Balika Vidyapith, Lakhisarai
Class 12Sc Sub Physics Date 04 01 21
Modern Physics (Unit 08)

Half – Life Period:

Half life period is the time required for the disintegration of half of the amount of the radioactive substance originally present.

If T is the half – life period, then

$$\frac{N}{N_0} = \frac{1}{2} = e^{-\lambda T} \qquad \text{(since } N = N_0 / 2\text{)}$$

$$e^{\lambda T} = 2$$

$$\lambda T = \log_e 2 = 0.6931$$

$$T = \frac{0.6931}{\lambda} \quad \text{or} \quad \lambda = \frac{0.6931}{T}$$

Time t in which material changes from N_0 to N:

$$t = 3.323\ T \log_{10} (N_0 / N)$$

Number of Atoms left behind after n Half – Lives:

$$N = N_0 (1/2)^n \quad \text{or} \quad N = N_0 (1/2)^{t/T}$$

Units of Radioactivity:

1. **The curie (Ci): The activity of a radioactive substance is said to be one curie if it undergoes 3.7×10^{10} disintegrations per second.**

   1 curie = 3.7×10^{10} disintegrations / second

2. **The rutherford (Rd): The activity of a radioactive substance is said to be one rutherford if it undergoes 10^6 disintegrations per second.**

   1 rutherford = 10^6 disintegrations / second

3. **The becquerel (Bq): The activity of a radioactive substance is said to be one becquerel if it undergoes 1 disintegration per second.**

   1 becquerel = 1 disintegration / second

1 curie = 3.7×10^4 rutherford = 3.7×10^{10} becquerel

Nuclear Fission:

Nuclear fission is defined as a type of nuclear disintegration in which a heavy nucleus splits up into two nuclei of comparable size accompanied by a release of a large amount of energy.

$$_0n^1 + {}_{92}U^{235} \rightarrow ({}_{92}U^{236}) \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3\,{}_0n^1 + \gamma\ (200\ MeV)$$