

Radius of an atom
 $1 \times 10^{-10}\text{m}$

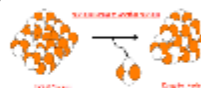


Electrons gained

Negative ion

Electrons lost

Positive ion



Atom	Same number of protons and electrons
Ion	Unequal number of electrons to protons
Mass number	Number of protons and neutrons
Atomic number	Number of protons

Particle	Charge	Size	Found
Neutron	None	1	In the nucleus
Proton	+	1	
Electron	-	Tiny	Orbits the nucleus

Isotope	${}^6_3\text{Li}$		${}^7_3\text{Li}$	
---------	-------------------	--	-------------------	--

Different forms of an element with the same number of protons but different number of neutrons

Discovery of the nucleus

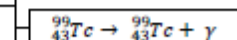
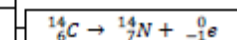
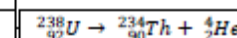
Democritus	Suggested idea of atoms as small spheres that cannot be cut.
J J Thomson (1897)	Discovered electrons— emitted from surface of hot metal. Showed electrons are negatively charged and that they are much less massive than atoms.
Thomson (1904)	Proposed 'plum pudding' model— atoms are a ball of positive charge with negative electrons embedded in it.
Geiger and Marsden (1909)	Directed beam of alpha particles (He^{2+}) at a thin sheet of gold foil. Found some travelled through, some were deflected, some bounced back.
Rutherford (1911)	Used above evidence to suggest alpha particles deflected due to electrostatic interaction between the very small charged nucleus, nucleus was massive. Proposed mass and positive charge contained in nucleus while electrons found outside the nucleus which cancel the positive charge exactly.
Bohr (1913)	Suggested modern model of atom — electrons in circular orbits around nucleus, electrons can change orbits by emitting or absorbing electromagnetic radiation. His research led to the idea of some particles within the nucleus having positive charge; these were named protons.
Chadwick (1932)	Discovered neutrons in nucleus — enabling other scientists to account for mass of atom.

Decay	Range in air	Ionising power	Penetration power
Alpha	Few cm	Very strong	Stopped by paper
Beta	Few m	Medium	Stopped by Aluminium
Gamma	Great distances	Weak	Stopped by thick lead



Radioactive decay	Unstable atoms randomly emit radiation to become stable
Detecting	Use Geiger Muller tube
Unit	Becquerel
Ionisation	All radiation ionises

Decay	Emitted from nucleus	Changes in mass number and atomic number	
Alpha (α)	Helium nuclei (${}^4_2\text{He}$)	-4	-2
Beta (β)	Electron (${}^0_{-1}\text{e}$)	0	+1
Gamma (γ)	Electromagnetic wave	0	0
Neutron	Neutron	-1	0



Atoms and Isotopes

Atoms and Nuclear Radiation

AQA
ATOMIC
STRUCTURE

PHYSICS ONLY: Hazards
and uses of Radioactive
emissions and of
background radiation