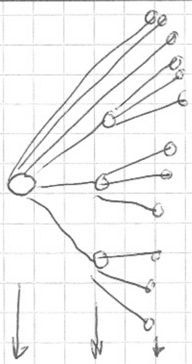
Exp. Entwicklungen II, GBM7M

(1)



1 4 16

$\rightarrow$ $q = 4$; Ver-4-fachung pro Tag

$\tau = 1$ Tag

$N_0 = 1$

$N(t) = 800'000$

$$800'000 = 1 \cdot 4^{\frac{t}{1}}$$

$$800'000 = 4^t \quad / \log$$

$$\log 800'000 = t \cdot \log 4$$

$$t = \frac{\log 800'000}{\log 4} \cong \underline{\underline{9.8 \text{ Tage}}}$$

(2) $t_1 : 150\,d \; : \; 64$ $\qquad N_0 = ? \quad \tau = ?$

$t_2 : 270\,d \; : \; 1'024$ $\qquad q = 2$

$t_2 - t_1 = 120\,d$

Setze 64 Tiere als N_0 und für $t = 120\,d$ 1024 Tiere

$$1024 = 64 \cdot 2^{\frac{120}{\tau}} \quad / : 64$$

$$16 = 2^{120/\tau} \quad / \log$$

$$\log 16 = \frac{120}{\tau} \cdot \log 2 \quad / \cdot \tau : \log 16$$

$$\tau = \frac{120 \cdot \log 2}{\log 16} = \underline{\underline{30 \text{ Tage}}}$$

"Richtiges" N_0 : bez. 64 Tiere 150 Tage rückwärts rechnen, d.h. $t = -150$ Tage (minus!)

$$N(t = -150) = 64 \cdot 2^{\frac{-150}{30}} = 64 \cdot 2^{-5} = 64 \cdot \frac{1}{2^5}$$

$$= 64 \cdot \frac{1}{32} = \underline{\underline{2 \text{ Tiere}}}$$

(3) $pH\ 4 \longrightarrow pH\ 5.301$

$$pH = -\log[H^+]$$

$pH\ 4$: $$4 = -\log[H^+] \quad \Big| \cancel{10^x}$$

$$\cancel{10^4}\ -4 = \log[H^+] \quad \Big| 10^x$$

$$10^{-4} = 10^{\log[H^+]}$$

$$10^{-4} = [H^+]$$

$pH\ 5.301$: $$10^{-5.301} = [H^+]$$

$$\frac{10^{-4}}{10^{-5.301}} \cong \underline{\underline{20\text{-fach}}}$$

(4) $$T(t) = T_0 \cdot \left(\tfrac{1}{2}\right)^{t/\tau}$$ $T_0 = 120\,°C$

$T(t=10') = 80\,°C$

a) $$80 = 120 \cdot \left(\tfrac{1}{2}\right)^{\frac{10}{\tau}} \quad \Big| \cancel{\log}\ :120$$

$$\frac{2}{3} = \left(\frac{1}{2}\right)^{\frac{10}{\tau}} \quad \Big| \log$$

$$\log\frac{2}{3} = \frac{10}{\tau} \cdot \log\frac{1}{2} \quad \Big| \cdot\tau : \log {}^{2}/_{3}$$

$$\tau = \frac{10 \cdot \log {}^{1}/_{2}}{\log {}^{2}/_{3}} \cong \underline{\underline{17.1\ \text{min.}}}$$

τ speichern, nicht runden!

17.095112....

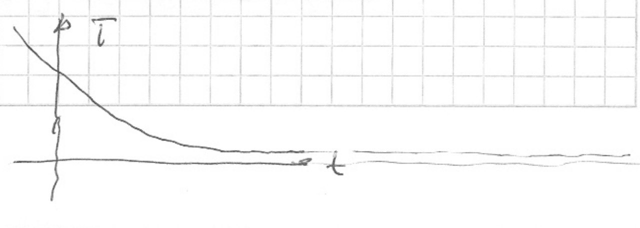
b) $$30 = 120 \cdot \left(\tfrac{1}{2}\right)^{t/\tau} \quad \Big| :120$$

$$\frac{1}{4} = \left(\frac{1}{2}\right)^{t/\tau} \quad \Big| \log$$

$$\log {}^{1}/_{4} = \frac{t}{\tau} \cdot \log {}^{1}/_{2}$$

$$t = \frac{\tau \cdot \log {}^{1}/_{4}}{\log {}^{1}/_{2}} = \underline{\underline{34.19\ \text{min.}}}$$

c) never ever



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$T(5') = 900\,°C$

$T(8') = 757.32\,°C$ 3 min

Wähle $t = 5'$ als Nullpunkt:

$$757.32 = 900 \cdot \left(\tfrac{1}{2}\right)^{3/\tau}$$

$$\frac{757.32}{900} = \left(\tfrac{1}{2}\right)^{3/\tau} \quad / \log$$

$$\log(\;''\;) = \frac{3}{\tau} \log \frac{1}{2}$$

$$\tau = \frac{3 \cdot \log \frac{1}{2}}{\log\left(\frac{757.32}{900}\right)} = \underline{\underline{12.05\,min}}$$

$$T(t = -5') = 900 \cdot \left(\tfrac{1}{2}\right)^{\frac{-5}{\tau}} = \underline{\underline{1'200\,°C}}$$

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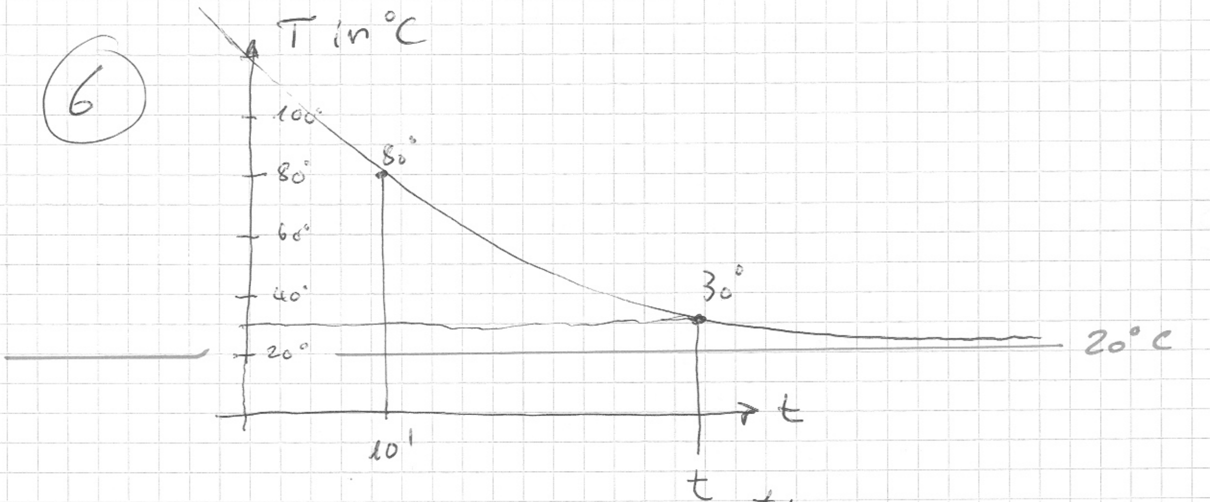

$$T(t) = T_0 \cdot \left(\tfrac{1}{2}\right)^{t/\tau} + C \;; \quad T_0 = 100$$

$$= 120° - 20°$$

$$T(t) = 100 \cdot \left(\tfrac{1}{2}\right)^{t/\tau} + 20 \qquad C = 20\,°C$$

→ von $120° \to 20°$ ist wie $100° \to 0°$

$$T(t = 10) = 80 = 100 \cdot \left(\tfrac{1}{2}\right)^{10/\tau} + 20 \quad / -20$$

$$60 = 100 \;\; '' \;\; '' \quad /:100$$

$$\frac{3}{5} = \left(\tfrac{1}{2}\right)^{10/\tau} \quad / \log$$

$$\log 3/5 = \frac{10}{\tau} \cdot \log \frac{1}{2}$$

$$\tau = \frac{10 \cdot \log 1/2}{\log 3/5} \approx 13.57\,min$$

$T = 30°C:$ $$30 = 100 \cdot \left(\frac{1}{2}\right)^{t/\tau} + 20 \quad | -20$$

$$10 = 100\,(\;)\;\ldots \quad |:100$$

$$\frac{1}{10} = \left(\frac{1}{2}\right)^{t/\tau} \quad | \log$$

$$\log {}^{1}\!/_{10} = \frac{t}{\tau} \cdot \log {}^{1}\!/_{2}$$

$$t = \frac{\tau \cdot \log {}^{1}\!/_{10}}{\log {}^{1}\!/_{2}} \cong \underline{\underline{45.06'}}$$

(7) Wähle $t = 10$ Tage als Nullpunkt mit $N_0 = 10.079\,g$

$$25.398 = 10.079 \cdot 2^{4/\tau} \qquad 4 = 14 - 10$$

$$\underline{\underline{\tau \cong 3 \text{ Tage}}}$$

$$N(t=-10) = 10.079 \cdot 2^{\frac{-10}{3}} = \underline{\underline{1 \text{ Gramm}}}$$

(8) $$10 \cdot \log\left(\frac{I}{I_0}\right) = L \text{ in dB}$$

$$10 \cdot \log\left(\frac{5I}{I_0}\right) = 80 \quad |:10$$

$$\log\left(\frac{5I}{I_0}\right) = 8 \quad | 10^x$$

$$10^{\log(\;)} = 10^8 \qquad 10^{\log x} = x$$

$$\frac{5I}{I_0} = 10^8$$

$$\frac{I}{I_0} = \frac{1}{5} \cdot 10^8$$

$$10 \cdot \log\left(\frac{x \cdot I}{I_0}\right) = 96.02$$

$$x \cdot \frac{I}{I_0} = 10^{9.602}$$

$$\frac{x \cdot \frac{I}{I_0}}{\frac{I}{I_0}} = \frac{10^{9.602}}{\frac{1}{5} \cdot 10^8} = \underline{\underline{200 \text{ Sänger}}}$$

(9) $q = 1/2$; $\tau = 24'110$

$$\frac{1}{1000} = 1 \cdot \left(\frac{1}{2}\right)^{t/24110} \quad / \log$$

$$-3 = \frac{t}{24110} \cdot \log \frac{1}{2}$$

$$\frac{-3 \cdot 24110}{\log 1/2} = t \cong \cancel{80'000 \text{ Jahre}}$$

240'275 Jahre

(10) 20d : 7.89 g

50d : 0.923 g

$\curvearrowright$ 30 Tage

$$0.923 = 7.89 \cdot \left(\frac{1}{2}\right)^{\frac{30}{\tau}}$$

$$\frac{0.923}{7.89} = \left(\frac{1}{2}\right)^{\frac{30}{\tau}} \quad / \log$$

$$\log(\text{"}) = \frac{30}{\tau} \cdot \log 1/2$$

$$\tau = \cancel{\log\left(\frac{0.923}{7.89}\right)}$$

$$\tau = \frac{30 \cdot \log 1/2}{\log\left(\frac{0.923}{7.89}\right)} \cong \underline{\underline{9.691 \text{ Tage}}}$$

$$N(t=-20) = 7.89 \cdot \left(\frac{1}{2}\right)^{\frac{-20}{\tau}} = \underline{\underline{33\,g}}$$