The half-life of polonium-210 is 8 days. How long will it take for a sample of this substance to decay to 3% of its original amount?

**ANSWER:**

In this partial example, we will only find the value of $k$ in the formula $A = A_0 e^{kt}$.

Since the half-life is 8 days, this means that when $t = 8$, the amount is half of what we started with. If we started with $A_0$, then half of that is $0.5A_0$. In other words, if we start with $A_0$, then when $t = 8$ we have $A = 0.5A_0$. Using the equation, we have

$$A = A_0 e^{kt}$$

$$0.5A_0 = A_0 e^{k \cdot 8}$$

$$0.5A_0 = A_0 e^{8k}$$

$$0.5 = e^{8k}$$

$$\ln(0.5) = \ln(e^{8k})$$

$$\frac{\ln(0.5)}{8} = k$$

$$k \approx -0.086643$$

Since we need $k$ to 6 decimal places, then we have $k \approx -0.086643$. Then the exponential model is $A = A_0 e^{-0.086643t}$.

If the substance decays to 3% of its original amount, this means that $0.03A_0$ is left, because we started with an amount of $A_0$. 