This was the experiment we conducted:

Percentage Composition/Empirical Formula of MgO

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Partner:

Objective/Purpose

Stoichiometric measurements are among the most important in chemistry; they indicate the proportions by mass in which various substances react. In this experiment, stoichiometric determinations will be investigated for magnesium and molecular oxygen, O2.

Equipment/Reagents

- Safety gear (apron, glasses, closed-toe shoes)
- Porcelain crucible and cover
- Crucible tongs
- Clay Triangle
- Magnesium Turnings (or ribbon)
- pH paper
- 6 M HCl

Calculations

- $Mg_3N_2 + 3H_2O \rightarrow 3MgO + 2NH_3$

Procedure

- Obtain a crucible and cover, and examine them. The crucible and cover are extremely fragile and expensive. Use caution handling them.

- If there is any loose dirt in the crucible, moisten and rub it gently with a paper towel to remove the dirt. If dirt remains in the crucible, bring it to the hood, add 5-10ml of 6 M HCl, and allow the crucible to stand for 5 minutes. Discard the HCl and rinse the crucible with water. If the crucible is not clean at this point, consult with the instructor about other cleaning techniques, or replace the crucible. After the crucible has been cleaned, use tongs to handle the crucible and cover.

- Set up a clay triangle on a ringstand. Transfer the crucible and cover to the triangle. The crucible should sit firmly in the triangle (the triangle's arms can be bent slightly if necessary).

- Begin heating the crucible and cover with a small flame to dry them. When the crucible and cover show no visible droplets of moisture, increase the flame to full intensity, and heat the crucible and cover for 5 minutes.

- Remove the flame, and allow the crucible and cover to cool to room temperature.

- When the crucible and cover are completely cool, use tongs or a paper towel to move them to a clean, dry watch glass or flat glass plate. Do not place the crucible directly on the lab bench. Weigh the crucible and cover to the nearest milligram (0.001 g).

- Return the crucible and cover to the clay triangle. Reheat in the full heat of the burner flame for 5 minutes. Allow the crucible and cover to cool completely to room temperature.

- Reweigh the crucible after it has cooled. If the weight of this time differs from the earlier weight by more than 5 mg (.005 g), reheat the crucible for an additional 5 minutes and reweigh when cool. Continue the heating/weighing until the weight of the crucible and cover is constant to within 5 mg.

- Add to the crucible approximately 1 teaspoon of magnesium turnings (or about 8 inches of magnesium ribbon coiled into a spiral).

- Using tongs, transfer the crucible/cover and magnesium to the balance and weigh to the nearest milligram (.001 g).

- Set up the crucible on the clay triangle with the cover very slightly ajar. With a very small flame, begin heating the crucible gently.

- If the crucible begins to smoke when heated, immediately cover the magnesium completely and remove the heat for 2-3 minutes. The smoke consists of the magnesium oxide product and must not be lost from the crucible.

- Continue to heat gently for 5-10 minutes with the cover of the crucible slightly ajar. Remove the heat and allow the crucible to cool for 1-2 minutes.

- Remove the cover and examine the contents of the crucible. If portions of the magnesium still demonstrate the shiny appearance of the free metal, return the cover and heat with a small flame for an additional 5 minutes; then reexamine the metal. Continue heating with a small flame until no shiny metallic pieces are visible.

- When the shiny magnesium metal appears to have been converted fully to the dull gray oxide, return the cover to its slightly ajar position, and heat the crucible with the full heat of the burner flame for 5 minutes. Then slide the cover to about the half-open position, and heat the crucible in the full heat of the burner flame for an additional 5 minutes.

- Remove the heat and allow the crucible and contents to cool completely to room temperature. Remove the crucible from the clay triangle and set it on a sheet of clean paper on the lab bench.

- With a stirring rod, gently break up any large chunks of solid in the crucible. Rinse any material that adheres to the stirring rod into the crucible with a few drops of distilled water. With a dropper, add about 10 drops of distilled water to the crucible, spreading the water evenly throughout the solid.

- Return the crucible to the clay triangle, and set the cover in the slightly ajar position. With a very small flame, begin heating the crucible to drive off the water that has been added. Beware of spattering during the heating. If spattering occurs, remove the flame and close the cover of the crucible.

- As the water is driven off, hold a piece of moistened pH paper (with forcepts) in the stream of steam being expelled from the crucible. Any nitrogen that had reacted with the magnesium is driven off as ammonia during the heating and should give a basic response with pH paper (note ammonia smell).

- When it is certain that all the water has been driven off, slide the cover so that it is in approximately the half-open position, and increase the size of the flame. Heat the crucible and contents in the full heat of the burner for 5 minutes.

- Allow the crucible and contents to cool completely to room temperature. When they are completely cool, weigh the crucible and contents to the nearest milligram (.001g).

- Return the crucible to the triangle and heat for another 5 minutes in the full heat of the burner flame. Allow the crucible to cool completely to room temperature and reweigh. The two measurements of the crucible and contents should give weights that agree within 5mg (.005 g). If this agreement is not obtained, heat the crucible for additional 5-minute periods until two successive weighings agrees within 5mg.

- Clean out the crucible, and repeat the determination.

- Calculate the weight of magnesium that was taken, as well as the weight of the magnesium oxide that was present after the completion of reaction. Calculate the percentage of magnesium in the magnesium oxide from your experimental data. Calculate the mean for your two determinations.

- Calculate the theoretical percentage of magnesium (by mass) in magnesium oxide, and compare this to the mean experimental value. Calculate the percent error in your determination.

These were the results (I need help calculating the blanks in the table):

Data/Results

	Trial 1	Trial 2
Weight of empty crucible (after first heating)	**32.240g**	**32.424g**
Weight of empty crucible (after second heating)	**32.235g**	**32.241g**
Weight of crucible with Mg	**32.589g**	**32.571g**
Weight of Mg taken	**.352g**	**.333g**
Weight of crucible/MgO (after first heating)	**32.810g**	**32.791g**
Weight of crucible/MgO (after second heating)	**32.809g**	**32.787g**
Weight of MgO produced		
Weight of oxygen gained		
% magnesium in the oxide		
Mean % magnesium		
% Error		

And answering these questions:

1) Calculate the percentage by mass of magnesium and oxygen in magnesium oxide, MgO:

2) Suppose 2.033 g of magnesium is heated in air. What is the theoretical amount of magnesium oxide that should be produced?

3) Suppose a similar experiment was performed, using calcium metal in place of magnesium.
a) calculate the theoretical percentage of calcium in calcium oxide:

b) If a 1.358g sample of calcium metal was heated in oxygen, what mass of calcium oxide would be produced?

4) Why did the weights change as they did in the experiment?