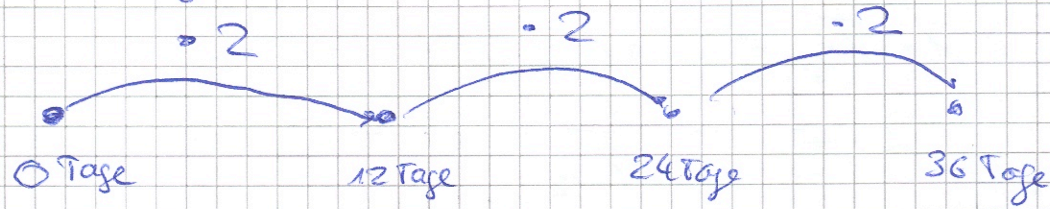
TBM 8A, 2.5.2014

(1) 12 Tage:



Wenn Zeitintervall gedrittelt wird, gilt:

$n = 8$ (ver-8-fachung)

$T_8 = 36$ Tage

Wird diese Periode gedrittelt, gilt:

~~thus~~ $n' = \sqrt[3]{n} = \sqrt[3]{8} = 2$

$\Longrightarrow$ $\underline{\underline{T_2 = 12 \text{ Tage}}}$

Rechnerisch:

$$T_8 = 36 \text{ Tage}$$

$$\lambda \cdot T_8 = \ln(8)$$

$$\lambda = \frac{\ln 8}{36} \cong 0.057'762$$

$$\lambda \cdot T_2 = \ln(2)$$

$$T_2 = \frac{\ln(2)}{\lambda} = \frac{\ln 2}{\frac{\ln 8}{36}}$$

$$= \frac{36 \cdot \ln 2}{\ln 8} = \frac{36 \cdot \ln 2}{\ln(2^3)} = \frac{36 \cdot \ln 2}{3 \cdot \ln 2}$$

$$= \frac{36}{3} = \underline{\underline{12 \text{ Tage}}}$$

(2) $N_0 = 3 \cdot 10^{-8}\,\%$

$N(t) = 3.642 \cdot 10^{-9}\,\%$

$T_{1/2} = 5'736\,a$

$$\lambda \cdot T_{1/2} = \ln(1/2) = -\ln(2)$$

$$\lambda = -\frac{\ln 2}{T_{1/2}} \cong -0.000'120'842 / \text{Jahr}$$

$$N(t) = 3.642 \cdot 10^{-9}\,\% = 3 \cdot 10^{-8}\,\% \cdot e^{\lambda t}$$

$$\frac{3.642 \cdot 10^{-9}}{3 \cdot 10^{-8}} = e^{\lambda t}$$

$$\ln\left(\quad " \quad \right) = \lambda t$$

$$t = \frac{\ln\left(\frac{3.642 \cdot 10^{-9}}{3 \cdot 10^{-8}}\right)}{\lambda}$$

$$\cong \underline{\underline{17'449.83 \cong 17'500\,a}}$$

③

$$380'000 \cdot 10^{6} = 0.1 \cdot 2^{n}$$

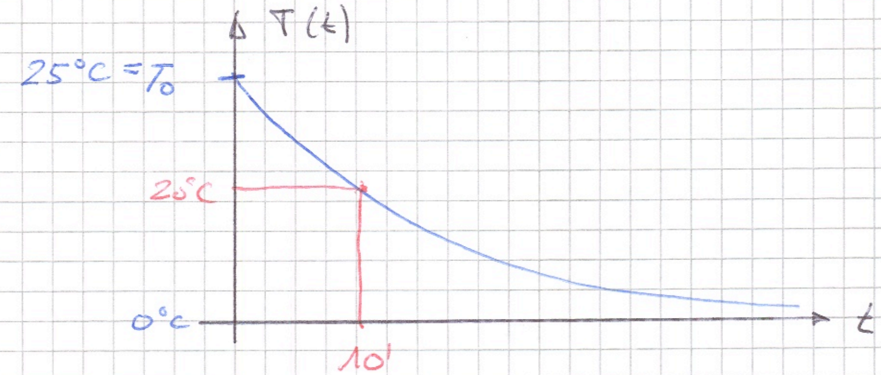
$$380 \cdot 10^{10} = 2^{n} \quad / \ln$$

$$\ln(\quad " \quad) = n \cdot \ln(2)$$

$$n = \frac{\ln(380 \cdot 10^{10})}{\ln(2)} \cong 41.79$$

42 Mal

④



$$T(t) = T_0 e^{\lambda t}$$

$$T(t = 10') = 20 = 25 \cdot e^{\lambda \cdot 10} \quad /:25$$

$$\frac{20}{25} = \frac{4}{5} = e^{10\lambda} \quad / \ln$$

$$\ln(4/5) = 10\lambda \quad /:10$$

$$\lambda = \frac{1}{10} \cdot \ln(4/5) \cong -0.022'314/\text{min}$$

$$\lambda \cdot T_{1/2} = \ln(1/2) = -\ln 2$$

$$T_{1/2} = -\frac{\ln 2}{\lambda} \cong 31.063' = \underline{\underline{31.1'}}$$

$$T(t) = 8 = 25 \cdot e^{\lambda t} \quad /:25$$

$$\frac{8}{25} = e^{\lambda t} \quad / \ln$$

$$\ln(8/25) = \lambda t$$

$$t = \frac{\ln(8/25)}{\lambda} \cong \underline{\underline{51.063' \cong 51.1'}}$$

(5) $N(t=12d) = 158.341\,mg$

$N(t=30d) = 1'920\,mg$ 18 Tage

Setze $N(t=12d) = 158.341\,mg$ "provisorisch" als N_0:

$$N(t) = 158.341 \cdot e^{\lambda t}$$

$$N(t=18d) = 1920 = 158.341 \cdot e^{\lambda \cdot 18}$$

$$\lambda = \frac{\ln\left(\frac{1920}{158.341}\right)}{18} \cong 0.138'629$$

$$\lambda \cdot T_2 = \ln 2 \Rightarrow \underline{\underline{T_2 = \frac{\ln 2}{\lambda} \cong 5\text{ Tage}}}$$

Das effektive N_0 liegt bez. ~~18~~ 158.341 mg 12 Tage in Vergangenheit:

$$N_0 = 158.341 \cdot e^{\lambda(-12)}$$

$$= \cancel{18}\,158.341 \cdot e^{-12\lambda} = \underline{\underline{30\,mg}}$$

Lösung mittels Solve:

Define $f(t) = n_0 \cdot e^{k \cdot t}$

Solve $\left(f(12) = 158.341 \text{ and } f(30) = 1920, \{k, n_0\}\right)$

$1\,kg = 10^6\,mg$:

$$10^6\,mg = 30\,mg \cdot e^{\lambda t}$$

$$\ln\left(\frac{10^6}{30}\right) = \lambda t$$

$$t = \frac{\ln\left(\frac{10^6}{30}\right)}{\lambda} \cong \underline{\underline{75.123'}}$$

(6) $T_{1/2} \cdot \lambda = \ln(1/2) = -\ln 2$

$$\lambda = -\frac{\ln 2}{T_{1/2}} \cong -0.086'419'786/d$$

$$N(t=1d) = N_0 \cdot e^{\lambda \cdot 1} = N_0 e^{\lambda}$$

Setze $N_0 = 1$; dann ist

$$N(t=1d) = N_0 e^{1\lambda} = e^{\lambda} \cong 0.917$$

$$\frac{1-0.917}{1} = \underline{8.279\,\%}$$