AP CHEMISTRY • HOLIDAY HOMEWORK 假期作业

1 Moles and formulas – 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)		
moles	摩尔			
Avogadro's number	阿伏伽德罗常数			
molar mass	摩尔质量			
Isotopes	同位素			
relative abundance	相对丰度			
empirical formula	实验式			

Recall

You have already met the building blocks of chemistry:

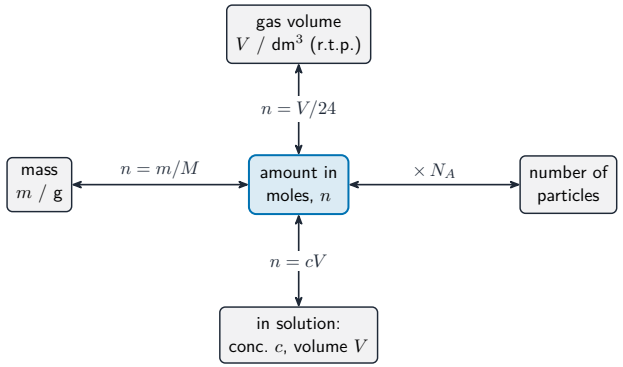
- Atoms are far too small to count one by one.
- Every element has a **relative atomic mass** written on the periodic table.
- You have written formulas like H_2O and CO_2.

This sheet lines up the "counting" tool chemists use – the mole. Each idea has a worked example.

New ideas

1 The mole

Because atoms are so tiny, chemists count them in **moles** 摩尔. One mole is **Avogadro's number** 阿伏伽德罗常数 of particles, $N_A = 6.022 \times 10^{23}$.



2 Molar mass

The **molar mass** 摩尔质量 M (grams per mole) comes straight from the periodic table. It converts between mass and moles:

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

Worked example. 36.0 g of water ($M = 18.0$ g/mol) is $n = \dfrac{m}{M} = \dfrac{36.0}{18.0} = 2.0$ mol, which is $2.0 \times 6.022 \times 10^{23} = 1.2 \times 10^{24}$ molecules.

3 Isotopes and relative atomic mass

Isotopes 同位素 are atoms of the same element with different numbers of neutrons. The relative atomic mass is the **weighted average** of the isotope masses, using their **relative abundance** 相对丰度.

Worked example. Chlorine is 75.8% chlorine-35 and 24.2% chlorine-37: $A_r = (35)(0.758) + (37)(0.242) = 35.5$ – closer to 35 because it is more abundant.

4 Empirical formula

The **empirical formula** 实验式 is the simplest whole-number ratio of atoms. Find it by turning each element's mass into moles and dividing by the smallest.

Worked example. A compound of 40.0% C, 6.7% H, 53.3% O: C $= \frac{40.0}{12} = 3.33$, H $= \frac{6.7}{1} = 6.7$, O $= \frac{53.3}{16} = 3.33$; dividing by 3.33 gives 1 : 2 : 1, so CH_2O.

Watch out: the relative atomic mass is a **weighted** average – it sits closer to the more abundant isotope, not exactly halfway between the two.

Practice

Try these in order. The methods are all above.

2.1 How many moles are in 22.0 g of carbon dioxide ($M = 44.0$ g/mol)? [2]

2.2 How many molecules are in 0.50 mol of a gas? ($N_A = 6.022 \times 10^{23}$) [2]

2.3 An element is 60% of an isotope of mass 20 and 40% of an isotope of mass 22. Find its relative atomic mass. [3]

2.4 Find the mass of 3.0 mol of water ($M = 18.0$ g/mol). [2]

2.5 A compound is 50% sulfur and 50% oxygen by mass ($S = 32$, $O = 16$). Find its empirical formula. [3]