CH 117 Session 5

January 31, 2014

\*Note that the Equil. Constant and numbers used in the questions for this exercise were made up.

1. Write the equilibrium expression for the following reactions:

2 N2 (g) + 3 H2 (g) 🡨🡪 2 NH3 (g)

CH3COOH + H2O (l) 🡨🡪 CH3CHOO- + H3O+

CaCO3 (s)  CaO(s) + CO2(g)

2. For the reaction, CO(g) + 2 H2 (g)  CH3OH(g), Keq is 1.45E-3. What would the Keq. be for 2CO(g) + 4 H2 (g)  2CH3OH(g).

b. What would the Keq be for 2CH3OH(g)  2CO(g) + 4 H2 (g).

3. For the reaction 2 N2 (g) + 3 H2 (g) 🡨🡪 2 NH3 (g), Kc is 4\*105. Find Kp at 400C.

b. Under what conditions would Kp = Kc

4. True or False: When Kc is greater than 1, reaction is product favored.

b. When Qc > Kc, the reaction will shift in which direction.

5. N2(g) + 3H2(g) <--> 2NH3(g). At equilibrium there contains 1.5 moles of N2, 2 moles of H2, and 3 moles of NH3­ in a 1.5L container. Find Kc.

6. Suppose you mix 1 M of CO and 1 M of H2 together. What would the equilibrium concentration of all reactant and product be?

CO (g) + 2 H2 (g)  CH3OH (g) Kc is 1.45E-2

7. Consider the following reaction. CO (g) + 2 H2 (g)  CH3OH Kc= 3.01\*10-4

If you started with 1 M of CO, 1 M of H­2, and 1 M of CH3OH, which direction would the reaction shift? Would the conc. of H2 be greater than 1 M?

8. Consider the reaction 2 N2 (g) + 3 H2 (g) 🡨🡪 2 NH3. What happens to Keq when the conc. of NH3 is decreased?

b. Which way doe the reaction shift if H2 concentration is decreased?

9. Consider the reaction 2 N2 (g) + 3 H2 (g) 🡨🡪 2 NH3 (g). How would reduce volume by half shift the reaction?

10. Consider the reaction 2HI 🡨🡪 H2 + I2. How would increasing the volume shift the reaction?

b. True/False: Kp and Kc are equal. Explain reasoning.

11. Consider the reaction CH3COOH + H2O (l) 🡨🡪 CH3CHOO- + H3O+. How would the reaction shift if H2O was evaporated so that half the volume disappeared.

12. Consider the reaction H2(g) + Cl2(g) <==> 2HCl(g). ∆H= -55kj/mol. What would happen to Kc if temperature increased?

13. Consider the reaction 2 N2 (g) + 3 H2 (g) 🡨🡪 2 NH3 (g). Predict whether entropy increases or decreases when products are formed.

b. At higher temperature, which effect determines the position of equilibrium more, energy effect or entropy effect?