* Radioactivity *

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

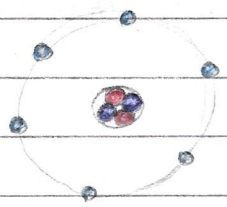
* The α particle source was encased in metal with a small aperture, allowing a fine beam of α particles to emerge.
* Air was pumped out to leave a vacuum; α particles are absorbed by a few cm of air.
* Gold was chosen because it's malleable; can be made into thin sheets.
* The α particles were detected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

>

mass = 1.67×10^{-27} kg

radius = 0.8×10^{-15} m

volume = $4/3\pi r^3$

$= 4/3\pi \times (0.8 \times 10^{-15})^3$

$= 2.14 \times 10^{-45}\ m^3$

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

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	$1/1840$	$-e$	10^8 m/s	thin aluminium
γ	0	0	3×10^8 m/s	thick lead

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

is more likely to cause ionisation.

a decay

$$^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{2}He$$

B decay

B^-

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + \bar{\nu}$$

($\bar{\nu}$: anti-neutrino)

neutron ⟶ proton

B^+

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z-1}Y + {}^{0}_{+1}e + \nu$$

(ν: neutrino)

proton ⟶ neutron.

Q-5) Family of sub-atomic particles.

- **Hadrons**
  - ↳ affected by strong nuclear force.
    - **Baryons**
      - ↳ 3 quarks
    - **Mesons**
      - ↳ 2 quarks.
- **Leptons**
  - ↳ not affected by strong nuclear force.
  - eg electrons.

eg protons (uud)
neutrons (udd)

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