

Mass - Volume Stoichiometry Worksheet Answers

① a) determine limiting reagent

$$\text{Na} \quad \frac{90.0\text{g}}{23.0\text{g/mol}} = 3.913 \text{ mol}$$

$$\text{H}_2\text{O} \quad \frac{80.0\text{g}}{18.0\text{g/mol}} = 4.444 \text{ mol}$$

Since Na and H₂O coeff. are both 2, the Na is limiting.

b) calc L of H₂

$$\frac{\text{Na}}{\text{H}_2} \quad \frac{2}{1} = \frac{3.913 \text{ mol}}{x}$$

$$\begin{aligned} &1.9565 \text{ mol of H}_2 \\ &\times 22.414 \text{ L/mol} \\ &= \underline{\underline{43.8 \text{ L}}} \end{aligned}$$

$$x = 1.9565 \text{ mol of H}_2$$

c) determine excess amount remaining

$$4.444 - 3.913 = 0.531 \text{ mol of H}_2\text{O remaining}$$

$$0.531 \text{ mol} \times 18.0 \text{ g/mol} = \underline{\underline{9.56 \text{ g}}}$$

② determine limiting reagent

$$P_4 \quad 2.50 \text{ g} / 123.90 \text{ g/mol} = 0.02018 \text{ mol}$$

$$O_2 \quad 0.750 \text{ L} / 22.414 \text{ L/mol} = 0.03346 \text{ mol}$$

$$P_4 \quad \frac{0.02018}{1} \quad O_2 \quad \frac{0.03346}{5} \quad \underline{O_2 \text{ is limiting}}$$

calc P_4O_{10} formed

$$\frac{O_2}{P_4O_{10}} \quad \frac{5}{1} = \frac{0.03346}{x} \quad x = 0.00670 \text{ mol } P_4O_{10}$$

$$0.00670 \text{ mol} \times 283.89 \text{ g/mol} = \underline{\underline{1.90 \text{ g}}}$$

calc excess P_4

method #1

1) find grams of O_2 $0.03346 \text{ mol} \times 32.0 \text{ g/mol} = 1.07 \text{ g}$

2) subtract from mass of product $1.90 \text{ g} - 1.07 \text{ g} = 0.83 \text{ g}$
of P_4 that reacted

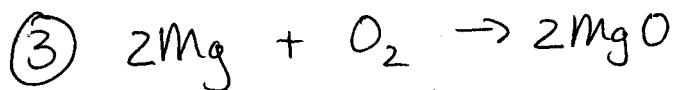
3) subtract from starting amount $2.50 \text{ g} - 0.83 \text{ g} = \underline{\underline{1.67 \text{ g}}}$

method #2

1) P_4 and O_2 react in a 1:5 ratio $\frac{0.03346 \text{ mol}}{5} = 0.00670 \text{ mol}$
 P_4 reacted

2) determine grams of P_4
 $123.90 \text{ g/mol} \times 0.00670 \text{ mol} = 0.83 \text{ g reacted}$

3) $2.50 \text{ g} - 0.83 \text{ g} = \underline{\underline{1.67 \text{ g remaining}}}$



Determine limiting reagent

$$\text{Mg} \quad \frac{1.00\text{g}}{24.305\text{g/mol}} = 0.04114 \text{ mol}$$

$$\text{O}_2 \quad \frac{0.500\text{g}}{32.00\text{g/mol}} = 0.02231 \text{ mol}$$

$$\text{Mg} \quad \frac{0.04114}{2} \quad \text{O}_2 \quad \frac{0.02231}{1} \quad \text{Mg is limiting}$$

calc MgO produced

$$\frac{\text{Mg}}{\text{MgO}} \quad \frac{2}{2} = \frac{0.04114}{x} \quad x = 0.04114 \text{ mol MgO}$$

$$0.04114 \text{ mol} \times 40.304 \text{ g/mol} = \underline{\underline{1.66 \text{ g}}}$$

Calc excess O_2

method #1

1) calc grams of oxygen reacted $1.66\text{g} - 1.00\text{g} = 0.66\text{g}$

2) calc grams of oxygen at start $0.02231 \text{ mol} \times 32.0\text{g/mol} = 0.714\text{g}$

3) subtract from starting amount $0.714\text{g} - 0.66\text{g} = \underline{\underline{0.054\text{g}}}$
(rounding error)

method #2

1) Mg and O_2 react in a 2:1 ratio $\frac{0.04114 \text{ mol}}{2} = 0.02057 \text{ mol}$ of O_2 reacted

2) calc moles of O_2 remaining $0.02231 - 0.02057 = 0.00174 \text{ mol}$

3) convert to grams $0.00174 \text{ mol} \times 32.0\text{g/mol} = \underline{\underline{0.056\text{g}}}$