Chem 1515.001 - 006
Problem Set #8
Spring 2002

Name____________________________________

TA's Name ______________________________

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ALL work must be shown to receive full credit. **Due in lecture at 8:30 a.m. on Wednesday, March 27, 2002.**

PS8.1. A 0.522 gram quantity of $COBr_2$ is sealed in a glass bulb of 0.100 L volume and heated to a temperature of 73 ˚C. At 73 ˚C the $COBr_2$ partially decomposes according to the equation

$$COBr_2(g) \rightleftarrows CO(g) + Br_2(g)$$

for which $K_c = 0.190$. Calculate the concentration of each species at 73 ˚C.

PS8.2. The equilibrium constant, K_p, for the reaction

$$CO_2(g) + H_2(g) \rightleftarrows H_2O(g) + CO(g)$$

is 0.137. Calculate the partial pressure of all species at equilibrium for each of the following original mixtures:

a) 1.0 atm of CO_2 and 1.0 atm of H_2.

b) 1.0 atm of CO_2, 1.00 atm of H_2 and 1.0 atm of H_2O.

c) 1.0 atm of H_2O and 1.0 atm of CO.

PS8.3. At 1000 K the equilibrium constant, K_c, for the reaction

$$2NO(g) + O_2(g) \rightleftarrows 2NO_2(g)$$

is 0.833. Calculate the concentrations of all species at equilibrium when 0.600 moles of NO_2 are placed in a 2.00 L container at 1000 K.

PS8.4. At 25 ˚C, 0.560 mol of O_2 and 0.20 mol of N_2O were placed in a 1.00 liter vessel and allowed to react according to the equation

$$2N_2O(g) + 3O_2(g) \rightleftarrows 4NO_2(g)$$

When the system reached equilibrium, the concentration of NO_2 was found to be 0.020 M.

a) What were the equilibrium concentrations of N_2O and O_2?

PS8.4. (Continued)

b) What is the value of K_c for this reaction at 25 ˚C?

PS8.5. The reaction

$$NOBr(g) \rightleftarrows NO(g) + \frac{1}{2}Br_2(g)$$

has been carefully studied at 350 ˚C and the K_c is 0.079. Which direction (left-to-right or right-to-left) will the reaction proceed to establish equilibrium under each of the following initial conditions?

a) $[NOBr]_o = 0.100$ M : $[NO]_o = 0$: $[Br_2]_o = 0$

b) $[NOBr]_o = 0$: $[NO]_o = 0.100$ M : $[Br_2]_o = 0.100$ M

c) $[NOBr]_o = 0.100$ M : $[NO]_o = 0$: $[Br_2]_o = 0.100$ M

d) $[NOBr]_o = 0.100$ M : $[NO]_o = 0.100$ M : $[Br_2]_o = 0.100$ M

e) $[NOBr]_o = 0.200$ M : $[NO]_o = 0.0500$ M : $[Br_2]_o = 0.100$ M

PS8.6. Consider the reaction

$$2H_2S(g) + 3O_2(g) \rightleftarrows 2H_2O(g) + 2SO_2(g)$$

for which $\Delta H_{rxn} = -1036$ kJ. Predict how the $[SO_2]$ will change when the equilibrium is disturbed by;

a) Addition of O_2

b) Addition of H_2O

c) Addition of a catalyst

d) Increase in temperature

e) Decrease in the volume of the reaction container

PS8.7. The equilibrium constant, K_p, for the reaction

$$2NOBr(g) \rightleftarrows 2NO(g) + Br_2(g)$$

is 6.25 at 25 ˚C and ΔH° = 34.4 kJ. Calculate the magnitude of the equilibrium constant at 75 ˚C.

PS8.8. Given the reaction

$$XeF_4(g) \rightleftarrows Xe(g) + 2F_2(g)$$

A 10.0 liter vessel at 298 K initially contains a sample of XeF_4 at 1.25 atm. After the reaction achieves equilibrium, the total pressure in the vessel is 2.95 atm. Calculate K_p from this data.

PS8.9. The equilibrium constant, K_c, for the reaction

$$N_2(g) + O_2(g) \rightleftarrows 2NO(g)$$

is 2.50×10^{-6} at a particular temperature. If the $[N_2]_o = 2.00$ M, the $[O_2]_o = 1.00$ M and the $[NO]_o = 0$ M, calculate the equilibrium concentration of all species.