

Advanced Chemistry
Chapter 13 Test: Equilibrium

Multiple Choice: Circle the best answer.

1. When a reaction has reached equilibrium:
 - a. The molecules are in a passive state, therefore no more products are formed.
 - b. The products are reacting, while the reactants are passive.
 - c. The reactants are reacting, while the products are passive.
 - d. Both reactants and products are formed continuously.

2. Which of the following is true for a system whose equilibrium constant is relatively small?
 - a. It will take a short time to reach equilibrium
 - b. It will take a long time to reach equilibrium
 - c. The equilibrium lies to the left
 - d. The equilibrium lies to the right.
 - e. Two of these are correct.

3. The reaction quotient for a system is 7.2×10^{-2} . If the equilibrium constant for the system is 36, what will happen as equilibrium is approached?
 - a. There will be a net gain in product.
 - b. There will be a net gain in reactant.
 - c. There will be a net gain in both product and reactant.
 - d. There will be a no net gain either product or reactant.
 - e. The equilibrium constant will decrease until it equals the reaction quotient.

4. Which of the following statements is true?
 - a. When two opposing processes are proceeding at identical rates, the system is at equilibrium.
 - b. Catalysts are an effective means of changing the position of equilibrium.
 - c. The concentration of the products equals that of reactants and is constant at equilibrium.
 - d. An endothermic reaction shifts toward reactants when heat is added to the reaction.
 - e. None of the above statements is true.

5. Consider the chemical system:
$$\text{CO} + \text{Cl}_2 \leftrightarrow \text{COCl}_2 ; K = 4.6 \times 10^9 \text{ L/mol.}$$
How do the equilibrium concentrations of the reactants compare to the equilibrium concentration of the products?
 - a. They are much smaller.
 - b. They are much bigger.
 - c. They are about the same.
 - d. They have to be exactly equal.
 - e. You can't tell from the information given.

6. Consider the following system at equilibrium:



Which of the following changes will shift the equilibrium to the right?

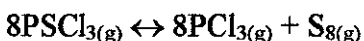
- I. increasing the temperature
- II. decreasing the temperature
- III. increasing the volume
- IV. decreasing the volume
- V. removing some NH_3
- VI. adding some NH_3
- VII. removing some N_2
- VIII. adding some N_2

- a. I, IV, VI, VII
- b. II, III, V, VIII
- c. I, VI, VIII
- d. I, III, V, VII
- e. I, IV, V, VIII

7. For a certain reaction, $Q = 2.33$, while $K = 3.54$. What do you expect to happen?

- a. The reaction will proceed forward.
- b. The reaction will proceed backward.
- c. The reaction will proceed away from equilibrium.
- d. The direction cannot be determined.

8. At equilibrium, $[\text{PSCl}_3] = 1.00 \text{ M}$, $[\text{PCl}_3] = 7.8 \times 10^{-4} \text{ M}$, while $K = 1.3 \times 10^{-29}$. Calculate $[\text{S}_8]$.



- a. 1.00M
- b. $1.6 \text{ E } -26 \text{ M}$
- c. $9.5 \text{ E } -5 \text{ M}$
- d. 94.88 M

9. For a certain reaction at 25.0°C , the value of K is 1.3×10^{-3} . At 50.0°C the value of K is 3.4×10^{-1} . This means the reaction is

- a. Exothermic
- b. Endothermic
- c. More information is needed

10. Consider the gaseous reaction $\text{CO}(\text{g}) + \text{Cl}_2(\text{g}) \leftrightarrow \text{COCl}_2(\text{g})$.

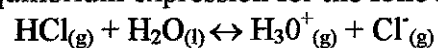
What is the expression for K_p in terms of K ?

- a. $K(\text{RT})$
- b. $K/(\text{RT})$
- c. $K(\text{RT})^2$
- d. $K/(\text{RT})^2$
- e. $1.K(\text{RT})$

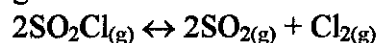
Name: _____ Date: _____

Part II. Problem Solving

11. Write the equilibrium expression for the following reaction:



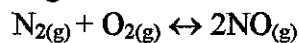
12. Given the following reaction at 25°C:



a. Write the equilibrium expression for the reaction above

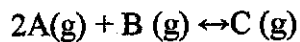
b. Calculate the equilibrium constant if the equilibrium concentrations are $[\text{SO}_2\text{Cl}] = 0.037 \text{ M}$, $[\text{SO}_2] = 0.591 \text{ M}$, $[\text{Cl}_2] = 1.24 \text{ M}$.

13. Calculate K_p given the following information:



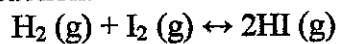
A 1.00 L vessel at 273 K contains 0.0290 moles of nitrogen gas, 0.00290 moles of oxygen gas, and 1.92 micromoles of nitrogen oxide at equilibrium.

14. For the following reaction, 3.00 moles of A and 4.00 moles of B are placed in 5.00 L container. The value of K is 0.90.



If 3.0 moles of A and 4.00 moles of B had been placed in a 2.5 L container at the same temperature the equilibrium constant would be?

15. Consider the reaction:



has $K_p = 45.9$ at 763 K. A particular equilibrium mixture at that temperature contains gaseous HI at a partial pressure of 4.00 atm and hydrogen at 0.200 atm. What is the partial pressure of I_2 ?

16. According to the graph below, what chemical was added to the equilibrium mixture and how did the system respond?

