Strong and Weak Electrolytes

Strong and Weak Electrolytes

- A **strong electrolyte** dissociates <u>completely</u> into ions in water:

$$MX \rightarrow M^+(aq) + X^-(aq)$$

- A **weak electrolyte** dissociates only partially into ions:

$$MX \leftrightarrows M^+(aq) + X^-(aq)$$

The double arrow represents an *equilibrium*.

- Electrolytes consist of acids, bases, and salts.

Acids

- An **acid** dissolves to produce H^+ ions (protons) in water.

- A **strong acid** dissociates completely:

$$HCl(g) \rightarrow H^+(aq) + Cl^-(aq)$$

initial:	1 mol	0 mol	0 mol
final:	0 mol	1 mol	1 mol

- A **weak acid** dissociates only partially:

$$HC_2H_3O_2(l) \leftrightarrows H^+(aq) + C_2H_3O_2^-(aq)$$

initial:	1 mol	0 mol	0 mol
final:	<1 mol	<1 mol	<1 mol

Bases

- A base dissolves to produce OH^- (hydroxide ions) in water.
- **Strong bases** are metal hydroxides:

$$NaOH(s) \rightarrow Na^+(aq) + OH^-(aq)$$

- **Weak bases** are molecular compounds:

$$NH_3(g) + H_2O \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

Salts

- **Salts** are ionic compounds other than hydroxides.

- We consider all salts to be strong electrolytes:

$$LiCl(s) \rightarrow Li^{+}(aq) + Cl^{-}(aq)$$

$$Ca(NO_3)_2(s) \rightarrow Ca^{+2}(aq) + 2\ NO_3^{-}(aq)$$

- Whatever amount of salt dissolves dissociates completely:

$$BaSO_4(s) \xrightarrow{H_2O} BaSO_4(aq)$$

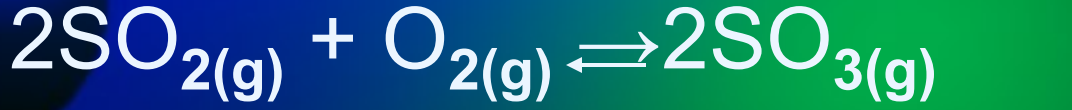
$$BaSO_4(aq) \rightarrow Ba^{+2}(aq) + SO_4^{-2}(aq)$$

Equilibrium

For answering Section 20.4 Acid/Base Practive Problems

Chapter 19...

- Reversible Reactions -
  - In a reversible reaction, the reactions occur simultaneously in both directions
  - double arrows used to indicate this



  - In principle, almost all reactions are reversible to some extent

Items from Chapter 19…

- Equilibrium Constants (K_{eq})
  - Chemists generally express the position of equilibrium in terms of numerical values
  - These values relate to the concentrations of reactants and products at equilibrium

Equilibrium Constants

consider this reaction:

$$aA + bB \rightarrow cC + dD$$

The equilibrium constant (K_{eq}) is the ratio of product concentration to the reactant concentration at equilibrium, with each concentration raised to a power (= the coefficient)

Can you write the equation for K_{eq} ?

HINTS:

- When you see the words 'ratio of' *this* to *that*' , the *THIS* is in the numerator and the *THAT* is in the denominator. THIS/THAT
- Recall the symbol for concentration is [ ]

[ ] means molarity 'M' (mol/L)

$$K_{eq} = \frac{\text{Product}}{\text{Reactants}}$$

$$K_{eq} = \frac{[C]^c \times [D]^d}{[A]^a \times [B]^b}$$

[ ] = molarity = moles per liter

Try this: Write the K_{eq} for this equation:

$$N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$$

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Equilibrium Constants

the equilibrium constants provide valuable information, such as whether products or reactants are favored:

$K_{eq} > 1$, products favored at equilibrium

$K_{eq} < 1$, reactants favored at equilibrium