$$\boxed{P.E = -2 K.E}$$

$$P.E = \cancel{-2} \times \frac{1}{\cancel{8}\pi\varepsilon_0} \frac{e^2}{r}$$

$$= -\frac{e^2}{4\pi\varepsilon_0 r}$$

$$\text{Total Energy} = P.E + K.E$$

$$= -\frac{1}{4\pi\varepsilon_0}\frac{e^2}{r} + \frac{1}{8\pi\varepsilon_0}\frac{e^2}{r}$$

$$= \frac{-e^2}{8\pi\varepsilon_0 r}$$

$$\boxed{T.E = -K.E}$$

Negative symbol shows that electron is bound to nucleus in the orbit around it.

If T.E were positive, It electron would not be in orbit

Atomic Spectra of Hydrogen

Take a atomic gas or vapour, excite it to low pressure by passing electric current.

It emits radiation, which look is the form bright ~~light~~ lines on dark background.

Such a spectrum is called absorbtion spectrum.

E_{bn} is constant (nearly)

$30 < A < 170$

For $A = 56$ E_{bn} is maximum

<u>Conclusion</u>

* Force between the nucleon is attractive to produce a binding energy and keep nucleon stuck to each other

* E_{bn} in the range $30 < A < 170$ is nearly constant shows that nuclear force is short ranged.

For higher atomic mass there are more number of orbit. The distance between the nucleus and electron become larger so the nuclear force becomes lesser and the binding energy reduced.

Consider a nucleus $A = 240$ now break it into two nuclei of $A = 120$ in this process ~~As~~ energy is released. This process is called as nuclear fission.

Consider two light nuclei $A \leq 10$. Now join them to form a heavier nuclei. The E_{bn} is more than E_{bn} of lighter nuclei. In this process energy is released.

This process is called nuclear fussion

β^- decay

$$^{32}_{15}P \rightarrow {}^{32}_{16}S + e^- + \bar{\nu}$$

β^+ decay

$$^{22}_{11}Na \rightarrow {}^{22}_{10}Ne + e^+ + \nu$$

where $\bar{\nu}$ is the antineutrino and ν is the neutrino.

~~Neutron~~ Neutrino are very small particle with mass ~~less~~ less than electron but does not have charge.

They interact weakly with other ~~for~~ particle so they are difficult to be dected.

They can penetrate through large quantity of matter without any interaction (earth)

In β^- Neutron is converted into proton i e

$$n \rightarrow p + e^- + \bar{\nu}$$

for β^+ Proton is converted into neutron

$$p \rightarrow n + e^+ + \nu$$

Gamma Decay

When a nucleus ~~is~~ in excited state is spontaneous-ly decayed to its ground state a photon is emitted whose energy is equal to the difference in two

$$\boxed{\tau = \frac{1}{\lambda}}$$

$$T_{1/2} = \frac{\ln 2}{\lambda} = \tau \ln 2$$

$$\boxed{T_{1/2} = \tau \ln 2}$$

Q.1 The sequence of stepwise decay of radioactive nuclei is

$$D \xrightarrow{\alpha} D_1 \xrightarrow{\beta^-} D_2$$

atomic number of D_2 – 71 $A \to D_2$ [illegible]

Find the A & Z of D

$_{71}D$ [illegible] ${}^{176}_{70}D_1$

${}^{180}_{72}D$

$${}^{176}_{70}D_1 \xrightarrow{\beta^-} {}^{176}_{71}D_1$$

$${}^{180}_{72}D \xrightarrow{\alpha} {}^{176}_{70}D_1$$

(2) $D \xrightarrow{\beta^-} D_1 \xrightarrow{\alpha} D_2$

${}^{176}_{71}D_2$

$${}^{180}_{73}D_1 \xrightarrow{\alpha} {}^{176}_{71}D_2$$

$${}^{180}_{74}D \to {}^{180}_{73}D_1$$