Radioactivity

- Most unstable atoms have different numbers of protons and neutrons.

- Radioactive atoms emit ionising radiation from the nucleus. Atoms decay at random times. An atom that absorbs ionising radiation may change into an ion.

- Three types of ionising radiation include:

α radiation - alpha particles consist of two neutrons and two protons - which can be thought of as a nucleus of Helium!

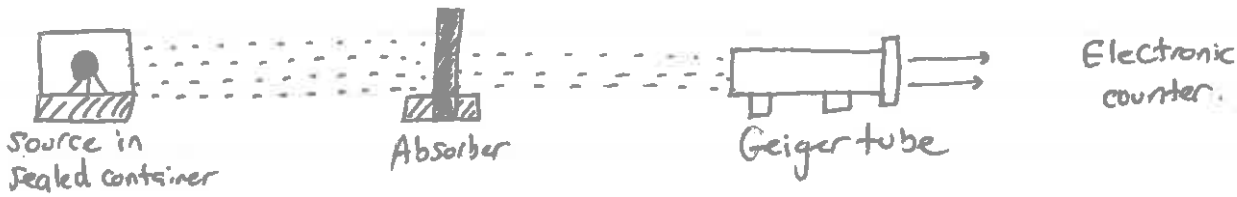
β radiation - beta particles are the electrons emitted when neutrons change to protons. They are very fast moving.

γ radiation - gamma radiation is a high energy electromagnetic wave.

Radioactive radiation is dangerous because it contains so much energy that it can ionise the atoms in living cells. (ionise means to knock of electrons!). This damage can cause them to die in large numbers and potentially cause cancer. Each of the radiations have different penetrating powers.

Measuring Penetrating power of α, β and γ

- To do this we would use a Geiger counter set up below:



Method:

Step ① - measure background radiation with Geiger counter (measure count rate).

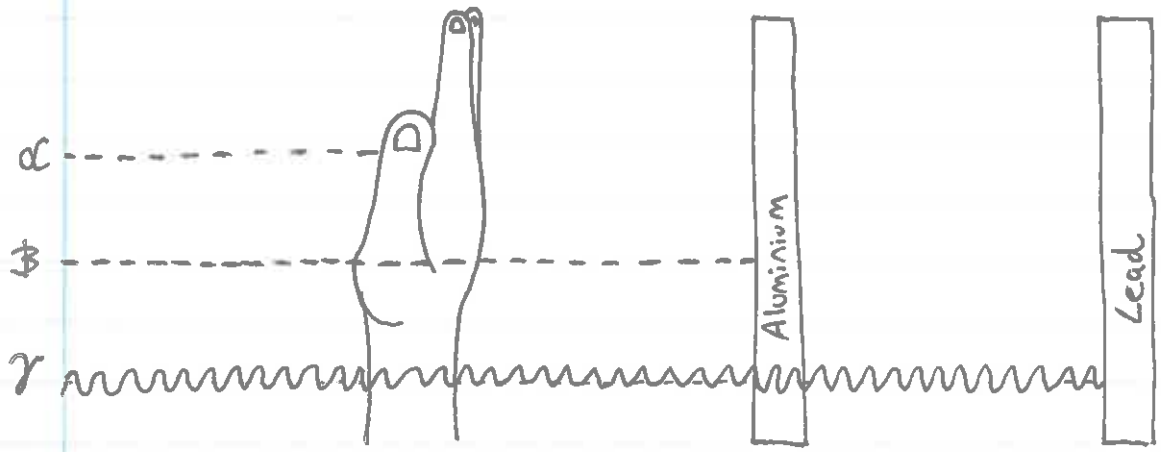
Step ② - Measure count rate with source in place, subtracting the background count rate.

Step ③ Place absorber material between sample and tube and remeasure count rate.

Step ④ keep adding more and more material until source count rate is zero.

Step ⑤ we could also test range in air by moving the tube away from source and noting distance and count rate.

Penetrating Power of Ionising Radiation



α particles are blocked by the skin, though they can cause burns.
β particles can pass through the body but are stopped by thin sheets of metal
γ radiation can pass through both and it takes very thick layers of lead to shield against them.

Ionising Ability of α, β and γ

α radiation is the most ionising. If inside the body it can cause huge amounts of damage and in large enough quantities death. A fugitive Russian spy named Alexander Litvinenko was killed by polonium-210 poisoning which was an α emitter.

β radiation is moderately ionising and still very dangerous.

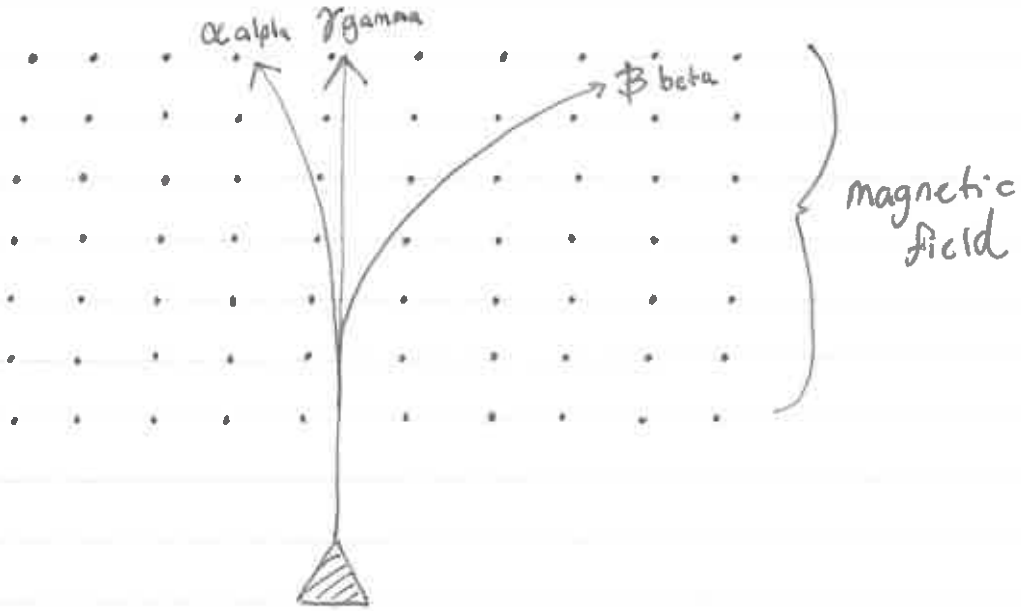
γ radiation is the least ionising and are the least dangerous to life.

- Both α and β radiation can be deflected by a magnetic field. β radiation is a fast moving electron and therefore has a very low mass and a negative charge, it is easily deflected.

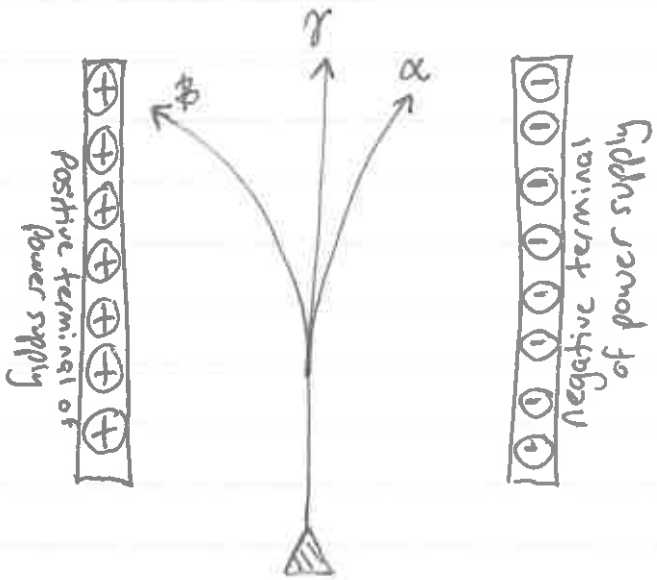
• α radiation has a much greater mass than β, and has a 2+ charge. This would be deflected in the opposite direction to β radiation.

• γ radiation is NOT deflected by a magnetic field as it is uncharged.

Radiation in a magnetic field



Radiation in an electric field.



• Deflection is the same in an electric field.