

* Radioactivity *

Q-1) Rutherford's model & α particle scattering.

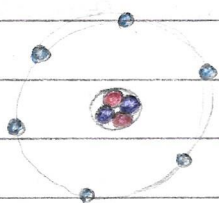
- * The α particle source was encased in metal with a small aperture, allowing a fine beam of α particles to emerge.
- * Air was pumped out to leave a vacuum; α particles are absorbed by a few cm of air.
- * Gold was chosen because it's malleable; can be made into thin sheets.
- * The α particles were detected when they hit a solid 'scintillating' material.

→ Most α particles passed straight through, without being affected.

↳ most of the nucleus is empty space.

→ some were backscattered

↳ most of the mass of the atom is concentrated in a tiny space.



Particle	mass	charge.
proton	1	+e
neutron	1	0
electron	0.0005	-e

Q-2) Calculating density of a proton.

?

$$\text{mass} = 1.67 \times 10^{-27} \text{ kg}$$

$$\text{radius} = 0.8 \times 10^{-15} \text{ m}$$

$$\begin{aligned} \text{volume} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3}\pi \times (0.8 \times 10^{-15})^3 \\ &= 2.14 \times 10^{-45} \text{ m}^3 \end{aligned}$$

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{7.8 \times 10^{17} \text{ kg m}^{-3}}{2.14 \times 10^{-45} \text{ m}^3}$$

Assumptions:

- ① the shape of the atom is spherical
- ② empty spaces are not considered

Q-3) What are isotopes?

> Isotopes are nuclei of the same element, having the same no. of protons, but different no. of neutrons.

* Isotopes have same chemical properties but different physical properties.

Q-4) Ionising radiation.

> Ionisation is the loss or gain of electrons.

What is conserved

- ① Nucleon no.
- ② Photon no.
- ③ mass energy

particle	mass	charge	speed	penetration
α	4	+2e	10^6 m/s	paper
β	$\frac{1}{1840}$	-e	10^8 m/s	thin aluminium
γ	0	0	$3 \times 10^8 \text{ m/s}$	thick lead

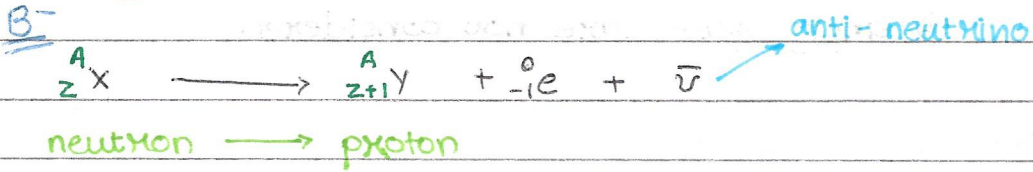
α particle has a higher mass & charge, & is slower than β \therefore is more likely to interact with any atom it passes & \therefore

is more likely to cause ionisation.

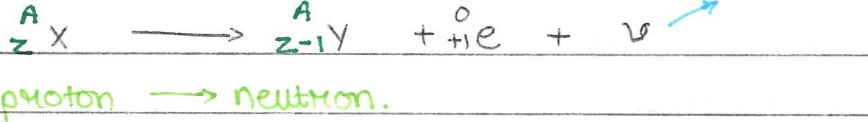
alpha decay



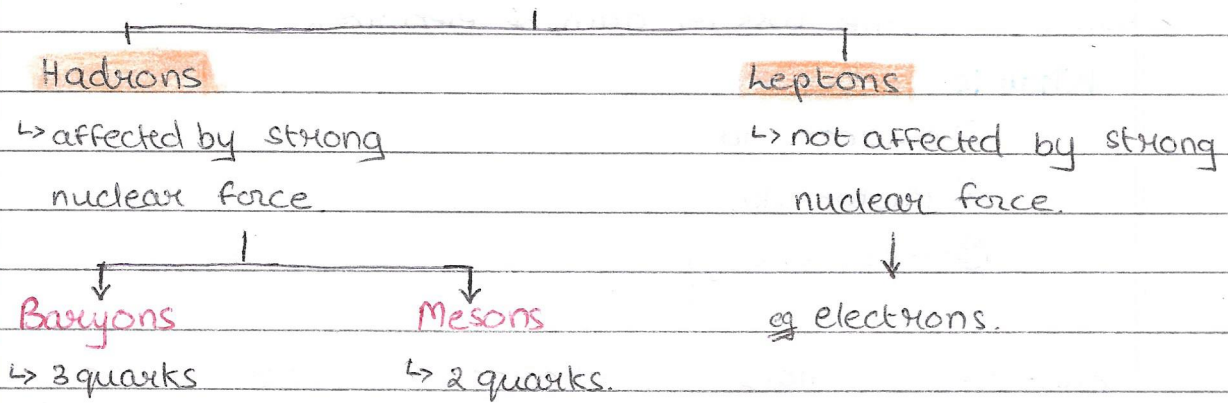
B⁻ decay



B⁺ decay



Q-5) Family of sub-atomic particles.



eg protons (uud)
neutrons (udd)

* 1 eV = 1.6×10^{-19} J
* 1 MeV = 1.6×10^{-13} J