I. Objective Question:

A. Multiple-Choice Questions

1. In phloem, the direction in which the translocation of food takes place is

1. downwards
2. upwards
3. both upwards and downwards
4. none of these

Answer: both upwards and downwards

Reason — Food material moves through the phloem in both directions, upwards as well as downwards.

2. Water is absorbed by the root hair cells through

1. osmosis
2. active transport
3. transpiration
4. ascent of sap

Answer: osmosis

Reason — The concentration of water in the root is lower than that of soil, thus water flows from soil to cell by Osmosis.

3. The movement of salt or mineral molecules from a region of their higher concentration to a region of their lower concentration is called

1. osmosis
2. active transport
3. diffusion
4. blending

Answer: diffusion

Reason — Diffusion is the movement of salt or mineral molecules from a region of their higher concentration to a region of their lower concentration

4. The fluid containing mineral salts and water enclosed in a vacuole of a cell is called

1. cytoplasm
2. nucleoplasm
3. cell sap

4. tonoplast

Answer: cell sap

Reason — Cell Sap is the fluid containing mineral salts and water enclosed in the vacuole of a cell.

5. The pressure developed in roots due to the continuous inflow of water which pushes the sap upwards is called

1. root pressure
2. sap pressure
3. transpiration pull
4. stem pressure

Answer: root pressure

Reason — The pressure developed in roots due to the continuous inflow of water which pushes the sap upwards is called Root Pressure.

6. Prepared food material is carried through

(a) Xylem

(b) Vascular Tissues

(c) Phloem

(d) Stomata

ANS:(c) **Phloem**

Reason: It is the chief conducting tissue of vascular plants responsible for the conduction of organic solutes (food). This conduction may be bi-directional i.e. from leaves to storage organs or maybe storage organs to growing parts of a plant.

7. The rate of transpiration will _____ if the atmospheric pressure is low

a. Increase
b. Decrease
c. Stay unchanged
d. Can't be determined

Answer: Increase

Reason: The rate of transpiration increases when atmospheric pressure is low. During low atmospheric pressure, air will move out of the plant as a result of diffusion. At low pressure, the water vapour moves fast thus the rate of transpiration increases.

8. The main function of guard cells is to help with _____

a. Transpiration
b. Guttation
c. Transcription
d. None of the above

Answer: Transpiration

Reason: The guard cells surround each stoma for their protection. They are the cells that regulate the rate of transpiration by opening and closing of stomata. The guard cells swells up and open the stomata for the exchange of gases when the plant has an excess of water.

9. Living cells placed in an isotonic solution tend to retain their shape and size. This is based on the principle of

a. Diffusion
b. Transpiration
c. Osmosis
d. None of the above

Answer: Osmosis

Reason: Osmosis is the concept that involves the moment of water molecules inside and outside of the cell. An isotonic solution is one in which the concentration of solute and water molecules are in equilibrium. If the cell is placed in isotonic solution the net change will be zero. So, the cells retain their size.

10. **Transport of food materials in higher plants occurs through**

a. Flowers
b. Companion cells
c. Tracheid's
d. Sieve elements

Answer: Sieve elements

Reason: Sieve elements are made of sieve cells. They are the components of phloem tissue and transport food material in plants. Sieve elements in angiosperms are sieve tubes and companion cells. While in gymnosperms and pteridophytes, they sieve cells.

11. The movement of materials from the leaves to other tissues of the plant is called _____

e. Tropic movement
f. Guttation
g. Transpiration
h. Translocation

Answer: Translocation

Reason: Translocation is the movement of materials from leaves to other tissues throughout the plant. This movement is carried out by specialized vascular tissues called phloem.

12. What is the main function of the phloem tissue in plants?

A) Transport of water and minerals

B) Support and mechanical strength

C) Transport of sugars and nutrients

D) Protection against pathogens

Answer: C) Transport of sugars and nutrients

Explanation: Phloem tissue transports sugars (produced during photosynthesis) and other organic nutrients from leaves (sources) to other parts of the plant (sinks) where they are needed.

13. Which process is responsible for the movement of water from roots to leaves against gravity in tall trees?
    A) Osmosis
    B) Capillary action
    C) Transpiration pull
    D) Active transport

Answer: C) Transpiration pull

Explanation: Transpiration pull is the force that pulls water up from the roots to the leaves due to the evaporation of water through the stomata (transpiration) and the cohesive and adhesive properties of water molecules in the xylem.

14. Which plant tissue type is responsible for providing flexibility and support to young stems and leaves?
    A) Xylem
    B) Phloem
    C) Sclerenchyma
    D) Parenchyma
    Answer: C) Sclerenchyma
    Explanation: Sclerenchyma tissue consists of thick-walled, lignified cells that provide support and mechanical strength to young stems and leaves, as well as to mature plant parts.

15. What is the role of the stomata in plant leaves?
    A) Absorbs sunlight for photosynthesis
    B) Regulates water loss and gas exchange
    C) Stores water and minerals
    D) Produces oxygen during respiration
    Answer: B) Regulates water loss and gas exchange

Explanation: Stomata are small openings in the epidermis of leaves that regulate gas exchange (CO_2 uptake and O_2 release) and control transpiration (loss of water vapor) by opening and closing their guard cells.

16. Which environmental condition would decrease the rate of transpiration in plants?
    A) High humidity
    B) Low temperature
    C) Strong winds
    D) Bright sunlight

Answer: A) High humidity

Explanation: High humidity reduces the rate of transpiration because it reduces the gradient of water vapor between the leaf interior and the external atmosphere, slowing down the loss of water vapor from the stomata.

17. What is the function of the phloem sieve tubes in plants?
    A) Transport of water and minerals
    B) Transport of sugars and organic nutrients
    C) Support and mechanical strength
    D) Facilitation of gas exchange

Answer: B) Transport of sugars and organic nutrients

Explanation: Phloem sieve tubes transport sugars (mainly sucrose), amino acids, and other organic nutrients produced in photosynthetic tissues (sources) to non-photosynthetic tissues or storage organs (sinks) where they are utilized or stored.

18. Which process contributes to the movement of sugars from leaves to other parts of the plant in the phloem tissue?
    A) Transpiration pull
    B) Active transport
    C) Translocation
    D) Osmosis

Answer: C) Translocation

Explanation: Translocation is the process by which sugars and other organic nutrients are transported through the phloem tissue from source tissues (e.g., leaves) to sink tissues (e.g., roots, fruits, flowers) where they are utilized or stored.

19. Which environmental factor directly influences the rate of photosynthesis in plants?

A) Wind speed

B) Soil texture

C) Light intensity

D) Atmospheric pressure

Answer: C) Light intensity

Explanation: Light intensity directly affects the rate of photosynthesis because it provides the energy required for the conversion of carbon dioxide and water into sugars and oxygen.

20. Which plant tissue type is responsible for the primary growth in length of roots and shoots?
    A) Xylem
    B) Phloem
    C) Meristem
    D) Sclerenchyma

Answer: C) Meristem

Explanation: Meristem tissue is responsible for the primary growth in length of roots and shoots, providing cells that differentiate into various types of specialized cells, including xylem, phloem, and epidermal cells.

21. What is the role of companion cells in the phloem tissue?

A) Storage of sugars

B) Transport of sugars

C) Support and protection

D) Regulation of gas exchange

Answer: B) Transport of sugars

Explanation: Companion cells are specialized parenchyma cells in the phloem tissue that assist in the loading and unloading of sugars into and out of sieve tube elements, facilitating long-distance transport of sugars throughout the plant.

22. What is the function of root pressure in plants?

A) Pulling water from roots to leaves

B) Pushing water and minerals into xylem

C) Opening and closing stomata

D) Absorbing sunlight for photosynthesis

Answer: B) Pushing water and minerals into xylem

Explanation: Root pressure is the force that pushes water and dissolved minerals from the root cortex into the xylem, aiding in the upward movement of water in the absence of transpiration.

23. What is the function of the pith in the plant stem?

A) Storage of sugars

B) Regulation of gas exchange

C) Support and mechanical strength

D) Transport of water and minerals

Answer: C) Support and mechanical strength

Explanation: The pith is the central, spongy tissue found in the centre of some plant stems. It provides support and mechanical strength to the stem.

24. In which part of the plant would you expect to find the highest concentration of starch as a storage carbohydrate?
A) Leaves
B) Roots
C) Stem
D) Flowers
Answer: B) Roots

Explanation: Roots typically store carbohydrates in the form of starch, which serves as a reserve for energy and growth during periods of low photosynthetic activity.

25. Which of the following is NOT a function of the phloem tissue in plants?**

A) Transporting sugars

B) Transporting amino acids

C) Transporting water and minerals

D) Transporting hormones

Answer: C) Transporting water and minerals

Explanation: Phloem tissue primarily transports sugars (mainly sucrose), amino acids, and hormones throughout the plant. Water and minerals are transported primarily through the xylem tissue.

26. Which of the following plant adaptations helps reduce water loss during periods of drought?**

A) Increased stomatal density

B) Thick cuticle on leaves

C) Enhanced root hair development

D) Larger leaf surface area

Answer: B) Thick cuticle on leaves

Explanation: A thick cuticle on leaves reduces water loss by forming a barrier that limits transpiration during dry conditions.

27. What is the primary function of the tracheids and vessel elements in xylem tissue?

A) Transporting sugars

B) Transporting water and minerals

C) Providing mechanical support

D) Facilitating gas exchange

Answer: B) Transporting water and minerals**

Explanation: Tracheids and vessel elements are specialized cells in xylem tissue that transport water and dissolved minerals from roots to shoots in plants.

II. Very Short Answer Questions:

Q1. How are roots useful to plants? Give any two points.

Answer: Roots are useful to the plants in the following way:

1. It absorbs water and minerals from the soil and transports it upward to various parts of a plant.

2. Roots are important to make the plant rigidly fixed to the ground.

Q2. Under what conditions do the plant transpire?

(a) more quickly and

(b) most slowly?

Answer:

(a) Transpiration is faster on hot summer days as compared to cold winters.

(b) In humid air, transpiration is reduced. Air cannot hold any water molecules when it is already laden with moisture (humidity).

Q3. Name any two micro-nutrients.

Answer: Boron and manganese are examples of two micro-nutrients.

Q4. Name a disease in plants caused by the deficiency of zinc.

Answer: Chlorosis is a disease in plants caused by the deficiency of zinc.

II. Short Answer Questions:

Q5. Define the following terms:

A. Osmosis **B. Diffusion** **C. Active Transport** **D. Transpiration**

E. Transpiration pull

Answer:

Osmosis — The movement of water through a semi-permeable membrane from an area of its higher concentration to an area of its lower concentration is called Osmosis.

Diffusion — The movement of salt or mineral molecules from a region of their higher concentration to a region of their lower concentration is called diffusion.

Active transport — The movement of mineral ions from a region of their lower concentration to a region of their higher concentration by using energy (ATP) is called Active transport.

Transpiration — The loss of water in the form of water vapour through the stomata of the leaves and other aerial parts of a plant is called transpiration.

Transpiration pull — The process by which water is sucked up through the xylem as a result of water loss by transpiration is called transpiration pull.

Q6. Differentiate between: Diffusion and Active transport.

Answer:

Sl. No.	Diffusion	Active transport
1.	It is the movement of molecules or ions of a substance from a region of their higher concentration to a region of their lower concentration.	It is the movement of ions of a substance from their lower concentration region to their higher concentration region using energy.
2.	It is the movement of solute or solvent molecules.	It is the movement of ions only (no water).
3.	No cell energy is needed.	Cell energy is needed in the form of ATP.
4.	It occurs through a non-living permeable membrane.	It occurs through a living selectively permeable membrane.

Q7. How does the food manufactured in the leaves reach different parts of the plant?

Answer: The sugar molecules manufactured by the leaves by photosynthesis are transported throughout the plant by phloem. The transport of soluble products of photosynthesis is called translocation. Phloem has cells called sieve tubes which are placed one above the other to form long tubes through which food is transported.

Q8. Give two points of importance of transpiration in plants.

Answer: Two points of importance of transpiration in plants are:

1. Cooling effect — Transpiration from the aerial parts of the plant, cools down the plant surface.

2.Ascent of sap and distribution of minerals — Transpiration results in the development of low water potential in the leaf tissues. Thus, water moves from the xylem tissue to the leaf cells and helps in the ascent of sap. Mineral ions also move up along with water due to the transpiration pull.

Q. xylem, tracheids, and xylem vessels are placed end to end like tubes. How does this help plants?

Answer: In xylem, tracheids and xylem vessels are placed end to end like tubes. These cells are dead which means they don't have protoplasm. Thus it makes a clear straw-like passage for the easy movement of water and minerals in the plant. Also, these cells have lignified walls, which make their walls stiff, provide structural support, and prevent the walls from collapsing during water transport.

Q. Describe the functions of the following :

1. Xylem: It is a type of vascular tissue present in plants, which primarily transports water, dissolved nutrients, and mineral salts from the roots up the stem to the leaves.

Functions:

•The main function of the xylem is the conduction of water and minerals from the roots to different parts of the plant body.

•Tracheids and xylem fibers provide mechanical support.

•Xylem parenchyma helps in the storage of starch and other materials.

2. Phloem: It carries dissolved food that are prepared by the leaves to the different parts of the plants.

Functions:

•The main functions is to conduct food material from the leaves to the other regions of plants and also to storage organs.

•Phloem parenchyma helps in the storage of organic matter.

•Phloem fibers provide mechanical support.

IV. Long Answer Question:

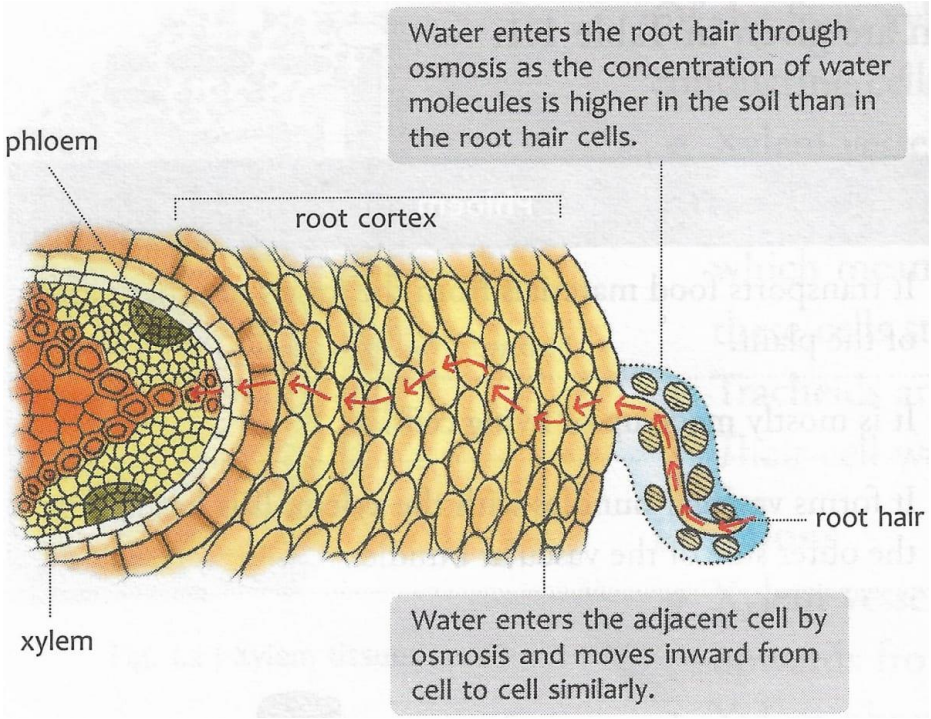
Q9. How do the roots of plants absorb water?

Answer: The roots have thin layered, unicellular outgrowths of the epidermis; which are called root hairs. They increase the surface area for absorption of water from the soil. Following are the steps of absorption of water:

- Water is absorbed by the root hairs by the process of Osmosis. The concentration of water molecules is more in soil as compared to the cell. This causes osmosis to occur, and so water is absorbed by the root hair cells from outside as shown in the given diagram.

- Water molecules move through osmosis from root hair cells to adjacent cells of the inner tissue.
- This process continues until the water reaches the xylem tissue in the root. Thus, water moves from root hair cells through the root cortex to the xylem in the root.
- Inside the xylem, water travels upwards from one cell to another against the force of gravity.

Below diagrams shows the absorption and movement of water in root cells:



Q10: Compare and contrast the roles of phloem and xylem in the transportation of substances in plants.

Answer: The phloem and xylem are specialized plant tissues responsible for transporting different substances to various parts of the plant. Here's a comparison of their roles:

- **Phloem:**
  - **Function:** Transports sugars (mainly glucose), amino acids, and other organic nutrients (like hormones) from source (e.g., leaves) to sink (e.g., roots, stems, fruits).
  - **Direction:** Moves substances bidirectionally (upward and downward) depending on the plant's needs.
  - **Mechanism:** Translocation occurs through living cells called sieve tubes, which are connected end-to-end with sieve plates. Companion cells help in maintaining the sieve tubes.
- **Xylem:**

- **Function:** Transports water, dissolved minerals (like nitrogen, phosphorus, potassium), and some organic nutrients from roots to aerial parts of the plant.
- **Direction:** Moves substances unidirectionally (upward) due to transpiration pull and root pressure.
- **Mechanism:** Water moves through non-living cells (tracheids and vessel elements) that form continuous tubes. Xylem vessels are strengthened by lignin, providing structural support.

Contrasts:

- **Composition:** Phloem consists of living cells (sieve tubes and companion cells), while xylem contains mostly non-living cells (tracheids and vessel elements).
- **Substances transported:** Phloem transports sugars and organic nutrients, whereas xylem transports water, minerals, and some organic nutrients.
- **Direction of movement:** Phloem transports substances bidirectionally, whereas xylem transports substances unidirectionally (mostly upward).

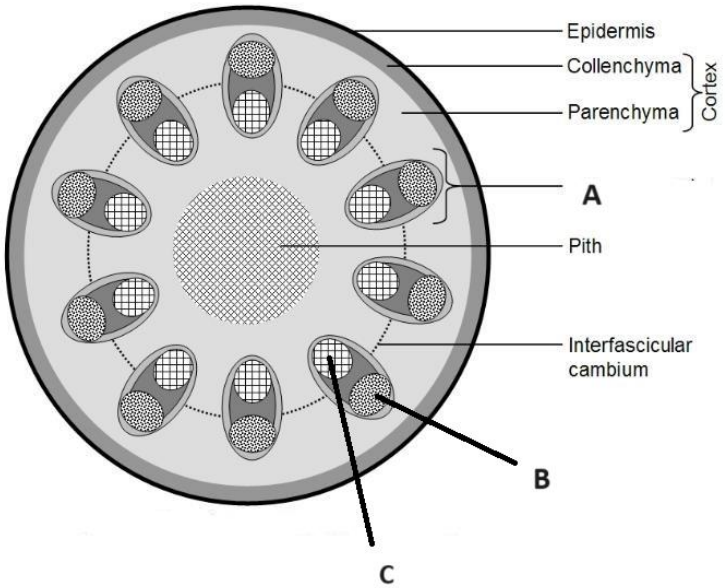
Similarities:

- Both tissues are involved in the long-distance transport of substances within the plant.
- They are essential for the overall growth, development, and survival of plants.

Picture Study:

Q1(B). Identify A, B, and C

Q1(B). Write important differences between B and C.



Answer: **A** – Vascular bundle **B**- Phloem **C** -Xylem

Following are the important differences between xylem and phloem:

Xylem	Phloem
Definition	
Xylem tissues are the tubular-shaped structure, with the absence of cross walls. This tissue resembles the shape of a star.	Phloem tissues are tubular-shaped, elongated, structures with the presence of walls with thin sieve tubes.
Location	
It is located in the centre of the vascular bundle.	It is located on the outer side of the vascular bundle.
Fibers	
Xylem fibers are smaller.	Phloem fibers are larger.
Found In	
They are present in roots, stems, and leaves.	They are present in stems and leaves, which later transport and grow in roots, fruits, and seeds.
Movements	
These tissues move in a Unidirectional. (only in one direction – upward direction)	These tissues move in a Bidirectional. (both ways – up and down)
Comprises	
They live with hollow dead cells.	They live with cytoplasm without the nucleus.
No of Tissues	
The total amount of xylem tissue is more.	The total amount of phloem tissue is less.
Features	
It consists of tracheid, vessel elements, xylem parenchyma, xylem sclerenchyma, and xylem fibers.	It consists of four elements: companion cells, sieve tubes, bast fibers, phloem fibers, intermediary cells, and the phloem parenchyma.

Functions	
Transports soluble mineral nutrients and water molecules from the roots to the aerial parts of the plant.	Transports food and other nutrients including sugar and amino acids from leaves to storage organs and growing parts of the plant.
Vascular Bundles	
Forms vascular bundles with phloem.	Forms vascular bundles with xylem.
Functions	
Provides mechanical strength to the plant and helps in strengthening the stem.	Translocates the synthesized sugars by the photosynthetic areas of plants to storage organs like roots, bulbs, and tubers.
Functions	
It is responsible for replacing the total amount of lost water molecules through transpiration and photosynthesis.	It is responsible for transporting proteins and mRNAs throughout the plan

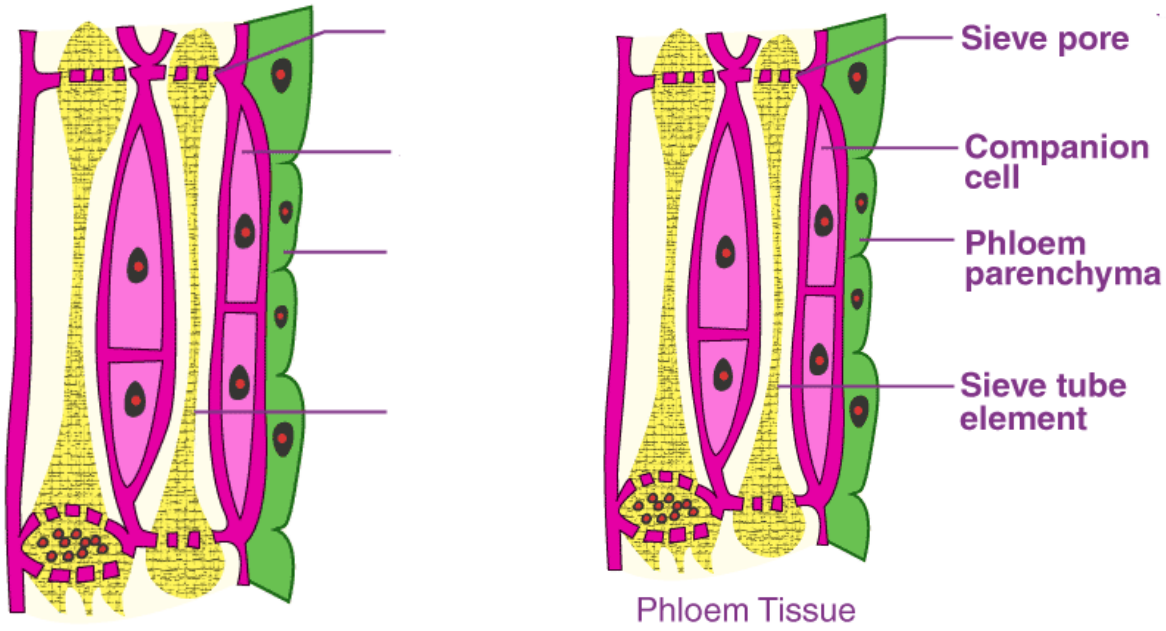
A.	Xylem	Phloem
1)	It transports water and minerals from roots to the apical parts of the plant.	It transports food material from the leaves to growing parts of the plant.
2)	Xylem consists of tracheids, vessels, xylem fibres and xylem parenchyma.	Phloem consists of sieve tubes, sieve cells, companion cells, phloem fibres and phloem parenchyma.
3)	Only xylem parenchyma is living.	Sieve tubes, sieve cells, companion cells and phloem parenchyma are living.
4)	Tracheids, vessels, xylem fibres are dead tissues.	Phloem fibres are dead tissues.
5)	Xylem gives mechanical strength to the plant.	Phloem does not give mechanical strength to the plant.
6)	Conduction of water by xylem is unidirectional i.e., from roots to apical parts of the plant.	Food material conduction is bidirectional i.e., from leaves to storage organs or growing parts or from storage organs to growing parts of plants.
7)	Xylem is star shaped.	Phloem is not in star shaped.
8)	Xylem occupies the center of the vascular bundle.	Phloem occurs on outer side of the vascular bundle.
9)	Tubular with hard walled cells.	Tubular with soft walled cells.

Q2. Label the diagram below.

A. What is the role of the companion cell?

B. Diagram below represents _____ tissue.

C. Write the functions of labeled elements.



Sieve Pores: Sieve pores of the sieve plates connect neighboring sieve elements to form the conducting sieve tubes of the phloem. Sieve pores are critical for phloem function.

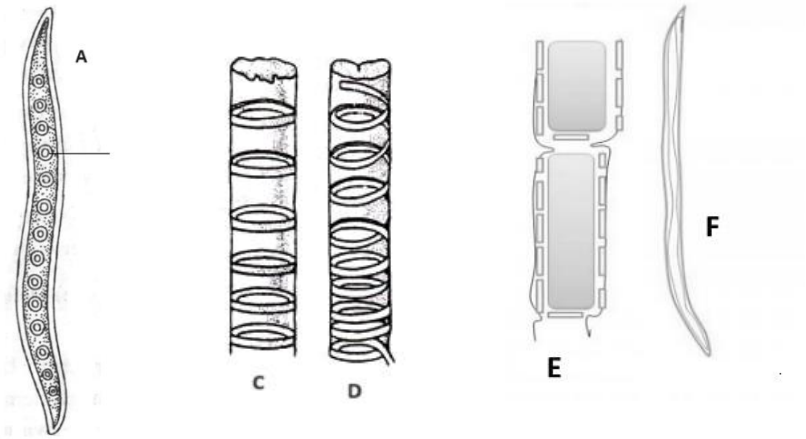
Sieve Tube: The sieve tube is an integral component of the phloem which is composed of several sieve tube elements that join end to end to form a channel for conduction. The main function of the sieve tube is the transport of carbohydrates, primarily sucrose, in the plant. They function as vessels transporting organic food and other materials across the plant. The interface of the tubes contains pores which help in conduction.

Companion Cells: The function of companion cells is to support sieve elements by carrying out cell metabolism and regulation. Companion cells. – transport of substances in the phloem requires energy. One or more companion cells attached to each sieve tube provide this energy.

Phloem parenchyma cells, are called transfer cells. Functions of phloem parenchyma:

- It stores food materials in the form of starch and fats.
- It also helps in the translocation of food.

Q3(A). Identify A, C, D, E, and F.



Q3(B): Write the main functions of C and D, E and F.

Answers 3(A):

A – Tracheid **C & D** – Vessels **E** - Xylem Parenchyma **F**- Xylem Fiber

Answers 3(B) :

(A) Functions of Tracheid:

- They provide mechanical support to the plants.
- They conduct water and minerals from the roots to the rest of the plant.

(B) Xylem vessels are one of the main components of a plant's vascular system. Their primary function is to transport water and nutrients from the roots to the leaves. Xylem vessels are long, thin tubes that are arranged in a series, with each tube connected to the next.

(E) Xylem Parenchyma: These are the only living cells of the xylem and they store starch and fat. They also assist in the short-distance transportation of water. Helps to combat vascular tissue damage during infection or drought. Maintenance of the xylem's transportation capacity.

(F) Xylem Fiber: Xylem fiber is present in between vessels and tracheids of the xylem tissue. It is made up of dead sclerenchyma cells and they provide mechanical strength to the tissue and are responsible for the upward transportation of the materials.