Self Assessment B

Question 1

A chemical reaction is at equilibrium when

- **A)** the concentrations of reactants is equal to the concentrations of products
- **B)** the limiting reagent has been completely depleted
- **C)** the rate of the forward reaction equals the rate of the reverse reaction
- **D)** A and B.

Question 2

What is the correct equilibrium constant expression for the following reaction? $2\ NO_2(g) \leftrightarrow 2\ NO(g) + O_2(g)$

- **A)** $K_{eq} = [O_2]^2[NO]/[NO_2]^2$
- **B)** $K_{eq} = [O_2][NO]^2/[NO_2]^2$
- **C)** $K_{eq} = [NO_2]^2/[NO]^2\ [O_2]$
- **D)** $K_{eq} = [NO_2]^2/[NO][O_2]^2$
- **E)** None of the above

Question 3

The equilibrium constant for the reaction $2\ NH_3(g) \rightarrow N_2(g) + 3\ H_2(g)$ is 3×10^{-3} at some temperature. What is K_{eq} for the reaction $0.5\ N_2(g) + 1.5\ H_2(g) \leftrightarrow NH_3(g)$ at the same temperature?

- **A)** 0.003
- **B)** 0.05
- **C)** 18
- **D)** 20

Question 4

Consider the reaction that describes the Haber process for the production of ammonia (NH_3): $N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g)$ for which K_c at 300°C is 9.5. Calculate K_p for this reaction at 300 °C.

- **A)** $K_p = 4.3 \times 10^{-3}$
- **B)** $K_p = 9.5$
- **C)** $K_p = 2.1 \times 10^{4}$
- **D)** $K_p = 1.6 \times 10^{-2}$

Question 5

For the reaction $H_2(g) + I_2(g) \leftrightarrow 2\ HI(g)$, $K_c = 12.3$ at some temperature T. If $[H_2] = [I_2] = [HI] = 3.21 \times 10^{-3}$ M at that temperature, which one of the following statements is true?

- **A)** The concentration of HI will rise as the system approaches equilibrium
- **B)** The system is at equilibrium, so the concentrations will not change
- **C)** The concentrations of H_2 and I_2 will increase as the system approaches equilibrium
- **D)** The concentrations of H_2 and HI will decrease as the system approaches equilibrium
- **E)** Not enough information is given to answer the question

Question 6

K_c for the reaction $2\ NH_3(g) \leftrightarrow N_2(g) + 3\ H_2(g)$ is 3×10^{-3} at some temperature. A 1.0 L mixture containing 1.0 mol of NH_3, 0.50 mol of N_2, and 0.15 mol of H_2 is prepared at this temperature When equilibrium is reached,

- **A)** there will be more N_2 and H_2 present
- **B)** there will be more NH_3 present
- **C)** there will be less N_2 but more H_2 present.
- **D)** there will be less NH_3 and less N_2 present
- **E)** No shift will occur

Question 7

If the equilibrium constant for the reaction $PCl_5 \leftrightarrow PCl_3 + Cl_2$ is 1.0, how many moles of PCl_5 must be placed into one liter of solution in order to obtain 0.50 mol of PCl_3 when the system reaches equilibrium?

- **A)** 0.25
- **B)** 0.50
- **C)** 0.75
- **D)** 1.00

Question 8

When the reaction $CH_3Cl + OH^- \leftrightarrow CH_3OH + Cl^-$ is started with 0.1 mol of CH_3Cl and 0.2 mol of OH^-, 0.03 mol of CH_3OH is present when the system reaches equilibrium. Calculate the equilibrium constant for the reaction.

- **A)** 0.18
- **B)** 0.08
- **C)** 0.0009
- **D)** 0.30

Question 9

At some temperature, K_c for the reaction $PCl_5(g) \leftrightarrow PCl_3(g) + Cl_2(g)$ is 0.020. If 0.10 mol of PCl_5 and 0.20 mol of PCl_3 are added to a 1-L flask, what will be the Cl_2 concentration when equilibrium is reached?

- **A)** 0.020 M
- **B)** 8.7×10^{-3} M
- **C)** 0.0052 M
- **D)** 0.12 M

Question 10

Consider the following reaction: $H_2(g) + I_2(g) \leftrightarrow 2\ HI(g)$ for which, at some temperature, $K_c = 4.0$. When the reaction is started with equimolar quantities of H_2 and I_2 and equilibrium is reached, 0.20 mol of HI is present. How much H_2 was used to start the reaction?

- **A)** 0.10 mol
- **B)** 0.23 mol
- **C)** 0.20 mol
- **D)** 4.0 mol