Answer on Question #76810, Physics / Atomic and Nuclear Physics

A 280 day old radioactive substance shows an activity of 6000 dps , 140 days later its activity becomes 3000 dps . What was its initial activity ? (A) 20000 dps (B) 24000 dps (C) 12000dps (D) 6000 dps.

Solution:

$$\lambda = \frac{1}{t} ln\left(\frac{A_0}{A}\right)$$

$$\lambda = \frac{1}{280} ln\left(\frac{A_0}{6000}\right)$$

So,

$$\lambda = \frac{1}{280 + 140} ln\left(\frac{A_0}{3000}\right)$$

$$3ln\left(\frac{A_0}{6000}\right) = 2ln\left(\frac{A_0}{3000}\right)$$

$$\left(\frac{A_0}{6000}\right)^3 = \left(\frac{A_0}{6000}\right)^2$$

We get

$$\frac{{A_0}^3}{{A_0}^2} = \frac{6000^3}{3000^2}$$

$$A_0 = 24 \times 10^3 = 24000$$

Answer: 24000