



Crack Notes [General Chem 4] Solution

Definitions/Formulas

- *Solution*: homogeneous mixture of compounds in single phase
- *Solvent*: what there's more of
- *Solute*: what there's less of
- *Ideal solution*: solute particles can't interact with each other
- *Colloid*: a solution with larger particles, usually opaque instead of clear
- *Solvation*: when an ionic compound dissolves in a solution (ionic bonds broken)
 - Polar/charged molecules can dissolve in polar solutions, etc.
- *Hydration*: when water molecules surround an ion
 - Creates an aqueous phase for ionic compounds
- *Electrolyte*: something that forms ions in aqueous solution, conducts electricity
 - Usually ionic compounds or acids/bases

Concentration

- *Molarity*: $M = \text{moles of solute (before dissociation)} / \text{volume of solution}$
- *Molality*: $m = \text{moles of solute} / \text{kilograms of solvent}$
- *Mole fraction*: $x = \text{moles of solute} / (\text{moles of all solutes} + \text{moles of solvent})$
- *Mass %*: $100\% * \text{mass of solute} / \text{total mass of solution}$
- *Parts per million*: $1000000 * \text{mass of solute} / \text{total mass of solution}$

Heat of solution

- Three step process:
 - (1) Solute-solute bonds broken (endothermic)
 - (2) Solvent-solvent bonds broken (endothermic)
 - (3) Solvent-solute bonds formed (exothermic)
- Heat of solution = sum of all changes in enthalpy
 - (-): new bonds stronger, (+): new bonds weaker
- Solution formation always has positive entropy

Vapor pressure

- Equilibrium between molecules leaving liquid & molecules coming back into liquid, directly prop to temperature
- *Boiling*: when vapor pressure reaches atmospheric pressure
- *Raoult's law*: addition of a nonvolatile solute decreases vapor pressure, $P_{actual} = \chi_{liquid} P_{liquid}$
 - Addition of volatile solute: $P_{actual} = \chi_{liquid} P_{liquid} + \chi_{volatile\ solute} P_{volatile\ solute}$
 - (-) heat of solution: negative deviation, (+) heat of solution: positive deviation
- *Solubility*: how likely a solute is to dissolve in a solvent
- *Precipitation*: opposite of dissolution
- *Saturated solution*: when rate of dissolution = rate of precipitation
- *Solubility product* K_{sp} : equilibrium constant
 - if $AB_2(s) \rightarrow A(aq) + 2B(aq)$, $K_{sp} = [A][B]^2$
- *Solubility*: max # of moles per liter that can dissolve in solution, can solve using K_{sp}
- *Spectator ions*: ions that aren't part of a compound you're adding, don't change solubility
- *Common ion effect*: ions that are part of compound you're adding, does change solubility



Crack Notes [General Chem 4] Solution

Solubility guidelines

- Things containing NO_3^- , NH_4^+ , alkali metal ions are soluble
- Things containing halogens are soluble EXCEPT when they contain Ag^+ , Hg_2^{2+} , Pb^{2+}
- Things containing SO_4^{2-} are soluble EXCEPT when they contain Hg_2^{2+} , Pb^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+}
- Things containing Ca^{2+} , Sr^{2+} , Ba^{2+} are soluble ONLY when they contain S^{2-} or OH^-
- Things containing CO_3^{2-} , PO_4^{3-} , S^{2-} , OH^- are soluble ONLY when they're attached to #1

Things that affect solubility

- Increasing pressure on a gas increases solubility (Henry's law)
- Increasing temperature usually increases solubility of solutes (b/c increase in entropy)
- Increasing temperature usually decreases solubility of gases