For Teachers Proving the Law of the Conservation of Mass

Module 1

Objective: Burning Magnesium

Necessary Lab Supplies

Reactants	Formula		Quantity (g) or Concentration (M)
Magnesium shavings	Mg		~0.3 g

List of lab equipment:

- tweezers;
- balances (readability of at least 2 decimal places);
- metal crucible;
- gas burner;
- fume hood;
- safety goggles;
- fireproof gloves;
- crucible tongs;
- heat-resistant surface (e.g. a ceramic tile);
- glass rod.

Lab Procedure

- Weigh the crucible and record its mass in the data record table. Using tweezers, weigh ~0.3 g of magnesium shavings into the metal crucible. If the shavings are quite big, it is better to use slightly less than more.
- Transfer the metal crucible to the fume hood and turn on the fan. Put on protective gloves and goggles. Using crucible tongs, place the crucible on a heat-resistant surface.
- Light a gas burner and burn the magnesium shavings in the metal crucible. Continue burning until there are no signs of further combustion.
- After the burning has finished, leave the crucible in the fume hood to cool down for another 20 minutes.
- After 20 minutes, turn off the fan in the fume hood, remove the crucible with burnt magnesium from the heat-resistant surface and weigh it. After weighing, examine the contents of the crucible using a glass rod.

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Additional Safety Notes

Magnesium is an active metal, so do not touch it with bare hands! Magnesium burns with a bright flame, so do not look directly at the flame during combustion! Since white smoke is emitted during combustion, it should be carried out in a fume hood with the fan turned on! Magnesium burns producing a very hot flame, so be careful and do not touch the crucible or anything else during this process!

Calculations (if necessary)

Further calculations depend on the mass of magnesium that is burned. Suppose it is 0.3 g. Theoretically, only the reaction of magnesium burning in oxygen occurs:

$$2Mg + O_2 \rightarrow 2MgO$$

1. The amount of magnesium is calculated: $\mathrm{n_{Mg}} = \frac{\mathrm{m}}{\mathrm{M}} = \frac{0{,}3}{24} = 0.0125\ \mathrm{mol}$

2. The chemical equation shows that the amount of magnesium corresponds with the amount of magnesium oxide.

3. This means that, in theory, the contents of the crucible should weigh: $\mathrm{m_{MgO}} = \mathrm{n} \cdot \mathrm{M} = 0.0125 \cdot 40 = 0.5\ \mathrm{g}$

However, the results usually do not resemble this figure. This is due to the fact that during combustion a white smoke occurs, it is magnesium oxide which means that the product is already losing its mass. Moreover, the crucible content is not homogeneous – it contains powdered products of different colours, which suggests that other reactions have also occurred.

Conclusions

When planning a lab exercise, it is crucial to think about the course of the experiment and whether it truly demonstrates what was envisioned.

Losses are an integral part of any process. For this reason, it is impossible to create equipment with 100% efficiency, materials with 100% recyclability, etc.

The environment is filled with reactants which must be taken into account when planning various production processes.

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