



DPP-2 Solution [pH Concept]

Chapter: Ionic Equilibrium

"This isn't just an assignment. It's a step toward your dream."

Q1. Which of the following solutions is most acidic?

- (1) pH = 5
- (2) pH = 3
- (3) pH = 9
- (4) pH = 13

Explanation / Approach

Lower pH \rightarrow higher acidity. Among the four values, pH = 3 is the lowest strongest acid.

Final Solution

Most acidic = pH 3 \rightarrow Option (2).

Q2. An aqueous solution whose pH = 0 is-

- (1) Basic
- (2) Acidic
- (3) Neutral
- (4) Amphoteric

Explanation / Approach

pH = 0 means very high [H] concentration \rightarrow extremely acidic.

Final Solution

Solution is strongly acidic \rightarrow (2).

Q3. The pH of solutions A, B, C and D are 9.5, 2.5, 3.5 and 5.5 respectively. The most acidic solution is-

- (1) D
- (2) C
- (3) A
- (4) B

Explanation / Approach

Out of 9.5, 2.5, 3.5, 5.5 \rightarrow smallest value = 2.5. Lower pH = higher acidity.

Final Solution

Most acidic = pH 2.5 → Solution B → Option (4).

Q4. A solution has pOH equal to 13 at 298 K. The solution will be—

- (1) highly acidic
- (2) highly basic
- (3) moderately basic
- (4) unpredictable

Explanation / Approach

$\text{pH} + \text{pOH} = 14 \rightarrow \text{pH} = 14 - 13 = 1$. pH = 1 strongly acidic.

Final Solution

Solution is highly acidic → Option (1).

Q5. The pH of 0.001 M HCl solution is—

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

Explanation / Approach

HCl is strong acid → complete ionisation. $[\text{H}^+] = 10^{-3}$ pH = 3.

Final Solution

pH = 3 → Option (3).

Q6. If $[\text{OH}^-] = 5.0 \times 10^{-5}$ M then pH will be—

- (1) $5 - \log 5$
- (2) $9 + \log 5$
- (3) $\log 5 - 5$
- (4) $\log 5 - 9$

Explanation / Approach

$\text{pOH} = -\log(5 \times 10^{-5}) = -(\log 5 + \log 10^{-5}) = -(\log 5 - 5) = 5 - \log 5$
Then $\text{pH} = 14 - \text{pOH} = 14 - (5 - \log 5) = 9 + \log 5$.

Final Solution

pH = $9 + \log 5$ → Option (2).

Q7. The hydrogen ion concentration is 6×10^{-4} M. Its pH will be—

- (1) 6
- (2) 3.22

(3) 4

(4) 2

Explanation / Approach

$$\text{pH} = -\log(6 \times 10^{-4}) = 4 - \log 6 = 4 - 0.78 = 3.22.$$

Final Solution

pH = 3.22 \rightarrow Option (2).

Q8. The pH of a 10^{-3} M KOH solution is–

(1) 3

(2) 10

(3) 11

(4) 12

Explanation / Approach

$$\text{KOH} = \text{strong base} \rightarrow [\text{OH}^-] = 10^{-3}. \text{pOH} = 3 \rightarrow \text{pH} = 14 - 3 = 11.$$

Final Solution

pH = 11 \rightarrow Option (3).

Q9. If pH = 3.31, then find out $[\text{H}^+]$ (Approx)

(1) 3.39×10^{-4}

(2) 5×10^{-4}

(3) 3.0×10^{-3}

(4) None

Explanation / Approach

$$[\text{H}^+] = 10^{-3.31} = 10^{-3} \times 10^{-0.31} = 10^{-3} \times 0.489 = 4.89 \times 10^{-4}.$$

Final Solution

Closest value = $5 \times 10^{-4} \rightarrow$ Option (2).

Q10. pH of tomato juice is 4.4. Then concentration of H_3O^+ will be–

(1) 3.9×10^{-4}

(2) 3.9×10^{-5}

(3) 3.9×10^{-4}

(4) 3.9×10^5

Explanation / Approach

$$[\text{H}^+] = 10^{-4.4} = 10^{-4} \times 10^{-0.4} = 10^{-4} \times 0.398 = 3.98 \times 10^{-5}.$$

Final Solution

$3.9 \times 10 \rightarrow$ Option (2).

Q11. If pH of a solution is 3, what is $[\text{OH}^-]$?

- (1) 10^{-3}
- (2) 10^{-11}
- (3) 10^{-7}
- (4) 10^{-10}

Explanation / Approach

$\text{pOH} = 14 - \text{pH} = 11$ $[\text{OH}] = 10^{11}$.

Final Solution

$[\text{OH}] = 10^{11} \rightarrow$ Option (2).

Q12. A sample of rain water has pH = 6.2. The OH^- ion concentration is—

- (1) 6.2×10^{-8}
- (2) $10^{-6.2}$
- (3) $10^{-7.8}$
- (4) $6.2 \times 10^{-7.8}$

Explanation / Approach

$\text{pOH} = 14 - 6.2 = 7.8$ $[\text{OH}] = 10$.

Final Solution

Correct = 10 \rightarrow Option (3).

Q13. How many H^+ ions are present in 1 ml of a solution whose pH is 13?

- (1) 10^{-16}
- (2) 6.022×10^{13}
- (3) 6.022×10^7
- (4) 6.022×10^{23}

Explanation / Approach

$\text{pH} = 13$ $[\text{H}] = 10^{13}$ M. 1 mL = 10^3 L Moles = $10^{13} \times 10^3 = 10^{16}$. Number of ions = $10^{16} \times N$ 6.022×10 .

Final Solution

Correct answer = 6.022×10 ions \rightarrow Option (3).

Q14. Find out pH of solution having 2×10^{-3} moles of OH^- in 2 litre solution—

- (1) $\text{pH} = 3$
- (2) $\text{pH} = 3 + \log 2$
- (3) $\text{pH} = 3 - \log 2$

(4) pH = 11

Explanation / Approach

$[\text{OH}] = (2 \times 10^3)/2 = 10^3$. $\text{pOH} = 3 \rightarrow \text{pH} = 11$.

Final Solution

pH = 11 \rightarrow Option (4).

Q15. If ionic product of water is $K_w = 10^{-16}$ at 4°C , then pH of neutral water at 4°C is—

- (1) 8
- (2) 6
- (3) 4
- (4) 7

Explanation / Approach

For neutral water:

$$[\text{H}^+] = [\text{OH}^-] = \sqrt{K_w} = \sqrt{10^{-16}} = 10^{-8}$$

$\text{pH} = -\log(10) = 8$.

Final Solution

Neutral pH at $4^\circ\text{C} = 8 \rightarrow$ Option (1).

Q16. If pure water has $\text{p}K_w = 13.36$ at 50°C , the pH of pure water will be—

- (1) 6.68
- (2) 7.0
- (3) 7.13
- (4) 6.0

Explanation / Approach

$$\text{p}K_w = -\log(K_w) = 13.36$$

Neutral water:

$$\text{pH} = \frac{\text{p}K_w}{2} = \frac{13.36}{2} = 6.68$$

Final Solution

pH = 6.68 \rightarrow Option (1).

Q17. At 100°C , $K_w = 10^{-12}$. pH of pure water at 100°C will be—

- (1) 7.0
- (2) 6.0
- (3) 8.0
- (4) 12.0

Explanation / Approach

Neutral water:

$$[H^+] = \sqrt{10^{-12}} = 10^{-6}$$

pH = 6. So at high temperature water is neutral at pH 6 (NOT 7).

Final Solution

pH = **6** → Option (2).

Q18. At 60°C, pure water has $[H_3O^+] = 10^{-6.7}$ mol/L. What is the value of K_w at 60°C :-

- (A) 10^{-6}
- (B) 10^{-12}
- (C) 10^{-67}
- (D) $10^{-13.4}$

Explanation / Approach

Neutral water:

$$[H^+] = [OH^-] = 10^{-6.7}$$

$$K_w = [H^+][OH^-] = 10^{-6.7} \times 10^{-6.7} = 10^{-13.4}$$

Final Solution

$K_w =$ **10^{13}** → Option (D).

Q19. If ionic product of water is $K_w = 10^{-16}$ at 4°C, then a solution with pH = 7.5 at 4°C will–

- (1) Turn blue litmus red
- (2) Turn red litmus blue
- (3) Be neutral to litmus
- (4) Be alkaline

Explanation / Approach

At 4°C → neutral pH = 8. Solution pH = 7.5 ; 8 → slightly acidic.

Final Solution

Solution turns **blue litmus red** → Option (1).

Q20. Ionic product of water will increase, if–

- (1) Dissociation of pressure
- (2) Add H^+
- (3) Add OH^-
- (4) Increase the temperature

Explanation / Approach

K_w increases with **increase in temperature** because dissociation is endothermic.

Final Solution

Correct option \rightarrow **(4)**.

Q21. With increase in temperature, pH of pure water–

- (1) Increases
- (2) Decreases
- (3) Remains constant
- (4) May increase or decrease

Explanation / Approach

Temperature $\uparrow \rightarrow K_w \uparrow \rightarrow [H] \uparrow \rightarrow$ pH **decreases**. BUT water is still neutral because $[H] = [OH]$.

Final Solution

pH decreases \rightarrow Option (2).

Q22. K_w of H_2O at 373 K is 1×10^{-12} . Identify, which of the following is incorrect :

- (A) $pH + pOH = 12$, for every aqueous solutions.
- (B) pH of H_2O is 6.
 $H^+ = [OH^-]$.
- (C) H_2O is acidic.

Explanation / Approach

At 373 K:

$$[H^+] = [OH^-] = 10^{-6}, pH = 6, pOH = 6 \Rightarrow pH + pOH = 12$$

But water is not acidic \rightarrow neutral because $[H] = [OH]$.

Final Solution

Incorrect statement = **HO is acidic** \rightarrow Option (D).

Q23. For water at 25°C, 2×10^{-7} moles per litre corresponds to which of the following?

- (1) $[H^+] + [OH^-]$
- (2) $[H^+]^2$
- (3) $[OH^-]^2$
- (4) $[H^+] - [OH^-]$

Explanation / Approach

At 25°C:

$$[H^+] = [OH^-] = 10^{-7}$$
$$[H^+] + [OH^-] = 2 \times 10^{-7}$$

Final Solution

Correct option → (1)

Q24. At 25°C, the dissociation constant for pure water is given by–

- (1) $(55.4 \times 10^{14})^{-1}$
- (2) 1×10^{-14}
- (3) $\frac{1 \times 10^{-14}}{18}$
- (4) None of these

Explanation / Approach

Dissociation constant of water (K_w) at 25°C = 1×10^{-14} .

Final Solution

Correct option → **(2)**

Q25. Ionic product of water is equal to–

- (1) Dissociation constant of water $\times [H_2O]$
- (2) Dissociation constant of water $\times [H^+]$
- (3) Product of $[H_2O]$ and $[H^+]$
- (4) Product of $[OH^-]^2$ and $[H^+]$

Explanation / Approach

$$K_w = [H^+][OH^-]$$

Final Solution

Correct relation = **K_w is dissociation constant $\times [H^+]$** → Option (2).

Q26. Which of the following expression is not true ?

- $H^+ = [OH^-] = \sqrt{K_w}$ for neutral solution.
 $H^+ > \sqrt{K_w}$ $[OH^-] < \sqrt{K_w}$ for acidic solution.
 $H^+ < \sqrt{K_w}$ $[OH^-] > \sqrt{K_w}$ for alkaline solution.
 $H^+ = [OH^-] = 10^{-7}$ M for a neutral solution at all temperatures.

Explanation / Approach

At temperatures other than 25°C,

$$[H^+] \neq 10^{-7}$$

Neutrality depends on equality of [H] and [OH], not pH = 7.

Final Solution

Incorrect expression = **(D)**.

Q27. pH of solution is increased from 3 to 6. Its H⁺ concentration will be–

- (1) Reduced to half
- (2) Doubled
- (3) Reduced by 1000 times
- (4) Increased by 1000 times

Explanation / Approach

pH increases from 3 → 6 That means [H] goes from 10³ → 10⁶.

$$\frac{10^{-6}}{10^{-3}} = 10^{-3} = \frac{1}{1000}$$

So H decreases **1000 times**.

Final Solution

[H] reduces by a factor of **1000** → Option (3).

Q28. In a solution of pH = 5, more acid is added in order to reduce the pH = 2. The increase in hydrogen ion concentration is–

- (1) 100 times
- (2) 1000 times
- (3) 3 times
- (4) 5 times

Explanation / Approach

Initial [H] = 10⁻⁵ Final [H] = 10⁻²

$$\frac{10^{-2}}{10^{-5}} = 10^3 = 1000$$

H increases by **1000 times**.

Final Solution

Increase in [H] = **1000 times** → Option (2).

Q29. If pH of a solution decreases from 9 to 6, then the hydrogen ion concentration will–

- (1) Become 3 times
- (2) Decrease 1000 times

- (3) Increase 1000 times
 (4) Remain same

Explanation / Approach

pH drops from 9 \rightarrow 6

$$[H^+] : 10^{-9} \rightarrow 10^{-6}$$

$$\frac{10^{-6}}{10^{-9}} = 10^3$$

So hydrogen ion increases **1000 times**.

Final Solution

[H] increases 1000 \times \rightarrow Option (3).

Q30. A solution with pH 2.0 is more acidic than the one with pH 6.0 by a factor of:

- (A) 3
 (B) 4
 (C) 3000
 (D) 10000

Explanation / Approach

pH = 2 \rightarrow [H] = 10^2 pH = 6 \rightarrow [H] = 10^{-6}

$$\frac{10^{-2}}{10^{-6}} = 10^4 = 10000$$

Final Solution

More acidic by **10,000 times** \rightarrow Option (D).

Q31. How many litres of water must be added to 1 litre aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2 ?

- (1) 0.1 L
 (2) 0.9 L
 (3) 2.0 L
 (4) 9.0 L

Explanation / Approach

pH 1 \rightarrow [H] = 10^{-1} pH 2 \rightarrow [H] = 10^{-2}

Dilution factor =

$$\frac{10^{-1}}{10^{-2}} = 10$$

Final volume = 10 \times initial volume = 10 L Water added = 10 - 1 = **9 L**.

Final Solution

Water to add = **9.0 L** \rightarrow Option (4).

Q32. How many moles of HCl must be removed from 1 litre of aqueous HCl solution to change its pH from 2 to 3 :-

- (A) 1
- (B) 0.02
- (C) 0.009
- (D) 0.01

Explanation / Approach

pH 2 \rightarrow $[H] = 10^2 = 0.01$ mol pH 3 \rightarrow $[H] = 10^3 = 0.001$ mol Moles to remove:

$$0.01 - 0.001 = 0.009$$

Final Solution

HCl removed = **0.009 mol** \rightarrow Option (C).

Q33. 8 g NaOH is dissolved in one litre of solution, the molarity of solution is-

- (1) 0.2 M
- (2) 0.4 M
- (3) 0.02 M
- (4) 0.8 M

Explanation / Approach

Molar mass of NaOH = 40 g/mol

$$\text{Moles} = \frac{8}{40} = 0.2$$

Volume = 1 L, so molarity = 0.2 M.

Final Solution

Molarity = **0.2 M** \rightarrow Option (1).

Q34. If 5 g of $\text{Ca}(\text{OH})_2$ is dissolved in 2 L solution, the molarity is-

- (1) 0.067 M
- (2) 0.034 M
- (3) 0.25 M
- (4) 0.125 M

Explanation / Approach

Molar mass $\text{Ca(OH)} = 40 + 2 \times 17 = 74 \text{ g/mol}$

$$\text{Moles} = \frac{5}{74} \approx 0.0676$$

Molarity = moles / volume =

$$\frac{0.0676}{2} \approx 0.0338$$

Final Solution

Molarity **0.034 M** → Option (2).

Q35. The formula weight of H_2SO_4 is 98. The weight of acid in 400 mL of 0.1 M solution is—

- (1) 2.45 g
- (2) 3.92 g
- (3) 4.90 g
- (4) 9.8 g

Explanation / Approach

Moles = $M \times V =$

$$0.1 \times 0.4 = 0.04 \text{ mol}$$

Mass = moles \times molar mass =

$$0.04 \times 98 = 3.92 \text{ g}$$

Final Solution

Mass of $\text{H}_2\text{SO}_4 = \mathbf{3.92 \text{ g}}$ → Option (2).

Q36. The amount of acetic acid present in 100 mL of 0.1M solution is—

- (1) 0.30 g
- (2) 3.0 g
- (3) 0.60 g
- (4) None

Explanation / Approach

Moles =

$$0.1 \times 0.1 = 0.01 \text{ mol}$$

Molar mass $\text{CH}_3\text{COOH} = 60 \text{ g/mol}$ Mass =

$$0.01 \times 60 = 0.6 \text{ g}$$

Final Solution

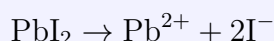
Mass of acetic acid = 0.60 g → Option (3).

Q37. If the molar concentration of PbI_2 is $1.5 \times 10^{-3} \text{ mol L}^{-1}$, the concentration of iodide ions in g-ion L^{-1} is–

- (1) 3.0×10^{-3}
- (2) 6.0×10^{-3}
- (3) 0.3×10^{-3}
- (4) 0.6×10^{-6}

Explanation / Approach

PbI_2 dissociates as:



So iodide concentration = $2 \times (1.5 \times 10^{-3}) = 3.0 \times 10^{-3} \text{ g-ion/L}$.

Final Solution

I concentration = 3.0×10^{-3} → Option (1).

Q38. What is the molar concentration of chloride ion in the solution obtained by mixing 300 mL of 3.0 M NaCl and 200 mL of 4.0 M BaCl_2 ?

- (1) 5.0 M
- (2) 1.8 M
- (3) 1.6 M
- (4) None of these

Explanation / Approach

NaCl gives 1 Cl BaCl gives 2 Cl

Moles from NaCl:

$$3.0 \times 0.3 = 0.9$$

Moles from BaCl_2 :

$$4.0 \times 0.2 = 0.8 \text{ mol BaCl}_2$$

Chloride = $2 \times 0.8 = 1.6 \text{ mol}$

Total Cl = $0.9 + 1.6 = 2.5 \text{ mol}$

Total volume = 0.5 L

$$[\text{Cl}^-] = \frac{2.5}{0.5} = 5 \text{ M}$$

Final Solution

Chloride concentration = 5.0 M → Option (1).

Q39. Normality of 2M sulphuric acid is–

- (1) 2 N

- (2) 4 N
- (3) N/2
- (4) N/4

Explanation / Approach

H₂SO₄ is dibasic → n-factor = 2

$$N = M \times n = 2 \times 2 = 4N$$

Final Solution

Normality = **4 N** → Option (2).

Q40. 0.5 g of NaOH is dissolved in 1 L of solution. The normality of the solution is—

- (1) 0.0125 N
- (2) 0.025 N
- (3) 0.05 N
- (4) 0.5 N

Explanation / Approach

Molar mass NaOH = 40 g/mol

$$\text{Moles} = \frac{0.5}{40} = 0.0125$$

NaOH is monobasic → N = M

$$N = 0.0125$$

Final Solution

Normality = **0.0125 N** → Option (1).