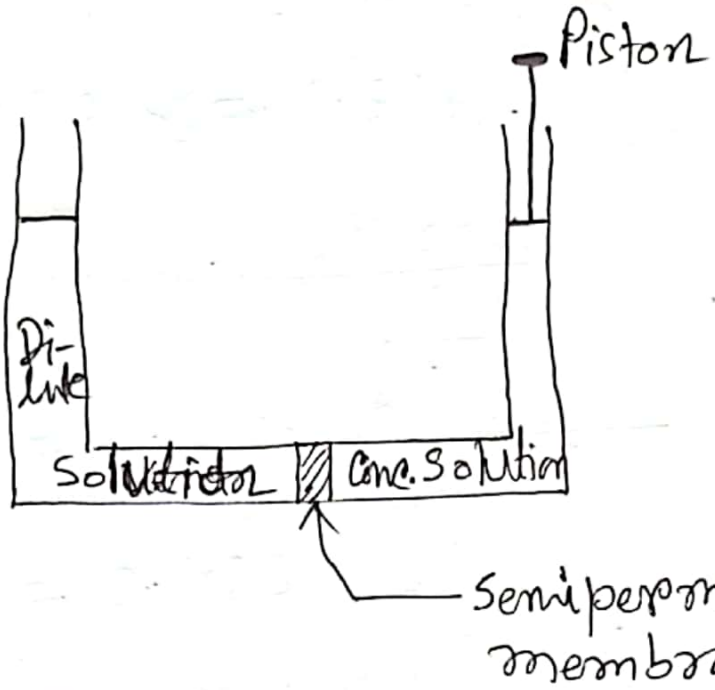
Osmotic pressure



The flow of the solvent through a semipermeable membrane from lower concentration to higher concentration, is known as osmosis.

A membrane which allows only solvent molecules to pass through it, is known as semipermeable membrane.

The required pressure to the solution in order to prevent osmosis of solvent into the solution through a semipermeable membrane.

Laws of osmotic pressure:

Osmotic pressure, $\pi = CRT$

where, C = molar concentration
R = Molar gas constant
T = Temperature

Law 1: At constant concentration, $\pi \propto T$

Law 2: At constant temperature, $\pi \propto C$

Again, $\pi = \frac{n}{V} RT$

Law 3: Equimolar of different solutes dissolved in the same volume of a solvent, exert/display equal osmotic pressure at particular temperature.

Again, $\pi = \frac{w_2/M_2}{V} RT$

where, w_2 = mass of solute, g
M_2 = molecular mass of solute, g/mol

V = Volume, L

R = $0.0821\ L\,atm\,K^{-1}\,mol^{-1}$

T = Temperature, K

Problem 1: Calculate the osmotic pressure of a 5% aqueous cane sugar solution at 15°C.

Answer: $\pi = 3.45$ atm

Problem 2: A solution containing 10.2 g of a substance per litre is found to be isotonic with a 2% solution of glucose ($M = 180$). Calculate the molecular mass of the substance at 27°C.

Answer: $M_2 = 91.8$ g/mole.

Isotonic, Hypertonic and Hypotonic

Solution-1 → π_1

Solution-2 → π_2

If $\pi_1 = \pi_2$ → They are isotonic to each other.

If $\pi_1 > \pi_2$ → Solution 1 is hypertonic solution w.r. to Solution 2.

If $\pi_1 < \pi_2$ → Solution 1 is hypotonic Solution w.r. to solution 2.

Osmosis

1) Slow process
2) Solvent
3) Semipermeable membrane
4) lower to higher

Diffusion

1) Rapid process
2) Solute and Solvent
3) No need
4) higher to lower