

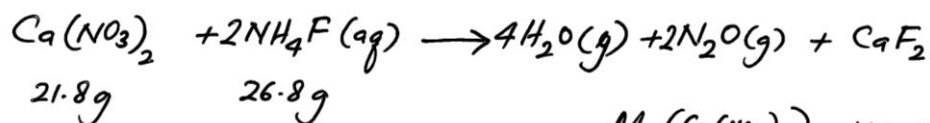
Q4.

21.8g of calcium nitrate react completely with 26.8g of ammonium fluoride to form water vapor, dinitrogen monoxide and calcium fluoride. What mass of each substance is present after reaction is complete?

ANSWER



Answer Q4 :



$$n(\text{Ca(NO}_3)_2) = \left(\frac{21.8\text{g}}{164.1} \right) \\ = 0.1328\text{ mol}$$

$$n_{\text{NH}_4\text{F}} = \left(\frac{26.8}{37.1\text{ gmol}^{-1}} \right) \\ = 0.722\text{ mol.}$$

$$M_r(\text{Ca(NO}_3)_2) = 164.1\text{ gmol}^{-1}$$

$$M_r(\text{NH}_4\text{F}) = 37.1\text{ gmol}^{-1}$$

$$M_r(\text{H}_2\text{O}) = 18.015\text{ gmol}^{-1}$$

$$M_r(\text{N}_2\text{O}) = 44.013\text{ gmol}^{-1}$$

$$M_r(\text{CaF}_2) = 78.074\text{ gmol}^{-1}$$

Comparing the ratio of (moles/coefficient):

$$\frac{n_{\text{Ca(NO}_3)_2}}{1} = \frac{0.1328}{1} = 0.1328 \leftarrow \text{smallest value} \\ \therefore \text{Ca(NO}_3)_2 = \text{limiting reactant}$$

$$\frac{n_{\text{NH}_4\text{F}}}{2} = \frac{0.722}{2} = 0.3610$$

$$n_{\text{H}_2\text{O}} = \frac{4}{1} \times n_{\text{Ca(NO}_3)_2} = (4 \times 0.1328)\text{ mols} = 0.5312$$

$$\therefore m_{\text{H}_2\text{O}} = (0.5312\text{ mol})(18.015) = 9.57\text{g (Ans)}$$

$$n_{\text{N}_2\text{O}} = \frac{2}{1} \times n_{\text{Ca(NO}_3)_2} = (2 \times 0.1328)\text{ mols} = 0.266$$

$$\therefore m_{\text{N}_2\text{O}} = (0.266)(44.013\text{ gmol}^{-1}) = 11.707\text{g (Ans)}$$

$$n_{\text{CaF}_2} = n_{\text{Ca(NO}_3)_2} = 0.1328\text{ mols}$$

$$\therefore m_{\text{CaF}_2} = (0.1328)(78.074) = 10.37\text{g (Ans)}$$

$$n_{\text{NH}_4\text{F}} = \frac{2}{1} \times n_{\text{Ca(NO}_3)_2} = (2 \times 0.1328) = 0.2656$$

$$\therefore m_{\text{NH}_4\text{F}} = (0.2656)(37.1) = 9.85\text{g}$$

$$\text{Excess NH}_4\text{F remains} = (26.8 - 9.85) = 16.95\text{g (Ans).}$$