Osmosis and osmotic pressure:-

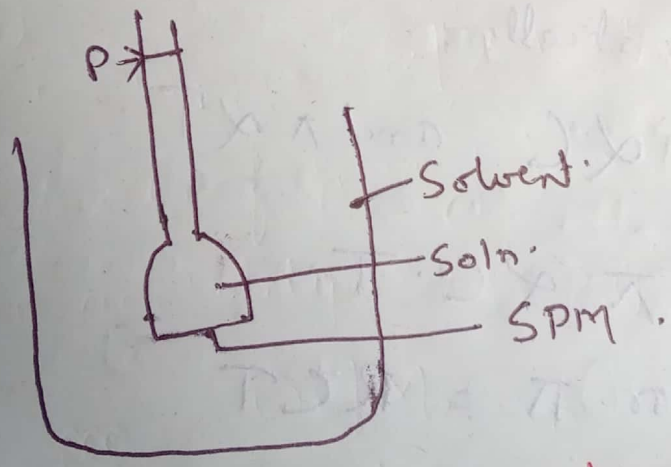
There are many phenomena which we observe in nature or at home.

For eg (1) raw mangoes shrivel when pickled in brine (salt water).

(2) wilted flowers revive when placed in fresh water.

(3) Blood cells collapse when suspended in saline water.

These all processes can be explained by osmosis.



The flow of solvent molecules from the solvent to solution or from a less concentrated soln to more concentrated solution through a SPM

is called osmosis.

The flow will continue till equilibrium is attained.

The flow of solvent from its side to solution side across a SPM can be stopped by applying extra pressure on soln. This pressure that just stops the flow of solvent is called as osmotic pressure of solution.

Osmotic pressure of a solution is the excess pressure that must be applied to a solution to prevent osmosis.

Osmotic pressure is a colligative property as it depends on number of solute molecules and not their identity.

For dilute solutions, Osmotic pressure (π) is directly proportional to the molar concentration (C) of the solution and its temp (T).

Mathematically,

$$\pi \propto C \text{ and } \pi \propto T.$$

$$\pi \propto C \cdot T.$$

$$\text{or } \pi = RCT$$

$$\pi = CRT$$

R = gas constant.

$$\pi = (n_2/V)RT.$$

Here ~~volume~~ V = volm of soln in ~~lits~~ litres.

n_2 = moles of solute.

If w_2 g of solute, of molar mass, M_2 is present in the solution, then –

$$n_2 = w_2/M_2.$$

$$\therefore \pi = \frac{n_2 RT}{V}$$

$\boxed{\pi V = nRT}$ → van't Hoff equation.

$$\pi V = \frac{w_2 RT}{M_2}$$

$$\text{or } \boxed{M_2 = \frac{w_2 RT}{\pi V}}$$

Isotonic soln:- Two solutions having same osmotic pressure at a given temp are called isotonic soln.

If one soln is of lower osmotic pressure, it is called hypotonic with respect to the more concentrated solution.

The more concentrated solution is said to be hypertonic with respect to dil. soln.

Explanation of some phenomena on basis of Osmosis:-

(i) Raw mangoes shrivel (shrink) into pickle when placed in concentrated common salt solution (brine). This is due to outflow of water through SPM membranes of mangoes due to osmosis. (exo osmosis)

ii) Wilted flowers revive when placed in fresh water. This is due to flow of water into the withered flowers through SPM due to osmosis (i.e endo-osmosis)

iii) People taking a lot of salt or salty food develop swelling or puffiness of their tissues, a disease called edema. This is due to retention of water in tissue cells and intracellular space on account of osmosis.

Reverse osmosis and Water Purification:-

The direction of osmosis can be reversed if a pressure larger than osmotic pressure is applied to the solution side.

That is, now the pure solvent flows out of the solution through SPM. This phenomenon is called R.O and is used in desalination of sea water.