Q1 - 25 July - Shift 1

20 mL of 0.1 M NH_4OH is mixed with 40 mL of 0.05 M HCl. The pH of the mixture is nearest to:

(Given: $K_b(NH_4OH) = 1 \times 10^{-5}$, log 2 = 0.30, log 3 = 0.48, log 5 = 0.69, log 7 = 0.84, log 11 =1.04)

(A) 3.2 (B) 4.2

(C) 5.2 (D) 6.2

Space for your notes:

Q2 - 26 July - Shift 2

Class XII students were asked to prepare one litre of buffer solution of pH 8.26 by their chemistry teacher. The amount of ammonium chloride to be dissolved by the student in 0.2 M ammonia solution to make one litre of the buffer is (Given pK_b (NH_3) = 4.74; Molar mass of NH_3 = 17 g mol^{-1}; Molar mass of NH_4Cl = 53.5 g mol^{-1})

(A) 53.5 g (B) 72.3 g

(C) 107.0 g (D) 126.0 g

Space for your notes:

Q3 - 27 July - Shift 1

At 310 K, the solubility of CaF_2 in water is 2.34×10^{-3}g /100 mL. The solubility product of CaF_2 is ___ $\times 10^{-8}$ $(mol/L)^3$. (Given molar mass : CaF_2 = 78 g mol^{-1})

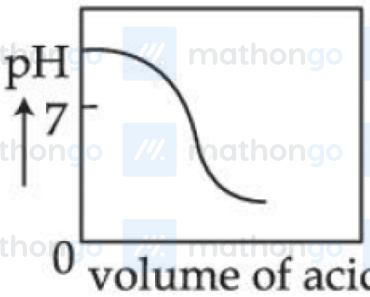
Space for your notes:

Q4 - 27 July - Shift 2

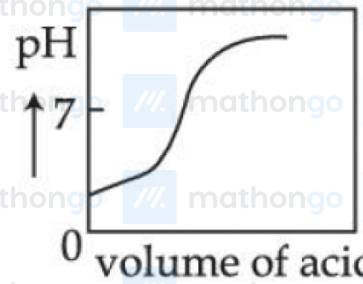
The Plot of pH-metric titration of weak base NH_4OH vs strong acid HCl looks like:

Space for your notes:

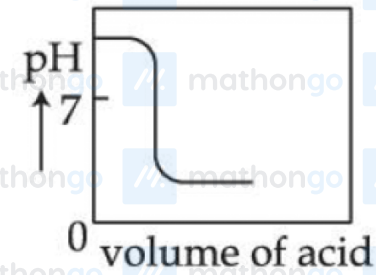
(A)



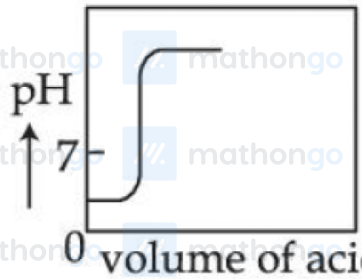
(B)



(C)



(D)



Q5 - 28 July - Shift 1

K_a for butyric acid (C_3H_7COOH) is 2×10^{-5}. The pH of 0.2 M solution of butyric acid is ___ $\times 10^{-1}$. (Nearest integer) [Given log 2 = 0.30]

Space for your notes:

Q6 - 29 July - Shift 1

If the solubility product of PbS is 8×10^{-28}, then the solubility of PbS in pure water at 298 K is $x \times 10^{-16}$ mol L^{-1}. The value of x is _____.

(Nearest Integer)

[Given $\sqrt{2} = 1.41$]

Space for your notes:

Q7 - 29 July - Shift 2

200 mL of 0.01 M HCl is mixed with 400 mL of 0.01M H_2SO_4. The pH of the mixture is ____.

(A) 1.14 (B) 1.78

(C) 2.34 (D) 3.02

Space for your notes:

Answer Key

Q1 (C) **Q2** (C) **Q3** (0) **Q4** (A)

Q5 (27) **Q6** (282) **Q7** (B)

Q1 (C)

$$NH_4OH + HCl \rightarrow NH_4Cl + H_2O$$

mmole 2 2

- - 2 mmole

$$\left[NH_4^+\right] = \frac{2\text{mmole}}{60\,\text{ml}} = \frac{1}{30}\,\text{M}$$

$$pH = \frac{pK_w - pK_b - \log C}{2} = \frac{14 - 5 + 1.48}{2} = 5.24$$

Q2 (C)

$$POH = 14 - 8.26$$

$$= pK_b + \log\frac{[NH_4^+]}{[NH_3]}$$

$$= 5.74 = 4.74 + \log\frac{[NH_4^+]}{0.2} \Rightarrow [NH_4^+] = 2$$

Hence

$$NH_4Cl = 2 \times 53.5 = 107\,\text{g}$$

Q3 (0)

Solubility of CaF_2 = S mole/L

$$S = \frac{2.34\times10^{-3}}{0.1\times78} = \frac{2.34}{78}\times10^{-2} = 3\times10^{-4}\,\text{mol/L}$$

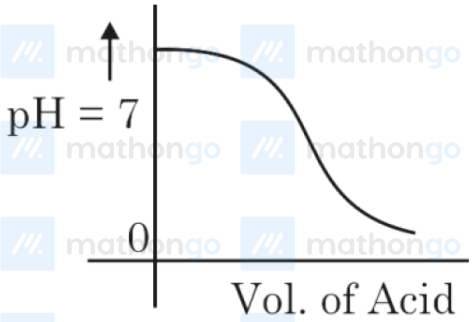
$$K_{sp}\,(CaF_2) = 4S^3 = 4(3\times10^{-4})^3$$

$$= 108\times10^{-12}$$

$$= 0.0108\times10^{-8}\,(\text{mol/L})^3$$

Q4 (A)

Titration curve of NH_4OH vs HCl (WB + SA).



Q5 (27)

K_a of Butyric acid $\Rightarrow 2\times10^{-5}$ PKa = 4.7

pH of 0.2 M solution

$$pH = \frac{1}{2}pK_a - \frac{1}{2}\log C$$

$$= \frac{1}{2}(4\cdot7)\frac{1}{2}\log(0.2)$$

$$= 2.35 + 0.35 = 2.7$$

$$pH = 27 \times 10^{-1}$$

Q6 (282)

$$K_{sp} = S^2$$

$$S = \sqrt{K_{sp}} = \sqrt{8\times10^{-28}} = 2\sqrt{2}\times10^{-14}$$

$$= 2.82 \times 10^{-14}$$

$$= 282 \times 10^{-16}$$

Ans. = 282

Q7 (B)

$HCl + H_2SO_4$

$$[H^+] = \frac{(0.01 \times 200) + (0.01 \times 2 \times 400)}{600}$$

$$= \frac{2+8}{600} = \frac{10}{600} = \frac{1}{60}$$

$$pH = -\log\left[\frac{1}{60}\right]$$

$$= 1.78$$