

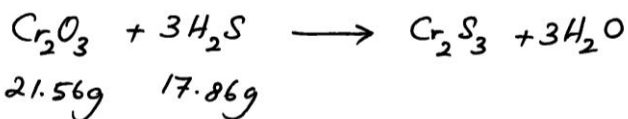
Q5.

Chromium(III) oxide reacts with hydrogen sulfide gas to form chromium(III) sulfide and water. What mass of each substance is present if 21.56g chromium(III) oxide and 17.86g hydrogen sulfide react completely?

ANSWER



Answer Q5 :



$$n_{\text{Cr}_2\text{O}_3} = \left(\frac{21.56}{151.99}\right) = 0.142 \text{ mols}$$

$$n_{\text{H}_2\text{S}} = \left(\frac{17.86}{34.08}\right) = 0.524 \text{ mols}$$

$$M_r(\text{Cr}_2\text{O}_3) = 151.99$$

$$M_r(\text{H}_2\text{S}) = 34.08$$

$$M_r(\text{H}_2\text{O}) = 18.015$$

$$M_r(\text{Cr}_2\text{S}_3) = 200.19$$

Comparing the ratio of (moles/coefficient)

$$\frac{n_{\text{Cr}_2\text{O}_3}}{1} = \frac{0.142}{1} = 0.142 \leftarrow \text{smallest value} \therefore \text{Cr}_2\text{O}_3 = \text{limiting reactant.}$$

$$\frac{n_{\text{H}_2\text{S}}}{3} = \frac{0.524}{3} = 0.175$$

$$n_{\text{Cr}_2\text{S}_3} = \frac{1}{1} \times n_{\text{Cr}_2\text{O}_3} = 0.142 \text{ mols}$$

$$\therefore m_{\text{Cr}_2\text{S}_3} = (0.142 \times 200.19) \text{g} = 28.43 \text{g (Ans)}$$

$$n_{\text{H}_2\text{O}} = \frac{3}{1} \times n_{\text{Cr}_2\text{O}_3} = (3 \times 0.142) \text{ mols} = 0.426 \text{ mols}$$

$$\therefore m_{\text{H}_2\text{O}} = (0.426 \times 18.015) \text{g} = 7.67 \text{g (Ans)}$$

$$n_{\text{H}_2\text{S}} = \frac{3}{1} \times n_{\text{Cr}_2\text{O}_3} = (3 \times 0.142) \text{ mols} = 0.426 \text{ mols}$$

$$\therefore m_{\text{H}_2\text{S}} = (0.426 \times 34.08) = 14.52 \text{g}$$

$$\text{Excess H}_2\text{S remains} = (17.86 - 14.52) \text{g} = 3.34 \text{g (Ans)}$$

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