Chem 1515.001 – 1515.006
InClass Exercise #5
Week of October 29, 2001
Fall 2001

Name_____
TA Name _____
Lab Section #_____

ALL work must be shown to receive full credit. **Due at the end of laboratory.**

ICE5.1. The reaction

$$PCl_{5(g)} \rightleftarrows PCl_{3(g)} + Cl_{2(g)}$$

was studied at 760 ˚C. 0.200 mol of PCl_5 are placed in a 1.00 liter container and allowed to decompose. After equilibrium was established the concentration of PCl_3 was found to be 0.195 M. Calculate the equilibrium constant for the reaction at this temperature.

Answer: $K_c = 7.6$

ICE5.2. The reaction

$$2H_2S_{(g)} + 3O_{2(g)} \rightleftarrows 2H_2O_{(g)} + 2SO_{2(g)}$$

has a $\Delta H = -1036$ kJ. Given the reaction is at equilibrium, predict the direction (L → R, R → L, or no change) the reaction will shift when disrupted by each of the following;

i) the amount of H_2O is increased
R → L

ii) the temperature of the reaction is increased
R → L

iii) the volume of the container is decreased
L → R

iv) the amount of H_2S is decreased
R → L

ICE5.3. At 1100 K 1.00 mol of SO_2 and 2.00 moles of O_2 are introduced into a 1.00 liter container and allowed to react according to the reaction,

$$2SO_{2(g)} + O_{2(g)} \rightleftarrows 2SO_{3(g)}$$

At equilibrium the concentration of SO_2 is 0.188 M. Calculate K_c for the reaction.

Answer: K_c = 11.7

ICE5.4. The magnitude of the equilibrium constant for the reaction,

$$H_{2(g)} + I_{2(g)} \rightleftarrows 2HI_{(g)}$$

is 54.7 at 700 K. If the initial partial pressure of H_2 is 0.250 atm and the partial pressure of I_2 is 0.500 atm at 700 K, calculate the concentrations of all species when the reaction reaches equilibrium.

Answer: [H_2] = 0.015 atm, [I_2] = 0.265 atm, [HI] = 0.470 atm

ICE5.5. Consider the reaction

$$CH_{4(g)} + H_2O_{(g)} \rightleftarrows CO_{(g)} + 3H_{2(g)}$$

for which $\Delta H_{rxn} = +206$ kJ. Assume a 1.00 L vessel containing an equilibrium mixture, predict how the $[CH_4]$ will change when the equilibrium is disturbed by,

a) addition of H_2O

$[CH_4]$ will decrease

b) addition of H_2

$[CH_4]$ will increase

c) increase in temperature

$[CH_4]$ will decrease

d) decrease in the volume of the reaction container

$[CH_4]$ will increase

ICE5.6. At 200 ˚C, 0.500 mol of H_2, 0.500 mol of N_2 and 0.500 mol of NH_3 are introduced into a 1.00 liter container and allowed to react according to the equation,

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

At equilibrium the concentration of NH_3 is 0.384 M. Calculate K_c for the reaction.

Answer: $K_c = 0.863$

ICE5.7. What conditions of temperature and pressure favor the formation of products in the reaction,

$$CH_{4(g)} + \frac{1}{2}O_{2(g)} \rightleftarrows CO_{(g)} + 2H_{2(g)} \qquad \Delta H^\circ = 35.7 \text{ kJ}$$

A) high temperature and low pressure.
B) high temperature and high pressure
C) low temperature and low pressure
D) low temperature and high pressure