

MR SULLY UNFOLDS PHYSICS ANSWERS

# Atoms, isotopes and the model of the atom

**AQA 4.4.1**
Atomic structure · Paper 1
Foundation & Higher

Name _____ Class _____ Date _____

Atoms are tiny, but we know a lot about what's inside them, and our model has changed as new evidence has been found.

**KEY IDEAS**

- Atoms have a radius of about $1 \times 10^{-10}$ m. The nucleus is less than 1/10 000 of the atom's radius but holds almost all the mass.
- Atomic number = number of protons. Mass number = protons + neutrons. **Isotopes** have the same number of protons, different numbers of neutrons.
- Model history: solid spheres → plum pudding → nuclear model (alpha scattering) → Bohr's electron shells → neutron (Chadwick).

## Section A · Recall

Grade 4–5

**1** Complete the table. [6]

| Particle | Relative charge | Where it is found |
|---|---|---|
| Proton | +1 | Nucleus |
| Neutron | 0 | Nucleus |
| Electron | −1 | Around the nucleus (energy levels) |

**2** An atom of aluminium has atomic number 13 and mass number 27. State the number of protons, neutrons and electrons. [3]

Protons: 13 · Neutrons: 14 · Electrons: 13

**3** What is an isotope? [1]

Atoms of the same element (same number of protons) with different numbers of neutrons.

## Section B · Explain

Grade 5–6

**4** Explain why atoms have no overall charge. [2]

They have equal numbers of protons and electrons,

so the positive and negative charges cancel.

**5** Describe the plum pudding model of the atom. [2]

A ball of positive charge

with negative electrons embedded in it.

**6** Explain how an atom becomes a positive ion. [1]

It loses one or more outer electrons.

## Section C · Stretch

Grade 7+

**7** Explain how electrons can move between energy levels. [2]

**Absorbing electromagnetic radiation moves an electron to a higher level (further from the nucleus).**

**Emitting EM radiation moves it to a lower level.**

## Exam-style question

AQA style

**8** In the alpha particle scattering experiment, alpha particles were fired at a very thin sheet of gold foil.

**a** Describe and explain what the results showed about the structure of the atom. [4]

**Most went straight through: the atom is mostly empty space.**

**Some were deflected: the centre (nucleus) is charged.**

**A very few bounced back: mass is concentrated in a tiny nucleus.**

**So the nucleus is tiny, dense and positively charged.**

**b** Explain why the plum pudding model was replaced. [2]

**It couldn't explain alpha particles bouncing back,**

**so a new model (the nuclear model) was needed to fit the evidence.**

**Total: _____ / 23**

| **How confident am I?** | Not yet | Nearly | Got it |
|---|---|---|---|
| I can describe the structure of an atom and its size | ☐ | ☐ | ☐ |
| I can calculate the numbers of protons, neutrons and electrons | ☐ | ☐ | ☐ |
| I can explain how the model of the atom developed | ☐ | ☐ | ☐ |