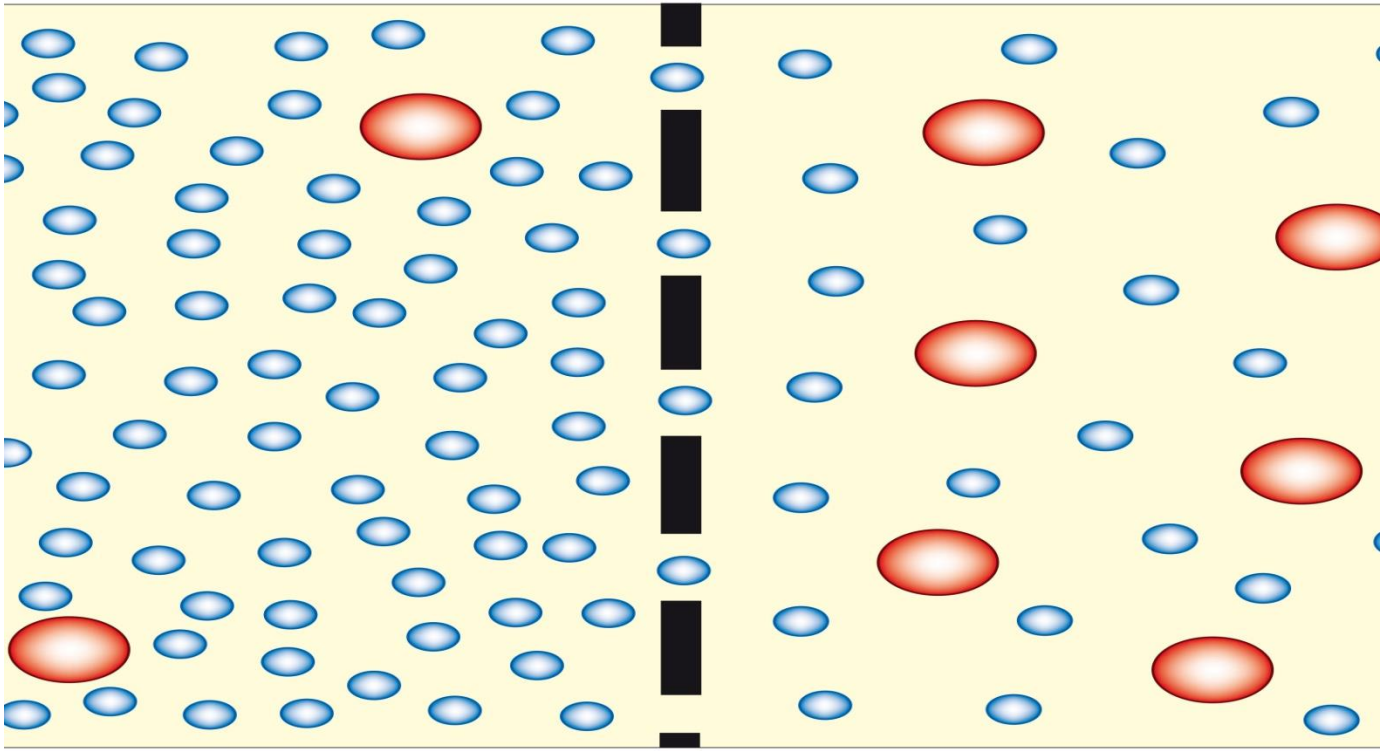
DIFFUSION AND OSMOSIS



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For B.Sc. Part II (Sub.) Group C (Plant Physiology)

Lecture No. 44

Diffusion ????

Movement of atoms, ions or molecules of a materials from an area of higher concentration to an area of their lower concentration is called diffusion.

✓ Diffusion is continued till the dynamic equilibrium is establish. At this stage the net movement of molecule is equal in both direction.

✓ Kinetic energy, present in the molecules of material is distributed equally in their available space by their nature.

Rate of diffusion: - Gas > Liquid > Solid

Diffusion pressure:

The diffused ions or molecules exert a pressure on the medium or substance in which diffusion take place, known as Diffusion pressure.

✓ Diffusion pressure developed due to difference in the concentration of molecules of the material.

✓ Water molecules moves from their higher concentration to the their lower concentration in plants..

✓ The diffusion rate decreased with increasing size of molecules.

✓ The speed and direction of movement of molecules of substances depends upon the concentration of the molecules.

✓ Diffusion pressure results due to the difference in the concentration of molecules.

✓ The potential ability of a substance to diffuse from an area of its higher concentration to an area of lower concentration, is called diffusion pressure.

Significance of diffusion:

✓ Exchange of gases like O2and CO2 take place through diffusion.

✓ The evaporation of water from the intercellular spaces during transpiration takes place by the process of diffusion.

✓ The distribution of hormones in the plants takes place through the diffusion.

✓ The ions of the minerals may diffused into the plant body by the process of diffusion.

Osmosis ????

Osmosis is defined as the diffusion of solvent (water in this context) from the solution of lower concentration to the solution of higher concentration when both the solutions are separated by a semipermeable membrane**.**

or

The movement of water from its higher chemical potential to its lower chemical potential without allowing the diffusion of solute by means of a semipermeable membrane is called osmosis. The chemical potential of water is also called water potential.

Types of membrane

Permeable membrane :

Permeable membranes are permeable for both - solutes and solvent. e.g. cell wall, filter paper.

(ii) Semipermeable membrane :

Such membranes allow diffusion of solvent molecules, but do not allow the solutes. e.g., artificial membrane like Cellophane and Copper ferrocyanide membranes, parchment paper, goat bladder

Selective permeable membrane :

Such membranes allow some selective solutes to pass through them along with the solvent molecules.

e.g., Cell membrane, Tonoplast, Organelles membrane.

These membranes are permeable for CO_2, N_2 O_2 gases, alcohol, ether and water, but impermeable for polysaccharides and proteins.

Impermeable membrane : Rubber membrane, Al-foil, Suberised cell wall, cork wall.

Types of solution

Isotonic solution :

If solution in which a cell is placed, has equal osmotic concentration to that of cell sap, the outer solution is called isotonic solution.

Hypotonic solution :

If the osmotic concentration of outer solution is lesser than that of the cell sap, the outer solution is called hypotonic solution. If a cell is placed in such solution endosmosis takes place, results, cell swells up.

Hypertonic solution :

If the osmotic concentration of a solution is higher than that of the other (cell sap), solution is known as hypertonic solution.

✓ If a cell placed in this type of solution, exosmosis takes place. It means water of the cell sap diffused out into the outer solution, resulting cell become flaccid.

e.g., Grapes placed in higher concentration of sugar solution becomes flaccid.

Osmotic pressure (O.P)

Osmotic pressure is the pressure developed in a solution when solution and water are separated by semipermeable membrane.

or

O.P. of solution is equal to pressure, which required to be applied on a solution in order to prevent an increase in its volume due to tendency of solvent to enter in when the two are separated by a semipermeable membrane.

✓The osmotic pressure of pure water is zero. O.P. is due to presence of solute into the solution.

✓ The osmotic pressure of solution is directly proportional to the concentration of solute in it.

✓ The osmotic pressure shows maximum variation in the plants cells.

✓ According to Hariss the osmotic pressure is highest in leaves and lowest in roots.

✓The highest osmotic pressure is found in the halophyte group.

✓ The lowest osmotic pressure is found in aquatic plants or hydrophytes.

✓Hydrophytes < Mesophytes < Xerophytes < Halophytes.

✓Osmotic pressure of a solution is measured by osmometer. O.P. of cell is measured by incipient plasmolysis. First osmometer was made by Pfeffer.

The osmotic pressure can be measured by various methods.

The formula of Vont Hoff for measuring O.P. :

OP = mRT

Here m = Molar concentration

R = Gas constant

T = Absolute temperature

This formula is valid for nonelectolytes

The O.P. of electrolytes is find out by the following formula-

OP = MRT I

Where I is the constant of ionization of electrolytes.

✓ The osmotic pressure of electrolytes is higher than that of non electrolytes.

✓ For example - solution of 1 M NaCl and 1 M glucose. The molar concentration of both solutions are equal but O.P. of 1 M NaCl is higher than solution of 1 M glucose.

✓ Water moves from lower O.P. towards the higher O.P.

Significance of Osmosis / Osmotic Pressure

✓ Water absorption from the soil by the plants.

✓ Transport of water from cell to cell in plants.

✓ To maintain turgor pressure.

✓ Origin of root pressure.

✓ Opening & Closing of stomata is affected by Osmosis.

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Thank You!!!