Your notes

KS3 Science: revision notes

C3.1 The periodic table

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Atoms

- An atom has a tiny **nucleus** containing **protons** (charge +1, relative mass 1) and **neutrons** (charge 0, relative mass 1). Electrons (charge –1, very small mass) move around the nucleus in shells.
- Atoms have no overall charge, because they have the same number of **protons** and **electrons**.
- The **atomic number** is the number of **protons**. The **mass number** is the number of protons plus neutrons. So neutrons = mass number – atomic number.
- **Isotopes** are atoms of the same element with different numbers of **neutrons**, such as carbon-12 and carbon-14.
- Atoms are about 0.1 nm (1×10^{-10} m) across, and the **nucleus** is about 10 000 times smaller than the atom.

Electron shells and the model of the atom

- **Electrons** fill the shells from the inside: up to 2 in the first shell, then 8, then 8. Sodium (11 **electrons**) is 2, 8, 1; chlorine (17) is 2, 8, 7.
- The group number is the number of **electrons** in the outer shell. The period number is the number of shells.
- The model of the atom changed as scientists found new evidence: Dalton (solid spheres), Thomson (discovered the **electron**: the plum pudding model), Rutherford (the gold foil experiment showed a tiny, positive **nucleus**), Bohr (**electrons** in shells) and Chadwick (discovered the neutron).
- Mendeleev arranged the elements into a periodic table and left gaps for elements not yet discovered, predicting their properties. The modern table is in order of **atomic number**.

Groups 1, 7 and 0

- Group 1, the **alkali metals**, have 1 outer **electron**. They are soft, are stored in oil, and react with water to make a metal hydroxide and hydrogen: sodium + water → sodium hydroxide + hydrogen. They get more reactive down the group, because the outer **electron** is further from the nucleus and lost more easily.
- Group 7, the **halogens**, have 7 outer **electrons** and exist as pairs of atoms (Cl_2). Fluorine is a pale yellow gas, chlorine a green gas, bromine a red-brown liquid and iodine a grey-black solid. Down the group they get darker, their melting and boiling points rise, and they get less reactive.
- A more reactive **halogen** displaces a less reactive one from its compound: chlorine + potassium bromide → potassium chloride + bromine.
- Group 0, the **noble gases**, have full outer shells, so they are very unreactive. Helium is used in balloons, neon in signs and argon in light bulbs.

Transition metals and standard form

- The **transition metals** are in the middle block. They have high melting points and densities, form coloured compounds, and are often used as catalysts (iron, nickel).
- Standard form writes very big or small numbers as a number between 1 and 10 multiplied by a power of 10: $3\,000\,000 = 3 \times 10^6$, and $0.0001 = 1 \times 10^{-4}$.

Key terms

Proton	A positive particle in the nucleus.
Neutron	A particle with no charge in the nucleus.
Electron	A negative particle that moves around the nucleus in shells.
Nucleus	The tiny centre of an atom, containing protons and neutrons.
Atomic number	The number of protons in an atom.
Mass number	The number of protons plus neutrons in an atom.
Isotope	An atom of the same element with a different number of neutrons.
Electron shell	An energy level that electrons occupy around the nucleus.
Alkali metal	An element in Group 1 of the periodic table.
Halogen	An element in Group 7 of the periodic table.
Noble gas	An unreactive element in Group 0 of the periodic table.
Transition metal	A metal in the central block of the periodic table.
Displacement reaction	A more reactive element taking the place of a less reactive one in a compound.

Your notes

Quick questions

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

1. What is the charge on a proton?
2. What is in the nucleus of an atom?
3. A sodium atom has atomic number 11 and mass number 23. How many neutrons does it have?
4. What is the electronic structure of sodium (atomic number 11)?
5. What are isotopes?
6. Whose gold foil experiment showed that atoms have a tiny nucleus?
7. Why did Mendeleev leave gaps in his periodic table?
8. What is made when sodium reacts with water?

Answers

1. +1
2. Protons and neutrons
3. 12
4. 2, 8, 1
5. Atoms of the same element with different numbers of neutrons
6. Ernest Rutherford
7. For elements that hadn't been discovered yet
8. Sodium hydroxide and hydrogen

What to do next

Practise 15 questions on this topic

Try 4 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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