Your notes

GCSE Chemistry: revision notes

Conservation of mass and balanced equations

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Start here: atoms are never lost

- In a chemical reaction, atoms are rearranged into new substances, but no atoms are made or destroyed.
- So the total mass of the products always equals the total mass of the reactants.
- That is why equations have to balance: there must be the same number of each kind of atom on both sides.

Conservation of mass

- No atoms are lost or made during a chemical reaction, so the mass of the products equals the mass of the reactants.
- This means chemical reactions can be shown by balanced symbol equations, with the same number of each type of atom on both sides.

Balancing equations

- Only change the big numbers in front of formulae, never the small numbers inside them.
- Example: $H_2 + O_2 \rightarrow H_2O$ becomes $2H_2 + O_2 \rightarrow 2H_2O$.
- Example: $Mg + O_2 \rightarrow MgO$ becomes $2Mg + O_2 \rightarrow 2MgO$.
- Check by counting the atoms of each element on each side.

Relative formula mass

- The relative formula mass (Mr) of a compound is the sum of the relative atomic masses (Ar) of the atoms in its formula.
- Example: Mr of CO_2 = 12 + (2 × 16) = 44. Mr of $CaCO_3$ = 40 + 12 + (3 × 16) = 100.
- In a **balanced equation**, the total Mr of the reactants (in the quantities shown) equals the total Mr of the products.

Apparent mass changes

- If a reactant is a gas from the air, the mass of solid increases. For example, when magnesium burns, oxygen from the air joins it, so the magnesium oxide is heavier than the magnesium.
- If a product is a gas that escapes, the mass decreases. For example, when a metal carbonate is heated, carbon dioxide escapes (**thermal decomposition**).
- In a **closed system**, where nothing can get in or out, the mass stays the same.

Uncertainty in measurements

- Whenever a measurement is made there is some **uncertainty** about the result.
- The range of a set of repeat measurements about the mean gives an estimate of the **uncertainty**: **uncertainty** = range ÷ 2.

Exam tip

- Balance equations by changing the big numbers in front. If a mass seems to change in an experiment, a gas has left or joined.

Common mistakes

- Changing the small numbers in a formula to balance an equation.
- Saying mass has been lost. It's only gone into the air as a gas.

Worked examples

12 g of magnesium burns to make 20 g of magnesium oxide. What mass of oxygen reacted?

Mass is conserved: the mass of the products equals the mass of the reactants.
magnesium + oxygen = magnesium oxide

Subtract to find the oxygen. **20 – 12**

Answer: 8 g of oxygen

Your notes

Balance the equation: $Mg + O_2 \rightarrow MgO$

Count the atoms on each side. **left: 1 Mg, 2 O. right: 1 Mg, 1 O**

Oxygen does not balance, so put a 2 in front of MgO (never change the small numbers in a formula). **$Mg + O_2 \rightarrow 2MgO$**

Now there are 2 Mg on the right, so put a 2 in front of Mg. **$2Mg + O_2 \rightarrow 2MgO$**

Check: 2 Mg and 2 O on each side. **balanced**

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

Your notes

Key terms

Conservation of mass	No atoms are lost or made in a reaction, so the total mass stays the same.
Balanced equation	A symbol equation with the same number of each type of atom on both sides.
Relative atomic mass (Ar)	The average mass of an element's atoms compared with 1/12 of the mass of a carbon-12 atom.
Relative formula mass (Mr)	The sum of the relative atomic masses of the atoms in a formula.
Thermal decomposition	Breaking down a substance using heat.
Closed system	A system where no substances can get in or out.
Uncertainty	How far a measurement might be from the true value; estimated as half the range.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What is the Mr of water, H_2O?
2. What is the Mr of calcium carbonate, $CaCO_3$?
3. What is the Mr of sodium chloride, NaCl?
4. What is the balanced equation for hydrogen burning in oxygen?
5. Why does the mass increase when magnesium is burned in air?
6. Why does the mass decrease when calcium carbonate is heated in an open tube?
7. 10.0 g of calcium carbonate decomposes to leave 5.6 g of calcium oxide. What mass of carbon dioxide was released?
8. What is the Mr of sulfuric acid, H_2SO_4?

Answers

1. 18
2. 100
3. 58.5
4. $2H_2 + O_2 \rightarrow 2H_2O$
5. Oxygen from the air combines with it
6. Carbon dioxide gas escapes

7. 4.4 g
8. 98

What to do next

Practise 11 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

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