## 67 COLLIGATIVE PROPERTIES

- properties unique to solutions.

- depend only on the CONCENTRATION of a solution and not the IDENTITY of the solute\*\*

\*\*ionic solutes: Remember that they dissociate into MULTIPLE IONS!

リ) Freezing point depression

- The freezing temperature of a SOLUTION gets lower as the CONCENTRATION of a solution increases.

2) Vapor pressure lowering

- The vapor pressure of a solution (pressure of sovent vapor over a liquid surface) goes DOWN as solution concentration goes UP

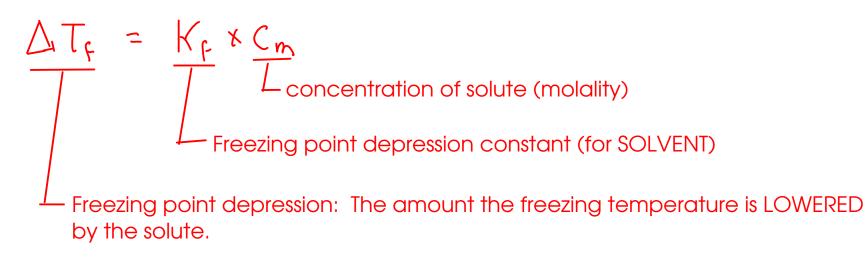
3) Boiling point elevation

- The boiling temperature of a solution increases as the concentration of the solution increases.

)Osmotic pressure

- The pressure required to PREVENT the process of osmosis





- Applications: In chemistry, this effect is often used to determine the molecular weight of an unknown molecule.

69 A solution of 2.500g of unknown dissolved in 100.0 g of benzene has a freezing point of 4.880 C. What is the molecular weight of the unknown?

$$\Delta T_F = K_F \times \frac{C_m}{L} = \frac{moles unknown}{kg solvent}$$

\* We can calculate the MOLAL concentration of the solution based on the FREEZING POINT DEPRESSION

$$0.575^{\circ}C = (S.065^{\circ}m)Cm$$
  
 $0.1135241856m = Cm = \frac{mol unknown}{kg benzene}$  benzeh

Find moles unknown using mass of benzene and the molal concentration

benzene

Molecular weight is mass per mole, so ...

$$MW = \frac{mass unknown}{mol unknown} = \frac{2.500 g}{0.01135241856 mol} = 220 g/mol}$$