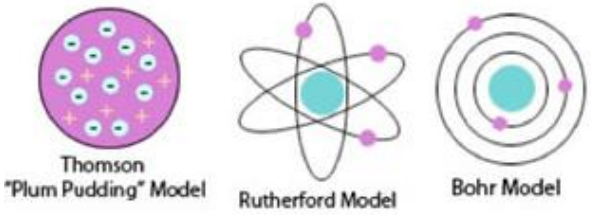
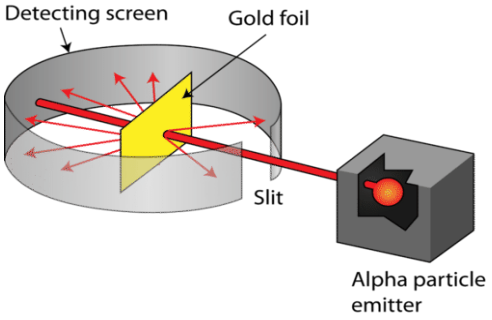
CP6 Radioactivity

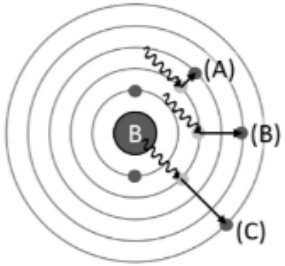


Subatomic particle	Location in atom	Relative charge	Relative mass
proton	nucleus	+1 (positive)	1
neutron	nucleus	0	1
electron	around nucleus	−1 (negative)	$\frac{1}{1835}$ (negligible)

1. Atomic Models

Atom	Smallest particle of an element.
Size of Atoms	2.5 x10^{-10} m in diameter
Element	Pure substance made of a single type of atom.
Plum-Pudding Model	Early idea of what atoms are like. Rutherford's experiment disproves this
Rutherford's Model	A positive **nucleus** with electrons going round it
Nucleus	The central part of an atom; very small and dense, positively charged. Made of protons and neutrons
Bohr's Model	Same as Rutherford's, but the electrons can only be in certain **orbits / shells**
Rutherford's experiment	Proves the existence of the nucleus





2. Inside Atoms

Subatomic Particle	Any particle smaller than atoms: protons, neutrons and electrons.
Nucleons	The particles in the nucleus: protons and neutrons.
Determining the Element	The number of protons determines which element an atom is.
Atomic Number	The number of protons in an atom.
Mass Number	The number of nucleons (protons and neutrons) in an atom.
Number of Neutrons	Mass number – atomic number
Isotopes	Versions of an element with the same number of protons, but different number of neutrons.
Naming Isotopes	Carbon-13, or ^{13}C, where 13 is the mass number

3. Electrons and Orbits

Orbits	Bohr's model of the atom has electrons in 'shells' or 'orbits', around the nucleus. The electrons can be 'excited' by gaining energy, or 'de-excited' when they lose it. Ionisation happens when the electron gains so much energy it leaves the atom.
Emission Spectrum	Pattern of bands of light at specific wavelengths caused by exciting a gaseous element with electricity.
Absorption Spectrum	Pattern of dark band in a 'rainbow' spectrum caused by a gas absorbing some of the light

4. Background Radiation

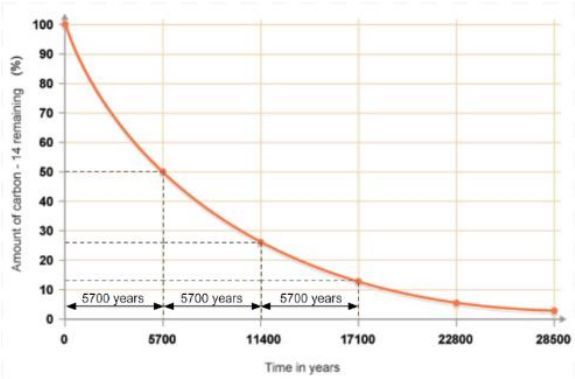
Background Radiation	Low levels of ionising radiation that we are constantly exposed to; mainly natural causes (food, rocks, gases) also artificial sources (nuclear industry, hospitals)
Radon Gas	a radioactive gas produced by some rocks in the ground
Geiger-Müller (GM) Tube	Used to measure radioactivity, produce a click each time radiation passes through it.
Count-rate	The number of times a GM tube detects radiation each second.
Corrected Count Rate	Measure the source, subtract the background radiation.
Dosimeter	A badge that changes colour in response to radiation exposure.
Dose	The amount of radiation received by a person.

5. Types of Radiation

Unstable Atom	An atom whose nucleus contains too much energy
Decay	When an unstable atom releases ionising radiation.
Alpha α or ^4_2He.	alpha particles are made of two protons and two neutrons
Beta-minus β^- or $^0_{-1}e$.	fast-moving **electrons**.
Beta-plus β^+ or ^0_1e.	**positrons**: particles with same mass as electrons but a positive charge.
Gamma γ.	Electromagnetic radiation. Extremely short wavelength.
Neutron	Fast-moving neutrons. Symbol: n.
Ionising Power	Alpha is most ionising, gamma least.
Penetrating Power	Gamma is most penetrating, alpha least

6. Half-Life

Half-life	The time for half of the undecayed atoms in a sample to decay.
Becquerel, Bq	The unit of radioactivity: 1 Bq = one decay per second.



7. Dangers of Radioactivity

Mutations	DNA damage caused by ionising radiation, can lead to cancer.
Minimising Radiation Risk	- Wear protective clothing - Handle with tongs - Limit time - Use protective shielding Wear dosimeter badges
Nuclear Power Risks	There is a small chance of accidents causing radioactive sources to escape
Irradiation	Exposure to radiation, stops when the source of radiation is removed.
Contamination	When radioactive particles are on or in the body.