Master Math for JEE Main & JEE Advanced

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JEE Mains 2020 Jan Chapter wise Question Bank

Ionic Equilibrium

Q1

Each of solution A and B of 100 L containing 4 g NaOH and 9.8 g H_2SO_4. Find pH of solution which is obtain by mixing 40 L solution of A and 10 L solution of B.

7th Jan Morning

Sol

10.60

$$M_{H_2SO_4} \Rightarrow \frac{9.8}{98\times100} = 10^{-3}$$

$$M_{NaOH} \Rightarrow \frac{4}{40\times100} = 10^{-3}$$

$$= \frac{40\times10^{-3} - 10\times10^{-3}\times2}{50} = \frac{20}{50}\times10^{-3}$$

$$[OH^-] = \frac{2}{5}\times10^{-3}$$

pOH = 3.397

pH = 10.603

Q2

3 gram of acetic acid is mixed in 250 mL of 0.1 M HCl. This mixture is now diluted to 500 mL. 20 mL of this solution is now taken in another container. $\frac{1}{2}$ mL of 5 M NaOH is added to this. Find the pH of this solution. (log 3 = 0.4771, pK_a = 4.74)

7th Jan Evening

Sol

5.22

m mole of acidic acid in 20 mL = 2

m mole of HCl in 20 mL = 1

m mole of NaOH = 2.5

$CH_3COOH + NaOH\ (remaining) \longrightarrow CH_3COONa + water$

2	3/2	0	0
0.5	0	3/2	-

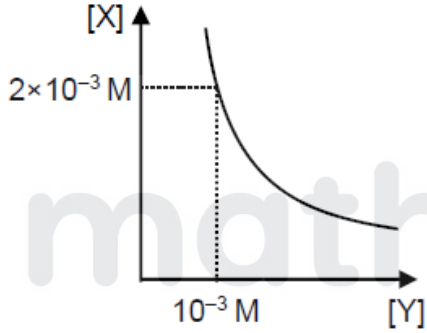
$$pH = PK_a + \log\frac{3/2}{2}$$

$= 4.74 + \log 3$

$= 4.74 + 0.48 = 5.22$

Q3

Select the correct stoichiometry and its k_{sp} value according to given graphs.
दिये गये आरेख के अनुसार सही रससमीकरणमती तथा इसके k_{sp} का सही मान है–



(1) XY, $K_{sp} = 2\times10^{-6}$ (2) XY_2, $K_{sp} = 4\times10^{-9}$

(3) X_2Y, $K_{sp} = 9\times10^{-9}$ (4) XY_2, $K_{sp} = 1\times10^{-9}$

8th Jan Morning

Sol

(1)

$$XY(s) \longrightarrow \underset{2\times10^{-3}}{X^+(aq)} + \underset{10^{-3}}{Y^-(aq)}$$

$K_{sp} = [X^+]\,[Y^-]$

or या, $K_{sp} = 2 \times 10^{-3} \times 10^{-3}$

or या, $K_{sp} = 2 \times 10^{-6}$

Q4

Ksp of $PbCl_2 = 1.6 \times 10^{-5}$

On mixing

300 mL, 0.134M $Pb(NO_3)_2$(aq.) + 100 mL, 0.4 M NaCl(aq.)

(1) Q > Ksp (2) Q < Ksp (3) Q = Ksp (4) Relation does not exit

9th Jan Morning

Sol

(1)

$Q = [Pb^{2+}][Cl^-]^2$

$= \frac{300 \times 0.134}{400} \times \left[\frac{100 \times 0.4}{400}\right]^2$

$= \frac{3 \times 0.134}{4} \times (0.1)^2$

$= 0.105 \times 10^{-2}$

$= 1.005 \times 10^{-3}$

$\boxed{Q > Ksp}$

Q5

Given K_{sp} for $Cr(OH)_3$ is 6×10^{-31} then determine $[OH^-]$.
(Neglect the contribution of OH^- ions from H_2O)
दिया है $Cr(OH)_3$ के लिये K_{sp}, 6×10^{-31} है तब $[OH^-]$ का निर्धारण कीजिये।
(H_2O से OH^- आयनों का योगदान नगण्य मानें।)

(1) $(18 \times 10^{-31})^{1/4}$ M (2) $(18 \times 10^{-31})^{1/2}$ M (3) $(6 \times 10^{-31})^{1/4}$ M (4) $\left(\frac{6}{27} \times 10^{-31}\right)^{1/4}$ M

9th Jan Evening

Sol

(1)

$Cr(OH)_3 \longrightarrow Cr^{+3} + 3OH^-$

s 3s

$K_{sp} = s \cdot (3s)^3$

$\Rightarrow 6 \times 10^{-31} = 27.s^4$

$\Rightarrow s = \left(\frac{6}{27} \times 10^{-31}\right)^{1/4}$

$[OH^-] = 3s$

$= 3 \times \left(\frac{6}{27} \times 10^{-31}\right)^{1/4} = (18 \times 10^{-31})^{1/4}$ M

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