Formation of Metal Oxides

Introduction:
One of the earliest theories of the nature of combustion proposed that substances burned because they contained a substance then known as "phlogiston". Furthermore, materials containing phlogiston had less mass after combustion than before because the phlogiston had left the material. The heat and light evident during many combustion reactions was considered a physical manifestation of the departure of the phlogiston.

The phlogiston theory was finally laid to rest when it was demonstrated that metals gain mass when they combust (oxidize). The student will be using magnesium ribbon to demonstrate this principle.

Purpose: To study the effect of the combustion process on the mass of a metal sample.

Materials:
- Ring Stand
- Clay triangle
- Crucible & tongs
- Magnesium metal
- Bunsen burner
- Analytical balance

Procedure:

Goggles and aprons must be worn at all times in the lab!

A) Preparation of Magnesium

1) Select a crucible and lid from the box on the side counter. Obtain a lid that securely covers the top of the crucible. Be certain that your crucible tongs can safely pick up the crucible and set it down without the crucible slipping through the opening. Select a clay triangle, also being certain that the crucible can be safely supported within the triangle. If the triangle is too large, obtain one that is a better fit.

2) Clean the crucible. Be certain that the crucible contains no reactive contamination. Wash it thoroughly, and dry it by heating it lightly over a Bunsen burner. Allow it to cool for several minutes before proceeding.

3) Place the crucible on the analytical scale. Handle the crucible and its lid only with the tongs. Remember that oils and moisture from your hands can contribute unwanted mass to virtually any object. Record the mass of the crucible and lid.

4) Mass out the magnesium ribbon: Using your forceps, move pieces of magnesium ribbon from the container on the counter to the inside of your crucible. Stop adding the magnesium when you are at or near 0.150 g of magnesium added. Record the mass of magnesium used.

B) Reaction of Magnesium

Using your tongs, place the crucible, with lid in place, in the clay triangle that should be supported within the ring of your ring stand. Place a Bunsen burner under the crucible, and begin heating the crucible with the hottest flame possible.

When the bottom of the crucible is glowing red, use your tongs to ever-so-slightly allow some air to enter by moving the lid. Try to catch a glimpse of the contents. The magnesium should begin to react as the oxygen becomes available. When you begin to see a bit of smoke escape, QUICKLY return the lid to its original position, sealing the crucible closed.

Wait from 30 seconds to a minute, and then allow a bit more air in, again sealing it up as the reaction begins to produce smoke. Repeat this procedure several times until the magnesium appears to have reacted completely.
Shut off the Bunsen burner, and allow the crucible to cool. Once cool, transfer the crucible, lid and contents to the same analytical balance that you used originally. Record the new mass.

If the mass of the crucible and contents has DECREASED, then you need to repeat the experiment, being more careful not to allow “smoke” to escape from the vessel. It can be a tricky process and sometimes must be repeated numerous times before obtaining acceptable results.

RESULTS
Data and Observations

| Mass of crucible | __________________________ grams |
| Mass of magnesium ribbon used | __________________________ grams |
| Total mass of magnesium and crucible before heating | __________________________ grams |
| Mass of magnesium and crucible after heating | __________________________ grams |

Describe the appearance of the magnesium ribbon before heating:

____________________________________________________________________________________
____________________________________________________________________________________

Describe the appearance of the crucible contents after heating:

____________________________________________________________________________________

Calculations
1. Mass of magnesium ash (magnesium oxide) after heating [(crucible and ash) – (crucible)]
2. Total mass gained by magnesium during the combustion process (mass of ash – mass of ribbon)
3. Write the formula for the compound magnesium oxide, and calculate its formula mass
4. Calculate the percentage composition (by mass) of the compound magnesium oxide
5. Using the percentage composition, and the original mass of magnesium ribbon, calculate the mass of magnesium oxide that SHOULD have been produced from your experiment.