

3. Smoking one “joint” of cannabis puts 5000 μg of THC into a person’s bloodstream on average.

The body starts to eliminate such toxins at a rate proportional to the amount present at any time.

A person’s blood was tested after 1 hour and found to contain 4800 μg of THC.

- Find a formula for the amount of THC in the body at any time t hours after smoking one “joint”.
- If the effects experienced can still be felt 5 hours after smoking a “joint” find the amount of THC in the blood at this time.
- If cannabis can still be detected in the blood when the amount of THC has reduced to 100 μg , find how long it would take for this to happen.

$$\frac{dM}{dt} = kM$$

$$\text{so } \int \frac{dM}{M} = \int k dt$$

$$\ln(M) = kt + c \quad (\text{subs } t = 0, M = 5000)$$

$$\ln(5000) = c$$

$$\ln\left(\frac{M}{5000}\right) = kt \quad (\text{subs } t = 1, M = 4800)$$

$$\ln\left(\frac{4800}{5000}\right) = k$$

$$k = -0.04082$$

$$\ln\left(\frac{M}{5000}\right) = -0.04082t \quad \text{EQU 1}$$

$$M = 5000 e^{-0.04082t} \quad \text{EQU 2}$$

$$(b) \text{ subs } t = 5 \text{ in EQU 2 so } M = 5000 e^{-0.04082 \times 5} \approx 4100 \mu\text{g}$$

$$(c) \text{ subs } M = 100 \mu\text{g in EQU 1 so } \ln\left(\frac{100}{5000}\right) = -0.04082t$$
$$t \approx 96 \text{ hours} = 4 \text{ days}$$

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