

Solution = something dissolved in something else.

Solid dissolved in liquid

- Examples:
- The liquid is called the *solvent*, the solid is called the *solute*
- How does temperature affect the solubility of a solid in a liquid?

Gas dissolved in liquid

- Examples:
- Increasing pressure increases solubility of a gas in a liquid. Henry's Law.
- How does temperature affect the solubility of a gas in a liquid?

Liquid dissolved in liquid

- Examples:
- If two liquids mix, they are miscible. If two liquids DON'T mix, they are immiscible.
- "like dissolves like"
- Which of the following liquids are likely to be miscible in water?
 C_6H_{14} , $C_6H_{13}OH$, $C_6H_{13}NH_2$, CCl_4 , CCl_3Br
- How do soaps and detergents work?

Units of concentration

- Molarity (M) = $\frac{\text{moles solute}}{\text{L solution}}$
- Molality (m) = $\frac{\text{moles solute}}{\text{kg solvent}}$
- Mole fraction (X) = $\frac{\text{moles}}{\text{total moles}}$

Colligative Properties = properties that change as concentration changes

- Boiling point elevation: $\Delta T_b = K_b m$ for water, $K_b = 0.512 \text{ }^\circ\text{C}/m$
- Freezing point depression: $\Delta T_f = K_f m$ for water, $K_f = 1.86 \text{ }^\circ\text{C}/m$
- Osmotic pressure: $\Pi = MRT$ $R = 0.0821 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol}$
- Vapor pressure: $P_A = X_A P_A^0$ $P_{H_2O}^0$ at $25^\circ\text{C} = 23.8 \text{ torr}$
or $\Delta P_A = X_B P_A^0$

Example Problems

- 1 can of Coke weighs 394 grams and 39 grams of that is sugar, $C_{12}H_{22}O_{11}$. What's the boiling point and freezing point of Coke? (assume sugar is the only solute)
- What is the vapor pressure of Coke? (assume sugar is the only solute)
- A liter bottle of 80-proof vodka contains about 7 moles of ethanol and about 33 moles of water. Calculate the vapor pressure of the water, the ethanol, and the total vapor pressure at 25°C.
 P_{ethanol}^0 at 25°C = 59 torr, P_{water}^0 at 25°C = 23.8 torr
- 0.48 moles of solute were dissolved in 800 mL of solvent. Calculate the osmotic pressure of this solution at 30°C.

Ion Concentration

- What is the concentration of Na^+ in 1 M NaCl?
What is the concentration of Cl^- in 1 M NaCl?
What is the total ion concentration in 1 M NaCl?
- What is the total ion concentration in 1 M Na_3PO_4 ?

Colligative Properties of Electrolytes vs. Nonelectrolytes

- Colligative properties depend on the number of particles in solution.
- Calculate the ΔT_b of a 10 m salt solution vs. a 10 m sugar solution.

