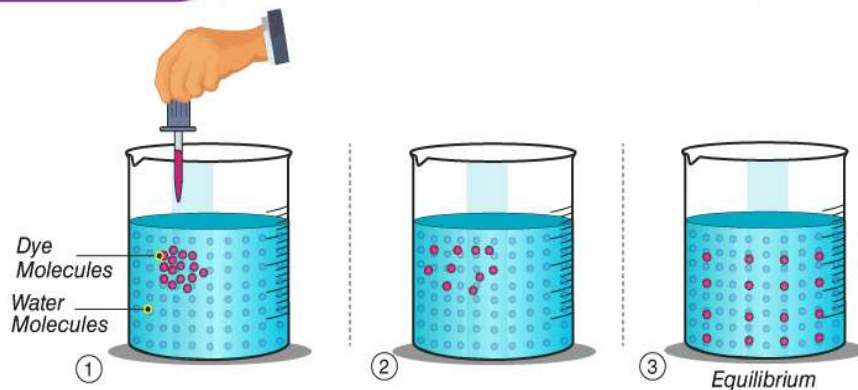


NUTAN MAHAVIDYALYA SAILU, DIST. PARBHANI

UNIT-I PLANT WATER RELATIONS

Different bio-physico-chemical phenomenon: -
Diffusion and Osmosis

DIFFUSION



BYJU'S
The Learning App

DR. KANTHALE P. R.
HEAD DEPARTMENT OF BOTANY

Diffusion,

Def-The tendency of molecules of liquid, solid or gas move a place of higher concentration to place of lower concentration. or Diffusion is the movement of ions, atoms or molecules of solutes, liquids or gases form the region of their higher concentration to a region of their lower concentration till an equilibrium is attained



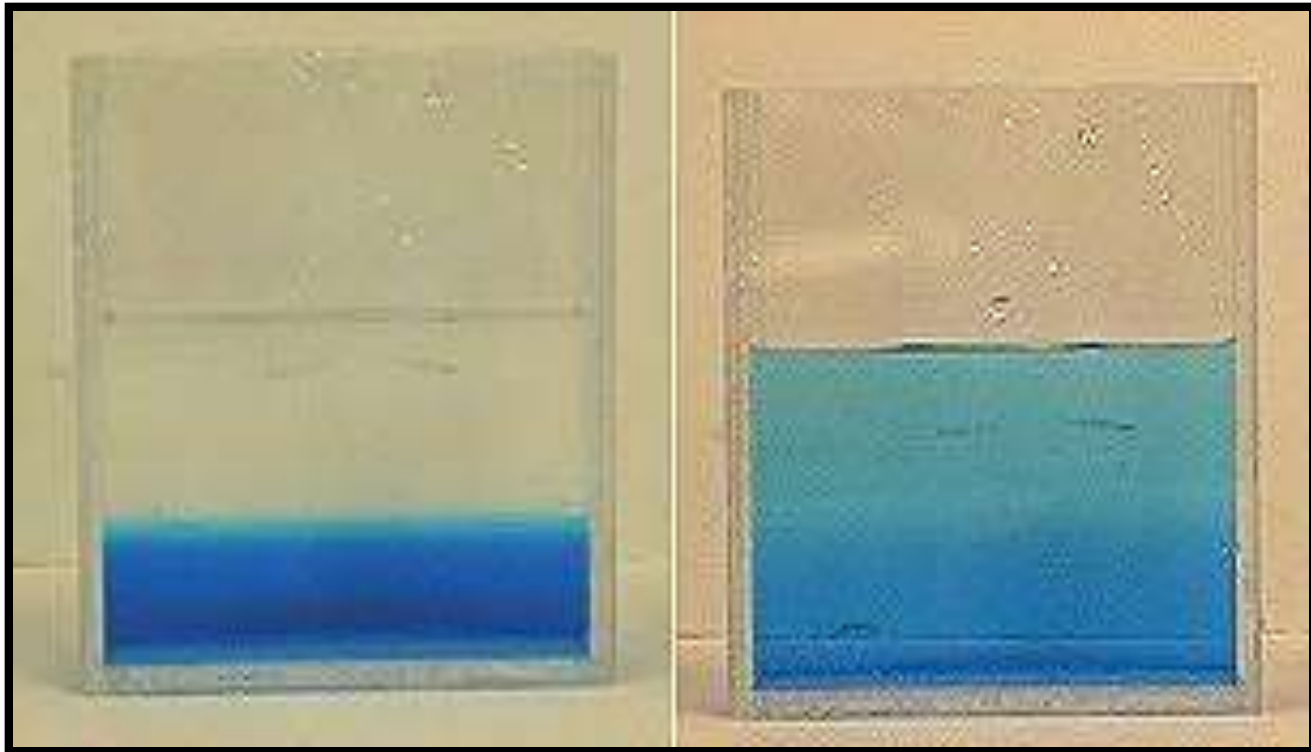
- Open bottle of ammonia or perfume in a room. The fumes or perfumes will spread all over the room in short time this is diffusion of gases



•



- Place a crystal of copper sulphate in a beaker containing water. The copper sulphate slowly dissolves in the water and its molecules move from the surface of the crystal to the remaining part of water. This is an example of diffusion of a solid.



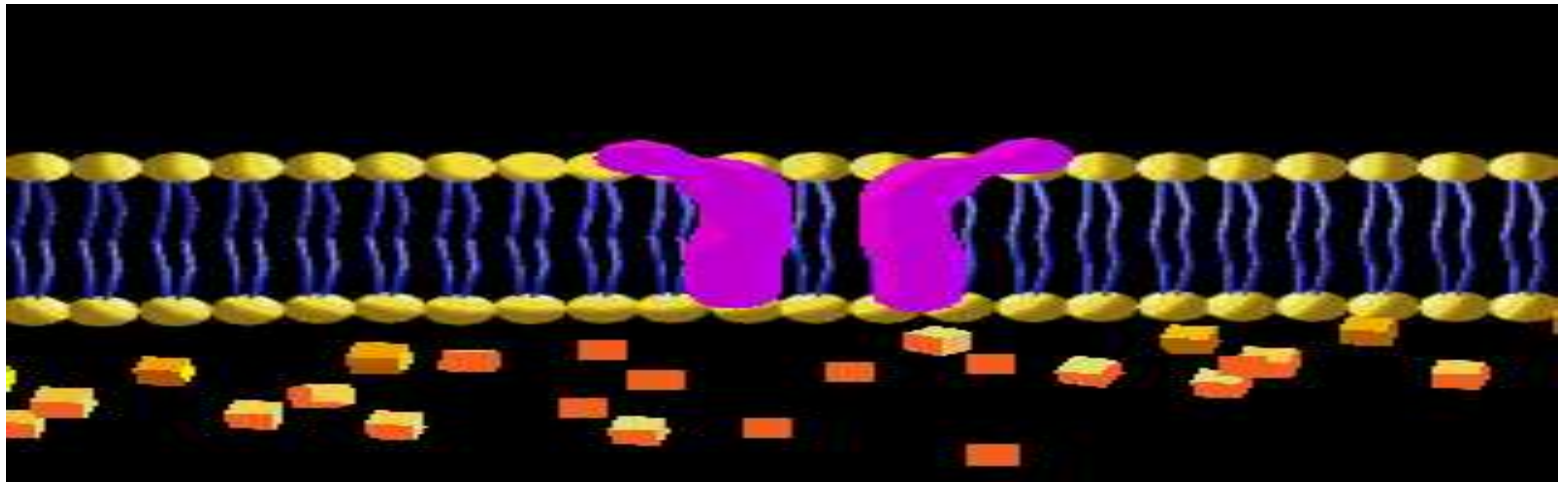
- The direction of migration is always from region where the molecules are in higher concentration to a region where their concentration is less.

- Diffusion pressure (DP) is the potential ability of solid, liquid or gas to diffuse from an area of its greatest concentration to an area of lesser concentration. The diffusion pressure of pure solvent is always more.

Types of Diffusion

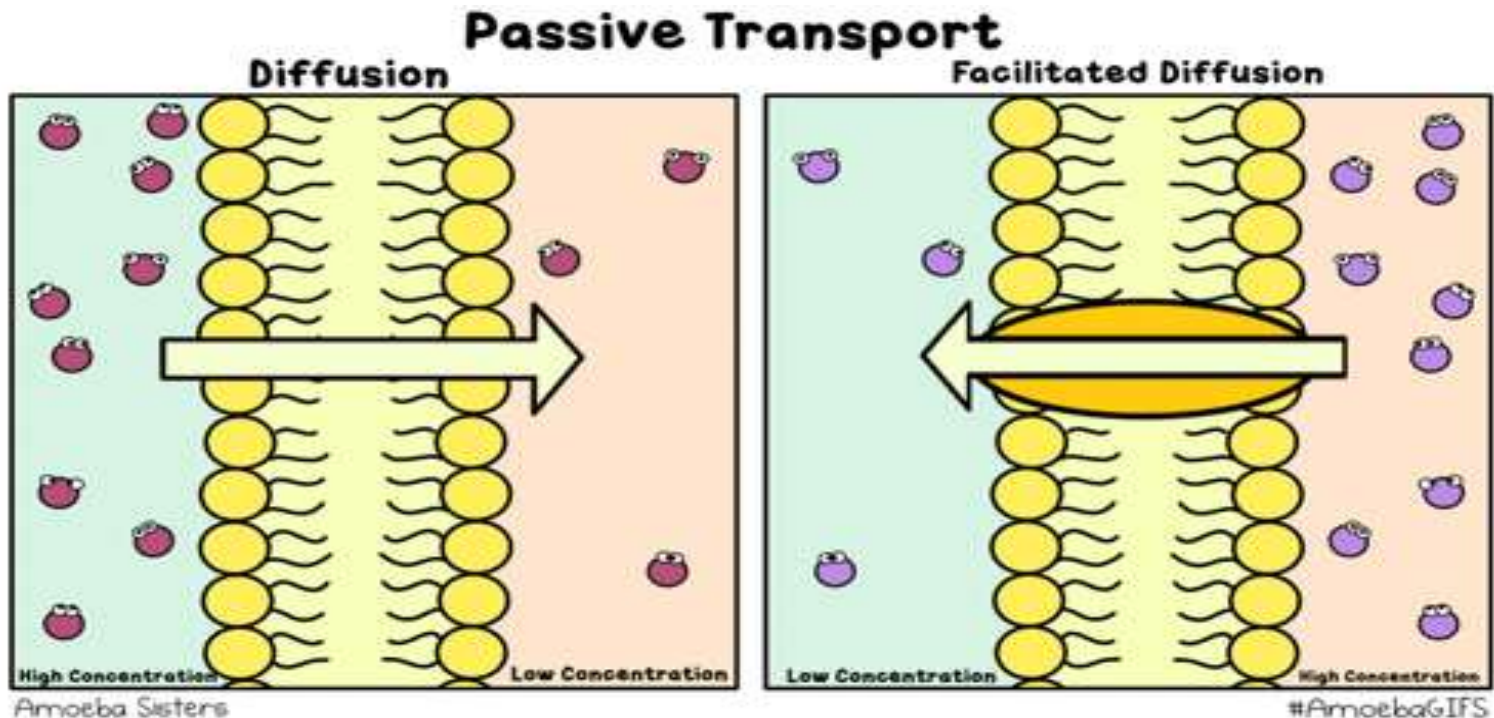
Simple diffusion

Process in which the substance moves through a semipermeable membrane without any help from transport proteins. For example, bacteria deliver small nutrients, water, and oxygen into the cytoplasm through simple diffusion.



Facilitated diffusion

Facilitated diffusion is a passive movement of molecules across the cell membrane from the region of higher concentration to the region of lower concentration by means of a carrier molecule.



Diffusion pressure

It is a hypothetical term coined by Meyer (1938) to denote the potential ability of the molecules or ions of any substance to diffuse from an area of their higher concentration to that of their lower concentration. DP is directly proportional to the diffusing particles.

Law of diffusion –

The process of diffusion of gases is governed by Grahams Law. It states that if other condition remaining same the rate of diffusion of gases are inversely proportional to the square roots of their density i.e. heavy gas will diffuse more slowly than of lighter gas

$$\frac{r_1}{r_2} \propto \sqrt{\frac{d_2}{d_1}}$$

d1 and d2- relative density of two gases

r1 and r2 – rate of diffusion

Ex. The hydrogen(molecular weight 2) and oxygen(molecular weight 32)

The rate of diffusion of H₂ will be 4 time more than the rate of diffusion of O₂ under ideal conditions

$$\frac{r_H}{r_O} \propto \sqrt{\frac{32}{2}} = \frac{16}{1} = 4$$

Graham's Law

Graham's Law

- Rate of diffusion of a gas is inversely related to the square root of its molar mass.
- The equation shows the ratio of Gas A's speed to Gas B's speed.

$$\frac{v_A}{v_B} = \sqrt{\frac{m_B}{m_A}}$$

Sample Problem 5.13**Applying Graham's Law of Effusion**

PROBLEM: A mixture of helium (He) and methane (CH₄) is placed in an effusion apparatus. Calculate the ratio of their effusion rates.

PLAN: The effusion rate is inversely proportional $\sqrt{\mathcal{M}}$ for each gas, so we find the molar mass for each substance using its formula and take the square root. The ratio of the effusion rates is the inverse of the ratio of these square roots.

SOLUTION: \mathcal{M} of CH₄ = 16.04 g/mol \mathcal{M} of He = 4.003 g/mol

$$\frac{\text{rate}_{\text{He}}}{\text{rate}_{\text{CH}_4}} = \sqrt{\frac{16.04}{4.003}} = \boxed{2.002}$$

Importance of diffusion of plants

- The exchange of gases like O₂ and CO₂ during photosynthesis and respiration takes place through stomata by diffusion
- During transpiration water vapours through intercellular spaces diffuse through stomata
- The diffusion of ions of mineral salts during passive absorption takes place
- Diffusion also helps in absorption of water through roots.

Osmosis

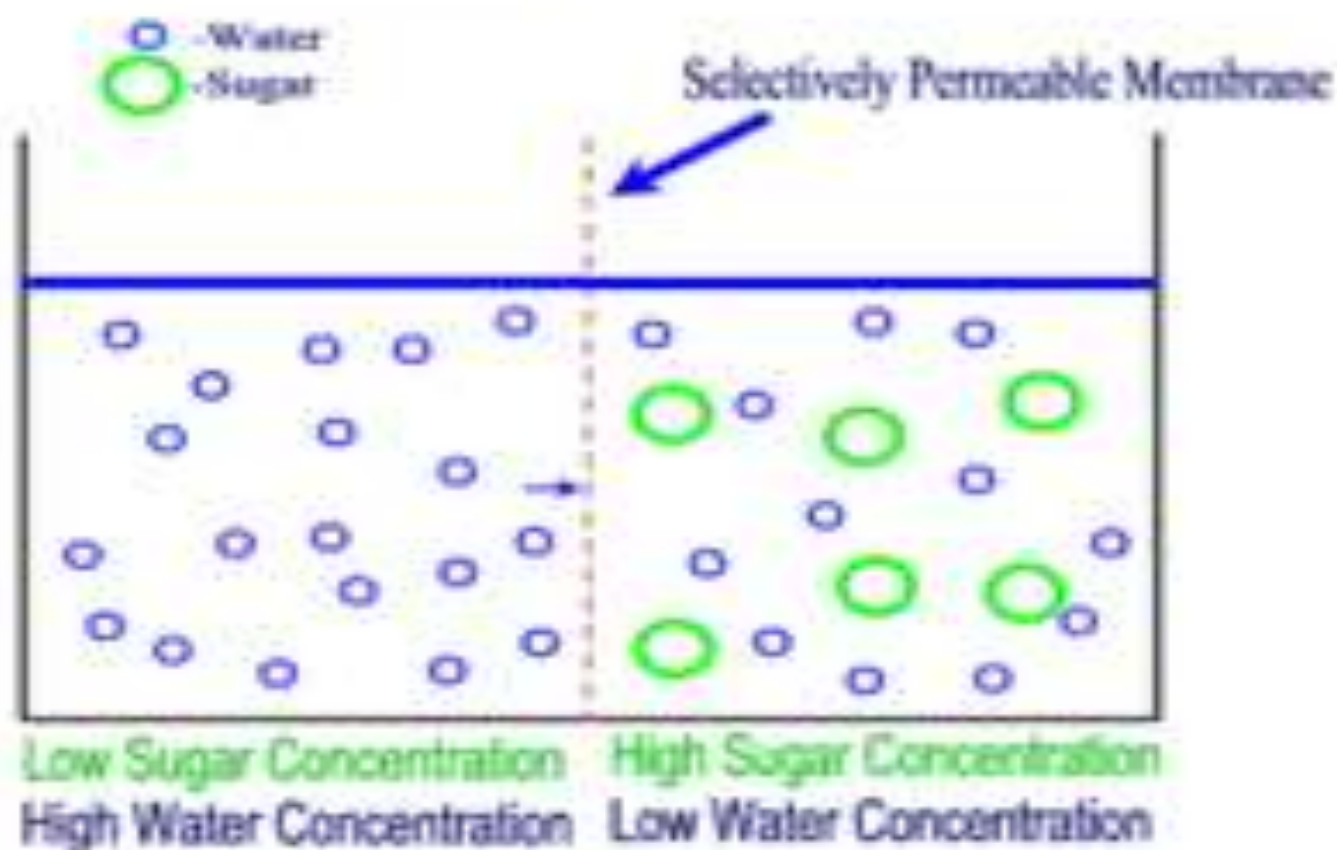
Def-

Osmosis is the transfer of solvents (Water molecules) from a region of higher concentration to a region of lower concentration through semi-permeable membrane.

Or

diffusion of water or any solvent through a semi permeable membrane is called osmosis.

Osmosis

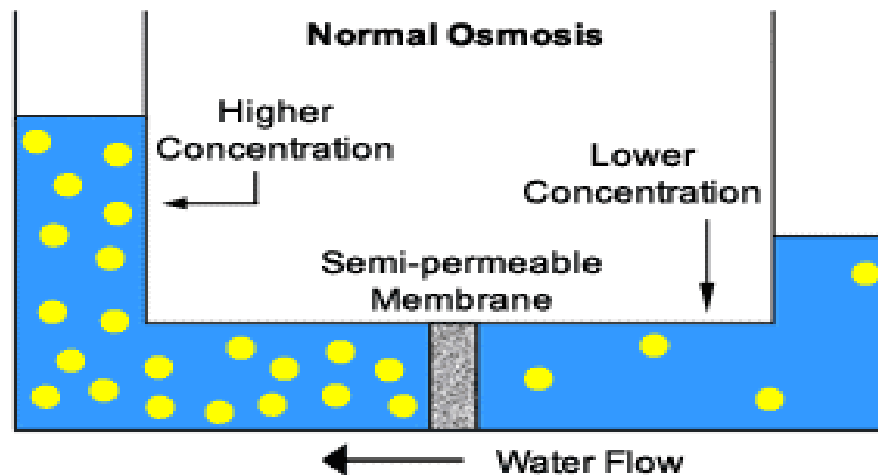


Osmotic Pressure

Osmotic pressure is the pressure required to stop water from diffusing through a membrane by osmosis.

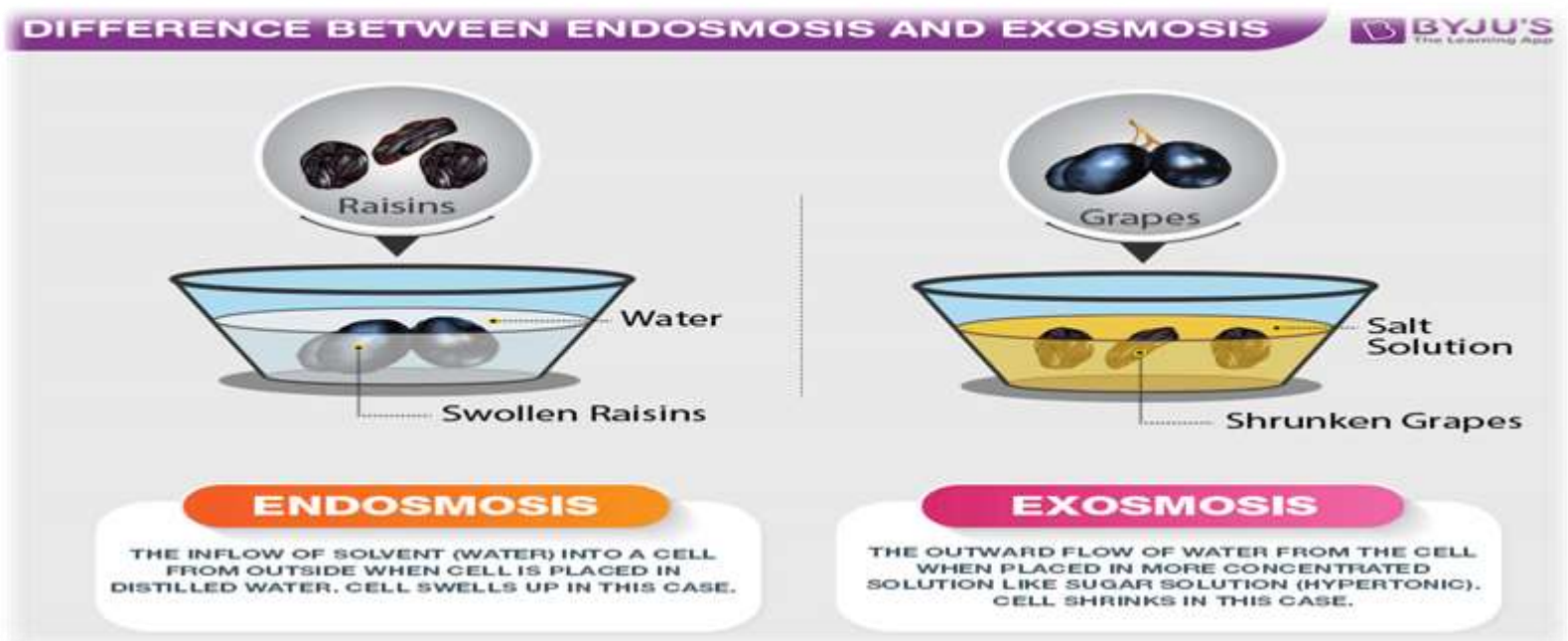
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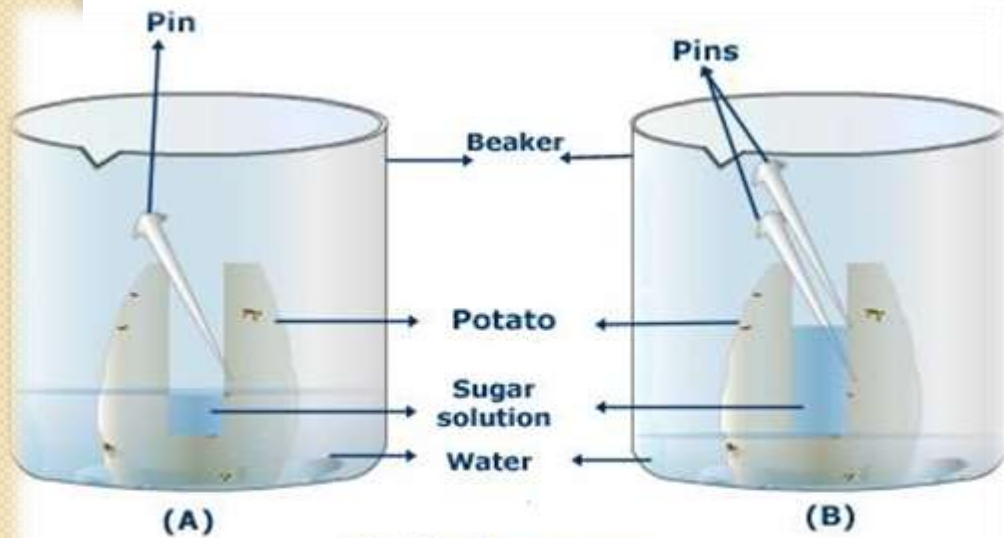
The pressure developed by water molecules on semi-permeable membrane is called osmotic pressure (O.P) or Osmotic pressure is defined as the minimum pressure applied to a solution to stop the flow of solvent molecules through a semipermeable membrane.



Types of Osmosis

- **Endosmosis**—Movement of water molecules into the cell when the cell is placed in hypotonic solution
- **Exosmosis**—Movement of water molecules out of the cell when the cell is placed in concentration solution



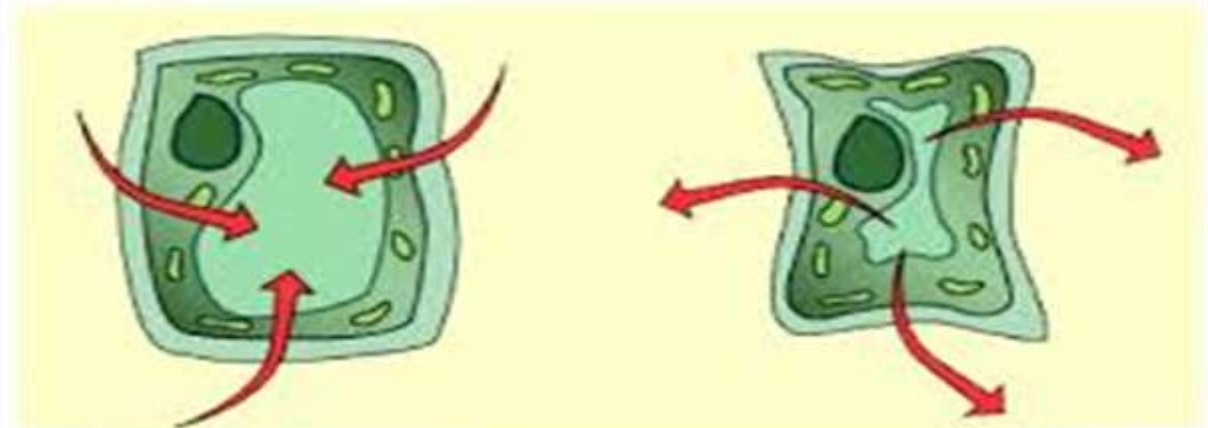


(A)

(B)

Potato Osmoscope

(A) Before Osmosis (B) After Osmosis



ENDOSMOSIS

EXOSMOSIS

Demonstration of osmosis

Potato Osmoscope

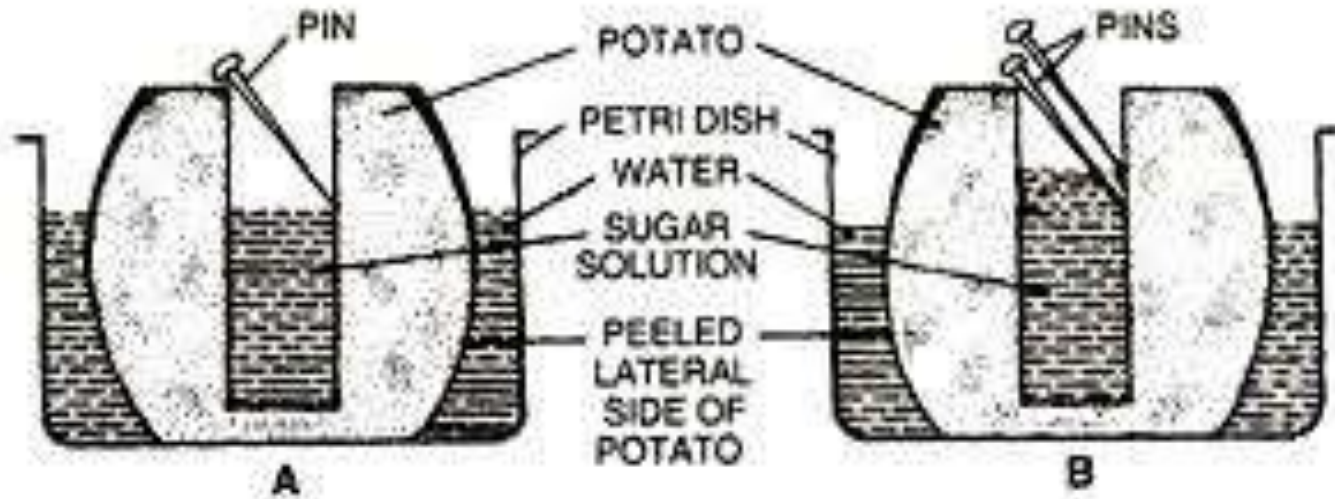
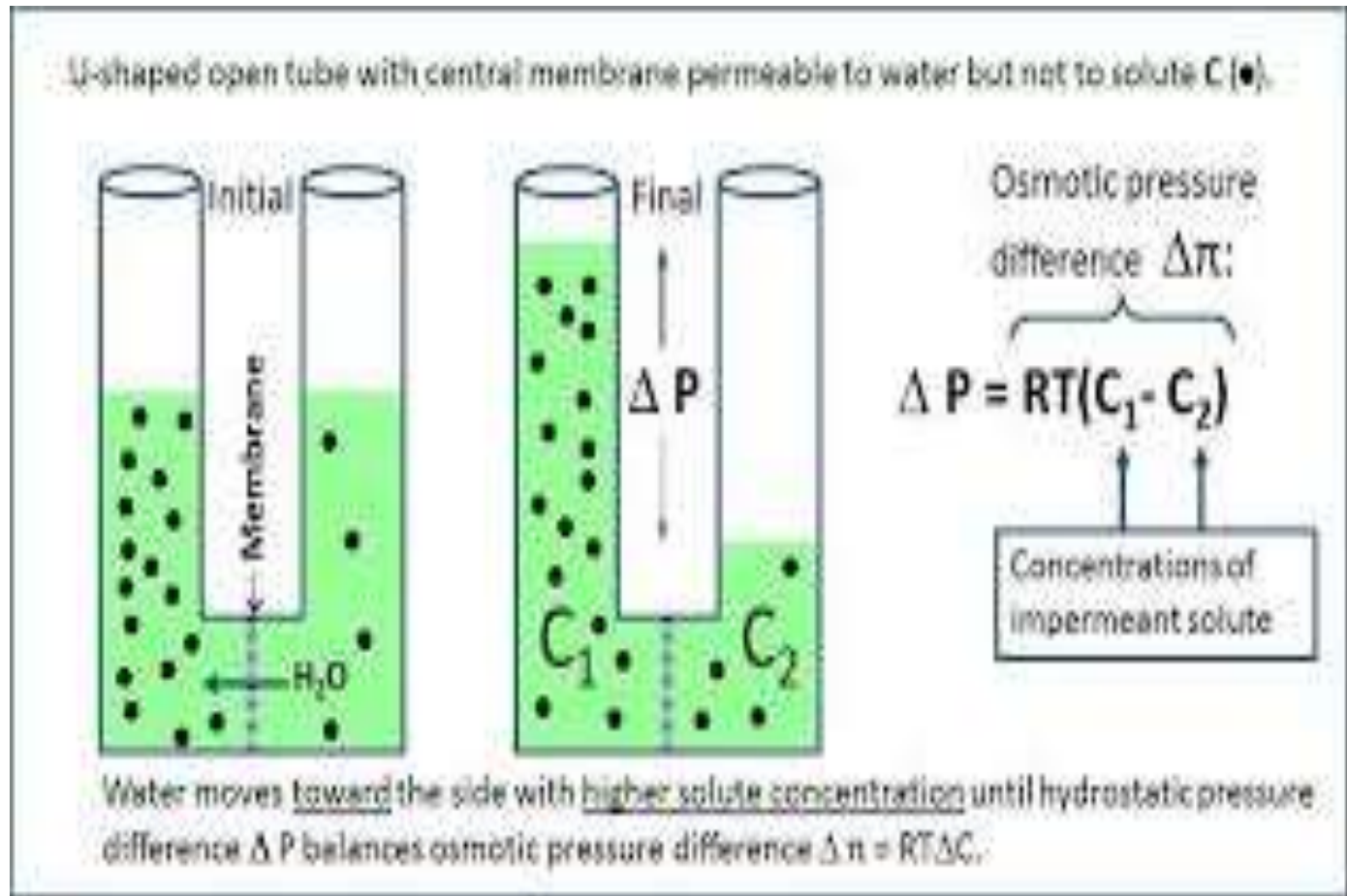


Fig. 11.8. Potato osmoscope experiment to demonstrate osmosis. A, Original level; B, Final level.

U- Shaped tube



Importance or Significance of Osmosis

- Osmosis influences the transport of nutrients and the release of metabolic waste products.
- It is responsible for the absorption of water from the soil and conducting it to the upper parts of the plant through the xylem.
- It stabilizes the internal environment of a living organism by maintaining the balance between water and intercellular fluid levels.
- It maintains the turgidity of cells.

- It is a process by which plants maintain their water content despite the constant water loss due to transpiration.
- This process controls the cell to cell diffusion of water.
- Osmosis induces cell turgor which regulates the movement of plants and plant parts.
- Osmosis also controls the dehiscence of fruits and sporangia.
- Higher osmotic pressure protects the plants against drought injury.

THANK YOU
FOR
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