

CLASS 9 SCIENCE — CHAPTER 3

NCERT SOLUTIONS

Tissues in Action

New NCERT *Exploration* Textbook | 2026–27

Chapter 3 is “**Tissues in Action**”, and its end-of-chapter section is “**Revise, Reflect, Refine**” with 15 questions.

Below are the solutions to the **actual textbook questions**. 

REVISE, REFLECT, REFINE

Q1. Meristematic tissues divide repeatedly. What property of their cells allows them to do this?

Options:

- (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)**

 **Explanation:**

Meristematic cells are actively dividing cells. Their structure is suited for continuous cell division.

They have:

-  Thin cell walls
-  Large and prominent nucleus
-  Dense cytoplasm

-  Many cell organelles
-  Generally no large vacuole
-  Very little intercellular space

Therefore, **option (iii)** is correct.

Q2. If a plant is unable to transport food from leaves to roots, which tissue is malfunctioning?

Options:

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

 **Answer: (ii) Phloem**

 **Explanation:**

Leaves prepare food through photosynthesis. This food needs to be transported to other parts of the plant, including:

-  Roots
-  Stems
-  Growing regions
-  Fruits

Phloem transports food from leaves to other parts of the plant.

 **Remember:**

Xylem → Water + minerals 

Phloem → Food 



Q3. Why are epithelial tissues lining an animal's internal organs usually only one or a few cells thick?

Options:

- (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:

Thin epithelial layers provide a short distance for substances to cross.

For example, in the lungs:



Oxygen needs to move from air into blood.



Carbon dioxide needs to move from blood into the air.

A thin epithelial layer allows this exchange to occur rapidly.



Therefore:

Thin epithelium → Short diffusion distance → Faster exchange



Q4. Straight-leg jump vs normal jump



Question:

Perform two jumps:

Straight-leg jump: knees and ankles kept stiff.

Normal jump: knees and ankles bent naturally.

How did the positions of your ankle, knee and hip differ?

 **Answer:**

 **Straight-leg jump**

The:

 Knee remains relatively straight.

 Ankle remains relatively stiff.

 Hip has less bending.

Therefore, the body has less flexibility for absorbing and generating movement.

 **Normal jump**

The:

 Knees bend.

 Ankles bend.

 Hips also flex.

This allows the muscles and joints to work together to produce a smoother and more powerful movement.

 **Conclusion:**

Normal jumping involves coordinated movement of several joints and muscles.

 **Q5. Which type of joint is involved when you bend your knees and ankles?**

Options:

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

✓ **Answer: (ii) Hinge joint**

🧠 **Explanation:**

The knee is a classic example of a:

Hinge joint

It mainly allows movement in one plane, such as:

↗ Bending

↘ Straightening

The ankle also permits mainly hinge-like movement.

★ **Examples:**

🦵 Knee → Hinge

👉 Elbow → Hinge

🧠 **Q6. Assertion–Reason**

The textbook gives four Assertion–Reason cases and four possible answer choices.

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.

✓ **Answer: (iii)**

Assertion is true, but Reason is false.

🧠 **Explanation:**

Lung epithelium is thin, allowing rapid gas exchange.

It is **not** made of multiple layers of tall cells.

Instead, the thin epithelial lining provides a short diffusion distance.

B. Assertion:

Cardiac muscle can contract continuously without fatigue.

Reason:

Cardiac muscle cells have a high number of mitochondria and an abundant blood supply.

✅ **Answer: (i)**

Both Assertion and Reason are true, and Reason correctly explains Assertion.

🧠 **Explanation:**

❤️ Cardiac muscle works continuously throughout life.

It requires a large and continuous supply of energy.

Cardiac muscle cells have:

⚡ Many mitochondria

🩸 Rich blood supply

These help provide the energy needed for continuous contraction.

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.

✅ **Answer: (iv)**

Assertion is false, but Reason is true.

 **Explanation:**

The statement about tendons is incorrect.

Correct:

Tendons connect muscle to bone.

Ligaments connect:

Bone ↔ Bone

Tendons transmit the force produced by muscles to bones.

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: (iii)**

Assertion is true, but Reason is false.

 **Explanation:**

A hinge joint mainly permits movement in one plane.

Examples:

 Knee

 Elbow

But hinge joints do **not** allow free movement in all directions.



Q7. Annual Growth Rings of a Teak Tree

The textbook provides the following data.

Age (years)	Diameter at breast height (cm)	Annual rings
5	4	5
10	8	10
20	24	20
25	28	25
30	32	30
40	40	40

The question asks you to plot:

X-axis → Age of tree

Y-axis → Diameter and number of annual rings

(i) Analyse the graph.

✓ **Answer:**

The diameter of the teak tree generally increases as its age increases.

For example:

🌱 5 years → 4 cm

🌳 10 years → 8 cm

🌳 20 years → 24 cm

🌳 40 years → 40 cm

Therefore:

Older tree → Generally larger stem diameter

The graph would show an overall increasing trend.

(ii) What is the relationship between diameter and annual rings?

 **Answer:**

The number of annual rings corresponds approximately to the age of the tree.

For example:

5 years → 5 rings

10 years → 10 rings

20 years → 20 rings

40 years → 40 rings

Therefore:

 **Number of annual rings ≈ Age of the tree in years**

The diameter also generally increases with age, although the relationship is not perfectly proportional.

(iii) Which specialised tissue is responsible for increasing the girth of the stem?

 **Answer:**

The tissue responsible is:



Lateral meristem

It is located along the circumference of the stem.

It produces new cells that increase the:

Diameter/girth of the stem.

The textbook explains that lateral meristematic cells divide and produce new cells in a concentric manner.



Q8. Debarking of a Tree by an Elephant

An elephant severely removes the bark of a tree. Answer the following.

(i) Which function(s) of the tree are hampered by debarking?

Answer:

The bark contains protective and conducting tissues.

Severe debarking can affect:

Protection of the inner tissues

Transport of food through phloem

Water balance and protection from water loss

Protection against pathogens

If the phloem is damaged, the transport of food from leaves to other parts is disrupted.

(ii) Which plant tissue would be affected by further damage to the tree trunk even after debarking?

 **Answer:**

Further damage could affect the:

Vascular tissues

particularly:

 **Phloem**

and

 **Xylem**

It may also damage the:

Cambium/lateral meristem

which is important for secondary growth.

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

 **Answer:**

If the vascular tissues are damaged:

 **Phloem damage**

Food transport from leaves to roots and other parts would be affected.

 **Xylem damage**

Transport of water and minerals from roots to the rest of the plant would be affected.

Thus, severe damage can interfere with both:

Food transport + Water/mineral transport

(iv) What assumptions are you making?

✓ **Answer:**

I assume that:

1. The debarking is severe enough to damage the conducting tissues.
2. The phloem has been affected.
3. The xylem has not been completely destroyed unless specifically stated.
4. The tree is otherwise healthy.

If these assumptions change, the answer would also change.

For example:

🌿 If only the outer protective layer is removed → internal transport may initially continue.

🌿 If phloem is severely damaged → food transport is affected.

🌿 If xylem is severely damaged → water and mineral transport is affected.

🌱 Q9. Flexible Mango Sapling

A young mango sapling bends during monsoon winds without breaking.

📖 **Question:**

Which tissue is responsible for this flexibility? What would happen if it were replaced by sclerenchyma?

✓ **Answer:**

The tissue responsible is:

🌿 Collenchyma

Why?

Collenchyma cells have unevenly thickened corners and provide:

 Mechanical support

 Flexibility

 Strength while allowing bending

Therefore, a young stem can bend in the wind without breaking.

What if replaced by sclerenchyma?

Sclerenchyma cells have:

 Thick walls

 Lignification

 High rigidity

If the flexible tissue were replaced by sclerenchyma, the stem would become:

More rigid and less flexible.

It could therefore be more likely to break under repeated bending forces.

Q10. Sugarcane Regeneration Experiment

Sohan uses two types of sugarcane cuttings. Type B grows while Type A does not.

(i) Why could Type B grow while Type A could not?

 **Answer:**

Type B cuttings likely contained:

 **A node with an intercalary/lateral bud**

Such regions contain meristematic cells capable of active division.

These cells produce new shoots and roots, allowing the cutting to develop into a new plant.

Type A lacked the necessary growing region.

(ii) What difference was present in Type B?

 **Answer:**

Type B had:

 **A viable node/bud capable of producing new growth.**

The node contains meristematic tissue that can divide and form new plant parts.

(iii) What observation or measurement determined whether the change had an effect?

 **Answer:**

Sohan could compare:

 Number of cuttings that sprouted

 Time taken for sprouting

 Shoot/root length

 Number of new shoots

 Overall growth after a fixed period

(iv) What parameters should be kept the same?

 **Answer:**

For a fair comparison, both types should have:

-  Same temperature
-  Same amount of water
-  Same light conditions
-  Similar soil/growth medium
-  Same observation period
-  Similar cutting size
-  Similar nutrient conditions

★ **Only the factor being tested should differ.**

Q11. What is a tissue?

Rohan says:

A tissue is a group of similar cells performing similar functions.

Rajiv says this is true for simple tissues but differs for complex tissues.

✓ **Answer:**

Rohan's statement is generally true for simple tissues.

A simple tissue is made up mainly of:

One type of cell

performing a particular function.

Examples:

-  Parenchyma
-  Collenchyma
-  Sclerenchyma

However, **complex tissues** contain different types of cells that work together to perform a common function.

Examples:

 **Xylem**

 **Phloem**

Therefore, Rajiv is correct that the definition needs to be expanded for complex tissues.

★ **Correct idea:**

A tissue is a group of cells that work together to perform a specific function; the cells may be similar or may be different types, especially in complex tissues.

Q12. Coconut Husk Fibres

 **Question:**

Coconut husk fibres are used for tough and fibrous mats. Which tissue provides this strength? Why can't living parenchyma serve the same purpose?

 **Answer:**

The tissue responsible is:

Sclerenchyma

Sclerenchyma cells have:

 Thick cell walls

 Lignin

 Strong, rigid structure

These properties provide mechanical strength.

Why not parenchyma?

Parenchyma cells are:

 Living

 Thin-walled

 Usually less rigid

They mainly perform functions such as:

 Storage

 Photosynthesis

Therefore, parenchyma cannot provide the same degree of toughness as sclerenchyma.

Q13. Are meristematic cells found only at root and shoot apices?

Vibha claims:

“Meristematic cells are located only at the root and shoot apices.”

 **Answer:**

 **The statement is incorrect.**

Meristematic tissues occur in three main locations:

1 Apical meristem

 Root and shoot tips

 Increases length.

2 Lateral meristem

 Along the sides/circumference of stems

 Increases girth.

3 Intercalary meristem

📍 Near nodes or bases of internodes in certain plants such as grasses

➡ Helps regeneration after cutting or grazing.

The textbook explicitly identifies these three types.

💡 **Question Neha could ask:**

“If meristematic tissue occurs only at root and shoot tips, how do stems increase in girth and how does grass grow again after being cut?”

This would lead Vibha to discover the roles of lateral and intercalary meristems.

Q14. Plant Cell vs Animal Cell — Vacuoles

A plant cell and an animal cell are the same size.

(i) Which cell will have a larger vacuole?

✅ **Answer:**

The:

Plant cell

will generally have the larger vacuole.

🧠 **Why?**

Plant cells typically possess a:

Large central vacuole

which stores:

💧 Water

 Dissolved substances

 Cell sap

and contributes to:

 Turgidity

Animal cells may have smaller temporary vacuoles, but they generally do not have one large central vacuole like plant cells.

(ii) What assumptions are you making?

 **Answer:**

I assume:

- The cells are typical healthy plant and animal cells.
- They are mature cells.
- The comparison is between cells of similar physiological condition.
- “Same size” refers approximately to overall cell dimensions.

If unusual cell types were compared, the answer could differ.

Q15. “Each plant tissue performs only one specific function.”

 **Question:**

What questions would you ask to critically examine this statement? What examples would you use?

 **Answer:**

The statement is an **oversimplification**.

I would ask:

Question 1:

Does each tissue perform exactly one function?

Question 2:

Can the same tissue contribute to more than one process?

Question 3:

Do environmental conditions change the functions performed by a tissue?

Question 4:

Can specialised tissues have supporting or additional roles?

Examples:

Parenchyma

It can:



Store food



Perform photosynthesis when chlorophyll is present



Help aquatic plants float when it develops large air spaces.

Epidermis

It:



Protects the plant



Reduces water loss



Helps absorption through root hairs



Allows gaseous exchange through stomata

Xylem

Primarily transports:

💧 Water and minerals

but also contributes to:

🧱 Mechanical support

★ Conclusion:

Plant tissues may have a **main specialised function along with additional roles**.

Therefore, the statement “each tissue performs only one specific function” is not completely correct.



CHAPTER 3 — QUICK ANSWER KEY

Q	Answer
1	(iii)
2	(ii) Phloem
3	(iii)
4	Normal jump uses bending of ankle, knee and hip
5	(ii) Hinge
6A	(iii)
6B	(i)
6C	(iv)
6D	(iii)
7(i)	Diameter generally increases with age
7(ii)	Annual rings $\approx$ age in years
7(iii)	Lateral meristem
8	Debarking affects protection and conducting tissues
9	Collenchyma

- 10 Type B contains a viable growing node/bud
- 11 Simple tissues have similar cells; complex tissues contain different cell types
- 12 Sclerenchyma
- 13 ❌ Incorrect; apical, lateral and intercalary meristems
- 14 Plant cell has the larger vacuole
- 15 Statement is an oversimplification

The textbook answer key confirms the objective answers for Q1, Q2, Q3, Q5 and Q6 as (iii), (iii), (ii), (iii), and A(iii), B(i), C(iv), D(iii) respectively.

CHAPTER 3 — IMPORTANT REVISION

PLANT TISSUES

Meristematic tissues

Actively dividing cells.

Three types:

 **Apical meristem** → Increase in length

 **Lateral meristem** → Increase in girth

 **Intercalary meristem** → Regrowth after cutting

PERMANENT TISSUES

Simple permanent tissues:

 **Parenchyma** → Storage/photosynthesis/other roles

🟡 **Collenchyma** → Flexible support

⬛ **Sclerenchyma** → Strong mechanical support

Complex permanent tissues:

💧 **Xylem** → Water and mineral transport

🍲 **Phloem** → Food transport

ANIMAL TISSUES

Epithelial tissue

Protection and exchange.

Connective tissue

Support and connection.

Examples:

🦴 Bone

🩸 Blood

🦵 Tendon

🔗 Ligament

Muscular tissue

Movement.

Nervous tissue

Control and coordination.

IMPORTANT JOINTS

Ball-and-socket

Allows movement in many directions.

Example:

Shoulder / hip

Hinge

Mainly movement in one plane.

Example:

Knee / elbow

Pivot

Allows rotation around an axis.

Example:

Neck joint

MUST-REMEMBER DIFFERENCES

Xylem vs Phloem

Xylem → Water + minerals 

Phloem → Food 

Collenchyma vs Sclerenchyma

Collenchyma → Flexible support

Sclerenchyma → Rigid strength

Meristematic vs Permanent

Meristematic → **Actively dividing**

Permanent → **Specialised, generally no longer actively dividing**

Tendon vs Ligament

Tendon → **Muscle ↔ Bone**

Ligament → **Bone ↔ Bone**

CHAPTER 3 KEY IDEA

Structure determines function.

The special structure of each tissue allows it to perform its particular role:

Meristem → **Growth**

Parenchyma → **Storage/photosynthesis**

Collenchyma → **Flexibility**

Sclerenchyma → **Strength**

Xylem → **Water transport**

Phloem → **Food transport**

Epithelium → **Protection/exchange**

Connective tissue → **Support/connection**

Muscle → **Movement**

Nervous tissue → **Control and coordination**

This is the central idea running through **“Tissues in Action.”**