Homework #1-5

③ 0.2 mol/month

Factors Affecting Reaction Rates

Temperature

Raising the temperature speeds up the rate of reaction

- More collisions, and more particles with enough kinetic energy to overcome activation energy barrier

Ex. burning of charcoal

Concentration

Increased concentration increases rate of reaction

- More particles, more collisions, higher rate of reaction

Ex. glowing splint in pure oxygen

Particle Size

Larger the particle, slower the rate of reaction

- Larger particle, less surface area, less reactant available for collision

Ex. Burning log in a fire

Catalyst

Lowers the activation energy for a reaction, increasing rate of reaction

- Not consumed in chemical reaction

Ex. Enzymes in digestive tract

Inhibitor - substance that interferes with the action of a catalyst, often by reacting with the catalyst

Chemical Equilibrium

Reversible Reaction

Reaction in which both the forward and reverse processes are occuring simultaneously.

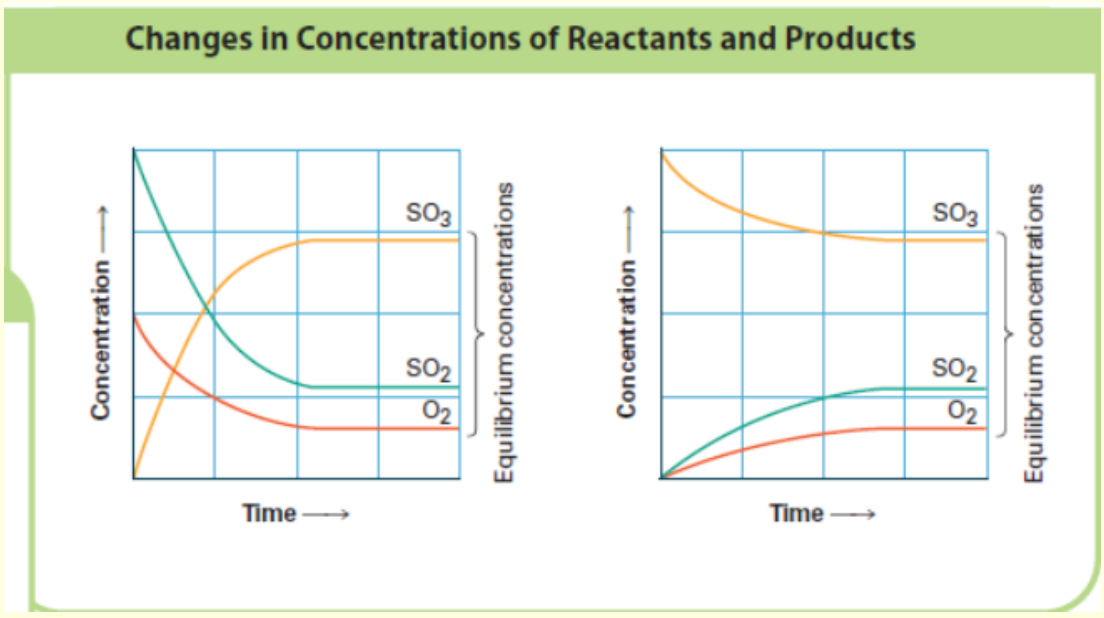
$$A + B \rightleftharpoons C$$

Chemical equilibrium

A system is said to have reached chemical equilibrium when the forward and reverse reactions are occuring at the same rate.

⟶ no net change occurs in the concentration of components of the system

http://www.chm.davidson.edu/ronutt/che115/EquKin/EquKin.htm



$$A + B \longrightarrow C$$

$$H_2 + \tfrac{1}{2}O_2 \longrightarrow H_2O$$

$$C \longrightarrow A + B$$

$$H_2O \longrightarrow H_2 + \tfrac{1}{2}O_2$$

Percent Reaction

Percent Reaction (percent yield) - is the amount of product measured at equilibrium compared with the maximum possible amount of product.

Equilibrium position
relative concentration of reactants and products at equilibrium
⇒0 % indicates no product formed
⇒100 % indicates the maximum possible product formed

- maximum amount of possible product is found using stoichiometry, assuming a forward reaction with no reverse reaction.

$$\% \text{ reaction} = \frac{\text{Experimental yield}}{\text{Theoretical yield (maximum)}} \times 100\ \%$$

Classifying Chemical Equilibria

< 50 % - reactants favored
> 50 % - products favored
> 99 % - quantitative

The equilibrium position of the reaction is indicated in the following manner :

$$\text{Ex.} H_{2(g)} + I_{2(g)} \overset{78\%}{<==>} 2HI_{(g)} \qquad t = 448^{o}$$

Indicates that 78 % of the total amount of HI possible is produced at 448°C. Therefore this is a **product** favored reaction.

Limiting Reagent

In a chemical reaction, the reactant that will "run out" first is called the **limiting reagent**.
The other reactant is called the **excess reagent**.

$$2NH_3 + 3CuO \longrightarrow N_2 + 3Cu + 3H_2O$$

18.1 g **90.4 g**

If NH_3 is L.R.

$$18.1\,g\,NH_3 \times \frac{1\,mol\,NH_3}{17.04\,g\,NH_3} \times \frac{1\,mol\,N_2}{2\,mol\,NH_3} \times \frac{28.02\,g\,N_2}{1\,mol\,N_2} = 14.882\,g\,N_2$$

If CuO is L.R.

$$90.4\,g\,CuO \times \frac{1\,mol\,CuO}{79.55\,g\,Cu} \times \frac{1\,mol\,N_2}{3\,mol\,CuO} \times \frac{28.02\,g\,N_2}{1\,mol\,N_2} = 10.614\,g\,N_2$$

∴ CuO is L.R.

SAMPLE PROBLEM : % REACTION

Find the % reaction and write the expression if 6.90 g of $H_{2(g)}$ and 32.0 g of $O_{2(g)}$ react to form 25.75 g of ice at - 70 C°.