

Q1. JEE Main 2026 (21 January Shift 2)

The first and second ionization constants of H_2X are 2.5×10^{-8} and 1.0×10^{-13} respectively. The concentration of X^{2-} in $0.1\text{M}\text{H}_2\text{X}$ solution is $\text{---} \times 10^{-15}\text{M}$. (Nearest Integer)

Q2. JEE Main 2026 (23 January Shift 1)

$x\text{mg}$ of pure HCl was used to make an aqueous solution. 25.0 mL of $0.1\text{M}\text{Ba}(\text{OH})_2$ solution is used when the HCl solution was titrated against it. The numerical value of x is $\text{---} \times 10^{-1}$. (Nearest integer) Given : Molar mass of HCl and $\text{Ba}(\text{OH})_2$ are 36.5 and 171.0 g mol^{-1} respectively.

Q3. JEE Main 2026 (22 January Shift 2)

Which of the following mixture gives a buffer solution with $\text{pH} = 9.25$?

Given : $\text{pK}_b(\text{NH}_4\text{OH}) = 4.75$

(1) $0.2\text{M}\text{NH}_4\text{OH}(0.5\text{ L}) + 0.1\text{M}\text{HCl}(0.5\text{ L})$

(2) $0.2\text{M}\text{NH}_4\text{OH}(0.4\text{ L}) + 0.1\text{M}\text{HCl}(1\text{ L})$

(3) $0.4\text{M}\text{NH}_4\text{OH}(1\text{ L}) + 0.1\text{M}\text{HCl}(1\text{ L})$

(4) $0.5\text{M}\text{NH}_4\text{OH}(0.2\text{ L}) + 0.2\text{M}\text{HCl}(0.5\text{ L})$

Q4. JEE Main 2026 (28 January Shift 1)

Consider a weak base 'B' of $\text{pK}_b = 5.699$. ' x ' mL of 0.02 M HCl and ' y ' mL of 0.02 M weak base 'B' are mixed to make 100 mL of a buffer of $\text{pH } 9$ at 25°C . The values of ' x ' and ' y ' respectively are: [Given: $\log 2 = 0.3010$, $\log 3 = 0.4771$, $\log 5 = 0.699$]

(1)

x	y
85.7	14.3

(3)

x	y
11.1	88.9

(2)

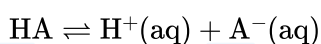
x	y
14.3	85.7

(4)

x	y
42.7	57.3

Q5. JEE Main 2026 (28 January Shift 1)

Consider the dissociation equilibrium of the following weak acid



If the pK_a of the acid is 4 , then the pH of 10 mMHA solution is --- . (Nearest integer)

[Given: The degree of dissociation can be neglected with respect to unity]

Q6. JEE Main 2026 (24 January Shift 1)

Consider two Group IV metal ions X^{2+} and Y^{2+} . A solution containing $0.01MX^{2+}$ and $0.01MY^{2+}$ is saturated with H_2S . The pH at which the metal sulphide YS will form as a precipitate is _____. (Nearest integer)

(Given: $K_{sp}(XS) = 1 \times 10^{-22}$ at $25^\circ C$, $K_{sp}(YS) = 4 \times 10^{-16}$ at $25^\circ C$, $[H_2S] = 0.1M$ in solution,

$K_{a1} \times K_{a2}(H_2S) = 1.0 \times 10^{-21}$, $\log 2 = 0.30$, $\log 3 = 0.48$, $\log 5 = 0.70$)

ANSWERS AND SOLUTIONS

1. 100

2. 1825

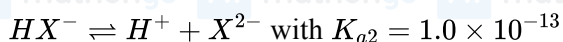
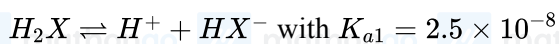
3. (1)

4. (2)

5. 3

6. 4

1. (100) For a weak diprotic acid H_2X , the ionization steps are:



Since $K_{a1} \gg K_{a2}$, the concentration of H^+ is primarily determined by the first ionization.

$$[H^+] \approx \sqrt{K_{a1} \cdot C} = \sqrt{2.5 \times 10^{-8} \times 0.1} = \sqrt{2.5 \times 10^{-9}} = 5 \times 10^{-5} M$$

Also, from the first ionization, $[HX^-] \approx [H^+] = 5 \times 10^{-5} M$

For the second ionization:

$$K_{a2} = \frac{[H^+][X^{2-}]}{[HX^-]}$$

$$\text{Substituting the values: } 1.0 \times 10^{-13} = \frac{(5 \times 10^{-5})[X^{2-}]}{5 \times 10^{-5}}$$

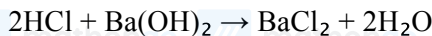
$$\text{Thus, } [X^{2-}] = K_{a2} = 1.0 \times 10^{-13} M$$

To express this in the form $x \times 10^{-15} M$:

$$1.0 \times 10^{-13} = 100 \times 10^{-15} M$$

The value is 100.

2. (1825) The reaction between HCl and $Ba(OH)_2$ is:



$$\text{Moles of } Ba(OH)_2 \text{ used: } n = 0.1 M \times 0.025 L = 0.0025 \text{ mol}$$

$$\text{From stoichiometry: moles of HCl} = 2 \times 0.0025 = 0.005 \text{ mol}$$

$$\text{Mass of HCl} = 0.005 \text{ mol} \times 36.5 \text{ g/mol} = 0.1825 \text{ g} = 182.5 \text{ mg}$$

$$\text{Expressing as } x = \frac{182.5}{10^{-1}} \times 10^{-1}$$

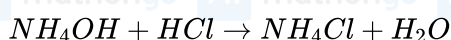
$$182.5 = 1825 \times 10^{-1}$$

The numerical value is 1825 (or 1.825×10^2 mg when expressed with standard scientific notation)

3. (1) $pOH = pK_b + \log \frac{\text{Salt}}{\text{Base}}$

$$4.75 = 4.75 + \log \frac{\text{Salt}}{\text{Base}}$$

Milimoles of [Salt] = milimoles of [Base]

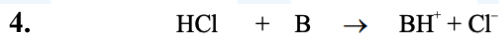


$$0.2M, 0.5L \quad 0.1M, 0.5L$$

$$100 \text{ mmole} \quad 50 \text{ mmole}$$

$$50 \text{ mmole} \quad - \quad 50 \text{ mmole}$$

$$\text{Milimoles of } NH_4OH = \text{milimoles of } NH_4Cl$$



$$\begin{array}{cc} 0.02\text{M} & 0.02\text{M} \\ \times \text{ml} & \times \text{ml} \end{array}$$

(2) t_r 0 0.02y - 0.02x 0.02x

$$pOH = pK_b + \log \left[\frac{\text{Salt}}{\text{Base}} \right]$$

$$5 = 5.699 + \log \left[\frac{\text{Salt}}{\text{Base}} \right]$$

$$\frac{x}{y-x} = \frac{1}{5}$$

$$6x = y$$

$$7x = 100$$

$$x = \frac{100}{7} \text{ ml}$$

$$y = \frac{600}{7} \text{ ml}$$

5. (3) For the weak acid dissociation $\text{HA} \rightleftharpoons \text{H}^+ + \text{A}^-$ with $\text{pK}_a = 4$

We have $\text{K}_a = 10^{-4}$.

For a 10 mM (0.01 M) solution where the degree of dissociation is negligible with respect to unity, the concentration of HA remains approximately 0.01 M.

The equilibrium expression gives

$$\text{K}_a = \frac{[\text{H}^+]^2}{[\text{HA}]}$$

Substituting: $10^{-4} = \frac{[\text{H}^+]^2}{0.01}$, which yields $[\text{H}^+]^2 = 10^{-6}$, so $[\text{H}^+] = 10^{-3} \text{ M}$.

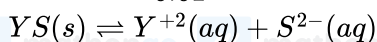
Therefore, $\text{pH} = -\log(10^{-3}) = 3$.

6. (4) $\text{XS}(s) \rightleftharpoons \text{X}^{+2}(\text{aq.}) + \text{S}^{2-}(\text{aq.})$

For precipitation of $\text{XS}(s)$

$$[\text{X}^{+2}][\text{S}^{2-}] \geq K_{sp}(\text{XS})$$

$$[\text{S}^{2-}] \geq \frac{1 \times 10^{-22}}{0.01} = 10^{-20}$$



For precipitation of $\text{YS}(s)$

$$[\text{Y}^{+2}][\text{S}^{2-}] \geq K_{sp}(\text{YS})$$

$$[\text{S}^{2-}] \geq \frac{4 \times 10^{-16}}{10^{-2}} = 4 \times 10^{-14}$$

Now, $\text{H}_2\text{S}(\text{aq}) \rightleftharpoons 2\text{H}^+(\text{aq}) + \text{S}^{2-}(\text{aq})$

$$\frac{[\text{S}^{2-}][\text{H}^+]^2}{\text{H}_2\text{S}} = K_{a_1} \times K_{a_2} = 1 \times 10^{-21}$$

$$[\text{S}^{2-}] = \frac{1 \times 10^{-21} \times [\text{H}_2\text{S}]}{[\text{H}^+]^2} \geq 4 \times 10^{-14}$$

$$[\text{H}^+]^2 \leq \frac{1}{4} \times 10^{-7} \times 10^{-1}$$

$$[H^+] \leq \frac{1}{2} \times 10^{-4} \Rightarrow pH \geq 4.3$$

Nearest integer pH = 4.