

RADIOACTIVITY

ATOMS - Smallest part of any substance which consists of a centralised dense part called nucleus.

ATOMIC NUMBER - (Z) - Number of proton present in nucleus of an atom.

MASS NUMBER (A) - Total number of proton and neutron present in nucleus.

ISOTOPES - Atoms belonging to the same element having same atomic number (Z) but different mass number.

Eg - Protium (${}^1_1\text{H}$) and deuterium (${}^2_1\text{H}$)

ISOTONES - Atoms with same neutrons (N) but different atomic number (Z).

Eg $\Rightarrow {}^{23}_{11}\text{Na}$ and ${}^{24}_{12}\text{Mg}$

ISOBARS - Atoms with same mass number (A) but different atomic number.

Eg $\Rightarrow {}^{23}_{11}\text{Na}$ and ${}^{23}_{12}\text{Mg}$

RADIOACTIVITY -

Spontaneous process by which a nucleus of an unstable atom decay by emitting radiations such as α , β and γ .

Substances which disintegrate by spontaneous emission of radiations are radioactive substances.

E.g. uranium, radium, polonium, thorium, actinium etc.

— Radioactivity is a nuclear phenomenon.

Properties of α (alpha) particles -

- Consists of Helium nuclei, ${}^4_2\text{He}$
- It is positively charged particle
- Least penetration power
- Highest ionisation power.
- Can't penetrate skin but harmful for humans
- effects a photographic plate
- Causes fluorescence on striking a fluorescent material.
- Affected by electric and magnetic fields.

Properties of β (Beta) particles -

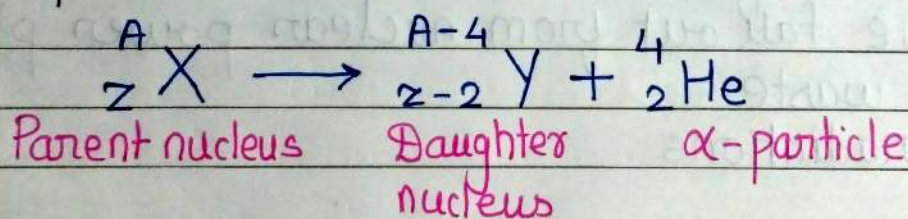
- Highly energetic electrons, which release from inside of a nucleus.
- Denoted by $-1\beta^0$ and $+1\beta^0$
- They are negatively and positively charged
- They have negligible mass.
- For emission of negative β particle, a neutron divides into proton and an electron and for $+\beta$ protons converts into neutron
- Greater penetration power compared to α particle
- Less ionisation power, still harmful.
- effects photographic plate
- Causes fluorescence on striking fluorescent material
- Affected by electric & magnetic field.

Properties of γ particles (Gamma) —

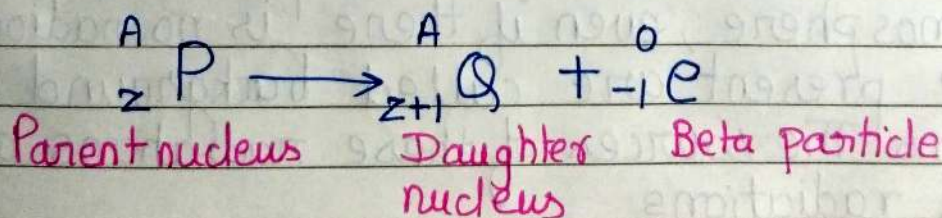
- Waves from high frequency end of electromagnetic spectrum which do not have mass.
- Neutral in nature
- Denoted by γ^0
- High penetrating power compared by α and β particle.
- Very harmful for living cell & causes mutation.
- effect photographic plate.
- Cause fluorescence when they strike a fluorescent material.
- Not affected by electric and magnetic fields.

CHANGES WITHIN THE NUCLEUS IN ALPHA, BETA AND GAMMA EMISSION —

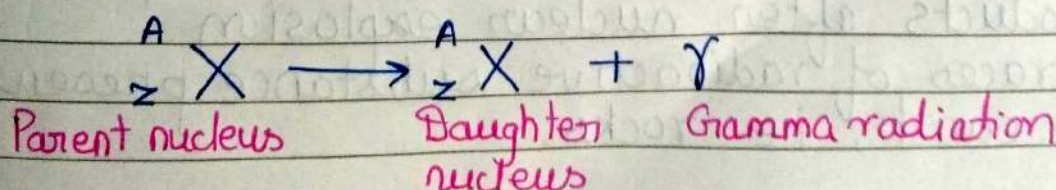
1) Alpha emission —



2) Beta emission —



3) Gamma emission —



USES OF RADIOACTIVITY -

- 1) Medical use
- 2) Industrial use
- 3) Scientific use

X-RAYS -

- These are electromagnetic waves.
- frequency ranges from 10^{16} to 3×10^{20} Hz

Uses -

- i) Surgery to detect fracture, stones in body
- ii) To detect fault, crack on bridges
- iii) For security purpose to detect metal or explosive material.
- iv) Used in scientific research.

Sources of harmful radiation -

- 1) Radioactive fall out from nuclear power plants
- 2) Nuclear waste
- 3) Cosmic radiations

BACKGROUND RADIATIONS -

All the radiations which are present in the atmosphere, even if there is no radioactive source present are called background radiations. The sources of these radiations are -

- i) cosmic radiations
- ii) natural and artificial radioactive isotopes.
- iii) products after nuclear explosion
- iv) traces of radioactive substance present in earth, i.e. rocks.

SAFETY MEASURES FOR HANDLING RADIOACTIVE MATERIALS -

- Know radiation safety limits to prevent excessive exposure.
- Wear lead lined apron and gloves for protection.
- Store radioactive substances in thick lead containers with narrow opening to prevent radiation spread.

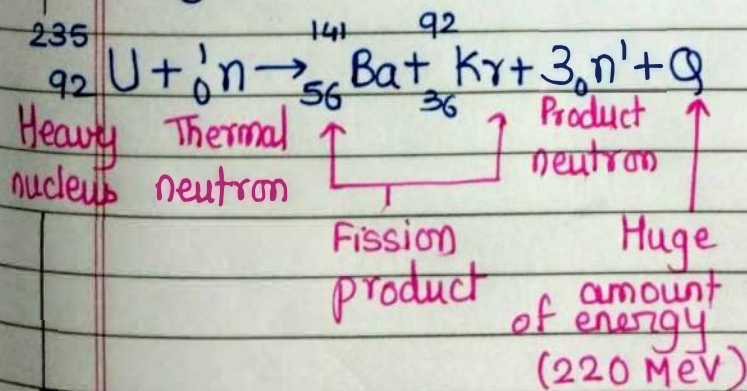
NUCLEAR ENERGY -

Energy released during the transformation of nuclei to another nuclei.

Two distinct ways of obtaining nuclear energy

NUCLEAR FISSION

- 1) Breaking of heavy nucleus into lighted nucleus.
- 2) It is a chain reaction.
- 3) It is a controlled process.
- 4) Produces enormous energy.
- 5) Fission products are hazardous.



NUCLEAR FUSION

- 1) Involves binding of two nucleus.
- 2) It is not a chain reaction.
- 3) It is uncontrolled process
- 4) More energy than fission
- 5) It does not cause pollution

