**EMPIRICAL FORMULA LAB**

|  |
| --- |
| An empirical formula gives the simplest whole number ratio of the different atoms in a compound. The empirical formula does not necessarily indicate the exact number of atoms in a single molecule. This information is given by the molecular formula, which is always a simple multiple of the empirical formula.  In this experiment, you will determine the empirical formula of a magnesium-oxygen product, a compound that is formed when magnesium metal reacts with oxygen gas. According to the law of conservation of mass, the total mass of the products must equal the total mass of the reactants in a chemical reaction. Therefore,  mass Mg + mass O2 = mass MgxOy  Since you will measure the mass of magnesium and the magnesium-oxygen product, you will be able to calculate the mass of oxygen consumed during the reaction. Then, the ratio between the moles of magnesium and the moles of oxygen consumed can be calculated. Finally, the empirical formula can be written on the basis of this ratio. |

**SAFETY:**

* Use tongs at all times when handling the hot crucible and lid.
* Do not look directly at the burning magnesium. Avoid inhaling the fumes produced while heating.

**PROCEDURE**

1. If necessary: Clean and dry a crucible and lid and place them on a clay triangle as shown in Figure 1. To dry them, heat strongly for 2 to 3 minutes over the burner. Then let them cool to room temperature. **CAUTION**: *Hot! Use crucible tongs to handle the crucible and lid throughout the experiment.*
2. Record the combined mass of the crucible and lid in your data table.
3. Polish a strip of magnesium ribbon with steel wool until it is shiny. Twirl the strip around a pencil and place in the crucible. Record the combined mass of the crucible, lid, and magnesium.
4. Leave the crucible lid slightly ajar. Heat the covered crucible gently over the burner. **CAUTION**: *Do not look directly at the burning magnesium metal. Avoid inhaling any fumes.*
5. When you see a bright light being emitted from the crucible, gently blow air in to keep the reaction going.
6. Turn off the burner. After the crucible has cooled to almost **room temperature** (should be at least 5 minutes), carefully add a few drops of water to decompose any nitrides that may have formed. **CAUTION**: *Use care when adding water. Too much water can cause the crucible to crack.*
7. Cover the crucible completely. Resume heating with the burner for 1 minute.
8. Turn off the burner. Cool the crucible, lid, and contents to room temperature. Record the combined mass of the crucible, cover, and product.
9. If needed, repeat procedure again. Clean the crucible and lid with soap and water. Towel-dry the crucible and lid.
10. Clean up your lab station.

**DATA TABLE**

Construct a data table to display the measurements taken during the procedure. Make sure that each value is clearly labeled, including units.

**Calculations**

**Show all calculations**.

1. Use your data to calculate the mass of magnesium and the mass of oxygen in the reaction.
2. Use the masses from #1 to calculate the percent composition (%Mg and %O) of the product
3. Determine the empirical formula of the magnesium-oxygen product. When you get to the last step, round to the nearest whole number. In book problems, you should multiply by 2, 3, etc. to get a whole number ratio. In this case, you need to round in order to compensate for experimental error.

**Questions**

1. Based on the charges of each element, write the formula for magnesium oxide. Does your experimental empirical formula agree with this formula?

2. The literature value for the %Mg in this magnesium-oxygen compound is 60.3%. Use this value to calculate the percent error of your experimental %Mg. *Comment on your degree of accuracy*.

3. Is your %Mg value too large or too small? What experimental errors might specifically account for this type of deviation?

**Write a short conclusion about empirical formulas and % composition. Include reasons for experimental error (Human error/machine error is not acceptable)**