

3.2 Relative masses of atoms and molecules

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS mass 质量 • relative atomic mass 相对原子质量 • relative formula mass 相对式量 • relative molecular mass 相对分子质量
 • relative masses 相对质量

Objective

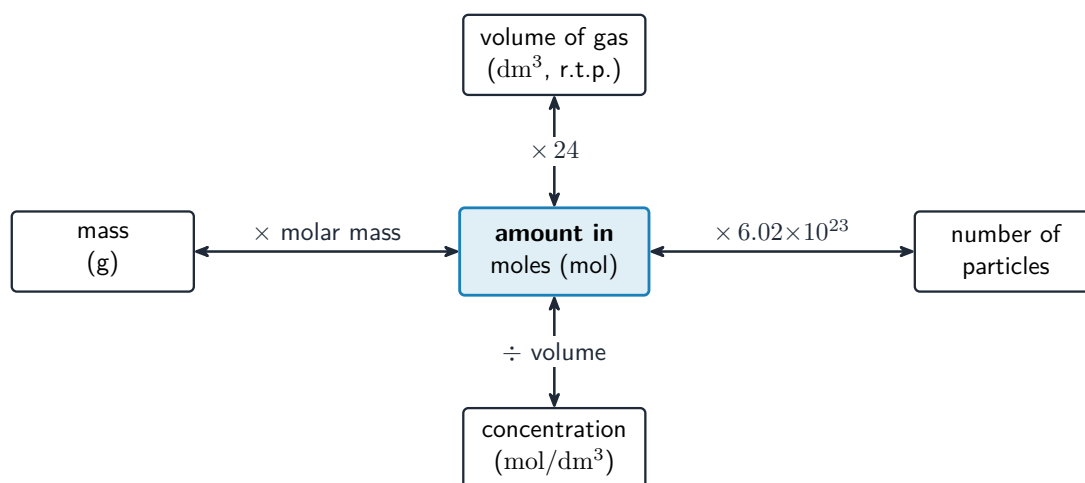
Build the skills to answer exam questions on **relative masses** 相对质量 — **relative atomic mass** 相对原子质量 (A_r), **relative molecular/formula mass** 相对分子/式量 (M_r), and reacting masses by simple proportion.

You must be able to:

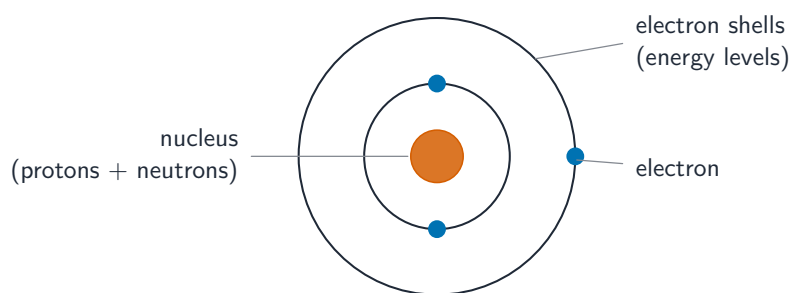
- state what A_r and M_r mean
- calculate M_r from a formula
- find a reacting mass by simple proportion

1 Worked examples

■ Calculating M_r



M_r is the sum of the A_r values of all the atoms in the formula



lithium, Li: 3 protons, 4 neutrons
electron configuration 2,1

Relative mass comes from the protons and neutrons in the nucleus

$$M_r(\text{H}_2\text{O}) = (2 \times 1) + 16 = 18.$$

Proportion: if 24 g of Mg makes 40 g of MgO, then 12 g of Mg makes 20 g of MgO.

2 Practice

2.1 Calculate the M_r of carbon dioxide, CO_2 (A_r : C = 12, O = 16). [2]

2.2 State what relative atomic mass means. [1]

3 Exam-style questions

3.1 The relative formula mass of CaCO_3 (A_r : Ca = 40, C = 12, O = 16) is: [1]

- A 68
 - B 82
 - C 100
 - D 116
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3.2 Calculate the M_r of ammonium nitrate, NH_4NO_3 (A_r : N = 14, H = 1, O = 16). [2]

3.3 48 g of magnesium reacts completely with oxygen to form 80 g of magnesium oxide.

(a) Find the mass of magnesium oxide formed from 12 g of magnesium. [2]

(b) Find the mass of oxygen that reacted with the 48 g of magnesium. [1]

Solutions

2.1 $M_r = 12 + (2 \times 16) = 44$.

2.2 the average mass of an atom of the element compared with $\frac{1}{12}$ the mass of a carbon-12 atom.

3.1 C. $40 + 12 + (3 \times 16) = 100$.

3.2 $(2 \times 14) + (4 \times 1) + (3 \times 16) = 28 + 4 + 48 = 80$.

3.3 (a) 12 g is a quarter of 48 g, so mass of MgO = $\frac{1}{4} \times 80 = 20$ g.

(b) oxygen = $80 - 48 = 32$ g.