

**Topic:** Half life

**Question:** Americium-241 has a half-life of 432 years. Find the decay constant.

**Answer choices:**

- A      0.160
- B      0.0160
- C      0.00160
- D      0.000160



**Solution: C**

The half life equation is

$$\frac{1}{2} = e^{kt}$$

Solve this for the decay constant  $k$ .

$$\ln \frac{1}{2} = \ln e^{kt}$$

$$\ln \frac{1}{2} = kt$$

$$k = \frac{\ln \frac{1}{2}}{t}$$

Use laws of logarithms to rewrite the log.

$$k = \frac{\ln 1 - \ln 2}{t}$$

$$k = \frac{0 - \ln 2}{t}$$

$$k = -\frac{\ln 2}{t}$$

Because  $k$  is a constant, we can absorb the negative sign into it.

$$k = \frac{\ln 2}{t}$$

Substitute  $t = 432$ .



$$k = \frac{\ln 2}{432}$$

$$k \approx 0.00160$$



**Topic:** Half life

**Question:** Carbon-19 has a decay constant of 0.000121. Find its half life.

**Answer choices:**

- A      5,782 years
- B      5,728 years
- C      5,278 years
- D      5,827 years



**Solution: B**

The half life equation is

$$\frac{1}{2} = e^{kt}$$

Solve this for time  $t$ .

$$\ln \frac{1}{2} = \ln e^{kt}$$

$$\ln \frac{1}{2} = kt$$

$$t = \frac{1}{k} \ln \frac{1}{2}$$

Use laws of logarithms to rewrite the log.

$$t = \frac{1}{k}(\ln 1 - \ln 2)$$

$$t = \frac{1}{k}(0 - \ln 2)$$

$$t = -\frac{\ln 2}{k}$$

Because  $k$  is a constant, we can absorb the negative sign into it.

$$t = \frac{\ln 2}{k}$$

Substitute the decay constant  $k = 0.000121$ .



$$t = \frac{\ln 2}{0.000121}$$

$$t \approx 5,728$$



**Topic:** Half life

**Question:** Plutonium-239 has a half-life of 24,110 years. Find the decay constant.

**Answer choices:**

- A      0.0000287
- B      0.000287
- C      0.000000287
- D      0.00000287



**Solution: A**

The half life equation is

$$\frac{1}{2} = e^{kt}$$

Solve this for the decay constant  $k$ .

$$\ln \frac{1}{2} = \ln e^{kt}$$

$$\ln \frac{1}{2} = kt$$

$$k = \frac{\ln \frac{1}{2}}{t}$$

Use laws of logarithms to rewrite the log.

$$k = \frac{\ln 1 - \ln 2}{t}$$

$$k = \frac{0 - \ln 2}{t}$$

$$k = -\frac{\ln 2}{t}$$

Because  $k$  is a constant, we can absorb the negative sign into it.

$$k = \frac{\ln 2}{t}$$

Substitute  $t = 24,110$ .





$$k = \frac{\ln 2}{24,110}$$

$$k \approx 0.0000287$$

