Equilibrium

- Calculating Concentration - Molarity (M)

$$\text{Molarity (M)} = \frac{\#\text{moles of substance dissolved (n)}}{\text{Volume of the solution in L (V)}}$$

$$M = \frac{n}{V}$$

n = convert mass to moles

1 mol = molar mass (MM)

given | 1 mol / MM

(Ex) Calculate the concentration (M) when 14.61 g NaCl (mass) are dissolved in .800 L (V) of solution.

$M = \frac{n}{V}$

$M = ?$

$n = .2500\ mol$

$V = .800\ L$

$14.61\ g\ NaCl \left| \frac{1\ mol}{58.44\ g} \right. = .2500\ mol$

Na: 22.99 g

Cl: + 35.45 g

58.44 g

$M = \frac{.2500\ mol}{.800\ L} = .313\ mol/L$

(Ex) Calculate the concentration (M) when 10.0 g of NaOH (mass) are dissolved in .500 L of solution.

$M = \frac{n}{V}$

$M = ?$

$n = .250\ mol$

$V = .500\ L$

$10.0\ g\ NaOH \left| \frac{1\ mol}{40.00\ g} \right. = .250\ mol$

$M = \frac{.250\ mol}{.500\ L} = .500\ mol/L$

Chemical Equilibrium

- Some reactions are reversible

reactants → products — forward reaction
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

reactants ← products — reverse reaction
$N_2(g) + 3H_2(g) \leftarrow 2NH_3(g)$

You show a reaction is reversible using a DOUBLE ARROW ↔

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

- Equilibrium occurs when...

the rate of the forward reaction EQUALS the rate of the reverse reaction

@ equilibrium...

- the concentration of reactants & products does NOT change.
- the concentration of reactants & products do NOT have to be equal

- Write an Equilibrium Expression

$$aA + bB \rightleftharpoons cC + dD$$

coefficients

only substances in aqueous or gas state are written in the expression

concentration

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

K_{eq}: equilibrium constant

Ex) write the equilibrium expression for:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

$$K_{eq} = \frac{[NH_3]^2}{[N_2]\cdot[H_2]^3}$$

Ex) write the equilibrium expression for:

$$Mg(s) + 2H_2O(l) \rightleftharpoons Mg(OH)_2(aq) + H_2(g)$$

$$K_{eq} = \frac{[Mg(OH)_2]\cdot[H_2]}{1}$$

Ex) write the equilibrium expression for:

$$Br_2(g) \rightleftharpoons Br_2(l)$$

$$K_{eq} = \frac{1}{[Br_2]}$$