Atoms

$^{12}_{6}C$

12 ← Mass Number (Protons + Neutrons)

6 ← Atomic Number (Protons and electrons)

Number of Neutrons =
Mass Number – Atomic number (12 - 6 = 6)

Isotopes: An isotope is an atom with the same number of protons but different number of neutrons.

Ions: An atom that has gained (positive ion) or lost (negative ion) electrons.

Some atoms are radioactive, they give out radiation from the nucleus. This is measured in Becquerels (Bq)

Alpha, Beta & Gamma

Name	What it is	What is its charge	What is its mass	Ionising Power	Absorbed by
Alpha	Helium nucleus	+2	+4	High	Paper/ air
Beta	Electron	-1	Tiny	Medium	Thin steel
Gamma	EM Wave	0	0	Low	Thick Lead

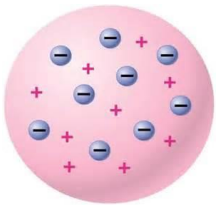
Alpha Decay (Atomic number -2, mass number -4)

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

Beta Decay (Atomic number +1, mass number 0)

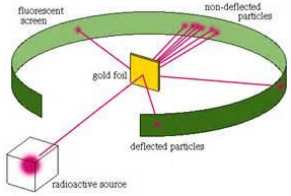
$$^{14}_{6}C \longrightarrow ^{14}_{7}N + ^{0}_{-1}\beta$$

Atomic Structure



1. In 1901 JJ Thompson suggested the '**plumb pudding**' model for the atom. With negative particles stuck in the middle of positive charge

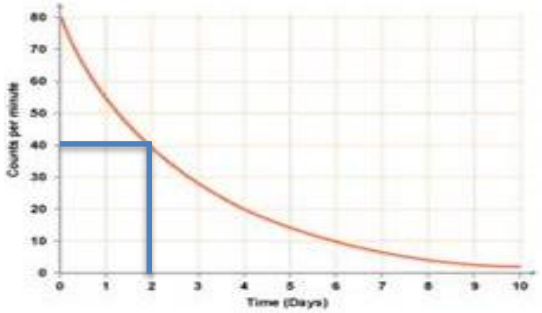
2. In 1909 Rutherford changed the accepted model using his alpha scattering experiment.



3a. He fired alpha particles at a sheet of gold foil.
3b. He expected them all to pass straight through
3c. Rarely one would bounce back
3d. This proved that the center of the atom was very small, held most of the mass and had a positive charge.
3e. The current model of the atom that we use today was born.

Half-life

The half-life of a radioactive source is **the time taken for half the material to decay**.



The half-life of the material above is 2 days.
The starting count was 80 half of it = 40
The time to get to 40 was 2 days.

In this example it would take: 2 days to get to get to 50%, 4 days to 25%, 6 days to get to

Nuclear fission (Triple Only)

1. Large radioactive atoms split in half (fission) because they are unstable.
2. When this happens a huge amount of energy is released.
3. Neutrons are released which hit and split more atoms, this is called a **chain reaction**.
4. This is the source of a nuclear power station or nuclear bomb's energy
5. Unfortunately a lot of radioactive waste is produced which stays radioactive for 1000's of years.

Nuclear Fusion (Triple Only)

1. Small light nuclei are forced together under huge heat and pressure – such as in the **core of the sun**.
2. The nuclei repel each other as they are both positively charged so it is hard to get them to fuse.
3. If the temperatures and pressures are large enough the nuclei will fuse to create a larger nuclei
4. A huge amount of energy is released
5. Fusion doesn't produce any radioactive waste
6. Scientists are yet to develop the technology to allow fusion to be used to produce electricity.

Radioactivity (Triple Only)

Radioactive atoms decay and release ionizing particles (alpha, beta and gamma)

There is a constant level of naturally occurring radiation all around us, this is known as '**background radiation**'. This is random when measured.

Background radiation comes from rocks, the air, our food and the sun. Very little comes from man-made devices such as powerstations.

Radiation is **ionizing**, this means it can damage your DNA and in large doses can cause cancer. It can also be used to kill cancerous cells.

Professionals working with radioactive sources protect themselves using lead glass.

Contamination is when the source is inside you