Mass - Volume Stoichiometry Worksheet Answers

(1) a) determine limiting reagent

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

H_2O $\frac{80.0\,g}{18.0\,g/mol} = 4.444\ mol$

Since Na and H_2O coeff. are both 2, the Na is limiting.

b) Calc L of H_2

$\frac{Na}{H_2} \quad \frac{2}{1} = \frac{3.913\ mol}{x}$

$x = 1.9565\ mol\ of\ H_2$

$1.9565\ mol\ of\ H_2 \times 22.414\ L/mol = \underline{\underline{43.8\ L}}$

c) determine excess amount remaining

$4.444 - 3.913 = 0.531\ mol\ of\ H_2O\ remaining$

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

(2) determine limiting reagent

P_4 $2.50\,g / 123.90\,g/mol = 0.02018\,mol$

O_2 $0.750\,L / 22.414\,L/mol = 0.03346\,mol$

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

Calc P_4O_{10} formed

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

$0.00670\,mol \times 283.89\,g/mol = 1.90\,g$

Calc excess P_4

method #1

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

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

3) subtract from starting amount $2.50\,g - 0.83\,g = 1.67\,g$

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method #2

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

2) determine grams of P_4

$123.90\,g/mol \times 0.00670\,mol = 0.83\,g$ reacted

3) $2.50\,g - 0.83\,g = 1.67\,g$ remaining

③ $2Mg + O_2 \rightarrow 2MgO$

Determine limiting reagent

Mg $1.00\,g / 24.305\,g/mol = 0.04114\ mol$

O_2 $0.500\,L / 22.414\,L/mol = 0.02231\ mol$

Mg $\frac{0.04114}{2}$ O_2 $\frac{0.02231}{1}$ Mg is limiting

Calc MgO produced

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

$0.04114\ mol \times 40.304\,g/mol = 1.66\,g$

Calc excess O_2

method #1

1) Calc grams of oxygen reacted: $1.66g - 1.00g = 0.66g$

2) Calc grams of oxygen at start: $0.02231\ mol \times 32.0\,g/mol = 0.714\,g$

3) subtract from starting amount: $0.714g - 0.66g = 0.054g$ (rounding error)

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method #2

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

2) Calc moles of O_2 remaining: $0.02231 - 0.02057 = 0.00174\ mol$

3) convert to grams: $0.00174\ mol \times 32.0\,g/mol = 0.056\,g$