31. An aqueous solution contains 0.10 M H_2S and 0.20 M HCl. If the equilibrium constants for the formation of HS^- from H_2S is 1.0×10^{-7} and that S^{2-} from HS^- ions is 1.2×10^{-13} then the concentration of S^{2-} ions in aqueous solution is : **(2018)**

(A) 6×10^{-21} (B) 5×10^{-19} (C) 5×10^{-8} (D) 3×10^{-20} ▶

32. An aqueous solution contains an unknown concentration of Ba^{2+}. When 50 mL of a 1 M solution of Na_2SO_4 is added, $BaSO_4$ just begins to precipitate. The final volume is 500 mL. The solubility product of $BaSO_4$ is 1×10^{-10}. What is the original concentration of Ba^{2+}? **(2018)**

(A) $1.1 \times 10^{-9} M$ (B) $1.0 \times 10^{-10} M$

(C) $5 \times 10^{-9} M$ (D) $2 \times 10^{-9} M$

33. Following four solutions are prepared by mixing different volumes of NaOH and HCl of different concentrations, pH of which one of them will be equal to 1 ? **(2018)**

(A) $100\,mL\,\dfrac{M}{10}\,HCl + 100\,mL\,\dfrac{M}{10}\,NaOH$ (B) $75\,mL\,\dfrac{M}{5}\,HCl + 25\,mL\,\dfrac{M}{5}\,NaOH$ ▶

(C) $60\,mL\,\dfrac{M}{10}\,HCl + 40\,mL\,\dfrac{M}{10}\,NaOH$ (D) $55\,mL\,\dfrac{M}{10}\,HCl + 45\,mL\,\dfrac{M}{10}\,NaOH$

34. A mixture of 100m mol of $Ca(OH)_2$ and $2\,g$ of sodium sulphate was dissolved in water and the volume was made up to 100 mL. The mass of calcium sulphate formed and the concentration of OH^- in resulting solution, respectively, are : (Molar mass of $Ca(OH)_2$, Na_2SO_4 and $CaSO_4$ are 74, 143 and $136\,g\,mol^{-1}$, respectively; K_{sp} of $Ca(OH)_2$ is 5.5×10^{-6}) **(2019)**

(A) $13.6\,g, 0.28\,mol\,L^{-1}$ (B) $1.9\,g, 0.14\,mol\,L^{-1}$

(C) $1.9g, 0.28\,mol\,L^{-1}$ (D) $13.6g, 0.14\,mol\,L^{-1}$

35. 20 mL of $0.1\,M\,H_2SO_4$ solution is added to $30\,mL$ of $0.2\,M\,NH_4OH$ solution. The pH of the resultant mixture is : [pk_b of $NH_4OH = 4.7$] **(2019)**

(A) 9.4   (B) 9.0   (C) 5.0   (D) 5.2

36. If K_{sp} of Ag_2CO_3 is 8×10^{-12}, the molar solubility of Ag_2CO_3 in 0.1 M $AgNO_3$ is : **(2019)**

(A) $8 \times 10^{-10} M$ (B) $8 \times 10^{-12} M$

(C) $8 \times 10^{-13} M$ (D) $8 \times 10^{-11} M$

37. For the equilibrium $2H_2O \rightleftharpoons H_3O^+ + OH^-$, the value of $\Delta G°$ at 298 K is approximately : **(2019)**

(A) $-80\,kJ\,mol^{-1}$ (B) $80\,kJ\,mol^{-1}$

(C) $100\,kJ\,mol^{-1}$ (D) $-100\,kJ\,mol^{-1}$

38. Consider the following statements

I. The pH of a mixture containing 400 mL of $0.1\,M\,H_2SO_4$ and 400 mL of 0.1 M NaOH will be approximately 1.3.

II. Ionic product of water is temperature dependent.

III. A monobasic acid with $K_a = 10^{-5}$ has a $pH = 5$. The degree of dissociation of this acid is 50%

IV. The Le Chatelier's principle is not applicable to common-ion effect.

The correct statements are: **(2019)**

(A) I and II **(B)** I, II and III **(C)** II and III **(D)** I, II and IV

39. If solubility product of $Zr_3(PO_4)_4$ is denotes by K_{sp} and its molar solubility is denoted by S, then which of the following relation between S and K_{sp} is correct ? **(2019)**

(A) $S = \left(\dfrac{K_{sp}}{6912}\right)^{1/7}$ **(B)** $S = \left(\dfrac{K_{sp}}{929}\right)^{1/9}$ **(C)** $S = \left(\dfrac{K_{sp}}{216}\right)^{1/7}$ **(D)** $S = \left(\dfrac{K_{sp}}{144}\right)^{1/6}$

40. What is the molar solubility of $Al(OH)_3$ in 0.2 M NaOH solution?

Given that, solubility product of $Al(OH)_3 = 2.4 \times 10^{-24}$: **(2019)**

(A) 3×10^{-22} **(B)** 12×10^{-23} **(C)** 12×10^{-21} **(D)** 3×10^{-19}

41. The molar solubility of $Cd(OH)_2$ is $1.84 \times 10^{-5}\,M$ in water. The expected solubility of $Cd(OH)_2$ in a buffer solution of $pH = 12$ is : **(2019)**

(A) $\dfrac{2.49}{1.84} \times 10^{-9}M$ **(B)** $2.49 \times 10^{-10}M$ **(C)** $6.23 \times 10^{-11}M$ **(D)** $1.84 \times 10^{-9}M$
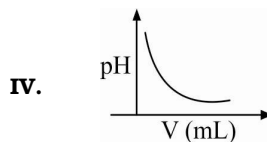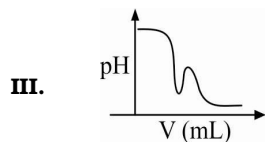
42. The pH of $0.02\,M\,NH_4Cl$ solution will be: [given $K_b(NH_4OH) = 10^{-5}$ and $\log 2 = 0.301$] **(2019)**

(A) 4.65 **(B)** 5.35 **(C)** 2.65 **(D)** 4.35

43. In an acid-base titration, 0.1 M HCl solution was added to the NaOH solution of unknown strength. Which of the following correctly shows the change of pH of the titration mixture in this experiment?

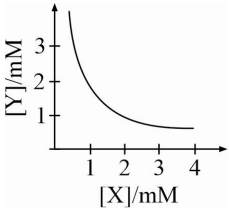**I.** **II.** **(2019)**

III. **IV.**
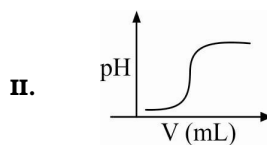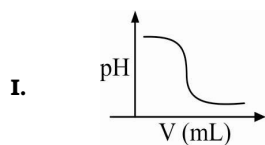
(A) I **(B)** II **(C)** III **(D)** IV

44. 3 g of acetic acid is added to 250 mL of 0.1 M HCl and the solution made up to 500 mL . To 20 mL of this solution $\dfrac{1}{2}$ mL of 5 M NaOH is added. The pH of the solution is_____. **(2020)**

[Given: pKa of acetic acid $= 4.75$, molar mass of acetic acid $= 60\,g/mol$, $\log 3 = 0.4771$]

Neglect any changes in volume.

45. For the following **Assertion and Reason** the correct option is: **(2020)**

Assertion : The pH of water increases with increase in temperature

Reason : The dissociation of water into H^+ and OH^- is an exothermic reaction

(A) Assertion is not true, but reason is true

(B) Both assertion and reason are true, but the reason is not the correct explanation for the assertion

(C) Both assertion and reason are false

(D) Both assertion and reason are true, and the reason the correct explanation for the assertion

46. The solubility product of $Cr(OH)_3$ at 298 K is 6.0×10^{-31}. The concentration of hydroxide ions in a saturated solution of $Cr(OH)_3$ will be : **(2020)**

(A) $(18 \times 10^{-31})^{1/4}$ **(B)** $(4.86 \times 10^{-29})^{1/4}$

(C) $(2.22 \times 10^{-31})^{1/4}$ **(D)** $(18 \times 10^{-31})^{1/2}$

47. The K_{sp} for the following dissociation is 1.6×10^{-5}

$$PbCl_2(s) \rightleftharpoons Pb^{2+}(aq) + 2Cl^-(aq)$$

Which of the following choices is correct for a mixture of 300 mL 0.134 M $Pb(NO_3)_2$ and 100 mL 0.4 M NaCl? **(2020)**

(A) $Q > K_{sp}$ **(B)** $Q = K_{sp}$

(C) Not enough data provided   **(D)** $Q < K_{sp}$

48. The stoichiometry and stability product of a salt with the solubility curves given below is, respectively :

(A) $XY_2, 4 \times 10^{-9} M^3$ **(B)** $XY_2, 1 \times 10^{-9} M^3$ **(2020)**

(C) $X_2Y, 2 \times 10^{-9} M^3$ **(D)** $XY, 2 \times 10^{-6} M^2$

49. The strength of an aqueous NaOH solution is most accurately determined by titrating : **(2020)**
(Note : consider that the appropriate indicator is used)

(A) Aq. NaOH in a volumetric flask and concentrated H_2SO_4 in a conical flask

(B) Aq. NaOH in a burette and oxalic acid in a conical flask

(C) Aq. NaOH in a burette and concentrated H_2SO_4 in a conical flask

(D) Aq. NaOH in a pipette and oxalic acid in a burette

50. Two solutions, A and B, each of 100 L was made by dissolving 4g of NaOH and 9.8 g of H₂SO₄ in water, respectively. The pH of the resultant solution obtained from mixing 40 L of solution A and 10 L of solution B is_____. **(2020)**