DPP–3 Solution [pH & pOH of Strong Acid and Strong Base]

Chapter: Ionic Equilibrium

"Tera sapna tujhe sirf tabhi milega, jab tu sach mein deserve karega"

GROUP–A: Acid Strength / Oxyacids

Q1. **Which is the strongest acid in the following?**

(1) H_2SO_3
(2) H_2SO_4
(3) $HClO_3$
(4) $HClO_4$

Explanation / Approach

For oxyacids of halogens: **More oxygen = stronger acid** due to greater oxidation state and strongest conjugate base stabilization.

Final Solution

Strongest acid = **HClO** Correct Option: **(4)**

Q2. **The correct order of acid strength is –**

(1) $HClO_4 < HClO_3 < HClO_2 < HClO$
(2) $HClO_2 < HClO_3 < HClO_4 < HClO$
(3) $HClO_4 < HClO < HClO_2 < HClO_3$
(4) $HClO < HClO_2 < HClO_3 < HClO_4$

Explanation / Approach

More oxygen → higher oxidation state → stronger acid. This increases electron withdrawal and stabilises the conjugate base.

Final Solution

Order: HClO< HClO < HClO < HClO Correct Option: **(4)**

GROUP–B: Strong Bases (NaOH, KOH, $Ca(OH)_2$)

Q3. **The pH of 0.01 M NaOH solution will be:**

(1) 9
(2) 7.01
(3) 2

(4) 12

Explanation / Approach

NaOH → strong base → full dissociation. [OH] = 0.01 M = 10^2 pOH = 2 → pH = 14 2 = 12

Final Solution

pH = **12** Correct Option: **(4)**

Q4. The pH of $\frac{M}{100}$ $Ca(OH)_2$ is

(1) 1.699
(2) 12
(3) 12.301
(4) 12.699

Explanation / Approach

Ca(OH) gives **2 OH ions**. [OH] = 2 × (M/100) = 0.02 M pOH = –log(0.02) = 1.699 pH = 14 – 1.699 = 12.301

Final Solution

pH = **12.301** Correct Option: **(3)**

Q5. H concentration when 4 g NaOH dissolved in 1 L water

(1) 10^{-1}
(2) 10^{-13}
(3) 10^{-4}
(4) 10^{-10}

Explanation / Approach

Moles NaOH = 4/40 = 0.1 [OH] = 0.1 → pOH = 1 pH = 13 → [H] = 10^{13}

Final Solution

[H] = **10^{13}** Correct Option: **(2)**

Q6. pH of solution containing 0.2 g NaOH in 100 mL solution

(1) 10.699
(2) 11.699
(3) 12.699
(4) 13.699

Explanation / Approach

Moles = 0.2/40 = 0.005 M = 0.005 / 0.1 = 0.05 M pOH = –log(0.05) = 1.301 pH = 12.699

Final Solution

pH = **12.699** Correct Option: **(3)**

Q7. **0.04 g NaOH per litre → pH?**

(1) 10
(2) 9
(3) 11
(4) 12

Explanation / Approach

Moles = 0.04/40 = 0.001 M pOH = 3 → pH = 11

Final Solution

pH = **11** Correct Option: **(3)**

Q8. **NaOH needed in 250 mL to obtain pH = 13**

(1) 10^{-13} g
(2) 10^{-1} g
(3) 1.0 g
(4) 4.0 g

Explanation / Approach

pH = 13 → pOH = 1 → [OH] = 0.1 Moles needed = 0.1 × 0.25 = 0.025 Mass = 0.025 × 40 = 1 g

Final Solution

Required NaOH = **1 g** Correct Option: **(3)**

Q9. **0.001 mol $M(OH)_2$ in 20 mL → pH?**

(1) 13
(2) 3.3
(3) 11
(4) 9.8

Explanation / Approach

M(OH) → 2 OH per molecule. Concentration = 0.001 / 0.02 = 0.05 M [OH] = 0.1 pOH = 1 → pH = 13

Final Solution

pH = **13** Correct Option: **(1)**

GROUP–C: Dibasic Acids & Normality

Q10. **For N/10 H_2SO_4, pH value is –**

(1) 1
(2) 0.586
(3) 0.856
(4) None

Explanation / Approach

HSO strong dibasic → Normality = 0.1 → [H] = 0.1 pH = 1

Final Solution

Correct Option: **(1)**

Q11. **H_2X is dibasic strong acid. pH = 1 → Find molarity**

(1) 0.1
(2) 0.05
(3) 0.2
(4) 0.5

Explanation / Approach

pH = 1 → [H] = 0.1 For dibasic acid: [H] = 2M 2M = 0.1 → M = 0.05

Final Solution

Correct Option: **(2)**

Q12. **Mass of dibasic acid (MW = 200) in 100 mL for N/10**

(1) 1 g
(2) 2 g
(3) 5 g
(4) 10 g

Explanation / Approach

N/10 → N = 0.1 For dibasic acid: N = 2M → M = 0.05 Moles in 0.1 L = 0.005 Mass = 0.005 × 200 = 1 g

Final Solution

Correct Option: **(1)**

GROUP–D: Ultra–Dilute Acids (Effect of Kw)

Q13. **$[H^+]$ of 10^{-8} M HCl at 298 K**

(1) 1.0×10^{-6}

(2) 1.0525×10^{-7}
(3) 9.525×10^{-8}
(4) 1.0×10^{-8}

Explanation / Approach

Ultra-dilute strong acid → water contributes 10 M. Total [H] = 10 + 10 = 1.1×10

Final Solution

Correct Option: **(2)**

Q14. pH of 10^{-9} M HCl

(1) 9
(2) Between 6 and 7
(3) 7
(4) Unpredictable

Explanation / Approach

[H] = 10 + 10 10 So pH slightly less than 7.

Final Solution

Correct Option: **(2)**

Q15. pH of 10^{-7} M HCl

(1) 7
(2) Slightly less than 7
(3) Slightly greater than 7
(4) 1

Final Solution

[H] = 10 + 10 = 2×10 → pH ¡ 7 Correct Option: **(2)**

Q16. What is pH of 10^{-6} M HCl?

(1) 6
(2) 7
(3) < 6
(4) > 7

Final Solution

Dominant [H] = 10 → pH = 6 Correct Option: **(3)**

Q17. pH of 10^{-7} M HCl

(1) 1
(2) 2
(3) Less than 7

(4) 0

Final Solution

Same as above: pH ¡ 7 Correct Option: **(3)**

Q18. pH of 10^{-11} M HCl

(1) 11
(2) 3
(3) Slightly greater than 7
(4) Slightly less than 7

Final Solution

[H] 10 → pH ¿ 7 Correct Option: **(3)**

Q19. 10^{-6} M HCl diluted 100 times → pH?

(A) 6
(A) 8
(A) 6.98
(A) 7.02

Final Solution

New [H] = 10 + 10 = 1.1×10 → pH 6.98 Correct Option: **(C)**

Q20. Which solution has pH = 8?

(A) 10^{-8} M HCl
(A) 10^{-8} M H^+
(A) 2×10^{-6} M $Ba(OH)_2$
(A) 10^{-8} M NaOH

Final Solution

Ba(OH) gives 2 OH → [OH] = 4×10 close to 10 Correct Option: **(C)**

Q21. 1 cc of 0.1 N HCl added to 1 L NaCl solution → pH?

(1) 7
(2) 0
(3) 10
(4) 4

Final Solution

Moles HCl = 10 → [H] = 10 → pH = 4 Correct Option: **(4)**