**Equilibrium Constant and Reaction Quotient Practice**

1. Write equilibrium constant expressions, Kc, for the following reactions:

a. 2 NO (g) + O2 (g) ⇌ 2 NO2 (g)

b. Zn (s) + 2 Ag+ (aq) ⇌ Zn2+ (aq) + 2 Ag (s)

c. Mg(OH)2 (s) + CO32− (aq) ⇌ MgCO3 (s) + 2 OH− (aq)

2. Given the equilibrium equation below: A2(g) + B2(g) ⇌ 2AB(g)

If, at equilibrium, the concentrations are as follows: [A2] = 3.45 M, [B2] = 5.67 M and [AB] = 0.67 M

a) Write the expression for the equilibrium constant, Keq

b) Find the value of the equilibrium constant, Keq at the temperature that the experiment was done.

3. Given the equilibrium equation:

X2(g) + 3Y2(g) ⇌ 2XY3(g)

at a temperature of 50°C, it is found that when equilibrium is reached that:

[X2] = 0.37 M, [Y2] = 0.53 M and [XY3] = 0.090 M

a) Write the equilibrium constant expression (Keq)

b) Calculate the value of Keq at 50°C.

4. Equilibrium is established in the reversible reaction 2 A(aq) + B(aq) ⇌ 2 C(aq). The equilibrium concentrations are [A] = 0.55 M, [B] = 0.33 M, [C] = 0.43 M. What is the value of Kc for this reaction?

5. Consider the reaction: A(g) + B(g) ⇌ C(g)

a) In an equilibrium mixture the following concentrations were found:

[A] = 0.45M, [B] = 0.63M and [C] = 0.30M.

Calculate the value of the equilibrium constant for this reaction.

b) At the same temperature, another equilibrium mixture is analyzed and it is found that [B] = 0.21 M and [C] = 0.70 M. From this and the information above, calculate the equilibrium [A].

6. For the reaction: H2(g) + I2(g) ⇌ 2HI(g), Kc = 12.3 at a certain temperature. If at a given moment in the reaction at that temperature, [H2] = [I2] = [HI] = 3.21 x 10–3 M, which direction will the reaction proceed to reach equilibrium? Explain your reasoning.

7. For the reaction: PCl5 (g) ⇌ PCl3 (g) + Cl2 (g), Kc = 0.0454 at 261°C. If a vessel is filled with these gases such that the initial concentrations are [PCl3] = 0.50 M, [Cl2] = 0.50 M and [PCl5] = 3.50 M, in which direction will a net change occur?

8. The equilibrium constant for the following reaction at 527°C is 5.10. If [CO] = 0.15 M, [H2O] = 0.25 M, [H2] = 0.42 M, and [CO2] = 0.37 M, calculate Q and determine how the reaction will proceed.

CO (g) + H2O (g) ⇌ H2 (g) + CO2 (g)

9. The equilibrium constant for the following reaction at 2130°C is 0.0025. If [N2] = 0.81 M, [O2] = 0.75 M, and [NO] = 0.030 M, find Q and determine the direction in which the reaction will proceed.

N2 (g) + O2 (g) ⇌ 2NO (g)

10. At 500°C, the equilibrium constant for the following reaction is 0.080. Given that [NH3] = 0.0596 M, [N2] = 0.600 M, and [H2] = 0.420 M, find Q and predict how the reaction will proceed.

N2 (g) + 3H2 (g) ⇌ 2NH3 (g)

11. At 1000°C, Keq = 1.0 x 10-13 for the following reaction. If [HF] = 23.0 M, [H2] = 0.540 M, and [F2] = 0.38 M, determine the value of Q and predict how the reaction will proceed.

2HF (g) ⇌ H2 (g) + F2 (g)

12. At 1227 °C, Keq for the following reaction is 0.15. If [SO2] = 0.344 M, [O2] = 0.172 M, and [SO3] = 0.056 M, find Q and determine how the reaction will proceed.

2SO2 (g) + O2 (g) ⇌ 2SO3 (g)

13. The equilibrium constant for the reaction

N2 (g) + 3 H2 (g) ⇌ 2 NH3 (g)

is Keq = 0.105.  At a certain point in the reaction, the concentrations are determined to be [N2] = 1.00 M, [H2] = 2.00 M and [NH3] = 2.00 M.  What is the reaction quotient and in which direction is the reaction moving?

**Answers:**

0.00039 0.0015 0.023 0.071 0.08 0.15 0.15 0.500 1.1 1.9 3.0 4.14 6. 1 left left left M no effect no effect right right right