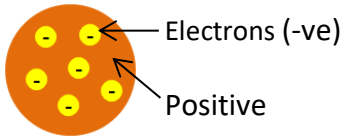
# C2 History of the Atom and Periodic Table

## History of the Atom

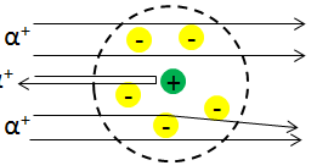
**John Dalton**
Atoms are solid spheres. Different spheres are made from different elements.

**JJ Thomson**
Measured charge and mass, showing atoms must contain electrons (-ve charges). Developed the **plum pudding model**.




**Ernest Rutherford**
He carried out **alpha particle scattering experiments**. If the plum pudding model was correct then the positive alpha particles should pass through or deflect slightly.

A few particles are deflected backwards. This must mean there is a **positive nucleus**.




Most particles pass through, a few are deflected.

**Niels Bohr**
Realised that if the electrons were in a cloud around a nucleus the atom would **collapse**. Suggested that the **electrons** orbit the nucleus in **fixed shells**. Experiments supported this.

Further experiments have shown the nucleus is made up of **protons and neutrons**.
James **Chadwick** carried out experiments to prove the existence of neutrons.

## Development of the Periodic Table

Scientists used to not know about atomic structure, protons, neutrons and electrons. They arranged the atoms in **order of atomic mass**. There were lots of elements that had not been discovered so many elements were placed in the **wrong group**.

Dmitri Mendeleev improved the design of the periodic table:

- **Left gaps** for undiscovered elements. When they were discovered they fitted the pattern
- Changed the order of some elements so that they **matched the properties** of the rest of the group (eg. Te and I are not in order of atomic mass but they fit the properties of the rest of their group.

## Group 1 Elements

React with **water** to form an **alkaline solution**: Lithium + water → lithium hydroxide + hydrogen
React vigorously when heated with **chlorine gas**: Sodium + chlorine → sodium chloride
React with **oxygen** to form **oxides**: Lithium forms lithium oxide ($Li_2O$), sodium forms sodium oxide and sodium peroxide ($Na_2O_2$) and potassium forms potassium peroxide and potassium superoxide ($KO_3$).
More reactive down the group – the outer electron is further from the nucleus so more easily lost.
Lower melting and boiling points down the group.

## Group 7 Elements

Less reactive down the group – the outer shell is further from the nucleus so harder to gain an electron.
Higher melting and boiling points down the group. Exist as pairs of atoms – eg. $Cl_2$
A more reactive halogen will **displace** a less reactive halogen: $Cl_2 + KBr \rightarrow 2KCl + Br_2$

F = yellow gas
Cl = dense green gas
Br = red-brown volatile liquid
I = dark grey solid

## Group 0 Elements

Full outer shells so are unreactive (inert).
Boiling point increases down the group - atoms have more electrons so stronger intermolecular forces form between molecules. Are colourless and non-flammable.

## Transition Metals

Are typical metals (strong, dense, shiny, good conductors).
Have more than one ion (eg. $CU^+$ and $CU^{2+}$) and form coloured compounds.