* **Question:** How can a compound’s formula be determined from its mass ratio?
* **Introduction:** This gravimetric analysis involves the combustion of magnesium metal in air to synthesize magnesium oxide. The mass of the product is greater than the mass of magnesium used because oxygen reacts with the magnesium metal. When the masses of the reactant and product have been carefully measured, the amount of oxygen used in the reaction can be calculated. The ratio of oxygen to magnesium can then be established, and the empirical formula of magnesium oxide can be determined.
* **Safety:** Goggles and aprons are required. Long hair must be tied back. Observe all safety precautions with the Bunsen burner. Do not look directly at the burning magnesium as the bright light could damage your eyes.

**Data Table**

*(Copy into your lab notebook before lab day.)*

|  |  |
| --- | --- |
|  | ***Mass (g)*** |
| ***Empty crucible & lid*** |  |
| ***Crucible, lid and Mg*** |  |
| ***Crucible, lid and magnesium oxide*** |  |

* **Procedure:** *(✓ each of the steps as you complete them.)*
* 1. Obtain a clean, dry crucible. Measure and record the mass of the empty crucible & lid.
* 2. Cut your Mg ribbon into tiny pieces (rice sized) and place them in the crucible.
* 3. Measure and record the mass of the crucible, lid and Mg.
* 4. Mount the crucible in the clay triangle and gently heat it for 1-2 minutes.
* 5. Then, heat the Mg strongly (glowing red), with the lid on, for 10 - 15 minutes. Opening the lid to let in air every 30 sec. – 1 min.
* 6. After this heating period, remove the lid off of the crucible and continue to strongly heat the Mg with no lid for 2 – 3 minutes.
* 7. The reaction is complete when no flashes of light occur in the Mg when the lid is off. If it flashes, heat some more.
* 8. Once the reaction appears complete, then allow the crucible and lid to cool (keep the lid on).
* 9. Once the crucible and lid have cooled to room temperature, add 3-5 drops of distilled water to the oxide with a dropper. Try to wet the entire sample, but do not flood it. Note the odor.
* 10. Very gently, heat the crucible with the lid on until the oxide appears dry, then heat strongly to ensure that the excess water is removed completely (2-3 minutes).
* 11. Allow the crucible, lid and contents (magnesium oxide) to cool and weigh it.
* 12. When you are done with the experiment, discard your magnesium oxide in the trash can, and clean & dry your crucible.
* **Calculations:**

1. **Mass of magnesium (Mg)**

Subtract the mass of the empty crucible & lid from the crucible, lid and Mg.

*mass of magnesium = mass of crucible, lid & Mg - mass of empty crucible*

1. **Mass of magnesium oxide.**

Subtract the mass of the empty crucible & lid from the crucible, lid and magnesium oxide.

*mass of magnesium oxide* = *mass of crucible, lid & magnesium oxide - mass of empty crucible*

1. **Mass of oxygen that reacted with Mg.**

Subtract the mass of magnesium from the mass of magnesium oxide.

*mass of oxygen that reacted with magnesium* = *mass of magnesium oxide* - *mass of magnesium*

1. **Moles of magnesium (Mg)**

*Convert the mass of Mg into moles of Mg using the atomic mass of Mg from the periodic table.*

1. **Moles of oxygen (O)**

*Convert the mass of O into moles of O using the atomic mass of O from the periodic table.*

1. **Empirical formula of magnesium oxide**
2. Set up a ratio of moles of Mg : moles of O.
3. Reduce this ratio to the lowest whole number ratio.
4. Use this lowest whole number ratio as the subscripts in MgxOy

* **Conclusion:**

“My experimental empirical formula of magnesium oxide is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ .”

EXTRA CREDIT: Explain the reason water was added in step #9. *(Hint: Oxygen is only 21% of the atmosphere.)*