

Chem12 Equilibrium-20

If K_{eq} is large, the products are favored at equilibrium. That is, the concentration of the products far exceeds the concentrations of the reactants. The reverse is true if K_{eq} is small.

Exercise 1) For the following reactions predict the relative amount of reactants and products at equilibrium.

- a) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ $K_{eq} = 52.2$
b) $4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$ $K_{eq} = 5 \times 10^{198}$
c) $Si(s) + O_2(g) \rightleftharpoons SiO_2(g)$ $K_{eq} = 2 \times 10^{142}$
d) $H_2O(g) \rightleftharpoons H_2(g) + (1/2)O_2(g)$ $K_{eq} = 2.3 \times 10^{-9}$

Exercise 2) Find K_{eq} for the reverse reaction given in 1a) above.

Exercise 3) Give the equilibrium expression.

- a) $CaCO_3(s) + CO_2(g) + H_2O(l) \rightleftharpoons Ca^{2+}(aq) + 2HCO_3^-(aq)$
b) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
c) $HCl(g) + LiH(s) \rightleftharpoons H_2(g) + LiCl(s)$
d) $Cu(OH)_2(s) \rightleftharpoons Cu^{2+}(aq) + 2OH^-(aq)$
e) $Cu(NH_3)_4^{2+}(aq) \rightleftharpoons Cu^{2+}(aq) + 4NH_3(aq)$

Exercise 4) In which reaction would $[Ag^+]$ be greater?

- a) $AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$ $K_{eq} = 1.8 \times 10^{-10}$
b) $AgI(s) \rightleftharpoons Ag^+(aq) + I^-(aq)$ $K_{eq} = 1.5 \times 10^{-16}$

Exercise 5) For the equilibrium reaction : $AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$, the K_{eq} is 1.8×10^{-10} . Find $[Ag^+(aq)]$ and $[Cl^-(aq)]$.

Answers : 1)a) products greater, b) products very much greater, c) products very much greater, d) reactants very much greater, 2) $1/52.2 = 0.0192$, 3)a) $\{[Ca^{2+}][HCO_3^-]^2\}/[CO_2]$, b) $\{[Cl_2][PCl_3]\}/[PCl_5]$, c) $[H_2]/[HCl]$, d) $[OH^-]^2[Cu^{2+}]$, e) $\{[NH_3]^4[Cu^{2+}]\}/[Cu(NH_3)_4^{2+}]$, 4) a (K_{eq} is larger), 5) Both concentrations are 1.3×10^{-5} mol/L.