

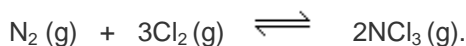
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Chemistry\_Questions\_0005

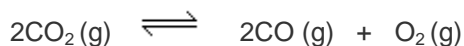
Nitrogen and chlorine react according to the following equation:



An analysis determines the following equilibrium concentrations:  $[\text{N}_2]$ :  $1.4 \times 10^{-3}$  M,  $[\text{Cl}_2]$ :  $4.3 \times 10^{-4}$  M,  $[\text{NCl}_3]$ :  $1.9 \times 10^{-1}$  M. Calculate K for the reaction, and include the units for K.

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



At this temperature, 6.00 mol of  $\text{CO}_2$  is placed in a 2.00 L container and allowed to come to equilibrium. If at equilibrium 4.86 mol of  $\text{CO}_2$  remains, what is K?

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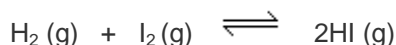
3. Referring to the reaction in Question #6,  $K = 2.00 \times 10^{-6}$  for the decomposition of  $\text{CO}_2$  at a certain temperature. If 3.50 mol of  $\text{CO}_2$  is initially placed into a 7.00 L chamber, calculate the equilibrium concentration of all three species. Use the concentration (ICE) table and apply the 5 % rule. Show mathematically your application of the 5 % rule.

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

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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  $\text{H}_2$  and  $\text{I}_2$  (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.

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6. Referring to the reaction in Question #9, equimolar amounts of  $\text{H}_2$  and  $\text{HI}$  (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.

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



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

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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  $K$ .

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9. Phosphorus pentachloride decomposes at  $190 \text{ deg C}$  according to the following equation:

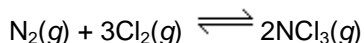


If the initial concentration of  $\text{PCl}_5$  is  $1.20 \text{ M}$ , what is the concentration of chlorine gas at equilibrium? The equilibrium constant  $K = 0.0814$  at this temperature. Show mathematically your application of the 5 % rule.

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### 10. The Equilibrium Constant. (Question 13.24)

For the reaction

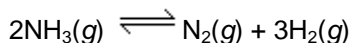


an analysis of an equilibrium mixture is performed at a certain temperature. It is found that  $[\text{NCl}_3 \text{(g)}] = 3.6 \times 10^{-1} \text{ M}$ ,  $[\text{N}_2 \text{(g)}] = 1.4 \times 10^{-3} \text{ M}$  and  $[\text{Cl}_2 \text{(g)}] = 4.1 \times 10^{-4} \text{ M}$ . Calculate  $K$  for the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

$K =$  \_\_\_\_\_

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

At a certain temperature,  $4.3 \text{ mol NH}_3$  is introduced into a  $2.0\text{-L}$  container, and the  $\text{NH}_3$  partially dissociates by the reaction

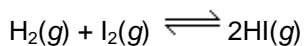


At equilibrium,  $2.0 \text{ mol NH}_3$  remains. What is the value of  $K$  for this reaction?

$K =$  \_\_\_\_\_

### 12. Equilibrium Calculations. (Question 13.46)

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

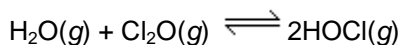


In an experiment, 1.33 mol  $\text{H}_2$ , 1.33 mol  $\text{I}_2$ , and 1.33 mol  $\text{HI}$  are introduced into a 1.00-L container. Calculate the concentrations of all species when equilibrium is reached.

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.

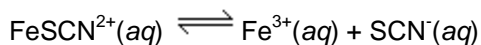
a. 1.0 g  $\text{H}_2\text{O}$  and 2.0 g  $\text{Cl}_2\text{O}$  are mixed in a 1.0-L flask.

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  $\text{HOCl}$  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  $\text{Fe}^{3+}$ ,  $\text{SCN}^-$ , and  $\text{FeSCN}^{2+}$  in a solution that is initially 2.0 M  $\text{FeSCN}^{2+}$ .

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