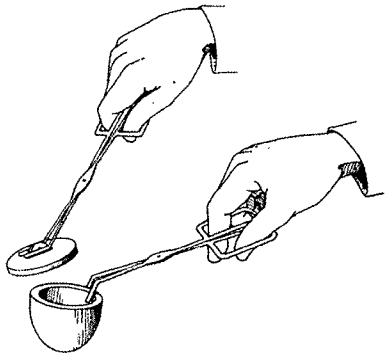
Chemistry
Tigard High
2015 - 2016

Name Example Calculations Block_____ Date_____

# Quantitative Determination Of An Empirical Formula: $Mg_xO_y$



Data

a.) Mass of empty crucible and lid: 24.03 g

b.) Mass of magnesium metal, crucible and lid: 24.45g

c.) Mass of crucible, lid, and magnesium-oxide product:

After first heating: 24.68 g

~~After second heating:~~ _____

~~After third heating:~~ _____ (if necessary)

Calculations (Show ALL calculations, including correct units and sig figs!)

1.) Mass of magnesium metal used. (A simple subtraction problem.) **b-a**

$24.45\,g - 24.03\,g = \boxed{0.42\,g}$

2.) Moles of magnesium metal. (A mass to mole conversion problem.)

$0.42\,g\,Mg \times \frac{1\ mol\ Mg}{24.31\,g\,Mg} = \boxed{0.017\ mol\ Mg}$

3.) Mass of oxygen. (A simple subtraction problem.) **c-b**

$24.68g - 24.45g = \boxed{0.23\,g}$

4.) Moles of oxygen. (A mass to mole conversion problem.)

$0.23\,g\,O \times \frac{1\ mol\ O}{16.00\,g\,O} = \boxed{0.014\ mol\ O}$

5.) Calculate the mole ratio of the magnesium-oxide product (divide the larger by the smaller). **#2 / #4**

$\frac{0.017\ mol\ Mg}{0.014\ mol\ O} = \frac{1.2\ mol\ Mg}{1\ mol\ O}$

6.) Determine the whole number mole ratio (for this lab, just round your ratio above to whole numbers).

$\frac{1.2\ mol\ Mg}{1\ mol\ O} \approx \frac{1\ mol\ Mg}{1\ mol\ O}$

7.) Use the known ionic charges for magnesium and oxygen to write the most probable empirical formula for the magnesium-oxide product.

**ionic formula for magnesium oxide**

(over)

8.) Experimental Percent Composition: **#1 / (c-a)** **#3 / (c-a)**

From your data, calculate the experimental percent composition for your magnesium-oxide product:

$$\% \text{ Mg} = \frac{0.42\text{g}}{24.68\text{g} - 24.03\text{g}} \times 100 = \boxed{65\%} \qquad \% \text{ O} = \frac{0.23\text{g}}{24.68\text{g} - 24.03\text{g}} \times 100 = \boxed{35\%}$$

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9.) Known Percent Composition:

From the empirical formula you determined in question #7, calculate the actual percent composition for this magnesium-oxide compound:

% Mg = **% comp calculation** % O = **% comp calculation**

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10.) Comparing your answers to #8 and #9, calculate your percent error: **(#9 - #8) / #9**

$$\text{Percent Error} = \left| \frac{\text{Known} - \text{Experimental}}{\text{Known}} \right| \times 100$$

- Magnesium: $\% \text{ error} = \left| \frac{60.31 - 65}{60.31} \right| \times 100 = \boxed{8\%}$

- Oxygen: $\% \text{ error} = \left| \frac{39.69 - 35}{39.69} \right| \times 100 = \boxed{10\%}$

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## Lab Procedures:

1. Record mass of the crucible, lid, and magnesium
2. Get set-up stamp
3. Heat crucible + magnesium with the lid off until the magnesium ignites. IMMEDIATELY, place the lid on the crucible and remove the Bunsen burner.
4. After the reaction (smoke) subsides, return the Bunsen burner and heat so that the bottom of the crucible glows a bright orange.
5. Continue to heat for about 12 minutes, removing the lid every 2-3 minutes to allow air to enter.
6. After 12 minutes, turn off the Bunsen burner and allow the crucible to cool for about 10 minutes.
7. Record the new mass of the crucible, lid, and magnesium-oxygen compound.
8. Scrape contents of the crucible into the trash, rinse with water and a test tube brush.