cell is the structural and functional unit of living organisms.
- **Discovery of Cell:** In 1665, Robert Hooke first discovered and introduced the term cell. Later in 1831, Robert Brown discovered the nucleus of the cell. In 1855, Virchow expanded the cell theory by suggesting that all cells arise from pre-existing cells.

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The egg of an ostrich is the largest known cell of a living animal and an average egg is 15 cm long and 13 cm wide.

- Organisms made of only one cell are called unicellular organisms, *e.g.*, *Amoeba*, *Chlamydomonas*, *Paramoecium* and bacteria.
- Organisms in which many cells group together to perform different functions of the body are called multicellular organisms, *e.g.*, some fungi, plants and animals.
- **Shape and Size of a Cell**
  - The shape and size of the cells are related to the specific function they perform.
  - The shape of the cell may be variable (*i.e.*, frequently changing its shape) or fixed and peculiar for a particular type of cell.
  - Variable shape occurs in *Amoeba* while fixed shape of cell occurs in most plants and animals.
  - Cells can be spherical, spindle-shaped, elongated or branched in nature.
- **Structure of a Cell:** Some of the main structures of a cell are plasma membrane, nucleus and cytoplasm.
- **Plasma Membrane:** It is the outermost layer of the cell that separates the contents of the cell from its external environment and is made up of lipids and proteins.
- **Functions of Plasma Membrane**
  - Its semipermeable nature allows or permits the entry and exit of some materials in and out of the cell.
  - It acts as a mechanical barrier and protects the internal contents of the cell from leaking out.
- **Diffusion:** It is the spontaneous movement of a substance from a region of higher concentration to a region of lower concentration. It plays an important role in gaseous exchange between the cells as well as the cell and its external environment.
- **Osmosis:** It is the flow of water molecules from higher to lower concentration through a selectively permeable membrane, *e.g.*, absorption of water by plant roots.

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Osmosis is the net diffusion of water across a selectively permeable membrane towards a higher solute concentration.

- **Osmosis in Different Types of Solution**
  - The medium surrounding the cell is **hypotonic**, if it has higher water concentration than the cell. The cell will gain water by osmosis. Water crosses the cell membrane in both directions, but more water will come into the cell than will leave. The cell is likely to swell up.
  - The medium surrounding the cell is **isotonic**, if it has same water concentration as the cell. Water crosses the cell membrane in both directions, but the amount going in is the same as the amount going out, so there is no overall movement of water. The cell will stay the same size.
  - The medium surrounding the cell is **hypertonic**, if it has lower water concentration than the cell. The cell will lose water by osmosis. Water crosses the cell membrane in both directions, but more water leaves the cell than enters it. Therefore, the cell will shrink.
- **Endocytosis:** It is the property of a cell that enables it to engulf in food and other material from its external environment. *Amoeba* acquires its food through endocytosis.

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Diffusion helps in gaseous exchange between the cells and to obtain nutrition from the environment.

- **Cell Wall:** It is a tough, rigid, non-living covering outside the plasma membrane. It is made up of cellulose and provides structural strength to plants.
- **Functions of Cell Wall**
  - It permits the cells of the plants, fungi and bacteria to withstand very dilute external media without bursting.
  - It protects the plasma membrane and prevents desiccation of dryness in cells.
- **Nucleus:** The nucleus is a pivotal organelle responsible for regulating almost all forms of cellular activities. It has a double-layered covering called **nuclear membrane**. The nuclear membrane has pores which allow the transfer of material from inside the nucleus to its outside *i.e.*, to the cytoplasm. The nucleus contains chromosomes (composed of DNA and protein), which contains information for inheritance of characters from parents to next generation in the form of DNA (Deoxyribo Nucleic Acid) molecules.

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- *Functional segments of DNA are called genes.*
- *DNA molecules contain the information necessary for constructing and organising cells.*

- **Types of a Cell:** Cells can be of two types:
  - **Prokaryotic Cell:** Such cells are primitive cells and they lack nucleus. Prokaryotes are unicellular organisms, *e.g.*, blue-green algae, bacteria, etc.

- **Eukaryotic Cell:** Such cells are advanced and complete cells containing a nucleus. Eukaryotes include all living organisms whether they are unicellular or multicellular, *e.g.*, fungi, plants and animals.

- **Functions of Nucleus**
  - It plays a crucial role in determining the way the cell will develop and what form it will exhibit at maturity, by directing the chemical activities of the cell.
  - It helps in the transmission of hereditary traits from parents to offsprings.
  - It plays a crucial role in cellular reproduction.
  - It controls all metabolic activities of a cell.
- **Cytoplasm:** It is the fluid content inside the plasma membrane. It contains many specialised cell organelles, which performs a specific function for the cell.

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Nucleoid is an undefined nuclear region in organisms like bacteria that contains only nucleic acids.

- **Functions of Cytoplasm**
  - It acts as a storehouse of molecules such as amino acid, glucose, vitamin, etc.
  - It acts as the site for certain metabolic pathways such as glycolysis, etc.
- **Cell Organelles:** These are membrane-bound structures that perform very crucial functions in cells. Some important cell organelles are endoplasmic reticulum, golgi apparatus, lysosomes, mitochondria, plastids and vacuoles.
- **Endoplasmic Reticulum (ER):** It is a large network of membrane-bound tubes and sheets similar in structure to the plasma membrane. It is of two types—Rough Endoplasmic Reticulum (RER) and Smooth Endoplasmic Reticulum (SER).
- RER has ribosomes (sites of protein manufacture) attached to its surface, hence, it appears to be rough.
- **Functions of Endoplasmic Reticulum**
  - SER helps in the manufacture of fat molecules or lipids.
  - ER helps in the transport of materials (especially proteins) between various regions of the cytoplasm or between the cytoplasm and the nucleus.
  - ER also functions as a cytoplasmic framework providing a surface for some of the biological activities of the cell.
  - SER plays a major role in detoxification of poisons and drugs in liver cells of vertebrates.

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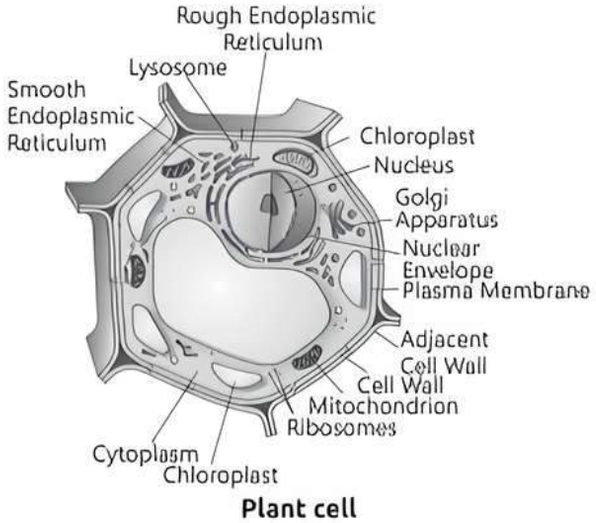
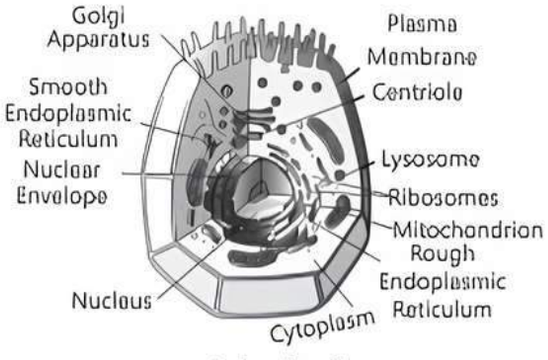
Membrane biogenesis is a process of building the cell membrane with the aid of proteins and lipids.

- **Golgi Apparatus:** It is a network of membrane-bound vesicles called **cisterns**, arranged parallel to each other in stacks.
- **Functions of Golgi Apparatus**
  - It carries out the storage, modification and packaging of substances in the vesicles.
  - It is helpful in the formation of lysosomes.
  - It also helps in the manufacture of complex sugars from simple sugars.
- **Lysosomes:** These are membrane-bound sacs filled with digestive enzymes (made by RER).
- **Functions of Lysosomes**
  - They help in digestion of foreign substances and disposal of worn-out cell organelles.
  - They provide protection against bacteria and virus and help to keep the cell clean.
  - During the disturbance in cellular metabolism, *e.g.*, when the cell gets damaged, lysosomes burst and the enzymes digest their own cell so, they are called **suicide bags of a cell**.
- **Mitochondria:** These are small rod-shaped organelles. It is a double membrane structure where outer membrane is smooth whereas inner membrane is deeply folded, which creates a large surface area for ATP-generating chemical reactions. It contains its own DNA and ribosomes.
- **Functions of Mitochondria**
  - They provide energy required for various chemical activities needed for life.
  - The body uses energy stored in ATP (Adenosine Triphosphate) for making new chemical compounds and for mechanical work. Hence, ATP is known as **energy currency of the cell** and mitochondria as the **powerhouse of the cell**.



Plant cell



Animal cell

- **Plastids:** These are double membrane-bound organelles present in most of the plant cells and absent in animal cells. Plastids are of three types:
  - **Chloroplasts:** Green-coloured plastids containing chlorophyll. They manufacture food by photosynthesis and are called **kitchen of cells**.
  - **Chromoplasts:** They are colourful plastids that provide colour to flowers and fruits.
  - **Leucoplasts:** These are colourless plastids which help in the storage of substances like starch, proteins and oils.

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Plastids also have their own DNA and ribosomes

- **Vacuoles:** These are the storage sacs for solid or liquid contents. They are large and permanent in plant cells whereas small-sized and temporary in animal cells. They are bounded by a membrane called as **tonoplast**.

▶ **Functions of Vacuoles**

- They are full of cell sap and provide turgidity and rigidity to the cell in plants.
- They play an important role in expelling excess water and some wastes from the cell in some of the unicellular organisms.
- Amino acids, sugars, various organic acids and some proteins are stored in vacuoles of plant cell.
- In *Amoeba*, food vacuole contains the food items that the *Amoeba* has consumed.

▶ **Cell Division :** It is the process of formation of new cells in organisms required for growth and reproduction. It helps to replace old, dead and injured cells as well as to form gametes.

▶ **Mitosis** and **Meiosis** are two main types of cell divisions:

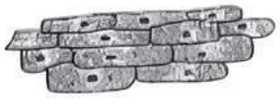
- **Mitosis:** It is the process in which a mother cell splits into two daughter cells each having the same number of chromosomes as in mother cell. It helps in growth and repair of tissues in organisms.
- **Meiosis:** It is a two-step process in which a mother cell splits to form four daughter cells with half the number of chromosomes in comparison to mother cell. It is responsible for formation of gametes (in animals and plants), which after fertilisation give rise to off spring.

Practice Exercise

Multiple Choice Questions

Q 1. Tanya prepared a temporary mount of onion peel and observed it under a microscope. Her teacher asked her to draw the diagram. Select the correct diagram of the cells found in onion peel.

a. 

b. 

c. 

d. 

Q 2. Living cells were discovered by: *(NCERT EXEMPLAR)*

a. Robert Hooke b. Purkinje
c. Leeuwenhoek d. Robert Brown

Q 3. Who discovered the nucleus of the cell?

a. Robert Hooke b. Robert Brown
c. Leeuwenhoek d. Purkinje

Q 4. Cell arises from pre-existing cell was stated by: *(NCERT EXEMPLAR)*

a. Haeckel b. Virchow
c. Robert Hooke d. Schleiden

Q 5. Who coined the term protoplasm?

a. Virchow b. Leeuwenhoek
c. Purkinje d. Robert Hooke

Q 6. Cell theory was given by: *(NCERT EXEMPLAR)*

a. Schleiden and Schwann b. Virchow
c. Robert Hooke d. Haeckel

Q 7. Select the correct pair that comprises of only unicellular organisms.

a. *Amoeba* and *Rhizopus*
b. *Paramoecium* and *Chlamydomonas*
c. Bacteria and fungi
d. Plants and animals

Q 8. Following are a few definitions of osmosis: Read carefully and select the correct definition. *(NCERT EXEMPLAR)*

a. Movement of water molecules from a region of higher concentration to a region of lower concentration through a semipermeable membrane.
b. Movement of solvent molecules from its higher concentration to lower concentration.
c. Movement of solvent molecules from higher concentration to lower concentration of solution through a permeable membrane.
d. Movement of solute molecules from lower concentration to higher concentration of solution through a semipermeable membrane.

Q 9. A cell will swell up if: *(NCERT EXEMPLAR)*

a. the concentration of water molecules in the cell is higher than the concentration of water molecules in surrounding medium.
b. the concentration of water molecules in surrounding medium is higher than water molecules concentration in the cell
c. the concentration of water molecules is same in the cell and in the surrounding medium.
d. concentration of water molecules does not matter.

Q 10. Root hair absorbs water from soil through:

a. osmosis b. active transport
c. diffusion d. endocytosis

Q 11. A cell loses water by osmosis when kept in a solution having a lower concentration of water than the cell. The given solution is:

a. hypertonic b. hypotonic
c. isotonic d. None of these

Q 12. *Amoeba* acquires its food through a process, termed: *(NCERT EXEMPLAR)*

a. exocytosis
b. endocytosis
c. plasmolysis
d. Both a. and b.

Q 13. Plasmolysis in a plant cell is defined as: *(NCERT EXEMPLAR)*

a. breakdown (lysis) of plasma membrane in hypotonic medium
b. shrinkage of cytoplasm in hypertonic medium
c. shrinkage of nucleoplasm
d. None of the above

Q 14. Which of the following are the main constituents of cell wall?

a. Cellulose b. Pectin c. Starch d. Protein

Q 15. A plant cell placed in a hypotonic solution will not burst because of presence of: *(NCERT EXEMPLAR)*

a. chloroplast b. plasma membrane
c. cytoplasm d. cell wall

Q 16. Select the correct statement(s) regarding nucleus.

(i) It has a double-layered covering.
(ii) It contains chromosomes.
(iii) It helps in the manufacture of lipids.
(iv) It plays a central role in cellular reproduction.

a. Only (iii) b. (i) and (ii)
c. (ii) and (iv) d. (i), (ii) and (iv)

Q 17. Chromosomes are made up of: *(NCERT EXEMPLAR)*

a. DNA b. protein
c. DNA and protein d. RNA

Q 18. The undefined nuclear region of prokaryotes are also known as: *(NCERT EXEMPLAR)*

a. nucleus b. nucleolus
c. nucleic acid d. nucleoid

Q 19. The only cell organelle seen in prokaryotic cell is: *(NCERT EXEMPLAR)*

a. mitochondria b. ribosomes
c. plastids d. lysosomes

Q 20. Which of these is not related to endoplasmic reticulum? *(NCERT EXEMPLAR)*

a. It behaves as transport channel for proteins between nucleus and cytoplasm.
b. It transports materials between various regions in cytoplasm.
c. It can be the site of energy generation.
d. It can be the site for some biochemical activities of the cell.

Q 21. Which organelle plays a crucial role in detoxifying many poisons and drugs in a cell? *(NCERT EXEMPLAR)*

a. Golgi apparatus
b. Lysosome
c. Smooth Endoplasmic Reticulum
d. Vacuoles

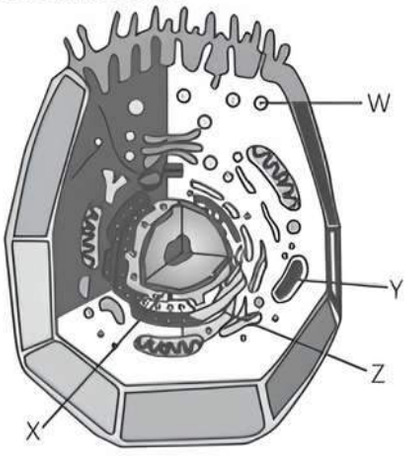
Q 22. Find out the correct sentence. *(NCERT EXEMPLAR)*

a. Enzymes packed in lysosomes are made through RER (Rough Endoplasmic Reticulum).
b. Rough endoplasmic reticulum and smooth endoplasmic reticulum produce lipid and protein respectively.
c. Endoplasmic reticulum is related with the destruction of plasma membrane.
d. Nucleoid is present inside the nucleoplasm of eukaryotic nucleus.

Q 23. Which of the following is an incorrect statement?

a. Lysosomes are formed by Golgi apparatus.
b. Mitochondria and plastids have their own DNA.
c. ATP is generated in the mitochondria of a cell.
d. When the cell divides, its chromosomes get organised into chromatin material.

Q 24. Refer to the given figure of an animal cell. Select the incorrect statement regarding part 'X' in the given figure of animal cell.



a. It determines cell development.
b. It is a non-membranous cellular organelle.
c. It is not well-defined in prokaryotic cells.
d. It helps in transmission of hereditary traits from parents to offsprings.

Q 25. Which of these options are not a function of ribosomes? *(NCERT EXEMPLAR)*

(i) It helps in manufacture of protein molecules.
(ii) It helps in manufacture of enzymes.
(iii) It helps in manufacture of hormones.
(iv) It helps in manufacture of starch molecules.

a. (i) and (ii) b. (ii) and (iii)
c. (iii) and (iv) d. (iv) and (i)

Q 26. The cell organelle involved in forming complex sugars from simple sugars are: *(NCERT EXEMPLAR)*

a. endoplasmic reticulum b. ribosomes
c. plastids d. Golgi apparatus

Q 27. Silver nitrate solution is used to study: *(NCERT EXEMPLAR)*

a. endoplasmic reticulum b. Golgi apparatus
c. nucleus d. mitochondria

Q 28. Which of the following is called powerhouse of cell?

a. Lysosome b. Nucleus
c. Mitochondrion d. Golgi body

Q 29. DNA is not present in:

a. plastids b. mitochondria
c. nucleus d. ribosome

Q 30. Organelle other than nucleus, containing DNA is: *(NCERT EXEMPLAR)*

a. endoplasmic reticulum b. Golgi apparatus
c. mitochondria d. Lysosome

Q 31. Kitchen of the cell is: *(NCERT EXEMPLAR)*

a. mitochondria b. endoplasmic reticulum
c. chloroplast d. Golgi apparatus

Q 32. Which of the following cell organelle is called suicidal bag of cell?

a. Mitochondria b. Lysosome
c. Golgi body d. Cytoplasm

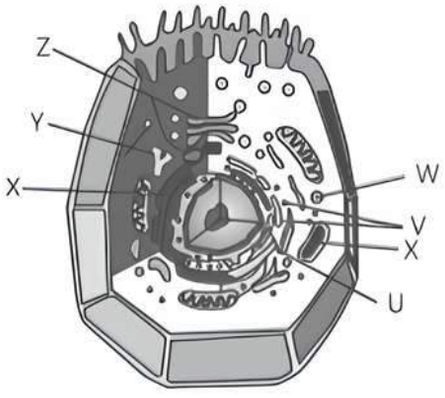
Q 33. Double membrane is absent in:

a. mitochondrion b. chloroplast
c. nucleus d. lysosome

Q 34. Find out the false sentence. *(NCERT EXEMPLAR)*

a. Golgi apparatus is involved with the formation of lysosomes.
b. Nucleus, mitochondria and plastid have DNA; hence, they are able to make their own structural proteins.
c. Mitochondria is said to be the powerhouse of the cell as ATP is generated in them.
d. Cytoplasm is called as protoplasm.

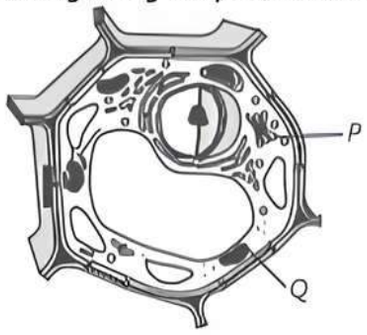
Q 35. Refer to the given figure and select the incorrect statement(s) regarding the given figure.



(i) Part *U* looks rough because of part *V*.
(ii) Part *X* is double membranous whose inner membrane is deeply infolded to create large surface area for chemical reactions.
(iii) Part *Y* functions include the storage and packaging of products.
(iv) Part *Z* often have connections with the membranes of ER.

a. (iii) and (iv) b. (i) and (iv)
c. (i), (iii) and (iv) d. Only (iii)

Q 36. Given is the figure of a plant cell. Select the correct statement regarding the parts marked as *P* and *Q*.

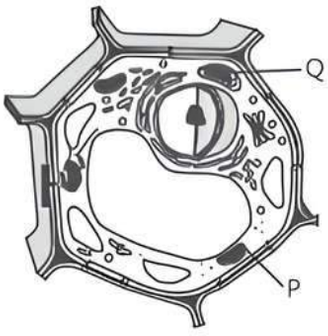


a. Both *P* and *Q* serve as the storage units of a cell.
b. *Q* can synthesize their own proteins.
c. Both *P* and *Q* have their own ribosomes.
d. Both *P* and *Q* are found in prokaryotic as well as eukaryotic cells.

Q 37. Which of the cell organelles consists of chloroplast?

a. Plastids b. Mitochondria
c. Vacuoles d. Cell wall

Q 38. In the given figure, showing the ultrastructure of a plant cell, identify the parts marked as *P* and *Q* and select the correct statements regarding the labelled parts.



(i) Part *P* is exclusively present only in plant cells.
(ii) ATP is produced in part *Q*.
(iii) Part *P* provides extra strength to a plant cell.
(iv) Part *Q* contains hereditary information of the cell.

a. (i) and (ii) b. (iii) and (iv)
c. Only (iii) d. (i) and (iii)

Q 39. Which out of the following is not a function of vacuole? *(NCERT EXEMPLAR)*

a. Storage
b. Providing turgidity and rigidity to the cell
c. Waste excretion
d. Locomotion

Q 40. Which of the following are covered by a single membrane? *(NCERT EXEMPLAR)*

a. Mitochondria b. Vacuole
c. Lysosome d. Plastid

Q 41. In ..... type of cell division, the produced daughter cells have half the chromosomes as the original cell.

a. mitosis b. meiosis
c. somatic d. None of these

Assertion & Reason Type Questions

Directions (Q. Nos. 42-52): *Each of the following questions consists of two statements, one is Assertion (A) and the other is Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.*

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
c. Assertion (A) is true but Reason (R) is false.
d. Assertion (A) is false but Reason (R) is true.

Q 42. Assertion (A): Cell is called the structural and functional unit of life.

Reason (R): It performs functions like respiration, obtaining nutrition, clearing of waste material, or forming new proteins.

Q 43. **Assertion (A):** Plasma membrane allows the entry or exit of selected materials in and out from the cell.
Reason (R): Plasma membrane is a living membrane and is selectively permeable in nature.

Q 44. **Assertion (A):** A cell swells up when present in a hypotonic solution.
Reason (R): More water molecules enter the cell than they leave.

Q 45. **Assertion (A):** Chromosomes are visible under a microscope when the cell is about to divide.
Reason (R): In a cell which is not dividing, DNA is present as a part of chromatin material.

Q 46. **Assertion (A):** The cells that have membrane bound organelles are called eukaryotic.
Reason (R): The cells that lack membrane bound organelles are called prokaryotic.

Q 47. **Assertion (A):** The endoplasmic reticulum which lacks ribosomes is called Smooth Endoplasmic Reticulum (SER).
Reason (R): SER is mainly involved in protein synthesis.

Q 48. **Assertion (A):** Digestive enzymes present in lysosome are very powerful and can breakdown all types of organic materials.
Reason (R): These enzymes are made by RER.

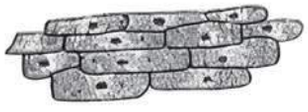
Q 49. **Assertion (A):** Mitochondria is known as the powerhouse of the cell.
Reason (R): Mitochondria synthesises energy in the form of ATP during respiration which is vital for various life activities.

Q 50. **Assertion (A):** Leucoplasts contain various yellow or orange pigments.
Reason (R): Leucoplasts store fats, starch and proteins.

Q 51. **Assertion (A):** Plant cells have very large vacuoles.
Reason (R): In plants cells, vacuoles are full of cell sap.

Q 52. **Assertion (A):** *Amoeba* acquires its food through endocytosis.
Reason (R): *Amoeba* captures the food within a sac-like structure called the food vacuole inside which digestion of food takes place.

Answers

1. (b)

2. (c) Leeuwenhoek
3. (b) Robert Brown
4. (b) Virchow
5. (c) Purkinje
6. (a) Schleiden and Schwann
7. (b) *Paramoecium* and *Chlamydomonas*
8. (a) Movement of water molecules from a region of higher concentration to a region of lower concentration through a semipermeable membrane.
9. (b) the concentration of water molecules in surrounding medium is higher than water molecules concentration in the cell.
10. (a) osmosis
11. (a) hypertonic
12. (b) endocytosis
13. (b) shrinkage of cytoplasm in hypertonic medium
14. (a) Cellulose
15. (d) cell wall
16. (d) (i), (ii) and (iv)
    SER helps in the manufacture of lipids.
17. (c) DNA and protein
18. (d) Nucleoid
19. (b) ribosomes
20. (c) It can be the site of energy generation.
    Mitochondria is the site of energy generation.
21. (c) Smooth Endoplasmic Reticulum
22. (a) Enzymes packed in lysosomes are made through RER (Rough Endoplasmic Reticulum)
    RER and SER produce protein and lipid respectively.
    Endoplasmic reticulum is related with the formation of plasma membrane.
    Nucleoid refers to the undefined nuclear material of prokaryotes.
23. (d) When the cell divides, its chromosomes get organised into chromatin material.
    Whenever the cell is about to divide, the chromatin material gets organised into rod-shaped structures called chromosomes.
24. (b) It is a non-membranous cellular organelle.
    X represents nucleus of a cell. *X* has a double layered covering called nuclear membrane.
25. (c) (iii) and (iv)
    The ribosomes are the sites of protein manufacture and digestive enzymes.
26. (d) Golgi apparatus
27. (b) Golgi apparatus
28. (c) Mitochondrion
29. (d) ribosome
    Nucleus contains chromosomes, which are composed of DNA and protein.
30. (c) mitochondria
    Mitochondria and plastids have their own DNA.
31. (c) chloroplast
32. (b) Lysosome
33. (d) lysosome
34. (d) Cytoplasm is called as protoplasm.
    Cytoplasm is a part of protoplasm of the cell.
35. (d) Only (iii)
    Here, *U*, *V*, *X*, *Y*, *Z* represent RER, ribosomes, mitochondria, SER and Golgi apparatus respectively. Part *Z*, *i.e.*, Golgi apparatus functions include storage and packaging of products.
36. (b) *Q* can synthesize their own proteins.
    P and *Q* represents Golgi apparatus and mitochondria respectively. The main function of Golgi apparatus includes the storage, modification and packaging of secretory products in vesicles.

It is not found in prokaryotic cells. Mitochondria are semi-autonomous organelles, in the sense that they have their own DNA and ribosomes and thus, are able to make some of their own proteins. Mitochondria are also absent in prokaryotic cells like Golgi apparatus.

37. (a) Plastids
38. (d) (I) and (iii)

Here, *P* represents cell wall which is present only in plant cells, fungi and bacteria that provides structural strength to the plants. *Q* represents chloroplasts which are the sites of photosynthesis in plants. Whereas ATP is generated in mitochondria and nucleus have the hereditary information that pass from generation to next generation.

39. (d) Locomotion
40. (b) Vacuole
41. (b) melosis
42. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
43. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
44. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
45. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
46. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
47. (c) Reason (R) is false because SER helps in the manufacture of fat molecules or lipids.
48. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
49. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
50. (d) Assertion (A) is false because leucoplasts are white or colourless cell organelle found in plant cells.
51. (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
52. (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

Case Study Based Questions

Case Study 1

Diffusion is the process of movement of molecules under a concentration gradient. It is an important process occurring in all living beings. Diffusion helps in the movement of substances in and out of the cells. The molecules move from a region of higher concentration to a region of lower concentration until the concentration becomes equal throughout.

Read the given passage carefully and give the answer of the following questions:

Q 1. Name the process which is useful for the movement of substances like CO_2 and O_2 across the plasma membrane.

a. Osmosis b. Diffusion
c. Endocytosis d. Plasmolysis

Q 2. Osmosis is the diffusion of:

a. Water b. Free energy
c. Solute and solvent d. None of these

Q 3. Diffusion finally stops when:

a. concentration of particles of one region becomes higher than the other.
b. concentration of particles of one region becomes lower than the other.
c. concentration of particles of two regions becomes the same.
d. None of the above

Q 4. Which of the following statement defines hypertonic solutions?

a. A solution that has a lesser concentration of solutes on the outside of a cell when compared with the inside of a cell
b. A solution that has a greater concentration of solutes on the outside of a cell when compared with the inside of a cell
c. A solution that has same concentration of solutes on the outside of a cell when compared with the inside of a cell
d. None of the above

Q 5. If the two solutions have same concentrations, they are said to be:

a. Isotonic b. Hypertonic
c. Hypotonic d. Dilute

Answers

1. (b) Diffusion
2. (a) Water
3. (c) concentration of particles of two regions becomes the same
4. (b) A solution that has a greater concentration of solutes on the outside of a cell when compared with the inside of a cell
5. (a) Isotonic

Case Study 2

The nucleus is a membrane-bound organelle found in eukaryotic cells. It is found in the middle of the cells, and it contains DNA arranged in chromosomes. It is surrounded by the nuclear envelope, a double nuclear membrane, which separates the nucleus from the cytoplasm. The outer membrane is continuous with the rough endoplasmic reticulum. The nuclear envelope contains pores which control the movement of substances in and out of the nucleus.

Read the given passage carefully and give the answer of the following questions:

Q 1. Nucleus was discovered by:

a. Leeuwenhoek b. Purkinje
c. Robert Brown d. Robert Hooke

Q 2. Which part of the cell helps the transfer of material from the nucleus to the cytoplasm?

a. Nuclear pores b. DNA
c. Chromatin material d. None of these

Q 3. What is the function of nucleus of a cell?

a. It controls all the metabolic activities of the cell.
b. It bring about growth of the cell by directing the chemical activities of the cell.
c. It controls the heredity characteristics of an organism.
d. All of the above

Q 4. Which of the following statement is true about chromosomes?

a. It is present within the nucleus.
b. It carries genes and helps in inheritance.
c. They are visible as rod-shapes structures only when the cell is about to divide.
d. All of the above

Q 5. The main difference between eukaryotes and prokaryotes is:

a. eukaryotes have nucleoid and prokaryotes have nucleus.
b. eukaryotes have nucleus and prokaryotes have nucleoid.
c. eukaryotes do not have membrane-bound cell organelles while prokaryotes have membrane bound cell organelles.
d. eukaryotes are unicellular and prokaryotes are multicellular.

Answers

1. (c) Robert Brown
2. (a) Nuclear pores
3. (d) All of the above
4. (d) All of the above
5. (b) eukaryotes have nucleus and prokaryotes have nucleoid.

Case Study 3

A cell is the basic structural and functional unit of a living organism, which makes anything alive and is self-sufficient to carry out all the fundamental functions of an organism. A small organ-like structure present inside the cell is called a cell organelle. It has a particular structural makeup and performs a specific function. They coordinate and function efficiently for the normal functioning of the cell. A few of them function by providing shape and support, whereas some are involved in the locomotion and reproduction of a cell.

Read the given passage carefully and give the answer of the following questions:

Q 1. Organelles that are surrounded by two membranes are:

a. nucleus and mitochondria
b. nucleus and Golgi bodies
c. endoplasmic reticulum and lysosomes
d. endoplasmic reticulum and mitochondria

Q 2. The organelles that are present in eukaryotes but not in prokaryotes is/are:

a. Golgi apparatus b. vacuoles
c. ribosome d. Both a. and b.

Q 3. From the following, an organelle with ribosomes attached to its surface is:

a. chloroplast
b. rough endoplasmic reticulum
c. smooth endoplasmic reticulum
d. mitochondria

Q 4. Select the incorrect statement regarding cell organelles.

a. Lysosomes are a kind of waste disposal system of the cell.
b. Mitochondria and chloroplast are similar in external structure.
c. Vacuoles are small-sized in animal cells, while plant cells have very large vacuoles.
d. SER is involved in storage, modification and packaging of products in vesicles.

Q 5. Match the columns and select the correct option.

Column I	Column II
A. Lysosomes	(i) Powerhouses of the cell
B. Chloroplasts	(ii) Storage of amino acids, sugars, etc.
C. Vacuoles	(iii) Suicide bags of cell
D. Mitochondria	(iv) Kitchen of the cell

a. A-(iv), B-(iii), C-(ii), D-(i)
b. A-(iii), B-(i), C-(ii), D-(iv)
c. A-(iii), B-(iv), C-(ii), D-(i)
d. A-(iv), B-(ii), C-(i), D-(iii)

Answers

1. (a) nucleus and mitochondria
2. (d) Both a. and b.
3. (b) rough endoplasmic reticulum
4. (d) SER is involved in storage, modification and packaging of products in vesicles.
5. (c) A-(iii), B-(iv), C-(ii), D-(i)

Case Study 4

Rohan carried out the following osmosis experiment:

He took four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato.

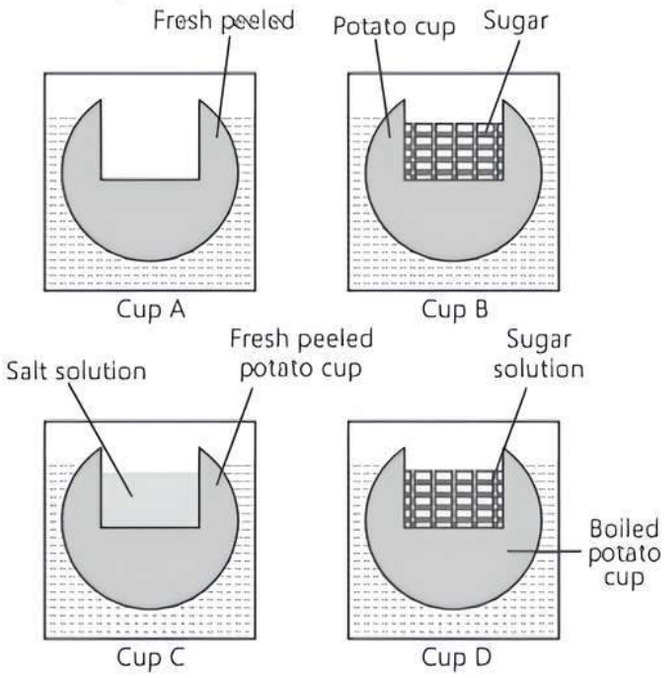
Put each potato cup in a trough containing water. Now,

(i) keep cup A empty.

(ii) put one teaspoon sugar in cup B.

(iii) put one teaspoon salt in cup C.

(iv) put one teaspoon sugar in the boiled potato cup D.



Keep these for two hours and then observe the four potato cups.

Read the given passage carefully and give the answer of the following questions:

Q 1. Explain why water gathers in the hollowed portion of *B* and *C*.

Q 2. Why is potato *A* necessary for this experiment?

Q 3. Explain why water does not gather in the hollowed-out portions of *A* and *D*.

Q 4. Write down two differences between diffusion and osmosis?

Q 5. State two conditions required for osmosis.

Answers

1. Since, sugar and salt was present in *B* and *C* respectively, water from the trough gathered in the hollowed portions of potato in *B* and *C* by the process of osmosis through the semipermeable membrane of potato.

2. Potato *A* is necessary for carrying out this experiment because it helps us to check what changes occurred during the course of the experiment and helps us to compare the results.

3. Water does not gather in the hollowed portion of potato *A* as it was empty. Water also does not gather in the cup *D* because the potato used was boiled and has lost its semipermeable membrane.

4. Differences between Diffusion and Osmosis:

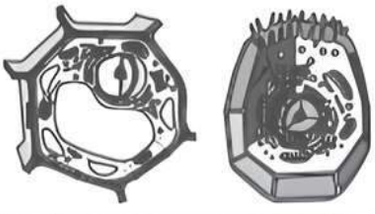
Diffusion	Osmosis
It can occurs in any medium.	It occurs only in liquid medium.
The diffusing molecules may be solids, liquids or gases.	It involves the movement of solvent molecules only.
Semipermeable membrane is not required.	Semipermeable membrane is required.

(Any two)

5. Conditions for osmosis are:
   (i) There should be two solutions of different concentrations.
   (ii) The membrane separating these two solutions should be semipermeable.

Case Study 5

Plants and animals are made up of millions of cells and these cells have several similarities and differences. Structurally, plant and animal cells are very similar because they are both eukaryotic cells. They both contain membrane-bound organelles such as the nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, and vacuoles.



Read the given passage carefully and give the answer of the following questions:

Q 1. Create a Venn diagram to compare the structure of plant and animal cells.

Q 2. What will happen, if we put a plant and animal cell in an isotonic solution?

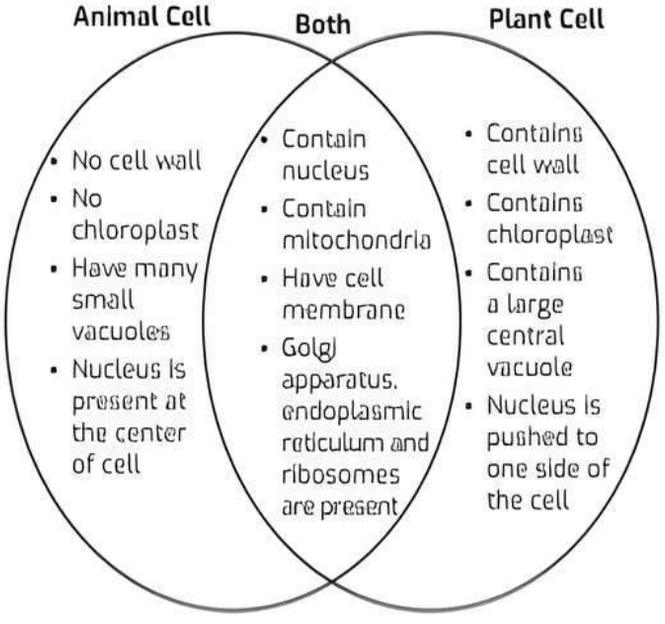
Q 3. Write the functions of cell wall in plant cell.

Q 4. Name the largest animal cell.

Q 5. Name two organisms (other than plants) with cell wall.

Answers

1.



2. If plant and animal cells are kept in isotonic solutions then cells will not swell or shrink. Hence, there will not be any change in cells.
3. Cell wall permits the cells of plants to withstand very dilute (hypotonic) external media without bursting. Also, plant cells can withstand much greater changes in the surrounding medium because of cell wall.
4. Largest animal cell is ostrich egg.
5. Fungi and bacteria.

Very Short Answer Type Questions

Q 1. Who discovered cells and how? *(NCERT INTEXT)*

Ans. Cells were first discovered by Robert Hooke in 1665, while examining a thin slice of cork with the help of a primitive microscope.

Q 2. Which of the following organisms lack a nuclear membrane? *Chlamydomonas*, mosquito, butterfly, snake, *Paramecium*.

Ans. *Chlamydomonas* and *Paramecium*.

Q 3. 'Every multicellular organism has arisen from a single cell'. Justify this statement.

Ans. Each cell divides to produce cells of its own kind. Since, all cells arise from the pre-existing cells, thus, it can be said that every multicellular organism has arisen from a single cell.

Q 4. Name three functional regions of a cell.

Ans. Plasma membrane, cytoplasm and nucleus.

Q 5. What is osmosis? *(NCERT EXERCISE)*

Ans. It is the movement of water molecules from a region of high water concentration to a region of low water concentration through a selectively permeable membrane.

Q 6. How does an *Amoeba* obtain its food? *(NCERT EXERCISE)*

Ans. *Amoeba* obtains its food by the process of endocytosis. In this process, the cell engulfs the food and other materials from its external environment due to the flexibility of the cell membrane.

Q 7. Why do egg shells dissolve in dilute hydrochloric acid?

Ans. Egg shells are made of calcium carbonate which reacts with HCl and forms soluble calcium chloride.

Q 8. Name the process by which unicellular freshwater organisms and most of the plant cells tend to gain water.

Ans. Osmosis is the process by which unicellular organisms and most of the plant cells gain water.

Q 9. What would happen if the plasma membrane ruptures or breaks down? *(NCERT EXERCISE)*

Ans. Rupture or breakdown of plasma membrane would result in the exposure of cell component to the external environment and would ultimately result in cell death.

Q 10. What is the function of cellulose in plant cell?

Ans. Cellulose is a complex substance that provides structural strength to the plants.

Q 11. When a living plant cell loses water through osmosis, there is contraction of contents of the cell away from the cell wall. What is this phenomenon called?

Ans. This phenomenon is called plasmolysis.

Knowledge BOOSTER

Plasmolysis leads to shrinkage or contraction of the protoplasm of a plant cell due to loss of water from the cell.

Q 12. Why is the nucleus called the director of the cell?

Ans. The nucleus controls and coordinates all the metabolic functions of the cell. So, it is called the director of the cell.

Q 13. What is DNA? Where is it present?

Ans. DNA is Deoxyribo Nucleic Acid. It holds the genetic information of all living organisms and is located in the nucleus.

Q 14. When do chromatin fibres organise themselves into chromosomes?

Ans. Chromatin fibres organise themselves into chromosomes when the cell is about to divide.

Q 15. How is a bacterial cell different from an onion peel cell?

Ans. Bacterial cells are prokaryotic cells and do not possess membrane-bound organelles, whereas onion peel cell is an eukaryotic cell with a well defined nucleus and membrane-bound organelles.

Q 16. Name the site organelle where proteins are synthesised in a cell.

Ans. Ribosomes are the organelles where proteins are synthesised in a cell.

Q 17. What would happen to the life of a cell if there was no Golgi apparatus? *(NCERT EXERCISE)*

Ans. If there was no Golgi apparatus in the cell, lysosomes would not be formed. This will cause accumulation of worn-out cell organelles within the cell, which may cause cell death.

Q 18. Name the organelle of the cell which has a membrane-bound sac filled with powerful digestive enzymes. Write its any one function in the cells.

Ans. Lysosome has membrane-bound sacs filled with powerful digestive enzymes.

Function: They help to keep the cell clean by digesting any foreign material.

Q 19. Which organelle is known as the powerhouse of the cell? Why? *(NCERT EXERCISE)*

Ans. Mitochondria are called the powerhouse of the cell as they are sites for synthesis of ATP molecules, the energy currency of the cell.

Q 20. Identify and name the following structures:
(i) The undefined nuclear region of a prokaryotic cell.
(ii) Site for releasing energy inside the cell.

Ans. (i) Nucleoid (ii) Mitochondria

Q 21. Name the following:
(i) Suicide bag of a cell. (ii) Kitchen of a cell.

Ans. (i) Lysosome (ii) Chloroplast

Q 22. Which kind of plastid is more common in:
(i) roots of the plant (ii) leaves of the plant
(iii) flowers and fruits *(NCERT EXEMPLAR)*

Ans. (i) Leucoplast (ii) Chloroplast (iii) Chromoplast

Q 23. Name the cell organelle, other than mitochondria, which has its own DNA and ribosomes.

Ans. Plastid is the cell organelle, other than mitochondria, having its own DNA and ribosomes.

Q 24. Name the plastids which store starch, oils and protein granules.

Ans. Leucoplasts are the plastids which store materials such as starch, oils and protein granules.

Knowledge BOOSTER

Leucoplasts are the non-pigmented organelles found in the non-photosynthetic parts of plant such as roots.

Q 25. Why do plant cells possesses large-sized vacuoles? *(NCERT EXEMPLAR)*

Ans. Plant cells possess large-sized vacuole as vacuoles not only store many important substances, they also contain cell sap that give turgidity and rigidity to the cell.

Q 26. Which type of cell division is required for growth and repair of body and which type is involved in formation of gametes? *(NCERT EXERCISE)*

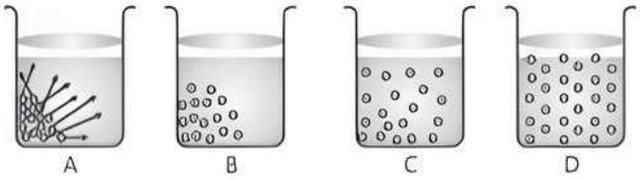
Ans. Mitosis is the type of cell division that is required for growth and repair of body, whereas meiosis is involved in formation of gametes.

Short Answer Type-I Questions

Q 1. Why is the cell called the structural and functional unit of life?

Ans. Cell is called the structural unit of life because all the organisms are made up of cells.
It is called the functional unit of life because each cell performs basic functions like respiration, obtaining nutrition, clearing of waste material, or forming new proteins, that are characteristics of all living forms.

Q 2. Diagrammatic representation of an experiment is given below.



Identify and define the phenomenon responsible for *D*.

Ans. The given diagram is showing the process of diffusion. Diffusion is the spontaneous movement of a substance from a region of higher concentration to a region of lower concentration.

Q 3. How do substances like CO_2 and water move in and out of the cell?

Ans. **Movement of CO_2:** Carbon dioxide moves in and out of the cell through diffusion or passage from the area of its higher concentration to the area of its lower concentration, across the cell membrane.
Movement of Water: The movement of water in and out of the cell occurs by the process of osmosis or passage of water from the area of higher concentration (*e.g.*, dilute solution) to the area of lower concentration (*e.g.*, strong solution), through the cell membrane, which acts like a semipermeable membrane.

Q 4. Why does the skin of your fingers shrink when you wash clothes for a long time? *(NCERT EXEMPLAR)*

Ans. During washing of clothes, osmosis takes place in the skin cells because soap solution is a hypertonic solution, *i.e.*, more concentrated than our skin cells. Hence, water from skin will move out in soap solution and leads to shrinkage of skin of our fingers while washing clothes for a long time.

Q 5. If cells of onion peel and RBC are separately kept in hypotonic solution, what among the following will take place? Explain the reason for your answer.
(i) Both the cells will swell.
(ii) RBC will burst easily while cells of onion peel will resist the bursting to some extent.
(iii) (i) and (ii) both are correct.
(iv) RBC and onion peel cells will behave similarly.
(NCERT EXEMPLAR)

Ans. (ii) The RBCs burst easily because they are animal cells and do not have cell wall. The onion peel (plant cell) possess cell wall which makes it resistant to bursting due to swelling caused by osmosis.

Q 6. A plant cell is placed in a hypotonic solution. What will happen? Will the cell burst? Why or why not?

Ans. When a plant cell is placed in a hypotonic solution, water enters into the cell by osmosis and the cell start to swell. However, the plant cell will not burst due to rigid cell wall and therefore, cell becomes turgid, *i.e.*, swollen and hard.

Q 7. In brief, state what happens when:
(i) Dry apricots are left for sometime in pure water and later transferred to sugar solution?
(ii) *Rheo* leaves are boiled in water first and then a drop of sugar syrup is put on it?

Ans. (i) Dry apricots when left in pure water, will gain water due to endosmosis and swell. When placed in a sugar solution, they lose water due to exosmosis and will shrink.
(ii) Cells in plasma membrane get killed due to boiling, hence, plasmolysis will not occur because only the living cells can absorb water by osmosis.

Q 8. Preeti was observing live cells of an onion peel in biology laboratory. She observed cell wall, cytoplasm and nucleus clearly. Suddenly her friend, by mistake, spilled a few drops of salt water on the slide. After some time, Preeti observed the slide and found some changes.

(i) What would have been the change in the live cells of onion peel after adding salt water?

(ii) Name the type of process involved.

Ans. (i) Salt water is a hypertonic solution, so water will move out of the cells through osmosis leading to shrinkage of contents of the cell away from cell wall.

(ii) The process involved is plasmolysis.

Q 9. Describe the structural features of cell membrane and cell wall.

Ans. Cell membrane is a living, flexible and selectively permeable membrane made up of organic molecules called proteins and lipids.

Cell wall is non-living and freely permeable, and is mainly composed of cellulose.

Q 10. Why is endocytosis found in animals only? *(NCERT EXEMPLAR)*

Ans. Endocytosis is observed in animal cells only as plasma membrane of animal cells is in direct contact with external medium. In a plant cell, it is not possible because a rigid cell wall is present over the plasma membrane in them, thus blocking the direct contact of plasma membrane with external medium. Thus, this process is found in animals only.

Q 11. Explain how do cell walls permit the cells of fungi to withstand very dilute external media without bursting?

Ans. If a cell wall is surrounded by a very dilute external medium, the cell gains water through osmosis. Thus, the cell swells up. This builds up pressure against the cell wall. The wall also exerts an equal pressure against the swollen cell. Thus, due to equal pressure from both the sides, the cells of fungi can withstand very dilute external media without bursting.

Q 12. Differentiate between Nucleus and Nucleoid.

Ans. Difference between Nucleus and Nucleoid:

Basis of Difference	Nucleus	Nucleoid
Definition	A nucleus is a membrane-bound structure in which eukaryotes assemble their genetic materials.	Nucleoid is a particular area in which prokaryotes assemble their genetic materials.
Structure	Nucleus is well organised and is large.	Nucleoid is poorly organised and is small.
Chromosomes	More than one chromosome is present.	Only one chromosome is present.

(Any two)

Q 13. Where are chromosomes located in a cell? What are they composed of ? What important information do they contain?

Ans. Chromosomes are located inside the nucleus of a cell. They are composed of DNA and proteins. They contain information for inheritance of characters from parents to next generation in the form of DNA molecules.

Q 14. How are chromatin, chromatid and chromosomes related to each other? *(NCERT EXEMPLAR)*

Ans. Chromosomes are made up of chromatids and chromatids are made up of chromatin. Chromatin is an intertwined mass of thread-like structures made of DNA and protein. During cell division, chromatin condenses to form thicker rod-like structures called chromosomes. Each chromosome consists of two similar halves called chromatids.

Q 15. State any two differences between smooth endoplasmic reticulum and rough endoplasmic reticulum.

Ans. Difference between SER and RER:

Basis of Difference	Smooth Endoplasmic Reticulum	Rough Endoplasmic Reticulum
Ribosomes	Ribosomes are not attached to its surface.	Ribosomes are attached to its surface.
Function	It helps in the manufacture of lipids.	They are the sites of protein manufacture.

Q 16. (i) **In which form does mitochondria release energy? Write its full form.**

(ii) **The inner membrane of mitochondria is deeply folded. What is the advantage of these folds?**

Ans. (i) The energy required for various chemical activities needed for life is released by mitochondria in the form of ATP (Adenosine Triphosphate) molecules.

(ii) These folds increase surface area for ATP-generating chemical reactions.

Q 17. Write two similarities and one dissimilarity between mitochondria and plastids.

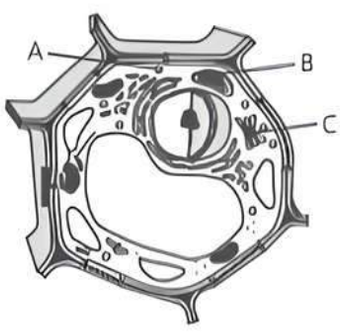
Ans. Two similarities between mitochondria and plastids are:

(i) Both are double membrane structures.

(ii) Both of them have their own DNA and ribosomes.

Dissimilarity between mitochondria and plastids is that mitochondria is the site of production of energy whereas plastid is the site of photosynthesis.

Q 18. Identify the given diagram. Label the parts *A*, *B* and *C*.



Ans. The given diagram represents a plant cell.

A is Lysosome,

B is Chloroplast and

C is Golgi apparatus.

Q 19. Define cell division. Mention the two types of cell division.

Ans. Cell division is the process by which a mother cell divides into two or more daughter cells in order to grow, to replace old, dead and injured cells, and to form gametes required for reproduction.

There are two types of cell division-mitosis and meiosis.

Short Answer Type-II Questions

Q 1. Differentiate between diffusion and osmosis.

Ans. Difference between diffusion and osmosis:

Basis of Difference	Diffusion	Osmosis
Occurrence	Diffusion can take place in any medium.	Osmosis occurs only in a liquid medium.
Definition	It is the movement of a substance from the area of its higher concentration to the area of its lower concentration.	It is the movement of water from the area of its higher concentration to the area of lower concentration.
Molecules involved	The diffusing molecules may be solids, liquids or gases.	It involves movement of solvent molecules only.
Need	It does not require a semipermeable membrane.	It requires a semipermeable membrane.

Knowledge BOOSTER

Osmosis is the result of diffusion across a semipermeable membrane.

Q 2. (i) What is osmosis?

(ii) What happens to a cell when it is placed in hypotonic, isotonic and hypertonic solutions respectively?

Ans. (i) Osmosis: Osmosis is the movement of water molecules through a selectively permeable membrane along the concentration gradient.

(ii) (a) Cell in Hypotonic Solution: Swells up due to endosmosis (passage of water into the cell) and becomes turgid.

(b) Cell in Isotonic Solution: No change.

(c) Cell in Hypertonic Solution: Cell contents shrink due to exosmosis or outward passage of water.

Q 3. Two beakers *A* and *B* contain water and concentrated sugar solution respectively. An equal number of dried raisins are kept in the beakers for a few hours and then taken out.

(i) Explain the reason for the difference in the physical appearance of raisins which were taken out of the two beakers.

(ii) On the basis of the above observations, categorise the two solutions as hypotonic and hypertonic.

Ans. (i) Raisins placed in beaker *A* appeared swollen as they absorbed water from the surroundings while those of beaker *B* were shrunken because water concentration is less outside the raisin covering.

(ii) Solution (here water) in beaker *A* is hypotonic (as it causes entry of water into raisins) while solution in beaker *B* is hypertonic due to loss of water from the raisins.

Q 4. (i) State and explain the process by which *Amoeba* obtains its food.

(ii) Why is the plasma membrane called a selectively permeable membrane?

Ans. (i) *Amoeba* obtains its food by the process of **endocytosis.** The part of plasma membrane that comes in contact with food particle invaginates, engulfs it and is pinched off into cytoplasm as phagosome. Phagosome is fused with a lysosome to produce a food vacuole. Digestion occurs in food vacuole and the digested materials pass out into the cytoplasm. The vacuole having undigested matter rises to the surface and performs exocytosis to throw out the undigested matter.

(ii) Plasma membrane regulates the movement of selective substances in and out of the cell, therefore, it is called a selectively permeable membrane.

Knowledge BOOSTER

Selectively permeable membrane involves the movement of ions and small molecules as well as large polymers which can be passive or active with or without the expenditure of energy.

Q 5. State three differences between cell membrane and cell wall.

Ans. Difference between cell membrane and cell wall:

Basis of Difference	Cell Wall	Plasma or Cell Membrane
Occurrence	It is present in plant cells only.	It is present in both animal and plant cells.
Cell covering	It is the outermost covering of plant cells.	It is the outermost covering of animal cells.
Location	It is present outside the plasma membrane.	It is present outside the cytoplasm.
Structure	Cell wall is rigid and comparatively thick.	Plasma membrane is flexible and comparatively thin.
Permeability	It is non-living and permeable.	It is living and selectively permeable.
Composition	It is made up of cellulose.	It is made up of lipids and proteins.

(Any three)

Q 6. Briefly explain the structure and function of nucleus.

Ans. Structure: Nucleus is a large, spherical, dense cellular structure made up of four components:

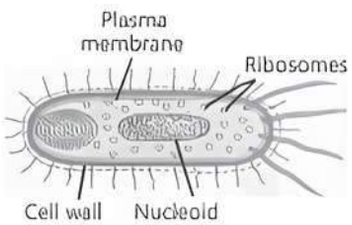
(i) A double-membrane porous envelope (nuclear envelope).
(ii) Nuclear sap or nucleoplasm.
(iii) Chromatin made of threads of DNA and proteins which get converted into chromosomes at the time of cell division.
(iv) Nucleolus—a rounded, naked structure attached to chromatin which serves as the site of ribosome formation.

Functions:

(i) Nucleus controls all the cellular activities.
(ii) It contains genetic or hereditary information over its chromosomes for expression of various traits.
(iii) It plays a central role in cellular reproduction.

Q 7. Draw a neat and well-labelled diagram of a typical prokaryotic cell.

Ans.



Prokaryotic Cell

Q 8. (i) What is membrane biogenesis?
(ii) Explain what happens when a drop of concentrated sugar solution is placed on a *Rheo* leaf mounted on a glass slide. Name this phenomenon. Would the same happen if *Rheo* leaf was boiled before mounting? Give reason for your answer.

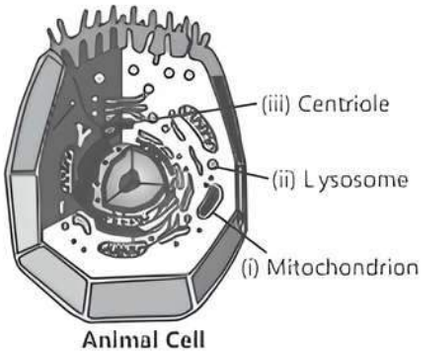
Ans. (i) Membrane biogenesis is a process of building cell membrane *i.e.*, some of the membrane proteins and lipids are replaced with newly made proteins and lipids. The proteins and lipids required for membrane biogenesis are synthesised by endoplasmic reticulum.

(ii) (a) A concentrated sugar solution will cause exosmosis in cells of *Rheo* peel mounted over a glass slide. The phenomenon called plasmolysis takes place and there is shrinkage of the contents of the cell away from the cell wall.

(b) Plasmolysis does not occur in cells of Rheo leaf peel if it has been boiled before mounting. This is because boiling kills the cells and exosmosis can occur only in living cells.

Q 9. Draw the diagram to show animal cell and label the following parts:
(i) Powerhouse of the cell.
(ii) Suicidal bag
(iii) Organelle which helps in the development of spindle fibres during cell division.

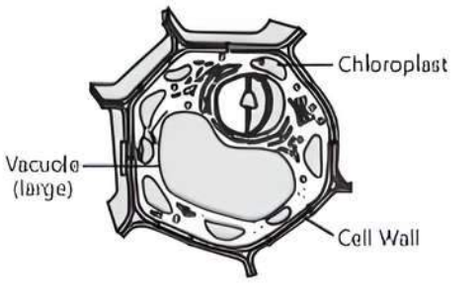
Ans.



Animal Cell

Q 10. Draw the diagram of a plant cell and label any three parts which make it different from an animal cell.

Ans.



Plant Cell

Q 11. Describe the role played by lysosomes. Why are these termed as suicide bags?

Ans. Lysosomes play an important role in:
(i) Destruction of foreign material.
(ii) Intracellular digestion of food.
(iii) Digestion and removal of worn-out cell organelles.

Lysosomes are termed as suicide bags because during disturbance in cellular metabolism, when the cell gets damaged, lysosomes may burst and the enzymes eat up their own cells.

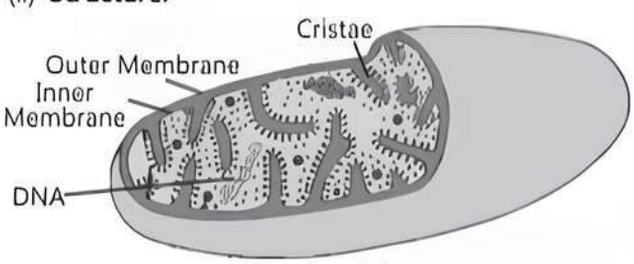
Knowledge BOOSTER

Lysosomes completely breakdown cells that have died called as autolysis.

Q 12. (i) Which organelles supply energy to a cell? In what form it is stored?
(ii) Explain the structure of this organelle.
(iii) Does this organelle contain DNA? Why?

Ans. (i) Mitochondria supplies energy to a cell. This energy is stored in the form of ATP. So, mitochondria is known as the 'Powerhouse of the cell.'

(ii) **Structure:**



Mitochondria

(iii) Yes, mitochondria possess its own DNA and ribosomes which help in the synthesis of a number of proteins for their functioning.

Q 13. Name a cell organelle found only in a plant cell and mention its various types.

Ans. The cell organelles found only in a plant cell are plastids.

The various types of plastids are:

(i) Chloroplasts (Green plastids)

(ii) Chromoplasts (Coloured plastids)

(iii) Leucoplasts (White or colourless plastids)

Q 14. (i) Name the organelles which provide turgidity to the plant cell. Name any two substances which are present in it.

(ii) How are they useful in unicellular organisms?

Ans. (i) Vacuoles provide turgidity to the plant cell. The substances present in it are:

(a) Water.

(b) Dissolved storage and waste substances (some proteins, salts, amino acids and organic acids).

(ii) In unicellular organisms, vacuoles take part in:

(a) Osmoregulation and excretion by contractile vacuoles.

(b) Digestion of food in food vacuoles.

Q 15. Differentiate between mitosis and meiosis.

Ans. Difference between mitosis and meiosis:

Basis of Difference	Mitosis	Meiosis
Number of daughter cells	Two daughter cells are formed.	Four daughter cells are formed.
Number of chromosomes	The daughter cells have the same number of chromosomes as mother cell.	The daughter cells have half the number of chromosomes than that of the mother cell.
Function	Mitosis is required for growth and repair of tissues in organisms.	Formation of gametes, which after fertilisation give rise to offspring.

Long Answer Type Questions

Q 1. Describe the structure of nucleus.

OR

Explain in detail what do you know about the structure of nucleus?

Ans. Robert Brown, in 1831, discovered nucleus in the cell. It is the largest and prominent cell component. It is spherical or oval in shape and is generally located in the centre of the cell.

Nucleus has the following important parts:

(i) Nuclear Membrane: It is a double-layered membrane, which separates nucleus from the cytoplasm.

(ii) Nucleoplasm: It is a homogeneous and granular dense fluid present inside the nucleus, in which chromatin and nucleolus are suspended.

(iii) Chromatin Material: It consists of a long, coiled network of thread-like structures. The chromatin material is made up of Deoxy Ribonucleic Acid (DNA) which is responsible for storing and transmitting the hereditary information from one generation to the other. It condenses in the form of compact bodies called chromosomes at the time of cell division.

(iv) Nucleolus: It is more or less a round structure present inside the nucleus. The nucleolus contains RNA (Ribonucleic Acid) and proteins. RNA helps in protein synthesis.

Q 2. (i) Why does nuclear membrane have pores?

(ii) Why do chromosomes contain DNA in the nucleus?

(iii) What will happen if the organisation of a cell is damaged due to certain physical or chemical reasons?

Ans. (i) For allowing and controlling the exchange of materials between the nucleus and cytoplasm, nuclear membrane has *pores*.

(ii) The nucleus of a cell contain chromosomes which contain DNA in the form of genes which carry genetic information from one generation to other.

(iii) If the organisation of a cell is destroyed due to some physical or chemical influence, then the cell will not be able to perform functions like respiration, obtaining nutrition, clearing of waste material or forming new proteins. Ultimately, the cell will die after some time.

Q 3. How is a prokaryotic cell different from a eukaryotic cell? *(NCERT Exercise)*

Ans. Difference between a prokaryotic cell and a eukaryotic cell:

Basis of Difference	Prokaryotic Cell	Eukaryotic Cell
Size	Cell size is generally small (1–10 μm).	Cell size is generally large (5–100 μm).
Nuclear region	Nuclear region is called nucleoid and is not surrounded by a nuclear membrane.	Nuclear region is surrounded by a nuclear membrane (well-organised nucleus).
Chromosomes	Only a single chromosome is present.	More than one chromosome are present.
Nucleolus	Nucleolus is absent.	Nucleolus is present.
Cell organelles	Membrane-bound cell organelles are absent.	Cell organelles bounded by membrane are present.
Cell division	Cell division takes place by fission or budding.	Cell division takes place either mitotically or meiotically.

Q 4. (i) What is lacking in a virus which makes it dependent on a living cell to multiply?
(ii) Expand RER and SER. Differentiate between their structure and function.

Ans. (i) Virus does not have a metabolic machinery due to the lack of cytoplasm. Therefore, it is dependent upon the metabolic machinery of other living cells to multiply.

(ii) RER—Rough Endoplasmic Reticulum.
SER—Smooth Endoplasmic Reticulum.
Structure: RER consists of ribosomes on its surface, therefore, it is rough, whereas, SER does not consist of any ribosomes and hence, it is smooth.
Function: Due to the presence of ribosomes, RER takes part in protein synthesis, while SER helps in the manufacture of fat molecules or lipids.

Q 5. (i) What is endoplasmic reticulum?
(ii) Describe its function.
(iii) Name two types of endoplasmic reticulum.
(iv) What crucial role does it play in the liver cells of vertebrates?

Ans. (i) **Endoplasmic Reticulum:** It is a large network of membrane-bound tubes and sheets, which look like long tubules or round or oblong bags (vesicles).

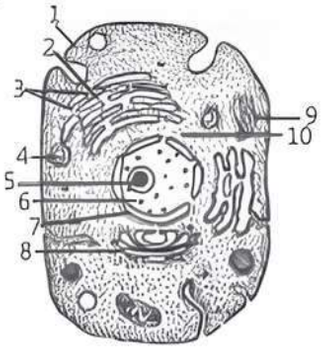
Knowledge BOOSTER
The membrane of endoplasmic reticulum constitutes more than half of the total membrane of an average animal cell.

(ii) Functions:
(a) It serve as channels for the transport of materials (especially proteins) between various regions of the cytoplasm or between the cytoplasm and the nucleus.
(b) It functions as a cytoplasmic framework providing a surface for some of the biochemical activities of the cell.

(iii) Types: There are two types of endoplasmic reticulum *i.e.*, Smooth Endoplasmic Reticulum (SER) and Rough Endoplasmic Reticulum (RER). Rough endoplasmic reticulum bears ribosomes on its surface which are absent over SER.

(iv) Detoxification: SER present in vertebrate liver detoxifies poisons and drugs.

Q 6. Given below is a diagrammatic sketch of electron microscopic view of an animal cell:



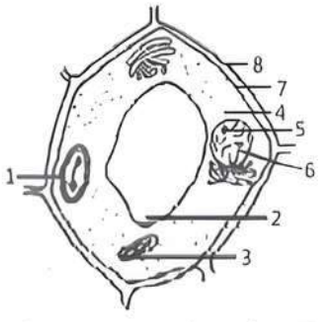
(i) Label the parts indicated by lines as 1 to 10.
(ii) Give two reasons to support that it is an animal cell.
(iii) How many mitochondria are shown in the diagram?

Ans. (i) 1 – Cell membrane
2 – Rough Endoplasmic Reticulum (RER)
3 – Smooth Endoplasmic Reticulum (SER)
4 – Lysosome
5 – Nucleolus
6 – Nucleus
7 – Nuclear envelope or Nuclear membrane
8 – Golgi bodies
9 – Mitochondrion
10 – Cytoplasm

(ii) It is an animal cell because:
(a) A cell wall made up of cellulose is absent.
(b) It has no definite shape and possesses prominent and well-developed Golgi bodies.

(iii) Two mitochondria are shown in the diagram.

Q 7. Given below is a diagrammatic sketch of a certain generalised cell.



(i) Name the parts numbered as 1 to 8.
(ii) Is it a plant cell or an animal cell? Give two reasons in support of your answer.
(iii) Give the functions of parts marked as 1 and 8.

Ans. (i) 1 – Chloroplast, 2 – Vacuole, 3 – Mitochondrion, 4 – Cytoplasm, 5 – Nucleolus, 6 – Nucleus, 7 – Cell membrane, 8 – Cell wall

(ii) It is a plant cell because:
(a) It has a definite shape having a cell wall.
(b) Chloroplasts are present.

(iii) Functions:
1–Chloroplast: It synthesises food by trapping solar energy, thus, it is called 'kitchen of the cell'.
8–Cell Wall: It protects the plasma membrane and internal structures of the cell. It also helps in transporting various substances in and out of the cell.

Knowledge BOOSTER
Chloroplasts contain chlorophyll that enables photosynthesis to occur so that plants can convert sunlight into chemical energy.

Q 8. (i) In the given diagram, identify the parts marked *B* and *C*.

(ii) What are the substances that organelle *A* stores?

(iii) Mention one function each of organelles *B* and *C*.

Ans. (i) *B* – Golgi apparatus.
C – Chloroplast.

(ii) *A* – Central vacuole.
It stores sugars, amino acids, organic acids and some proteins.

(iii) Function:

(a) *B* – Storage, modification and packaging of products in vesicles.

(b) *C* – Photosynthesis in plants.

Q 9. Make a comparison and write down ways in which plant cells are different from animal cells.

(NCERT EXERCISE)

Ans. Comparison between a plant cell and an animal cell:

Basis of Difference	Plant Cell	Animal Cell
Outermost covering	The outermost covering of the plant cell is the cell wall which is made up of cellulose.	The outermost covering is the plasma membrane, made up of proteins and lipids.
Plastids	Plastids are present.	Plastids are absent.
Vacuoles	Vacuoles are large in size and lesser in number.	Vacuoles are smaller in size and more in number.
Centrioles	Centrioles are absent.	Centrioles are present within the centrosome.
Shape	It has a fixed, rectangular shape.	It has a round, irregular shape.
Position of Nucleus	Nucleus lies along the periphery of the cell.	Nucleus lies in the centre of the cell.

(Any five)

Q 10. Why is mitochondria called 'powerhouse of the cell'? Give three similarities and one difference between mitochondria and plastids.

Ans. Mitochondria is considered as the 'powerhouse of the cell' because the energy required by various chemical activities needed for life is released by mitochondria in the form of ATP. The energy stored as ATP is used for making new chemical compounds as well as for mechanical work.

Similarities between Mitochondria and Plastids:

Three similarities between mitochondria and plastids are:

(i) Both mitochondria and plastids have their own DNA and ribosomes.

(ii) External structures of mitochondria and plastids are almost the same.

(iii) Both mitochondria and plastids have more than one membrane layer.

Difference between Mitochondria and Plastids: Mitochondria are present in both plant and animal cells whereas plastids are present only in plant cells.

Q 11. (i) Distinguish between chloroplast and leucoplast with respect to their pigments and function.

(ii) How would (a) a plant cell and (b) an animal cell behave when placed in hypotonic solution of sodium chloride? Explain giving reason.

Ans. (i) Difference between chloroplast and leucoplast:

Basis of Difference	Chloroplast	Leucoplast
Colour	It is green in colour due to the presence of chlorophyll.	It is colourless due to the absence of any pigment.
Functions	It takes part in photosynthesis.	It commonly stores starch, oils and protein granules.

(ii) A cell placed in hypotonic solution swells up due to endosmosis or osmotic entry of water inside the cell. In plant cell, swelling is limited as it has a rigid cell wall.

Due to the absence of a cell wall, an animal cell will continue to swell up, till it bursts.

Q 12. What are the main functions of each of the following cell components?

(i) Plasma membrane **(ii) Chromosomes**
(iii) Lysosomes **(iv) Ribosomes**
(v) Nucleus **(vi) Mitochondria**
(vii) Nucleolus **(viii) Cell wall**
(ix) Chloroplast **(x) Cytoplasm**

Ans. **(i) Plasma Membrane:** It acts as a semipermeable membrane and allows only selective substances to pass through it.

(ii) Chromosomes: They transfer hereditary characters from parents to offsprings, *i.e.*, from one generation to another.

(iii) Lysosomes: They act as 'waste disposal system of the cell' which help to keep the cell clean.

(iv) Ribosomes: They help in protein synthesis.

(v) Nucleus: It controls all the metabolic activities of the cell.

(vi) Mitochondria: It is the 'powerhouse' of the cell which stores and releases energy in the form of ATP.

(vii) Nucleolus: It acts as a platform for ribosome formation.

(viii) Cell Wall: It provides rigidity and structural strength to plants.

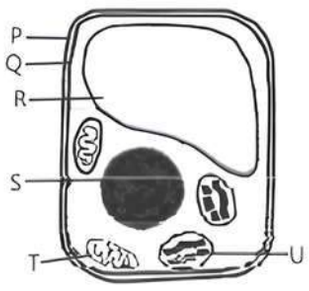
(ix) Chloroplast: It carries out photosynthesis in plant cells and synthesises food by trapping solar energy.

(x) Cytoplasm: It is the fluid content inside the plasma membrane which contains many specialised cell organelles.

Chapter Test

Multiple Choice Questions

Q 1. Which labelled organelles helped a student to conclude that it is a plant cell?



a. *P* and *R* only b. *P* and *S* only
c. *P*, *R* and *T* only d. *P*, *R* and *U* only

Q 2. When a cell is placed in a medium, and it increases in size, the external medium is:

a. isotonic b. hypotonic
c. hypertonic d. None of these

Q 3. Cell sap is found in which of the following cell organelles?

a. Vacuole b. Lysosomes
c. Nucleus d. Golgi apparatus

Q 4. 'Division of labour' in multicellular animals means.

a. All functions are performed by a single type of cell
b. A function is performed jointly by many cells
c. Different functions are performed by different types of cells.
d. Different functions are performed at different times by a single cell type.

Assertion and Reason Type Questions

Directions (Q. Nos. 5-6): *Each of the following questions consists of two statements, one is Assertion (A) and the other is Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:*

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
c. Assertion (A) is true but Reason (R) is false.
d. Assertion (A) is false but Reason (R) is true.

Q 5. Assertion (A): Mitochondria are called 'powerhouse of the cell'.

Reason (R): Mitochondria produce cellular energy in the form of ATP.

Q 6. Assertion (A): Plasma membrane is selectively permeable.

Reason (R): Plasma membrane allows some molecules to pass through it more easily than others.

Case Study Based Question

Q 7. Leucoplasts are colourless plastids. They store starch, oil, proteins. Chromoplasts are coloured plastids. They contain pigments, *e.g.*, Chloroplasts contain green pigment present in the plant cell. Chromoplasts provide colour to various flowers and fruits.

Read the given passage carefully and give the answer of the following questions:

(i) What is the function of leucoplasts?

a. They store starch, oil, proteins.
b. They provide colour to various flowers and fruits.
c. They help in photosynthesis.
d. They give support to the plants.

(ii) Which plastids provide colour to fruits and flowers?

a. Leucoplasts b. Chromoplasts
c. Chloroplasts d. Proteinoplast

(iii) Which of the following statement is true?

a. Plastids are present in both plant and animal cell
b. Plastids are absent in plant as well as animal cell
c. Plastids are present only in plant cell
d. Plastids are present only in animal cell

(iv) Which plastids bring about the process of photosynthesis?

a. Leucoplasts b. Chromoplasts mainly
c. Chloroplasts d. None of these

Very Short Answer Type Questions

Q 8. What is plasmolysis?

Q 9. Name the cell organelle in which the following structures are present:

(i) Cristae (ii) Stroma

Short Answer Type-I Questions

Q 10. Who gave the term 'Golgi apparatus'? Write down the functions of Golgi apparatus.

Q 11. State two conditions required for osmosis.

Q 12. Why are lysosomes also known as 'scavengers of the cells'?

Short Answer Type-II Questions

Q 13. Distinguish between hypotonic solution, isotonic solution and hypertonic solution.

Q 14. (i) Write two points of difference between nuclear region of a bacterial cell and nuclear region of an animal cell.

(ii) Which structure present in the nuclear region of a living cell bears genes?

Q 15. Write a short note on cell division and its types.

Long Answer Type Questions

Q 16. Explain main functional regions of a cell with the help of a diagram.

Q 17. Write the main functions of at least ten cell components.