

Transportation in Plants

REVIEW QUESTIONS

Multiple Choice Questions:

1. Put a tick mark (✓) against the correct alternative in the following statements:

(a) Diffusion occurs when molecules move:

1. from lower concentration to higher concentration.
2. from higher concentration to lower concentration through a membrane.
3. from higher concentration to lower concentration.
4. when energy is used.

Answer: (3) from higher concentration to lower concentration.

(b) Ascent of sap in plants takes place through:

1. Cortex
2. Epidermis
3. Xylem
4. Phloem

Answer: (3) Xylem

(c) If the xylem vessels of a plant are plugged:

1. The leaves will turn yellow
2. No food will be made
3. The plant will wilt (shrivel)
4. The plant will continue to grow

Answer: (3) The plant will wilt (shrivel)

(d) Force responsible for the ascent of sap is:

1. Capillary force
2. Root pressure
3. Transpirational pull
4. All the three

Answer: (4) All the three

(e) Raisins swell when put in:

1. Rain water
2. Tap water
3. Mustard oil
4. Saturated sugar solution

Answer: (1) Rain water

(f) The root-hairs are suited for absorbing water from the soil because:

1. They have a large surface area
2. They have a semi-permeable membrane
3. They contain a solution of higher concentration than the surrounding water.
4. All the three.

Answer: (4) All the three.

(g) Transpiration is defined as:

1. the rise of water up to the stem of a plant.
2. the elimination of water with dissolved water products.
3. the loss of water as water vapour from the aerial parts of a plant.
4. the loss of water as water vapour from the roots as well as the leaves of the plant.

Answer: (3) the loss of water as water vapour from the aerial parts of a plant.

(h) Which one of the following favours the fastest transpiration rate ?

1. A cool, humid, windy day,
2. A hot, humid, windy day,
3. A hot, humid, still day,
4. A hot, dry, windy day.

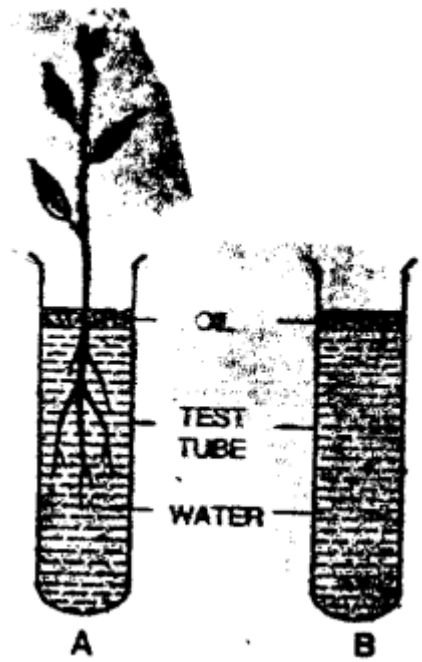
Answer: (4) A hot, dry, windy day.

Short Answer Questions:

Question 1.

An experiment was set up as shown in the figure below. After some time, the Water

level in test tube A fell down but not in test tube B.



Why was there a fall in the water level of test tube A and not in that of test-tube B ?

Answer:

In test tube A the water level falls because the water was absorbed by the plant through its roots dipped in water. Here no water loss occurs due to evaporation from the water surface due to presence of oil.

In test tube B the water level remains unchanged as it does not contain a rooted plant. Due to the presence of oil on surface no water loss occurs due to evaporation.

Question 2.

How are roots useful to the 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 transport it upward to various parts of a plant.
2. Roots fix the plant firmly in the ground.

Question 3.

What do xylem vessels carry?

Answer:

The xylem vessels carry the water and minerals absorbed by the roots to the stem and leaves.

Question 4.

Name the plant tissue which helps in carrying the food to different parts.

Answer:

Phloem.

Question 5.

Define the terms:

(a) semi-permeable membrane

(b) osmosis.

Answer:

(a) Semi-permeable membrane: It is a membrane that allows the movement of solvent molecules (e.g. water molecules) through it but prevents the movement of solute particles (e.g. sugar or salt molecules).

For example: Egg membrane, parchment membrane, cellophane paper etc. are semi-permeable membranes.

(b) Osmosis: The diffusion of water molecules through a semi-permeable membrane from a region where water is more concentrated to a region where it is less concentrated is called osmosis.

In other words, osmosis is the diffusion of water from its pure state or dilute solution into a stronger or concentrated solution through a semi-permeable membrane.

Question 6.

Under what conditions do plant transpire (a) more quickly and (b) most slowly?

Answer:

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

(b) Transpiration is reduced if the air is humid. Air cannot hold any water molecules when it is already laden with moisture (humidity).

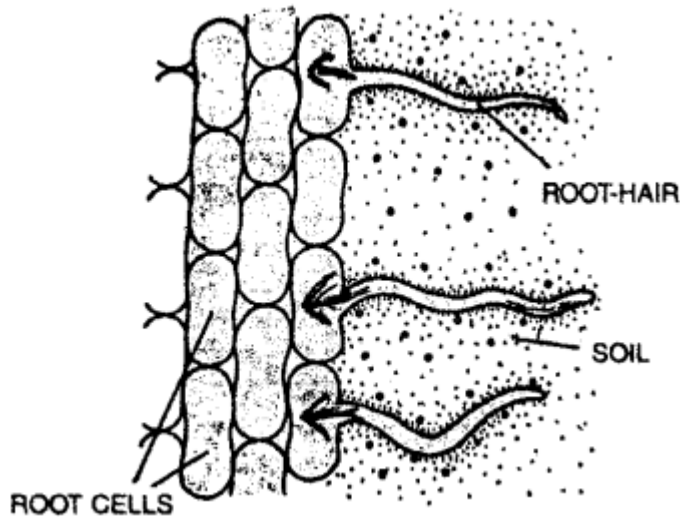
Question 7.

Given here is an enlarged diagram of a part of the root. Draw arrows on the diagram to show the movement of water passing through different parts.



Answer:

Path of water through the root hair to the xylem vessels.



Question 8.

Why is the structure of the root hair quite suitable for absorbing water from the soil ?

Answer:

The root hairs are suitable for absorbing water from the soil in the following three ways:

1. The root hairs present a large surface area. More the surface area, greater is absorption.
2. The cell wall is of cellulose nature and forms permeable membrane and the plasma membrane around the vacuole forms the semi-permeable membrane.
3. Root hairs have solution (cell sap) of a higher concentration than the surrounding soil water.

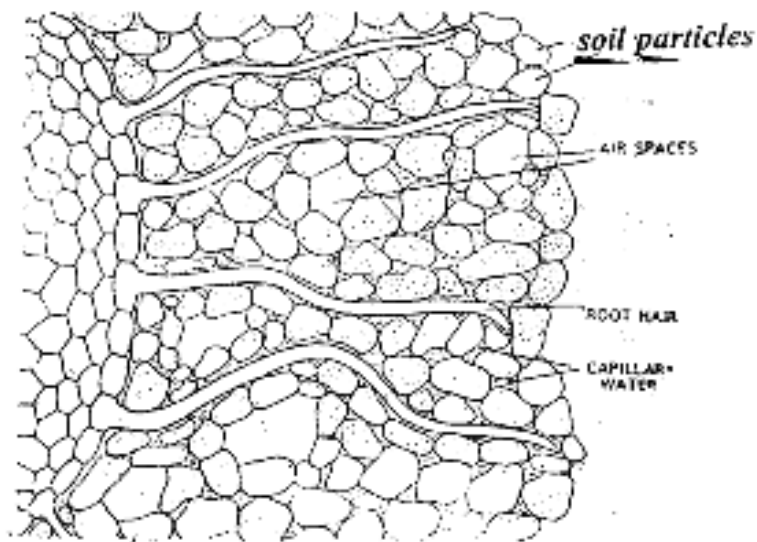
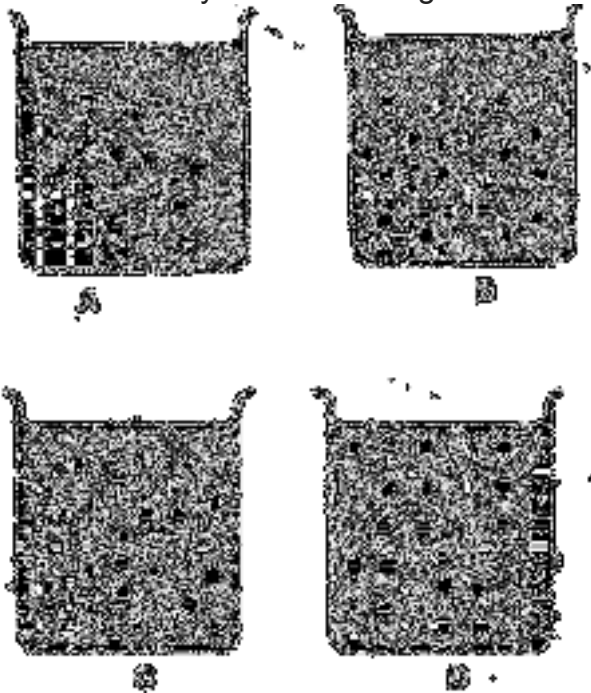


Fig. Unicellular root hairs through the soil particles

Question PQ.

In an experimental set-up, a dye was placed at the bottom of a beaker filled with water as shown in figure A, below. After some time, the entire water in the beaker got coloured uniformly as shown in figure D.



Answer:

(a) Name and define the phenomenon shown in the experiment.

Answer: The phenomenon is diffusion. Diffusion is the movement of the molecules or atoms of a substance (whether in a solid, liquid or gaseous state) from the region of higher concentration to the region of lower concentration.

(b) In all the four figures, two kinds of molecules are shown symbolically – larger and smaller. Which molecules are of the solute and which are of the solvent?

(a) Larger: (b) Smaller:

Answer: (a) The larger molecules are of the solute (dye)

(b) The smaller molecules are of the solvent (water)

(c) If all the dark shaded molecules in A are tightly enclosed in a cell membrane, what will be the nature of movement of the molecules, if any ?

Answer: As the concentration of solvent molecules is more in the left side of the figure A. The cell membrane will act as semi permeable membrane and will allow only the solvent molecules of water to move towards the solute particles. So the solvent molecules will move towards the solute particles. This will show the phenomenon or process of osmosis.

Question 9.

Briefly explain, how transpiration helps in upward conduction of water in plants? (a) (b)

Answer:

(a) Plants continuously absorb water through their roots. This water is sent up through the stem to all parts of the plant, including the leaves. Only a little amount, of water is retained in the plant or utilised by it in photosynthesis. The rest of it gets evaporated into the atmosphere as water vapour through the stomata present in the epidermis of the leaves and other aerial parts of the plant. This creates a suction pressure which pulls up water from xylem of the roots to the stem and then to the leaves.

(b) Xylem tissues are in the form of capillary tubes (tracheids and fibres) where narrower the diameter, greater will be the force. Whenever the xylem vessels lay empty, such as during the loss of water by transpiration, the water from below rises into them by a capillary force.

During day time, water is lost from the surface of the leaves by the process of transpiration. In this process, more and more water molecules are pulled up due to their tendency of remaining joined (cohesion). Such pulling force created by the leaves is very important in the case of tall trees where an upward conduction of water takes place.

Question 10.

How does temperature, light intensity and wind affect transpiration?

Answer:

Temperature: Transpiration is faster on hot summer days as compared to cold winters.

Light intensity: The transpiration rate is increased due to the increase in light intensity.

During daytime in the sunlight, the rate of transpiration is faster. This is because the stomata remain open to allow the inward diffusion of carbon dioxide for photosynthesis. During dark, the stomata are closed, and hence transpiration hardly occurs at night.

Wind: Transpiration is more when the wind is blowing faster as water evaporates faster from the leaves.

Question 11.

The set up shown alongside was kept in sunlight for an hour. It was observed that drops of water appeared on the inside of the polyethylene bag.



- (a) Name the process which is being demonstrated.
- (b) Why was the pot and its soil left uncovered by the polythene bag ?
- (c) Why was the pot left in the sunlight?
- (d) Suppose the pot in this experiment was placed inside a dark room instead of placing it in sunlight for some time. What difference will be noticed?

Answer:

(a) The process demonstrates the loss of water that has appeared in the polythene bag is transpiration.

As the potted plant covered with polythene bag is kept in the sunlight there will be loss of water through the stomata present on the leaves. The water drops will appear inside the polythene bag as a result of loss of water from the stomata. This is due to transpiration.

(b) As the potted plant is kept in the sun. The water vapours will also be given by the pot and the wet soil. These vapours (water drops) will also go inside the polythene if it covers the pot and the soil.

We left the pot and soil uncovered by the polythene so that we may find the loss of water from the aerial parts of the plant covered with polythene bag. This shows that the water gets deposited in the polythene bag has come from the aerial parts of plant.

(c) As we keep the pot in the sunlight the stomata will open and the loss of water i.e., transpiration takes place from the aerial parts of the potted plant and the stomata. The loss of water will be more (transpiration) in the sun, and water vapours will appear in the polythene bag very soon.

(d) As we keep the pot inside the room, the stomata will not open fully and the rate of loss of water will be very-very less, and no water vapours will appear in the polythene bag. By keeping the pot in the room the loss of water will be very less and as a result the transpiration will be very less.

Question 12.

State whether the following statements are true or false. Rewrite the false statements correctly.

(a) Water absorption mainly occurs through the root-hair.

True

(b) Water enters the root-hair by osmosis.

True

(c) Water absorbed by the roots reaches the leaves and is used in producing food for the entire plant.

True

(d) A semi-permeable membrane allows larger molecules to pass through, but prevents the smaller ones.

False. A semi-permeable membrane allows smaller molecules to pass through, but prevents the larger ones.

(e) Transpiration is the loss of water from the roots of the plant.

False. Transpiration is the loss of water from the aerial parts of the plant.

(f) Transpiration cools the plant when it is hot outside.

True

(g) During transpiration, the leaves lose more water from their upper surface.
False. During transpiration, the leaves lose more water from their lower surface.

Question 13.

Fill in the blanks with suitable terms given below: (Fast, Leaves, Stomata, Conducting, Ascent, Humid)

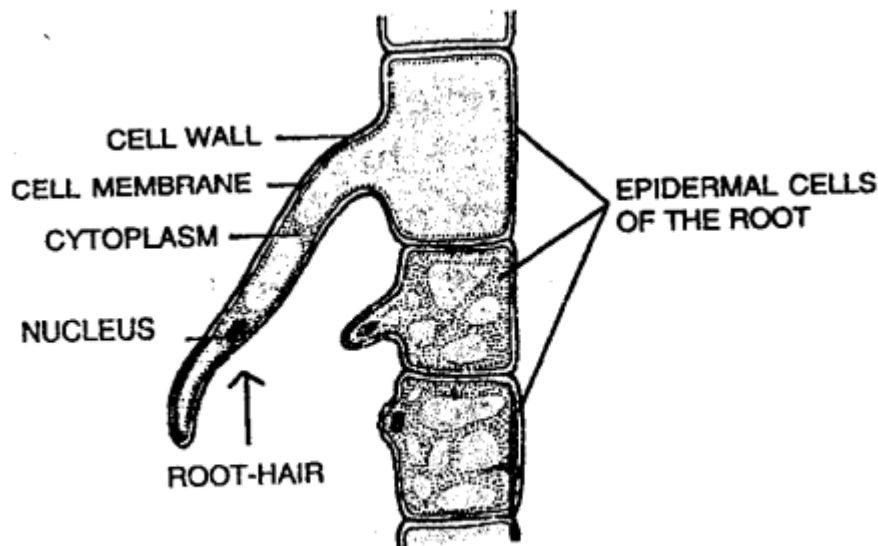
- (a) Transportation in plants is carried out by a **conducting** system.
- (b) The upward movement of sap that contains water and minerals is called **ascent** of sap.
- (c) Transpiration is more when the wind is blowing **fast**.
- (d) Most water gets evaporated from the plant from its **leaves**.
- (e) Transpiration is reduced if the air is **humid**.
- (f) The leaves have more **stomata** on their lower surface.

Long Answer Questions:

Question 1.

Draw a magnified view of the root-hair, and describe, how it helps in the absorption of water from the soil.

Answer:



Root-hair (Highly magnified)

Give above is a magnified view of a root-hair. It is a long protuberance of a cell. This cell contains a fluid called cell sap which is more concentrated than the surrounding soil water.

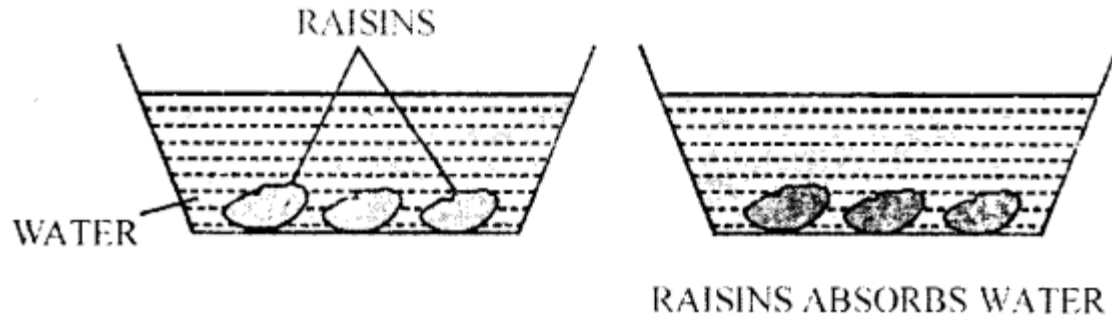
The root hair is covered by a very thin cell membrane that allows water molecules to pass through, but prevents the larger molecules. So the water from the soil passes into the root hairs by osmosis.

Question PQ.

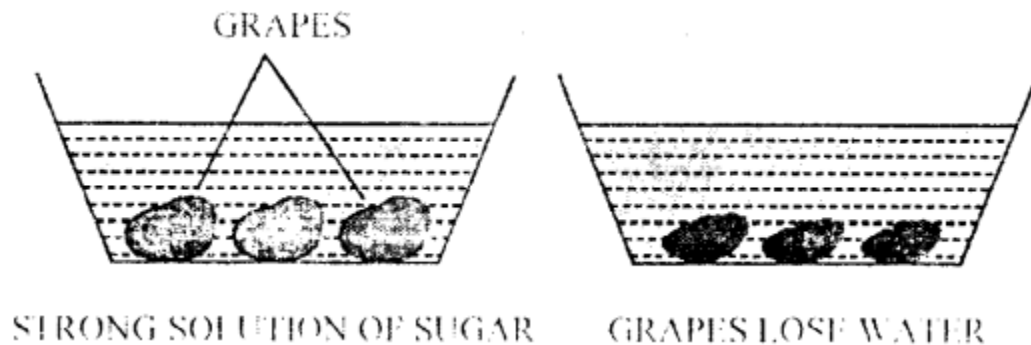
“Raisins swell in water, and grapes shrink in syrup.” Explain this phenomenon briefly.

Answer:

When we put some raisins in a bowl containing water, after 10-12 hours, we will notice that the raisins have swelled up. The raisins have absorbed water.



But when we put some soft-skinned grapes in another bowl containing thick syrup of sugar. After 10-12 hours we will notice that grapes have shrunk. The grapes have lost water.



In both cases the gain or loss of water is through the peel acting as a kind of semi-permeable membrane. This membrane has very minute pores which allow water molecules to pass through, but prevent the larger ones of sugar.

Question 2.

How does transpiration help the roots absorb water and minerals from the soil?

Answer:

Transpiration process in plants creates a suction pressure which pulls up water from xylem of the roots to the stem and then to the leaves.

Xylem tissues are in the form of capillary tubes (tracheids and fibres) where narrower the diameter, greater will be the force. Whenever the xylem vessels lay empty, such as during the loss of water by transpiration, the water from below rises into them by a capillary force.

Due to transpirational pull more and more water molecules are pulled up due to their tendency of remaining joined (cohesion). Such pulling force created by the leaves is very important in the case of tall trees where an upward conduction of water takes place.

Question 3.

Define the three processes by which plants absorb water and minerals from the soil.

Answer:

Following are the three processes which help the plants to absorb water and minerals from the soil.

1. **Diffusion:** Soil water moves into the root hairs through the process of diffusion from higher concentration to lower concentration as we put sugar in the milk and the sugar molecules are evenly distributed in the milk and occupy inter molecular spaces of milk.
2. **Osmosis:** The cell sap and the cell walls act as semi- permeable membranes and permeable membranes. The concentration of the cell sap is more as compared to the water + minerals present in the soil. So the water and dissolved minerals enters the roots by the process of osmosis.
3. **Active transport:** Root hairs absorb water and minerals from the soil. Water diffuses into the root hairs as the concentration of water is more as compared to root hair.
But in case of minerals these move from lower concentration to molecules of higher concentration. So the minerals from the soil along with water move into the roots. So this is active transport in the opposite direction which needs energy.

Question 4.

How water absorbed by the roots is important for the plants?

Answer:

The water absorbed by the roots is important for the plant in three main ways:

1. **Transportation:** The water in the plant body transports substances in solution from one part to another.
2. **Food production:** Water is used in producing food (photosynthesis) by combining it with carbon-dioxide from the air in the presence of sunlight.
3. **Cooling:** Water is used to cool the plant by evaporation through leaves when it is hot outside.

Question 5.

Name the factors which affect the rate of transpiration? State their role in each case.

Answer:

The following are the main factors that affect the rate of transpiration:

1. **Sunlight:** During daytime, the rate of transpiration is faster. This is because the stomata remain open to allow the inward diffusion of carbon dioxide for photosynthesis.
During dark, the stomata are closed, and hence transpiration hardly occurs at night.
2. **Temperature:** Transpiration is faster on hot summer days as compared to cold winter.

3. **Wind:** Transpiration is more when the wind is blowing faster as water evaporates faster from the leaves.
4. **Humidity:** Transpiration is reduced if the air is humid. Air cannot hold any water molecules when it is already laden with moisture (humidity).
5. **Low atmospheric pressure:** The rate of transpiration increases when the pressure is low.

Question 6.

Mention the two ways in which transpiration helps the plants.

Answer:

Transpiration helps the plants in the following ways:

1. **Cooling effect:** In transpiration, water gets evaporated from the plant. The heat required for this evaporation is obtained from the plant itself (latent heat) and thus the plant is able to cool itself w'hen it is hot outside.
2. **Transpiration helps in maintaining the concentration of the sap inside the plant body:** The roots continue to absorb water from the soil. If excess water is not evaporated out, the sap would become dilute, preventing further absorption of water along with the minerals required by the plant.

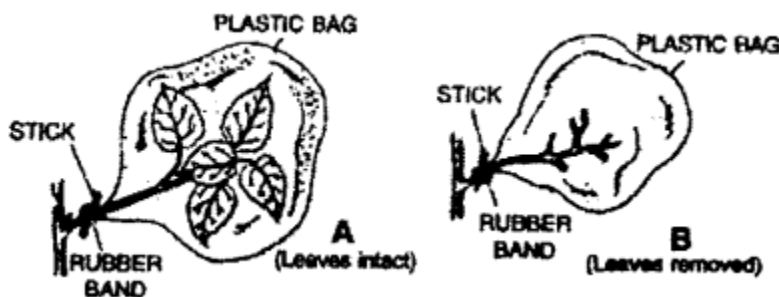
Question 7.

Describe an experiment to show that the plant loses water through its leaves.

Answer:

Experiment: To demonstrate that the plants lose water through its leaves.

- Take one small-sized, well-watered potted plant having a few branches. Place a polythene bag over its one branch as shown in A and tie it with a rubber band.



- Remove all the leaves from another branch (B) of the same plant, cover this too with a polythene bag and tie it with a rubber band.
- Place the plant in sunlight, and observe it after 4-6 hours. You will notice that drops have appeared on the inner surface of the polythene bag over branch A, while no water drops appear on branch B.
- This set-up indicates that most water gets evaporated from the plant through its leaves.

Question 8.

Name any three minerals whose deficiency causes diseases in plants. Give the symptoms of each deficiency.

Answer:

The nutrient elements i.e. minerals are essential for the plants to grow well and complete their life-cycle properly. The minerals are divided into two main categories:

(i) Macro-Nutrients: They are required in larger concentrations and they are obtained from soil.

The three macro-nutrients (minerals) whose deficiency causes diseases in plants are:

1. Nitrogen (N) – Yellowing of leaves, wrinkling of cereal grains.
2. Phosphorus (P) – Purple and red spots on leaves, delay in seed germination.
3. Potassium (K) – Poor Growth

(ii) Micro Nutrients: They are required in small amounts and they are also obtained from soil.

The three micro-nutrients (minerals) whose deficiency causes diseases in plants are:

1. Iron (Fe) – Yellowing of Leaves.
2. Manganese (Mn) – Yellowing of leaves, with grey spots.
3. Zinc (Zn) – Distorted leaves, yellowing of leaves, stunted plant growth.

Question 9.

List out the differences between xylem and phloem.

Answer:

The Xylem tissue consists of four types of cells:

1. **Tracheids:** They are elongated dead cells with tapering ends. Their main function is in upward conduction of water and provide mechanical support.
2. **Vessels:** They are like tube-like structures placed one above the other forming long channels. They provide mechanical support and also transport water and mineral salts laterally and vertically upward.
3. **Fibres:** They are long, narrow and tapering at both ends. They provide only mechanical support.
4. **Parenchyma:** They are living cells and help in the conduction of water and minerals, and serve for the storage of food.

The Phloem tissue consists of four types of cells:

1. **Sieve tubes:** They are formed of sieve cells and form the main conducting part of the phloem. These are cylindrical cells arranged in vertical rows, joined end to end. Their end walls are perforated by pores and are called sieve plates. Sieve plates help in passing food material from cell to cell.

2. **Companion Cells:** They are associated with sieve tubes. It help sieve tubes in the conduction of food material.
3. **Parenchyma:** It is formed of thin-walled unspecialized parenchymatous cells and these cells store food.
4. **Phloem fibres:** They are dead sclerenchyma fibres formed of elongated cells. These provide mechanical strength.

ADDITIONAL QUESTIONS

I. Multiple choice questions. Tick (✓) the correct choice:

1. Movement of water in the plant body takes place through

- (a) xylem
- (b) vascular tissues
- (c) phloem
- (d) stomata

Answer: (a) xylem

2. Prepared food material is carried through

- (a) xylem
- (b) vascular tissues
- (c) phloem
- (d) stomata

Answer: (c) phloem

3. Water from the soil enters the root xylem by the process

- (a) diffusion
- (b) evaporation
- (c) osmosis
- (d) transpiration

Answer: (c) osmosis

4. The loss of water through the stomata of leaves is called

- (a) transpiration
- (b) wilting
- (c) evaporation
- (d) osmosis

Answer: (a) transpiration

II. Fill in the blanks:

1. Water passes into a root by the process called **osmosis**.
2. Osmosis occurs through a **partially permeable** membrane.
3. Movement of water occurs from a **weaker** solution into a **stronger** solution in osmosis.
4. Water is lost from the leaves by **transpiration**.
5. Upward movement of water takes place through **xylem**.

III. Which of the following statements are true (T) and which ones are false (F)? Mark T or F:

1. In Spirogyra, transport of materials takes place through osmosis.
False. In Spirogyra, transport of materials takes place through diffusion.
2. Xylem and phloem are vascular tissues.
True.
3. 'Girdling experiment' demonstrates food synthesis in plants.
False. 'Girdling experiment' demonstrates food transport in plants.

IV. Define the following:

1. Osmosis
2. Transpiration
3. Transpiration stream
4. Diffusion

Answer:

1. **Osmosis:** Osmosis is the process by which water molecules move from a weaker solution into a stronger solution through a partially permeable membrane.
2. **Transpiration:** Transpiration is the loss of water in vapour form from the leaves into the air.
3. **Transpiration stream:** The continuous flow of water from roots to the leaves (via xylem vessels) where it evaporates into the air by transpiration is called transpiration stream.
It can be summarised as:
Soil → root hair → xylem vessels → leaves → air.
4. **Diffusion:** Diffusion is the movement of particles from a high concentration to a low concentration until they are spread out evenly.

V. Describe the function of the following:

1. **Xylem**
2. **Phloem**

Answer:

1. **Xylem:** Xylem transports water and soluble mineral nutrients from the roots up the stem to the leaves.
2. **Phloem:** Phloem transports dissolved food from the leaves to all other parts of the plant.

VI. Answer the following questions:

Question 1.

Name the two aspects of transport in higher plants.

Answer:

The two aspects of transport in higher plants are:

Movement of water and minerals from the roots up to other plant parts through xylem vessels.

Movement of synthesised food from leaves to other plant parts through phloem.

Question 2.

How does transport of materials take place in unicellular plants?

Answer:

Transport of material in unicellular plants takes place by diffusion. The particles move from an area of high concentration to an area of low concentration to attain an equilibrium.

Question 3.

What are root hair? Mention the function performed by the root hair.

Answer:

Root hair are unicellular hair like structures present behind the root tip. The function of the root hair is to absorb water and mineral salts from the soil by osmosis. They enhance the surface area so that plant can take up water and other nutrients that are further away in the soil.

Question 4.

Name the process by which water loss takes place through the leaves.

Answer:

Transpiration.

Question 5.

Mention the significance of transpiration.

Answer:

Transpiration is responsible for the continuous upward flow of water from the roots to the leaves. As water is lost from the leaves by transpiration, more is sucked up from the xylem vessels. Thus, it helps in the rise of cell sap by forming transpiration stream.

Question 6.

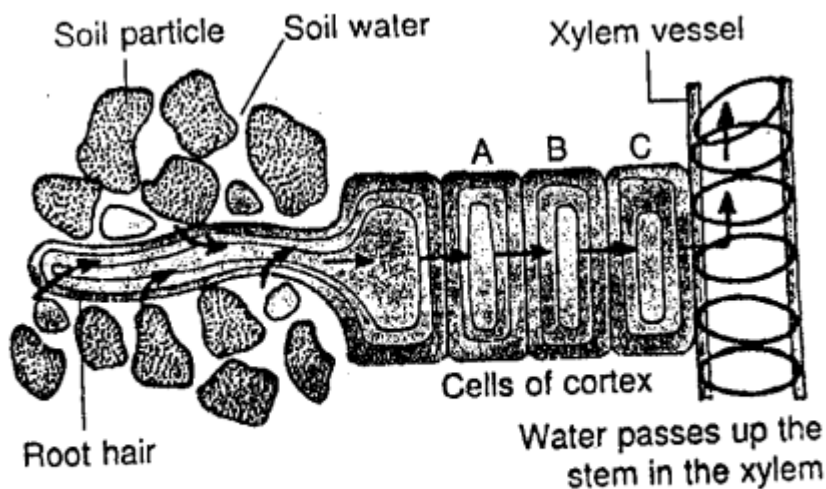
How does movement and absorption of water take place through the roots?

Answer:

The water is absorbed by the root hair from the soil by osmosis.

Water moves into plant cells by osmosis as follows:

1. The cell membrane of the plant cell is partially permeable.
2. The cell sap inside the vacuole is a strong solution whereas water in the soil is a weak solution.
3. Water moves into the plant cell by osmosis.
4. The concentration of the sap in the vacuole is now weaker.
5. Water passes from the weak solution into the strong solution in the next cell by osmosis.
6. This continues until water reaches the root xylem.
7. From the root xylem, it is pulled up in the stem and leaves through transpiration.



The pathway of water across a root and higher up

Question 7.

Differentiate between osmosis and transpiration.

Answer:

Osmosis is the process by which water molecules move from a weaker solution into a stronger solution through a partially permeable membrane. It occurs between cells.

Transpiration is the loss of water in vapour form from the leaves into air. It occurs when water is released into air.

Question 8.

Find the odd one out and give reasons.

Root hair, xylem, root, phloem

Answer:

Phloem.

Reason: Root hair, root and xylem are involved in the absorption and movement of water in a plant whereas phloem transports the food in a plant.

Question 9.

How does transpiration help in the uptake of water from the soil?

Answer:

Transpiration is the loss of water in vapour form from the leaves into the air. As water is used up or lost from the leaves, more is sucked up from the xylem vessels. It's like sucking water up a straw. So there is a continuous flow of water from the roots to the leaves. This movement of water up the xylem is called the transpiration stream.

Question 10.

Crossword Puzzle

ACROSS

1. Special tubes through which food material is carried inside the plants body.
3. Channel through which movement of water and minerals occurs.
4. Red coloured fluid inside blood vessels.
5. Loss of water in vapour from the leaves.
9. Four chambered organ located in the chest cavity.
10. Blood vessels which bring blood into the heart. DOWN
2. Red coloured pigment which is a carrier of oxygen.
6. Blood vessels which carry blood from the heart.
7. Blood cells which help in clotting of blood.
8. Process by which water passes into the root hair.

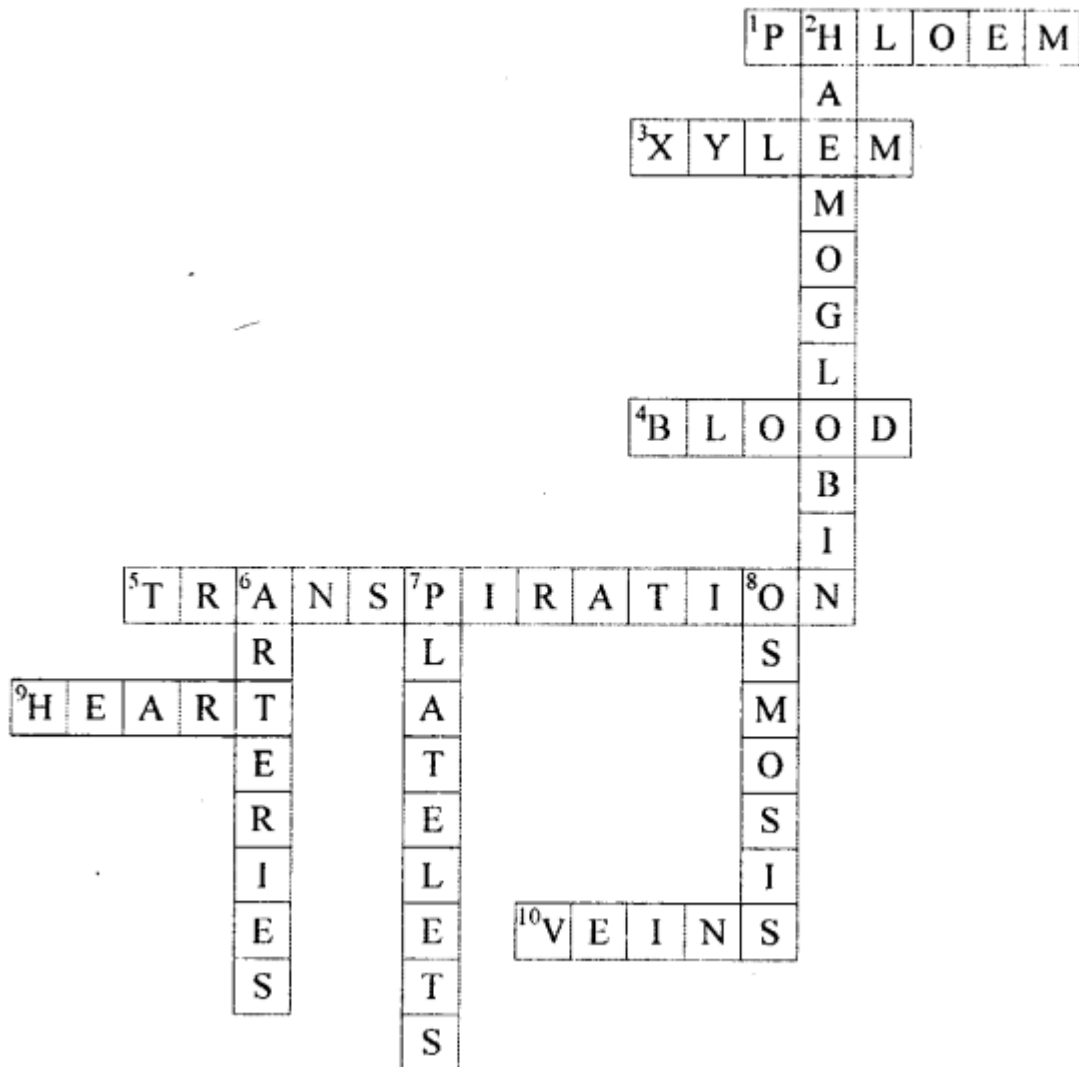
Answer:

ACROSS

- | | |
|-----------|------------------|
| 1. Phloem | 3. Xylem |
| 4. Blood | 5. Transpiration |
| 9. Heart | 10. Veins |

DOWN

- | | |
|----------------|-------------|
| 2. Haemoglobin | 6. Arteries |
| 7. Platelets | 8. Osmosis |



Question 11.

Why is there a need for a transport system in plants and animals?

Answer:

In multicellular plants and animals, a simple process of diffusion cannot move enough oxygen, water, food, waste products with sufficient speed in enough quantity. So, circulatory system in animals and conducting tissues in plants have been developed.

Question 12.

What does vascular tissue or conducting tissue comprise of?

Answer:

In plants, the transport of materials takes place by conducting tissues which comprise of special tubes called xylem and phloem.

Question 13.

What is sap?

Answer:

Circulation in plants is carried by a liquid called sap. Like blood in animals, it delivers useful substances to plant parts and carries away harmful waste materials. Movement of sap occurs through xylem and phloem elements.

Question 14.

Give two major functions of roots.

Answer:

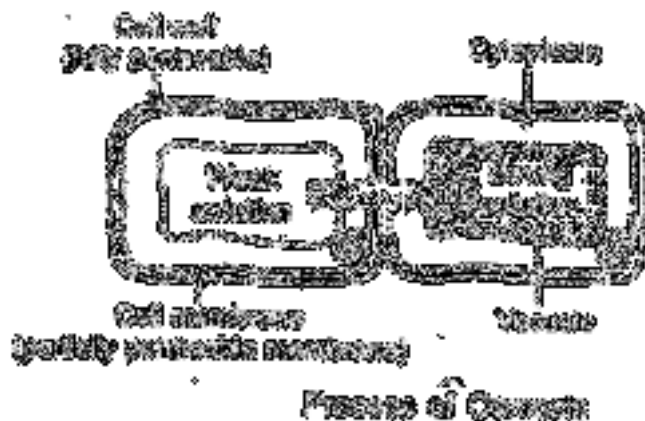
1. Roots fix the plant to the soil.
2. Roots absorb water and mineral salts from the soil.

Question 15.

With the help of a diagram, explain osmosis in plant cells.

Answer:

Water moves into plant cells by osmosis as follows:



1. The cell membrane of the plant cell is a partially permeable membrane.
2. The cell sap inside the vacuole is a strong solution.
3. Water passes into the plant cell by osmosis.
4. The concentration of the sap in the vacuole is now weaker.
5. Water passes from the weak solution into the strong solution in the next cell by osmosis.

Question 16.

Which experiment demonstrates the transport of food material in plants by phloem?

Answer:

Girdling experiment: Girdling of stem removes phloem tissue and the downward and upward movement of food gets blocked. So the stem portion shows swelling in the area due to accumulation of food material.

Question 17.

Why do raisins (dried grapes) swell when kept soaked in water?

Answer:

The raisins contain a concentrated sap and therefore water molecules from the outside move in through partially permeable membrane of the raisins by osmosis and raisins swell.