

Dr S.K. Gupta

20-05-2020

Dept. of Chemistry
Marwari College, DB

Day - I (H) - Solution

Topics $\rightarrow$ Laws of Osmotic Pressure

Determination of ~~Molecular~~ Molecular-Mass of solute.

Laws of Osmotic Pressure (π) $\rightarrow$

According to Van-Hoff's which study the O.P. of the dilute or ideal-solution. He observed that ideal

solution behaves like an ideal-gas & the different gas laws are applicable to the dilute solution as well.

For dilute solution -

$$O.P. (\pi) \propto CRT$$

C = Molar-Concⁿ of solution (molarity)

T = Absolute Temp^r of solution

R = gas-Constant

For a solution, at a given Temp^r, both R & T are constant.

Thus $\pi \propto C$

We observed that O.P depends upon the molar concentration (mols/lit) of the solute & it is a colligative property.

Various Types of Solution

(1) Isotonic Solution :- The two-solns having equal Osmotic Pressure is called isotonic solution.

(a) When two isotonic-solutions are separated by SPM, the osmosis process does not occur.

(b) At const. Temp, isotonic solution have same-molar-concns.
Thus $C_1 = C_2$

$$n_1 \cdot \frac{n_1}{V_1} = \frac{n_2}{V_2}$$

$$n_1 \cdot \frac{W_1}{M_1 \times V_1} = \frac{W_2}{M_2 \times V_2}$$

The above formula applied only when solute neither associates nor dissociates.

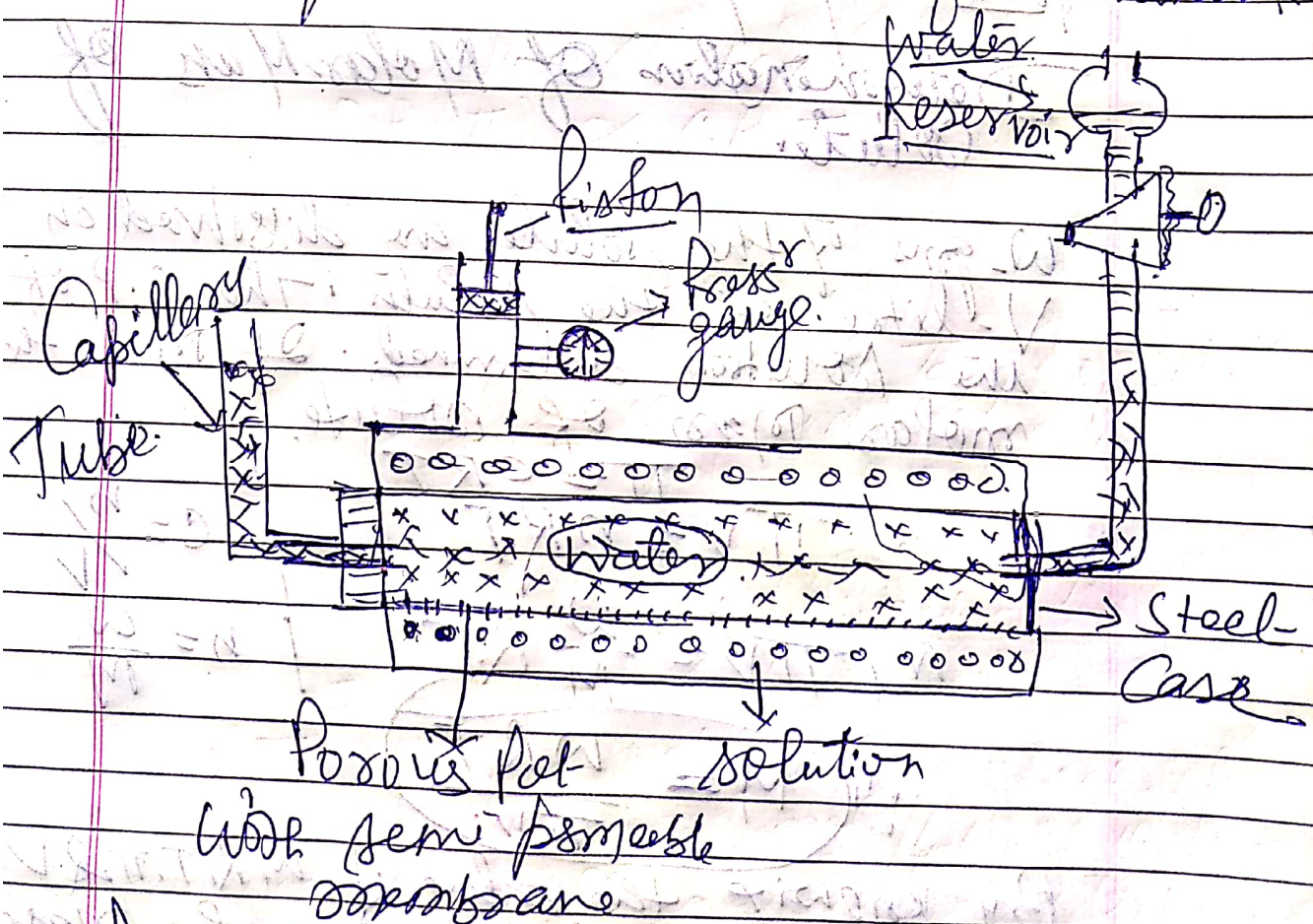
(2) Hypertonic Solution & Hypotonic Solution

If two-solns having different O.P, then the solution having higher O.P is called hypertonic but those having lower value of O.P called hypotonic solution.

Determination of Osmotic Pressure

There are various methods for the determination of D.P. The most simple & preferred method is Besley and Hastler's Method.

This method involves the measurement of external pressure which is just sufficient to prevent the entry of solvent into solution through a semi permeable membrane. This pressure is equal to the O.P. of the solution.



In above apparatus set up as given

Water & solution are taken in the forms
sol. and steel vessel respectively. Due
to osmosis, water tends to move into
Steel vessel from the forms sol through
SPM. It is indicated by the fall in
water level in the capillary tube.

This flow of water is stopped
by applying the pressure on the solution with
the help of the piston so that the level of
water in the capillary tube does not change.
The pressure so applied is equal to the
O.P. and can be measured from the
Barometer-gauge.

Determination of Molar Mass of Solute

W-gms of the solute are dissolved in
V-litres of the solution. The O.P of
the solution determined. If M is the
molar mass of solute.

$$\pi = CRT$$

$$\pi V = nRT$$

$$n, \pi V = \frac{W}{M} RT$$

$$M = \frac{WRT}{\pi V}$$

$$C = \frac{n}{V}$$

$$n = \frac{W}{M}$$

By knowing the value of W, R, T, π & V
we can calculate molar mass
of solute.