

Practical Investigation: Determining the Empirical Formula of Magnesium Oxide

Aim

To determine the empirical formula of magnesium oxide by reacting magnesium metal with oxygen in air.

Background

Magnesium reacts with oxygen when heated strongly to form magnesium oxide, a white solid. Magnesium reaction with oxygen, however, may not go to completion and some magnesium may also form magnesium nitride (Mg_3N_2) due to nitrogen in air. This must be considered when analysing results.

The empirical formula shows the simplest whole-number ratio of atoms in a compound.

Hypothesis

Materials

- Magnesium ribbon
- Crucible with lid
- Pipe clay triangle
- Bunsen burner
- Heatproof mat
- Tongs
- Digital balance (± 0.01 g)
- Safety goggles , lab coat

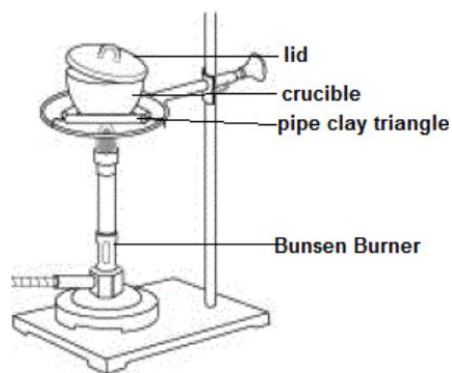


Figure 1- setup of the practical



Method

1. Measure the mass of a clean, dry crucible and lid. Record the result.
2. Add a small strip of magnesium ribbon and measure total mass. Record the result
3. Heat the crucible gently at first, then strongly with lid slightly ajar, as shown in fig 1.
4. Periodically lift the lid to allow oxygen in. You will notice a bright glow and white smoke coming out of the crucible. This is MgO escaping and should be minimised.
5. Continue heating until the magnesium fully reacts and a white powder forms. You will notice the ribbon does not glow when the lid is lifted.
6. Allow crucible to cool completely.
7. Measure final mass of crucible + product. Record the result.
8. Record all data and calculate mass changes.

Results and calculations

Item weighed	Mass (g)
Crucible + lid	
Crucible + lid + Mg (before heating)	
Crucible + lid + product (after heating)	
Mass of Mg	
Mass of O	

Observations

Calculations

1. Mass of magnesium used

$$\text{Mass Mg} = (\text{crucible} + \text{Mg}) - (\text{crucible})$$

2. Mass of oxygen gained

$$\text{Mass O} = (\text{final mass}) - (\text{initial Mg mass} + \text{crucible})$$

3. Convert to moles

- Mg:

$$\text{moles Mg} = \frac{\text{mass}}{24.3}$$

- O:

$$\text{moles O} = \frac{\text{mass}}{16.0}$$

4. Simplest whole-number ratio

Divide all mole values by the smallest value to get the simplest ratio and hence the empirical formula.

Mg : O ratio

Questions

1. What is meant by empirical formula?

_____ (1 mark)

2. Why is the crucible lid opened slightly during heating?

_____ (2 marks)

3. State one source of error in this experiment.

_____ (2 marks)

4. Why might the mass increase be less than expected?

_____ (2 marks)

5. Explain why magnesium nitride formation affects results.

_____ (2 marks)

6. A student obtains a Mg:O mole ratio of 1 : 0.8. Suggest a reason and correction.

_____ (2 marks)

