2. β -particles: The fast-moving stream of electrons that are produced during the conversion of a neutron into a proton is called β rays.

The β -particle is not present initially in the nucleus but it is produced due to the conversion of a neutron into a proton.

- The charge and mass of a **beta particle** is same as that of an **electron**.

A beta particle is an electron of nuclear origin.

a. **Negative β -particle:** A fast moving electron emitted from the nucleus during radioactivity.

The $Negative\ \beta$ -particle is not present initially in the nucleus but it is produced due to the conversion of a neutron into a proton.

$$_0n^1 \longrightarrow {}_1p^1 + {}_{-1}e^0 + \bar{\nu} \qquad [\ \bar{\nu} = anti\ neutrino\ ]$$

$$_6C^{14} \longrightarrow {}_7N^{14} + \beta^- + \bar{\nu} \qquad [Negative\ Beta\ decay]$$

b. **Positive β -particle:** A fast moving positron (antiparticle of electron) emitted from the nucleus during radioactivity**.**

The $Positive\ \beta$ -particle is not present initially in the nucleus but it is produced due to the conversion of a proton into a neutron.

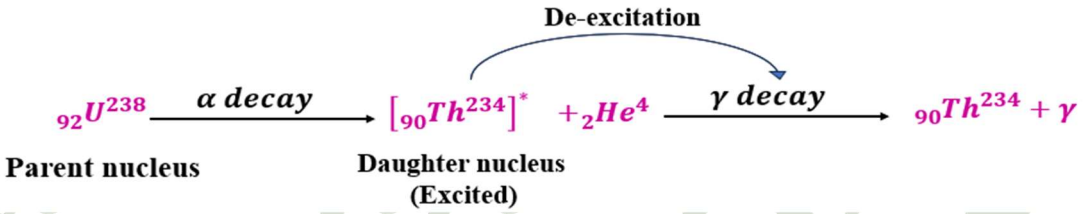
$$_1p^1 \longrightarrow {}_0n^1 + {}_{+1}e^0 + \nu \qquad [\ \nu = neutrino\ ]$$

$$_{29}Cu^{64} \longrightarrow {}_{28}Ni^{64} + \beta^+ + \nu \qquad [Positive\ Beta\ decay]$$

3. γ-rays: The electromagnetic waves having very short wavelength of the order of $0.005A^o$ to $0.5A^o$ are called γ - rays**.**

After α or β decay, a new nucleus is formed (called as daughter nucleus). This daughter nucleus usually remains in excited state. During the de-excitation of the nucleus, it loses energy in the form of **γ radiation.**

Hence, gamma decay always occurs after alpha or beta decay.



- Alpha and beta decays of a radioactive nucleus usually leave the daughter nucleus in an excited state.
- If the excitation energy available with the daughter nucleus is not sufficient for further particle emission, it loses its energy by emitting electromagnetic radiations, also known as **γ-rays**.
- Atomic mass and charge of the daughter nucleus remains the same before and after the emission of **γ** -rays. Thus **γ** -rays are electromagnetic waves having no mass and no charge.

Electron capture:

Here the parent nucleus captures one of the orbital electrons with the emission of a neutrino (ν). Mass number of the daughter nucleus remains the same and atomic number decreases by one unit. For example,

$$_{29}Cu^{64} + {}_{-1}e^0 \longrightarrow {}_{28}Ni^{64} + \nu$$

- Write the properties of alpha, beta and gamma particles.
- Alpha particles have the maximum ionizing power but minimum penetrating power. Explain.