Attractions

Intra molecular - atom to atom bonds inside a molecule

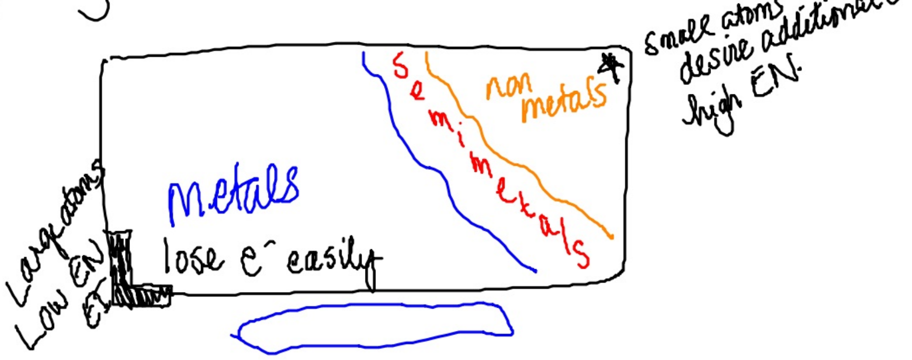
Ionic - transfer of electrons between atoms with very different electronegativities.

covelent - sharing of electrons between atoms

polar covalent - somewhat similar electronegativities

non-polar covalent - almost same electronegativities

Electronegativity: the atoms attraction to electrons in a bond



Intermolecular Forces - between molecules

1. Van der Waals or London dispersion Forces - Temporary - WEAK
   Due to the movement of electrons.
   Found in non-polar molecules.

2. Dipole to Dipole - attractive force between polar molecules - Strong

3. Hydrogen bonding - only occurs when Hydrogen is connected with NOF - Strongest attraction

The stronger the intermolecular forces the more difficult it becomes to change phase – it requires a greater amount of energy.

<u>Specific heat capacity</u> (C_p): the amount of heat energy required to raise the temperature of 1 gram of a substance 1°C.

* <u>1 calorie</u> is the energy required to raise the temp of 1 gram of water 1°C. (1 calorie = 4.184 joules)

1 Calorie (Food Calorie) = 1000 calories

<u>Heat of vaporization</u> : energy required to vaporize a substance H_{vap}.

Energy = mass $\cdot H_{vap}$ or moles $\cdot H_{vap}$

How much energy is needed to vaporize 8.2 moles of substance X if it's heat of vaporization is 93.4 Joule/mole?

<u>if grams given + need moles</u>

grams given $\times \frac{1\,mol}{\text{molar mass}}$
(from Periodic Table)

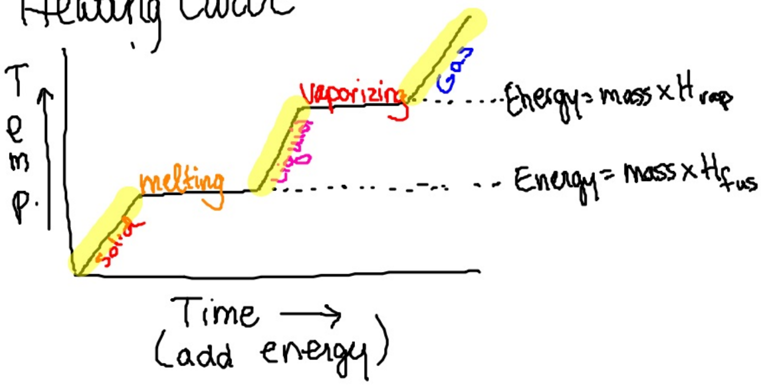
Heat of fusion: energy required to melt a substance. H_{fus}.

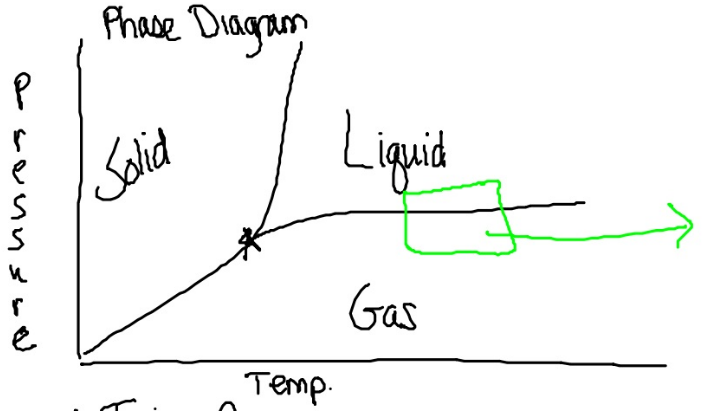
Energy = mass $\cdot H_{fus}$

if the temp changes —

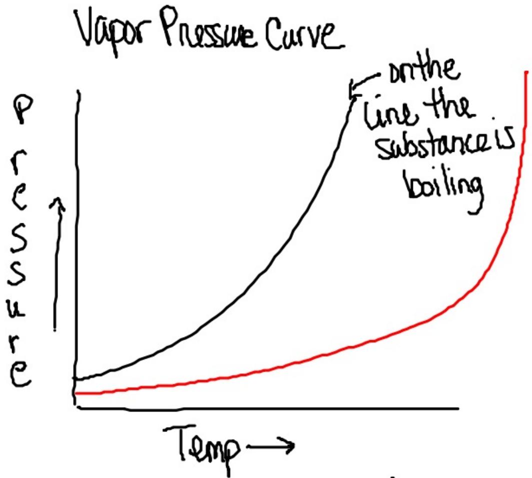
$$\text{Energy} = (\text{mass})(\underbrace{T_{final} - T_{initial}}_{\Delta T})(C_p)$$

Heating Curve





★ Triple Point



black line- lower bp = lower strength of attractive forces

red line- high bp- stronger attractive forces

Gas Laws

Boyle's Law $V_1P_1 = V_2P_2$

Gay-Lussac $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

T must be in Kelvin!

Charles' Law $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Combined Gas Law: $\frac{V_1P_1}{T_1} = \frac{V_2P_2}{T_2}$ (only used for changing conditions)

Ideal Gas Law (not changing)

$PV = nRT$ -or- $PV_{mm} = gRT$

n ← moles

mm ← molar mass

g ← grams

Dalton's Partial Pressures:

$$P_{Total} = P_1 + P_2 + P_3 + \ldots\ldots$$