84.122- Section 207 Quiz 6 Name KEY
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Useful Information: $\Delta G = -RT \ln K$

1. Provide the equilibrium constant expression for Kp for the following reaction. (5 pts)

$2\ CH_3Cl(g) + Cl_2(g) \leftrightarrow 2\ CH_2Cl_2(g) + H_2(g)$

$$K_p = \frac{[P_{CH_2Cl_2}]^2 (P_{H_2})}{(P_{CH_3Cl})^2 (P_{Cl_2})}$$

2. Provide the equilibrium constant expression for K for the following reaction. (5 pts)

$KClO_3(s) \leftrightarrow KClO(s) + O_2(g)$

$$K = [O_2]$$

3. Determine the value of K for the following reaction if the equilibrium concentrations are as follows: $[N_2]_{eq} = 3.6$ M, $[O_2]_{eq} = 4.1$ M, $[N_2O]_{eq} = 3.3 \times 10^{-18}$ M. Show your work for partial credit. (10 pts)

$2\ N_2(g) + O_2(g) \leftrightarrow 2\ N_2O(g)$

$$K = \frac{[N_2O]^2}{[N_2]^2[O_2]} = \frac{(3.3\times10^{-18})^2}{(3.6)^2(4.1)} =$$

$$2.0\times10^{-37}$$

Answer: _____

4. Consider the following reaction and its equilibrium constant:

$$SO_2(g) + NO_2(g) \leftrightarrow SO_3(g) + NO(g) \qquad K = 0.33$$

A reaction mixture contains 0.39 M $SO_2$, 0.14 M $NO_2$ , 0.11 M $SO_3$ and 0.14 M NO. Which of the following statements is TRUE concerning this system? Show your method. No credit if your work isn't shown, (10 pts)

a) The reaction will proceed in the direction of reactants.
b) The equilibrium constant will decrease.
c) The reaction will proceed in the direction of products.
d) The reaction quotient will decrease.
e) The system is at equilibrium.

$$Q = \frac{[NO]_{in}[SO_3]_{in}}{[SO_2]_{in}[NO_2]_{in}} = \frac{(.11)(.14)}{(.39)(.14)}$$

$$= 0.28$$

Reaction goes to the right

5. a) Which of the following reactions will have the largest equilibrium constant (K) at 298 K? (3 pts)

a) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ $\Delta G° = +131.1$ kJ
b) $2\ Hg(g) + O_2(g) \rightarrow 2\ HgO(s)$ $\Delta G° = -180.8$ kJ
c) $3\ O_2(g) \rightarrow 2\ O_3(g)$ $\Delta G° = +326$ kJ
d) $Fe_2O_3(s) + 3\ CO(g) \rightarrow 2\ Fe(s) + 3\ CO_2(g)$ $\Delta G° = -28.0$ kJ
e) It is not possible to determine without more information.

b) Calculate the value of the equilibrium constant for the reaction you chose in part 5(a). Show your work. (7 pts)

$$\Delta G = -RT\ln K$$

$$\frac{-180.8\text{kJ}}{-8.314\times10^{-3}\frac{\text{kJ}}{\text{K}}(298\text{K})} = \ln K = 72.97$$

$$K = 4.9\times10^{31}$$

Answer: _____