



6. A nuclear power plant supplying electrical power to a village uses a radioactive material of half life T years as the fuel. The amount of fuel at the beginning is such that the total power requirement of the village is 12.5 % of the electrical power available from the plant at that time. If the plant is able to meet the total power needs of the village for a maximum period of nT years, then the value of n is

Answer: Requirement is $12.5\% = \frac{12.5}{100} = \frac{1}{8}$

Let A_0 = Initial activity , therefore requirement = $\frac{A_0}{8}$

Let after t years activity = $\frac{A_0}{8}$

Therefore $\frac{A_0}{8} = A_0 e^{-\lambda t}$ or $8 = e^{\lambda t}$ or $\log 8 = \lambda t \rightarrow (1)$

We know $\frac{1}{\lambda} = \frac{T}{\log 2}$ or $\lambda = \frac{\log 2}{T} \rightarrow (2)$

Putting value of λ in (1) we get $\log 8 = \frac{\log 2}{T} t$

or $t = 3T$

Answer: 3