Unit 09 Problem Set 4 #1a,2b,3-8 KEY

1a	
57. At 35°C, $K = 1.6 \times 10^{-5}$ for the reaction $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$ Calculate the concentrations of all species at equilibrium for each of the following original mixtures. **a.** 2.0 moles of pure NOCl in a 2.0-L flask **b.** 1.0 mole of NOCl and 1.0 mole of NO in a 1.0-L flask **c.** 2.0 moles of NOCl and 1.0 mole of Cl_2 in a 1.0-L flask	1a) [NOCl] = 0.969 M [NO] = 0.031 M [Cl2] = 0.0155M
2b	
54. At 25°C, $K = 0.090$ for the reaction $H_2O(g) + Cl_2O(g) \rightleftharpoons 2HOCl(g)$ Calculate the concentrations of all species at equilibrium for each of the following cases. **a.** 1.0 g H_2O and 2.0 g Cl_2O are mixed in a 1.0-L flask. **b.** 1.0 mole of pure HOCl is placed in a 2.0-L flask.	2b) $[H_2O]$ = 0.22 M $[Cl_2O]$ = 0.22 M [HOCl] = 0.060 M
3	
62. A sample of solid ammonium chloride was placed in an evacuated container and then heated so that it decomposed to ammonia gas and hydrogen chloride gas. After heating, the total pressure in the container was found to be 4.4 atm. Calculate K_p at this temperature for the decomposition reaction $NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$	K_P = 4.8
4	
78. For the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ at 600. K, the equilibrium constant, K_p, is 11.5. Suppose that 2.450 g PCl_5 is placed in an evacuated 500.-mL bulb, which is then heated to 600. K. **a.** What would be the pressure of PCl_5 if it did not dissociate? **b.** What is the partial pressure of PCl_5 at equilibrium? **c.** What is the total pressure in the bulb at equilibrium? **d.** What is the percent dissociation of PCl_5 at equilibrium?	a) P_{PCl5} = 1.158 atm b) P_{PCl5} = 0.098 atm c) P = 2.218 atm d) 91.5%
5	
80. For the following reaction at a certain temperature $H_2(g) + F_2(g) \rightleftharpoons 2HF(g)$ it is found that the equilibrium concentrations in a 5.00-L rigid container are $[H_2] = 0.0500\ M$, $[F_2] = 0.0100\ M$, and $[HF] = 0.400\ M$. If 0.200 mole of F_2 is added to this equilibrium mixture, calculate the concentrations of all gases once equilibrium is reestablished.	$[H_2]$ = 0.025 M $[F_2]$ = 0.025 M [HF] = 0.45 M

6	
61. At 25°C, $K_p = 2.9 \times 10^{-3}$ for the reaction $NH_4OCONH_2(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$ In an experiment carried out at 25°C, a certain amount of NH_4OCONH_2 is placed in an evacuated rigid container and allowed to come to equilibrium. Calculate the total pressure in the container at equilibrium.	P = 0.270 atm
7	
Phosgene, $COCl_2$, is prepared from CO and Cl_2 according to the following equation: $CO + Cl_2 \rightarrow COCl_2$. Kc at 395 °C is 1.23×10^3. If 2.00 mol of CO and 3.50 mol of Cl_2 are added to a 5.00 liter reaction vessel at 395 °C, what would the equilibrium concentrations be for all species?	$[CO] = 0.001$ $[Cl_2] = 0.301$ $[COCl_2] = 0.399$ (Because K is so high, reaction essentially goes to completion, i.e. $x \rightarrow 0.4$)
8	
86. For the reaction below, $K_p = 1.16$ at 800.°C. $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ If a 20.0-g sample of $CaCO_3$ is put into a 10.0-L container and heated to 800.°C, what percentage by mass of the $CaCO_3$ will react to reach equilibrium?	$x = P_{CO2} = 1.16$ atm $n_{CO2} = n_{CaCO3} = 0.1317$ mol CaCO3 reacted 13.17 g CaCO3 reacted 66%