

A. MULTIPLE CHOICE TYPE

Q – 1 Multiple choice questions

1. Transpiration pull will be maximum under which set of the following conditions?
(a) Open stomata, dry atmosphere and moist soil,
(b) Open stomata, high humid atmosphere and well irrigated soil,
(c) Open stomata, high humid atmosphere and dry soil,
(d) Closed stomata, dry atmosphere and dry soil
2. With decrease in atmospheric pressure, the rate of transpiration will
(a) increase, (b) decrease rapidly, (c) decrease slowly, (d) remain the same
3. One of the internal factors which affect the rate of transpiration, is
(a) big size of the leaf, (b) Colour of the leaf,
(c) sunken stomata, (d) sunny day
4. Guttation takes place through
(a) stomata, (b) lenticels, (c) lower epidermis of leaves, (d) hydathodes
5. Transpiration will be fastest when the day is
(a) cool, humid and windy, (b) hot, humid and still, (c) hot, humid and windy, (d) hot, dry and windy
6. Most of the transpiration in tall trees occurs through
(a) Stomata, (b) Lenticels, (c) Cuticle, (d) Bark
7. Transpiration is best defined as
(a) loss of water by the plant, (b) evaporation of water from the aerial surfaces of a plant,
(c) loss of water, as water vapour, by a plant, (d) release of water by a plant into the atmosphere
8. The rate of transpiration is more when
(a) atmosphere is dry, (b) temperature is high,
(c) humidity is high, (d) atmosphere is dry and temperature is high
9. The loss of water as water vapour from the aerial parts of a plant is known as
(a) evaporation, (b) perspiration, (c) guttation, (d) transpiration

B. VERY SHORT ANSWER TYPE

Q – 1 Name the following

1. Openings on the stem through which transpiration occurs
Lenticels
2. The process by which the intact plant loses water in the form of droplets
Guttation
3. An instrument used to find the rate of transpiration
Potometer

4. A plant in which the stomata are sunken
Nerium
5. The apparatus to record the rate of transpiration in a cut shoot.
Ganong's photometer
6. Any two parts of a leaf which allow transpiration
Stomata and cuticle
7. The structure in a leaf that allows guttation
Hydathodes
8. Loss of water as droplets from the margins of certain leaves.
Guttation

Q – 2 Fill in the blanks:

1. Transpiration is the loss of water as water from the parts of the plant. (vapour, aerial)
2. Closing of and shedding of leaves reduce (stomata, transpiration)
3. Transpiration helps in creating force and in eliminating excess (suction, water (heat))

C. SHORT ANSWER TYPE

**Q – 1 Given below is an example of a certain structure and its special functional activity:
chloroplasts and photosynthesis**

In a similar way, write the functional activity against each of the following:

1. Hydathodes and Ans. (guttation)
2. Leaf spines and Ans. (protection and reduced transpiration)
3. Lenticels and Ans. (transpiration)
4. Xylem and Ans. (conduction of water and mineral salts)

Q – 2 State whether the following statements are True (T) or False (F)?

1. Most transpiration occurs at midnight.
False. Most transpiration occurs at mid-day.
2. Transpiration creates a pull for the upward movement of the sap.
True
3. Wind velocity has an effect on transpiration.
True
4. Atmospheric humidity promotes transpiration from a green plant.
False. Atmospheric humidity reduces transpiration from a green plant.
5. Transpiration helps to cool the body of the plant.
True

6. Voltmeter is an instrument used for measuring the rate of transpiration in green plants.
False. Potometer is an instrument used for measuring the rate of transpiration in green plants.

Q – 2 Give suitable explanation for the following :

- 1. A higher rate of transpiration is recorded on a windy day rather than on a calm day.**

Transpiration increases with the velocity of wind. If the wind blows faster, the water vapours released during transpiration are removed faster and the area surrounding the transpiring leaf does not get saturated with water vapour.

- 2. Excessive transpiration results in the wilting of the leaves.**

When the rate of transpiration far exceeds the rate of absorption of water by roots, the cells lose their turgidity. Hence, excessive transpiration results in wilting of the leaves.

- 3. Some plants show wilting of their leaves at noon even when the soil is well-watered.**

In some plants, e.g. balsam, the leaves of the plants wilt during the midday inspite of the fact that there is plenty of water in the soil because during the midday the rate of transpiration exceeds the rate of absorption of water by the roots. The cells, therefore, lose turgidity. In evening or at night, the stomata are narrowed or constricted and the temperature is not high, therefore, there is no loss of water through transpiration and turgidity of leaves is re-acquired and they stand erect.

- 4. More transpiration occurs from the lower surface of a dorsiventral leaf.**

There are more stomatal openings on the lower surface of a dorsiventral leaf. More the number of stomata, higher is the rate of transpiration. Hence more transpiration occurs from the lower surface.

- 5. The stomata in most plants are more numerous on the lower surface of the leaf as compared to the upper surface.**

Stomata are minute openings in the epidermal layer of leaves. The stomata in most plants are more numerous on the lower surface of a leaf as compared to the upper surface because lower surface does not face direct sunlight. This arrangement helps to reduce the rate of transpiration.

- 6. Forests tend to bring more rains.**

Due to transpiration, huge quantities of water are released into the atmosphere by vast stretches of forests. Thus, transpiration increases the moisture in the atmosphere and brings more rain.

- 7. On a bright sunny day, the leaves of certain plants roll up.**

On a bright sunny day, the rate of transpiration is much higher than any other days. The leaves of certain plants roll up on a bright sunny day to reduce the exposed surface and thus reduce the rate of transpiration.

- 8. Water transpired is the water absorbed.**

Plants absorb water continuously through their roots, which is then conducted upwards to all the aerial parts of the plant, including the leaves. Only a small quantity of this water i.e. about 0.02% is used for the photosynthesis and other activities. The rest of the water is transpired as water vapour. Hence water transpired is the water absorbed.

9. Cork and bark of trees help in preventing loss of water.

Cork and Bark of trees are tissues of old woody stems. Bark is thick with outermost layer made of dead cells and the cork is hydrophobic in nature. These properties make them water-proof and hence they prevent transpiration.

10. Perspiration and transpiration help to cool the body temperature of the organism.

In both perspiration and transpiration, water is lost by evaporation from the body of the organism as water vapour. This evaporation reduces the temperature of the body surface and brings about cooling in the body of the organism.

D. DESCRIPTIVE TYPE

Q – 1 Define the following terms.

1. Transpiration

Transpiration is the loss of water in the form of water vapour from the aerial parts (leaves and stem) of the plant.

2. Exudation

The process by which plants lose water or other fluids along with dissolved substances directly in liquid form and not as water vapour is called exudation.

3. Potometer

Potometer is a device that measures the rate of water intake by a plant and this water intake is almost equal to the water lost through transpiration.

4. Wilting

The collapsing of leaves due to excessive loss of water i.e. transpiration or due to some disease is called wilting.

5. Hydathodes

Special pore-bearing structures present on the margins of the leaf to allow exudation are called hydathodes

6. Cuticle

Cuticle is a waxy layer secreted by the epidermis on the two surfaces of the leaf which prevents evaporation of water from the leaf surfaces

Q – 2 Distinguish between the following pairs:

1. Stomata and Lenticels

Stomata	Lenticels
They are minute openings in the epidermal layer of leaves.	They are minute openings on the surface of old woody stems.
Maximum transpiration occurs through stomata.	Lesser transpiration occurs through lenticels.

2. Guttation and bleeding

Guttation	Bleeding
It is the removal of excess of water from the plants because of excess water buildup in the plant.	It is the removal of water from the plant because of injury.
Water escapes from specialised structures called hydathodes.	Water escapes in the form of sap from the injured part of the plant.

3. Transpiration and Evaporation

Transpiration	Evaporation
It is the loss of water in the form of vapour from the aerial parts of the plant.	It is the loss of water from the surface of water bodies in the form of vapour.
It is a slow process.	It is comparatively a faster process.

Q – 3 Suppose you have a small rose plant growing in a pot. How would you demonstrate transpiration in it?

Take the small potted rose plant and cover it with a transparent polythene bag. Tie its mouth around the base of the stem. Leave the plant in sunlight for an hour or two.



Drops of water will soon appear on the inner side of the bag due to the saturation of water vapour given out by the leaves. A similar empty polythene bag with its mouth tied and kept in sunlight will show no drops of water. This is the control to show that plants transpire water in the form of water. If tested with dry cobalt chloride paper, the drops will be confirmed as water only.

Q – 4 What is lenticular transpiration? Mention one major difference between lenticular transpiration and stomatal transpiration.

Transpiration occurring through lenticels i.e. minute openings on the surface of old stems is called lenticular transpiration.

Stomatal transpiration is controlled by the plant by altering the size of the stoma, where as this does not happen in case of lenticular transpiration. This is because the lenticels never close, but remain

open all the time. The amount of stomatal transpiration is much more than the amount of lenticular transpiration.

Q – 5 Droplets of water may sometimes be seen along the margins of the leaves of a banana plant, growing in wet soil in the mornings. Are these dew drops? Comment upon your answer.

No, they are not dew drops.

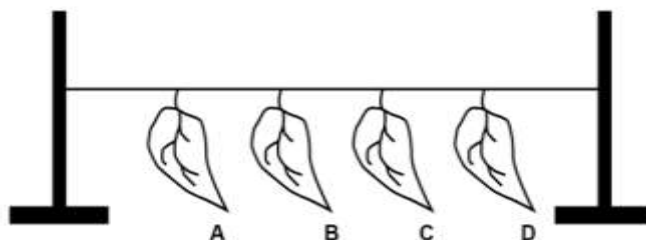
This is water given out by the plant body through guttation. Since the banana plant is growing in humid environment, transpiration is hampered. But the roots continue to absorb water from the soil. This builds up a huge hydrostatic pressure within the plant and forces out the excess water from the hydathodes, which are pores present at the tips of veins in the leaf. This is observed especially during the mornings.

Q – 6 Briefly explain how the rate of transpiration is affected by:

1. Intensity of light — During the day, the stomata are open to facilitate the inward diffusion of carbon dioxide for photosynthesis. At night they are closed. Hence more transpiration occurs during the day. During cloudy days, the stomata are partially closed and the transpiration is reduced.
2. Humidity of the atmosphere — Transpiration is reduced if the air outside is humid. Thus, high humidity in the air reduces the rate of outward diffusion of the internal water vapour across stomata, thereby reducing the rate of transpiration.
3. Temperature — If the outside temperature is higher, there is more evaporation from the leaves, therefore, more transpiration. Increase in temperature allows more water to evaporate and the decrease in temperature reduces evaporation. Warm air can hold more water than cold air.

E. STRUCTURE / APPLICATION / SKILL TYPE

Q – 1 The given figure represents an experiment:



- (a) Leaf A was coated with grease on both the surfaces.
- (b) Leaf B was coated with grease on the lower surface.
- (c) Leaf C was coated with grease on the upper surface.
- (d) Leaf D was left without any application of grease.

All the four leaves A, B, C and D were left in a room for about 24 hours.

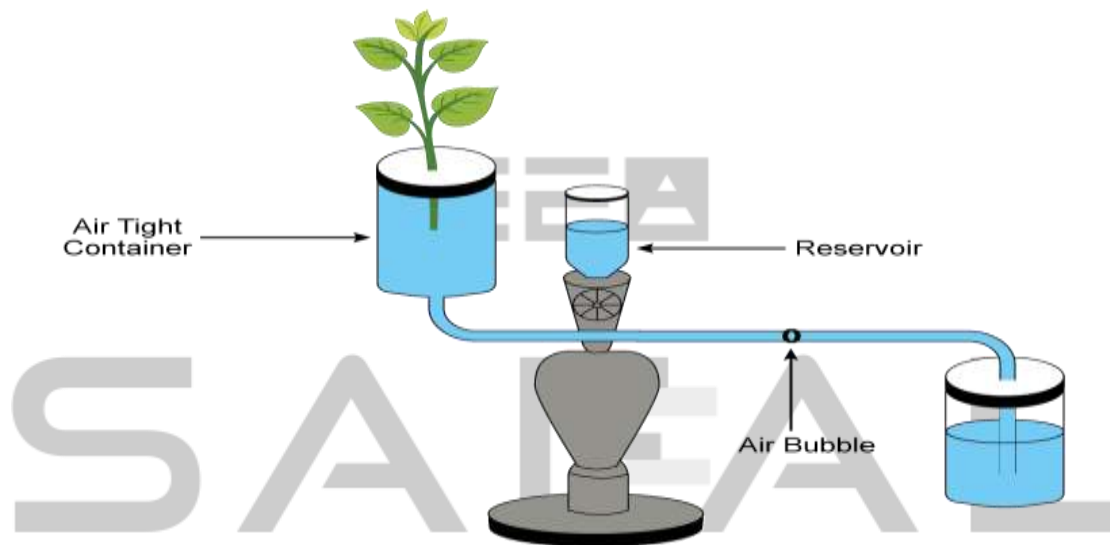
(i) Which leaf dries first? Give reason.

Leaf D — The leaf with no greasing on either surfaces would dry first because it would lose water from both surfaces i.e. it would lose maximum quantity of water.

(ii) **Which leaf dries last? Give reason.**

Leaf A — It was coated with grease on both the surfaces. Hence, it would dry last because greasing prevents evaporation of water and transpiration occurs through stomata which are present more on the lower surface of the leaf.

Q – 2 Given below is the diagram of an apparatus used to study a particular phenomenon in plants:



Answer the following with reason

1. Name the apparatus.

Ganong's potometer

2. What is it used for?

Ganong's potometer is used to measure the water intake of a plant which is almost equal to the water lost through transpiration.

3. What is the role played by the air-bubble in this experiment?

The movement of the air bubble and its position in the capillary tube indicates the volume of water lost through transpiration in a given time.

4. What is the use of the reservoir?

The water in the reservoir can be released into the capillary tube by opening the stop cock. This allows the air bubble to restore back to its original position.

5. What happens to the movement of the air-bubble if the apparatus is kept:

(i) **In the dark,**

If the apparatus is kept in the dark, there will be no transpiration as the stomata would be closed. As a result, there would be no movement of the air bubble and it would remain stable.

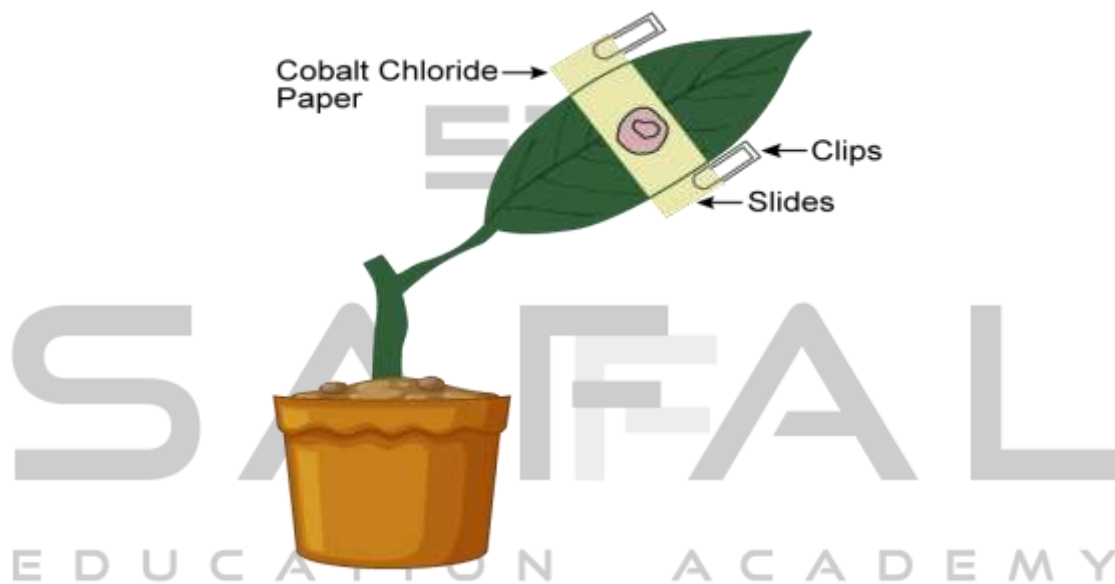
(ii) **In sunlight,**

If the apparatus is kept in bright sunlight, the rate of transpiration will be more. As a result, the movement of the air bubble would be larger since there would be more loss of water due to transpiration.

(iii) In front of a fan

If the apparatus is kept in front of a fan, the rate of transpiration will be more. As a result, the movement of the air bubble would be larger since there would be more loss of water due to transpiration as the velocity of wind/air increases.

Q – 3 Given ahead is the diagram of an experimental set up to study the process of transpiration in plants. Study the same and then answer the questions that follow:



1. Name the colour of dry cobalt chloride paper.

Blue.

2. Is the experimental leaf a monocot or a dicot? Give a reason to support your answer.

The experimental leaf is a dicot leaf as it shows reticulate venation and there are more number of stomatal openings on the undersurface of a dicot leaf. Hence, transpiration is more and can be easily observed.

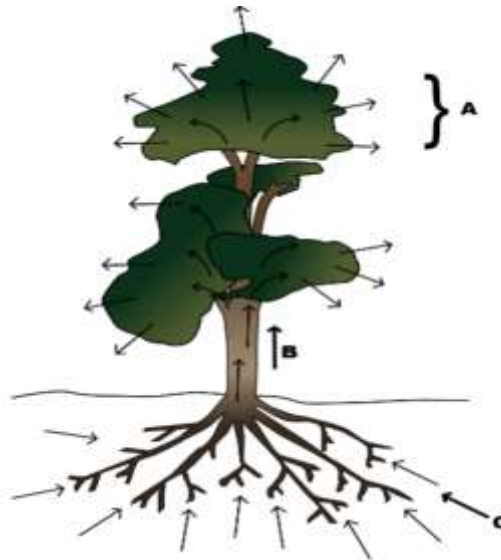
3. Why are glass slides placed over the dry cobalt chloride papers?

Glass slides are placed over the dry cobalt chloride papers so as to retain the strips in their position.

4. After about half an hour what change, if any, would you expect to find in the cobalt chloride paper placed on the dorsal and ventral sides of the leaf? Give a reason to support your answer.

The cobalt chloride paper on the dorsal side will turn less pink or turns pink in a much longer time; while the one on the ventral side will turn more pink. This occurs because the ventral surface has more number of stomata as compared to the dorsal surface. As a result, the rate of transpiration is more on the ventral side than on the dorsal side of a dicot leaf.

Q – 4 An outline sketch of a tree is shown in a diagram below. Study the same and answer the questions that follow:



(a) Name and define the phenomenon labelled A in the diagram.

A is transpiration. Transpiration is the evaporative loss of water from the aerial parts (leaves and stem) of the plants.

(b) Write the significance of the process mentioned in A for the plants.

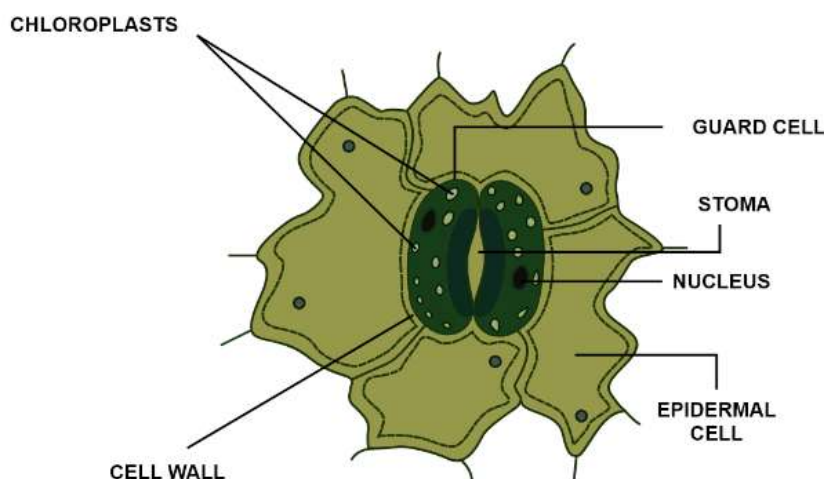
Significance of transpiration for the plants: (i) Cooling effect, (ii) Creating suction force. (iii) Distribution of water and minerals.

(c) What do the direction of arrows in B and C indicate? Name the phenomenon.

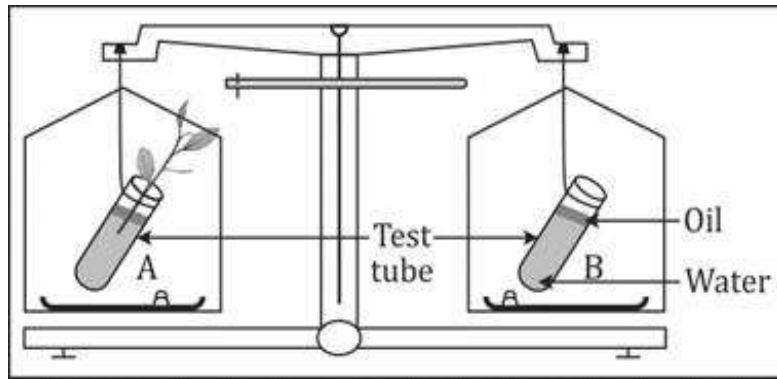
(c) Arrow B indicates water passing up the trunk and the phenomenon is ascent of sap. Arrow C indicates water absorbed by roots from the soil and the phenomenon is called Endosmosis.

(d) Draw a neat and labelled diagram of an opened stomata.

Below diagram shows an opened stomata:



Q – 5 The figure given below represents an experimental setup with a weighing machine to demonstrate a particular process in plants. The experimental setup was placed in bright sunlight. Study the diagram and answer the following questions.



1. Name the process intended for study.

Transpiration

2. Define the above mentioned process.

Transpiration is a process by which water is lost in the form of water vapour from aerial parts of the plant.

3. When the weight of the test tubes A and B is taken before and after the experiment, what change is observed? Justify.

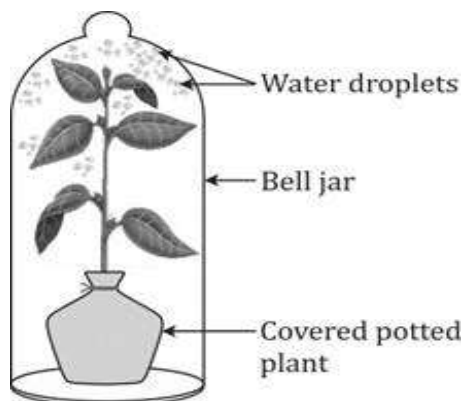
Weight of test tube A before the experiment was more than its weight after the experiment. This is because water from test tube A has evaporated due to transpiration.

Weight of test tube B remains the same before and after the experiment, because no loss of water occurs in test tube B.

4. What is the purpose of keeping the test tube B in the experimental setup?

Test tube B is used here as a control. This makes the observation of the change in test tube A easy.

Q – 6 An apparatus as shown below was set up to investigate a physiological process in plants. The setup was kept in sunlight for two hours. Droplets of water were then seen inside the bell jar. Answer the questions that follow:



1. Name the process being studied.

Transpiration

2. Explain the process named above in (a).

3. Transpiration is a process during which water is lost in the form of water vapour through aerial parts of the plant.

4. Why was the pot covered with a plastic sheet?

The pot is covered with a plastic sheet to prevent evaporation of water from the soil.

5. Suggest a suitable control for this experiment.

A control for this experiment will be an empty polythene bag with its mouth tied.

6. Mention two ways in which this process is beneficial to plants.

Transpiration is beneficial to plants in the following ways:

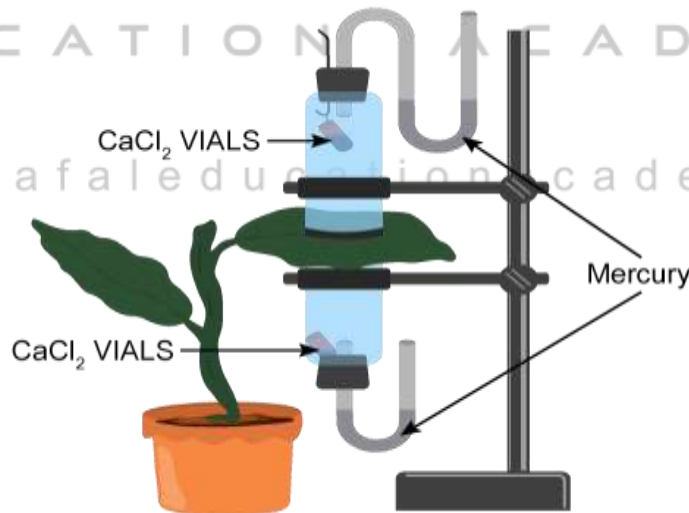
- (i) It creates a suction force in the stem which enables the roots to absorb water and minerals.
- (ii) It helps in cooling the plant in hot weather.

7. List three adaptations in plants to reduce the above mentioned process.

Adaptations in plants to reduce transpiration are

- (i) Leaves may be modified into spines as in cactus or into needles as in pines.
- (ii) The number of stomata is reduced and they may be sunken in pits.
- (iii) Leaves may be folded or rolled up.

Q – 7 The apparatus shown in the following diagram is Garreau’s potometer designed to demonstrate unequal transpiration from the two surfaces of a dorsiventral leaf. Before keeping the leaf in between the cups, anhydrous calcium chloride (CaCl_2) contained in two small vials were weighed and placed in both the cups. The ends of the cups were closed with corks through which two mercury manometers were connected. After few hours, CaCl_2 vials were taken out and weighed again.



1. What is the purpose of keeping CaCl_2 vials inside the cup?

CaCl_2 is a hygroscopic compound that absorbs moisture/water without changing its state. CaCl_2 vials inside the cup to absorb water.

2. After few hours CaCl_2 vials were taken out and weighed again. Will you expect any difference in weight? If so, give reason.

Yes, after few hours the weight of the CaCl_2 vials will increase because they will absorb water lost by the leaf of the plant due to transpiration.

3. What is the purpose of using a manometer?

Manometer is used to measure the pressure. In order to measure the pressure exerted by the fluid, the fluid is allowed to exert pressure on one of the closed ends of the tube. Under the effect of the pressure, the liquid inside the manometer tube gets displaced and the amount of displaced liquid is measured.

4. What do you mean by transpiration?

Transpiration is the loss of water in the form of water vapour from the aerial parts (leaves and stem) of the plant.

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