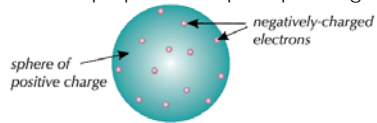


Physics Crib Sheet: Topic 4

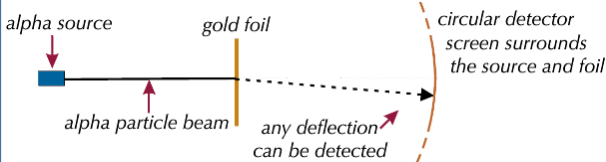
History of the atom

Democritus thought all matter was made of identical lumps
Dalton thought matter was made of "atoms" which couldn't be broken up

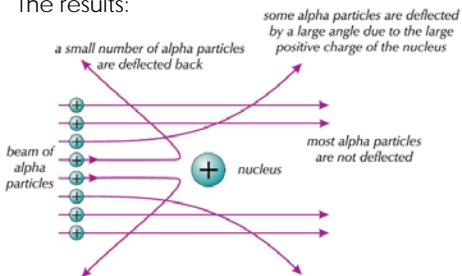
Thomson discovered electrons that could be removed from atoms and proposed the plum pudding model



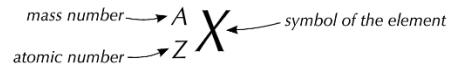
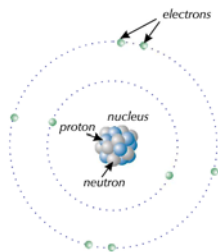
The alpha particle scattering experiment (1909 Rutherford)



The results:



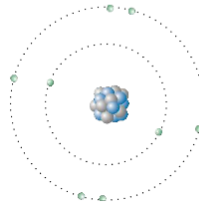
This evidence and further experimentation led to the current nuclear model



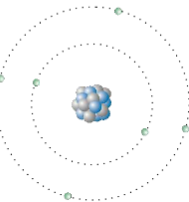
particle	mass	charge
proton	1	+1
neutron	1	0
electron	$\frac{1}{2000}$	-1

Ions – these can be formed through *ionisation* (when an atom loses or gains electrons to become charged)

an oxygen atom with 8 protons, 8 neutrons and 8 electrons

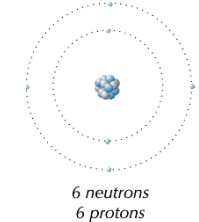


an oxygen ion with 8 protons, 8 neutrons and 6 electrons

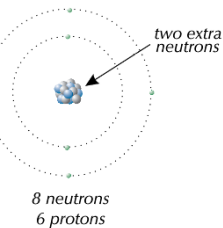


Isotopes – different forms of the same atom which have the same number of protons & electrons but different number of neutrons (same atomic number & charge, different mass number)

carbon-12, ^{12}C



carbon-14, ^{14}C

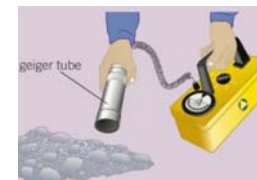


Radioactive decay

Unstable isotopes randomly decay into other elements and give out radiation to try to become more stable. Ionising radiation is emitted which causes ionisation

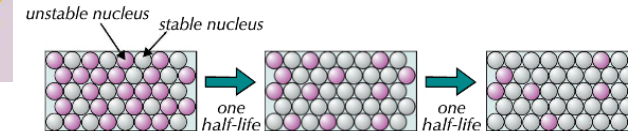
Type of radiation	What is it made of?	Charge	Penetrating ability	Ionising ability
Alpha	2 neutrons & 2 protons	+1	Low	Strong
Beta	Fast moving electron	-1	Moderate	Moderate
Gamma	Short wavelength EM wave	None	High	weak

Radiation can be measured with a Geiger-Muller tube and counter



Half life (measured in becquerels)

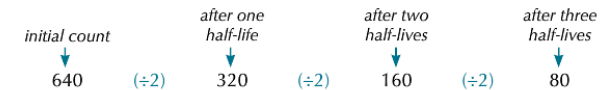
The time it takes for the number of nuclei of a radioactive isotope in a sample to halve



Calculating half life. Example:

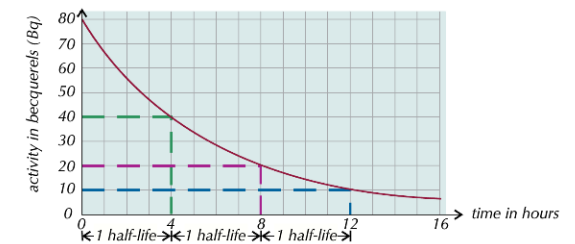
The activity of a radioisotope is 640 cpm (counts per minute).
Two hours later it has fallen to 80 cpm.
Find the half-life of the sample.

You must go through it in short simple steps like this:



It takes three half-lives for the activity to fall from 640 to 80. Hence two hours represents three half-lives, so the half-life is $120 \text{ mins} \div 3 = 40 \text{ minutes}$.

Calculating from a graph:



Objects near a radioactive source irradiated by it (exposed to radiation)
Contamination – when radioactive atoms get onto or into a material.
Safety precautions – store in lead-lined boxes, use gloves and tongs, wear protective suits

Most dangerous:
Outside the body – beta and gamma
Inside the body – alpha

