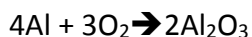


Answer on # 71458, Chemistry / General Chemistry

Question : Aluminium combines with oxygen gas to form aluminium oxide, Al_2O_3 , if 100.0g reacts with 100.0g of oxygen, how many grams of aluminium oxide are produced and which reactant is the limiting reactant

Solution:



To find the limiting reactant, change the grams of each reactant to moles by dividing by molar mass:

$$m(\text{Al}) = 100.0 \text{ g}, n(\text{Al}) = 100.0 \text{ g} / 26.98 \text{ g/mol} = 3.71 \text{ mol}$$

$$m(\text{O}_2) = 100.0 \text{ g}, n(\text{O}_2) = 100.0 \text{ g} / 31.99 \text{ g/mol} = 3.13 \text{ mol}$$

To determine the limiting reactant, divide the moles of each substance by the coefficient of that substance from the balanced chemical equation. The lowest value from this division is the limiting reactant. The limiting reactant is the key to all subsequent calculations.

$$\text{For Al: } 3.71 \text{ mol} / 4 \text{ mol} = 0.93 \text{ (limiting)}$$

$$\text{For O}_2: 3.13 \text{ mol} / 3 \text{ mol} = 1.04 \text{ (in excess)}$$

So, Al is limiting because there is have a smaller relative amount of it available to react. Then find mass of Al_2O_3 by normal stoichiometry calculation and solving simple proportion

$$3.71 \text{ mol} - 2 \text{ mol}$$

$$4 \text{ mol} - x \text{ mol}$$

$$n(\text{Al}_2\text{O}_3) = x = (2 * 3.71) / 4 = 1.86 \text{ mol}$$

$$m(\text{Al}_2\text{O}_3) = 1.86 \text{ mol} * 101.96 \text{ g/mol} = 189.65 \text{ g}$$

Answer: Al is a limiting reagent, m (Al_2O_3) = 189.65 g

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