

CHAPTER 6

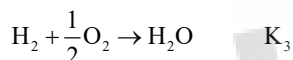
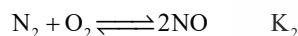
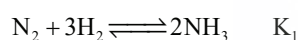
Equilibrium

Law of Chemical Equilibrium, Equilibrium Const. and Its Application

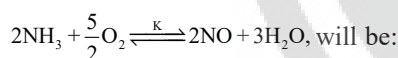
1. $3\text{O}_2(\text{g}) \rightleftharpoons 2\text{O}_3(\text{g})$ for the given reaction at 298 K, K_c is found to be 3.0×10^{-59} . If the concentration of O_2 at equilibrium is 0.040 M, then concentration of O_3 in M is: (2022)

- a. 1.2×10^{21} b. 4.38×10^{-32}
c. 1.9×10^{-63} d. 2.4×10^{31}

2. The equilibrium constants of the following are:

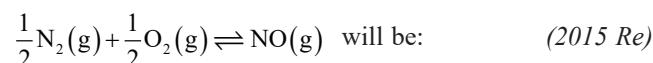


The equilibrium constant (K) of the reaction: (2017-Delhi)



- a. $K_2^3 K_3 / K_1$ b. $K_1 K_3^3 / K_2$
c. $K_1 K_3^3 / K$ d. $K_2 K_3 / K_1$

3. If the equilibrium constant for



- a. K^2 b. $K^{1/2}$
c. $\frac{1}{2}K$ d. K

4. If the value of an equilibrium constant for a particular reaction is 1.6×10^{12} , then at equilibrium the system will contain: (2015)

- a. Mostly reactants
b. Mostly products
c. Similar amounts of reactants and products
d. All reactants

Relation Between K, Q and G, Factors Affecting Equilibria

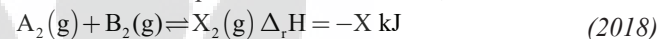
5. Hydrolysis of sucrose is given by the following reaction:



If the equilibrium constant (K_c) is 2×10^{13} at 300 K, the value of $\Delta_r G^\circ$ at the same temperature will be : (2020)

- a. $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (2 \times 10^{13})$
b. $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (3 \times 10^{13})$
c. $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (4 \times 10^{13})$
d. $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (2 \times 10^{13})$

6. Which one of the following conditions will favour maximum formation of the product in the reaction,



- a. Low temperature and high pressure
b. Low temperature and low pressure
c. High temperature and low pressure
d. High temperature and high pressure

7. Which one of the following statements is not correct? (2017-Delhi)

- a. Coenzymes increase the catalytic activity of enzyme
b. Catalyst does not initiate any reaction
c. The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium
d. Enzymes catalyse mainly bio-chemical reactions

8. A 20 litre container at 400 K contains $\text{CO}_2(\text{g})$ at pressure 0.4 atm and an excess of SrO (neglect the volume of solid SrO). The volume of the containers is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be: (2017-Delhi)



- a. 2 litre b. 5 litre
c. 10 litre d. 4 litre

9. Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3 . If a larger amount of KHSO_4 is added to the mixture, the rate of nitration will be: (2016-I)

- a. Doubled b. Increase
c. Decrease d. Unchanged



10. Which of the following statements is correct for a reversible process in a state of equilibrium? (2015)
 a. $\Delta G^\circ = -2.303 RT \log K$ b. $\Delta G^\circ = 2.303 RT \log K$
 c. $\Delta G = -2.303 RT \log K$ d. $\Delta G = 2.303 RT \log K$
11. For a given exothermic reaction, K_p and K'_p are the equilibrium constants at temperature T_1 and T_2 , respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2 , it is readily observed that (2014)
 a. $K_p > K'_p$ b. $K_p < K'_p$
 c. $K_p = K'_p$ d. $K_p = \frac{1}{K'_p}$
12. For the reversible reaction,
 $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{Heat}$. The equilibrium shifts in forward direction: (2014)
 a. By decreasing the pressure
 b. By decreasing the concentrations of $N_2(g)$ and $H_2(g)$
 c. By increasing pressure and decreasing temperature
 d. By increasing the concentration of $NH_3(g)$
13. $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction:
 $3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$
 The reaction can go to completion by removing OH^- ions by adding: (2013)
 a. HCl b. KOH
 c. CO_2 d. SO_2
14. Conjugate base for Bronsted acids H_2O and HF are: (2019)
 a. OH^- and H_2F^+ , respectively
 b. H_3O^+ and F^- , respectively
 c. OH^- and F^- , respectively
 d. H_3O^+ and H_2F^+ , respectively
15. Which of the following fluoro-compounds is most likely to behave as a Lewis base? (2016-II)
 a. CF_4 b. SiF_4
 c. BF_3 d. PF_3
16. Which of these is least likely to act as a Lewis base? (2013)
 a. CO b. F^-
 c. BF_3 d. PF_3
18. Which among the following salt solutions is basic in nature? (2020-Covid)
 a. Ammonium sulphate b. Ammonium nitrate
 c. Sodium acetate d. Ammonium chloride
19. Following solutions were prepared by mixing different volumes of $NaOH$ and HCl of different concentrations: (2018)
 A. $60 \text{ mL } \frac{M}{10} HCl + 40 \text{ mL } \frac{M}{10} NaOH$
 B. $55 \text{ mL } \frac{M}{10} HCl + 45 \text{ mL } \frac{M}{10} NaOH$
 C. $75 \text{ mL } \frac{M}{5} HCl + 25 \text{ mL } \frac{M}{5} NaOH$
 D. $100 \text{ mL } \frac{M}{10} HCl + 100 \text{ mL } \frac{M}{10} NaOH$
 pH of which one of them will be equal to 1?
 a. B b. A
 c. C d. D
20. The percentage of pyridine (C_5H_5N) that forms pyrimidine ion ($C_5H_5N^+H$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is: (2016-II)
 a. 0.77% b. 1.6%
 c. 0.0060% d. 0.013%
21. What is the pH of the resulting solution when equal volumes of $0.1 \text{ M } NaOH$ and $0.01 \text{ M } HCl$ are mixed? (2015 Re)
 a. 2.0 b. 7.0
 c. 1.04 d. 12.65
22. Aqueous solution of which of the following compounds is the best conductor of electric current? (2015 Re)
 a. Hydrochloric acid, HCl b. Ammonia, NH_3
 c. Fructose, $C_6H_{12}O_6$ d. Acetic acid, $C_2H_4O_2$
23. Which of the following salts will give highest pH in water? (2014)
 a. $NaCl$ b. Na_2CO_3
 c. $CuSO_4$ d. KCl

Acids, Bases and Salts

Ionization of Acids & Bases, pH Scale, Hydrolysis

Buffer Solutions

17. The pK_b of dimethylamine and pK_a of acetic acid are 3.27 and 4.77 respectively at $T(K)$. The correct option for the pH of dimethylammonium acetate solution is: (2021)
 a. 5.50 b. 7.75
 c. 6.25 d. 8.50
24. The pH of the solution containing 50 mL each of 0.10 M sodium acetate and 0.01 M acetic acid is (2022)
 [Given pK_a of $CH_3COOH = 4.57$]
 a. 2.57 b. 5.57
 c. 3.57 d. 4.57
25. Which will make basic buffer? (2019)
 a. 50 mL of $0.1 \text{ M } NaOH + 25 \text{ mL}$ of $0.1 \text{ M } CH_3COOH$
 b. 100 mL of $0.1 \text{ M } CH_3COOH + 100 \text{ mL}$ of $0.1 \text{ M } NaOH$
 c. 100 mL of $0.1 \text{ M } HCl + 200 \text{ mL}$ of $0.1 \text{ M } NH_4OH$
 d. 100 mL of $0.1 \text{ M } HCl + 100 \text{ mL}$ of $0.1 \text{ M } NaOH$
26. Which one of the following pairs of solution is not an acidic buffer? (2015 Re)
 a. H_3PO_4 and Na_3PO_4
 b. $HClO_4$ and $NaClO_4$
 c. CH_3COOH and CH_3COONa
 d. H_2CO_3 and Na_2CO_3

a. $\text{Na}_2\text{S} > \text{CuS} > \text{ZnS}$
b. $\text{Na}_2\text{S} > \text{ZnS} > \text{CuS}$
c. $\text{CuS} > \text{ZnS} > \text{Na}_2\text{S}$
d. $\text{ZnS} > \text{Na}_2\text{S} > \text{CuS}$

[illegible]