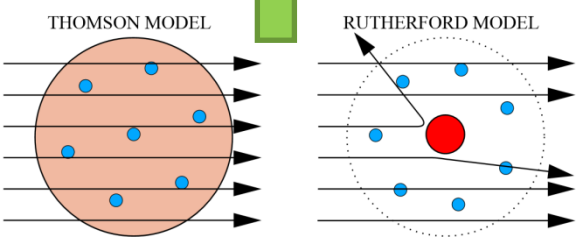
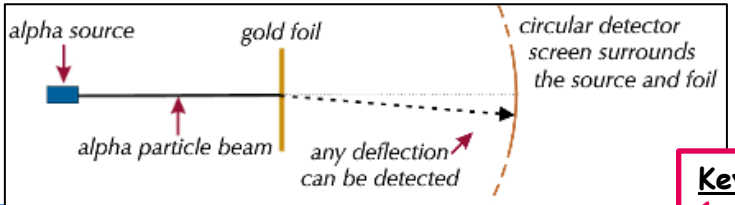
Y8 6.7 Atomic Structure

START

Rutherford realised that the positively charged alpha particles were being repelled and deflected by a tiny concentration of positive charge in the atom.

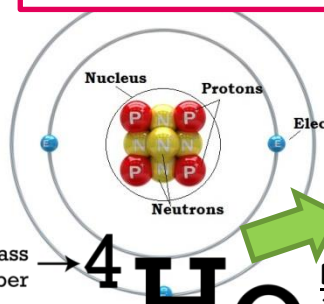




Geiger Marsden experiment. Alpha particles fired at gold leaf. Rutherford expected them to pass straight through, but some of the particles emerged from the foil at different angles and some even came straight back.

Experimental evidence led to previous models being replaced.

Models of the atom help to understand something that is too small to see.



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

Rules:

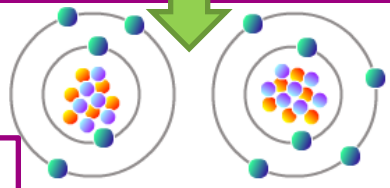
1. Mass number = protons + neutron
2. Atomic number = no. of protons
3. no. of electrons = no. of protons

Atoms make up everything. **Element:** a substance made of only one type of atoms. Atoms are about 0.0000000001m across

Key words:

1. **Alpha radiation:** The least penetrative radiation, stopped by paper. Alpha particle consists of 2 protons and 2 neutrons
2. **Beta radiation:** Stopped by paper. Beta particle consists on an electron
3. **Gamma radiation:** The most penetrative radiation, stopped by lead. Gamma radiation causes a high frequency electromagnetic wave to be emitted.

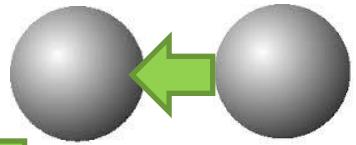
Isotope
The same elements and have the same number of protons **but** different numbers of neutrons



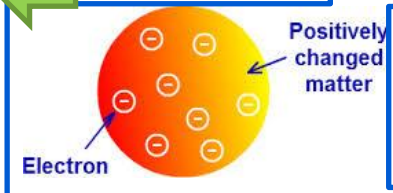
Electrons exist in shells (energy levels). The inner shells are filled first. Maximum number of electrons in the first three shells are [2,8,8]

The first shell can only hold 2 electrons but each shell after that can hold 8.

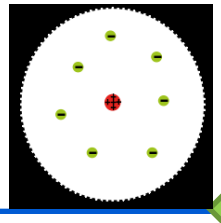
Elements with the same number of electron shells are in same period of the periodic table. Elements with the same number of outer shell electrons are in the same group



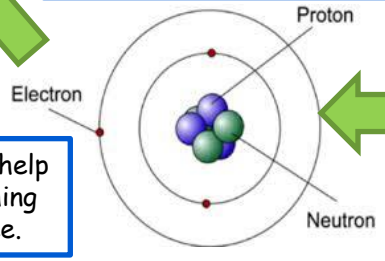
Dalton
Thought the atom was a solid dense ball



Thomson 1897
Plum pudding model, positive ball and negative electrons



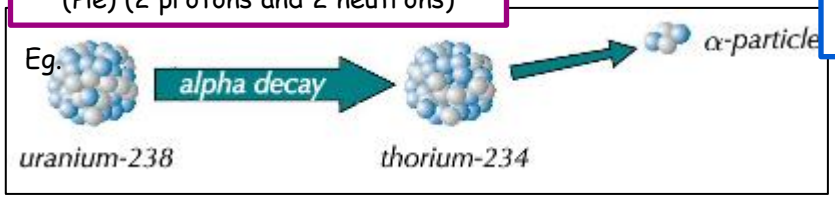
Rutherford 1911
Dense positive nucleus which has most of the mass



Bohr 1913
Electrons were in orbitals round a positive nucleus

START

Alpha (α) – an atom decays into a new atom and emits an alpha particle (He) (2 protons and 2 neutrons)

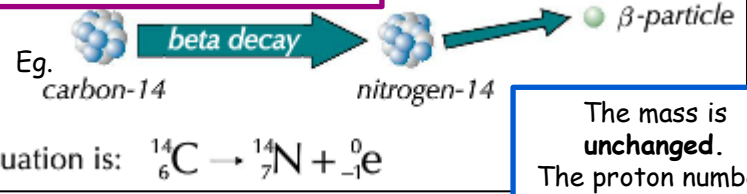


The mass number **decreases by 4.** The proton number **decreases by 2**

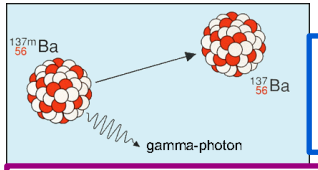
$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$

Type of radiation	Symbol	What is it made from?	How far will it travel in air?	What stops it?
Alpha	α	2 protons and 2 neutrons	cm	Air/paper
Beta	β	An electron	10-15 cm	Aluminium
Gamma	γ	High frequency EM wave	Many metres	Thick lead or concrete

Beta decay – a neutron turns into a proton and releases and electron

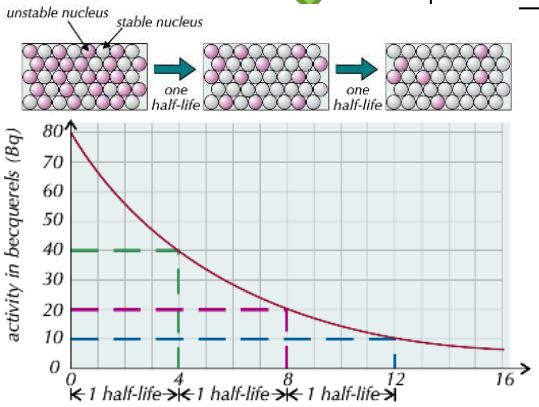


The mass is **unchanged.** The proton number **increases by 1**



The mass number and the proton number **unchanged**

In gamma decay, a high frequency EM wave is emitted

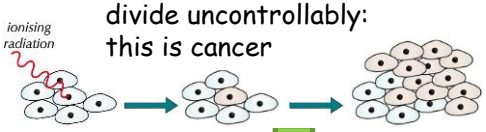


Key words:

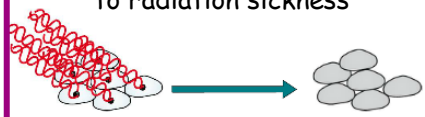
1. **Isotope:** An atom of an element that has the same number of protons but different number of neutrons. Some isotopes are unstable
2. **Ionising:** can break atoms and molecules into smaller fragments. These charged particles are called ions. Damages cells.
3. **Half life:** The time taken for the radioactivity of a sample of an unstable isotope to reduce by half.
4. **Radioactive decay:** the change in the nucleus of an unstable atom. It becomes a different element and emits radiation when this happens. It is a random event.
5. **Irradiation:** exposure to radiation
6. **Contamination:** radioactive particles getting onto objects or people.

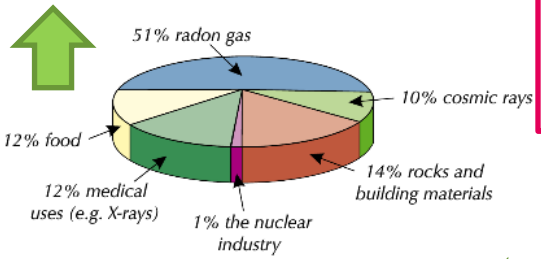
Outside the body, sources of beta and gamma are the most dangerous – can penetrate skin. Inside the body, sources of alpha are the most dangerous – because they are the most ionising.

Exposure to radiation can cause cells to mutate and divide uncontrollably: this is cancer



Exposure to high doses tends to kill cells, leading to radiation sickness





Radiation dose: the likelihood of damage to your cells if you are exposed to radiation. Measured in Sieverts (Sv)

Occupation precautions Radiographers: lead aprons and lead screens. Nuclear industry workers: face masks and exposure badges

Medical uses of radiation
Medical **Tracers**: injection of an isotope to help doctors investigate an illness.
Radiotherapy: the use of gamma rays to kill cancers.

We are all exposed to low-level radiation all the time. This is called **background radiation.**