Determining a Chemical Formula

Pre-Lab Discussion:
In a compound, regardless of the size of the sample, the mass ratio between the atoms of that compound will always be the same. This mass ratio can be used to determine the formula, or atom ratio, of the compound. The problem is that the atom ratio is NOT the same as the mass ratio but, by using the relative mass from the periodic table, the mass ratio from an experiment can be converted into an atom ratio. For example 10.0 g of water is separated an analyzed in a lab producing 1.12 grams of hydrogen and 8.88 grams of oxygen. The mass ratio would be;

EXPERIMENTAL RATIO	1.12 g hydrogen / 8.88 g oxygen	or a ratio of 0.126 hydrogen to 1 oxygen

Using the mass from the periodic table hydrogen has a relative mass of 1.01 g and oxygen 16.0 g. The mass ratio would be;

PERIODIC TABLE RATIO	1.01 g hydrogen / 16.0 g oxygen	or a ratio of 0.0631 hydrogen to 1 oxygen

When the two ratios are compared the experimental mass ratio of hydrogen is very close to 2x as much as the periodic table ratio of hydrogen; therefore, you would expect the ATOM ratio to be 2 atoms hydrogen to 1 atom oxygen, or H_2O. Fortunately chemist have a more convient way to calculate the formula of a compound using the mole concept, next chapter.

In this experiment, you will synthesis a sample of magnesium oxide to determine the mass of magnesium and oxygen present and the experimental mass ratio. Then, with the assistance of the periodic table mass ratio, you will determine the atom ratio and the chemical formula for magnesium oxide.

Purpose: Calculate the experimental mass ratio of magnesium oxide and the chemical formula of magnesium oxide.

Equipment:

crucible and cover	scissors	clay triangle	safety goggles	crucible tongs
pipet	ring stand	burner	iron ring	balance

Materials: Magnesium ribbon (Mg), 20cm

Safety
Don't touch a **hot crucible** with your fingers, and be sure you use tongs to shift the position of the hot crucible cover in step 3. Do not place any magnesium ribbon in an open flame. Tie back long hair and secure loose clothing when working with an open flame. Always wear safety goggles.

Procedure

1. Clean a crucible and cover. Mass the crucible without the cover.
2. Cut a 20-cm length of magnesium ribbon into 1-cm pieces. Place the pieces in the crucible and measure the mass of the crucible and its contents. Make careful observation of the magnesium ribbon.
3. Cover the crucible and place it in the clay triangle (Figure 13-1). Heat *gently* for 2 minutes. Using crucible tongs, carefully tilt the cover to provide an opening for air to enter the crucible. Heat the partially covered crucible *strongly* for as long as the teacher directs.
4. Turn off the burner, cover the crucible, and allow the contents to cool. When the crucible is cool enough to touch, remove the crucible for the clay triangle remove the lid and examine the contents carefully.
5. Measure the combined mass of the crucible and contents. Record your data and final observations.

DATA:

1. Mass of empty crucible _____g

2. Mass of crucible + Mg _____g

3. Mass of crucible + Magnesium oxide _____g

CALCULATIONS:

1. Find the mass of magnesium used in the reaction.
2. Find the mass of oxygen used in this reaction.
3. Calculate the mass ratio of Magnesium to Oxygen, this is your experimental ratio.
4. Calculate the mass ratio of Magnesium to Oxygen using the relative masses from the periodic table.
5. Compare the two mass ratios and determine the chemical formula of magnesium oxide.

CONCLUSION AND QUESTIONS:

1. A sample of sulfur having a mass of 1.28 g combines with oxygen to form a compound with a mass of 3.20 g. What is the chemical formula of this compound?