Answer on Question #56780 – Math – Algebra

5. *The function Q(t) = Qoe^-kt may be used to model radioactive decay. Q represents the quantity remaining after t years; k is the decay constant, 0.00011. How long, in years, will it take for a quantity of plutonium-240 to decay to 25% of its original amount?*
A: 12,602 years
B: 1,575 Years
C: 3,150 years
D: 9,450 years

Solution

$$Q(t) = Q_0 e^{-kt}$$

Q(t)	Q_0
25%	100%

$$\frac{Q(t)}{Q_0} = 0.25$$

$$e^{-kt} = 0.25$$

If k=0.00011, then

$$e^{-0.00011t} = 0.25$$

$$-0.00011t = \ln(0.25)$$

$$t = \frac{\ln(0.25)}{-0.00011}$$

$$t \approx 12{,}602.68$$

Answer: A: 12,602 years.

4. *Plutonium-240 decays according to the function Q(t)= Qoe^-kt . How long will it take 27 grams of plutonium-240 to decay to 9 grams?*
K is the decay constant, 0.00011
A: 2,100 years
B: 1.44 years
C: 18,900 years
D: 9,987 years

Solution:

$$Q(t) = Q_0 e^{-kt}$$

Q(t)	Q_0
9 g	27 g

$$9 = 27e^{-kt}$$

$$e^{-kt} = \frac{9}{27} = \frac{1}{3}$$

If k=0.00011, then

$$e^{-0.00011t} = \frac{1}{3}$$

$$-0.00011t = ln\frac{1}{3}$$

$$t = \frac{ln\frac{1}{3}}{-0.00011}$$

$$t \approx 9{,}937.38$$

Answer: *D: 9,987 years*.