

Q- Q- A drug tagged with a radioactive tracer (half life = 6.05 hours) is prepared for a patient.

(a) What is the decay constant for the radioactive tracer?

(b) If the initial mass of the radioactive tracer is 1g, what mass of it will remain after 24 hours?

(a) The decay constant is related to half-life as

$$\lambda = \frac{0.693}{T_{\frac{1}{2}}}$$

Or
$$\lambda = \frac{0.693}{T_{\frac{1}{2}}} = \frac{0.693}{6.05 \times 60 \times 60} = 3.18 \times 10^{-5} \text{ s}^{-1}$$

(b) As we know

$$N = N_0 e^{-\lambda t}$$

Here N_0 is number of nuclei at $t = 0$ and N at t , then we can write

$$\frac{m}{m_0} = \frac{N}{N_0} = e^{-\lambda t}$$

Substituting values, we get

$$\frac{m}{1 \text{ g}} = e^{-3.18 \times 10^{-5} \times 24 \times 3600} = e^{-2.747} = 0.064$$

Hence mass of radioactive traces remains after 24 hour is 0.064 g.