

## Revise, Reflect, Refine

### 1. Meristematic tissues divide repeatedly. What property of their cells allows them to do this?

- (i) They have thick walls for protection.
- (ii) They contain large vacuoles that store nutrients.
- (iii) They have thin walls, dense cytoplasm and large prominent nucleus.
- (iv) They are functionally differentiated cells.

#### Answer:

(iii) They have thin walls, dense cytoplasm and large prominent nucleus.

**Explanation:** Meristematic cells are specialised for continuous and rapid cell division. Their properties that enable this are:

- **Thin cell walls** – Allow easy expansion and division without rigid constraints.
- **Dense cytoplasm** – Rich in organelles needed for active metabolism and cell division.
- **Large prominent nucleus** – Contains genetic material and controls cell division actively.
- **No vacuoles** – Vacuoles are absent so cells are tightly packed, with maximum space for organelles needed for division.



## 2. If a plant is unable to transport food from leaves to roots which tissue is malfunctioning?

- (i) Xylem
- (ii) Phloem
- (iii) Epidermis
- (iv) Sclerenchyma

**Answer:**

- (ii) Phloem

**Explanation:** Phloem is the vascular tissue responsible for transporting food (sugars prepared by photosynthesis) from the leaves to other parts of the plant including roots, fruits, and growing regions. This process is called translocation.

- Xylem transports water and minerals from roots to leaves – so xylem is not the answer here.
- Epidermis is a protective tissue; it does not transport food.
- Sclerenchyma provides mechanical support; it does not transport food either.

## 3. Why are the epithelial tissues that line an animal's internal organs usually only one or a few cells thick?

- (i) To store food efficiently.
- (ii) To provide maximum strength.



- (iii) To allow quick exchange of materials across them.
- (iv) To reduce friction.

**Answer:**

- (iii) To allow quick exchange of materials across them.

**Explanation:**

- The distance for diffusion is minimal – substances can cross the membrane rapidly.
- This is critical in the lungs where oxygen must quickly pass into blood and carbon dioxide must exit.
- In the intestine, nutrients must be quickly absorbed into blood capillaries.

Thick epithelium (like skin) is for protection against friction and microbes, not for exchange. Hence internal exchange surfaces are thin while external protective surfaces are thick.

**4. You can perform these two jumps (Fig. 3.21):**

Straight-leg jump – keep knees and ankles stiff.

Normal jump – bend knees and ankles naturally.

How did your ankle, knee and hip positions differ between the two jumps?





**Answer:**

<b>Body Part</b>	<b>Straight-leg Jump</b>	<b>Normal Jump</b>
Knees	Kept stiff and straight – no bending	Bend naturally on landing, absorbing impact
Ankles	Stiff – toes point down rigidly	Flex and extend to provide push-off force and cushion landing
Hips	Remain mostly fixed – little movement	Flex and extend to aid jumping height and balance
Experience	Painful, jarring impact on landing; difficult to balance	Smooth, controlled landing with good balance



## 5. Which type of joint is involved when you bend your knees and ankles?

- (i) Ball and socket
- (ii) Hinge
- (iii) Pivot

**Answer:**

- (ii) Hinge

**Explanation:**

The knee and ankle are classic examples of hinge joints. Like a door hinge, these joints allow movement in only one plane – bending (flexion) and straightening (extension). They do NOT allow rotation or sideways movement.

## 6. In each of the following cases (A, B, C and D), choose the correct option as given below:

- (i) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (ii) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- (iii) (A) is true, but (R) is false.
- (iv) (A) is false, but (R) is true.

A. Assertion: Epithelium is well-suited for gas exchange in the lungs. Reason: It consists of multiple layers of tall cells that slow down diffusion.

B. Assertion: Cardiac muscle can contract continuously without fatigue. Reason: Cardiac muscle cells have a high number of



mitochondria and an abundant blood supply.

C. Assertion: Tendons connect bone to bone and allow joint movement. Reason: Tendons are made of tough connective tissue that transmits force from muscle to bone.

D. Assertion: In a hinge joint, movement occurs primarily in one plane. Reason: The bone ends are shaped to allow sliding in all directions.

**Answer:**

A. (iii) — A is true, but R is false.

B. (i) — Both A and R are true and R is the correct explanation of A.

C. (iv) — A is false, but R is true.

D. (iii) — A is true, but R is false.

**7. Plot a graph between the age of a tree (in years) on the x-axis and the diameter of the tree (in cm) along with the number of annual rings formed over time on the y-axis, using the data given in the Table 3.7.**

**Data related to the age of a teak tree, and corresponding increase in the diameter of stem and number of annual rings**

S.NO	Age of the teak tree(years)	DRH(Diameter at Breast Height) of tree(cm)	Number of annual rings formed
1.	5	4	5
2.	10	8	10
3.	20	24	20
4.	25	28	25
5.	30	32	30
6.	40	40	40

(i) Analyse the graph in terms of the diameter of the stem over time and share the interpretation.

(ii) What is the relation between the diameter of the teak tree to the annual rings formed?

(iii) Which specialised tissue is responsible for the girth of the stem and where is it located?

### Answer:

(i) The diameter of the teak tree increases steadily with age, but not at a uniform rate. Between year 10 and year 20, the diameter shows a large jump (from 8 cm to 24 cm), suggesting a period of very rapid growth. After year 20, growth continues but at a slower, more gradual rate. Overall, the older the tree, the wider

its trunk – showing continuous lateral growth throughout the tree's life.

(ii) The number of annual rings exactly equals the age of the tree in years (e.g., 5 years = 5 rings, 40 years = 40 rings). The diameter also increases with age. Therefore, more annual rings = greater diameter. Each ring represents one year of growth by the lateral meristem. Thus, the diameter is directly related to the number of annual rings formed.

(iii) The tissue responsible for increase in girth (thickness) is the Lateral Meristem. It is located along the circumference of stems (in a ring running around the stem). The lateral meristem divides and produces new cells inside and outside, leading to an increase in the diameter of the stem. Each year, one new ring of wood is added by this tissue, forming the annual growth rings visible in a cross-section of the trunk.

**8. In a forest, it was observed that one of the trees was severely debarked by an elephant to meet its food requirements, as the bark is a rich source of nutrients (Fig. 3.22).**

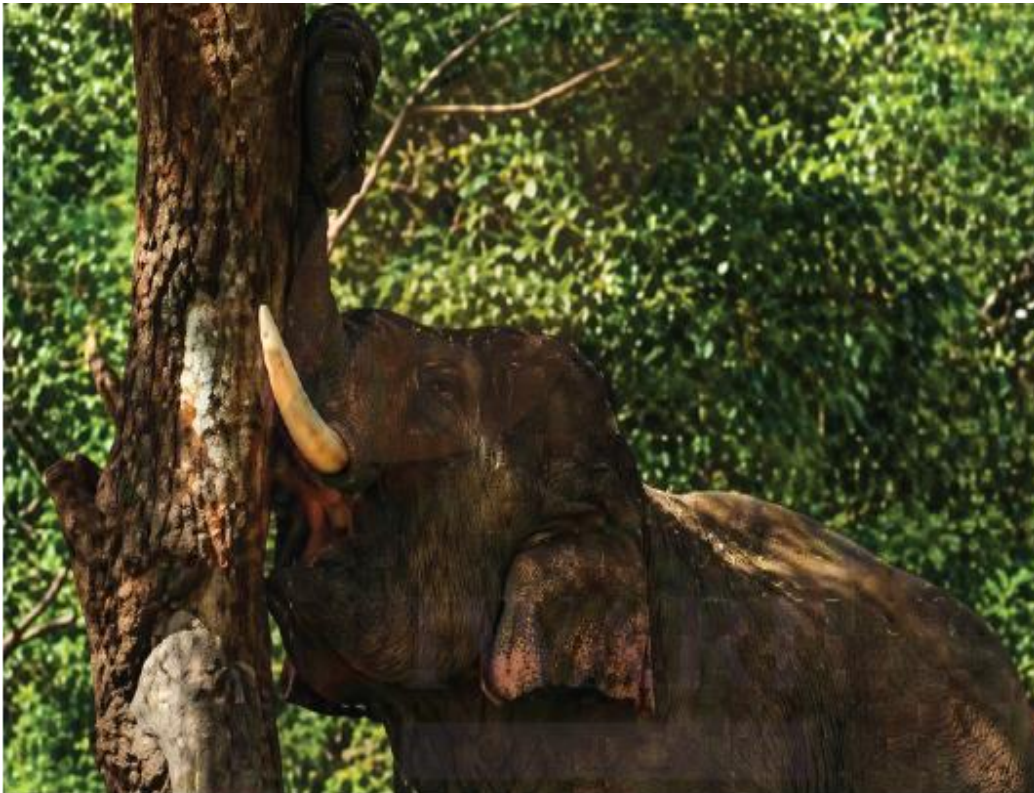
Based on your learning, answer the following:

- (i) Which function(s) of the tree is/are hampered by debarking?
- (ii) Which plant tissue would be affected by further damage to the tree trunk even after debarking?



(iii) Which function of the tree would be hampered if the tissues beneath the bark were severely damaged?

(iv) What assumptions are you making to answer the questions above? How would the answer change if your assumptions are also changed?



**Answer:**

(i) Functions hampered by debarking

- **Protection is lost:** The bark (formed by cork cells) protects the inner tissues from mechanical damage, pathogens, water loss, and temperature extremes. Removal exposes inner living tissues to infection and drying out.

- **Food transport is disrupted:** The phloem lies just beneath the bark. Debarking damages the phloem, preventing the transport of food (sugars) from leaves to roots.

- **Water loss increases:** The waxy cuticle and cork layer



prevent excessive water loss. Without it, the tree desiccates rapidly.

(ii) If the trunk is further damaged beneath the bark, the Xylem would be affected. Xylem is the inner woody tissue of the trunk that transports water and minerals from the roots to the leaves. Damage to xylem would cut off water supply to the entire tree, causing wilting and death.

(iii) If the phloem and xylem (both vascular tissues present just beneath the bark) are severely damaged:

- Water transport (by xylem) – roots cannot receive water signals; leaves wilt and dry.
- Food transport (by phloem) – roots starve as they cannot receive food from leaves; root growth and mineral absorption stop.
- The tree would eventually die due to failure of both conducting systems.

(iv) Assumptions made

- We assume the phloem is located just beneath the bark and that the elephant's debarking exposed this layer.
- We assume the xylem is largely intact after initial debarking (only the outer bark and phloem are removed).
- We assume the tree has no alternative pathways (such as grafting or regrowth) to compensate for the loss.



- If our assumption that phloem is intact changes (i.e., phloem is also removed), then even water transport would be affected sooner, as roots would lose the signal to absorb water.

**9. Aamrapali observed that a young mango sapling's stem bends flexibly during monsoon winds and does not break. Which tissue is responsible for this flexibility?**

Predict and provide your explanation of the impact if the existing tissue was replaced by sclerenchyma.

**Answer:**

Collenchyma is responsible for this flexibility. Collenchyma consists of living cells with unevenly thickened corners due to pectin (a flexible, rubber-like chemical). This tissue provides both support AND flexibility to young plant stems, leaf stalks (petioles) and tendrils – allowing them to bend without breaking under mechanical stress like monsoon winds.

**Impact if collenchyma were replaced by sclerenchyma:**

- Sclerenchyma cells have thick, lignified (hardened) cell walls – they are dead cells that provide rigidity and strength but NO flexibility.
- If the mango sapling's stem had sclerenchyma instead of collenchyma, the stem would become stiff and brittle.
- During monsoon winds, instead of bending, the stem would snap and break – causing serious damage to the plant.



- This would also prevent growth movements (like growing toward light), as rigid sclerenchyma cannot bend.
- The plant's survival in windy conditions would be severely compromised.

**10. Sohan designed an experiment for the regeneration of sugarcane, where he used cuttings to grow sugarcane. He used two types of cuttings, type 'A' and type 'B' (Fig. 3.23).**

After a few weeks, type 'B' cuttings sprouted and developed into sugarcane plants, whereas the type 'A' cuttings did not sprout.

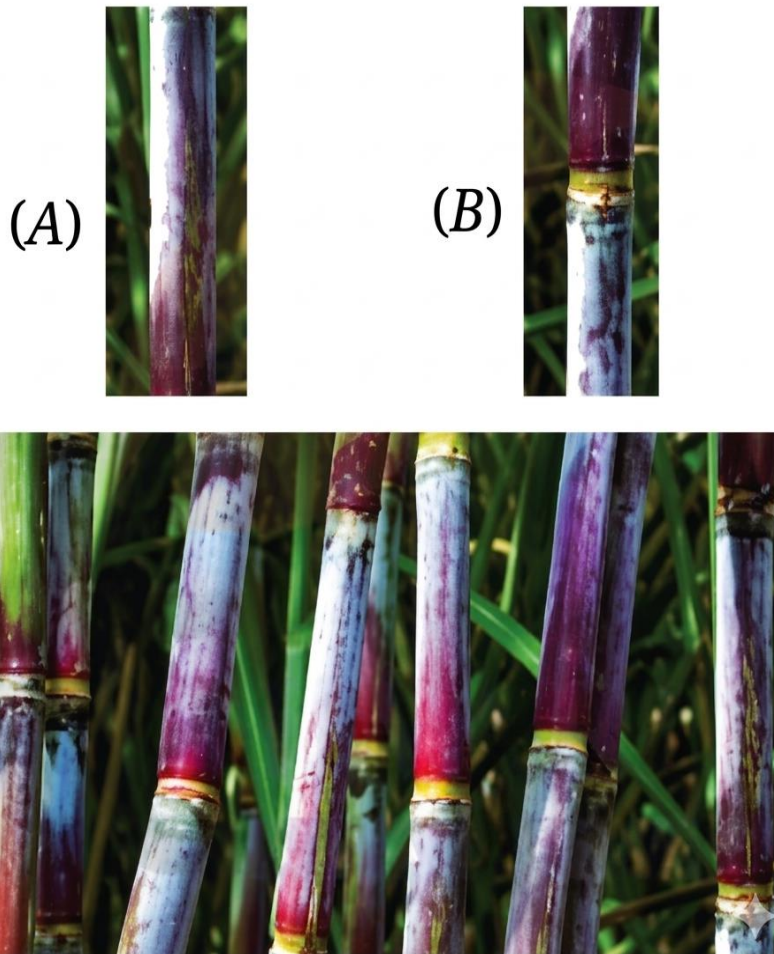
(i) Why were the type 'B' cuttings able to grow as sugarcane but type 'A' could not?

(ii) What difference was present in type 'B' compared to type 'A'?

(iii) What observation or measurement was made to determine whether this change had an effect?

(iv) What parameters should be kept the same for both types of cuttings to ensure a fair comparison?





**Answer:**

(i) Type B cuttings were able to grow because they contained nodes with intercalary meristem – actively dividing meristematic tissue located at the nodes of the stem. This tissue enabled the cutting to regenerate and sprout new shoots and roots. Type A cuttings lacked this meristematic tissue (likely taken from internodal regions only) and therefore could not regenerate or sprout.

(ii) Type B cuttings included the nodes of the sugarcane stem — the region where intercalary meristematic cells are located.



These meristematic cells retain the ability to divide and differentiate into new plant tissues. Type A cuttings were likely taken from internodal regions – between nodes – which contain only permanent tissues (no meristematic cells), so they cannot regenerate.

(iii) The key observation was whether the cuttings sprouted new shoots and roots or not – measured by visible growth (emergence of new shoots/leaves) after a few weeks. Additionally, measurement of the length of new growth over time would quantify the difference. The fact that Type B showed sprouting while Type A showed none was the determining observation.

(iv) Parameters to keep the same for fair comparison

- Length of cuttings – both types should be of similar length.
- Age and health of the parent plant – cuttings from the same plant or same-aged plants.
- Growing conditions – same soil type, amount of water, sunlight, and temperature for both types.
- Time of planting – both planted at the same time.
- Orientation of cutting – both planted in the same direction (right-side up).
- Number of cuttings – same number of each type to allow statistical comparison.



**11. During the discussion in class, Rohan gives a statement that, “A tissue is a group of similar cells performing similar functions”. But Rajiv counter argues that, “this is true in case of simple tissues but little different in case of complex tissues”.**

Provide your explanation in view of the discussion in class.

**Answer:**

Both Rohan and Rajiv are partially correct. Here is a complete explanation:

**Rohan’s statement** is the basic definition of a tissue and holds well for simple permanent tissues like parenchyma, collenchyma, and sclerenchyma — where all cells are of the same type and perform the same function (e.g., all parenchyma cells store food and have thin walls).

**Rajiv’s argument** is correct for complex permanent tissues like xylem and phloem:



<b>Tissue</b>	<b>Cell types present</b>	<b>Different cells, different roles</b>
Xylem	Tracheids, Vessels, Xylem parenchyma, Xylem fibres	Tracheids/vessels transport water; parenchyma stores food; fibres give strength
Phloem	Sieve tubes, Companion cells, Phloem parenchyma, Phloem fibres	Sieve tubes transport food; companion cells regulate sieve tubes; fibres give support

In complex tissues, the different types of cells work together as a team to perform a common overall function (conduction), even though each cell type does a different specific job. So the tissue as a whole has a common function, but the individual cells within it are NOT all similar in structure or specific function. This is why Rajiv's refinement of Rohan's definition is important and accurate.

**12. Coconut husk fibres are used for mats which are tough and fibrous. Which tissue has structural features suitable for providing this strength? Explain why living parenchyma couldn't serve the same purpose.**

**Answer:**

Sclerenchyma tissue has structural features suitable for providing this strength. Coconut husk fibres are made

of sclerenchyma.

The structural features that make sclerenchyma suitable for providing strength are:

- Cells have thick, lignified (hardened) cell walls – lignin is an extremely strong polymer that makes cell walls rigid and durable.
- Most sclerenchyma cells are dead at maturity – they no longer need metabolic resources and are essentially hollow tubes of strong lignified material.
- The cells are long and fibrous in shape, arranged in bundles, providing tensile strength and resistance to tearing.
- This gives materials like coconut husk, jute and walnut shells their characteristic hardness and toughness.

Parenchyma cannot serve the same purpose because:

- Parenchyma cells have thin cell walls (not lignified) – they are soft and flexible, providing NO structural rigidity or strength.
- Parenchyma cells are living and metabolically active – they would decompose over time if used as a structural material, making them unsuitable for durable applications like mats.
- They contain large vacuoles and intercellular spaces – making them soft, compressible, and unsuitable for fibrous, tough applications.



**13. Vibha claims to her friend Neha that, “Meristematic cells are located only at the root and shoot apices”. What do you think about this statement?**

What question can Neha ask Vibha to help her understand further if the statement is incorrect?

**Answer:**

Vibha’s statement is incomplete and partially incorrect. Correct explanation: Plants actually have three types of meristematic tissues located in different positions:

Type of Meristem	Location	Function
Apical meristem	Tips (apices) of roots and shoots	Increase length of root and shoot
Lateral meristem	Along the circumference of stems	Increases girth/ thickness of stem
Intercalary meristem	At the base of internodes are just above nodes	Helps plants regrow after cutting or grazing

Questions Neha can ask to Vibha:

- “If meristems are only at root and shoot tips, then how does a tree trunk increase in thickness (girth) over years?”
- “When we mow a lawn or a cow eats grass, how does the grass grow back if the tip is removed? Which meristem is responsible for that?”

- “When the tip of a plant is cut off and new branches appear from the nodes below, which meristem makes this possible?”

These questions would guide Vibha to discover lateral and intercalary meristems on her own.

#### **14. A plant cell and an animal cell are of the same size.**

(i) Which cell will have a larger vacuole? Give reasons.

(ii) What assumptions are you making to answer the question above?

**Answer:** The plant cell will have a larger vacuole.

**Reasons:**

- Mature plant cells typically have a single large central vacuole that can occupy up to 80–90% of the cell volume. It is surrounded by a selectively permeable membrane called the tonoplast.
- The plant cell vacuole stores water, minerals, sugars, and waste materials. It also maintains turgor pressure — the internal pressure that keeps the plant cell firm and the plant upright.
- Animal cells, in contrast, may have small, temporary vacuoles (if any) used for transport or storage of materials, but these are much smaller and not as prominent or permanent as in plant cells.
- Since both cells are the same size, the plant cell’s large vacuole would leave less space for cytoplasm and other organelles, while the animal cell would have more cytoplasm and organelles relative to its volume.



(ii) Assumptions made

- We assume the plant cell is a mature plant cell (e.g., from a leaf or stem), not a young meristematic cell (which has no vacuole).
- We assume the animal cell is a typical body cell (not a specialised cell like a fat cell/adipocyte, which stores large fat droplets).
- If the assumption changes (e.g., plant cell is a young meristematic cell), then neither cell would have a large vacuole.

**15. A textbook states, “Each plant tissue performs only one specific function”. What questions would you ask to critically examine the correctness of this statement?**

What examples of tissues would you take to find out the answers to these questions?

**Answer:**

The statement “Each plant tissue performs only one specific function” is not entirely correct and needs to be critically examined. To test this statement, we should ask questions like –

1. Does parenchyma only store food or does it perform other functions too?
  2. Does epidermis only provide protection or does it also help in other processes?
  3. Do complex tissues like xylem perform only one function?
- Parenchyma is the best example to challenge this statement. Although parenchyma mainly stores food, it also performs photosynthesis in the green parts of the plant. In aquatic plants,



specialised parenchyma forms air spaces which help them float. So parenchyma clearly performs more than one function.

- Epidermis is another good example. It forms the outermost protective layer of the plant body and protects against mechanical injury and microorganisms. But it also contains stomata in leaves which help in gaseous exchange and transpiration. In roots, epidermal cells form root hair which absorb water and minerals from the soil. So epidermis performs protection, absorption as well as transpiration – clearly more than one function.
- Xylem is a complex permanent tissue which not only transports water and minerals from roots to other parts of the plant but also provides mechanical strength and support to the plant.

Therefore, the statement is incorrect. Multiple plant tissues perform more than one specific function, and the examples of parenchyma, epidermis and xylem clearly prove this point.

