Chapter Summary: Acids and Bases

Arrhenius Theory: acids are hydrogen ion (H^+) donors and bases produce hydroxide ions (OH^-).
Drawback – only for aqueous solutions and does not explain why ammonia is a base.

The Bronstead-Lowry Theory: acids are proton (H^+) donors and base is a proton acceptor. However H^+ does can not exist so it must attach itself with a small molecule and in case of water to H_2O and gives H_3O^+, the hydronium ion.

HCl	+	H_2O	$\longrightarrow$	H_3O^+	+	Cl^-
Acid		base		conjugate acid		conjugate base

HCl /Cl^- acid – conjugate base pair and
H_2O/H_3O^+ base/conjugate acid pair

Lewis Acid and Bases:
Lewis acid – electron pair acceptor e.g. BF_3, $AlCl_3$
Lewis base – electron pair donor e.g. NH_3, H_2O

Amphoteric: a substance that can act as either and acid or base e.g. H_2O.
Strong vs weak acids – strong acids dissociate completely, weak acids are in equilibrium.

Strength of acids: based on the following characteristics.

1) molecular structure:
   a) size of atom: acid strength increases as you go down the periodic table e.g. HI > HCl. You can also view this as bond strength. HF has the strongest bond hence hardest to break.
   b) Acid strength increases as you go across the periodic table H_2O > NH_3 because of electronegativity.
2) oxoacids:
   a) more number of oxygen atoms lead to stronger acid e.g. H_2SO_4 > H_2SO_3
   b) HOCl > HOBr because of electronegativity of halogen.
3) carboxylic acids: RCOOH, if R group has electron withdrawing groups then the acid will be stronger.

Strength of conjugate acid (CA) and conjugate bases (CB):
Strong base gives weak CA and weak base gives strong CA
Strong acid gives weak CB and weak acid gives strong CB

Reaction is favored in the direction which leads to the formation of weaker acid or base (or CB and CA).

The pH scale: numerical value of strength of acids and bases.
$pH = -\log [H_3O^+]$ $\quad$ $pOH = -\log [OH^-]$ $\quad$ $pK_w = pH + pOH = 14.00$