

Answer on Question #71447, Chemistry / General Chemistry

Question:

For the reaction, calculate how many grams of the product form when 24.4 g of O₂ completely reacts. Assume that there is more than enough of the other reactant.
 $4\text{Cr(s)} + 3\text{O}_2\text{(g)} \rightarrow 2\text{Cr}_2\text{O}_3\text{(s)}$

Solution:

Let's define the mole number of each compound in the reaction: 3 mole of oxygen with 2 mole of chromium completely reacts and forms 2 mole of chromium (III) oxide. To calculate the mass of product we can use following ratio:

$$3n(\text{O}_2) = 2n(\text{Cr}_2\text{O}_3)$$

$$n(\text{Cr}_2\text{O}_3) = \frac{2}{3}n(\text{O}_2)$$

$$\frac{m(\text{Cr}_2\text{O}_3)}{M(\text{Cr}_2\text{O}_3)} = \frac{2 m(\text{O}_2)}{3 M(\text{O}_2)}$$

$$m(\text{Cr}_2\text{O}_3) = \frac{2 m(\text{O}_2)}{3 M(\text{O}_2)} M(\text{Cr}_2\text{O}_3)$$

$$m(\text{Cr}_2\text{O}_3) = \frac{2}{3} \cdot \frac{22.4\text{g}}{32\frac{\text{g}}{\text{mol}}} \cdot 152\frac{\text{g}}{\text{mol}} = 77.3\text{ g}$$

Answer: The mass of the Chromium (III) oxide is 77.3 g.

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