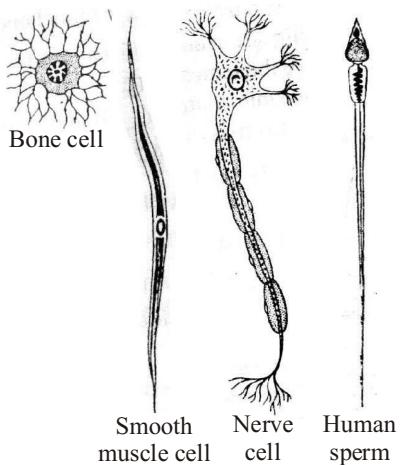


Chapter 1

Cell & Tissues

- In 1665, **Robert Hooke** saw cells for the first time in a thin slice of cork with his crude microscope.
- Cork under microscope resembled “honeycomb” like structures made up of several compartments. Robert Hooke called them ‘cells’.
- A tissue is a group of cells of similar structure and function arranged in the body so as to give the highest possible efficiency to the function they perform.
- All living organisms are made up of cells. In unicellular or acellular organisms a single cell may constitutes a whole organism. E.g. *Amoeba*, *Chlamydomonas*. In multicellular organisms many cells group together in a single body and assume different functions. E.g. fungi, plants.
- Various cells of human body vary in structure according to their function.



Various cells from the human body

- Each living cell perform certain basic functions that are characteristic of all living forms.
- Prokaryotes** — Bacteria and some other organisms lack a well defined nucleus surrounded by nuclear membrane. Membrane-bound cell organelles are absent.
- Eukaryotes** — Organisms with a well defined nucleus surrounded by nuclear membrane. Membrane-bound cell organelles are present.
- Structural Organisation of a Cell :**
 - (i) Plasma membrane or Cell membrane :** It is the outermost covering of the cell which separates the contents of the cell from its external environment. It allows entry and exit of only certain materials so it is also called selectively permeable membrane. CO_2 and O_2 move across the membrane through *diffusion*.

It is made up of lipids and proteins. Fluid Mosaic Model of Plasma membrane was proposed by **Singer** and **Nicolson**.

Diffusion — It is the movement of a substance from a region of higher concentration to a region of lower concentration.

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

Fate of animal or plant cell in Hypertonic, Hypotonic and Isotonic solution :

- Hypertonic solution** — The concentration of solution is more than that of cell. Therefore, the cell will loose water by exosmosis and shrink.
- Hypotonic solution** — The concentration of solution is less than that of cell. Therefore, the cell will gain water by endosmosis and swell up.
- Isotonic solution** — The concentration of solution is same as that of cell. Therefore, there will be no movement of water, and cell size will remain same.

Functions : (i) It separates contents of the cell from external environment.

(ii) It helps in engulfing food by endocytosis as in *Amoeba*.

(ii) **Cell wall** — It is outermost covering which lies outside the plasma membrane. Plant cell wall is composed of a complex substance cellulose which provides structural strength to plants. Due to cell wall, plants, fungi and bacteria withstand much greater changes in the surrounding medium than animal cell.

Plasmolysis : Shrinking of protoplasm of a cell due to exosmosis when kept in hypertonic solution.

Functions : (i) It provides rigidity and strength to the cell.

(ii) It helps to sustain during unfavourable conditions.

(iii) **Nucleus** — It is the dark coloured, spherical or oval structure near the centre of a cell. It has a double layered covering called nuclear membrane. Nucleus contains hereditary material called chromosomes.

Functions : (i) It plays an important role in cellular reproduction.

(ii) It plays an important role in inheritance of characters from parents to the offsprings.

• **Cytoplasm** : A large region of each cell enclosed by the cell membrane. It contains many specialised cell organelles which perform specific functions for the cell.

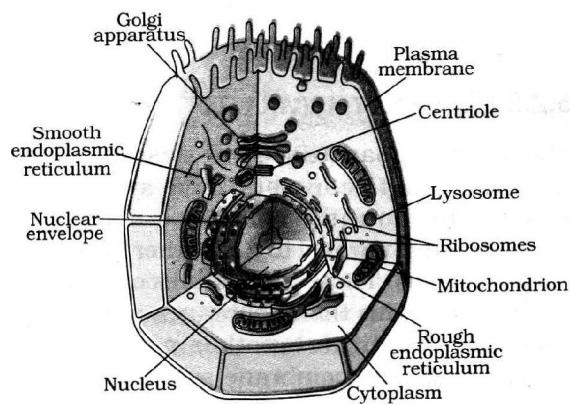
(iv) **Endoplasmic Reticulum (ER)** — It is a large network of membrane-bound tubules. It is two types-

(a) **Rough endoplasmic reticulum (RER)** — contains ribosomes attached to its surface. Ribosomes are site of protein synthesis.

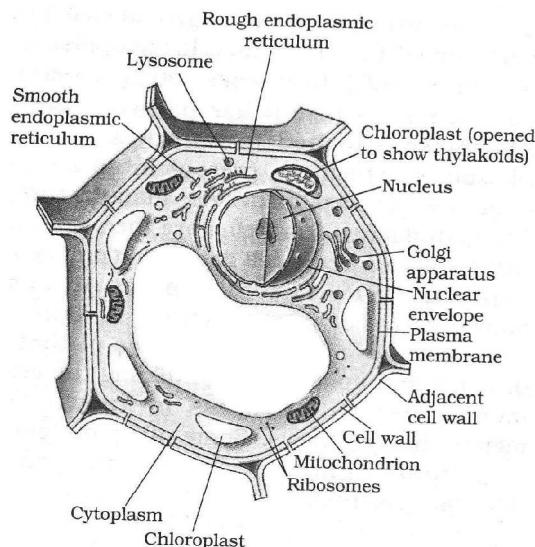
(b) **Smooth endoplasmic reticulum (SER)** — It helps in manufacture of fats and lipids.

Functions: (i) It act as a channel for transport of materials within cytoplasm or between cytoplasm and nucleus.

(ii) In liver cells of vertebrates, SER detoxifies poisons and drugs



Animal cell



Plant cell

(v) **Golgi apparatus** — Discovered by **Camillo Golgi**. It consists of membrane bound vesicles arranged parallel to each other in stacks called cisternae, connected with ER.

Functions : (i) It helps in transport of substances synthesised near ER inside and outside the cell.

(ii) It helps in storage, modification and packaging of products in vesicles.

(vi) **Lysosomes** — These are membrane bound sacs filled with digestive enzymes. When cell gets damaged, lysosomes burst and enzymes digest their own cell. So, they are also called “**suicide bags**” of a cell.

Functions: It keeps the cell clean by digesting foreign materials and old worn-out cell organelles.

(vii) **Mitochondria** — These are double membrane bound organelles. The outer membrane is porous while the inner membrane is deeply folded providing large surface for ATP—generating chemical reactions. So, they are also called “**Power houses**” of the cell. Mitochondria have its own DNA and ribosomes.

Functions : It helps in ATP and Protein synthesis.

(viii) **Plastids** — They are present only in plant cells. They are two types — Chromoplasts (coloured plastids) and Leucoplasts (white plastids). Plastids that contain green colour pigment, chlorophyll are called chloroplasts. They also have their own DNA and ribosomes.

Functions: (i) Chloroplasts play an important role in photosynthesis in plants.

(ii) Leucoplasts store starch, oil and protein granules.

(ix) **Vacuoles** — These are storage sacs for solid or liquid contents. They are small sized in animal cell and large sized in plant cells.

Functions : (i) Vacuoles provide turgidity and rigidity to the cell.

(ii) Contractile vacuoles help in expelling excess water and wastes in some animals.

- Cells specialising in one function is carried out by a cluster of cells at a definite place in the body called a **tissue**. Blood, phloem and muscle are all example of tissues.

Are plants and animals made of same types of tissues :

- (i) Plants are stationary, adopted for sedentary mode of life while animals live active locomotive life.

- (ii) The growth in plants is limited to certain regions while there is no such demarcation of dividing and non – dividing regions in animals.

- Plant tissues :** On the basis of dividing capacity plant tissues can be classified as :

(i) **Meristematic tissue :** Growth of plants occurs only in regions where meristematic tissues are present. Depending on the region where they are present, they are classified as apical, lateral and intercalary meristem.

- (a) **Apical meristem** — It is present at the growing tips of stem and root and increases the length of the stem and root.

- (b) **Lateral meristem** — It increases the girth of stem or root. It is also called cambium.

- (c) **Intercalary meristem** — It is located at the base of leaves or internodes on twigs.

- (ii) **Permanent tissue:** The cells formed by meristematic tissue acquire permanent shape, size and function and lose the ability to divide.

(a) Simple permanent tissue —

- (1) **Parenchyma** — It consists of unspecialised cell with thin cell walls. The cells are loosely packed with large intercellular spaces. When it contains chlorophyll and performs photosynthesis it is called **chlorenchyma**. In aquatic plants, they have large air cavities and give buoyancy to the plants called **aerenchyma**.

Functions— (i) It provides support to the plants
 (ii) It stores food and water in stems and roots.

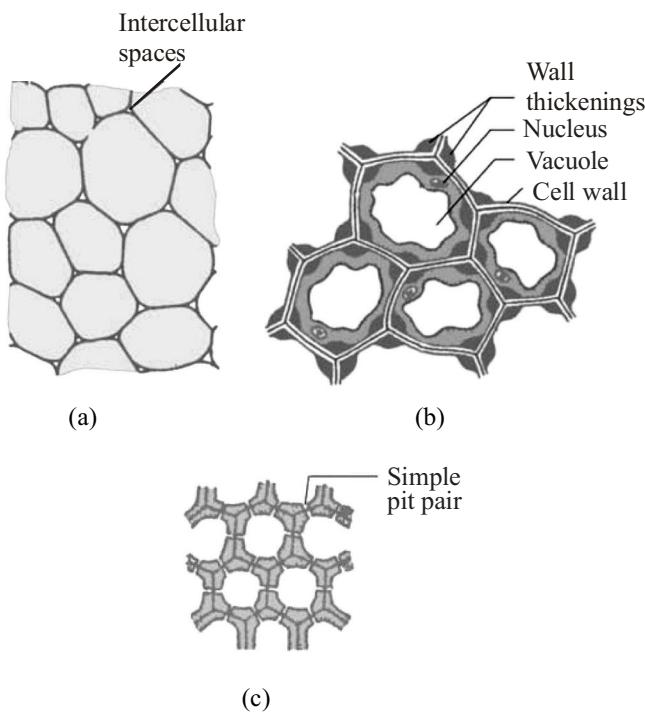
(2) **Collenchyma**— The cells are living, elongated and irregularly thickened at the corners. They have very little intercellular spaces.

Functions— (i) It provides flexibility to plant parts like leaf and stem. (ii) It provides mechanical support.

(3) **Sclerenchyma**— The cells are dead. They are long and narrow. Walls are thickened due to deposition of lignin.

Functions— (i) It makes plant hard and stiff., *e.g.* Coconut husk. (ii) It provides mechanical strength.

Various types of simple tissues (a) parenchyma, (b) collenchyma and (c) sclerenchyma as shown below :



(b) **Complex permanent tissue**— It is made of more than one type of cells. All cells perform same function. It is of two types – xylem and phloem.

(i) **Xylem**— It consists of tracheids, vessels, xylem parenchyma and xylem fibres. Cell are thick walled and mostly dead.

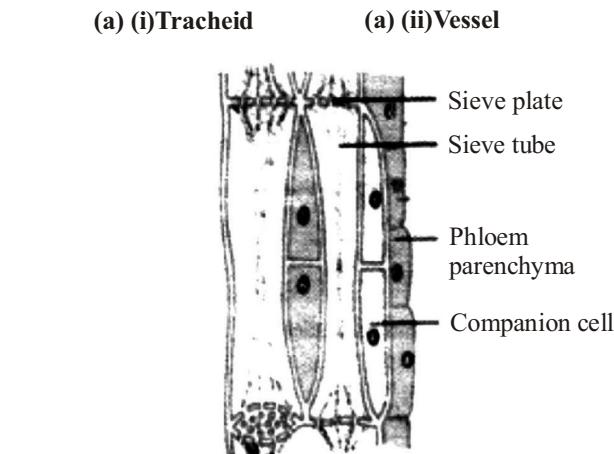
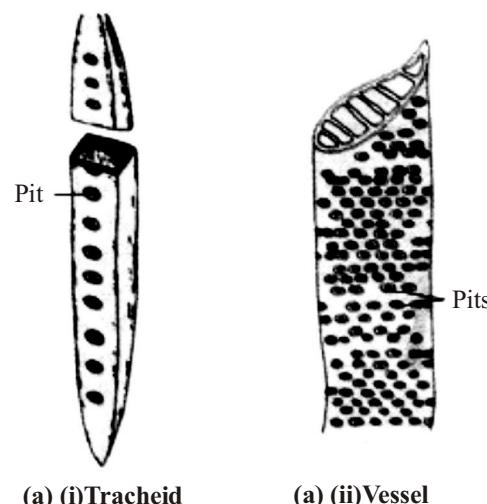
Functions : (i) Tracheids and vessels transport water and minerals vertically.

(ii) Fibres are supportive.

(ii) **Phloem**— It is made of sieve tubes, companion cells, phloem fibres, and phloem parenchyma. Except phloem fibres, phloem cells are living.

Function— (i) Transports food from leaves to other parts of the plant.

Various type of complex tissues : (a) Xylem (i) Tracheid
 (ii) Vessel (b) Phloem as shown below



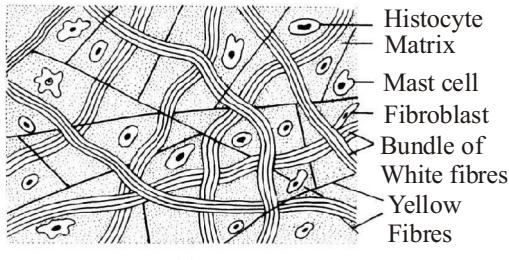
• **Animals Tissues**— On the basis of functions performed, animal tissues are divided as :-
 Epithelial tissue, connective tissue, muscular tissue and nervous tissue.

(i) **Epithelial tissue**— It forms protective covering in the animal body, covers organs and separates different body systems. Different types of epithelial tissues on the basis of functions are—

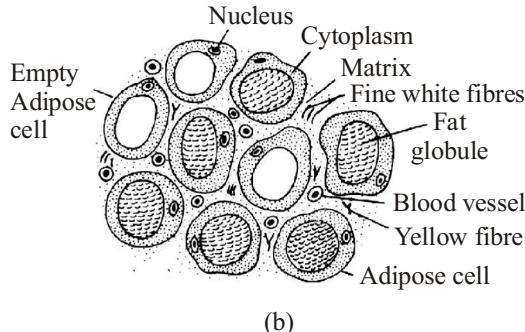
- Simple squamous epithelium**— Cells are extremely thin, flat and form delicate lining. Oesophagus, lining of mouth are made of it.
- Stratified squamous epithelium**— In the skin epithelial cells are arranged in many layers to prevent wear and tear.
- Columnar epithelium**— It is present in the inner lining of intestine, pillar like tall cells. In respiratory tract the epithelial cells have hair-like projections called cilia on the outer surface.
- Cuboidal epithelium**— It is made of cube-shaped cells. It forms lining of kidney tubules and ducts of salivary glands.
- Glandular epithelium**— In glands, a portion of the epithelium tissue folds inwards.

(ii) **Connective tissue** — The cells are loosely packed and embedded in intercellular matrix. It is of following types :-

- (1) **Areolar tissue** — It is found between skin and muscles, around blood vessels, nerves and bone marrow. It fills space inside organs, helps in repair of tissues.
- (2) **Adipose tissue** — It is fat storing, found below the skin and between internal organs.
- (3) **Bone** — It forms framework to support the body. Bone cells lie embedded in hard matrix composed of calcium and phosphorous.
- (4) **Ligament** — connects two bones.
- (5) **Tendons** — connect muscles to bones.
- (6) **Cartilage** — It has widely spaced cells. It is present in nose, ear, trachea, larynx.
- (7) **Blood** — It is a fluid connective tissue. Fluid matrix is called **plasma** that contains red blood cells (RBCs), white blood cells (WBCs) and platelets unit.



(a)



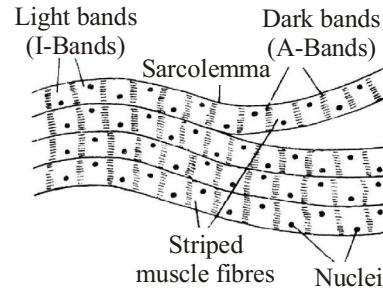
(b)

Connective tissues : (a) areolar tissues and (b) adipose tissue shown above

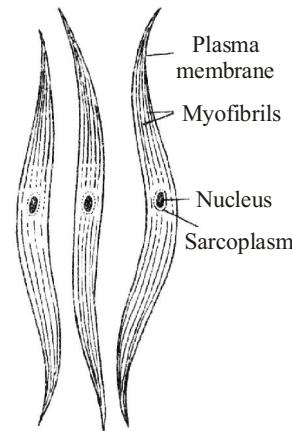
(iii) **Muscular tissue** — It consists of elongated cells called muscle fibres. They are responsible for movement in our body. The three types of muscles are :-

- (1) **Striated muscles** — They have alternate light and dark bands or striations. The cells are long, cylindrical, unbranched and multinucleate. They move according to our will so as called voluntary muscles. Eg. muscles of hands and legs.
- (2) **Smooth muscles** — The cells are long with pointed ends and uninucleate. They are also called involuntary muscles eg. muscles found in iris of eye, ureters, bronchi of lungs, alimentary canal.
- (3) **Cardiac muscles** — The muscle cells are cylindrical, branched and uninucleate. They are involuntary. E.g. the muscles of heart.

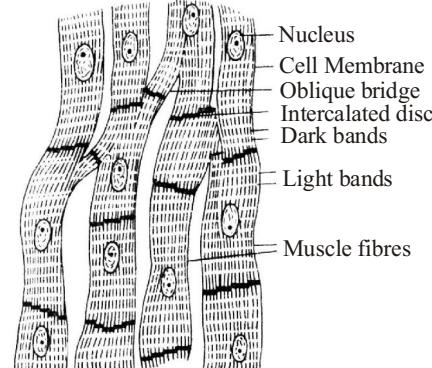
Various types of muscles fibres : (a) striated muscle, (b) smooth muscle and (c) cardiac muscle as shown below :



(a)

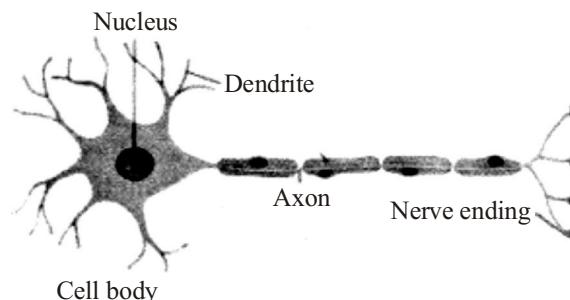


(b)



(c)

(iv) **Nervous tissue** — They are found in brain, spinal cord and nerves. They transmit the stimulus. A neuron consists of a cell body with a nucleus and cytoplasm. It has a long part called axon and many short, branched parts called dendrites. Many nerve fibres together form a nerve.



Neuron-unit of nervous tissue

Exercise 1

DIRECTIONS : This section contains multiple choice questions. Each question has 4 choices (1), (2), (3) and (4) out of which only one is correct.

- Cell were first discovered by
 - Robert Hooke
 - Leeuwenhoek
 - Purkinje
 - Virchow
- The plasma membrane is
 - permeable
 - impermeable
 - selectively permeable
 - both (1) and (2)
- Nuclear material without cover is found in
 - mycoplasma and green algae
 - bacteria and fungi
 - bacteria and blue green algae
 - none of the above
- The word 'prokaryote' means a cell
 - with many nuclei
 - with one nucleus
 - with diffused nucleus
 - without chloroplast
- Minute structures on bacterial cell are called
 - hair
 - cilia
 - flagella
 - pili
- Cell theory was proposed by
 - Schleiden and Schwann
 - Robert Brown
 - Leeuwenhoek
 - Purkinje
- The undefined nuclear region in a bacteria is
 - nucleoid
 - nucleus
 - chromosome
 - nucleolus
- Nucleus plays a crucial part in
 - metabolism
 - cellular reproduction
 - lipid synthesis
 - protein synthesis
- Which of the following is not present in prokaryotes ?
 - Ribosomes
 - Cell wall
 - Plasma membrane
 - Nuclear membrane
- Chemical nature of carrier molecules facilitating transport across plasma membrane is
 - starchy
 - sugary
 - proteinaceous
 - fatty acidic
- ER remains associated with
 - dictyosomes
 - mitochondria
 - karyotheca
 - chloroplast
- Vacuole is surrounded by
 - plasmalemma
 - cell wall
 - tonoplast
 - plasmodesmata
- The organisms that lack membranes are
 - Viruses
 - Bacteria
 - Protozoans
 - Fungi
- The organelle attached to the ER is
 - ribosomes
 - lysosomes
 - golgi bodies
 - proteins
- Golgi bodies help in
 - excretion of steroids
 - storage and secretion
 - translation
 - transcription
- According to fluid mosaic model plasma membrane is composed of
 - phospholipids, extrinsic and intrinsic proteins
 - phospholipids and oligosaccharides
 - phospholipids and hemicellulose
 - phospholipids and integral glycoproteins
- The presence of organelle is only revealed by electron microscope.
 - chloroplast
 - mitochondria
 - Golgi bodies
 - lysosome
- One of these is the smallest in size
 - Ribosome
 - Lysosome
 - Mitochondria
 - Chloroplast
- The SER helps in building the cell membrane. This process is called
 - protein synthesis
 - membrane abiogenesis
 - membrane biogenesis
 - glycogenesis
- Golgi apparatus is involved in the formation of :
 - lysosome
 - vacuoles
 - plastids
 - mitochondria
- DNA is a component of
 - mitochondria
 - chloroplast
 - cytoplasm
 - peroxisome
- One of these is single membrane organelle
 - lysosome
 - mitochondria
 - nucleus
 - endoplasmic reticulum
- The cell organelle containing the flattened membrane bounded cisternae are located near the nucleus is
 - mitochondria
 - Golgi
 - centrioles
 - nucleolus
- The entry of mineral ions in a plant cell during absorption is by
 - passive absorption
 - active absorption
 - osmosis
 - endocytosis
- The suicide bags of the cells are
 - plastids
 - mitochondria
 - lysosomes
 - ribosomes
- The power houses of the cells are
 - mitochondria
 - plastids
 - golgi complex
 - ribosomes
- Vesicles are essential for the normal functioning of the Golgi apparatus because
 - they provide energy for chemical reactions.
 - they move proteins and lipids between different parts of the organelle.
 - they contribute to the structural integrity of the organelle.
 - they produce the sugars that are added to proteins.
- Amino acid chains built by the ribosomes then move to the
 - golgi apparatus
 - lysosome
 - endoplasmic reticulum
 - mitochondria
- Simple tissues are
 - parenchyma, xylem and collenchyma
 - parenchyma, collenchyma and sclerenchyma
 - parenchyma, xylem and sclerenchyma
 - parenchyma, xylem and phloem

B-174

Scholastic Aptitude Test (SAT) — BIOLOGY

30. The living cells providing tensile strength are
 (1) parenchyma (2) collenchyma
 (3) sclerenchyma (4) sclerotic cells

31. The energy currency of the cell is
 (1) ADP (2) ATP
 (3) NADP (4) FADP

32. The organelle that is present only in plant cells is
 (1) mitochondria (2) endoplasmic reticulum
 (3) ribosomes (4) plastids

33. Quiescent centre is found in
 (1) root tip (2) cambium
 (3) shoot tip (4) leaf tip

34. The conducting cells of xylem are
 (1) tracheary elements (2) sieve elements
 (3) companion cells (4) all the above

35. The chief function of vessels in the plant body is
 (1) to translocate food material
 (2) to conduct water and mineral salts
 (3) to support living cells
 (4) all the above

36. Inner surface of fallopian tubes, bronchi and bronchioles are lined by
 (1) squamous epithelium (2) ciliated epithelium
 (3) columnar epithelium (4) cubical epithelium

37. The organelles that contain their own genetic material are
 (1) Mitochondria, Vacuoles
 (2) Plastids, Golgi complex
 (3) Mitochondria, Plastids
 (4) Ribosomes, Nucleolus

38. The photosynthetic pigment is
 (1) chlorophyll (2) chronophyll
 (3) xanthophyll (4) fucoxanthin

39. Average life span of human R.B.C. is
 (1) 100 days (2) 90 days
 (3) 120 days (4) 80 days

40. Which set clearly identify striated muscles ?
 (1) Cylindrical, syncytial and unbranched
 (2) Spindle, unbranched and uninucleated
 (3) Cylindrical, striped and nucleated
 (4) Cylindrical, striped and branched

41. Cardiac muscle cells are cylindrical branched
 (1) uninucleate and voluntary
 (2) uninucleate and involuntary
 (3) multinucleate and voluntary
 (4) multinucleate and involuntary

42. Blood, phloem and muscle are
 (1) tissues (2) organs
 (3) cells (4) organ system

43. Certain specific regions where growth takes place in plants is called
 (1) perisperm (2) endosperm
 (3) meristem (4) stele

44. The fibrous tissue which connects the two bone is
 (1) connective tissue (2) tendon
 (3) ligament (4) adipose tissue

45. Largest number of cell bodies of neuron in our body are found in
 (1) retina (2) spinal cord
 (3) brain (4) tongue

46. Neurons are classified on the basis of
 (1) number of nucleus present
 (2) number of processes arising from the cell body
 (3) number of dendrites present
 (4) number of axons present

47. The girth of the stem or root increases due to
 (1) apical meristem (2) intercalary meristem
 (3) lateral meristem (4) None

48. The process of formation of permanent tissue in plants is called
 (1) scalarification (2) differentiation
 (3) cell thickening (4) specialisation

49. Tissues that have long and narrow cells are called
 (1) cuboidal epithelium (2) squamous epithelium
 (3) germinal epithelium (4) columnar epithelium

50. The vascular tissues of the plant function in
 (1) support
 (2) support and transport of materials
 (3) secretion of plant hormones
 (4) All of the above

51. Which tissue lacks blood supply and heals slowly?
 (1) Nervous (2) Muscle
 (3) Cartilage (4) Bone

52. The basic packing tissue is
 (1) sclerenchyma (2) collenchyma
 (3) xylem (4) parenchyma

53. The tissue in leafstalks below the epidermis is made up of
 (1) collenchyma (2) sclerenchyma
 (3) parenchyma (4) xylem

54. The thickening of the walls of the sclerenchyma tissues is due to
 (1) suberin (2) magnesium
 (3) lignin (4) calcium

55. The waxy, water resistant layer in the xerophytic plants is secreted by
 (1) endodermis (2) cortex
 (3) phloem (4) epidermis

56. Which of these options are not a function of Ribosomes ?
 (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.
 (1) (i) and (ii) (2) (ii) and (iii)
 (3) (iii) and (iv) (4) (iv) and (i)

57. A person met with an accident in which two long bones of hand were dislocated. Which among the following may be the possible reason ?
 (1) Tendon break (2) Break of skeletal muscle
 (3) Ligament break (4) Areolar tissue break

58. While doing work and running, you move your organs like hands, legs etc. Which among the following is correct ?
 (1) Smooth muscles contract and pull the ligament to move the bones.
 (2) Smooth muscles contract and pull the tendons to move the bones.
 (3) Skeletal muscles contract and pull the ligament to move the bones.
 (4) Skeletal muscles contract and pull the tendon to move the bones.

59. The two kidney shaped cells of the stomata are called
 (1) epidermis (2) guard cells
 (3) stoma (4) phloem

60. Xylem and Phloem are
 (1) parenchyma
 (2) simple tissues
 (3) simple permanent tissues
 (4) complex permanent tissues

61. The only living tissue in the xylem is
 (1) tracheids (2) vessels
 (3) xylem parenchyma (4) xylem fibres

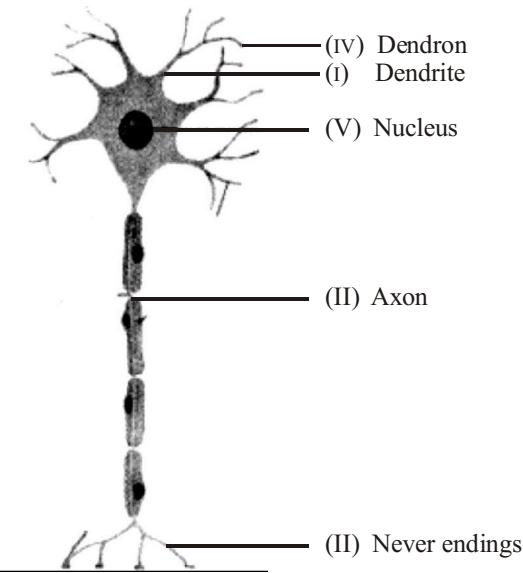
62. In Phloem the materials can move in
 (1) upward direction (2) downward direction
 (3) both the directions (4) None

63. Which muscles act involuntarily ?
 (i) Striated muscles (ii) Smooth muscles
 (iii) Cardiac muscles (iv) Skeletal muscles
 (1) (i) and (ii) (2) (ii) and (iii)
 (3) (iii) and (iv) (4) (i) and (iv)

64. A nail is inserted in the trunk of a tree at a height of 1 metre from the ground level. After 3 years the nail will
 (1) move downwards
 (2) move upwards
 (3) remain at the same position
 (4) move sideways

65. Geeta was asked to prepare a temporary mount of onion peel and list the steps. While writing, she wrote the following steps which may not be in proper sequence. The correct sequence would be
 (i) Add a few drops of safranine stain and transfer to a slide.
 (ii) Cover it with a cover slip.
 (iii) Add a drop of glycerine.
 (iv) Take out onion peel.
 (v) Keep the peel in water in a petridish.
 (1) i, ii, iii, iv, v (2) iv, v, iii, ii, i
 (3) iv, v, i, iii, ii (4) v, iv, i, iii, ii

66. Anuradha observed a slide of nerve cell and drew its diagram. Choose the correct labelling.

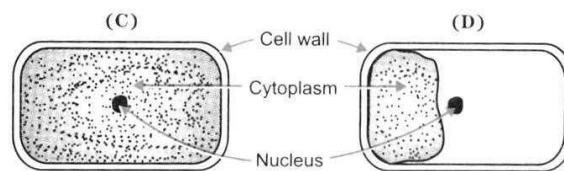
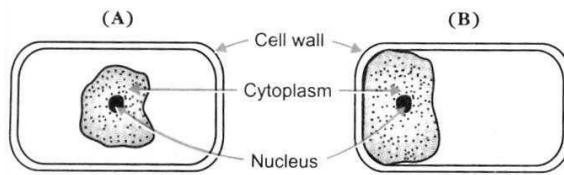


(1) I, II, III, IV, V are correct.
 (2) V, II, III are correct.
 (3) IV, V, II, III are correct.
 (4) Only I and IV are correct.

67. The lining of the kidney tubules is formed by
 (1) squamous epithelium
 (2) cuboidal epithelium
 (3) columnar epithelium
 (4) simple squamous epithelium

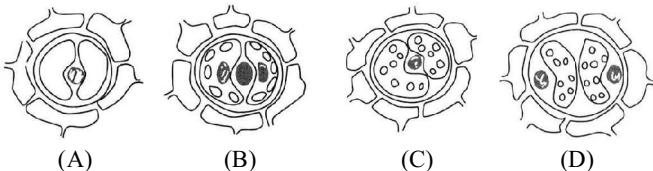
68. The hard matrix of the bone consists of
 (1) calcium & sodium
 (2) magnesium & sodium
 (3) phosphorous & magnesium
 (4) calcium & phosphorous

69. Onion peel cells were placed in hypertonic solution for some time and then observed under the microscope out of A, B, C, D which is the correct observation ?



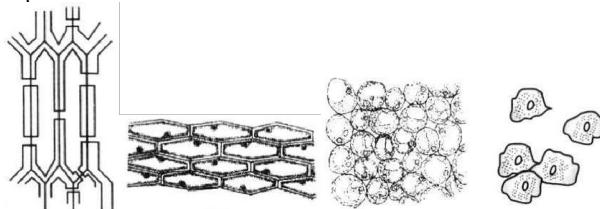
(1) A (2) B
 (3) C (4) D

70. Students observed the epidermal peel of a leaf under the high power of a microscope. The following are the sketches made by them.



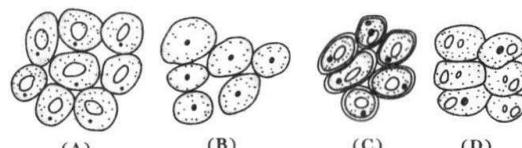
(A) (B) (C) (D)
 The correct sketch is
 (1) A (2) B
 (3) C (4) D

71. Four slides were observed under the microscope for spot test as shown below. The correct identification of the four spots is



(A) (B) (C) (D)
 (1) A : onion peel, B : cheek cells, C : sclerenchyma, D : parenchyma
 (2) A : cheek cells, B : parenchyma, C : sclerenchyma, D : onion peel
 (3) A : parenchyma, B : cheek cells, C : onion peel, D : sclerenchyma
 (4) A : sclerenchyma, B : onion peel, C : parenchyma, D : cheek cells

72. Four students observed a thin transverse section of plant stem and sketched the parenchyma tissue as given below.



The correct diagram is
 (1) A (2) B
 (3) C (4) D

Exercise

2

Matching Based MCQ

DIRECTIONS (Qs 1 to 8) : Match Column-I with Column-II and select the correct answer using the codes given below the columns.

1. **Column I** **Column II**

(A) Structures with one unit membrane (p) Lysosome
 (B) Structures with two membranes (q) Ribosome
 (C) Structures without membrane (r) Plastids
 (D) Structure with membrane bound tubules (s) Endoplasmic reticulum
 (1) A – (r) ; B – (p) ; C – (q) ; D – (s)
 (2) A – (p) ; B – (r) ; C – (q) ; D – (s)
 (3) A – (p) ; B – (q) ; C – (r) ; D – (s)
 (4) A – (p) ; B – (r) ; C – (s) ; D – (q)

2. **Column I** **Column II**

(A) Cell wall (p) Workbench for protein synthesis
 (B) Cell membrane (q) External support and protection, made up of cellulose
 (C) Nucleus (r) Containment of cytoplasm, osmosis
 (D) Ribosomes (s) Location of chromatin
 (1) A – (q) ; B – (r) ; C – (s) ; D – (p)
 (2) A – (r) ; B – (q) ; C – (s) ; D – (p)
 (3) A – (r) ; B – (q) ; C – (p) ; D – (s)
 (4) A – (r) ; B – (p) ; C – (q) ; D – (s)

3. **Column I** **Column II**

(A) Endoplasmic reticulum (p) Sorting, packaging, labeling of cell products
 (B) Chloroplast (q) Production and segregation of proteins to be secreted
 (C) Golgi body (r) Digestion of nutrients and wornout cell parts
 (D) Lysosomes (s) Organelle of photosynthesis
 (1) A – (s) ; B – (q) ; C – (p) ; D – (r)
 (2) A – (s) ; B – (q) ; C – (r) ; D – (p)
 (3) A – (s) ; B – (r) ; C – (q) ; D – (p)
 (4) A – (q) ; B – (s) ; C – (p) ; D – (r)

4. **Column I** **Column II**

(A) Nerve cells (p) Protection
 (B) Muscle cells (q) Carry messages
 (C) Blood (r) Movement
 (D) Epithelial cells (s) Transport of oxygen
 (1) A – (r) ; B – (q) ; C – (p) ; D – (s)
 (2) A – (q) ; B – (r) ; C – (p) ; D – (s)
 (3) A – (q) ; B – (r) ; C – (s) ; D – (p)
 (4) A – (q) ; B – (s) ; C – (r) ; D – (p)

5. **Column I** **Column II**

(A) Jute (p) Cutin
 (B) Bottle cork (q) Lignin
 (C) Cuticle (r) Suberin
 (D) Pear (s) Sclereids
 (1) A – (r) ; B – (q) ; C – (p) ; D – (s)
 (2) A – (q) ; B – (r) ; C – (p) ; D – (s)
 (3) A – (q) ; B – (r) ; C – (s) ; D – (p)
 (4) A – (q) ; B – (s) ; C – (r) ; D – (p)

6. **Column I** **Column II**

(A) Dermal tissue (p) Covers, protects
 (B) Meristematic tissue (q) Makes up bulk of plant; stores nutrients
 (C) Ground tissue plant; regulates gas exchange (r) Conduct water and dissolved nutrients
 (D) Vascular tissues (s) Adds new cells through growth
 (1) A – (r) ; B – (s) ; C – (p) ; D – (q)
 (2) A – (s) ; B – (r) ; C – (p) ; D – (q)
 (3) A – (s) ; B – (r) ; C – (q) ; D – (p)
 (4) A – (s) ; B – (q) ; C – (r) ; D – (p)

7. **Column I** **Column II**

(A) Loose connective (p) Ears and joints
 (B) Dense connective (q) Circulatory system
 (C) Blood (r) Under skin
 (D) Cartilage (s) Ligaments and tendons
 (1) A – (s) ; B – (r) ; C – (p) ; D – (q)
 (2) A – (r) ; B – (s) ; C – (p) ; D – (q)
 (3) A – (r) ; B – (s) ; C – (q) ; D – (p)
 (4) A – (r) ; B – (q) ; C – (s) ; D – (p)

8. **Column I (Cell)** **Column II (Function)**

(A) Parenchyma (p) Water transport
 (B) Sclerenchyma (q) Provide buoyancy to aquatic plants
 (C) Tracheids (r) Storage, division
 (D) Aerenchyma (s) Mechanical strength
 (1) A – (r) ; B – (s) ; C – (p) ; D – (q)
 (2) A – (s) ; B – (r) ; C – (p) ; D – (q)
 (3) A – (s) ; B – (r) ; C – (q) ; D – (p)
 (4) A – (s) ; B – (q) ; C – (r) ; D – (p)

Statement Based MCQ

9. Consider the following statements:

(a) In living organisms, the mitochondria are the only cell organelle outside the nucleus that contain DNA.

(b) Nuclei and mitochondria are surrounded by a double membrane.

Which of these statement(s) is/are correct ?

(1) (a) only (2) (b) only
 (3) Both (a) and (b) (4) Neither (a) nor (b)

10. Consider the following statements :

- Connective tissue functions in binding and supporting animal tissues.
- Histology is the study of cells and tissues.
- Adipose tissue is a type of connective tissue.
- Blood is a type of connective tissue.

Which of these statement(s) is/are correct ?

- (a), (b) and (c)
- (a), (c) and (d)
- (b), (c) and (d)
- All are correct

11. Consider the following statements:

- The ER functions both as a passageway for intracellular transport and as a manufacturing surface.
- Ribosomes are present in eukaryotic cells only.
- SER detoxifies many poisons and drugs.

Which of these statement(s) is/are correct ?

- (a) and (b)
- (b) and (c)
- (a) and (c)
- All are correct

12. Consider the following statements:

- Epithelial cells have a lot of intercellular spaces.
- Epithelial tissue is the simplest tissue.
- Ciliated epithelium helps in removing unwanted particles from trachea.
- Epithelial layer does not allow regulation of materials between body and external environment.

Which of these statement(s) is/are correct ?

- (b) and (c)
- (c) and (d)
- (b) and (d)
- All are correct

13. Consider the following statements :

- Unstriped muscles are always innervated by nerves from autonomous nervous system.
- Striated muscles are voluntary muscles.
- Cardiac muscles undergo rhythmic contraction and relaxation throughout life.

Which of these statement(s) is/are correct ?

- (a) and (b)
- (b) and (c)
- (a) and (c)
- All are correct

14. Consider the following statements:

- Lysosomes are formed by endoplasmic reticulum.
- The inner membrane of mitochondria is porous.
- The enzymes found inside lysosomes are synthesized by rough endoplasmic reticulum.
- Osmosis is a special type of diffusion of water from a dilute solution to a concentrated solution.

Which of these statement(s) is/are correct ?

- (a) only
- (b) only
- (c) and (d)
- All are correct

15. Consider the following statements :

- A nerve is a bundle of axons of the neurons.
- Collenchyma cells are dead and have irregular thickenings at the corners.
- Skin epithelium is called stratified squamous epithelium because it has one layer of cells.
- Tendons connect muscles to bones.

Which of these statement(s) is/are correct ?

- (a) and (b)
- (c) only
- (a) and (d)
- All are correct

16. Consider the following statements :

- Lysosomes are called as 'suicide bags' of a cell.
- The folds of inner membrane of mitochondria increase the area for ATP generating chemical reactions.
- Lysosomes are produced by endoplasmic reticulum.
- Chlamydomonas* is a multicellular organism.

Which of these statement(s) is/are correct ?

- (a) and (b)
- (b) and (c)
- (c) and (d)
- All are correct

Passage Based MCQ

DIRECTIONS (Qs. 17 to 23) : Read the passage(s) given below and answer the questions that follow.

PASSAGE - 1

Mitochondria are called power house or storage batteries or ATP mills as there are sites for ATP formation (Respiration) through electron transport and oxidative phosphorylation which is used in various metabolic activities or functions of the cell.

- ATP is formed in
 - mitochondria
 - nucleus
 - lysosome
 - ribosomes
- The site for cellular respiration is
 - nucleus
 - ribosome
 - mitochondria
 - endoplasmic reticulum
- Mitochondria are the site for
 - phosphorylation
 - oxidative phosphorylation
 - transpiration
 - carboxylation

PASSAGE - 2

Eukaryotic cells have more DNA than prokaryotic cells because in eukaryotic cells complex chromosomes composed of DNA and histone proteins. But in prokaryotic cells histone protein is absent.

- Which of the following is absent in prokaryotes ?
 - DNA
 - RNA
 - plasma membrane
 - Mitochondria
- The cell organelles are found in
 - bacterial cells
 - cyanobacterial cells
 - prokaryotic cells
 - eukaryotic cells

PASSAGE - 3

In any cell, nucleus controls cellular activities and ribosomes are the sites of protein synthesis. While lysosomes are bags of digestive enzymes, energy formation takes place in the mitochondria.

- Which cells are likely to posses the highest numbers of mitochondria?
 - Hair cells
 - Skin surface cells
 - Red blood cells
 - Muscle cells
- Which cells are likely to show much lysosomal activity?
 - Damaged cells
 - Gland cells
 - Hair cells
 - Skin cells

Assertion Reason Based MCQ

DIRECTIONS (Qs. 24 to 30) : Following questions consist of two statements, one labelled as the '**Assertion**' and the other as '**Reason**'. You are to examine these two statements carefully and select the answer to these items using the code given below.

Code :

- (1) Both A and R are individually true and R is the correct explanation of A:
- (2) Both A and R are individually true but R is not the correct explanation of A.
- (3) A is true but R is false
- (4) A is false but R is true.

24. **Assertion :** Larger cells are less efficient.
Reason : Surface volume ratio is more in large cells.

25. **Assertion :** Schleiden and Schwann were the first to put forward cell theory.
Reason : The cells are always living unit.

26. **Assertion :** Lysosomes help in photorespiration.
Reason : Lysosome have hydrolytic enzymes.

27. **Assertion :** Cell wall is not found in animal cell.
Reason : Animal cells are covered by cell membrane.

28. **Assertion :** Eukaryotic cells have more DNA than prokaryotic cells.
Reason : Eukaryotic are genetically more complex than Prokaryotes.

29. **Assertion :** Endoplasmic reticulum acts as a circulatory.
Reason : Endoplasmic reticulum functions as cytoskeleton.

30. **Assertion :** Mitochondria is known as power house of cell.
Reason : ATP production takes place here.

Correct Definition Based MCQ

31. Choose the best definition of 'tissue'?

- (1) A living multicellular organism that has several organ system.
- (2) A group of similar cells performing a specific function.
- (3) A spherical body, which can be seen under higher magnification of microscope.
- (4) Green coloured part present in leaves.

32. Choose the best definition of 'vacuole'?

- (1) An fluid filled structure surrounded by membrane.
- (2) A thread like structure containing nuclear material.
- (3) A jelly like substance which is present between nucleus and cell membrane.
- (4) The basic structural units of an organism.

33. Choose the best definition of 'multicellular'?

- (1) The single celled organism.
- (2) The cytoplasmic projection which helps in locomotion and feeding of *Amoeba*.
- (3) Organisms made of more than one cell.
- (4) A group of tissues which together perform specific function.

Feature Based MCQ

Hints & Solutions

Exercise 1

1. (1) Robert Hooke observed a thin slice of cork under the microscope. He observed small box like structures which he named as cells.
2. (3) The plasma membrane allows the entry and exit of some of the materials in and out of the cell. It also prevents movement of some other materials. Some substances like carbon-dioxide or oxygen move across the cell membrane by a process called diffusion. On the other hand, substances like water moves across the cell membrane through the process called osmosis. Therefore, the cell membrane is called a selectively permeable membrane.
3. (3) 4. (3) 5. (4) 6. (1)
7. (1) In prokaryotes, the nucleoid is an irregularly shaped region within the cell where the genetic material is localised.
8. (2) Cell division is a process by which a cell, called the parent cell, divides into two cells, called daughter cells. In meiosis however, a cell is permanently transformed and cannot divide again. Cell division takes from 3 minutes to 6 hours to complete. The primary concern of cell division is the maintenance of the original cell's genome. Before division can occur, the genomic information which is stored in chromosomes must be replicated, and the duplicated genome separated cleanly between cells.
9. (4) 10. (3) 11. (3) 12. (3)
13. (1) A virus is a sub-microscopic particle (ranging in size from 20 - 300 nm) that can infect the cells of a biological organism. Viruses can replicate themselves only by infecting a host cell.
14. (1) The surface of the rough endoplasmic reticulum is studded with protein-manufacturing ribosomes giving it a "rough" appearance. The ribosomes only bind to the ER once it begins to synthesize a protein destined for sorting. The membrane of the rough endoplasmic reticulum is continuous with the outer layer of the nuclear envelope.
15. (2) 16. (1) 17. (4) 18. (2)
19. (3) The smooth endoplasmic reticulum has functions in several metabolic processes, including synthesis of lipids, metabolism of carbohydrates and calcium concentration, drug detoxification, and attachment of receptors on cell membrane proteins.
20. (1) The Golgi apparatus is integral in modifying, sorting, and packaging the substances for cell secretion or for use within the cell. It primarily modifies proteins delivered from the rough endoplasmic reticulum, but is also involved in the transport of lipids around the cell, and the creation of lysosomes.
21. (4) 22. (1) 23. (2) 24. (2)
25. (3) Lysosomes are organelles that contain digestive enzymes (acid hydrolases). They digest excess or worn out organelles, food particles, and engulfed viruses or bacteria. The membrane surrounding a lysosome prevents the digestive enzymes inside from destroying the cell.
26. (1) In cell biology, a mitochondrion is a membrane-enclosed organelle, found in most eukaryotic cells. Mitochondria are sometimes described as "cellular power plants," because they generate most of the cell's supply of ATP, used as a source of chemical energy.
27. (2) 28. (4) 29. (2) 30. (2)
31. (2) Adenosine 5'-triphosphate (ATP) is a multifunctional nucleotide that is most important as a "molecular currency" of intracellular energy transfer. ATP transports chemical energy within cells for metabolism. It is produced as an energy source during the processes of photosynthesis and cellular respiration and consumed by many enzymes and a multitude of cellular processes including biosynthetic reactions, motility and cell division.
32. (4) Plastids are major organelles found in plants and algae. Plastids are responsible for photosynthesis, storage of products like starch and for the synthesis of many classes of molecules such as fatty acids and terpenes which are needed as cellular building blocks and/or for the function of the plant.
33. (1) 34. (1) 35. (2) 36. (2)
37. (3) Although most of a cell's DNA is contained in the cell nucleus, mitochondria have their own independent genomes. As mitochondria contain ribosomes and DNA, and are only formed by the division of other mitochondria, it is generally accepted that they were originally derived from endosymbiotic prokaryotes. Plastid DNA exists as large protein-DNA complexes associated with the inner envelope membrane and called 'plastid nucleoids'. Each nucleoid particle may contain more than 10 copies of the plastid DNA.
38. (1) Chlorophyll is a green pigment found in most plants, algae, and cyanobacteria. Chlorophyll absorbs most strongly in the blue and red but poorly in the green portions of the electromagnetic spectrum, hence the green color of chlorophyll-containing tissues like plant leaves. Chlorophyll is vital for photosynthesis, which helps plants obtain energy from light.
39. (3) 40. (1) 41. (2)
42. (1) Muscle tissue is separated into three distinct categories: visceral or smooth muscle, which is found in the inner linings of organs; skeletal muscle, which is found attached to bone in order for mobility to take place; and cardiac muscle which is found in the heart. Vascular tissue is a complex tissue found in vascular plants, meaning that it is composed of more than one cell type. The primary components of vascular tissue are the xylem and phloem. Connective tissue - It holds everything together. Blood is a connective tissue.
43. (3) A meristem is a tissue in plants consisting of undifferentiated cells (meristematic cells) and found in zones of the plant where growth can take place.
44. (3) 45. (3) 46. (2)

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Scholastic Aptitude Test (SAT) — BIOLOGY

47. (2) The intercalary meristem increases the girth of the stem or root. The intercalary meristems occur only in monocot stems between mature tissues. They are cylindrical meristems located around the nodes and are an adaptation to grazing herbivores and lawnmowers.

48. (2) Differentiated plant cells generally cannot divide or produce cells of a different type. Therefore, cell division in the meristem is required to provide new cells for expansion and differentiation of tissues and initiation of new organs, providing the basic structure of the plant body.

49. (4) 50. (2) 51. (3)

52. (4) Parenchyma cells are thin-walled cells of the ground tissue that make up the bulk of most nonwoody structures, although sometimes their cell walls can be lignified. Parenchyma cells in between the epidermis and pericycle in a root or shoot constitute the cortex, and are used for storage of food.

53. (1) Collenchyma tissue is composed of elongated cells with unevenly thickened walls. They provide structural support, particularly in growing shoots and leaves.

54. (3) Sclerenchyma is a supporting tissue. Two groups of sclerenchyma cells exist: fibres and sclereids. Their walls consist of cellulose and/or lignin. Sclerenchyma fibres are of great economical importance, since they constitute the source material for many fabrics flax, hemp, jute, ramie.

55. (4) A xerophyte or xerophytic organism is an organism, which is able to survive in an ecosystem with little to no water or moisture; usually in environments where heat accounts for a similar amount of water loss to that of transpiration.

56. (3) 57. (3) 58. (4)

59. (2) A stoma is a tiny opening or pore, found mostly on the underside of a plant leaf, and used for gas exchange. The pore is formed by a pair of specialized sclerenchyma cells known as guard cells which are responsible for regulating the size of the opening.

60. (4) Vascular tissue is a complex tissue found in vascular plants, meaning that it is composed of more than one cell type. The primary components of vascular tissue are the xylem and phloem. These two tissues transport fluid and nutrients internally.

61. (3) Xylem parenchyma is the only living tissue of the xylem while the tracheids, vessels and the fibres are all dead tissues.

62. (3) In the xylem, the substances move only in the upward direction but in the phloem substances move in both the directions.

63. (2) 64. (3) 65. (3) 66. (2)

67. (2) Cuboidal cells have a shape similar to a cube, meaning its width is the same size as its height. The nuclei of these cells are usually located in the center. The lining of the kidney tubules is formed by it.

68. (4) The matrix comprises the other major constituent of bone. It has inorganic and organic parts. The inorganic is mainly crystalline mineral salts and calcium, which is present in the form of hydroxyapatite. The matrix is initially laid down as unmineralized osteoid. Mineralisation involves osteoblasts secreting vesicles containing alkaline phosphatase. This cleaves the phosphate groups and acts as the foci for calcium and phosphate deposition.

69. (2) It shows cytoplasm shrunk and collected on a side of the cell due to loss of water.

70. (2) Guard cells have nucleus as well as chloroplasts.

71. (4) Correct identification of the four tissues.

72. (1) The cells of parenchyma tissue are thin walled, isodiametric, nucleated and have dense cytoplasm.

Exercise 2

1. (2) 2. (1) 3. (4) 4. (3)

5. (2) 6. (2) 7. (3) 8. (1)

9. (2) Mitochondria are present in animals as well as in plants that contain DNA but in plants, plastids are also present that have their own DNA and ribosomes.

10. (4)

11. (3) Ribosomes are present in prokaryotic as well as in eukaryotic cells.

12. (1) Epithelial cells are tightly packed and form a continuous sheet. They have only a small amount of cementing material between them and almost no intercellular spaces. The permeability of the cells of various epithelia plays an important role in regulating the exchange of materials.

13. (4)

14. (3) Lysosomal membrane is formed in ER, later it is modified and transferred to the cis face of Golgi apparatus where further processing release lysosome. In mitochondria, the outer membrane is porous while the inner membrane is deeply folded.

15. (3) Collenchyma cells are living, elongated and irregularly thickened at the corners. Skin epithelium is called stratified squamous epithelium because their cells are arranged in many layers to prevent wear and tear.

16. (1) *Chlamydomonas* is a single-celled green alga. Lysosome membrane formed in ER and further processing done in Golgi apparatus to form lysosome.

17. (1) ATP is formed in mitochondria because mitochondria is the power house of a cell.

18. (3)

19. (2) Mitochondria act as sites for ATP formation through oxidative phosphorylation and electron transport.

20. (4) Mitochondria are present in eukaryotes only.

21. (4) This is one of the features of eukaryotic cells that distinguish them from prokaryotic cells.

22. (4) Muscle cells possess highest number of mitochondria because mitochondria is the power house of cell of ATP formation.

23. (1) Lysosomes keep the cell clean by digesting damaged cells.

24. (3) Small cells function more efficiently than large cells. Small cells can exchange substances more readily than large cells because small objects have a higher surface area-to-volume ratio than larger objects.

25. (3) No, the cells are not always living units. In sclerenchyma tissue, the cells are dead which provide mechanical strength to the plants. Cells are always wearing out. They are then replaced by new ones.

26. (4) Lysosomes help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles.

27. (1) 28. (1) 29. (2) 30. (1)

31. (2) 32. (1) 33. (3) 34. (3)

35. (3) 36. (4)