

## CHEMICAL EQUILLIBRIUM

- The equilibrium constant for a reaction is  $10^{+22}$  at 300K, the standard free energy change for this reaction is  
 (A)  $-115 \text{ kJ}$  (B)  $+115 \text{ kJ}$   
 (C)  $166 \text{ kJ}$  (D)  $-166 \text{ kJ}$
- The normal vapour density of  $\text{PCl}_5$  is 104.25. At  $250^\circ\text{C}$ , its vapour density is 57.9. The degree of dissociation of  $\text{PCl}_5$  at this temperature will be  
 (A) 40% (B) 60%  
 (C) 80% (D) 90%
- For the reactions,  
 $\text{A} \rightleftharpoons \text{B}; K_c = 2$ ,  $\text{B} \rightleftharpoons \text{C}; K_c = 4$ ,  $\text{C} \rightleftharpoons \text{D}; K_c = 4$   
 $K_c$  for the reaction  $\text{A} \rightleftharpoons \text{D}$  is  
 (A)  $2 + 4 + 6$  (B)  $\frac{2 \times 4}{6}$   
 (C)  $\frac{4 \times 6}{2}$  (D)  $2 \times 4 \times 4$
- The equilibrium constant for the reaction. The reaction is  $\text{Br}_2 \rightleftharpoons 2\text{Br}^-$  at 500K and 700K are  $10^{-10}$  and  $10^{-5}$  respectively. Hence the reaction is  
 (A) Endothermic (B) Exothermic  
 (C) Fast (D) Slow
- If pressure is applied to the liquid vapour equilibria  
 $\text{liquid} \rightleftharpoons \text{vapour}$   
 the boiling point of the liquid  
 (A) will decrease (B) will increase  
 (C) many increase or decrease (D) will not change
- $K_p/K_c$  of the reaction  
 $\text{CO}_{(g)} + \frac{1}{2}\text{O}_{2(g)} \rightleftharpoons \text{CO}_{2(g)}$

- (A)  $RT$  (B)  $\frac{1}{\sqrt{RT}}$   
 (C)  $\sqrt{RT}$  (D) 1

7. For a system  $A_{(g)} + B_{(g)} \rightleftharpoons C_{(g)}$   
 eqm. conc. 0.06 0.12 0.216

The value of  $K_c$  is

- (A) 250 (B) 416  
 (C) 30 (D) 125

8. On applying pressure to the equilibrium,  $\text{Ice} \rightleftharpoons \text{water}$

Which phenomenon will happen

- (A) More ice will be formed (B) More water will be formed  
 (C) Equilibrium will not be disturbed  
 (D) Water will evaporate

9. Densities of diamond and graphite are 3.5 and 2.3 grams respectively.

Increase of pressure on the equilibrium  $C_{\text{diamond}} \rightleftharpoons C_{\text{graphite}}$

- (A) Favours backward reaction (B) Favours forward reaction  
 (C) Have no effect (D) Increase the reaction rate

10. The decomposition of  $N_2O_4$  into  $NO_2$  is carried out at 280 K in chloroform. When equilibrium has been established, 0.2 moles of  $N_2O_4$  and  $2 \times 10^{-3}$  moles of  $NO_2$  are present in 2 litre of the solution. The equilibrium constant for the reaction,  $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ , is

- (A)  $1 \times 10^{-2}$  (B)  $2 \times 10^{-3}$   
 (C)  $1 \times 10^{-5}$  (D)  $2 \times 10^{-5}$

11. One mole of  $N_2O_{4(g)}$  at 300K is kept in a closed container under one atm. It is heated to 600K when 20% by mass of  $N_2O_{4(g)}$  decomposes to  $NO_{2(g)}$ . The resultant pressure is

- (A) 1.2 atm (B) 2.4 atm  
 (C) 2.0 atm (D) 1.0 atm

12. At 30°C,  $K_p$  for the dissociation reaction

$\text{SO}_2\text{Cl}_{2(g)} \rightleftharpoons \text{SO}_{2(g)} + \text{Cl}_{2(g)}$  is  $2.9 \times 10^{-2}$  atm. If the total pressure is 1 atm, the degree of dissociation of  $\text{SO}_2\text{Cl}_2$  is

- (A) 87% (B) 13%  
(C) 17% (D) 29%

13. A vessel at 1000K contains  $\text{CO}_2$  with a pressure of 0.5 atm. Some of the  $\text{CO}_2$  is converted into CO on the addition of graphite. The value of K if the total pressure at equilibrium is 0.8 atm is

- (A) 1.8 atm (B) 3 atm  
(C) 0.3 atm (D) 0.18 atm

14. Vapour density of  $\text{PCl}_5$  is 104.16 but when heated at  $230^\circ\text{C}$  its vapour density is reduced to 62. The degree of dissociation of  $\text{PCl}_5$  at this temperature will be

- (A) 6.8% (B) 68%  
(C) 46% (D) 64%

15. For the reaction  $\text{SO}_2(g) + \frac{1}{2}\text{O}_2(g) \rightleftharpoons \text{SO}_3(g)$   $K_p = 1.7 \times 10^{12}$  at  $20^\circ\text{C}$  and 1 atm pressure. Calculate  $K_c$ .

- (A)  $1.7 \times 10^{12}$  (B)  $0.7 \times 10^{12}$   
(C)  $8.40 \times 10^{12}$  (D)  $1.2 \times 10^{12}$

16. For a gaseous equilibrium

$2\text{A}(g) \rightleftharpoons 2\text{B}(g) + \text{C}(g)$ ,  $K_p$  has a value 1.8 at 700K. What is the value of  $K_c$  for the equilibrium  $2\text{B}(g) + \text{C}(g) \rightleftharpoons 2\text{A}$  at that temperature

- (A)  $\approx 0.031$  (B)  $\approx 32$   
(C)  $\approx 44.4$  (D)  $\approx 1.3 \times 10^{-3}$

17. For the reaction  $\text{N}_2\text{O}_4(g) \rightleftharpoons 2\text{NO}_2(g)$  the reaction connecting the degree of dissociation ( $\alpha$ ) of  $\text{N}_2\text{O}_4(g)$  with its equilibrium constant  $K_p$  is

- (A)  $\alpha = \frac{K_p/P}{4 + K_p/P}$  (B)  $\alpha = \frac{K_p}{4 + K_p}$   
(C)  $\alpha = \left[ \frac{K_p/P}{4 + K_p/P} \right]^{1/2}$  (D)  $\alpha = \left[ \frac{K_p}{4 + K_p} \right]^{1/2}$

18. In a closed container at 1 atm pressure 2 moles of  $\text{SO}_2(g)$  and 1 mole of  $\text{O}_2(g)$  were allowed to react to form  $\text{SO}_3(g)$  under the influence of a catalyst. Reaction

$2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$  occurred. At equilibrium it was found that 50% of  $\text{SO}_2(\text{g})$  was converted to  $\text{SO}_3(\text{g})$ . The partial pressure of  $\text{O}_2(\text{g})$  at equilibrium will be

- (A) 0.66 atm (B) 0.493 atm  
 (C) 0.33 atm (D) 0.20 atm

**19.**  $K_p$  for a reaction at  $25^\circ\text{C}$  is 10 atm. The activation energy for forward and reverse reactions are 12 and 20 kJ / mol respectively. The  $K_c$  for the reaction at  $40^\circ\text{C}$  will be

- (A)  $4.33 \times 10^{-1} \text{ M}$  (B)  $3.33 \times 10^{-2} \text{ M}$   
 (C)  $3.33 \times 10^{-1} \text{ M}$  (D)  $4.33 \times 10^{-2} \text{ M}$

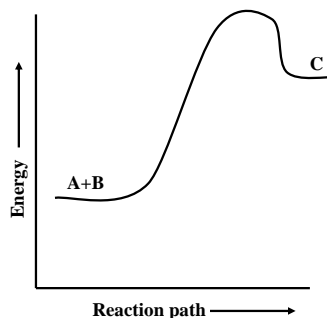
**20.** The energy profile for the reaction:



is shown as:

The equilibrium constant for the said equilibrium

- (A) increases with the increase in temperature  
 (B) decrease with the increase in temperature  
 (C) does not change with the change in temperature  
 (C) is equal to the rate constant of the forward reaction



- |              |              |              |     |
|--------------|--------------|--------------|-----|
| 1. <b>A</b>  | 2. <b>C</b>  | 3. <b>D</b>  |     |
| 4. <b>A</b>  | 5. <b>B</b>  | 6. <b>B</b>  |     |
| 7. <b>C</b>  | 8. <b>B</b>  | 9. <b>A</b>  |     |
| 10. <b>C</b> | 11. <b>B</b> | 12. <b>C</b> | 13. |
| <b>A</b> 14. | <b>B</b> 15. | <b>C</b>     |     |
| 16. <b>B</b> | 17. <b>C</b> | 18. <b>D</b> |     |
| 19. <b>C</b> | 20. <b>A</b> |              |     |

## IONIC EQUILLIBRIUM

- An acid type indicator, HIn, differs in colour form its conjugate base ( $\text{In}^-$ ). The human eye is sensitive to colour difference only when the ratio  $[\text{In}^-]/[\text{HIn}]$  is greater than 10 or smaller than 0.1.. What should be the minimum change in the pH of the solution to observe a complete colour change ( $K_{\text{in}} = 1.0 \times 10^{-5}$ )?
 

(A) 4	(B) 2
(C) 6	(D) 1
- Which of the following mixture will be a buffer solution when dissolved in 500 ml. of water?
 

(A) 0.20 mole of aniline and 0.20 mole of HCl.
(B) 0.20 mole of aniline and 0.20 mole of NaOH
(C) 0.20 mole of NaCl and 0.20 mole of HCl
(D) 0.20 mole of aniline and 0.1 mole of HCl
- pH of 0.01  $(\text{NH}_4)_2\text{SO}_4$  and 0.02 M  $\text{NH}_4\text{OH}$  buffer [ $\text{pK}_a(\text{NH}_4^+) = 9.26$ ] is
 

(A) 9.26	(B) $9.26 + \log 2$
(C) 4.74	(D) $4.74 + \log 2$
- The conjugate acid of  $\text{NH}_2^-$  is
 

(A) $\text{NH}_4^+$	(B) $\text{NH}_3$
(C) $\text{NH}_2\text{OH}$	(D) $\text{N}_2\text{H}_4$

5. Which of the following salts when dissolved in water will hydrolyse?  
 (A) NaCl (B) KCl  
 (C) NH<sub>4</sub>Cl (D) Na<sub>2</sub>SO<sub>4</sub>
6. The following reaction occurs in the body  
 $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$ . If CO<sub>2</sub> escapes from the system  
 (A) pH will decrease  
 (B) hydrogen ion concentration will decrease  
 (C) H<sub>2</sub>CO<sub>3</sub> concentration remain unaltered  
 (D) forward reaction will be promoted
7. The solubility product of BaSO<sub>4</sub> is  $1.5 \times 10^{-9}$ . The precipitation in a 0.01 M Ba<sup>2+</sup> ions solution will start on adding H<sub>2</sub>SO<sub>4</sub> of concentration  
 (A) 10<sup>-9</sup> M (B) 10<sup>-8</sup> M  
 (C) 10<sup>-7</sup> M (D) 10<sup>-6</sup> M
8. There is no effect of dilution on pH of the following  
 (A) 0.01 M CH<sub>3</sub>COOH + 0.01M CH<sub>3</sub>COONa (B) 0.01M H<sub>3</sub>COONH<sub>4</sub>  
 (C) 0.01M NH<sub>4</sub>OH + 0.01 M NH<sub>4</sub>Cl (D) in all cases
9. The pK<sub>a</sub> of acetylsalicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about 2 – 3 and the pH in the small intestine is about 8. Aspirin will be  
 (A) unionised in small intestine and in the stomach  
 (b) completely ionised in the small intestine and in the stomach  
 (C) ionised to the stomach and almost unionised in the small intestine  
 (D) ionised in the small intestine and almost unionised in the stomach
10. The molar solubility of calcium phosphate be S. What is its solubility product?  
 (A) S<sup>5</sup> (B) 108S<sup>5</sup>  
 (C)  $\frac{S^5}{108}$  (D)  $\frac{108}{S^5}$
11. pH of Ba(OH)<sub>2</sub> is 12. Its solubility product is  
 (A) 10<sup>-6</sup> (B) 4 × 10<sup>-6</sup>  
 (C) 0.5 × 10<sup>-7</sup> (D) 5 × 10<sup>-7</sup>

- 12.** At 25°C, the pH of pure water is 7. It dissociates  $\text{H}_2\text{O}_{(l)} + \text{H}_2\text{O}_{(l)} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$   
 $\text{H}_3\text{O}^+_{\text{aq.}} + \text{OH}^-_{\text{aq.}} \rightleftharpoons 2\text{H}_2\text{O}_{(l)}$  at 25°C;  $\Delta H^\circ = -13.7 \text{ K cal mol}^{-1}$ . pH of water of at 37°C is expected to be  
 (A) greater than 7 (B) less than 7  
 (C) equal to 7 (D) none of true
- 13.** The compound whose 0.1M solution is basic is  
 (A) ammonium acetate (B) ammonium chloride  
 (C) ammonium sulphate (D) sodium acetate
- 14.** The dissociation constant of an acid HA is  $1 \times 10^{-5}$ , the pH of 0.1M solution of acid will be approximately  
 (A) 3 (B) 5  
 (C) 1 (D) 6
- 15.** A 0.1 M solution of HCN is 0.01% ionised, the ionisation constant for HCN is  
 (A)  $10^{-9}$  (B)  $10^{-7}$   
 (C)  $10^{-5}$  (D)  $10^{-3}$
- 16.** The solubility of sparingly soluble substance AgCl can be increased by the addition of  
 (A) aq.  $\text{NH}_3$  (B) aq. NaCN  
 (C) Both (D) None of these
- 17.** The aqueous solution of  $\text{NH}_4\text{CN}$  is slightly alkaline because  
 (A)  $\text{CN}^-$  ion hydrolyses to a greater extent than  $\text{NH}_4^+$  ion.  
 (B)  $\text{NH}_4^+$  ion hydrolyses to a greater extent than  $\text{CN}^-$  ion  
 (C) both hydrolyses to an equal extent  
 (D) it is a salt
- 18.** If  $\text{pK}_b$  of  $\text{F}^-$  ion at 25°C is 10.83, the ionisation constant of HF in water at this temperature is  
 (A)  $1.75 \times 10^{-5}$  (B)  $3.52 \times 10^{-3}$   
 (C)  $6.75 \times 10^{-4}$  (D)  $5.38 \times 10^{-2}$

**19.** The molar solubility of AgCl in 1.8 M AgNO<sub>3</sub> solution is ( $K_{sp}$  AgCl =  $1.8 \times 10^{-10}$ )

(A)  $10^{-10}$

(B)  $10^{-5}$

(C)  $1.82 \times 10^{-10}$

(D) None

**20.** To a solution having equal concentration of Cl<sup>-</sup>, Br<sup>-</sup> and I<sup>-</sup>, solid AgNO<sub>3</sub> is slowly added. Which one will precipitate out first?  $K_{sp}(\text{AgCl}) > K_{sp}$

(AgBr)  $> K_{sp}(\text{AgI})$

(A) AgCl

(B) AgBr

(C) AgI

(D) All precipitated

simultaneously



1. **B**

2. **D**

3. **A**

4. **B**

5. **C**

6. **B**

7. **D**

8. **D**

9. **D**

10. **B**

11. **D**

12. **B**

13. **D**

14. **A**

15. **A**

16. **C**

17. **A**

18. **C**

19. **A**

20. **C**