Date

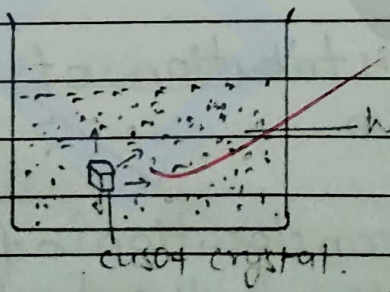
Plant Physiology

Diffusion:-

The process of movement of molecules, ions, gases, solutes from their higher concentration to lower concentration is called diffusion. Ex:- If a bottle of perfume is opened in a closed room the perfume spread by diffusion.

Experiment of Diffusion:-

When a crystal of copper sulphate is placed in beaker containing water, a dense blue colour is seen around the crystal. It decrease with increase in distance from the crystal representating the diffussion of copper sulphate molecules in water. Here, the $CuSO_4$ mol. move towards $CuSO_4$ finally the mole. of both water and $CuSO_4$ are distributed equally throughout the solution.



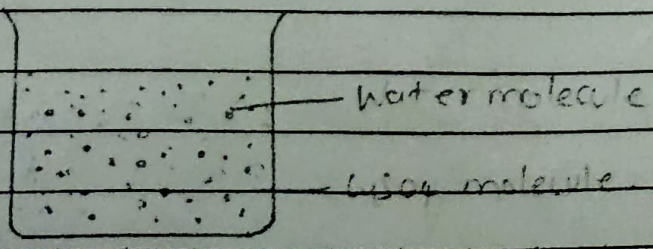


fig:- Diffusion of $CuSO_4$ and H_2O

Diffusion Pressure:-

The pressure developed by the diffusing particles from the area of higher to lower concentration is called diffusion pressure.

Significance of Diffusion Pressure

1. It helps in the exchange of gases during respiration & photosynthesis.
2. It also help in exchange of gases during transpiration.
3. Passive absorption of minerals takes place by diffusion.
4. It help in pollination because insects are attracted towards plant due to diffusion of aroma of flower.
5. It help in distribution of substance in the protoplasm.
6. It help in translocation of food in different parts of the body.

Osmosis:

The process of movement of water or solvent from their higher concentration to lower concentration through semi-permiable membrane is called osmosis.

Types of Osmosis.

Two types of Osmosis:

1. **Endosmosis.**

When a living cell placed inside the hypotonic solution, water enters inside the cell and cell become turgid is called endoosmosis.

2. **Exosmosis.**

The outward movement of water from a cell when it is placed in hypertonic soln is called exosmosis. By this process cell beaomes flucid.

Types of solution:

i. **Hypotonic**

It is the solution in which the concentration of solute is lower then the concentration of solvent.

ii. **Hypertonic**

It is the solution in which the concentration of solute is higher then the concentration of solvent.

iii) Isotonic

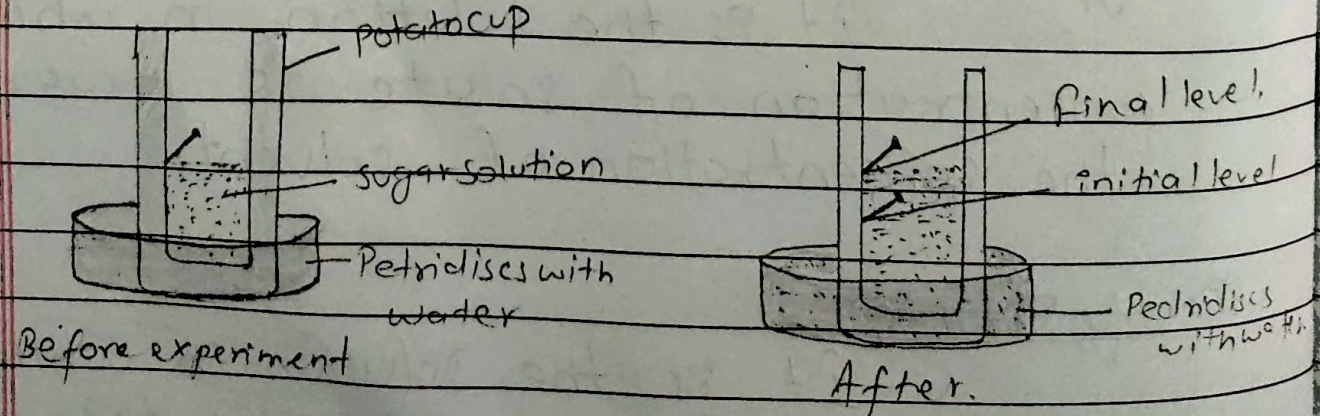
In this type the concentration of both solutie and solvent are equal.

Experiment :- To demonstrate the osmo by using photo osmoscope.

Appartus :- A large sized poterto, Sugar Solut petridiscs and two pins.

Procedure :-

Peel off the skin of large sized potato with knife and cut its one end to make flat base. Make a hole or cavity in the potato by using ~~and~~ knife and fill the sugar solution in to the cavity and mark the initial level. The the whole apparatus / potato placed inside ~~the~~ a petridiscs containg water and leave it about few hours.



Result:

After some time the level of sugar sol^{n} in the cavity raise up this is because of movement of water through higher concentration to lower concentration. This is called Osmosis.

Significance of Osmosis:-

1) Osmosis help in growth of tissue.
2) It also help in opening & closing of stomata.
3) The roots of plant absorb water by osmosis.
4) Cell to cell movement of water in the plant occurs by Osmosis.
5) It help in movement of plant's parts like leaf of Nagmaste (Mimosa plant or touch me not plant).
6) Osmosis help to control the desiscence of anther to foods, etc.

Plasmolysis

The process of shrinkage of protoplasm of plant cell due to loss of water when it is placed inside hypertonic solution. The process is called plasmolysis and cell is called plasmolysed cell.

Deplasmolysis

When a plasmolysed cell placed inside hypotonic solution water enters into the cell and cell become turgid. The process is called deplasmolysis.

Significance of plasmolysis

1. Plasmolysis is the phenomenon of living cell. Dead cell cannot show plasmolysis.
2. It indicates the semi-permiable nature of plasma membrane.
3. It help in food preservation.
4. It is used to determine the osmotic pressure of cell sap.
5. It checks the growth of bacteria and fungi in jam, jerry, etc. as bacteria & fungi are plasmolysed in Conc. Sugar Soln.

Imbibition

The process of increase in volume or diameter of a solid substance by soaking water is called imbibition.

Eg:- Swelling of doors and windows in wiet season, Swelling of seeds, gum, etc.

Significance of Imbibition

1. It help in germination of seed because the stored food in seed swell causing the seed pore ruptyre.

2. Before absorption of water, the wall of root hair swells by imbib water.
3. Busting of pollen grains inside the ovary though imbibition.
4. Wooden door and windows are jammed during rainy season due to osmosis.

5. The ripping of fruits takes place by imbibition

Osmotic relation of a cell.

Living cell consits of plasma membrane and cell sap. Plasma membrane is really not a semi-permiable membrane and it allow to pass across it small amount of solute. also so it is called selective permiable membrane. When a living cell placed in water on hypertonic sol^{n} water enters the cell sap by endosmosis. As a result of entry of water into the cell sap a pressure develops inside the protoplasm against the cell wall. And cell become turgid. This pressure is called turger pressure.

To balance the turgor pressure the cell also exert a pressure, the pressure exerted by the cell wall against the expanding protoplasm is called wall pressure.

Diffusion pressure Deficit (DPD)

The amount of solute by which the diffusion pressure of a solution is lowered than the pure solvent or water is called diffusion pressure deficit, (DPD). Diffusion pressure of a solvent is maximum. ~~the~~ As the solute is added the diffusion pressure of a solution is decreased. If the DPD is greater, the cell try to absorb water. In other word, it can be said that DPD is the index of water sucking ability of a cell. So it is called suction pressure. Suction pressure is defined as the force per unit area with which water enter

in a cell. The term DPD was first given by B.S Mayer in 1938.

DPD = OP - TP (osmatic press. - Turger. Press)
DPD = OP - 0 [cell · flaceid].
DPD = O(OP - TP) [cell is turgid]

TP = WP = 0 [cell turgid]
TP > WP [cell brust]
WP > TP [cell flaceid].

Osmotic Pressure

The pressure required to stop the net movement of pure water into a solution through plasma membrane is called Osmotic pressure. It is measured by atmosphere. The measurement tools name osmometer. The movement of solvent from their higher concentration or lower osmotic pressure to lower concentration of higher osmotic pressure takes place in the process of osmosis. The osmotic pressure of pure water is zero.

Absorption of water

Plant absorb water through its entire surface that is roots, stem and leaf however the water mainly absorbed by roots. The area of young roots where consists of different forms of water like more absorption takes place is root hair zone. Soil consists of different forms of water like gravitation at water, feild capacity water. plant absorbs only capillary water present beth the space of the soil particles.

The total amount of water present in the soil is called Holand. The water that can be absorbed by plant is called chard. and the water that donot absorb by plant is called Echard.

Pathway of Absorption of water

The entry of water into the root hair dilutes the all water molecules in root hair increases as compared to adjacent particle cells. At this stage DPD of root hair is slower than that of adjacent Particle cells and water enters in these cells. By this process water enters into passage cells of endoosmosis that is present opposite to the protoxylem. They allow water to enter the pericycle. In xylem turger pressure is lower. so, water enters into the xylem from pericycle for upward movement of water.

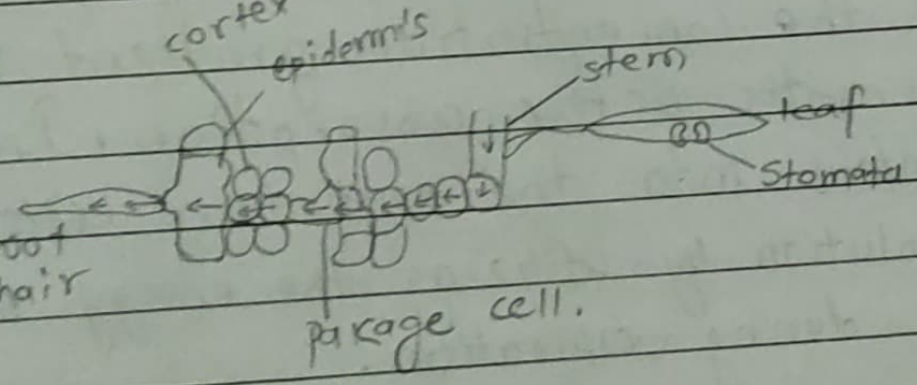
Types of Absorption

There are two types of absorption:-

1Y Passive absorption

The absorption of water not due to the activity of roots cells but due to the other process is called passive absorption. It occurs mainly due to transpiration. During transpiration water evaporates out from the ariel parts of the plant through stomata of leaves.

Removal of water through stomata creates a tension into the stomatare cavity that reaches to the xylem of leaf from xylem of leaf tension transmited xylem of root tension transmitted into root hair cell through endodermesis & cortex. Due to this tension water can be easily absorbed by root hair cell from the soil.



2) Active absorption.

According to this method water absorbed as a result of activity of roots. shoot doesn't play any role. These are 2 theories in active absoption.

i) Oosmotic Theory

The absorption of water occurs due to Oosmotic concentration of root hair is called Oosmotic absorption. Roothair cell consists of cytoplasm that is considered as concentrated solution. In roots there is presence of water or water along with minerals that behave as a hypotonic solution or weak soln. Root hair cells absorb water by the proces of Osmoosis because the cytoplasm of root hair cell show high Osmotic concentration.

ii) Non Oosmotic active absorption.

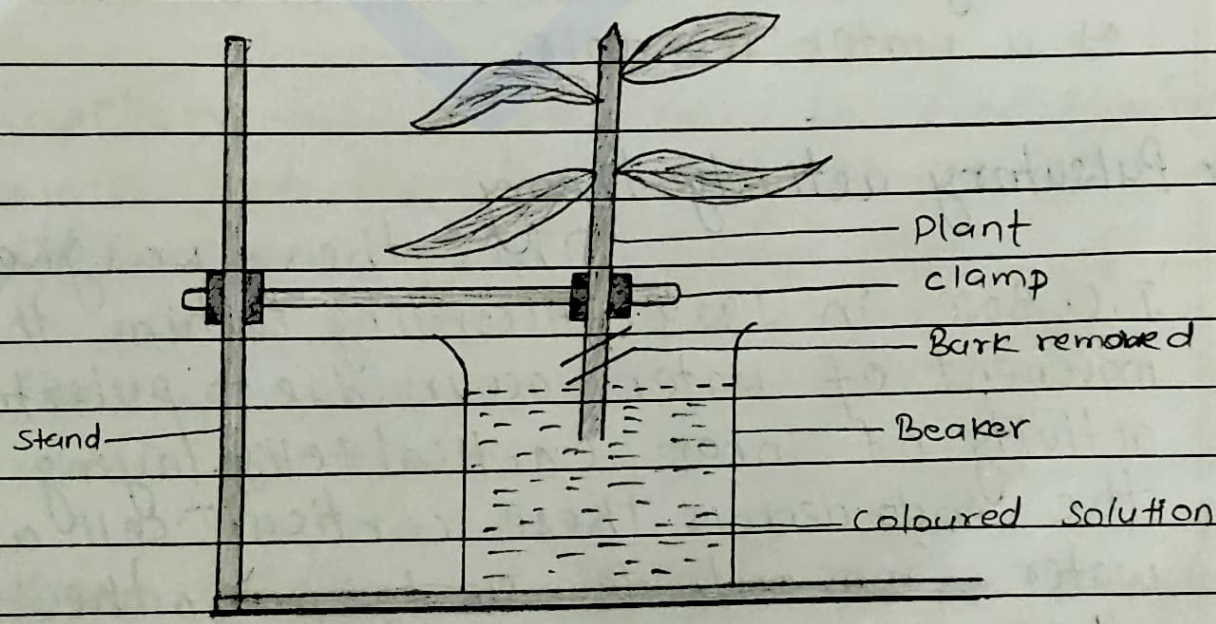
The absorption of water against the concentration gradient is called non-oosmotic active absorption. In this case water enters into the root hair cells from mineral solution by utilizing the energy of root hair cells during respiration.

Ascent of sap

The upward movement of water into different parts of the body against the force of gravity is called ascent of sap. It is completed into 2 steps:-

i) Path of ascent of sap

The upward movement of water occurs through the xylem tube. It can be showed by simple experiment. If a twig of plant is taken and placed it in a beaker containing colourful water. After sometime it ~~observe~~ observe that the leaf of twig remain fresh. The twig is taken out and cut the transverse section. The T.S. of stem show the coloured solution is filled only in xylem tube. It means that the upward movement of water occurs only through the xylem tube.



2) Mechanism of ascent of sap

Plants are variable in size. The ascent of sap can be easily explained in a smaller plant. In tallest tree, the upward movement of water is a complex phenomena and cannot be explained by simple way. The different theories have been given about ascent of sap.

1) Vital Theory

The supporters of this theory says that. "The upward movement of water occurs due to activity of living cells. Few important vital theories are!-

a) Pumping activity theory

This theory was proposed by 'Goldewaski' in '1884'. According to him the upward movement of water occurs due to pumping activity of living cells like xylem parachyma, the trachoids and vessels behave as a water reservoir.

b) Pulsatory activity theory

This theory was given by 'J.C. Bose' in '1923'. According to him the upward movement of water occurs due to pulsatory activity of inner cortical cells laying outside the endodermis. These cortical cell absorb water from outside and pump the water the vessels.

iv) In gymnosperm pteridophytes the xylem vessels are absent and other xylem elements do not form continuous channel.

v) The capillary tube has very small diameter that can raise water upto 150 cm but most of plant height is more than this.

b) Imbibition Theory

Sacs in 1878 supported that the ascent of sap can take place through the wall of xylem by imbibition. Later this theory is also rejected because the ascent of sap take place through the lumen of the xylem not through the wall.

3) Root Pressure theory.

This theory was proposed by Stepes Holes in 1727. According to this theory the upward movement of water occurs due to the root pressure that develops in root due to accumulation of absorb water.

Cause of root pressure:

The water is absorbed by root hair accumulated in the cortex. Due to this cortical cell become turgid exert pressure on their food content and force them towards the xylem elements. After losing water these cell become flaccid and xylem again absorb water and pass it to the xylem. As a result a pressure is setup in the root called root pressure.

Transpiration,

Transpiration is defined as "the process of the loss of water vapour from the internal tissues of living plants through the aerial parts such as the leaves, green stem, flower, etc." About 98-99% of water is thrown out through aerial parts. There are 4 types of transpiration. They are:-

1) Stomatal transpiration

The loss of water in the form of water vapour through stomata is called stomatal transpiration. Stomata are found in the epidermis of leaves and young stems. About 90% of water evaporates through it. It takes place only in day time.

2) Cuticular transpiration,

The loss of water in the form of water vapour through cuticles present in external to the epidermis is called cuticular transpiration. About 2 to 10% of total water evaporates through it.

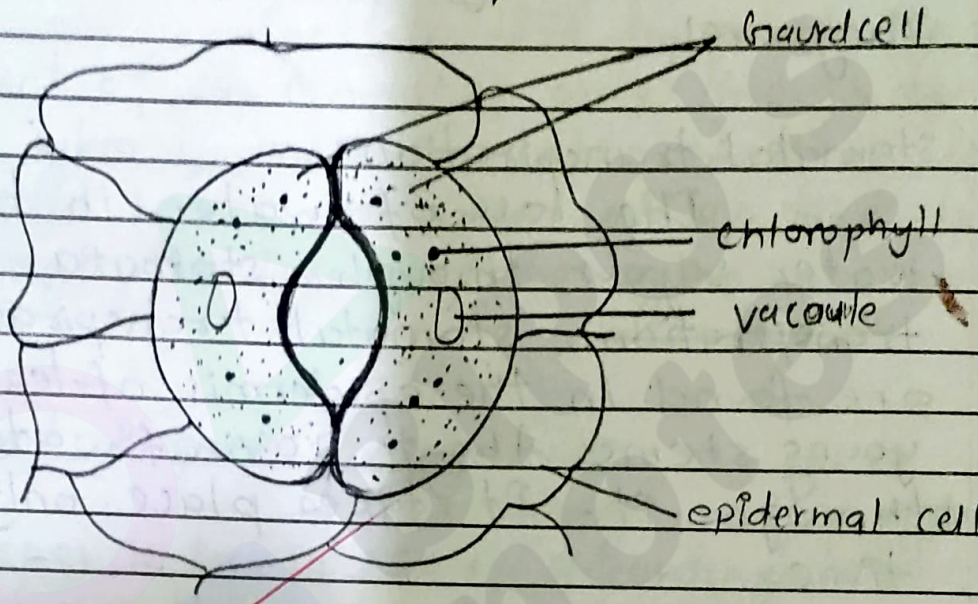
3) Lenticular traspiration:

The loss of water through lenticles present in woody stem is called lenticular transpiration. About 1 to 2% of water evaporates from this method.

4) Bark transpiration:-

Removal of water vapours through the bark is known as bark transpiration. About 0.6 - 1% of total water removed by it. It occurs continuously during day and night.

Structure of stomata,



stomata are the main pathway through which transpiration and gaseous exchange during respiration and photosynthesis takes place. stomata are minute pores found in epidermis of aerial parts especially in leaf. They are absent in root and non-green part of the plant.

Each stomata surrounded by two specialized epidermal cells called Guard cells. The cell wall of Guard cell around the stomatal pore are thickened and

inelastic due to presence of secondary cellulose layer. Rest of the cell wall of stomata is thin and elastic. Guard cell contain a thin layer of cytoplasm and a larger central vascule. Its cytoplasm contain a nucleas and a no. of chlorophyll. The shape of of a guard cell is kidney shape in dicot and dumbbell shaped in monocot.

~~Role of sto~~

~~Significance of transpiration~~

1) Advantages,

a) It creates force and helps in the ascent of sap.

b) Transpiration helps in keeping the tempr of the plant low even when the plant is exposed to bright sunlight.

c) It helps in the distribution of water throughout the plant.

d) It helps in evaporating excess amount of water.

e) Trans piration secures the concentration of cell sap and thus help in Osmosis.

f) It brings about the opeaning and closing of stomata which indirectly influence the process of photosynthesis and respiration.

2) Disadvantages:-

a) Since most of the water absorbed by the plants is transpired, the transpiration involved wasteful expenditure of energy.

b) Excessive transpiration may cause water deficit and injury to plant by desiccation.

c) Excessive transpirations leads to stunted growth of plants.

d) Higher rate of transpiration reduces photosynthesis which causes the growth to reduce.

e) Excessive transpiration cause wilting and drying of plants.

Anti transpirants

Anti-transpirants are the chemical substance that are used to reduce the rate of transpiration. These substance are sprayed on crop plants during dry season to avoid wilting when the rate of transpiration is high.

Guttation

It is the process of loss of water in the form of water droplets along with minerals (cell sap) from the tip of the leaf veins. The amount of water loss by this process is negligible as compared to that lost by transpirate. About 345 genera belonging to 115 families are reported to guttate.

Examples:- Garden Nasturtium, Oat, the cereals, Balsam, Tomato, etc.

Significance of Guttation:

1) It helps the plants to dispose of the unwanted solutes.
2) It helps the plants to improve the acquisition of nutrients.
3) It helps in maintaining water balance for the proper growth and the development of the plant body.
4) It helps in the progressive development of hydrostatic pressure that helps to pump water up to the leaves.
5) Guttation fluid help for non-invasive measurements and organic and inorganic chemical quantification.

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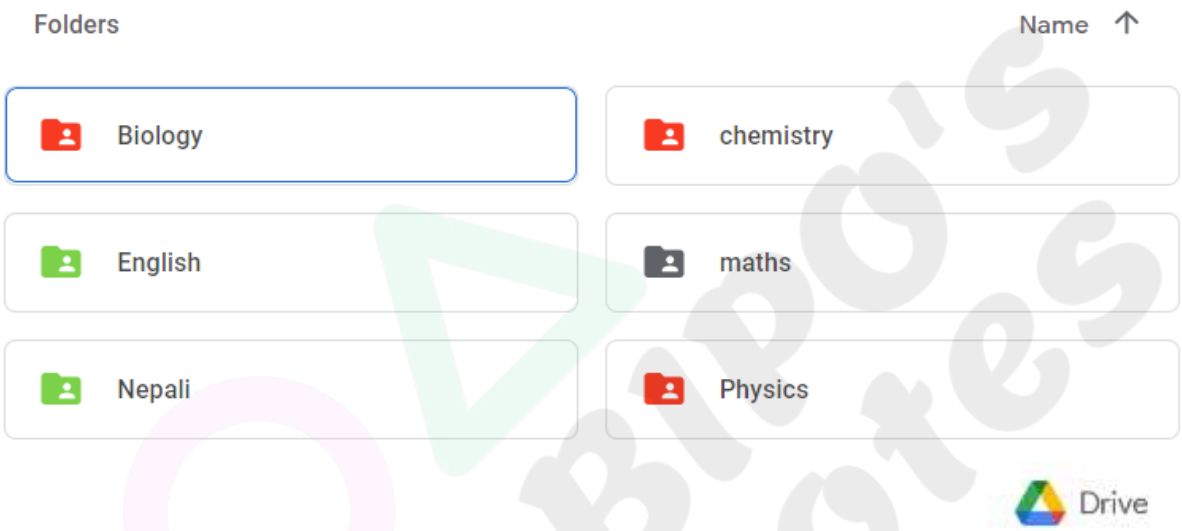
Class 12 complete notes and paper collection.



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