

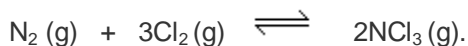
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Nitrogen and chlorine react according to the following equation:



An analysis determines the following equilibrium concentrations: $[\text{N}_2]$: 1.4×10^{-3} M, $[\text{Cl}_2]$: 4.3×10^{-4} M, $[\text{NCl}_3]$: 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:

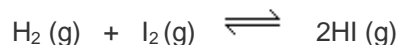


At this temperature, 6.00 mol of CO_2 is placed in a 2.00 L container and allowed to come to equilibrium. If at equilibrium 4.86 mol of CO_2 remains, what is K?

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.

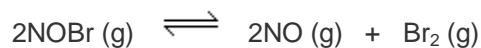
5. Hydrogen and iodine react to form hydrogen iodide in the following equation, which has $K = 62.2$ at a certain temperature:



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 .



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: $[\text{NOBr}] = 0.0610 \text{ M}$, $[\text{NO}] = 0.0151 \text{ M}$, and $[\text{Br}_2] = 0.0108 \text{ M}$. Is the reaction at equilibrium, or will it proceed to the right or to the left? Show your numerical comparison of Q and K .

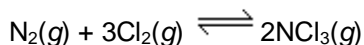
9. Phosphorus pentachloride decomposes at 190 deg C according to the following equation:



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

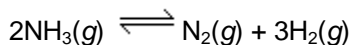


an analysis of an equilibrium mixture is performed at a certain temperature. It is found that $[\text{NCl}_3(\text{g})] = 3.6 \times 10^{-1} \text{ M}$, $[\text{N}_2(\text{g})] = 1.4 \times 10^{-3} \text{ M}$ and $[\text{Cl}_2(\text{g})] = 4.1 \times 10^{-4} \text{ M}$. Calculate K for the reaction at this temperature. (Type your answer using the format $8.050\text{e-}3$ 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

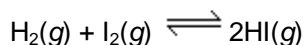


At equilibrium, 2.0 mol NH_3 remains. What is the value of K for this reaction?

$K =$ _____

12. Equilibrium Calculations. (Question 13.46)

At a particular temperature, $K = 1.00 \times 10^2$ for the reaction

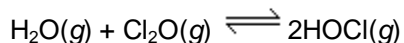


In an experiment, 1.33 mol H_2 , 1.33 mol I_2 , and 1.33 mol HI are introduced into a 1.00-L container. Calculate the concentrations of all species when equilibrium is reached.

At equilibrium, $[\text{H}_2] = \text{_____ } M$, $[\text{I}_2] = \text{_____ } M$, and $[\text{HI}] = \text{_____ } M$

13. Equilibrium Calculations. (Question 13.48)

At 25 °C, $K = 0.090$ for the reaction



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

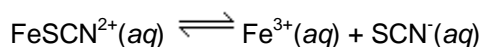
a. 1.0 g H_2O and 2.0 g Cl_2O are mixed in a 1.0-L flask.

At equilibrium, $[\text{H}_2\text{O}] = \text{_____ } M$, $[\text{Cl}_2\text{O}] = \text{_____ } M$, and $[\text{HOCl}] = \text{_____ } M$

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

At equilibrium, $[\text{H}_2\text{O}] = \text{_____ } M$, $[\text{Cl}_2\text{O}] = \text{_____ } M$, and $[\text{HOCl}] = \text{_____ } M$

14. At a certain temperature, $K = 2.6 \times 10^{-4}$ for the reaction



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

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