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CELL: THE BUILDING BLOCK OF LIFE
Class 09 - Science (Exploration)

Time Allowed: 2 hours

Maximum Marks: 152

1. A newly discovered organism has cells that conduct all metabolic activities directly in its semi-fluid internal substance, and genetic material is present in a region without a surrounding membrane. How would this organism's cellular structure be categorized, and what implications does this have for its internal complexity? **[1]**
 - a) Plant cell; implying the presence of chloroplasts for energy.
 - b) Animal cell; requiring external energy sources.
 - c) Eukaryotic; indicating high internal compartmentalization.
 - d) Prokaryotic; suggesting a simpler internal organization.
2. Which characteristic of the cell wall in plant cells helps plant roots absorb water and nutrients from the soil? **[1]**
 - a) It is permeable to water and dissolved minerals.
 - b) It contains proteins to transport substances.
 - c) It is selectively permeable.
 - d) It is rigid and maintains shape.
3. A chemical interferes with the function of cristae within the mitochondria. What would be the direct impact on cellular processes? **[1]**
 - a) Reduced ATP production
 - b) Inefficient waste breakdown
 - c) Decreased lipid synthesis
 - d) Impaired genetic information transfer
4. Which crucial biological process is primarily responsible for the growth and repair of existing tissues in an organism? **[1]**
 - a) Meiosis
 - b) Photosynthesis
 - c) Respiration
 - d) Mitosis
5. Why do new cells formed during tissue repair need to be genetically identical to the old cells they replace? **[1]**
 - a) To simplify the process of cell differentiation.
 - b) To maintain the original function and structure of the tissue.
 - c) To introduce genetic variation and adaptability.
 - d) To facilitate the process of sexual reproduction.
6. An observer uses a microscope with a field of view diameter of 5000 μm . If 50 cells are counted along the diameter, what is the estimated real size of one cell? **[1]**
 - a) 250 μm
 - b) 100 μm
 - c) 50 μm
 - d) 10 μm

7. The total magnification of a microscope is determined by combining the magnifying power of which two components? **[1]**
- a) Body tube and Handle
 - b) Fine adjustment knob and Coarse adjustment knob
 - c) Mirror and Stage
 - d) Eyepiece and Objective Lens
8. A scientist observes a cell under a microscope and notes the presence of a cell wall, chloroplasts, and a large central vacuole. This cell is most likely to be absent in which of the following organisms? **[1]**
- a) A photosynthetic bacterium
 - b) A unicellular alga
 - c) A multicellular plant
 - d) An animal
9. What is the primary reason for a small cut on the skin healing and falling hair growing back? **[1]**
- a) Cells in our body can differentiate into different types.
 - b) Cells in the body grow larger.
 - c) Cells grow and divide
 - d) The body increases in overall size.
10. What role do chromoplasts play in stimulating plant reproduction? **[1]**
- a) They store nutrients essential for seed development.
 - b) They synthesize chlorophyll, which is vital for the growth of reproductive organs.
 - c) They produce hormones that directly trigger flowering.
 - d) Their bright colors attract pollinators and seed dispersers.
11. If the nuclear membrane of an eukaryotic cell were to become completely impermeable, what would be the immediate and critical impact on cellular function? **[1]**
- a) Energy production would dramatically increase.
 - b) It would enhance the protection of genetic material.
 - c) Material transfer would stop, halting gene expression.
 - d) The cell would become unicellular.
12. Why is the inner membrane of the mitochondrion highly folded into cristae? **[1]**
- a) To allow easy movement into the matrix.
 - b) To protect the mitochondrial DNA from damage.
 - c) To increase the surface area for energy production
 - d) To facilitate the fusion of mitochondria with other organelles.
13. Which organelle is referred to as the 'house of coded instructions'? **[1]**
- a) Endoplasmic Reticulum
 - b) Nucleus
 - c) Mitochondria
 - d) Ribosomes
14. If a cell's lysosomes stop functioning correctly, what would be the most immediate consequence for the cell? **[1]**
- a) The cell would be unable to regulate
 - b) The cell would lose its ability to

substance passage.

synthesize proteins.

c) Waste materials and damaged organelles would accumulate.

d) Energy production within the cell would cease entirely.

15. What is the primary role of meiosis in sexually reproducing organisms? **[1]**

a) Repairing damaged tissues

b) Normal growth and maintenance

c) Asexual reproduction

d) Creation of genetic diversity

16. Who was the first person to observe a cell and in what year? **[1]**

a) Anton van Leeuwenhoek in 1675

b) Matthias Schleiden in 1838

c) Robert Hooke in 1665

d) Louis Pasteur in 1865

17. The fluid-mosaic model describes the cell membrane as fluid. What does this fluidity primarily allow for within the membrane structure? **[1]**

a) Formation of a rigid, static barrier.

b) Restriction of all molecular movement.

c) Solidification at body temperature.

d) Molecules to move sideways, flip, and rotate.

18. Which organelle is responsible for modifying, sorting, and packaging proteins and lipids? [1]

a) Lysosomes

b) Endoplasmic Reticulum

c) Golgi apparatus

d) Mitochondria

19. Which scientist expanded the Cell Theory by stating that new cells are formed only from pre-existing cells? **[1]**

a) Gottlieb Haberlandt

b) Matthias Schleiden

c) Theodor Schwann

d) Rudolf Virchow

20. How do single-celled organisms interact with their environment? **[1]**

a) Through specialized tissues and organs

b) Exclusively through passive diffusion of all substances

c) By exchanging materials through the cell membrane.

d) By developing complex internal communication systems

21. What happens to the number of chromosomes in each daughter cell after the first division in meiosis? **[1]**

a) It doubles compared to the parent cell.

b) It is reduced to half of the parent cell's number.

c) It remains the same as the parent cell.

d) It becomes zero.

22. When a Rhoeo leaf peel is placed in a concentrated sugar solution, the inner content shrinks, but **[1]** the overall cell size remains unchanged due to the cell wall. In contrast, onion peel cells, when similarly treated, would also maintain their overall shape despite plasmolysis. What critical property of the cell wall does this demonstrate in both plant types?

a) The cell wall actively transports water into the cell.

- b) The cell wall is selectively permeable and regulates solute movement.
- c) The cell wall is flexible and allows cells to change shape.
- d) The cell wall is rigid, providing structural support.
23. Consider a case where a plant cell develops a defect that prevents its leucoplasts from storing starch effectively. What visible consequence would this have on the plant? **[1]**
- a) The plant would struggle to grow and store excess energy.
- b) The plant would exhibit abnormal leaf coloration.
- c) The plant would experience reduced water uptake.
- d) The plant's flowers and fruits would lose their vibrant colors.
24. What is the outcome of mitosis regarding the genetic information in daughter cells? **[1]**
- a) The genetic information is randomly distributed, leading to variation.
- b) Each daughter cell gets the same DNA and chromosome number.
- c) Each daughter cell gets different DNA and chromosome numbers.
- d) Daughter cells get half the DNA but the same chromosome number.
25. What is the limit of resolution of the human eye? **[1]**
- a) 1 mm
- b) 0.1 mm
- c) 0.01 mm
- d) 10 mm
26. What is the primary function of an objective lens and an eyepiece in a compound microscope? **[1]**
- a) To filter the light spectrum.
- b) To adjust the field of view.
- c) To provide magnification of an object.
- d) To stabilize the specimen.
27. If a manufacturing defect causes the ribosomes in a pancreatic cell to become detached from the endoplasmic reticulum, what would be the most immediate consequence on the cell's function? **[1]**
- a) Accumulation of cellular waste
- b) Impaired protein synthesis and secretion
- c) Difficulty in maintaining cell shape
- d) Reduced energy production
28. An organism is undergoing intense repair and replacement of cells that are regularly lost, such as skin cells. Which cell division process would be most prevalent in these tissues? **[1]**
- a) Both mitosis and meiosis equally, depending on the organism's age.
- b) Meiosis, because it ensures genetic recombination for adaptation.
- c) Mitosis, which continuously replaces lost cells while maintaining genetic consistency.
- d) Only cell enlargement without division, to compensate for loss.
29. What is cellulose, the primary component of plant cell walls, made of? **[1]**
- a) Nucleic acids
- b) Lipids
- c) Proteins
- d) A carbohydrate made of linked glucose units.
30. What is the primary function of cell division in the context of replacing dead or damaged **[1]**

epidermal cells?

- a) To create new cells for sexual reproduction.
- c) To ensure genetic diversity in the organism.

- b) To generate new, functional cells for repair and maintenance.
- d) To reduce the overall size of the organism.

31. **Assertion (A):** The fluid-mosaic model accurately describes the cell membrane's structure and function. [1]

Reason (R): The cell membrane contains a lipid bilayer with embedded proteins acting as gatekeepers.

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

32. **Assertion (A):** Animal cells shrink considerably in concentrated sugar solutions. [1]

Reason (R): Animal cells lack a cell wall and cannot withstand osmotic pressure.

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

33. **Assertion (A):** Cells are the fundamental structural and functional units. [1]

Reason (R): Even in organ systems, cells retain their basic unit role.

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

34. **Assertion (A):** Microscopic improvements are essential for detailed cellular study. [1]

Reason (R): Magnification, resolution, and contrast are continuously enhanced in microscopes.

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

35. **Assertion (A):** Diffusion can occur without the presence of a membrane. [1]

Reason (R): Osmosis requires a selectively permeable membrane to occur.

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

36. Define totipotency in plants and explain its importance for plant regeneration techniques. [2]

37. How does a cell multiply? [2]

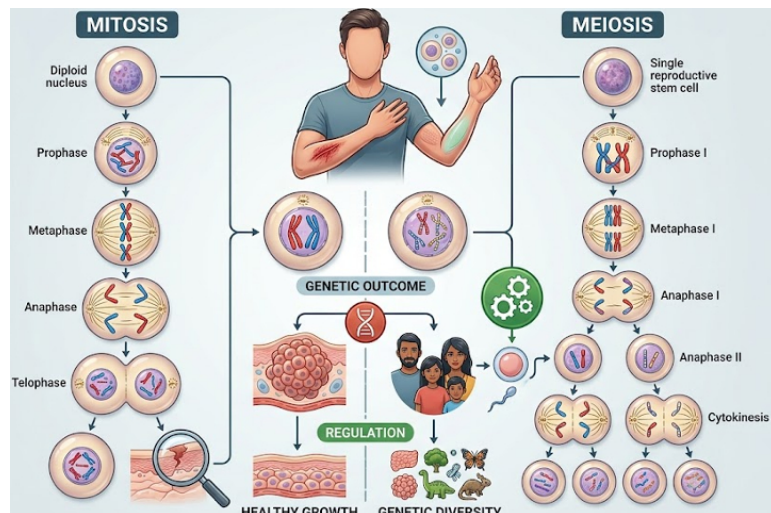
38. Where does a cell come from? [2]

39. If the skin cells start dividing by meiosis instead of mitosis, what do you think will happen to a cut on the skin? [2]

40. Which organelle is responsible for storing starch in plant cells and how does it appear? [2]

41. Where does meiosis occur in animals, and what specific cells are produced through this process? [2]
42. Explain how cell numbers increase during body growth, distinguishing it from individual cell enlargement. [2]
43. Explain how the structural differences between Rough Endoplasmic Reticulum (RER) and Smooth Endoplasmic Reticulum (SER) relate to their distinct functions within a cell. [2]
44. Explain contact inhibition in animal cells and contrast it with how plant cells manage growth. [2]
45. Describe the fundamental purpose of cell division in living organisms. [2]
46. What consequences would you predict for a plant cell if its cell wall were to become as flexible as a cell membrane? [2]
47. State the two principal assertions of the classical cell theory. [2]
48. What argument would you give for the necessity of a cell wall in plants usually fixed in one place versus in animals usually moving from one place to the other? [2]
49. What are the two primary types of cell division, and what is the main function of each? [2]
50. Why is it important to cut the two potato pieces in roughly equal size and measure their initial weight before placing them in different liquids? [2]
51. How is the cell structural and functional unit of life? [2]
52. Why are cells considered the fundamental unit of structure and function in living organisms? [2]
53. Do white flowers contain any pigment? Give reasons. [2]
54. Name the primary carbohydrate component of plant cell walls and explain its significance for human digestion. [3]
55. What is the recognized basic level at which life is said to exist? [3]
56. What are plastids, and how do chloroplasts and chromoplasts differ in their function concerning plant coloration and energy production? [3]
57. Describe the fundamental components that form the basic structure of most cells, detailing their primary roles. [3]
58. What is the minimum distance at which two points can be seen as distinct by the unaided human eye when viewed from approximately 25 cm? [3]
59. Explain why plant cells retain their external shape when they lose water in a concentrated solution while animal cells do not. [3]
60. How have technological interventions facilitated the creation of new knowledge in understanding the world beyond the naked eye? [3]
61. What is the primary function of chromosomes, and how does their form change within a cell cycle? [3]
62. Instead of many small ones, why does a cell not have a single giant mitochondrion? How does this relate to the concept of surface area? [3]
63. Explain how the structural characteristics of mitochondria contribute to their role as the 'powerhouses of the cell'. [3]
64. What are the three primary features of a microscope that scientists have continually improved over time to enhance its utility? [3]
65. What would happen if gametes are formed by mitotic divisions? [3]
66. **Read the following text carefully and answer the questions that follow:** [4]
Cells in living organisms grow and divide to replace old, damaged, or dead cells, enabling growth, repair, and maintenance. This process, known as cell division, occurs continuously in certain

tissues like skin. In eukaryotic organisms, cell division is highly organised and follows a sequence called the cell cycle. There are two main types of cell division: mitosis and meiosis. Mitosis is responsible for growth and repair, producing two genetically identical daughter cells with the same number of chromosomes as the parent cell. This ensures stability of genetic information. In contrast, meiosis occurs in reproductive cells and produces four daughter cells, each with half the number of chromosomes.



This reduction is essential for maintaining the chromosome number after fertilisation and also introduces genetic variation. Proper regulation of these processes is crucial, as errors in mitosis can lead to uncontrolled cell growth, while errors in meiosis may result in genetic disorders or reduced fertility.

- i. What is cell division? (1)
- ii. What is the function of mitosis? (1)
- iii. How is meiosis different from mitosis? (2)

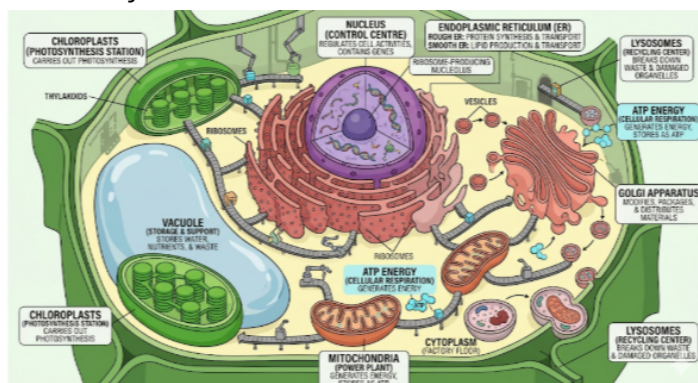
OR

Why is proper control of cell division important? (2)

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

[4]

The interior of a cell functions as a highly coordinated system where various organelles perform specialised roles to maintain life. The nucleus acts as the control centre, containing DNA and genes that regulate all cellular activities and inheritance. Ribosomes serve as sites for protein synthesis, while the endoplasmic reticulum helps in the production and transport of proteins and lipids. The Golgi apparatus modifies, packages, and distributes these materials within or outside the cell. Lysosomes break down waste materials and damaged organelles, keeping the cell clean.



Mitochondria generate energy through cellular respiration and store it as ATP, which powers cellular processes. In plant cells, plastids like chloroplasts carry out photosynthesis, while

vacuoles store water, nutrients, and waste, helping maintain cell structure. All these organelles work together like parts of a factory, ensuring that the cell functions efficiently and responds to its needs.

Questions:

- i. What is the function of the nucleus? **(1)**
- ii. Which organelle is known as the powerhouse of the cell? **(1)**
- iii. How do different cell organelles work together in a cell? **(2)**

OR

What role does the Golgi apparatus play in a cell? **(2)**

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

The Cell Theory explains the fundamental nature of living organisms and was developed through the work of scientists such as Matthias Schleiden, Theodor Schwann, and Rudolf Virchow. It states that all living organisms are made up of cells, the cell is the basic unit of structure and function, and all cells arise from pre-existing cells. Cells grow, divide, and eventually die, maintaining balance in the body. This process is regulated, but if it fails, it can lead to problems such as uncontrolled cell division seen in cancer. In normal conditions, animal cells stop dividing when they come into contact with each other, a process called contact inhibition.



Additionally, cells undergo programmed cell death to remove unnecessary or damaged cells. Thus, cells not only form the building blocks of life but also ensure proper growth, repair, and functioning of living organisms.

Questions:

- i. What does the Cell Theory state about living organisms? **(1)**
- ii. What is contact inhibition? **(1)**
- iii. Why is programmed cell death important? **(2)**

OR

What happens when cell division is not properly controlled? **(2)**

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

Cells are extremely small and cannot usually be seen with the unaided human eye because of its limited resolving power, which is about 0.1 mm. This limit means that two objects closer than this distance appear as a single point. To study such tiny structures, scientists use microscopes, which employ convex lenses or combinations of lenses like the objective lens and eyepiece to magnify

objects. The invention of the microscope greatly advanced cell biology. Robert Hooke was the first to observe cells in 1665 using a simple microscope and named them after noticing box-like structures in cork.



Modern light microscopes use different objective lenses, such as 10X or 40X, to improve magnification and resolution. The total magnification is calculated by multiplying the magnifying power of the eyepiece and objective lens. Continuous improvements in resolution, contrast, and magnification have made microscopes essential tools for studying cell structure in detail.

Questions:

- i. What is the limit of resolution of the human eye? **(1)**
- ii. Who discovered cells and how? **(1)**
- iii. How does a microscope help in studying cells? **(2)**

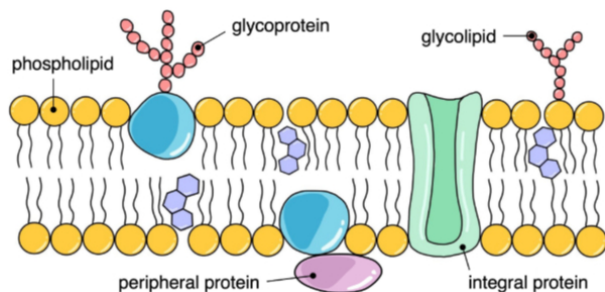
OR

How is total magnification of a microscope calculated? **(2)**

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

[4]

The cell membrane is a thin, flexible boundary that surrounds the cell, protecting its contents and controlling the movement of substances. It is also called the plasma membrane and is selectively permeable, allowing some substances like water and gases to pass while restricting others. The movement of water across this membrane occurs through osmosis, where water travels from a region of higher concentration to lower concentration. Structurally, the membrane is made of lipids and proteins and follows the fluid mosaic model, where molecules can move freely, making it dynamic. In addition to the cell membrane, plant cells possess a rigid outer layer called the cell wall, mainly composed of cellulose.



This provides strength, maintains shape, and protects the cell. Unlike plant cells, animal cells lack a cell wall, making them more flexible. The cell wall is permeable and works with the membrane to regulate the movement of substances.

Questions:

- i. What is the function of the cell membrane? **(1)**
- ii. What is osmosis? **(1)**

iii. Why do plant cells not shrink completely in a concentrated solution? **(2)**

OR

How is the structure of the cell membrane described by the fluid mosaic model? **(2)**

71. i. Distinguish between the outcomes of mitosis and meiosis in terms of the number of daughter cells produced and their genetic content relative to the parent cell. **[5]**
ii. Explain why children resemble their parents but are not exactly the same, considering the role of a specific type of cell division.
iii. Describe the significance of the reduction in chromosome number during one of the cell division processes for sexual reproduction.
72. How do scientific advancements in microscopy, specifically regarding resolution, contrast, and magnification, contribute to a deeper understanding of cellular processes and structures? **[5]**
73. Draw a well-labelled schematic diagram of a plant or an animal cell using these clues- **[5]**
i. Nucleus appears as a dark and round body inside the cell.
ii. ER spreads like a network of extended nuclear envelope.
iii. Mitochondria and chloroplasts are rod shaped.
74. What is the primary function of a cell wall in plant cells, and how does its composition support this role? **[5]**
75. i. What is the fundamental unit of structure and function in all living organisms? **[5]**
ii. Provide examples of unicellular and multicellular organisms.
iii. How are tissues, organs, and organ systems organized from this basic unit?

Solution
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1.
(d) Prokaryotic; suggesting a simpler internal organization.
Explanation:
The absence of a membrane-bound nucleus and the presence of genetic material in an uncovered region indicate a prokaryotic cell. Prokaryotes lack membrane-bound organelles, so most metabolic activities occur in the cytoplasm, resulting in a simpler internal structure than eukaryotic cells.
2. **(a)** It is permeable to water and dissolved minerals.
Explanation:
The plant cell wall is freely permeable, allowing water and dissolved minerals from the soil to pass through it and reach the cell membrane. This property helps root cells efficiently absorb essential nutrients and water needed for plant growth and survival.
3. **(a)** Reduced ATP production
Explanation:
Cristae are folds of the inner mitochondrial membrane that contain enzymes involved in cellular respiration. Damage to or interference with cristae reduces the efficiency of ATP generation, limiting the energy available for the cell's activities.
4. **(d)** Mitosis
Explanation:
Mitosis is the cell division process dedicated to producing new cells for growth, repair, and maintenance of an organism.
5. **(b)** To maintain the original function and structure of the tissue.
Explanation:
Maintaining genetic identity ensures that the new cells perform the same functions and fit seamlessly into the existing tissue structure, preserving tissue integrity and function.
6. **(b)** 100 μm
Explanation:
The estimated size of one cell is calculated by dividing the field of view diameter by the number of cells across it: $5000 \mu\text{m} \div 50 = 100 \mu\text{m}$. Therefore, the approximate real size of each cell is 100 μm .
7. **(d)** Eyepiece and Objective Lens
Explanation:
The total magnification of a microscope is calculated by multiplying the magnifying power of the eyepiece lens by that of the objective lens. For example, a 10x eyepiece and a 40x objective lens provide a total magnification of 400x.
8. **(d)** An animal
Explanation:
The presence of a cell wall, chloroplasts, and a large central vacuole is characteristic of plant cells. Animal cells lack all three of these features. Therefore, a cell with these structures would be absent in animals but found in plants and many algae.

9.
(c) Cells grow and divide
Explanation:
Small cuts heal and hair grows back because cells undergo **cell division**, producing new cells that replace damaged, dead, or lost cells. This process helps repair tissues and maintain normal body functions.
10.
(d) Their bright colors attract pollinators and seed dispersers.
Explanation:
Chromoplasts, with their yellow, orange, or red pigments, provide bright colors to flowers and fruits, which visually attract pollinators and animals for seed dispersal, thus aiding plant reproduction.
11.
(c) Material transfer would stop, halting gene expression.
Explanation:
The nuclear membrane contains pores that allow the exchange of RNA, proteins, and other molecules between the nucleus and cytoplasm. If it became completely impermeable, essential communication would stop, preventing protein synthesis, ribosome formation, and normal cellular function.
12.
(c) To increase the surface area for energy production
Explanation:
The folding of the inner mitochondrial membrane into cristae significantly increases its surface area, providing more space for the embedded enzymes and proteins involved in cellular respiration and ATP synthesis.
13.
(b) Nucleus
Explanation:
The nucleus contains chromosomes with DNA, which holds the genetic information and is described as the 'house of coded instructions'.
14.
(c) Waste materials and damaged organelles would accumulate.
Explanation:
Lysosomes are responsible for breaking down waste materials and worn-out cellular components. If they ceased to function, these materials would accumulate, leading to cellular toxicity and dysfunction.
15.
(d) Creation of genetic diversity
Explanation:
Meiosis produces gametes with half the chromosome number and introduces genetic variation through processes like crossing over and independent assortment. This variation is essential for sexual reproduction and evolution.
16.
(c) Robert Hooke in 1665
Explanation:

Robert Hooke was the first scientist to observe and describe cells in 1665. While examining a thin slice of cork under a microscope, he saw tiny box-like compartments and named them "cells," laying the foundation for cell biology.

17. **(d)** Molecules to move sideways, flip, and rotate.
Explanation:
The fluid-mosaic model states that phospholipids and some proteins within the cell membrane can move within the bilayer. This fluidity allows molecules to move sideways, rotate, and occasionally flip, helping the membrane remain flexible and functional.
18. **(c)** Golgi apparatus
Explanation:
The Golgi apparatus acts like the cell's post office, modifying, sorting, and packaging proteins and/or lipids.
19. **(d)** Rudolf Virchow
Explanation:
Rudolf Virchow in 1855 expanded the Cell Theory with the principle that all cells arise from pre-existing cells.
20. **(c)** By exchanging materials through the cell membrane.
Explanation:
Even single-celled organisms exchange materials and respond to their environment through the cell membrane.
21. **(b)** It is reduced to half of the parent cell's number.
Explanation:
After the first division of meiosis (Meiosis I), homologous chromosome pairs separate, reducing the chromosome number by half. As a result, each daughter cell contains half the number of chromosomes compared to the original parent cell.
22. **(d)** The cell wall is rigid, providing structural support.
Explanation:
During plasmolysis, water leaves the cell and the cell membrane pulls away from the cell wall. However, the rigid cell wall maintains the cell's original shape and size. This demonstrates the structural support function of the cell wall in plant cells.
23. **(a)** The plant would struggle to grow and store excess energy.
Explanation:
Leucoplasts are colorless plastids that store food materials, especially starch. If they cannot store starch effectively, the plant will have difficulty storing excess energy produced during photosynthesis. This can reduce growth, development, and the plant's ability to survive unfavorable conditions.
24. **(b)** Each daughter cell gets the same DNA and chromosome number.
Explanation:

In mitosis, the parent cell divides to produce two genetically identical daughter cells. Each daughter cell receives the same DNA and the same number of chromosomes as the parent cell, ensuring growth, repair, and replacement of cells.

25. **(b)** 0.1 mm
Explanation:
The limit of resolution of the human eye is stated as 0.1 mm.
26. **(c)** To provide magnification of an object.
Explanation:
The combination of objective lens and eyepiece works to magnify the image of the observed object.
27. **(b)** Impaired protein synthesis and secretion
Explanation:
Pancreatic cells produce and secrete large amounts of proteins, such as digestive enzymes. Ribosomes attached to the rough endoplasmic reticulum synthesize these proteins. If the ribosomes detach, protein production and secretion would be disrupted, affecting the cell's primary function.
28. **(c)** Mitosis, which continuously replaces lost cells while maintaining genetic consistency.
Explanation:
Mitosis helps in growth, repair, and replacement of worn-out or damaged cells. The daughter cells formed are genetically identical to the parent cell.
29. **(d)** A carbohydrate made of linked glucose units.
Explanation:
The plant cell wall is primarily made of cellulose, a type of carbohydrate formed by many glucose units linked together.
30. **(b)** To generate new, functional cells for repair and maintenance.
Explanation:
Cell division, specifically mitosis, is crucial for replacing old, dead, or damaged cells to maintain tissue integrity and function.
31. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
The fluid-mosaic model explains that the membrane is a lipid bilayer with embedded proteins, and these proteins are crucial for regulating substance passage, thus supporting the model's description of function.
32. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Animal cells, lacking a rigid cell wall, are unable to resist the osmotic movement of water out of the cell when placed in a concentrated solution, leading to significant shrinkage.
33. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:

The fact that cells remain the fundamental unit even when organized into complex structures like organ systems reinforces their role as the basic unit of life.

34. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Improving magnification, resolution, and contrast directly enables more detailed study of cells, making improvements essential.

35.

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

Explanation:

Both statements are true. Diffusion is the general movement down a concentration gradient, while osmosis is specifically the diffusion of water across a selectively permeable membrane. R states a condition for osmosis, not a reason for diffusion's nature.

36. Totipotency is the ability of a plant cell to develop into a complete plant when provided with suitable nutrients and favourable conditions. This property is important because it forms the basis of plant tissue culture technology, enabling regeneration of whole plants from single cells.

37. A cell multiplies by cell division. In this process, the parent cell grows, replicates its DNA, and divides into two daughter cells. This occurs through mitosis for growth and repair, ensuring each new cell receives identical genetic material.

38. A cell comes from a pre-existing cell through cell division. New cells are formed when existing cells grow and divide, ensuring continuity of life and transmission of genetic material from parent to daughter cells.

39. It would not heal properly.

Reason:

Meiosis produces half the number of chromosomes and forms non-identical cells meant for reproduction. Skin repair needs identical diploid cells, which are produced by mitosis.

40. Leucoplasts are the organelles responsible for storing starch in plant cells. They are colourless plastids that lack pigments. These structures store food materials such as starch, oils, or proteins, depending on their type. In cells like those of potato and taro, leucoplasts store starch in the form of granules.

41. In animals, meiosis occurs in the reproductive organs. In males, it takes place in the testes to produce sperm cells, while in females, it occurs in the ovaries to produce egg cells. These cells, called gametes, are essential for sexual reproduction and carry half the number of chromosomes.

42. Body growth occurs mainly through an increase in the number of cells rather than the enlargement of individual cells. Cells grow only up to a certain size, after which they divide to form new cells. This process of repeated cell division increases the total number of cells, leading to overall growth.

43. Rough Endoplasmic Reticulum (RER) has ribosomes attached to its surface, giving it a rough appearance and enabling it to synthesise proteins. Smooth Endoplasmic Reticulum (SER) lacks ribosomes, making it smooth in structure, and is involved in the synthesis and storage of lipids and hormones. These structural differences directly determine their specific functions.

44. Contact inhibition is a process in animal cells where cell division stops when cells come into contact with neighbouring cells, preventing overcrowding. In contrast, plant cells do not show contact inhibition due to their rigid cell walls. Instead, they follow a different growth pattern, allowing continuous growth without such regulation.

45. Cell division serves as a fundamental biological process enabling growth, repair of damaged tissues, and reproduction in living organisms. It ensures the replacement of old or lost cells, contributing to the maintenance and survival of the organism. This process is essential for multicellular development from a single cell.

46. If the cell wall became as flexible as the cell membrane, the plant cell would lose rigidity and shape. It could not withstand turgor pressure, leading to swelling or bursting. The plant would lose structural support, become weak, and may collapse.

47. The classical cell theory asserts:

(1) all living organisms consist of one or more cells

(2) the cell is the basic structural and functional unit of life, performing essential processes;

48. Plants remain fixed, so a rigid cell wall is necessary for support, protection, and maintaining shape against external forces. Animals are mobile and need flexibility; absence of a cell wall allows cells to change shape, enabling movement and specialized functions.
49. The two primary types of cell division are mitosis and meiosis. Mitosis is crucial for normal growth, tissue repair, maintenance, and asexual reproduction, producing genetically identical cells. Meiosis, however, is vital for sexual reproduction, forming gametes and contributing to genetic diversity.
50. Cutting equal-sized potato pieces and measuring initial weight ensures a fair test in osmosis experiments. It keeps surface area and mass constant, so any change in weight is due only to movement of water, not differences in size, giving accurate and comparable results.
51. A cell is the structural unit as all organisms are made of cells. It is the functional unit because all vital activities-metabolism, respiration, growth, and reproduction-occur within cells. Thus, cells form the building blocks and carry out essential life processes.
52. Cells are considered the fundamental unit because all living organisms are made of cells, and every essential life process occurs within them. Even when organised into tissues and organs, cells perform vital functions, making them the smallest units capable of sustaining life.
53. Yes, white flowers do contain pigments.
White flowers usually lack colored pigments like anthocyanins, but they often contain colorless or very faint pigments (like flavones). Also, their white appearance is mainly due to reflection of all wavelengths of light by air spaces in the petal cells, rather than complete absence of pigments.
54. The primary carbohydrate forming the plant cell wall is cellulose, a polysaccharide made of many glucose units linked in long chains. Cellulose fibers provide rigidity and structural support to cells and plant tissues, helping maintain shape, withstand mechanical stresses, and keep plants upright. In human digestion cellulose acts as dietary roughage; it is not digested to glucose by human enzymes but aids bowel movement and digestion by adding bulk and promoting healthy intestinal function.
55. The cell is the basic level at which life exists. All living organisms are made up of cells, whether they are unicellular like bacteria and yeast or multicellular like plants and animals. Even in complex organisms, cells form tissues, tissues form organs, and organs form organ systems. Despite this organization, the cell remains the fundamental unit responsible for structure and function, carrying out all essential life processes.
56. Plastids are specialised organelles found in plant cells that are involved in food synthesis and storage. Chloroplasts contain chlorophyll and are responsible for photosynthesis, converting sunlight into chemical energy. Chromoplasts, on the other hand, contain pigments such as yellow, orange, or red, which give colour to fruits and flowers. While chloroplasts are involved in energy production, chromoplasts mainly help in attracting pollinators and aiding seed dispersal through coloration.
57. Most cells consist of three basic components: the plasma membrane, cytoplasm, and nucleus. The plasma membrane is a selectively permeable boundary that controls the movement of substances in and out of the cell. The cytoplasm is a semi-fluid substance where various organelles are suspended and where most cellular activities occur. The nucleus is a prominent structure that contains genetic material (DNA) and controls cell functions. Together, these components ensure the cell maintains its structure, regulates activities, and carries out essential life processes.
58. When viewed from a distance of about 25 cm, the human eye can distinguish two points as separate only if they are at least 0.1 mm apart. If the distance between the points is less than this, they appear as a single point. This limit is known as the resolution of the human eye and defines its ability to see fine details without any optical aid.
59. Plant cells retain their external shape in a concentrated solution because they have a rigid cell wall that maintains their structure. When water is lost through osmosis, the inner contents shrink, but the cell wall prevents collapse. In contrast, animal cells lack a cell wall, so when they lose water, the entire cell shrinks and changes shape.
60. Technological tools like microscopes have enabled scientists to observe cells, organelles, and microorganisms beyond naked-eye limits. Advances such as electron microscopy and imaging techniques have revealed detailed structures and processes, leading to new knowledge about cell function, disease mechanisms, and life at the microscopic level.

61. Chromosomes are vital carriers of genetic information, specifically for the inheritance of characteristics from one generation to the next, stored as DNA molecules. In a non-dividing cell, this DNA exists as an entangled mass called chromatin material. However, as the cell prepares for division, the chromatin material condenses and organizes into distinct, rod-shaped structures known as chromosomes. This transformation enables accurate segregation of genetic material to daughter cells, ensuring proper inheritance.

62. A cell does not have a single giant mitochondrion because it would be inefficient.

Reason (Surface Area concept):

Many small mitochondria provide a **larger total surface area** compared to one big mitochondrion of the same volume. Since energy production (ATP formation) occurs on the inner membrane, **more surface area → more energy production**.

Also, smaller mitochondria allow:

- Better distribution of energy throughout the cell
- Faster exchange of materials

63. Mitochondria have a double-membrane structure that supports efficient energy production. The outer membrane is smooth, while the inner membrane is folded into cristae, increasing the surface area for chemical reactions. These folds contain enzymes necessary for cellular respiration, where glucose is broken down to release energy. This energy is stored in ATP molecules, which power cellular activities. The specialised structure allows mitochondria to produce energy efficiently.

64. The three main features of a microscope that have been improved are resolution, contrast, and magnification. Resolution determines how clearly two close objects can be distinguished. Contrast enhances the visibility of different parts of an object by creating differences in brightness. Magnification enlarges the image of small objects. Improvements in these features have made microscopes powerful tools for studying cells and their internal structures in greater detail.

65. Gametes would be diploid (2n) instead of haploid (n).

Result:

- After fertilization → zygote becomes tetraploid (4n)
- Chromosome number would double every generation
- Leads to genetic imbalance and abnormal development

Conclusion:

Meiosis is essential to maintain a constant chromosome number across generations.

66. i. Cell division is the process by which new cells are formed from pre-existing cells. It helps organisms grow, repair damaged tissues, and replace old or dead cells, ensuring proper functioning and maintenance of the body.

ii. Mitosis helps in growth, repair, and maintenance of the body. It produces two genetically identical daughter cells with the same number of chromosomes, ensuring that genetic information remains unchanged in body cells.

iii. Meiosis differs from mitosis in that it produces four daughter cells with half the number of chromosomes, while mitosis produces two identical cells with the same chromosome number. Meiosis also introduces genetic variation, whereas mitosis maintains genetic stability.

OR

Proper control of cell division is important because errors can lead to serious problems. Uncontrolled mitosis may cause tumour formation, while errors in meiosis can result in genetic disorders, developmental issues, or reduced fertility in organisms.

67. i. The nucleus acts as the control centre of the cell. It contains DNA and genes that regulate cellular activities, control growth, and store hereditary information, ensuring proper functioning and transmission of traits from one generation to another.

ii. Mitochondria are known as the powerhouse of the cell because they produce energy through cellular respiration. This energy is stored in the form of ATP, which is used to carry out various cellular activities efficiently.

iii. Different cell organelles work together like a coordinated system. Each organelle performs a specific function, such as energy production, protein synthesis, or waste removal, and together they ensure the smooth functioning, growth, and survival of the cell.

OR

The Golgi apparatus modifies, sorts, and packages proteins and lipids produced in the cell. It transports these materials to different parts of the cell or outside it, acting like a distribution and shipping centre within the cell.

68. i. The Cell Theory states that all living organisms are made up of one or more cells, the cell is the basic unit of structure and function, and all new cells arise from pre-existing cells, ensuring continuity of life.
- ii. Contact inhibition is the process by which normal animal cells stop dividing when they come into contact with neighbouring cells. This prevents overcrowding and helps maintain proper organisation and controlled growth of tissues in the body.
- iii. Programmed cell death is important because it removes damaged, unwanted, or unnecessary cells in a controlled manner. It helps in normal development, such as forming fingers in embryos, and maintains balance and proper functioning of tissues.

OR

When cell division is not properly controlled, cells may divide uncontrollably, leading to tumour formation. These tumours can be harmful, especially if cancerous, as they may invade nearby tissues and spread to other parts of the body.

69. i. The limit of resolution of the human eye is about 0.1 mm. This means that two objects closer than this distance cannot be seen separately and appear as a single point when viewed from the normal near point of vision.
- ii. Robert Hooke discovered cells in 1665 using a self-designed microscope. While observing a thin slice of cork, he noticed small box-like compartments and named them "cells," marking the beginning of cell biology.
- iii. A microscope helps in studying cells by magnifying tiny structures that cannot be seen with the naked eye. It uses lenses to enlarge images and improve clarity, resolution, and contrast, allowing scientists to observe detailed structures and understand cell functions.

OR

The total magnification of a microscope is calculated by multiplying the magnifying power of the eyepiece and the objective lens. For example, if both lenses have a magnification of 10X, the total magnification becomes 100X, making the object appear 100 times larger.

70. i. The cell membrane protects the cell and controls the movement of substances in and out. It is selectively permeable, allowing essential materials like gases and water to pass while restricting harmful or unnecessary substances from entering the cell.
- ii. Osmosis is the movement of water across a selectively permeable membrane from a region of higher water concentration to a region of lower concentration. This process helps maintain balance in cells and is important in plant water absorption.
- iii. Plant cells do not shrink completely in a concentrated solution because of their rigid cell wall. While the inner contents lose water and shrink due to osmosis, the cell wall maintains the overall shape and prevents the cell from collapsing entirely.

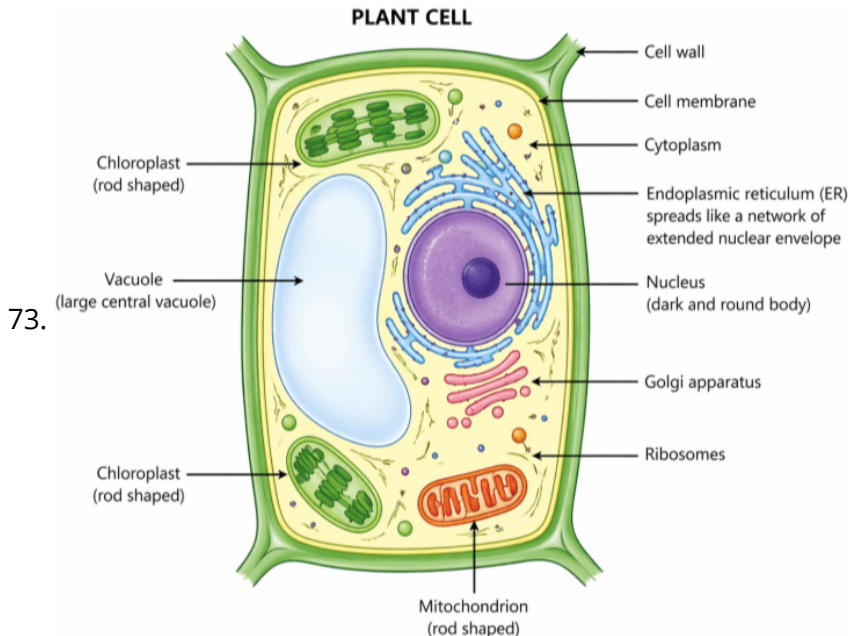
OR

The fluid mosaic model describes the cell membrane as a flexible structure made of a lipid bilayer with proteins embedded in it. The molecules can move sideways, making the membrane dynamic, while proteins act as gateways for substances to pass through.

71. i. Mitosis produces two genetically identical daughter cells from one parent cell, each retaining the same DNA and chromosome number as the parent. Meiosis involves two divisions, ultimately forming four daughter cells, each with half the number of chromosomes and DNA content compared to the parent cell, leading to genetic variation.
- ii. Children resemble their parents but are not exactly the same due to meiosis. Meiosis, occurring in reproductive organs, produces gametes that carry half of each parent's genetic material. When these gametes combine during fertilization, they create a unique genetic combination, leading to variations and diversity, rather than exact copies.
- iii. The reduction in chromosome number during meiosis is crucial for sexual reproduction. Gametes produced through meiosis have half the number of chromosomes. This halving ensures that when

two gametes fuse during fertilization, the original chromosome number characteristic of the species is restored in the offspring, maintaining genetic stability across generations.

72. Advancements in microscopy have significantly improved our understanding of cells by enhancing resolution, contrast, and magnification. Resolution allows scientists to distinguish between two closely spaced structures, making it possible to observe fine cellular details. Improved contrast helps differentiate various parts of a cell by highlighting differences in brightness, enabling clearer visualization of structures. Magnification enlarges tiny cells and their components, making them visible to the human eye. Together, these improvements allow scientists to study cellular structures and processes more accurately, leading to deeper insights into how cells function, interact, and carry out essential life activities.



74. The primary function of the cell wall in plant cells is to provide rigidity, protection, and structural support. It helps plants withstand environmental stresses such as wind and rain and maintains the shape of cells, keeping leaves and stems firm and upright. The cell wall is primarily made of cellulose, a carbohydrate composed of long chains of glucose molecules. This composition gives the wall strength and durability. Despite being rigid, it is permeable, allowing water and dissolved minerals to pass through. This combination of strength and permeability supports both protection and transport, enabling proper functioning of plant cells.
75. i. The fundamental unit of structure and function in all living organisms is the cell.
ii. Examples of unicellular organisms include bacteria and yeast. Examples of multicellular organisms include plants, fish, birds, and humans.
iii. A group of similar cells performing similar functions forms tissues. Different tissues are organized to form an organ, and several organs work together to form organ systems.