Equilibrium worksheet 2

Equilibrium

7.4 Calculating the Equilibrium Constant
7.5 Magnitude of the Equilibrium Constant
7.6 Properties of the Equilibrium Constant

1) The equilibrium concentrations for the reaction below were found to be $[AgNO_3] = 0.0070\ M$, and $[Cu(NO_3)_2] = 0.48\ M$ at a certain temperature.

$$2\ AgNO_3(aq) + Cu(s) \rightleftharpoons Cu(NO_3)_2(aq) + 2\ Ag(s)$$

Find the equilibrium constant, K_c, for the reaction.

2) The equilibrium concentrations for the reaction below were found to be $[N_2] = 0.13\ M$, $[H_2] = 7.9 \times 10^{2}\ M$, and $[NH_3] = 1.6\ M$ at a certain temperature. Find the equilibrium constant, K_c, at this temperature.

$$N_2(g) + 3\ H_2(g) \rightleftharpoons 2\ NH_3(g)$$

3) The equilibrium constant, K_c, for the reaction below is 0.10 at 25°C.

$$2\ ICl(g) \rightleftharpoons Cl_2(g) + I_2(g)$$

Find the equilibrium concentration of chlorine gas, $Cl_2(g)$, if the equilibrium concentrations of $ICl(g)$ and $I_2(g)$ are known to be 0.50 M and 0.40 M respectively.

4) The equilibrium partial pressures for the reaction bellow are $P(CO) = 0.598$ atm and $P(CO_2) = 0.159$ atm at 1080 K.

$$CO_2(g) + C(graphite) \rightleftharpoons 2\ CO(g)$$

Find the value of the equilibrium constant, K_p.

5) The equilibrium partial pressures for the reaction bellow are $P(PCl_3) = 0.12$ atm, $P(Cl_2) = 0.16$ atm and $P(PCl_5) = 1.30$ atm at 455 K. Find the value of the equilibrium constant, K_p.

$$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$$

6) The equilibrium partial pressures for the reaction bellow are $P(CO) = 1.31$ atm, $P(H_2O) = 10.00$ atm, $P(CO_2) = 6.10$ atm, and $P(H_2) = 20.5$ atm at 700 K. Find the value of the equilibrium constant, K_p.

$$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$$

7) When each of the following processes reach equilibrium, does the system in question contain mostly reactants, mostly products, or fairly equal concentrations of both reactants and products? Justify your answers.

a. $2\ H_2(g) + O_2(g) \rightleftharpoons 2\ H_2O(g)$ $\quad K_c = 9.1 \times 10^{80}$ at 25°C

b. $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$ $\quad K_c = 1.4 \times 10^{-21}$ at 25°C

8) The equilibrium constant, K_c, for the following reaction is 6.44×10^5 at 230°C.

$$2\ NO(g) + O_2(g) \rightleftharpoons 2\ NO_2(g)$$

a. Calculate the equilibrium constant, K_c, for the reaction below at 230°C.

$$NO(g) + \tfrac{1}{2}\ O_2(g) \rightleftharpoons NO_2(g)$$

b. Calculate the equilibrium constant, K_c, for the reaction below at 230°C.

$$2\ NO_2(g) \rightleftharpoons 2\ NO(g) + O_2(g)$$

c. Calculate the equilibrium constant, K_c, for the reaction below at 230°C.

$$NO_2(g) \rightleftharpoons NO(g) + \tfrac{1}{2}\ O_2(g)$$

9) The equilibrium constant, K_p, for the following reaction is 1.3×10^{14} at 850°C.

$$C(s) + CO_2(g) \rightleftharpoons 2\ CO(g)$$

a. Calculate the equilibrium constant, K_p, for the reaction below at 850°C.

$$2\ C(s) + 2\ CO_2(g) \rightleftharpoons 4\ CO(g)$$

b. Calculate the equilibrium constant, K_p, for the reaction below at 850°C.

$$2\ CO(g) \rightleftharpoons C(s) + CO_2(g)$$

c. If the equilibrium constant, K_p, is 167 for $COCl_2(g) \rightleftharpoons CO(g) + Cl_2(g)$ at 850°C, find K_p for $COCl_{2(g)} \rightleftharpoons Cl_2(g) + \tfrac{1}{2}\ CO_2(g) + \tfrac{1}{2}\ C(s)$ at 850°C.

10) The equilibrium constant, K_c^{i}, is 3.2×10^{-34} for $2HCl(g) \rightleftharpoons H_2(g) + Cl_2(g)$ at 25°C. The equilibrium constant, K_c^{ii}, is 0.10 for $2\ ICl(g) \rightleftharpoons Cl_2(g) + I_2(g)$ at 25°C.

a. Calculate the equilibrium constant, K_c, for the reaction below at 25°C.

$$Cl_2(g) + I_2(g) \rightleftharpoons 2\ ICl(g)$$

b. Calculate the equilibrium constant, K_c, for the reaction below at 25°C.

$$2\ HCl(g) + I_2(g) \rightleftharpoons 2\ ICl(g) + H_2(g)$$

c. Calculate the equilibrium constant, K_c, for the reaction below at 25°C.

$$HCl(g) + \tfrac{1}{2}\ I_2(g) \rightleftharpoons ICl(g) + \tfrac{1}{2}\ H_2(g)$$

d. Calculate the equilibrium constant, K_c, for the reaction below at 25°C.

$$6\ HCl(g) + 3\ I_2(g) \rightleftharpoons 6\ ICl(g) + 3\ H_2(g)$$