4 Reactions, equations, and stoichiometry – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
chemical reaction			
precipitate			
physical change			
chemical change			
Stoichiometry			
limiting reactant			

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.

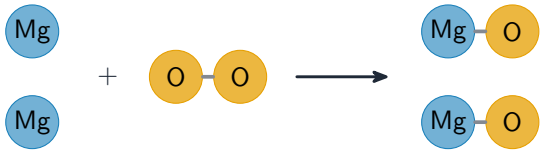
New ideas

1 Signs of a reaction

A **chemical reaction** rearranges atoms into new substances. You can tell one happened by a colour change, a gas or a **precipitate** (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.



$$2Mg + O_2 \rightarrow 2MgO$$

2 Mg and 2 O on each side: balanced

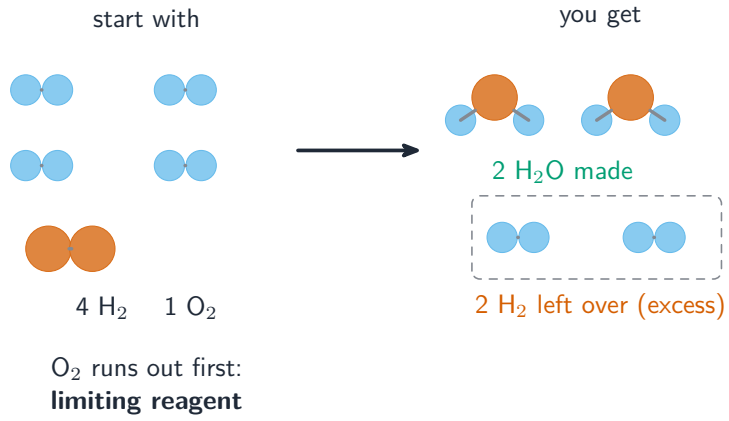
3 Physical or chemical change

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

4 Stoichiometry

Stoichiometry uses the balanced equation's mole ratio to link amounts. The path is always grams → moles → (mole ratio) → moles → grams. The **limiting reactant** runs out first and sets how much product forms.

$$2\mathbf{H_2} + \mathbf{O_2} \rightarrow 2\mathbf{H_2O}$$



Worked example. How much water forms when 4.0 g of hydrogen burns? $2H_2 + O_2 \rightarrow 2H_2O$. Moles of $H_2 = \frac{4.0}{2.0} = 2.0$; 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: $\mathrm{H_2 + O_2 \rightarrow H_2O}$. [2]

2.4 For $\mathrm{2Mg + O_2 \rightarrow 2MgO}$, 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? ($M(\mathrm{MgO}) = 40$ g/mol) [3]

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