DPP-8 – BUFFER SOLUTIONS-1(IDENTIFICATION)

Chapter: Ionic Equilibrium

"Assignments don't make you tired... they make you dangerous."

EASY LEVEL

Q1. The buffer solution play an important role in :

A buffer resists change in pH when small amounts of acid or base are added.

Buffers maintain nearly constant pH despite addition of small amounts of H^+ or OH^-. They do NOT increase or decrease pH; they simply keep it stable.

Solution: Buffers keep pH almost constant because they contain weak acid + conjugate base.

Final Answer: (C)

Q2. Which of the following solutions cannot act as a buffer system?

A buffer requires: Weak acid + its salt OR Weak base + its salt.

NaClO / $HClO_4$ contains a strong acid ($HClO_4$). Strong acids cannot form buffers.

Solution: Buffers are KH_2PO_4/H_3PO_4, pyridine/pyridinium, carbonate/bicarbonate. Strong acid pair does not buffer.

Final Answer: (2)

Q3. A buffer solution can not be prepared by mixing equimolar amounts of–

Strong acid + salt of strong acid NEVER forms a buffer.

HCl + NaCl → both strong acid its salt. No weak component → no buffer.

Solution: Other pairs (boric acid/borax, NH_3/NH_4Cl, CH_3COOH/CH_3COONa) are valid buffers.

Final Answer: (3)

Q4. Which of the following salt solution will act as a buffer?

A buffer must contain a weak acid + weak base combination.

CH_3COONH_4 is the salt of a weak acid (CH_3COOH) and weak base (NH_3). Such salts can act as buffers.

Solution: NH_4Cl (acidic), CH_3COONa (basic), NaCl (neutral) — none are buffers alone.

Final Answer: (1)

Q5. Which one of the following pairs of solution is **not** an acidic buffer?

Acidic buffer = weak acid + its salt (with conjugate base).

$HClO_4$ is a **strong acid**. Strong acid + its salt cannot act as a buffer.

Solution: (H_2CO_3/Na_2CO_3) → buffer (H_3PO_4/Na_3PO_4) → buffer (CH_3COOH/CH_3COONa) → buffer $HClO_4/NaClO_4$ → NOT a buffer.

Final Answer: (3)

Q6. Which one of the following is NOT a buffer solution?

Weak acid + salt OR Weak base + salt → buffer.

$HClO_4$ is a strong acid; $KClO_4$ is a neutral salt → no buffer.

Solution: Others (H_2S/KHS, aniline/anilinium, carbonate/bicarbonate) are buffers.

Final Answer: (4)

Q7. Which of the following will act as buffer?

Check for weak acid/base + conjugate salt.

All three combinations are classical buffer systems: • Carbonate/Bicarbonate • Boric acid/Borate • Ammonium/Ammonia Hence all act as buffers.

Solution: All listed are valid buffers.

Final Answer: (4)

Q8. Which of the following pairs constitutes a buffer :-

A buffer must contain a weak acid/base + its salt.

HNO_2 (weak acid) + $NaNO_2$ (its salt) → buffer. All other options include strong acids or bases → no buffer.

Solution: Only option (1) forms a buffer.

Final Answer: (1)

Q9. The pH value of blood does not appreciably change by small addition of an acid or base because the blood :

Blood pH is regulated by natural buffer systems.

The bicarbonate buffer (H_2CO_3/HCO_3^-) + protein buffers maintain blood pH at 7.4.

Solution: Blood resists pH change due to presence of serum protein buffer.

Final Answer: (4)

MEDIUM LEVEL

Q10. Which of the following combinations will make a buffer solution(s)?

A buffer forms when weak acid/base + its salt coexist after partial neutralisation.

(i) $CH_3COONa + HCl \rightarrow$ partial neutralisation $\rightarrow CH_3COOH + CH_3COO^- \rightarrow$ BUFFER (ii) $CH_3COOH + NaOH \rightarrow$ partial neutralisation $\rightarrow CH_3COO^- + CH_3COOH \rightarrow$ BUFFER (iii) $CH_3COOH + CH_3COONa \rightarrow$ classical buffer pair.

Solution: All (i), (ii), (iii) form buffers.

Final Answer: All (i), (ii), (iii)

Q11. The pH of blood circulating in a human body is maintained around 7.4 by the action of which buffer system–

Blood uses natural biological buffers to maintain pH.

Dominant buffer = **H_2CO_3/HCO_3^-**. It regulates respiratory and metabolic pH balance.

Solution: Bicarbonate buffer controls blood pH.

Final Answer: (4)

Q12. 1 M NaCl and 1 M HCl are present in aqueous solution. The solution is :

A buffer requires at least one weak species.

$HCl \rightarrow$ strong acid $NaCl \rightarrow$ neutral salt No weak acid/base $\rightarrow$ NO buffer.

Solution: Solution is acidic, not buffered.

Final Answer: (A)

Q13. Which can act as buffer :-

Check if weak acid/base and its conjugate pair are present.

(A) NH_4OH + NaOH → strong base present → NO buffer (B) HCOOH + CH_3COONa → different acid + salt → NO buffer (C) NaCN + HCl (partial neutralisation) → HCN + CN^- → BUFFER

Solution: Only option (C) forms a proper buffer.

Final Answer: (C)

Q14. When a small amount of HCl is added to a buffer solution of acetic acid and sodium acetate, then :

Buffers resist pH change via neutralisation by conjugate base.

Added HCl increases H^+ → CH_3COO^- consumes H^+ → forms CH_3COOH. Thus: • pH decreases slightly • H^+ increases slightly • CH_3COO^- decreases • Dissociation of acid decreases

Solution: All four listed statements occur.

Final Answer: (1), (2), (3), (4)

Q15. A buffer solution can be obtained from :

All valid buffer systems contain weak acid/base with its conjugate salt.

(A) HCN + KCN → weak acid + salt → BUFFER (B) CH_3COONH_4 → salt of weak acid + weak base → BUFFER (C) NH_4Cl + NH_4OH → weak base + its salt → BUFFER

Solution: All options are buffer systems.

Final Answer: (4)

Q16. Buffer solutions have constant acidity and alkalinity because :

Buffers remove added acid/base via equilibrium reaction.

Added H^+ is consumed by conjugate base, added OH^- is neutralized by weak acid → forming unionized species. Thus major pH change is prevented.

Solution: Reason (3) correctly explains buffer action.

Final Answer: (3)

HARD LEVEL

Q17. For preparing a buffer solution of pH = 7.0, which buffer system will you choose?

Select buffer pair whose pKa target pH.

Phosphoric acid system pKa values: pKa1 = 2.1 pKa2 = 7.2 pKa3 = 12.3
Desired pH = 7 → closest pKa = 7.2 → buffer pair = $H_2PO_4^-/HPO_4^{2-}$.

Solution: The correct buffer for pH 7 is the second phosphate buffer system.

Final Answer: (2)