CELL –THE UNIT OF LIFE

Real-Life Application Question

During intense physical activity, muscle cells require more energy.

Question:
Which cell organelle is likely to be more active and why?

Answer:
Mitochondria will be more active because they produce ATP, the energy required for muscle contraction and other cellular activities.

Higher-Order Competency Question

Case Study

A scientist studies two cells:

Feature	Cell X	Cell Y
Cell Wall	Present	Absent
Chloroplast	Present	Absent
Vacuole	Large	Small
Shape	Fixed	Irregular

Questions:

1. Identify Cell X and Cell Y.
2. Which cell can perform photosynthesis?
3. Which structure helps Cell X maintain its shape?
4. Why is Cell Y irregular in shape?

Answers:

1. Cell X – Plant cell; Cell Y – Animal cell.
2. Cell X can perform photosynthesis because it contains chloroplasts.
3. Cell wall helps Cell X maintain its shape.
4. Cell Y lacks a cell wall, so its shape is not fixed.

Assertion & Reasoning

Directions: In the following questions, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option:

- *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.*

Question 4

- **Assertion (A):** Lysosomes are often referred to as the "suicide bags" of a cell.
- **Reason (R):** Lysosomes contain powerful digestive (lytic) enzymes that can destroy damaged or worn-out organelles within the cell.

Answer: B. Both A and R are true but R is NOT the correct explanation of A.

Explanation: While both statements are scientifically accurate, the reason why they are specifically called "suicide bags" is that if the cell itself gets damaged or diseased, the lysosome bursts open and its enzymes digest the *entire cell* leading to autolysis (self-destruction), not just individual worn-out organelles.

Question 5

- **Assertion (A):** Mitochondria and Chloroplasts are considered semi-autonomous organelles.
- **Reason (R):** Both mitochondria and chloroplasts contain their own DNA and ribosomes, allowing them to synthesize some of their own proteins.

Answer: A. Both A and R are true and R is the correct explanation of A.

Explanation: Because they possess their own genetic material (DNA) and protein-manufacturing machinery (ribosomes), they can replicate independently of the nuclear control to an extent, making them semi-autonomous.

Question 6

Look at the structural evaluation of three unknown cells observed in a lab environment:

Feature	Cell X	Cell Y	Cell Z
Cell Wall	Absent	Present	Present
Centrosome	Present	Absent	Absent
Plastids	Absent	Present	Absent
Vacuole	Small/Many	Large & Central	Small/Absent

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- **Question:** Identify which cell is a **Plant Cell**, an **Animal Cell**, and a **Fungal/Bacterial Cell**, giving one clear justification for each.

Answer:

- **Cell X is an Animal Cell:** It lacks a cell wall and plastids, but possesses a **centrosome** (which helps in animal cell division).
- **Cell Y is a Plant Cell:** It contains a **cell wall, plastids** (chloroplasts), and a **large central vacuole** which pushes the cytoplasm to the periphery.
- **Cell Z is a Fungal/Bacterial Cell:** It has a cell wall but **lacks plastids**, meaning it cannot perform photosynthesis and relies on heterotrophic nutrition.

Chapter: Tissues

1. Observation-Based Question

A student observes two plant tissues under a microscope. Tissue A has thin-walled living cells, while Tissue B has thick-walled dead cells.

Question:
Identify Tissue A and Tissue B. State one function of each.

Answer:

- Tissue A: Parenchyma – Stores food and water.
- Tissue B: Sclerenchyma – Provides mechanical strength and support.

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2. Application-Based Question

A farmer notices that the stems of young plants bend easily but mature stems remain upright.

Question:
Which tissue helps young stems bend without breaking? Explain.

Answer:
Collenchyma tissue helps young stems bend without breaking because its cells have unevenly thickened walls that provide flexibility and support.

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3. Analysis Question

A plant growing in a desert has tissues with large air spaces and water-storing cells.

Question:
How do these tissues help the plant survive?

Answer:
The water-storing cells help conserve water during dry conditions, while air spaces assist in gaseous exchange and buoyancy in some plants.

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4. Reasoning Question

Xylem and phloem are both conducting tissues.

Question:
Why are they called complex tissues?

Answer:
They are called complex tissues because they consist of more than one type of cell working together to perform a common function.

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5. Problem-Solving Question

A tree trunk remains strong even during storms.

Question:
Which tissue mainly provides this strength and why?

Answer:
Sclerenchyma provides strength because its cells have thick, lignified walls that make the tissue hard and rigid.

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6. Data Interpretation Question

A student prepares a table:

Tissue	Living/Dead	Main Function
A	Living	Storage

Tissue	Living/Dead	Main Function
B	Living	Flexibility
C	Dead	Strength

Question:
Identify tissues A, B, and C.

Answer:

- A – Parenchyma
- B – Collenchyma
- C – Sclerenchyma

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7. Critical Thinking Question

A person suffers a deep cut on the skin.

Question:
Which type of animal tissue helps repair the damaged area?

Answer:
Epithelial tissue helps in covering and repairing damaged surfaces through rapid cell division.

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8. Application-Based Question

The walls of the stomach continuously contract and relax during digestion.

Question:
Which tissue is responsible for this movement?

Answer:
Smooth muscle tissue is responsible because it carries out involuntary movements in internal organs.

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9. Comparative Question

Both tendons and ligaments are connective tissues.

Question:
Differentiate between them based on their functions.

Answer:

Tendon	Ligament
Connects muscle to bone	Connects bone to bone
Less elastic	More elastic

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10. Real-Life Situation

A football player injures a nerve in his leg and loses sensation in that area.

Question:
Which tissue is affected? What is its function?

Answer:
Nervous tissue is affected. It receives stimuli and transmits nerve impulses throughout the body.

Case-Based Study

Case Study

A biology student studies different tissues in a plant stem. He observes the following:

- Tissue A transports water from roots to leaves.
- Tissue B transports food from leaves to other parts.
- Tissue C stores food.
- Tissue D provides flexibility to young stems.

Questions

1. Identify Tissues A, B, C, and D.
2. Which of these tissues are simple permanent tissues?
3. Which tissue is a complex permanent tissue involved in water transport?
4. Why is Tissue D important in young stems?

Answers

1.
   - A – Xylem

    - B – Phloem
    - C – Parenchyma
    - D – Collenchyma
2. Simple permanent tissues: Parenchyma and Collenchyma.
3. Xylem.
4. It provides flexibility and mechanical support, allowing the stem to bend without breaking.

HOTS (Higher-Order Thinking Skills) Question

A plant is genetically modified and loses all its xylem tissue.

Question:
Predict what will happen to the plant and explain your answer.

Answer:
The plant will eventually wilt and die because water and minerals absorbed by the roots cannot be transported to the leaves and other parts of the plant. Therefore, photosynthesis and other life processes will be affected.

: Real-World Application

Scenario: During a severe storm with high winds, the young, green branches of a mango tree bend dynamically without snapping. However, an old, dry branch on the same tree breaks instantly.

Questions:

- **(a)** Which tissue provides the necessary elasticity and tensile strength to the young branches to prevent them from breaking?
- **(b)** Where is this tissue typically located structurally in the plant stem?

Answer:

- **(a) Collenchyma** tissue. It provides mechanical support combined with exceptional flexibility to young, growing plant parts.
- **(b)** It is located in the **hypodermis** (just beneath the epidermis) of young dicot stems and petiole stalks.

Question 3: Higher-Order Thinking Skills (HOTS)

Scenario: A laboratory experiment blocks the sieve tubes of the phloem tissue in a plant, while leaving the companion cells and xylem intact.

Question: Predict the immediate effect on the plant's survival and explain the biological reason behind it.

Answer:

- **Immediate Effect:** The downward and upward transport of synthesized food (sucrose) will stop, leading to starvation of the roots and other non-photosynthetic organs, eventually killing the plant.
- **Reasoning: Sieve tubes** are the main conducting elements of the phloem responsible for the translocation of food. Even though companion cells control the metabolic activities of the sieve tubes, they cannot physically transport the food themselves.

Section B: Animal Tissues (Reasoning & Case-Based)

Question 4: Comparative Reasoning

Scenario: An athlete twists their ankle during a race. The doctor diagnostics reveal a severe sprain rather than a muscle tear, explaining that a structural connector between two bones was overstretched.

Questions:

- **(a)** Name the connective tissue that was injured in this scenario.
- **(b)** How does this tissue differ structurally and functionally from a **Tendon**?

Answer:

- **(a)** The injured tissue is a **Ligament**.
- **(b) Difference Table:**

Feature	Ligament	Tendon
Connection	Connects **Bone to Bone**.	Connects **Muscle to Bone**.
Structure	Contains yellow elastic fibres; highly elastic with great strength.	Contains white collagen fibres; tough and inelastic.

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Question 5: Physiological Application

Scenario: The human stomach needs to aggressively churn food mixed with gastric juices, and the urinary bladder needs to expand significantly as it fills with urine.

Questions:

- **(a)** What type of muscle tissue is found in the walls of these internal organs?
- **(b)** State two unique structural features of this muscle tissue that allow it to perform involuntary long-term work without easily fatiguing.

Answer:

- **(a) Smooth Muscle tissue** (also known as Unstriated or Involuntary muscle).
- **(b) Structural Features:**
  - The cells are **spindle-shaped (fusiform)** with pointed ends and contain a single, central nucleus (**uninucleate**).
  - They do not have any cross-striations or bands, allowing slow, sustained, involuntary contractions without expending massive amounts of ATP quickly, preventing fatigue.

Question 6: Assertion & Reasoning

Directions: Choose the correct option:

- *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.*
- **Assertion (A):** Blood is uniquely classified as a fluid connective tissue.
- **Reason (R):** Blood cells are embedded in a liquid extracellular matrix called plasma, and they originate from the bone marrow to connect different organ systems metabolically.

Answer: A. Both A and R are true and R is the correct explanation of A.

Explanation: Unlike typical connective tissues where cells secrete solid matrix structural fibres (like collagen), blood cells circulate freely within a fluid matrix (plasma) allowing it to physically flow and functionally link every part of the body by transporting nutrients, gases, and wastes.

Section C: Comprehensive Matrix Question

Question 7

Match the specific epithelial tissues to their specialized real-world location and functional design:

Tissue Type	Primary Location	Functional Adaptability
1. Stratified Squamous	A. Inner lining of Intestine	X. Rapid diffusion / filtration
2. Ciliated Columnar	B. Skin surface (Epidermis)	Y. Protection against wear and tear
3. Simple Cuboidal	C. Respiratory tract (Trachea)	Z. Secretion & Absorption
4. Simple Squamous	D. Kidney tubules	W. Moving mucus/particles in one direction

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Answer:

- **1 — B — Y:** Stratified Squamous is found on the skin surface to provide protection against mechanical wear and tear via multiple cell layers.
- **2 — C — W:** Ciliated Columnar lines the trachea, utilizing hair-like cilia to lash and sweep mucus or dust away from the lungs.
- **3 — D — Z:** Simple Cuboidal lines kidney tubules to aid in the metabolic secretion and reabsorption of materials.
- **4 — A — X:** Simple Squamous acts as an ultra-thin barrier for rapid diffusion (Note: It also forms the lining of capillaries and lung alveoli).