Core practical: empirical formula

Teacher / technician

YEAR 10 / LESSON 46 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Supervised magnesium combustion only. No gas reduction, hydrate heating or nitride treatment. Trial and local risk assessment required; keep genuine imperfect results.

Coverage and delivery

Shared core: 1.31–1.33 and practical 1.36. This lesson covers magnesium combustion and formula calculations; water, hydrates and reduction need separate coverage.

Allow about 60 minutes. Follow the student sequence and use the answers to check reasoning.

Requisition • class of 30, working in 15 pairs

Item	Per pair / setup	Class total
Booklet / writing tools	1 per learner	30 sets
Crucible / lid / heating set / tongs	1 checked set per pair	15 sets
Eye protection / balance access	1 protector each; shared balances	30 protectors; balances
Cleaned magnesium ribbon	5–10 cm; maximum 0.20 g	18 pieces including spare

Immediate safety

Wear eye protection. Burning magnesium gives intense light: keep the lid over vigorous burning and do not stare at it. Treat all apparatus as hot; use tongs and a heat-resistant mat. Keep flammables away; avoid smoke/dust and never weigh hot apparatus.

Preparation and delivery

Read alongside the student method

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1. Supply 15 dry undamaged crucibles with lids and heating sets; 30 eye protectors. Staff pre-clean 5–10 cm ribbon pieces, at most 0.20 g each; supply 18 pieces including spare (up to 3.6 g). No magnesium powder or copper oxide is required.

2. Check each crucible sits securely in its triangle, tongs grip safely and balances are suitable. Demonstrate handling while cold, safe lighting and cooling areas. Teacher trials the local ribbon and heating time before class.

3. Pupils must not stare at the bright metal. Use the lid during vigorous burning and briefly admit air after it subsides. Avoid inhaling smoke; do not collect or handle dust. Do not add water to hot material.

4. Require complete cooling before every weighing and record all cycles. With a 0.01 g balance use a 0.01 g agreement criterion; do not claim this eliminates systematic error. Continue next lesson if needed.

5. Some magnesium can form nitride in air. Treat this as a limitation; no water/nitride treatment or gas-reduction procedure is included. Collect cooled residues under the school disposal plan.

6. Allow 10 minutes setup, 30 reaction/cooling cycles and 20 analysis; allow extra cooling time if necessary. Discuss empirical versus molecular formula; ionic MgO has formula units, not discrete MgO molecules.

Close of lesson

- Turn off gas; leave apparatus in the designated cooling area.
- Staff collect cooled residues and supervise cleaning; wash hands.

Check before teaching

Check the cards, reference data and quantities against this requisition. Keep the staff answer guide separate until the checking stage. Supplied numerical practice datasets are labelled examples; they are not class measurements.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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• Use the pupil's actual masses; no ideal experimental result is supplied. Calculate $(m_2-m_1)/24$ and $(m_3-m_2)/16$, then normalise. An uncertain ratio must be evaluated, not forced.

• Practice: Mg = 0.12 g → 0.0050 mol; O = 0.08 g → 0.0050 mol; 1:1 → MgO.

• The lid reduces loss of solid/smoke and screens bright burning; brief lifting admits oxygen. Leaving it open too long loses product.

• Hot apparatus is unsafe for the balance and gives unstable readings. Repeated cycles check whether mass is still changing, but not whether the material is perfectly pure.

• Lost oxide or incomplete oxidation usually makes the inferred oxygen gain too small. Nitride formation, pre-existing oxide, moisture and balance uncertainty can also affect the ratio.

• Empirical formula is the simplest atomic ratio; molecular formula is the actual atom count in a discrete molecule. CH_2O has relative formula mass 30; 180/30 = 6, so $C_6H_{12}O_6$. MgO is ionic and has no molecular formula.

References and provenance

Pearson Chemistry specification

Pearson core practical guide: combustion

RSC magnesium mass-change practical

Prepared 22 November 2026. Original wording, tables and questions. Sources inform the concepts and technique; the lesson scope and classroom quantities are explicitly described here. No laboratory trial or final school risk approval is claimed.