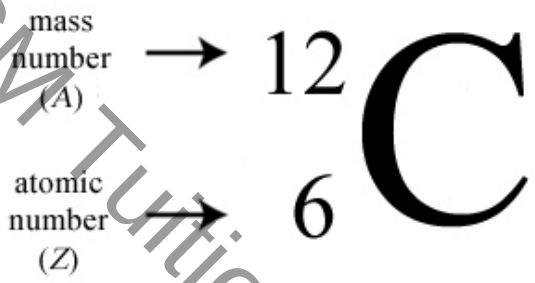
Isotopes

1- Definition:

- **Isotopes** are atoms of the same chemical element, with the **same number of protons**, same number of electrons but **differ only in the number of neutrons** they contain.

- **Isotopes are different to atoms.** The isotope of an element will have a different mass number to an atom of an element. This means that an isotope affects various physical properties of the element, but not the chemical properties.
- **Mass number of an atom = number of proton + number or neutrons**



- Atomic number means number of proton in an atom , so in carbon atomic number = 6= no of protons.
- We can find out the number of neutrons by

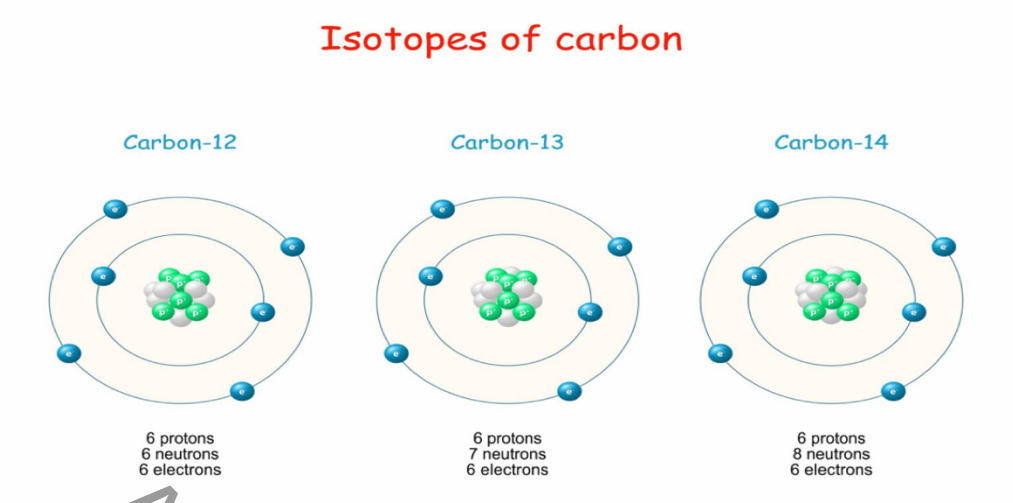
Mass number of an atom = number of proton + number or neutrons

12 = 6 + no of neutrons

No of neutrons = 12- 6 = 6

2- Properties of Isotopes

- **The physical properties of isotopes can vary.** Several physical properties are determined by the **mass** of the atom. Such as, **density**, **boiling point** and the **melting point**.
- **The chemical properties of isotopes are similar.** They are determined by the number and arrangement of **electrons** which do not change.

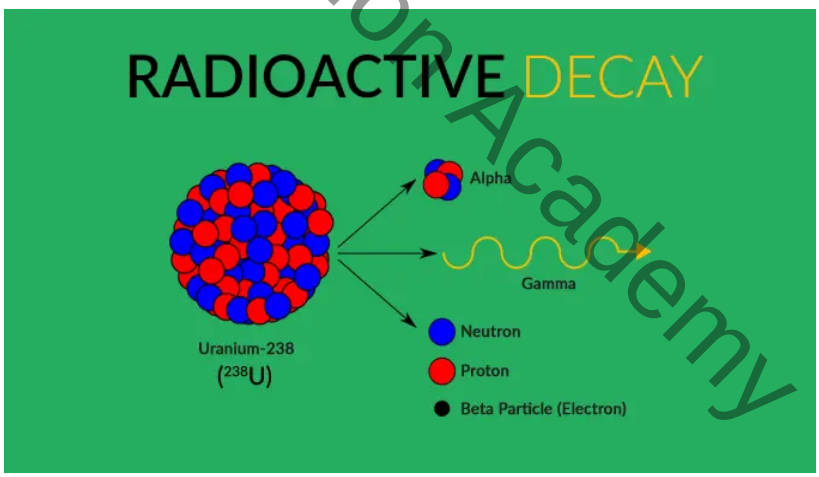


3- Radioactive decay:

a) All Element has different isotopes but only one or two are stable one.

b) Unstable isotopes tend to decay into other element and produce radiation to become stable This process is known as Radioactive decay.

c) They can also release neutron when they decay.



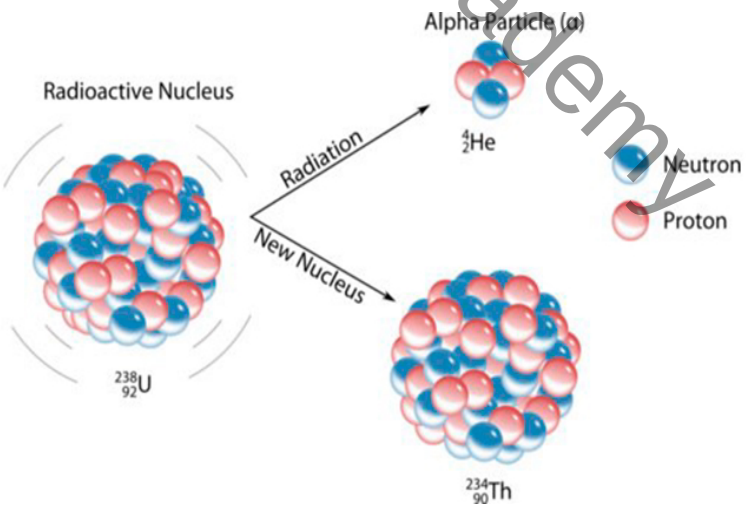
Ionising radiation

- Ionizing radiation is radiation with enough energy that to remove tightly bound electrons from the orbit of an atom, causing that atom to become +ve charged ion.
- Radioactive substance produces more types of radiation

1. alpha radiatioN
2. beta radiation
3. gamma radiation

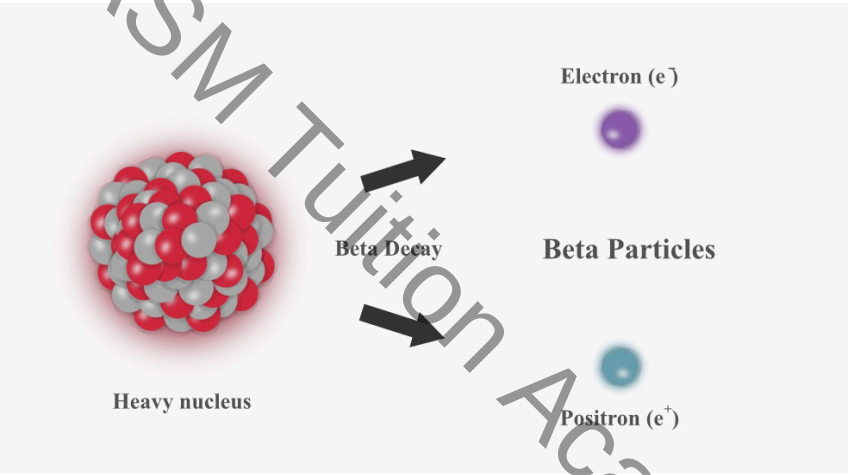
1- Alpha radiation

- It is a flow of **He nuclei** which results from **alpha decay** of the elements nuclei.
- Alpha radiation has high ionizing but **low penetrating power.**
- Human body can be protected from external alpha-particles flow by outerwear, rubber gloves, flu mask, even paper sheet.
- However, if alpha-particles sources penetrate a human body with air, water or food, it is very dangerous.
- **Use as smoke detector:** if there is smoke in the air, it binds to the ions causing current stop and alarm sounds.



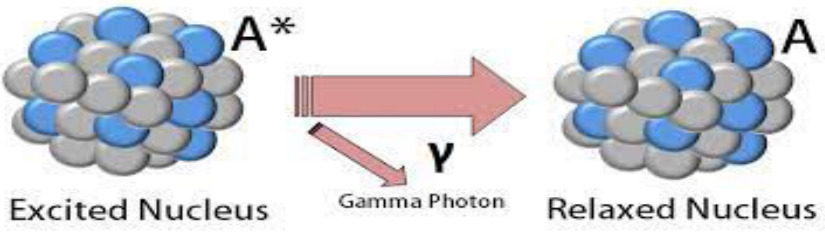
2- Beta radiation

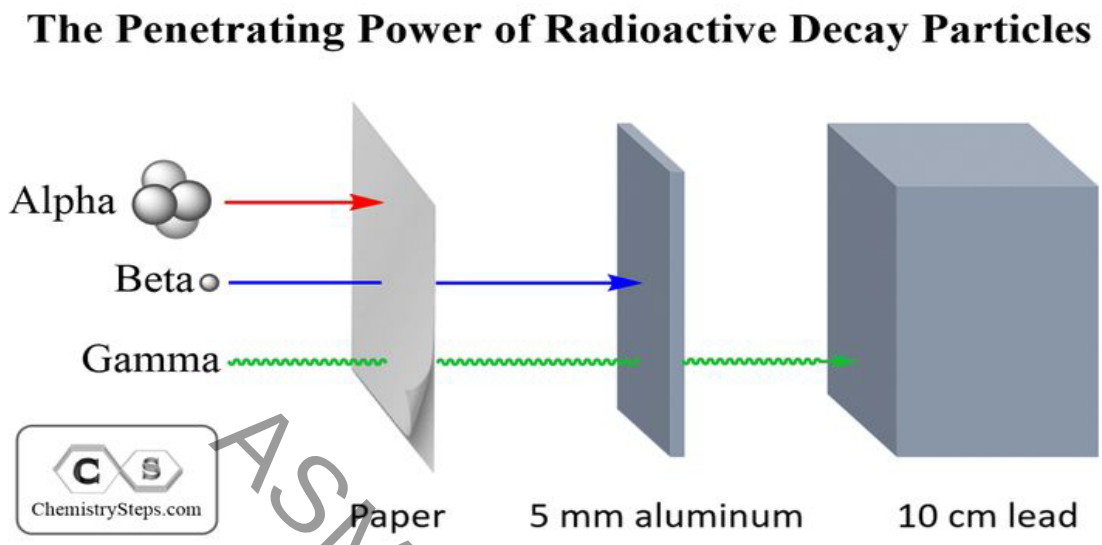
- It is a flow of electrons or **positrons**, which results from **beta** nuclei decay.
- Beta radiation has lower ionizing but **higher penetrating power** than that of alpha. Any shelter may serve a protection here.
- Beta particles can easily penetrate human skin and cause tissue damage and burns.
- Beta particle are absorbed by sheet of aluminium (around 5mm thick)
- **Used to test the thickness** of sheet of metal, as beta particle penetrate moderately



3- X-rays and Gamma radiation

- **It is** electromagnetic radiation, which comes together with nuclear transformations.
- Gamma rays are photons that come from the nucleus of the atom. Both types of ionizing radiation can pass through the human body if they have enough energy.
- It appears extremely difficult to protect oneself from both X-rays and gamma-rays.
- Gamma rays can be absorbed by thick sheets of lead or metered of concrete





Over view of 3 types of radiation

The three types of radiation

Use this table to find information about and to compare α, β and γ radiation

	Alpha (α)	Beta (β)	Gamma (γ)
Nature	It's a nucleus of helium ^4_2He. Two protons and two neutrons	It's an electron e^-	It's an electromagnetic wave
Charge	+2	-1	0
Mass	Relatively large	Very small	No mass
Speed	Slow	Fast	Speed of light
Ionizing effect	Strong	Weak	Very weak
Most dangerous	When source is inside the body	When source is outside the body	When source is outside the body