

4 Reactions, equations, and stoichiometry – 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)
chemical reaction	化学反应	_____
precipitate	沉淀	_____
physical change	物理变化	_____
chemical change	化学变化	_____
Stoichiometry	化学计量	_____
limiting reactant	限量反应物	_____

Recall

You have already worked with chemical reactions:

- A reaction makes **new substances** – you might see a colour change, bubbles, or a solid form.
- You have balanced equations so both sides have the same atoms.
- You have used moles to work out amounts.

This sheet lines up how to calculate amounts from an equation. Each idea has a worked example.

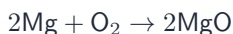
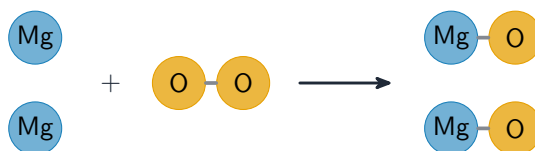
New ideas

■ 1 Signs of a reaction

A **chemical reaction** 化学反应 rearranges atoms into new substances. You can tell one happened by a colour change, a gas or a **precipitate** 沉淀 (solid) forming, or a temperature change.

■ 2 Balanced equations

Atoms are never created or destroyed, so an equation must be **balanced** – the same number of each atom on both sides.



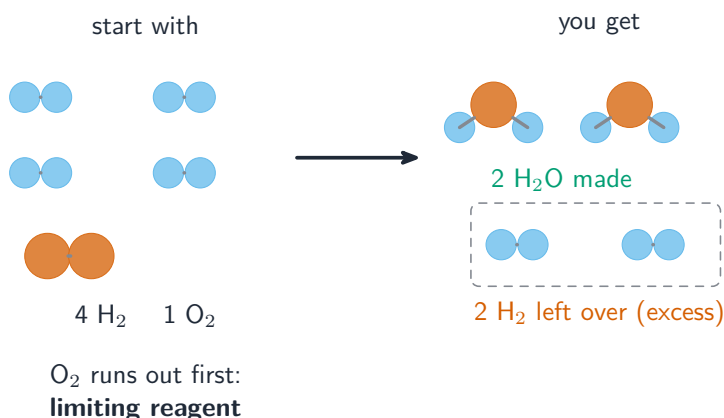
2 Mg and 2 O on each side: balanced

■ 3 Physical or chemical change

A **physical change** 物理变化 changes form but not identity (melting, dissolving); a **chemical change** 化学变化 makes new substances. Dissolving salt is physical – the salt is unchanged.

■ 4 Stoichiometry

Stoichiometry 化学计量 uses the balanced equation's mole ratio to link amounts. The path is always grams $\rightarrow$ moles $\rightarrow$ (mole ratio) $\rightarrow$ moles $\rightarrow$ grams. The **limiting reactant** 限量反应物 runs out first and sets how much product forms.



Worked example. How much water forms when 4.0 g of hydrogen burns? $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. Moles of $\text{H}_2 = \frac{4.0}{2.0} = 2.0$; the ratio is $2 : 2 = 1 : 1$, so 2.0 mol of water forms, mass = $2.0 \times 18 = 36$ g.

Watch out: always use the **mole ratio** from the balanced equation, not the mass ratio. Convert grams to moles first, cross the ratio, then convert back.

Practice

Try these in order. The methods are all above.

2.1 List three signs that a chemical reaction has taken place. [2]

2.2 State whether each is a physical or a chemical change: (a) ice melting, (b) wood burning. [2]

2.3 Balance this equation: $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$. [2]

2.4 For $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$, how many moles of MgO form from 3.0 mol of Mg? [2]

2.5 How many grams of MgO form from 0.20 mol of Mg in the reaction above? ($M(\text{MgO}) = 40 \text{ g/mol}$) [3]