Homework - Worksheet

Al^{3+} SO_4^{2-} Na^+ OH^-

1. c) $Al_2(SO_4)_{3(aq)} + 6NaOH \rightarrow 2Al(OH)_{3(s)} + 3Na_2SO_{4(aq)}$

"quantitatively"

2. $CO_{(g)} + Cl_{2(g)} \rightleftharpoons COCl_{2(g)}$ (L.R. = Cl_2) $V = 1.00 L$

	$CO_{(g)}$	$Cl_{2(g)}$	$COCl_{2(g)}$
init.	xs	1.5 mol	
eqm.	1.75 mol	0.70 mol	0.80 mol
$C = \frac{n}{V}$	1.75 mol/L	0.70 mol/L	0.80 mol/L

$\% \text{ rxn} = \frac{\text{exp.}}{\text{theor.}} \times 100\%$

$\% \text{rxn} = \frac{0.80 \text{ mol}}{1.5 \text{ mol}} \times 100\%$

$\% \text{rxn} = 53\%$

$1.5 \text{ mol } Cl_2 \times \frac{1 \text{ mol } COCl_2}{1 \text{ mol } Cl_2} = 1.5 \text{ mol } COCl_2$

b) $K = \frac{[COCl_{2(g)}]}{[CO_{(g)}][Cl_{2(g)}]}$

$K = \frac{[0.80]}{[1.75][0.70]}$

$K = 0.65$

Change in Equilibrium Conditions

A complete description of an equilibrium state of a system must indicate temperature, pressure, composition and concentrations of all entities.
(A percent reaction or equilibrium constant may be part of the the description.)
There are as many states of equilibrium of a chemical system as there are combinations of properties.

Le Chatelier's Principle
If a stress is applied to a system in dynamic equilibrium, the system changes in a way that relieves the stress, to re-achieve equilibrium.
- is a method of predicting in which direction an equilibrium will shift if the factors describing an equilibrium state (temperature, pressure, concentration) are changed.
- is useful in order to choose conditions which maximize the production of the desired product.

***catalysts** speed up the time to reach equilibrium but do not affect the final position of an equilibrium*

Summary p. 492: Variables Affecting Chemical Equilibria

Constant

$$A + B \rightleftharpoons C \qquad T = 448°C$$

[ ] [ ] [ ]

K

% rxn

Concentration

I. $3NO_{2(g)} + H_2O_{(l)} \longleftrightarrow 2HNO_{3(aq)} + NO_{(g)}$

⇒remove $NO_{(g)}$ shift right

⇒add $HNO_{3(aq)}$ shift left

Temperature

II. $2NaCl_{(s)} + H_2SO_{4(l)} + \text{energy} \longleftrightarrow 2HCl_{(g)} + Na_2SO_{4(s)}$

⇒heat system →

*think of energy as an entity in the equation

III. $2SO_{2(g)} + O_{2(g)} \longleftrightarrow 2SO_{3(g)} + \text{energy}$

⇒cool system (low T) →

$PV = nRT$

$P = \frac{nRT}{V}$

Pressure / Volume

⇒look at gaseous entities

IV. $2SO_{2(g)} + O_{2(g)} \longleftrightarrow 2SO_{3(g)}$ (3 → 2)

⇒decrease volume (increase pressure) →

⇒ increase volume (decrease pressure) ←

Worksheet