Crack Notes [General Chem 5]
Heat Capacity, Phase Change & Colligative Properties

Heat Capacity

Energy used to change temperature of a substance

Two types: constant volume and constant pressure, $C_p > C_v$ b/c constant pressure means some PV work can be done on surroundings

Heat capacity = energy needed PER DEGREE so $q = C\Delta T$ (C has units J/C or J/K)

Specific heat capacity = energy needed PER DEGREE PER UNITS MASS so $q = mc\Delta T$ (c has units J/mol*C or J/mol*K or J/g*C or J/g*K)

Water's specific heat capacity: $1\ cal / g^{\circ}C$

Calorimeter

Coffee cup calorimeter: measures constant pressure b/c at atmospheric pressure

Bomb calorimeter: measure constant volume b/c in a steel container

IN ALL CASES: knowing energy added, change in temperature lets you calculate C or c

Phase Changes

Know what graph of temperature vs. heat added looks like: FLAT at phase changes -> Slope = specific heat

Heat of fusion: energy added for solid -> liquid, or energy taken away for liquid -> solid

Heat of vaporization: energy added for liquid -> gas, or energy taken away for gas -> liquid

Melting/boiling are endothermic & increase S, freezing/condensing are exothermic

$q = mL$

Phase Diagram

Describes phases at different temperatures/pressure

Triple Point: where solid/liquid/gas meet, at that P/T the substance can be in all 3 phases

Critical point: if T>critical temp or P>critical pressure then you can't tell whether it's a gas or a liquid, it has properties of both

In water, the solid/liquid boundary slopes to the left (one of few substances for which this is true) -> increasing pressure will change solid to liquid b/c solid is LESS DENSE than liquid

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<u>Colligative Properties</u>: depend only on number
FOLLOWING IS FOR NONVOLATILE SOLUTES
Vapor pressure: $P_{actual} = \chi_{solution} P_{solution}$
Boiling point elevation: $\Delta T = k_b mi$

-> *m* is molality, *i* is # of particles something will turn into when it dissolves
-> i.e. 1 mol NaCl added to 1 kg of water will have *m=1*, *i=2*

Freezing point depression: $\Delta T = k_f mi$
Osmotic pressure: how much water wants to GO INTO a solution $\Pi = iMRT$

-> *M* is molarity
-> At equilibrium: osmotic pressure = hydrostatic pressure difference
$\Pi_1 = P_1 - P_2 = \rho g h_1 - \rho g h_2$