Isotopes and relative atomic mass

Teacher / technician

YEAR 10 / LESSON 9 / CHEMISTRY + SCIENCE (DOUBLE AWARD)

Staff preparation and answer guidance. Keep separate from student sheets. All X/Y abundance data are invented and labelled. No claims about natural abundances or physical isotope experiments are made.

Coverage and delivery

1.16–1.17: relative atomic mass and calculations from isotopic abundances.

Allow about 45 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
X-10 cards (Z = 5)	8 per pair	120
X-11 cards (Z = 5)	2 per pair	30
Calculator and tray/mat	1 per pair	15 sets
Student booklet	1 per student	30

Immediate safety

Desk activity only. Use pre-cut paper cards; keep small pieces out of mouths. No radioactive sources, chemicals or actual isotope samples are used.

Preparation and delivery

Read alongside the student method

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1. Prepare identical complete sets of ten fictional X cards per pair: eight X-10 and two X-11, all marked Z = 5. These are prescribed populations, not samples drawn from a hidden mixture.

2. Allow 10 minutes for isotope definitions, 10 minutes for counts and percentages, 15 minutes for weighted means and 10 minutes for inverse calculation and explanation.

3. Define relative atomic mass as the weighted mean mass of an atom of an element compared with one-twelfth of the mass of a carbon-12 atom. It is dimensionless. Exact isotope masses are not integers; mass numbers approximate them here.

Close of lesson

• Return all ten isotope cards to the set and retain your calculations. No chemical waste is produced.

Verification before use

Check quantities and available apparatus against this requisition. For heated work, complete the school risk assessment and trial the actual setup. This editorial review is not a record of a physical laboratory trial. All supplied calculation datasets are labelled teaching examples.

Answers and teaching notes

Expected explanations • do not give as experimental observations

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• X-10 has 5 protons and 5 neutrons; X-11 has 5 protons and 6 neutrons. Same proton count means the same element.

• X abundances are 80% and 20%; (8 × 10 + 2 × 11)/10 = 10.2, also (80 × 10 + 20 × 11)/100 = 10.2. The mean is nearer 10 because that isotope is more abundant.

• Y: (25 × 24 + 75 × 26)/100 = 25.5. The simple average is 25.0 and would apply only to equal abundances in this two-isotope model.

• 10(1 – f) + 11f = 10.6 gives f = 0.6, so 60% X-11 and 40% X-10.

• Each atom has a whole-number proton and neutron count. The weighted average describes a population, not a fractional neutron in one atom.

• Relative atomic mass is compared with one-twelfth of carbon-12 atom mass and has no unit. Electron structure explains similar chemical behaviour of isotopes; nuclear properties can differ.

References and provenance

Pearson Chemistry specification

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.