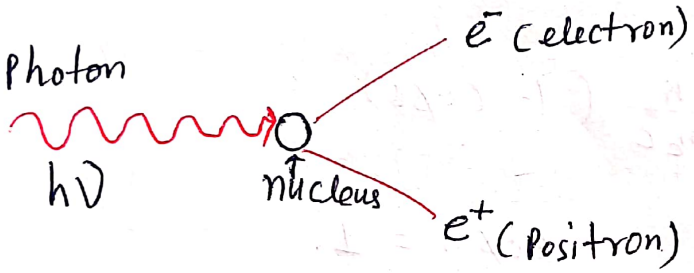
Pair Production => Pair production is the process in which the photons fall on a nucleus and there is the formation of electron and positron pair.

Positron is the antiparticle of electron and having equal mass of an electron but of opposite charge.



$$\gamma \Rightarrow e^- + e^+$$ Pair production

when a gamma-ray of threshold frequency falls on the nucleus the formation of electron and positron takes place, the gamma rays should be of at least has energy equivalent to the mass of two electron as calculated by the energy equation $E = mc^2$, her the energy of the photon should be at least 1.02 Mev.

In Pair production charge, momentum and energy are conserved.

$$h\nu = E_- + E_+$$

$$h\nu = (m_0c^2 + K.E_-) + (m_0c^2 + K.E_+)$$

where m_0c^2 → rest mass energy of the electron

$$h\nu = 2m_0c^2 + K.E_- + K.E_+$$

but $m_0c^2 = 0.511$ MeV

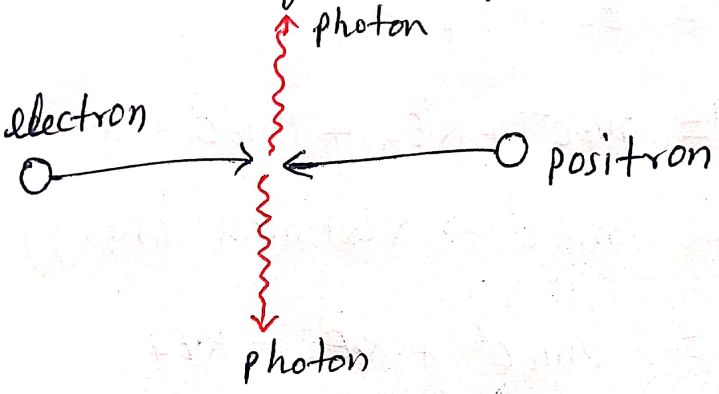
$$2m_0c^2 = 1.022 \text{ MeV}.$$

Therefore, for Pair production the energy of the photon $h\nu$ is greater than 1.022 MeV.

Pair Annihilation ⇒ Annihilation is a process in which the electron and positron combine to form a photon. It can also be called as the reverse process of Pair production.

$$e^- + e^+ \longrightarrow \gamma + \gamma$$

A low energy electron combines with a low energy Positron and forms photon, In this process, there is also the liberation of energy.



The total mass energy before is equal to the total mass energy after.

The energy carried by a photon is given as

$$E = h\nu$$

$$\nu = \frac{c}{\lambda}$$

$$\boxed{E = \frac{hc}{\lambda}}$$ energy of the photon.