CH1102.

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Expt. No. 06: Estimation method for calcium in water / milk by standard EDTA solution.

Q1. Monobasic Calcium Phosphate [$Ca_3(PO_4)_2$] is soluble in water but its di & tribasic forms are insoluble. So, $Ca_3(PO_4)_2$ is almost insoluble or very less soluble in water because the solubility product for dissociation of $Ca_3(PO_4)_2$ is $2.07 \times 10^{-33} << 1$.

Let the molar solubility of $Ca_3(PO_4)_2$ be S

$$Ca_3(PO_4)_2 \rightleftharpoons 3Ca^{2+} + 2PO_4^{3-}$$

$$\Rightarrow [Ca^{2+}] = 3C \;,\; [PO_4^{3-}] = 2C$$

$$\Rightarrow K_{sp} = [Ca^{2+}]^3 [PO_4^{3-}]^2 = (3C)^3 (2C)^2$$

$$\Rightarrow 2.07 \times 10^{-33} = 27 \times 4 \times C^5$$

$$\Rightarrow C^5 = \frac{2.07 \times 10^{-33}}{108} = 0.019 \times 10^{-33}$$

$$\Rightarrow C = (1.9 \times 10^{-35})^{1/5} = \underline{1.1 \times 10^{-7}\ M.}$$

∴ Molar Solubility of $Ca_3(PO_4)_2$ is 1.1×10^{-7} M which is very low. So, it's insoluble or very less soluble in water.

Q2. Calculate pH of 0.05M of $La(CH_3COO)_2$ where pKa is 4.74.

$\Rightarrow pK_a = 4.74$

$$La(CH_3COO)_2 \longrightarrow La^{2+} + 2CH_3COO^{\ominus}$$

0.05M $\qquad$ $2 \times 0.05 = 0.1$ M.

$La(CH_3COO)_2$

(Weak Acid + Strong Base)

$$pH = 7 + \frac{1}{2} pK_a + \frac{\log C}{2}$$

$$= 7 + \frac{1}{2}(4.74) + \frac{1}{2}\log(0.1)$$

$$= 8.87.$$

$\therefore$ pH = 8.87 ans.

Q3. Coordination no. of EDTA is 6.
EDTA is a hexadentate ligand that donate six $e^{\ominus}$ pairs to central metal atom and form a chelate. Chelate is a ring like structure that is formed when multidentate ligand donate more than one electron pairs to central metal atom. Chelation forming complexes are more stable. When EDTA donates its 6 electron pairs to central metal atom, it forms octahedral geometry with chelate which is more stable as compare to EBT complex, which is a tridentate ligand.