

2 Atoms, molecules and moles – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
relative atomic mass	相对原子质量	_____
mole	摩尔	_____
relative molecular mass	相对分子质量	_____
isotopes	同位素	_____
Avogadro constant	阿伏伽德罗常量	_____
molar mass	摩尔质量	_____

Recall

At IGCSE you used **relative atomic mass** 相对原子质量 and the idea of the **mole** 摩尔. Now we make those tools sharp, ready for AS calculations.

- Atoms are too light to weigh in grams, so we compare every mass to one standard.
- The mole lets us count huge numbers of particles by weighing.

Nothing here is harder than IGCSE —it just lines up the tools.

New ideas

Read these first, then do the Practice.

■ 1 Relative masses

- the **relative atomic mass** 相对原子质量 (A_r) is the average mass of an element's atoms compared with $\frac{1}{12}$ of a carbon-12 atom.
- the **relative molecular mass** 相对分子质量 (M_r) is the sum of the A_r values of

all the atoms in a molecule.

A_r is a **weighted average** over the **isotopes** 同位素. For chlorine (75% ^{35}Cl , 25% ^{37}Cl):

$$A_r = (0.75 \times 35) + (0.25 \times 37) = 35.5$$

75% ^{35}Cl	25% ^{37}Cl
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■ 2 The mole and the Avogadro constant

One **mole** 摩尔 contains the **Avogadro constant** 阿伏伽德罗常量 of particles:

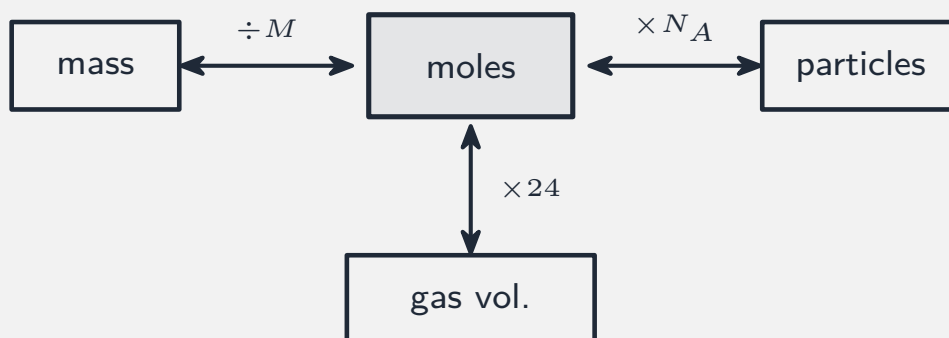
$$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$$

The mass of one mole in grams equals the relative mass —the **molar mass** 摩尔质量 (M , in g mol^{-1}).

■ 3 The key equation

$$n = \frac{m}{M}$$

where n = amount (mol), m = mass (g), M = molar mass.



Worked example. Moles in 8.0 g of CH_4 ($M = 16$): $n = 8.0/16 = 0.50 \text{ mol}$.

Watch out: when finding M_r , multiply each atom's A_r by how many of that atom there are — H_2O is $2(1) + 16 = 18$, not $1 + 16$.

Practice

Try these in order. Use A_r : H = 1, C = 12, N = 14, O = 16, Na = 23.

2.1 State the value of the Avogadro constant, with its units. [1]

2.2 Work out the relative molecular mass, M_r , of (a) H_2O , (b) CO_2 . [2]

2.3 How many moles are in 11.5 g of sodium ($A_r = 23$)? [2]

2.4 How many moles are in 36 g of water, H_2O ? [2]

2.5 Bromine has two isotopes: 50% ^{79}Br and 50% ^{81}Br . Calculate its relative atomic mass. [2]

2.6 How many molecules are in 0.50 mol of carbon dioxide? [1]

2.7 Challenge. How many oxygen atoms are there in 8.8 g of carbon dioxide, CO_2

$(M = 44)?$

[3]

