AS and A LEVEL
CHEMISTRY B (SALTERS)

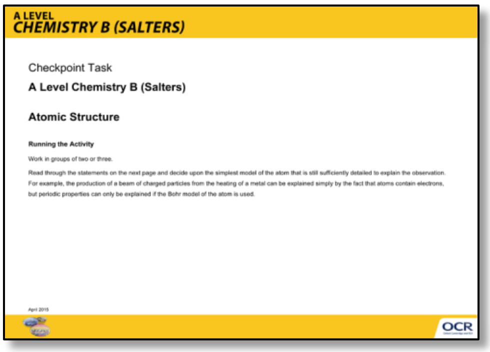
This Checkpoint Task should be used in conjunction with the KS4-KS5 Chemistry B Transition Guide – Atomic Structure.

A Level Chemistry B (Salters)

Atomic Structure

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Atomic Structure' which supports OCR A Level Chemistry B.



A LEVEL
CHEMISTRY B (SALTERS)

Checkpoint Task

A Level Chemistry B (Salters)

Atomic Structure

Running the Activity

Work in groups of two or three.

Read through the statements on the next page and decide upon the simplest model of the atom that is still sufficiently detailed to explain the observation. For example, the production of a beam of charged particles from the heating of a metal can be explained simply by the fact that atoms contain electrons, but periodic properties can only be explained if the Bohr model of the atom is used.

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The Activity:

This task provides learners with a selection of key scientists, in chronological order, accompanied by a brief reminder of their contributions towards the atomic structure model. Learners are also given a selection of statements which describe experimental observations.

This activity offers an opportunity for English skills development.

Learning Outcomes

This resource relates to specification learning outcome EL(g).

Associated materials:

'Atomic Structure' Checkpoint Task sheet.

Printing Instructions

Print the page of statements on A4 paper/card and cut them out (or have learners do this to save time!). Print the timeline page on A3 paper if possible, otherwise there is not enough room for learners to organise their work.

Running the Activity

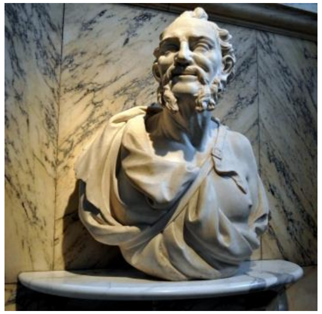
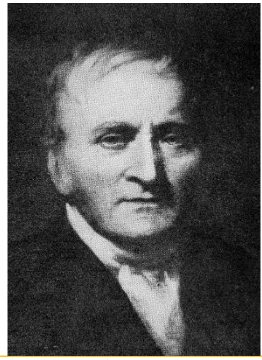
Learners should work in groups of two or three. The timeline is often familiar to them as it shows how our ideas of the atom have changed over time, becoming increasingly complex. The timeline is relevant to GCSE knowledge of atomic structure, ie the model of electrons within orbitals is not included. The statements describe experimental observations (not all have contributed towards our understanding of atomic structure).

Learners should read through the statements and decide upon the simplest model of the atom that is still sufficiently detailed to explain the observation. For example, the production of a beam of charged particles from the heating of a metal can be explained simply by the fact that atoms contain electrons, but periodic properties can only be explained if the Bohr model of the atom is used. Some of the statements are conceptually quite difficult at this stage – this allows extension for more able groups but you may want to inform the class that they might not be able to confidently place all the statements within the time limit given (approximately fifteen minutes is sufficient).

This activity is designed as an introduction to the need for a more sophisticated model for the atom – the statements regarding the difference in ionisation energies between magnesium and aluminium, and between nitrogen and oxygen, cannot be explained using the Bohr model alone. These statements can be removed if you do not wish to introduce sub-shells and orbitals at this time. Either way, learners should appreciate that common phenomena such as changes of state or reaction rates can be explained by very simple atomic models, and that new models do not need to 'overwrite' pre-existing ideas.

When liquids are heated they turn into a gas – when this gas is cooled again, it turns back into a liquid.	Increasing the temperature increases the rate of a chemical reaction.	Particles of dust or smoke appear to move randomly through water or air, changing direction all the time (Brownian motion).	Many chemicals can be split up into separate substances, but there is a limit to this – eventually you will get a ‘pure’ substance.
The first ionisation energy of sodium is much lower than the first ionisation energy of neon.	When light of a specific frequency is shone on the surface of a metal, charged particles are given off (this is known as the photoelectric effect).	When positively charged alpha particles are fired at a thin piece of gold foil, most of them pass straight through but some are deflected straight back.	The second ionisation energy of magnesium is much lower than the second ionisation energy of sodium.
The first ionisation energy of oxygen is slightly lower than the first ionisation energy of nitrogen.	Atoms of the same element, with the same chemical properties, can have different masses.	The properties of elements show periodicity when the elements are placed in order of increasing atomic number.	Metal electrodes can give off tiny particles that are attracted to a positive plate.
The total mass of substances at the end of a chemical reaction is the same as the total mass at the beginning.	Two chemical reactions in separate containers can produce a potential difference (voltage) if connected by a wire.	The first ionisation energy of aluminium is slightly lower than the first ionisation energy of magnesium.	The absorption and emission spectra of hydrogen consist of discrete lines.

Timeline

Democritus	John Dalton	J.J. Thomson	Ernest Rutherford
			
Everything is made up of tiny particles called atoms. The atom is indivisible.	Atoms cannot be created or destroyed. Elements are made up of only one type of atom. Atoms join together in chemical reactions.	Atoms contain tiny negatively charged particles called electrons. The rest of the atom is positive to balance out the charge, and the electrons are embedded in this like pieces of fruit in a pudding.	The positive charge and mass of the atom is concentrated in a tiny nucleus in the centre of the atom. The electrons exist randomly in the space around the nucleus.

Niels Bohr	James Chadwick	Louis de Broglie
		
Electrons are not randomly arranged around the atom. They exist in specific shells – like the orbits of the planets.	Some of the mass of the atom is accounted for by an uncharged particle, called a neutron. The neutron does not affect chemical properties of an element.	Just as waves can sometimes behave like particles, very small particles – like electrons – can behave like waves.