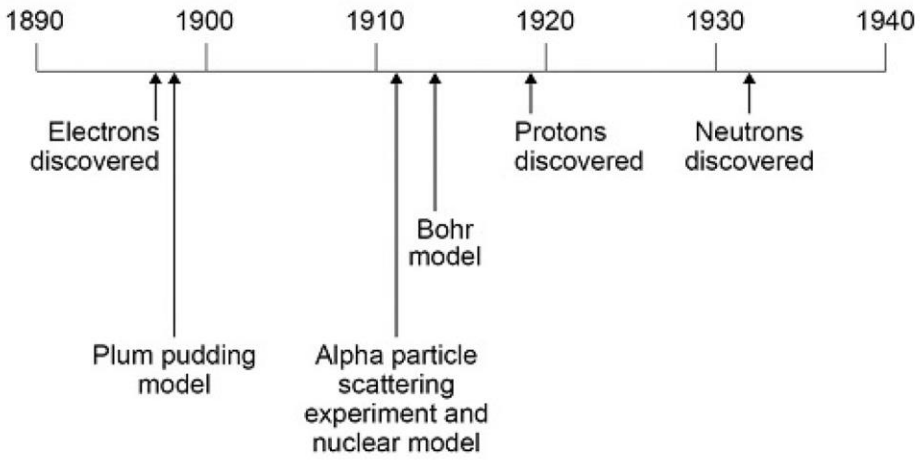
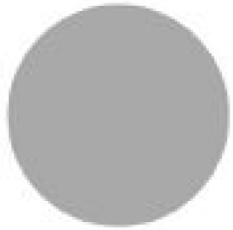
Chemistry Knowledge Organiser
Atomic structure (Trilogy Science)

Changing ideas about atoms



Early ideas about atoms

John Dalton described atoms as solid spheres of matter, rather like a snooker ball that could not be divided into anything smaller.

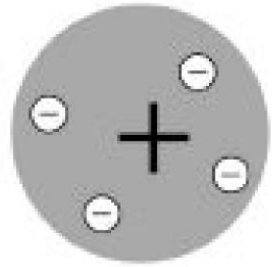


Plum pudding model

JJ Thompson discovered the **electron** – negatively charged particles which were smaller than atoms which .

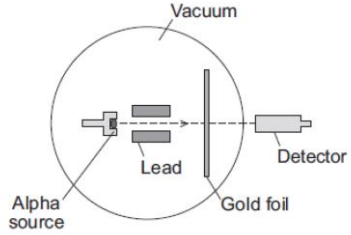
Daltons model was adapted to give the plum pudding model.

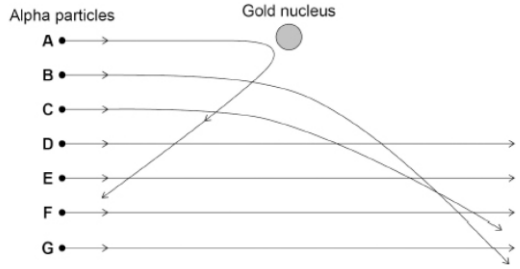
This said an atom is a **ball of positive charge** with **negative electrons embedded** in it.



Rutherford scattering

Ernest Rutherford fired alpha particles at a thin sheet of gold atoms.





Evidence	Conclusion
Most alpha particles passed straight through	Most of the atom is empty space and the mass is concentrated in the centre
Some particles were scattered	Atom has a positively charged nucleus

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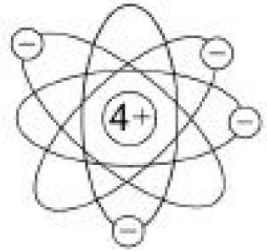
The nuclear model

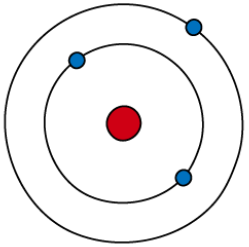
In the nuclear model developed by Rutherford atoms were:

- Mostly empty space
- Mass concentrated in nucleus
- Positive charge in nucleus
- Electrons separated from nucleus



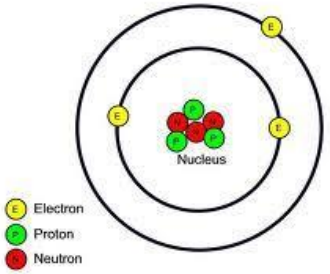
Bohr model

- Electrons orbit the nucleus
- At specific distances from the nucleus, in electron shells



Chadwick & the neutron

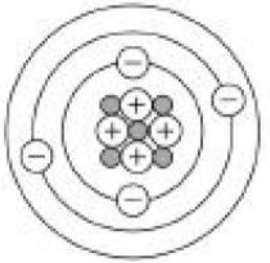
- In 1932 Chadwick discovered the neutron
- Because it had no charge it was difficult to discover and so was discovered later than the proton and electron



Modern structure of the atom

The radius of an atom is about $1x10^{-10}$ m (0.1 nm).

The radius of the nucleus is about 10 000 smaller than the atom.



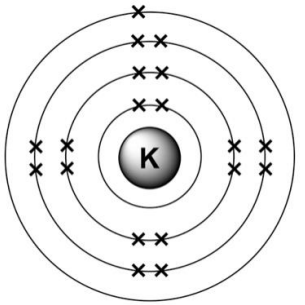
	Mass	Charge
Proton	1	+1
Neutron	1	0
Electron	0	-1

Atoms have no overall charge as they have the same number of positive protons as neutral electrons.

Electron configuration

Fill innermost shell first.

Maximum numbers of electrons:
Shell 1: 2 electrons
Shell 2: 8 electrons
Shell 3: 18 electrons



Example: Potassium

Potassium has an electron configuration of 2.8.8.1

When filling shell 3, 8 electrons go into it before 2 electrons then go into shell 4, then the remaining 10 electrons go into shell 3.

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Atomic number & mass number

Mass number = protons + neutrons → 19

Proton number = protons → 9

$^{19}_{9}F$

Number of neutrons = mass number – proton number

For atoms: number of electrons = number of protons

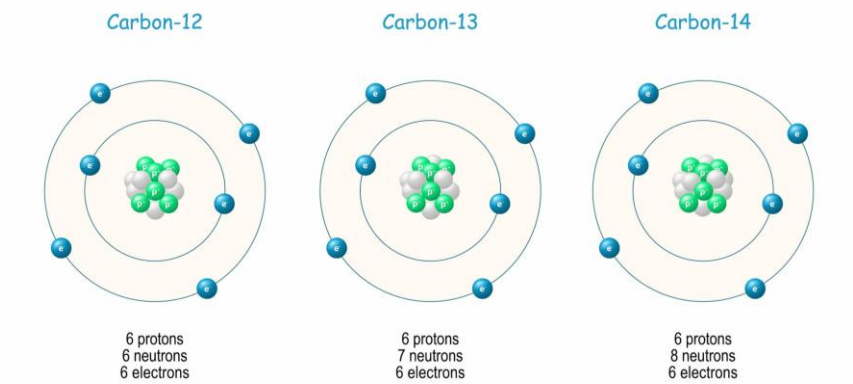
^{19}F would have 19 – 9 = 10 neutrons

Isotopes

Isotopes have same numbers of protons - they are the same element

Isotopes have different numbers of neutrons – different mass numbers

Isotopes have identical chemical properties – same electron structure



Calculating relative atomic mass (A_r)

$$A_r = \frac{\text{(mass number} \times \text{percentage) of isotope A + (mass number} \times \text{percentage) of isotope B}}{100}$$

	Mass number	Percentage abundance (%)
Isotope **A**	39	93.3
Isotope **B**	41	6.7

$A_r = \frac{(39 \times 93.3) + (41 \times 6.7)}{100}$

$A_r = 39.134$