The mole: mass and particle number

Teacher / technician

YEAR 10 / LESSON 42 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. Desk calculations; modern SI definition distinguished from rounded classroom practice.

Coverage and delivery

1.27–1.29: mole as amount-of-substance unit, mass–amount calculations and equation ratios; particle counting supports the school objectives.

Allow about 50 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
Calculator / periodic table	1 calculator each; 1 table per pair	30 calculators; 15 tables

Immediate safety

Desk activity only; no chemicals or practical equipment.

Preparation and delivery

Read alongside the student method

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1. Use 30 calculators and booklets. Check learners can enter 10^{23} using the exponent key; avoid typing a string interpreted as 10 × 23.

2. The exact entity count defines the mole; 6.02×10^{23} is a rounded classroom value. The old carbon-12 mass definition is historical and should not be presented as the current SI definition.

3. Replace the corrupted inherited powers and the erroneous century example. Do not attribute the exact modern constant to a direct measurement by Avogadro.

4. Label N (number of specified entities), n (amount in mol), m (mass) and M (molar mass). Numerically similar relative masses and molar masses still describe different quantities.

5. Allow 10 minutes definitions, 20 worked practice, 10 equation ratios and 10 corrections. Particle-count examples extend the lesson objectives; no physical particles or chemicals are measured.

Close of lesson

• Keep corrected calculations and return shared materials.

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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• 12.0 g Mg = 0.500 mol atoms ≈ 3.01×10^{23} atoms. 9.0 g water = 0.500 mol molecules ≈ 3.01×10^{23} molecules. 0.250 mol CO_2 ≈ 1.505×10^{23} molecules. 2.00 mol O_2 ≈ 1.204×10^{24} molecules (round suitably).

• m = nM = 0.250 × 44 = 11.0 g.

• n = $(1.204 \times 10^{24})/(6.02 \times 10^{23})$ = 2.00 mol; m = 2.00 × 32 = 64.0 g.

• 2.00 mol molecules contains 4.00 mol oxygen atoms, approximately 2.408×10^{24} atoms using the stated rounded constant.

• 0.50 mol O_2 requires 1.00 mol H_2 and can form 1.00 mol H_2O, assuming complete reaction with appropriate reactants available.

• A mole fixes entity count, not mass; mass depends on the entity. M_r has no units, whereas molar mass M is expressed here in g mol^{-1}.

References and provenance

Pearson Chemistry specification

BIPM current definition of the mole

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.