Laboratory Investigation Name _____

Chemistry: Form L4.5A Date _____ Period _____

Determining the Composition of a Compound

PROBLEM

How can the percent composition of a compound be measured?

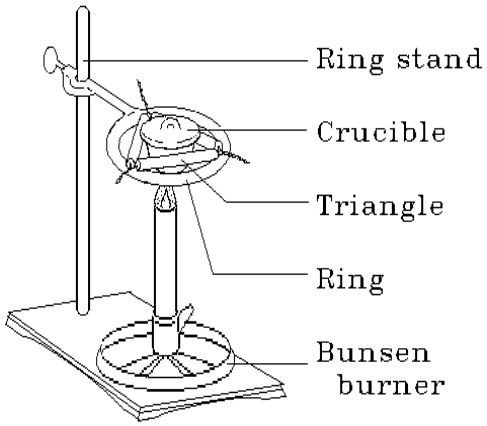
INTRODUCTION

Compounds do not vary in composition. A formula shows the ratio of elements in a compound. The ratio of elements in a compound is always fixed. For example, no matter how much magnesium you burn, the proportion of magnesium and oxygen in the compound formed will always be the same. In this laboratory you will produce the compound magnesium oxide by burning magnesium. Then you will determine the percentage by weight of each of its elements.

MATERIALS (*per group*)

Balance; Bunsen burner; crucible; magnesium ribbon; ring stand and iron ring; ruler; safety goggles; steel wool; striker; tongs; triangle; wire gauze

PROCEDURE



1. Put on safety goggles. *CAUTION: Wear safety goggles whenever you use the Bunsen burner.* Set up a ring stand with a triangle and a clean crucible as shown in the diagram at the right. Light the Bunsen burner with a striker. Adjust the flame so the tip of the cone is under the crucible. Heat the crucible for two to three minutes to be sure it is *completely* dry.

2. Using tongs, remove the crucible from the heat in two steps, first the cover and then the crucible itself. Set the crucible and cover aside on a wire gauze to cool.

3. When the crucible and cover are cool, measure their combined mass with a balance. Record the mass of the crucible and cover in the data table on the next page.

4. Using a ruler, measure and tear off a strip of magnesium ribbon about 30 cm long. Polish the strip of magnesium with steel wool. Tear the ribbon into about 30 pieces and place them in the crucible. Measure the mass of the crucible, cover, and magnesium. Record the mass in the data table. Calculate the mass of the magnesium and record the result.

5. Place the crucible on a triangle and ring stand. Make sure the crucible is covered. Heat on a low flame for 2-3 minutes. Then heat on a high flame for another 3 minutes. Using tongs, lift the crucible cover for an instant to allow air to enter. Continue heating, and lift and replace the cover again every few minutes until a white powder is formed. Then, tilt the cover slightly and heat for 8-10 minutes more with the cover partially open.

6. Using tongs, set the crucible and cover aside on a wire gauze to cool. After the crucible has cooled completely, add enough deionized water with a medicine dropper to cover the contents of the crucible.

7. Replace the cover of the crucible and heat for 3-4 minutes until the water evaporates. Remove the cover with tongs and heat the crucible for another 3-5 minutes without the cover.

8. Using tongs, set the crucible and cover aside on a wire gauze to cool for a few minutes. The crucible should contain a white powder. The powder is magnesium oxide. Measure the mass of the crucible plus the magnesium oxide and record it below. Calculate the mass of the magnesium oxide, the mass of the oxygen in the compound, and the percentages of magnesium and oxygen in the compound.

9. Calculate the theoretical percentages of magnesium and oxygen in the compound as follows: (1) Using the oxidation states from the periodic table, find the correct formula for magnesium oxide. (2) Find the theoretical mass of the magnesium by multiplying the atomic weight of the magnesium by its subscript. (3) Find the theoretical mass of the oxygen by multiplying the atomic weight of the oxygen by its subscript. (4) Find the theoretical mass of magnesium oxide by adding the theoretical mass of the magnesium to the theoretical mass of the oxygen. (5) Find the theoretical percentage of magnesium by dividing the theoretical mass of the magnesium by the theoretical mass of the compound and multiplying by 100. (6) Find the theoretical percentage of oxygen by dividing the theoretical mass of the oxygen by the theoretical mass of the compound and multiplying by 100. Compare your results to the accepted theoretical values.

OBSERVATIONS

[a] Mass of crucible, cover, and magnesium . . . . . _____

[b] Mass of crucible and cover . . . . . _____

[c] Mass of magnesium (**a**-**b**) . . . . . _____

[d] Mass of crucible, cover, and magnesium oxide . . . . . _____

[e] Mass of magnesium oxide (**d**-**b**) . . . . . _____

[f] Mass of oxygen (**e**-**c**) . . . . . _____

[g] Percentage of magnesium (**[c/e]×100**) . . . . . _____

[h] Percentage of oxygen (**[f/e]×100**) . . . . . _____

[i] Theoretical percentages:

(1) Formula for magnesium oxide _____

(2) Atomic mass of magnesium (from *Periodic Table*) . . . . . _____

(3) Atomic mass of oxygen (from *Periodic Table*) . . . . . _____

(4) Formula mass of magnesium oxide . . . . . _____

(5) Percentage of magnesium . . . . . _____

(6) Percentage of oxygen . . . . . _____

CONCLUSIONS

1. How do the theoretical percentages of magnesium and oxygen compare to those observed?

Why? _____

_____

2. When magnesium reacts with air, it combines with another element besides oxygen. Water is added during this procedure to react with the compound that forms from magnesium and this other element. What might this element be? (*HINT: What else is in the air besides oxygen?*) _____