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Time: 10' **Chem 205** **Friday, March 23, 2012**
Drop Quiz 4 **H. Deeb**

Name:

1. On analysis, an equilibrium mixture for the reaction:

$2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$

was found to contain 1.0 mol H_2S, 4.0 mol H_2, and 0.80 mol S_2 in a 4.0 L vessel at a certain temperature T_1.

a) Calculate the molar concentration of all species at equilibrium.

$[H_2S]_{eq} = \frac{n_{eq}}{V_{mol}} = \frac{1.0}{4.0} = 0.25\ mol/L$ $[H_2]_{eq} = \frac{n_{eq}}{V} = \frac{4.0}{4.0} = 1.0\ mol/L$

$[S_2]_{eq} = \frac{n_{eq}}{V} = \frac{0.80}{4.0} = 0.2\ mol/L$

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b) Calculate the equilibrium constant, K_c, for this reaction at T_1.

$K_c = \frac{[S_2]_{eq} \times [H_2]^2}{[H_2S]^2} = \frac{(0.2) \times (1.0)^2}{(0.25)^2} = \frac{0.2}{0.063} = 3.17$

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c) Knowing that the above reaction is endothermic, what will be the effect on the value of K_c if the temperature is decreased? Justify your answer.

if Temp is decreased, an exothermic reaction is favored, K_c of this rxn is decreased and K_c of the exothermic reaction will increase.

2. In today's experiment the deep red complex $FeSCN^{2+}$ is prepared, and the equilibrium constant for the reaction involved is determined.

a) Write the reaction involved in its preparation.

$Fe^{3+}_{(aq)} + SCN^-_{(aq)} \rightleftharpoons FeSCN^{2+}_{(aq)}$

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b) Different standard solutions of this colored complex were prepared to draw its calibration curve. Explain briefly (in general, you don't have to be specific) how the standard solutions are prepared, despite the fact that the reaction involves equilibrium.

We prepare diff standard solutions by mixing a certain amount of Fe^{3+} with SCN^- and we add distilled water to the line mark. Then a standard solution is prepared.

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c) Based on your answer in (b), suggest a blank solution to be used while determining the absorbance of the prepared standard solutions.

The blank solution shouldn't contain Fe^{3+} so instead Fe^{3+} we should add distilled water.

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Time: 10' **Chem 205** **March 8, Friday, 2013**
Drop Quiz 4 **H. Deeb**

$K = \frac{\text{prod}}{\text{reac}}$

Name: ____

1. Indicate whether the following statements concerning chemical equilibrium are **true (T)** or **false (F).**

- **T** F A large equilibrium constant indicates that the products are favored at equilibrium.
- **T** F At equilibrium, the concentration of all species participating in the reaction becomes constant with time.
- T **F** When equilibrium is reached, the forward and the reverse reactions stop. (-1)
- **T** F When a reaction has a small equilibrium constant, it means that it reaches equilibrium slowly.

2. The equilibrium constant for the following reaction at a particular temperature has a value of 2.1×10^3.

$H_2(g) + F_2(g) \rightleftharpoons 2\,HF(g)$

The equilibrium concentrations of $H_2(g)$ and $F_2(g)$ at this temperature are 0.0021 M each. What is the equilibrium concentration of HF(g) at the same conditions?

$K_c = 2.1 \times 10^3$

$K_c = \frac{[HF]^2}{[H_2][F_2]}$

$2.1 \times 10^3 = \frac{[HF]^2}{0.0021^2}$ $\quad [HF]^2 = 9.261 \times 10^{-3}$

$[HF] = 0.096\ M$

3. a) Write the expression for K_c for the following reaction:

$2\,NO_2(g) + 7\,H_2(g) \rightleftharpoons 2NH_3(g) + 4\,H_2O(l)$

$K_c = \frac{[NH_3]^2}{[NO_2]^2[H_2]^7}$

b) Write the chemical equation involved in K_c determination in today's experiment.

$Fe^{3+} + SCN^- \rightarrow Fe(OH)_3$. $FeSCN^{2+}$

(-3)

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Time: 10' **Chem 205** **March 8, Friday, 2013**
Drop Quiz 4 **H. Deeb**

Name: _

1. Indicate whether the following statements concerning chemical equilibrium are **true (T)** or **false (F).**

- (T) (F) A large equilibrium constant indicates that the products are favored at equilibrium.
- (T) F At equilibrium, the concentration of all species participating in the reaction becomes constant with time.
- (T) (F) When equilibrium is reached, the forward and the reverse reactions stop.
- (T) (F) When a reaction has a small equilibrium constant, it means that it reaches equilibrium slowly.

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2. The equilibrium constant for the following reaction at a particular temperature has a value of 2.1×10^3.

$H_2(g) + F_2(g) \rightleftharpoons 2\,HF(g)$

The equilibrium concentrations of $H_2(g)$ and $F_2(g)$ at this temperature are 0.0021 M each. What is the equilibrium concentration of HF(g) at the same conditions?

$$K = 2.1 \times 10^3 = \frac{[HF]^2}{[H_2][F_2]} = \frac{[HF]^2}{0,0021 \times 0,0021}$$

$$\frac{[HF]^2}{(0,0021)^2} = 2.1 \times 10^3 \Rightarrow \sqrt{2,1 \times 10^3} = \frac{\sqrt{[HF]^2}}{\sqrt{(0,0021)^2}} = \frac{[HF]}{0,0021}$$

$$45,8 = \frac{[HF]}{0,0021} \Rightarrow [HF] = 0,09618\ M$$

3. a) Write the expression for K_c for the following reaction:

$2\,NO_2(g) + 7\,H_2(g) \rightleftharpoons 2NH_3(g) + 4\,H_2O(l)$

$$K_c = \frac{[NH_3]^2}{[H_2]^7[NO_2]^2}$$

b) Write the chemical equation involved in K_c determination in today's experiment.

$$Fe^{3+}_{(aq)} + SCN^-_{(aq)} \rightleftharpoons FeSCN^{2+}_{(aq)}$$

$$K_c = \frac{[FeSCN^{2+}]}{[SCN^-][Fe^{3+}]}$$