

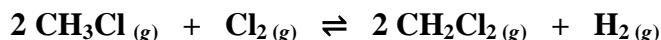


## INTRODUCTION TO CHEMISTRY (CHEM 101)

### Assessment on Chapter 05 - Topic 16

---

1. Express the equilibrium constant for the following reaction.



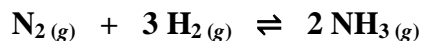
a.  $K = \frac{[\text{CH}_2\text{Cl}_2] \cdot [\text{H}_2]}{[\text{CH}_3\text{Cl}] \cdot [\text{Cl}_2]}$

b.  $K = \frac{[\text{CH}_2\text{Cl}_2]^2 [\text{H}_2]}{[\text{CH}_3\text{Cl}]^2 [\text{Cl}_2]}$

c.  $K = \frac{[\text{CH}_3\text{Cl}]^2 [\text{Cl}_2]}{[\text{CH}_2\text{Cl}_2]^2 [\text{H}_2]}$

d.  $K = \frac{[\text{CH}_2\text{Cl}_2]^2 [\text{H}_2]}{[\text{CH}_3\text{Cl}] [\text{Cl}_2]}$

2 Express the equilibrium constant for the following reaction.



a.  $K = \frac{[\text{NH}_3]^{1/2}}{[\text{N}_2] \cdot [\text{H}_2]^{1/3}}$

b.  $K = \frac{[\text{NH}_3]}{[\text{N}_2] \cdot [\text{H}_2]}$

c.  $K = \frac{[\text{NH}_3]^2}{[\text{N}_2] \cdot [\text{H}_2]^3}$

d.  $K = \frac{[\text{N}_2] \cdot [\text{H}_2]^3}{[\text{NH}_3]^2}$

3. Which of the following is the correct expression for the equilibrium constant?

a.  $K_c = \frac{[\text{Reactants}]}{[\text{Products}]}$

b.  $K_c = [\text{Reactants}] \times [\text{Products}]$

c.  $K_c = \frac{[\text{Products}]}{[\text{Reactants}]}$

d.  $K_c = [\text{Reactants}] + [\text{Products}]$

4. If  $K_c \ll 1$ , the reverse reaction is favored.

a. True

b. False

5. A chemical system is considered to have reached dynamic equilibrium when .....

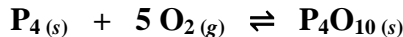
a. the amount of the products equals the amount of the reactants.

b. all of reactants have been converted to products.

c. the sum of the concentrations of the reactant species is equal to the sum of the concentrations of the product species.

d. the rate of the forward reaction is equal to the rate of the reverse reaction.

6. Express the equilibrium constant for the following reaction.



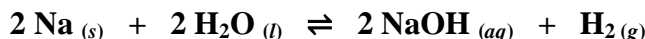
a.  $K_{\text{eq}} = \frac{[\text{P}_4] \cdot [\text{O}_2]^5}{[\text{P}_4\text{O}_{10}]}$

b.  $K_{\text{eq}} = \frac{[\text{P}_4\text{O}_{10}]}{[\text{P}_4] \cdot [\text{O}_2]^5}$

c.  $K_{\text{eq}} = [\text{O}_2]^{-5}$

d.  $K_{\text{eq}} = [\text{O}_2]^5$

7. Express the equilibrium constant for the following reaction.



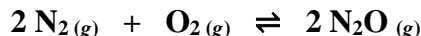
a.  $K_{\text{eq}} = \frac{[\text{NaOH}]^2 [\text{H}_2]}{[\text{Na}]^2 [\text{H}_2\text{O}]^2}$

b.  $K_{\text{eq}} = [\text{H}_2][\text{NaOH}]^{-2}$

c.  $K_{\text{eq}} = \frac{[\text{Na}]^2 [\text{H}_2\text{O}]^2}{[\text{NaOH}]^2 [\text{H}_2]}$

d.  $K_{\text{eq}} = [\text{H}_2][\text{NaOH}]^2$

8. Determine the value of  $K_c$  for the following reaction if the equilibrium concentrations are as follows:  $[\text{N}_2]_{\text{eq}} = 3.6 \text{ M}$ ;  $[\text{O}_2]_{\text{eq}} = 4.1 \text{ M}$ ;  $[\text{N}_2\text{O}]_{\text{eq}} = 3.3 \times 10^{-18} \text{ M}$



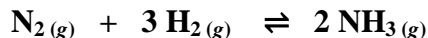
a.  $2.2 \times 10^{-19}$

b.  $4.5 \times 10^{18}$

c.  $2.0 \times 10^{-37}$

d.  $5.0 \times 10^{36}$

9. Determine the value of  $K_c$  for the following reaction, if the equilibrium concentrations are as follows:  $[\text{N}_2]_{\text{eq}} = 1.5 \text{ M}$ ;  $[\text{H}_2]_{\text{eq}} = 1.1 \text{ M}$ ;  $[\text{NH}_3]_{\text{eq}} = 0.47 \text{ M}$



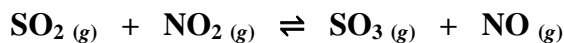
a. 3.5

b. 0.28

c. 9.1

d. 0.11

10. Consider the following reaction at equilibrium. What effect will adding more  $\text{SO}_3$  have on the system?



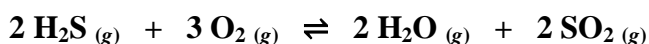
a. The reaction will shift in the direction of products.

b. The reaction will shift to decrease the pressure.

c. No change will occur since  $\text{SO}_3$  is not included in the equilibrium expression.

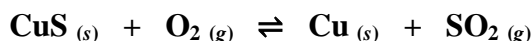
d. The reaction will shift in the direction of reactants.

11. Consider the following reaction at equilibrium. What effect will adding more H<sub>2</sub>S have on the system?



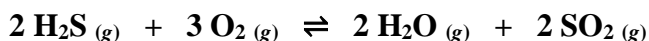
- a. The reaction will shift to the left.
- b. No change will be observed.
- c. The equilibrium constant will increase.
- d. The reaction will shift in the direction of products.

12. Consider the following reaction at equilibrium. What effect will reducing the volume of the reaction mixture have on the system?



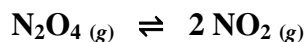
- a. The equilibrium constant will decrease.
- b. No effect will be observed.
- c. The reaction will shift to the right in the direction of the product.
- d. The equilibrium constant will increase.

13. Consider the following reaction at equilibrium. What effect will increasing the volume of the reaction mixture have on the system?



- a. The reaction will shift to the right in the direction of products.
- b. No effect will be observed.
- c. The reaction will shift to the left in the direction of reactants.
- d. The equilibrium constant will decrease.

14. What will happen to the following endothermic reaction in equilibrium if the temperature is raised?



- a. More NO<sub>2</sub> will be produced.
- b. Less NO<sub>2</sub> will be produced.
- c. More N<sub>2</sub>O<sub>4</sub> will be produced.
- d. There will be no change in concentrations.



INTRODUCTION TO CHEMISTRY (CHEM 101)

Assessment on Chapter 05 - Topic 17

---

1. Which of the following compounds is the weakest acid?

- a. HBr                       b. HCl                       c. HF                       d. HI

2. According to Arrhenius definition, an acid is a substance that produces ..... in water.

- a. NaCl                       b.  $\text{H}_2\text{O}^+$                        c.  $\text{H}^+$  or  $\text{H}_3\text{O}^+$                        d.  $\text{OH}^-$

3. One of the following acids is a diprotic acid

- a.  $\text{HNO}_3$                        b.  $\text{HClO}_4$                        c.  $\text{H}_2\text{SO}_3$                        d.  $\text{H}_3\text{PO}_4$

4. What is the conjugate acid of  $\text{HCO}_3^-$ ?

- a.  $\text{H}_3\text{O}^+$                        b.  $\text{H}_2\text{O}$                        c.  $\text{CO}_3^{2-}$                        d.  $\text{OH}^-$                        e.  $\text{H}_2\text{CO}_3$

5. What is the conjugate base of  $\text{H}_2\text{PO}_4^-$ ?

- a.  $\text{HPO}_4^{2-}$                        b.  $\text{PO}_4^{3-}$                        c.  $\text{H}_3\text{PO}_4$                        d.  $\text{H}_3\text{O}^+$                        e.  $\text{OH}^-$

6. Which of the following is NOT a conjugate acid-base pair?

- a.  $\text{NH}_4^+ / \text{NH}_3$                        b.  $\text{H}_3\text{O}^+ / \text{OH}^-$   
 c.  $\text{H}_2\text{SO}_3 / \text{HSO}_3^-$                        d.  $\text{HC}_2\text{H}_3\text{O}_2 / \text{C}_2\text{H}_3\text{O}_2^-$   
 e. All of them

7. Which pair is NOT a conjugate acid-base pair?

- a.  $(\text{CH}_3)_3\text{NH}^+ / (\text{CH}_3)_3\text{N}$                        b.  $\text{H}_2\text{SO}_4 / \text{H}_2\text{SO}_3$   
 c.  $\text{HNO}_2 / \text{NO}_2^-$                        d.  $\text{H}_3\text{O}^+ / \text{H}_2\text{O}$

8. Identify a triprotic acid.

- a.  $\text{CH}_3\text{COOH}$                        b.  $\text{H}_3\text{PO}_4$                        c.  $\text{H}_2\text{SO}_3$                        d.  $\text{HClO}_4$                        e.  $\text{H}_2\text{SO}_4$

9. Calculate the pH of a solution that contains  $3.9 \times 10^{-4} \text{ M H}_3\text{O}^+$  at  $25^\circ\text{C}$ .

- a. 4.59       b. 3.41       c. 10.59       d. 9.41       e. 0.59

10. Calculate the pH of a solution that contains  $2.4 \times 10^{-5} \text{ M H}_3\text{O}^+$  at  $25^\circ\text{C}$ .

- a. 2.40       b. 9.38       c. 4.62       d. 11.60       e. 4.17

11. Calculate the hydronium ion concentration in an aqueous solution with a pH of 9.85 at  $25^\circ\text{C}$ .

- a.  $7.1 \times 10^{-5} \text{ M}$        b.  $4.2 \times 10^{-10} \text{ M}$        c.  $8.7 \times 10^{-10} \text{ M}$        d.  $6.5 \times 10^{-5} \text{ M}$        e.  $1.4 \times 10^{-10} \text{ M}$

12. Calculate the pH of a solution that contains  $7.8 \times 10^{-6} \text{ M OH}^-$  at  $25^\circ\text{C}$ .

- a. 1.28       b. 5.11       c. 12.72       d. 8.89       e. 9.64

13. Calculate the pH for an aqueous solution of acetic acid that contains  $2.15 \times 10^{-3} \text{ M H}_3\text{O}^+$ .

- a.  $4.65 \times 10^{-12} \text{ M}$        b.  $2.15 \times 10^{-3} \text{ M}$        c. 2.67       d. 11.33

14. Calculate the pH for an aqueous solution of pyridine that contains  $2.15 \times 10^{-4} \text{ M}$  hydroxide ion.

- a.  $4.65 \times 10^{-11}$        b.  $2.15 \times 10^{-4}$        c. 3.67       d. 10.33

15. What is the hydronium ion concentration of an acid rain sample that has a pH of 3.45?

- a.  $2.82 \times 10^{-11} \text{ M}$        b.  $3.55 \times 10^{-4} \text{ M}$        c. 3.45 M       d. 10.55 M

16. What is the hydroxide ion concentration of a lye solution that has a pH of 9.20?

- a.  $6.31 \times 10^{-10} \text{ M}$        b.  $1.58 \times 10^{-5} \text{ M}$        c. 4.80 M       d. 9.20 M

17. A Lewis base is .....

- a. an electron pair donor.       b. an electron pair acceptor.  
 c. a proton donor.       d. proton acceptor.