Your notes

GCSE Chemistry: revision notes

Atoms, elements and isotopes

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Start here: what everything is made of

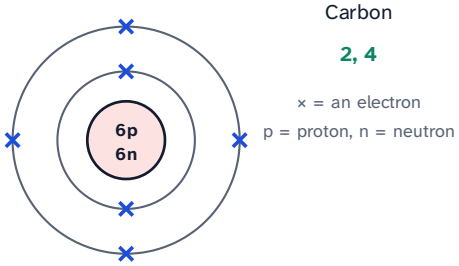
- Everything is made of **atoms**: tiny particles about 0.1 nanometres across. An **element** is a substance made of only one kind of **atom**.
- An **atom** has a tiny **nucleus** in the middle, made of **protons** and neutrons, with electrons moving round it in shells.
- **Protons** are positive, **electrons** are negative and **neutrons** have no charge. An atom has the same number of protons and electrons, so it has no overall charge.

Atoms

- An **atom** has a tiny central **nucleus** containing **protons** and neutrons, with electrons in shells around it.
- **Atoms** have no overall charge because they have equal numbers of **protons** and **electrons**.
- The radius of an **atom** is about 0.1 nm (1×10^{-10} m). The **nucleus** is less than 1/10 000 of that size.

Protons, neutrons and electrons

- **Proton**: relative mass 1, relative charge +1.
- **Neutron**: relative mass 1, relative charge 0.
- **Electron**: very small relative mass (about 1/2000), relative charge –1.



Atomic number and mass number

- **Atomic number** = the number of **protons**. Every **atom** of an element has the same atomic number.
- **Mass number** = the number of **protons** + **neutrons**.
- Number of **neutrons** = **mass number** – **atomic number**.

Isotopes

- **Isotopes** are **atoms** of the same **element** with the same number of protons but different numbers of neutrons.
- For example, chlorine-35 and chlorine-37 both have 17 **protons**.
- Relative atomic mass is the average mass of an **element**'s **isotopes**, taking their abundance into account.

Elements, compounds and mixtures

- An **element** contains only one type of **atom**.
- A **compound** contains two or more **elements** chemically combined in fixed proportions.
- A mixture contains substances that are not chemically joined. They can be separated by physical methods such as filtration or distillation.

Exam tip

- Use the periodic table: **protons** = **atomic number**; **electrons** are the same in an atom; neutrons = mass number – atomic number.
- Know the history in order: plum pudding, then the nuclear model from the alpha-scattering experiment, then Bohr's shells, then the **neutron**.

Common mistakes

- Using the **mass number** as the number of **protons**.
- Saying **isotopes** have different numbers of **protons**. They differ in **neutrons**.

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Worked examples

Sodium has an atomic number of 11 and a mass number of 23. How many protons, neutrons and electrons are in a sodium atom?

The atomic number is the number of protons. **11 protons**

An atom has no overall charge, so electrons = protons. **11 electrons**

Neutrons = mass number – atomic number. **23 – 11 = 12 neutrons**

Answer: 11 protons, 12 neutrons, 11 electrons

Chlorine is 75% chlorine-35 and 25% chlorine-37. Calculate its relative atomic mass.

Multiply each isotope's mass by how much of it there is. **75 × 35 = 2625 and 25 × 37 = 925**

Add them up and divide by 100. **(2625 + 925) ÷ 100**

Answer: 35.5 (which is why the periodic table gives chlorine 35.5)

Key terms

Atom	The smallest part of an element that can exist.
Nucleus	The centre of an atom, containing protons and neutrons.
Proton	A particle in the nucleus with relative mass 1 and charge +1.
Neutron	A particle in the nucleus with relative mass 1 and no charge.
Electron	A tiny particle with charge –1, found in shells around the nucleus.
Atomic number	The number of protons in an atom.
Mass number	The total number of protons and neutrons in an atom.
Isotope	Atoms of the same element with different numbers of neutrons.
Element	A substance made of only one type of atom.
Compound	Two or more elements chemically combined in fixed proportions.

Quick questions

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

1. What is the relative charge of a proton?
2. Where are neutrons found?
3. What does the atomic number tell you?
4. An atom has mass number 23 and atomic number 11. How many neutrons does it have?

Your notes

5. What are isotopes?
6. Why do atoms have no overall charge?
7. What is the relative mass of an electron?
8. What is a compound?

Answers

1. +1
2. In the nucleus
3. The number of protons
4. 12
5. Atoms of an element with different numbers of neutrons
6. They have equal numbers of protons and electrons
7. Very small (about 1/2000)
8. Two or more elements chemically combined

What to do next

Practise 12 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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