

Developing the atomic model

Specification references:

- C1.1.3 Scientific models of the atom
- WS 1.1, 1.2

Aims

In this activity students consider why ideas and models in science often improve over time by exploring how ideas about atoms have changed.

Learning outcomes

- describe how and why the atomic model has changed over time.
- know that scientific theories are revised or replaced by new ones in light of new evidence.

Teacher notes

Some students may need a little guidance in drawing the timeline. More able students could be challenged to draw the timeline to scale. Students could be asked to complete the task individually or in small groups. Students could research the topic and add more developments on their timeline.

The student follow up questions become more difficult so students can choose, or be guided to complete, the appropriate questions to increase their knowledge and understanding of the topic.

You may want to provide your students with A3 paper and colouring pencils.

Answers

The following dates apply to the information given in the student sheet:

- (1909) Rutherford used the experimental work of two of his students, Geiger and Marsden, to develop the nuclear model in which most of the mass is concentrated in the nucleus, with electrons in shells orbiting the nucleus.
- (1897–1906) Thomson carried out experiments that led to the discovery of electrons and proved that atoms could be split.
- (1913) Bohr discovered that electrons in atoms could only travel along certain 'shells'.
- (Early 1800s) Dalton developed understanding of atomic theory and came up with theories about what made up different elements. He determined that atoms were tiny particles, like hard spheres that couldn't be split, which made up elements.
- (1932) James Chadwick devised an experiment that showed the existence of neutrons.
- (5th century BC) Greek philosopher Democritus claimed atoms could not be split.

Student follow up

- 1 They help us understand things better / help us make predictions.
- 2 Any reasonable suggestion, such as, more evidence is available/technology has improved so we can make more reliable observations.
- 3 They thought atoms could not be split.
- 4 Protons and neutrons are found in the nucleus/centre.
Electrons are found in shells/levels.



- 6 An atom is made up of tiny negatively charged electrons embedded in a cloud of positive charge.
- 7 Atoms of a particular element are identical – we now know isotopes are different forms of the same element, they have the same atomic number but a different mass number (this has not been covered in the course so far, but more able students may already have been told or be familiar with the concept).
Atoms cannot be split – atoms are made of protons neutrons and electrons.
- 8 **a** The positive charge is only in a tiny spot at the centre of the atom, so the alpha particles pass straight through.
b The nucleus contains very dense positively charged protons, which repelled the positively charged alpha particles.