Nitrogen and chorine react according to the following equation:

$N_2\,(g) + 3Cl_2\,(g) \rightleftharpoons 2NCl_3\,(g)$.

An analysis determines the following equilibrium concentrations: $[N_2]$: 1.4×10^{-3} M, $[Cl_2]$: 4.3×10^{-4} M, $[NCl_3]$: 1.9×10^{-1} M. Calculate K for the reaction, and include the units for K.

_____

2. Carbon dioxide decomposes at 2700 K to carbon monoxide and oxygen:

$2CO_2\,(g) \rightleftharpoons 2CO\,(g) + O_2\,(g)$

At this temperature, 6.00 mol of CO_2 is placed in a 2.00 L container and allowed to come to equilibrium. If at equilibrium 4.86 mol of CO_2 remains, what is K?

_____

3. Referring to the reaction in Question #6, $K = 2.00 \times 10^{-6}$ for the decomposition of CO_2 at a certain temperature. If 3.50 mol of CO_2 is initially placed into a 7.00 L chamber, calculate the equilibrium concentration of all three species. Use the concentration (ICE) table and apply the 5 % rule. Show mathematically your application of the 5 % rule.

_____

4. Would pressurizing the chamber help or hinder the reaction in Question #6? Explain.

_____

5. Hydrogen and iodine react to form hydrogen iodide in the following equation, which has K = 62.2 at a certain temperature:

$H_2\,(g) + I_2\,(g) \rightleftharpoons 2HI\,(g)$

Equimolar amounts of H_2 and I_2 (0.420 mol each) are put into a 2.00 L chamber and the reaction goes to equilibrium. In which direction must the reaction proceed? Use the ICE table and determine the equilibrium concentrations of the reactants and product.

_____

6. Referring to the reaction in Question #9, equimolar amounts of H_2 and HI (0.540 mol each) are put into a 2.00 L chamber and the reaction goes to equilibrium. In which direction must the reaction proceed? Use the ICE table and apply the 5 % rule. Then determine the equilibrium concentrations of the reactants and product. Show mathematically your application of the 5 % rule.

_____

7. The value of K for the following reaction is 3.07×10^{-4} at 24.0 deg C.

$2NOBr\ (g) \rightleftharpoons 2NO\ (g) + Br_2\ (g)$

What is the value of K_p for this reaction at this temperature?

_____

8. For the reaction in Question #11, the compounds are initially present in the following concentrations: [NOBr] = 0.0610 M, [NO] = 0.0151 M, and $[Br_2]$ = 0.0108 M. Is the reaction at equilibrium, or will it proceed to the right or to the left? Show your numerical comparison of Q and K.

_____

9. Phosphorus pentachloride decomposes at 190 deg C according to the following equation:

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

If the initial concentration of PCl_5 is 1.20 M, what is the concentration of chlorine gas at equilibrium? The equilibrium constant K = 0.0814 at this temperature. Show mathematically your application of the 5 % rule.

_____

10. The Equilibrium Constant. (Question 13.24)

For the reaction

$N_2(g) + 3Cl_2(g) \rightleftharpoons 2NCl_3(g)$

an analysis of an equilibrium mixture is performed at a certain temperature. It is found that $[NCl_3(g)] = 3.6$ ¡¿ 10^{-1} *M*, $[N_2(g)] = 1.4$ ¡¿ 10^{-3} *M* and $[Cl_2(g)] = 4.1$ ¡¿ 10^{-4} *M*. Calculate *K* for the reaction at this temperature.
(Type your answer using the format 8.050e-3 for 8.050 ¡¿ 10^{-3}.)

K = _____

11. **Equilibrium Calculations. (Question 13.44)**

At a certain temperature, 4.3 mol NH_3 is introduced into a 2.0-L container, and the NH_3 partially dissociates by the reaction

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

At equilibrium, 2.0 mol NH_3 remains. What is the value of *K* for this reaction?

K = _____

12. Equilibrium Calculations. (Question 13.46)

At a particular temperature, K = 1.00 ¡¿ 10^2 for the reaction

$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

In an experiment, 1.33 mol H_2, 1.33 mol I_2, and 1.33 mol HI are introduced into a 1.00-L container. Calculate the concentrations of all species when equilibrium is reached.

At equilibrium, [H_2] = _____ M, [I_2] = _____ M, and [HI] = _____ M

13. Equilibrium Calculations. (Question 13.48)

At 25 ¨¬C, K = 0.090 for the reaction

$H_2O(g) + Cl_2O(g) \rightleftharpoons 2HOCl(g)$

Calculate the concentrations of all species at equilibrium for each of the following cases.

a. 1.0 g H_2O and 2.0 g Cl_2O are mixed in a 1.0-L flask.

At equilibrium, [H_2O] = _____ M, [Cl_2O] = _____ M, and [HOCl] = _____ M

b. 1.1 mol pure HOCl is placed in a 2.0-L flask.

At equilibrium, [H_2O] = _____ M, [Cl_2O] = _____ M, and [HOCl] = _____ M

14. At a certain temperature, K = 2.6 ¡¿ 10^{-4} for the reaction

$FeSCN^{2+}(aq) \rightleftharpoons Fe^{3+}(aq) + SCN^-(aq)$

Calculate the concentrations of Fe^{3+}, SCN^-, and $FeSCN^{2+}$ in a solution that is initially 2.0 M $FeSCN^{2+}$.

[Fe^{3+}] = _____ M, [SCN^-] = _____ M, and [$FeSCN^{2+}$] = _____ M