



## DPP-9-[Buffer-2 (Calculations)]

### Chapter: Ionic Equilibrium

*“A journey of a thousand miles begins with a single step.”*

#### A: Direct pH calculation of Buffer

- Q1. 500 mL 0.2M acetic acid + 500 mL 0.3M sodium acetate.  $K_a = 1.5 \times 10^{-5}$ . pH = ?**
- (1) 5.0
  - (2) 9.0
  - (3) 3.0
  - (4) 4.0
- Q2.  $pK_b$  for  $\text{NH}_4\text{OH}$  at certain temperature is 4.74. The pH of basic buffer containing equimolar  $\text{NH}_4\text{OH}$  &  $\text{NH}_4\text{Cl}$  will be–**
- (1) 7.74
  - (2) 4.74
  - (3) 2.37
  - (4) 9.26
- Q3. In buffer with equal  $[\text{B}^-]$  and  $[\text{HB}]$ ,  $K_b = 10^{-10}$ . pH = ?**
- (1) 4
  - (2) 2
  - (3) 10
  - (4) 6
- Q4. Concentrations of  $\text{NH}_4\text{Cl}$  and  $\text{NH}_4\text{OH}$  in a buffer are in the ratio 1:10. If  $K_b$  for  $\text{NH}_4\text{OH}$  is  $10^{-10}$ , then pH of buffer is–**
- (1) 4
  - (2) 5
  - (3) 9
  - (4) 11
- Q5. Buffer solution:  $[\text{NH}_3] = 0.30\text{M}$ ,  $[\text{NH}_4^+] = 0.20\text{M}$ .  $K_b = 1.8 \times 10^{-5}$ . pH = ? ( $\log 2.7 = 0.43$ )**
- (1) 9.08
  - (2) 9.43
  - (3) 11.72
  - (4) 8.73
- Q6. pH of buffer made by mixing 300 cc 0.3M  $\text{NH}_3$  + 500 cc 0.5M  $\text{NH}_4\text{Cl}$ .  $K_b = 1.8 \times 10^{-5}$ .**
- (1) 8.1187
  - (2) 9.8117
  - (3) 8.8117
  - (4) None

- Q7. A certain acidic buffer contains equal  $[X^-]$  and  $[HX]$ .  $K_b$  for  $X^-$  is  $10^{-10}$ . pH of buffer is–**
- (1) 4
  - (2) 7
  - (3) 10
  - (4) 14

## **B: Ratio of Salt/Acid or Base**

- Q8. In what ratio should  $NH_4Cl$  and  $NH_4OH$  be mixed to get  $pH = 9.26$ ? ( $pK_b = 4.74$ )**
- (1) 1:2.5
  - (2) 2.5:1
  - (3) 1:1
  - (4) 3.5:1
- Q9. pH of acidic buffer is 5.74 and  $pK_a = 4.74$ . Ratio  $[Salt]/[Acid] = ?$**
- (1) 10
  - (2) 20
  - (3) 30
  - (4) 40
- Q10. The dissociation constant of a weak acid is  $1 \times 10^{-4}$ . To prepare buffer with  $pH = 5$ , the ratio  $[Salt]/[Acid]$  should be–**
- (1) 1:10
  - (2) 4:5
  - (3) 10:1
  - (4) 5:4
- Q11. Henderson equation  $pH - pK_a = 1$  is applicable when:**
- (1) Acid = Base
  - (2) Acid  $\times 10 =$  Base
  - (3) Acid = Base  $\times 10$
  - (4) None of these
- Q12. 0.1N  $NH_4OH$  + 0.1N  $NH_4Cl$  buffer has  $pH = 9.25$ . Find  $pK_b$  of  $NH_4OH$ .**
- (1) 9.25
  - (2) 4.75
  - (3) 3.75
  - (4) 8.25

## **C: Finding $H^+$ and $OH^-$**

- Q13.  $[H^+]$  in 0.1M  $CH_3COOH$  + 0.1M  $CH_3COONa$ .  $K_a = 1.8 \times 10^{-5}$ .**
- (1)  $1.8 \times 10^{-7}$
  - (2)  $1.8 \times 10^{-5}$
  - (3)  $1.8 \times 10^{-2}$
  - (4)  $1.8 \times 10^{-3}$
- Q14. 0.05M  $NH_4OH$  + 0.001M  $NH_4Cl$ .  $K_b = 1.8 \times 10^{-5}$ . Find  $[OH^-]$ .**

- (1)  $3.0 \times 10^{-3}$
- (2)  $9.0 \times 10^{-4}$
- (3)  $9.0 \times 10^{-3}$
- (4)  $3.0 \times 10^{-4}$

**Q15.**  $[\text{H}^+]$  in 0.001M acetic acid is  $1.34 \times 10^{-4}$ . What is  $[\text{H}^+]$  after adding 0.164 g  $\text{CH}_3\text{COONa}$  to 1L of it?

- (1)  $9 \times 10^{-6}$
- (2)  $18 \times 10^{-6}$
- (3)  $4.5 \times 10^{-6}$
- (4)  $5 \times 10^{-6}$

## D: Indirect Buffer

**Q16.** Find  $[\text{H}^+]$  after mixing 20 mL 0.1M  $\text{CH}_3\text{COOH}$  and 10 mL 0.1M  $\text{NaOH}$ .  $K_a = 1.7 \times 10^{-5}$ .

- (1)  $1.7 \times 10^{-5}$
- (2)  $3.4 \times 10^{-5}$
- (3)  $3.4 \times 10^{-6}$
- (4)  $1.7 \times 10^{-4}$

**Q17.** 50 mL 0.1M  $\text{NH}_3$  + 10 mL 0.1M  $\text{HCl}$ .  $pK_b = 4.75$ .  $\text{pH} = ?$

- (1) 8.86
- (2) 4.74
- (3) 9.86
- (4) 5.32

**Q18.** If 60% of  $\text{CH}_3\text{COOH}$  is neutralised by  $\text{NaOH}$  and  $pK_a = 4.7$ ,  $\text{pH}$  will be—

- (1) Between 4.7 and 5.0
- (2) Less than 4.7 but more than 4.0
- (3)  $> 5.0$
- (4) Unchanged

**Q19.** Half of formic acid neutralised by  $\text{KOH}$ .  $K_a = 2 \times 10^{-4}$ .  $\text{pH} = ?$  ( $\log 2 = 0.3010$ )

- (1) 3.6999
- (2) 2.3010
- (3) 3.85
- (4) 4.3010

## E: Miscellaneous

**Q20.**  $K_a$  for  $\text{HCN} = 5 \times 10^{-10}$ . To maintain  $\text{pH}=9$ , volume of 5M  $\text{KCN}$  added to 10 mL 2M  $\text{HCN} = ?$

- (1) 4 mL
- (2) 7.95 mL
- (3) 2 mL
- (4) 9.3 mL

**Q21.** Amount of sodium propanoate added to 1 L solution containing 0.02 mol propanoic acid ( $K_a = 1.34 \times 10^{-5}$ ) for  $\text{pH}=4.75$ .

- (1)  $4.52 \times 10^{-2}$  mol
- (2)  $3.52 \times 10^{-2}$  mol
- (3)  $2.52 \times 10^{-2}$  mol
- (4)  $1.52 \times 10^{-2}$  mol

**Q22. Calculate pH of buffer prepared from 30 g  $\text{Na}_2\text{CO}_3$  in 500 mL water + 150 mL 1M HCl.  $K_a(\text{HCO}_3^-) = 5.63 \times 10^{-11}$ .**

- (1) 8.197
- (2) 9.197
- (3) 10.197
- (4) 11.197

**Q23. Ratio of pH of buffer with (1M  $\text{CH}_3\text{COONa}$  + 1M HCl) vs (1M  $\text{CH}_3\text{COONa}$  + 1M  $\text{CH}_3\text{COOH}$ ).**

- (1) 1:1
- (2) 2:1
- (3) 1:2
- (4) 2:2

**Q24. 10 mL solution contains 0.1M  $\text{NH}_4\text{Cl}$  + 0.01M  $\text{NH}_4\text{OH}$ . Which addition does NOT change pH?**

- (1) Add 1 mL water
- (2) Add 5 mL 0.1M  $\text{NH}_4\text{Cl}$
- (3) Add 5 mL 0.1M  $\text{NH}_4\text{OH}$
- (4) Add 10 mL 0.1M  $\text{NH}_4\text{Cl}$

**Q25. A basic buffer will obey  $\text{pOH} - \text{p}K_b = 1$  only under condition—**

- (1) Acid : Base = 1 : 10
- (2) Acid = Base
- (3) Conjugate acid : Base = 10 : 1
- (4) None of these

**Q26. Buffer solutions have constant acidity because they give unionised acid/base when small acid/base is added.**

- (1) True
- (2) False
- (3) Sometimes
- (4) Depends

**Q27. Which is not an acidic buffer?**

- (1)  $\text{H}_2\text{CO}_3 + \text{Na}_2\text{CO}_3$
- (2)  $\text{H}_3\text{PO}_4 + \text{Na}_3\text{PO}_4$
- (3)  $\text{HClO}_4 + \text{NaClO}_4$
- (4)  $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$

**Q28. Blood pH (7.26–7.42) is maintained by which buffer?**

- (1)  $\text{H}_2\text{CO}_3/\text{HCO}_3^-$
- (2)  $\text{H}_3\text{PO}_4/\text{H}_2\text{PO}_4^-$
- (3)  $\text{CH}_3\text{COOH}/\text{CH}_3\text{COO}^-$
- (4)  $\text{NH}_2\text{CH}_2\text{COOH}/\text{NH}_2\text{CH}_2\text{COO}^-$

**Q29. Blood pH does not change much when acid/base is added because of serum protein**

**buffer.**

- (1) True
- (2) False
- (3) Depends
- (4) None