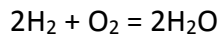


Question #64195, Chemistry / General Chemistry

A certain variety of coal is composed of 75% carbon, 15% hydrogen and 10% ash. How many cubic metres of air are required for the complete combustion of 425kg of this fuel?

Answer:

Suppose air at STP. From the fuel ash only will not be burned. Hydrogen burns:

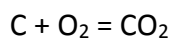


$$m(\text{H}_2) = 425\,000\text{ g} \times 0.15 = 63750\text{ g}$$

$$n(\text{H}_2) = \frac{m(\text{H}_2)}{M(\text{H}_2)} = \frac{63750\text{ g}}{2.01\frac{\text{g}}{\text{mol}}} = 31716.42\text{ mol}$$

$$n(\text{O}_2) = \frac{1}{2}n(\text{H}_2) = \frac{31716.42\text{ mol}}{2} = 15858.21\text{ mol}$$

Carbon burns:



$$m(\text{C}) = 425\,000\text{ g} \times 0.75 = 318750\text{ g}$$

$$n(\text{C}) = \frac{m(\text{C})}{M(\text{C})} = \frac{318750\text{ g}}{12.001\frac{\text{g}}{\text{mol}}} = 26560.29\text{ mol}$$

$$n(\text{O}_2) = n(\text{C}) = 26560.29\text{ mol}$$

$$n(\text{O}_2) = 26560.29\text{ mol} + 15858.21\text{ mol} = 42418.50\text{ mol}$$

$$V(\text{O}_2) = 22.4\frac{\text{L}}{\text{mol}} \times 42418.50\text{ mol} = 950174.4\text{ L} = 950.2\text{ m}^3$$

$$V(\text{air}) = \frac{950.2\text{ m}^3}{0.21} = \mathbf{4524.64\text{ m}^3}$$