

$$P.E = -2k.E$$

$$P.E = -2 \times \frac{1}{4\pi\epsilon_0} \frac{e^2}{r}$$

$$= -\frac{e^2}{4\pi\epsilon_0 r}$$

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

$$= -\frac{1}{4\pi\epsilon_0} \frac{e^2}{r} + \frac{1}{8\pi\epsilon_0} \frac{e^2}{r}$$

$$= -\frac{e^2}{8\pi\epsilon_0 r}$$

$$T.E = -k.E$$

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

If it were positive, the electron would not be in orbit.

Atomic Spectra of Hydrogen

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

It emits radiation, which looks like the form ~~bright~~ lines on dark background.

Such a spectrum is called absorption spectrum.

E_{bn} is constant (nearly)

$$30 < A < 170$$

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

Conclusion

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.

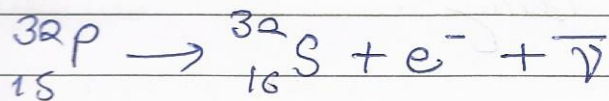
For higher atomic mass there are more numbers of orbit. The distance between the nucleus and electrons become larger so the nuclear force becomes lesser and the binding energy reduced.

Consider a nucleus $A=240$ now break it into two nuclei of $A=120$ in this process no energy is released. This process is called as nuclear fission.

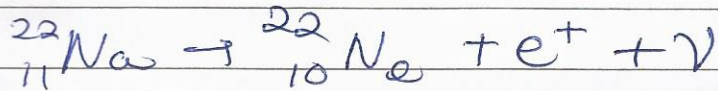
Consider two light nuclei $A \leq 10$. Now join them to form a heavier nuclei. The E_{bn} is more than E_{bn} of lighter nuclei. In this process energy is released.

This process is called nuclear fusion

β^- decay



β^+ decay



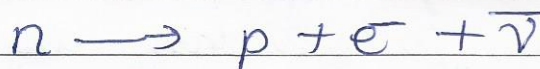
where $\bar{\nu}$ is the antineutrino and ν is the neutrino.

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

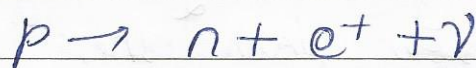
They interact weakly with other particles so they are difficult to be detected.

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

In β^- Neutron is converted into proton
ie



for β^+ Proton is converted into neutron



Gamma Decay

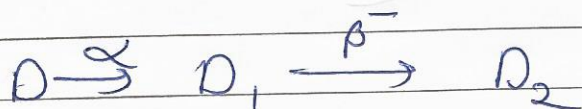
When a nucleus is in excited state is spontaneously decayed to its ground state a photon is emitted whose energy is equal to the difference in two

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

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

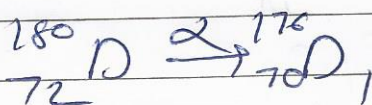
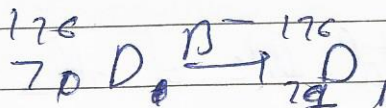
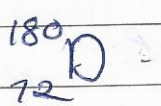
$$T_{1/2} = \tau \ln 2$$

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



atomic number of $D_2 = 71$ $A \rightarrow D$

Find the A & Z of D



(2)

