

Chemical Formula of Magnesium Oxide

Objective

To determine the percent composition and chemical formula for magnesium oxide.

Background

In this experiment you will determine the mass of oxygen that reacts with a known mass of pure metal to form a metal oxide. From the original mass of the metal and the final mass of the metal oxide, the mass of oxygen in the compound can be determined. From these three values, percent composition and empirical formula can be determined according to the explanation and examples on pp 175 – 176 in your text.

Procedure

Make sure to record your observations carefully throughout the experiment. Note what happens during the reaction and any changes in the appearance of the substance.

Clean out your crucible and lid as thoroughly as you can. Do not worry if there is still some solid material or stain that does not come off the porcelain. Place the crucible in a clay triangle with the lid in position and heat it with a Bunsen flame for two minutes. Heat gently at first, until any water is vaporized, and then heat strongly (until the crucible starts to turn red).

Allow the crucible to cool. *CAUTION: Do not set a hot crucible on the bench top. It will permanently damage the top.* Either leave it in the clay triangle or set it on your ring stand. When the crucible and lid are completely cool, weigh them to the nearest milligram (0.001 g). *CAUTION: Never weigh a hot crucible. It may damage the balance and it will give you a low weight because of convection currents around the balance.*

1. Cut off a piece of magnesium ribbon that is somewhere in the range of 0.1 to 0.5 grams.
2. Add the magnesium ribbon to the crucible and weigh the crucible + magnesium to the nearest milligram (0.001 g). *Be sure to use the same balance throughout the lab period and always include the lid when weighing.*
3. Place the crucible with the lid on the clay triangle and heat. After three minutes, move the lid slightly to one side to allow more air to enter the crucible. Do you notice any whitish magnesium oxide vapor escaping? If the reaction is too violent, replace the lid. Finally heat it very hot (until the crucible glows red) and maintain the high heat for 15 minutes.
4. Allow the crucible to cool enough to touch and then weigh to the nearest milligram (0.001 g).
5. Scrape the residue into the garbage and clean out the crucible.
6. Cut off a piece of magnesium ribbon that is somewhere in the range of 0.5 to 0.9 grams.
7. Repeat steps 2 through 5.

Using the masses of magnesium and magnesium oxide, determine the mass of oxygen (O not O₂) in your compound. Calculate the number of moles of magnesium and moles oxygen (O not O₂). Ask a lab aide to check your values and then post your calculated number of moles magnesium and oxygen in the Google spreadsheet available on Moodle. Your molar results must be posted before the end of the lab period.

Graph the data with moles of O on the x-axis and moles of Mg on the y-axis. Use the trendline feature in Excel to perform a linear regression of the data and obtain the ratio of moles of Mg to

moles of O from the slope of the trendline (you will need to check the box that displays your trendline equation on the chart). From this experimental mole ratio, write a reasonable chemical formula for magnesium oxide using integer values for the subscripts.

Results

- mass percent composition of magnesium oxide from your own data
- number of moles of magnesium and oxygen from your own data
- graph of moles Mg vs. moles O from the entire class's data with a trendline and linear regression equation
- whole number ratio of moles from the graph data
- chemical formula for magnesium oxide from the graph data

Questions

1. How does the chemical formula compare to the expected formula for magnesium oxide?
2. Think about what might have gone wrong during the experiment:
 - a. If some of the magnesium in your crucible remained unreacted, would it make the mass of oxygen that you measure too high or too low?
 - b. If some of your compound stuck to your stirring rod and was lost or if magnesium oxide powder escaped, would it make the mass of oxygen that you measure too high or too low?
 - c. If your ratio of moles of magnesium to oxygen was not a perfect whole number ratio, do the two situations above explain your error?
3. Here is the data from a similar experiment conducted with iron (Fe). Use the graph below to determine the chemical formula of iron oxide.

