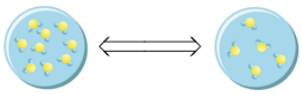
CONCEPT: THE COLLIGATIVE PROPERTIES

- The **4 Colligative Properties** discuss what happens to a _____ solvent as a solute is added to it.
  - □ As solute is added to a solvent some colligative properties _____ and others _____.
  - □ ___ Boiling Point and Osmotic Pressure. □ ___ Freezing Point and Vapor Pressure.

Colligative Properties

Boiling Point (BP)

Temperature where a ___ & ___ are in equilibrium.



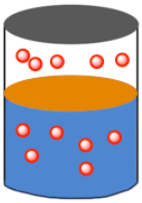
Freezing Point (FP)

Temperature where a ___ & ___ are in equilibrium.

Vapor Pressure

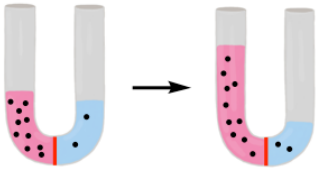
The pressure exerted by a ___ at the surface of a liquid.

□ Measureable at equilibrium.



Osmotic Pressure

The force that drives osmosis from ___ concentration to ___ concentration.



EXAMPLE: Pure benzene, C_6H_6, has a boiling point of 80.1°C. What is a possible new boiling point once an unknown amount of glucose is added to the benzene solvent?

a) 73.1°C b) 51.9°C c) 89.6°C d) 80.1°C

- The Van't Hoff Factor (___) equals the number of _____ produced from dissolving a soluble solute.

Van't Hoff Factor

Ionic Solutes

Ionic Compounds are composed of ___ and ___ ion.

$NaOH \longrightarrow$ _____ + _____ ___ ions, so i = ___

$(NH_4)_2CO_3 \longrightarrow$ _____ + _____ ___ ions, so i = ___

$Al_2(SO_4)_3 \longrightarrow$ _____ + _____ ___ ions, so i = ___

Covalent Solutes

Covalent Compounds are composed of only nonmetals.

□ They are _____ & _____.

Glucose, $C_6H_{12}O_6$

Cl_2

CH_3OH

$CO(NH_2)_2$

_____ ions formed, so i = ___

EXAMPLE: Which of the following compounds will have the largest value for the Van't Hoff factor?

a) $AlCl_3$ b) CO_2 c) ZnO d) NH_3 e) P_2S_5

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Solute Amount

- Solute amount added = number of _____ (i) x _____ of compound.

Osmolarity & Osmolality

Osmolarity (Solute) Formula	Osmolality (Solute) Formula
Osmolarity (solute) = ____ x M of Compound	Osmolality (solute) = ____ x m of Compound

EXAMPLE: What is the ionic molality of potassium ions in 1.18 m solution of K_3PO_4?

a) 1.18 b) 2.36 c) 9.44 d) 4.72 e) 3.54

PRACTICE: Which of the following compounds will have the **highest** boiling point?

a) 0.10 M sucrose b) 0.10 M AgCl c) 0.25 M NH_4NO_3 e) 0.45 M pure water

PRACTICE: Which of the following compound will have the **highest** vapor pressure?

a) 0.45 m dinitrogen pentoxide

b) 0.10 m aluminum chloride

c) 0.50 m iron (III) perchlorate

d) 0.15 m calcium phosphate

e) 0.30 m Potassium sulfide