Q26 :

Indicate the steps in the preparation of:

(i) K2Cr2O7 from chromite ore.

(ii) KMnO4 from pyrolusite ore.

Answer :

(i)

Potassium dichromate ($K_2Cr_2O_7$) is prepared from chromite ore $(FeCr_2O_4)$ in the following steps.

Step (1): Preparation of sodium chromate

$$4FeCr_2O_4 + 16NaOH + 7O_2 \longrightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8H_2O$$

Step (2): Conversion of sodium chromate into sodium dichromate

$$2Na_2CrO_4 + \text{conc.}H_2SO_4 \longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$$

Step(3): Conversion of sodium dichromate to potassium dichromate

$$Na_2Cr_2O_7 + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$$

Potassium chloride being less soluble than sodium chloride is obtained in the form of orange coloured crystals and can be removed by filtration.

The dichromate ion $(Cr_2O_7^{2-})$ exists in equilibrium with chromate (CrO_4^{2-}) ion at pH 4. However, by changing the pH, they can be interconverted.

$$\underset{\text{Chromate}}{2CrO_4^{2-}} \xleftrightarrow[\text{Alkali}]{\text{Acid}} \underset{\text{Hydrogen}}{2HCrO_4^{-}} \xleftrightarrow[\text{Alkali}]{\text{Acid}} \underset{\text{Dichromate}}{Cr_2O_7^{2-}}$$