

## Unit 2 - Radioactivity

Who devised the experiment that changed the way we thought of the atom in 1911?	Ernest Rutherford
Who carried out the experiment that changed the way we thought of the atom in 1911?	Geiger and Marsden - two research students working for Rutherford.
What was the outcome of the Rutherford (Geiger and Marsden) scattering experiment?	A change in the scientific thinking of what the atom's structure is like.
What was the target in the Rutherford (Geiger and Marsden) experiment?	Very thin gold foil (so it was only a couple of atoms thick).
What was fired at the gold foil in the Rutherford (Geiger and Marsden) experiment?	Alpha particles
Why was the gold foil fired at in a vacuum in the Rutherford (Geiger and Marsden) experiment?	Air would have absorbed the alpha particles before they reached the gold foil
How was the path of the alpha particles detected in the Rutherford and Marsden experiment?	When the alpha particles hit a zinc sulphide screen a flash of light was seen.
What was the model of the atom that preceded the nuclear model?	The 'plum pudding' model of the atom.
What were the findings of the Rutherford Geiger and Marsden) experiment?	Most of the alpha particles went straight through the gold foil or were deflected a tiny bit (as expected) but about 1 in 8000 were backscattered - deflected by more than 90 degrees
What was concluded from the Rutherford and (Geiger and Marsden) experiment?	That the atom had a dense, small, positively charged nucleus orbited by electrons so it is neutral overall and most of the atom is empty space
What was the 'plum pudding' model like?	A sphere of positive charge with negative charges embedded in it - like currants in a Christmas plum pudding.
What is the nuclear model of the atom like?	A tiny, dense, positive nucleus with negative electrons orbiting it (like the planets orbiting the Sun)
What is the mass of a proton (in atomic mass units)?	1u
What is the mass of a neutron (in atomic mass units)?	1u
What is the mass of an electron (in atomic mass units)?	Negligible to that of the proton or neutron - 0.00055u - NEVER say it is zero!
What is the charge of a proton? (in relative atomic charge units NOT coulombs)	+1 (no unit is necessary here)
What is the charge of a neutron? (in relative atomic charge units NOT coulombs)	zero
What is the charge of an electron? (in relative atomic charge units NOT coulombs)	-1 (no unit is necessary here)
What is the charge on an atom if the number of electrons is equal to the number of protons in the nucleus?	The atom has no net electrical charge.
What is an atom called that loses or gains electrons?	An ion.
What is significant about the number of protons in the nucleus?	All atoms of a particular element have the same number of protons.
What is an isotope?	Atoms of the same element (therefore having the same number of protons as each other) which have different numbers of neutrons are called isotopes.
What is atomic number?	The total number of protons in an atom's nucleus is called its atomic number.

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What is the mass number?	The total number of protons and neutrons in an atom's nucleus is called its mass number.
What is an alpha particle?	Two protons and two neutrons (a helium nucleus) that comes out of a nucleus.
What is a beta particle?	A fast electron that comes out of the nucleus.
What is a gamma ray?	High energy electromagnetic radiation.
Does losing a gamma ray change the particles in the nucleus?	No, it is still the same nucleus - it is just at a lower energy level.
What happens when a nucleus loses an alpha particle?	The nucleus loses two protons (therefore becoming a nucleus of a different element) and two neutrons.
What happens when a nucleus loses a beta particle?	The nucleus loses a neutron and gains a proton (therefore becoming a nucleus of a different element). The neutron has emitted a beta particle (losing negative charge and becoming positive).
Where does artificial background radiation come from?	Nuclear weapons and testing and nuclear power plants - medical uses.
Where does natural background radiation come from?	Cosmic rays, natural radioactive isotopes in the rocks and atmosphere - from there in food etc too - mainly (50%) radon in the atmosphere.
What is nuclear fission?	The splitting of atomic nuclei (speak of the nucleus splitting not the atom!)
How many parts does the nucleus split into?	Two
What else is produced besides the two fission fragments?	Besides the two smaller nuclei 2 or 3 neutrons are also released.
What is nuclear fission used for?	It is used in nuclear reactors as a source of heat energy which can be transformed to electrical energy.
What is nuclear fusion?	It is the joining together of two small atomic nuclei into one big nucleus. (Talk of nuclei not atoms!).
What is nuclear fusion used for?	It is the process by which energy is released in stars. (We are trying to create fusion reactors but haven't done it yet).
Which two fissionable substances are in common use in nuclear reactors.	Uranium 235 or Plutonium 239.
What is induced fission?	When we start the fission process off (like induced births...)
What type of fission occurs with uranium 235 or plutonium 239?	Induced fission - the nucleus must first absorb a neutron to start the process off.
Why does a chain reaction occur?	The neutrons released may go on to cause another fission which in turn releases more neutrons that then cause more fissions and so on. This is called a chain reaction.
What is the process by which energy is released in stars?	Nuclear fusion.
Which process (fusion or fission) releases the most energy per kilogram?	Fusion
What slows neutrons down?	Graphite moderator (moderates the speed of neutrons so they are more likely to be absorbed by the uranium nucleus)
What absorbs neutrons?	Boron control rods
What is nuclear fuel?	Pellets of enriched uranium or plutonium are put into fuel rods.
Why is thick concrete shielding necessary around a nuclear reactor?	Radioactive isotopes give out alpha, beta and gamma rays - gamma rays are very penetrating so a thick dense barrier needs to be put around it.