MCQ

If initial amount of a radioactive isotope is $1200g$. what will be the amount at the end of 100 *days* such that $k = 0.033$?

23535
53532
25355
32535 (correct)

Solution:

Here $\because A(t) = A_0 e^{kt}$, where $A_0 = 1200g, k = 0.033, t = 100$ days
$\therefore A(100) = 1200e^{0.033(100)} = 32535g$

Descriptive-Marks-02

If half-life of a radioactive isotope is 12 hours, then find k.

Solution:

Here $\because A(t) = A_0 e^{kt}$, where A_0 =initial amount, $t = 12$ hours $= \left(\frac{1}{2}\right)$days
For half-life; $A(t) = A(\frac{1}{2}) = \frac{A_0}{2}$
$\therefore \frac{A_0}{2} = A_0 e^{\frac{1}{2}k} \Longrightarrow e^{\frac{1}{2}k} = \frac{1}{2} \Longrightarrow \frac{1}{2}k \ln e = \ln\frac{1}{2} \Longrightarrow k = \frac{\ln\frac{1}{2}}{\frac{1}{2}} = -1.386\,3.$

Descriptive-Marks-03

Determine the age of the fossil using $(A(t) = A_0 e^{kt})$, where $A(t)$ is the amount present at any time t and A_0 be the original amount of $C-14$. Further the half life of carbon isotope is 5600 years.

Solution:

It is given that the solution of the initial value problem is
$A(t) = A_0 e^{kt}$
Since the half life of the carbon isotope is 5600 years. Therefore
$A(5600) = \frac{A_0}{2}$
So that
$\therefore \frac{A_0}{2} = A_0 e^{k(5600)} \Longrightarrow \frac{1}{2} = e^{k(5600)} \Longrightarrow 5600k \ln e = \ln(\frac{1}{2})$
$\Longrightarrow k = \frac{\ln(\frac{1}{2})}{5600} = -1.237\,8 \times 10^{-4} = -0.00012378$
Hence; $A(t) = A_0 e^{-0.00012378t}$.

Descriptive-Marks-05

A radioactive isotope has a half-life of 33 days. We have 75 g at the end of 40 days. How much radioisotope was initially present?

Solution:

$\because A(t) = A_0 e^{kt}$ —-(1)
and it is given that for half life $A(33) = \frac{A_0}{2}$
$\therefore \frac{A_0}{2} = A_0 e^{32k} \Longrightarrow \frac{1}{2} = e^{33k} \Longrightarrow 33k \ln e = \ln\frac{1}{2}$
$\Longrightarrow k = \frac{\ln\frac{1}{2}}{33} = -2.100\,4 \times 10^{-2} \approx -0.021$
Now since we have 75 g at the end of 40 days$\Longrightarrow A(40) = 75g$
$\therefore (1) \Longrightarrow 75 = A_0 e^{-0.021(40)} \Longrightarrow A_0 = \frac{75}{e^{-0.021(40)}} = 173.73g$