

Taavi Tammaru Tuuma füürise KT

1

$$A(t) = A_0 \cdot 0,5^{\frac{t}{\tau}}$$

$$t = 4,5 \cdot 10^9$$

Alu ^{238}U oletoone ei olegi vaid 10^9 -aastat varem.

$$\begin{array}{l} 10^9 \cdot 0,9928 \\ 10^9 \cdot 0,0072 \end{array} \quad \begin{array}{l} {}^{238}\text{U} \text{ osakest ja} \\ {}^{235}\text{U} \text{ osakest} \end{array}$$

$$A_0 = \frac{A(t)}{0,5^{\frac{t}{\tau}}}$$

$${}^{238}\text{U} \text{ jaoks} \quad A_0 = \frac{10^9 \cdot 0,9928}{0,5^{\frac{4,5 \cdot 10^9}{4,5 \cdot 10^9}}}$$

$$A_0 = 2 \cdot 10^9 \cdot 0,9928$$

$$A_0 = 19856 \cdot 10^9$$

$${}^{235}\text{U} \text{ jaoks} \quad A_0 = \frac{10^9 \cdot 0,0072}{0,5^{\frac{4,5 \cdot 10^9}{4,5 \cdot 10^9}}} = 5,82464 \cdot 10^8$$

$$A_{0,1} + A_{0,2} = 2,568064 \cdot 10^9$$

ehk see maa tekkimisel oli

${}^{238}\text{U}$ 77% ja ${}^{235}\text{U}$ 23%.

$$2 R = \lambda N$$

$$\underline{R_1 = q_s R} \quad q_s R_1 = R_2$$

$$q_s \lambda N_1 = \lambda N_2 \quad N_2 = q_s \quad \frac{N_2}{N_1} = 0,9$$

$$\ln\left(\frac{N(t)}{N_0}\right) = -\lambda t$$

$$\frac{dN}{dt} = -\lambda N$$

$$\frac{1}{N} dN = -\lambda dt$$

$$\int_{N(0)}^{N(t)} \frac{1}{N} dN = - \int_0^t \lambda dt$$

$$\ln(N(t)) - \ln(N_0) = -\lambda t$$

$$\ln\left(\frac{N(t)}{N_0}\right) = -\lambda t$$

$$\ln(0,9) = -\lambda t$$

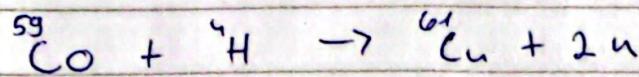
$$0,10536 = \lambda \cdot 1h$$

$$\lambda = 0,10536 \text{ s}^{-1}$$

Oo

3

$$a) \Delta I = I_{\text{ord}} - I$$



$$\Delta I = 4,5 \cdot 10^3 \cdot 0,646 \cdot n \cdot 2,5 \mu\text{m}$$

erga am vase leiden n

$$n = \frac{P N_A}{M_r} \quad n = \frac{8900 \cdot 6,02 \cdot 10^{23}}{59 \cdot 10^{-3} \text{ kg/mol}}$$

$$M(\text{Co}) = 59 \text{ g/mol}$$

$$n = 9,08 \cdot 10^{28}$$

$$\Delta I = 4,5 \cdot 10^3 \cdot 0,646 \cdot 9,08 \cdot 10^{28} \cdot 2,5 \cdot 10^{-6} \cdot 10^{-28}$$

$$\Delta I = 6,5 \cdot 10^{26} \text{ } ^{60}\text{Cu} \text{ rekunder}$$

$$b) \frac{dN}{dt} = I - \lambda N \quad \Delta I - \lambda N = 0$$

$$\frac{dN}{dt} \quad R(t) = \Delta I (1 - e^{-\lambda t})$$

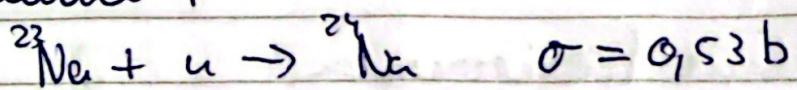
$$R(t) = 6,5 \cdot 10^8 (1 - e^{-0,203 t})$$

$$\lambda = - \frac{\ln(0,5)}{3,41} \quad \lambda = 0,203$$

$$R(t) = 6,5 \cdot 10^8 (1 - e^{-0,203 t}) = 2,2 \cdot 10^8 \text{ rekunder}$$

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Übungsaufgabe 4



$$P = \lambda N = ?$$

$$\text{kerkt} = 21,7 \text{ t}$$

$$\Delta I = I_0 \sigma n$$

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$$M(\text{Na}) = 23 \text{ g/mol}$$

$$N = \frac{\log A}{23 \text{ g}} = 2,6 \cdot 10^{23}$$

$$\Delta I = \frac{n \sigma}{S} \cdot I$$

$$\Delta I = 6 \cdot 10^{10}$$

$$\Delta I = \frac{N \sigma}{S} I$$

$$\Delta I = \frac{I}{S} N \sigma$$

$$\Delta I = \frac{I}{S} N \sigma$$

$$\Delta I = 6 \cdot 10^{10} \cdot 2,6 \cdot 10^{23} \cdot 10^{-24}, 0,53$$

$$= 6 \cdot 10^{10} \cdot 2,6 \cdot 0,53 \cdot 10^{-1}$$

$$= 8,268 \cdot 10^5 \text{ orakut rekrutis}$$

$$\cdot 10800 = 8,92544 \cdot 10^{13}$$

~~$$P = 8,268 \cdot 10^5 \cdot 78120 = 6,45896 \cdot 10^{14}$$~~

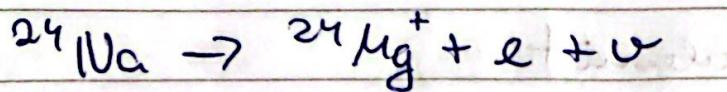
$$P = \lambda N \quad \lambda = \frac{1}{78120} =$$

$$\lambda = \frac{1}{78120} \cdot 8,92544 \cdot 10^{13} = 111,114 \cdot 10^9$$

$$P(f) = \Delta I \left(1 - e^{\frac{-\lambda t}{24000000}}\right) \quad \lambda = \frac{1}{\tau} = \frac{1}{78120}$$

$$P(f) = 111,114 \cdot 10^9 \left(1 - e^{\frac{-30}{78120}}\right) = 1067548057 \text{ 1/s}$$

Übersicht



Kontante valenit

$$Q = mc^2$$

$$Q = (m(^{24}\text{Na}) - m(^{24}\text{Mg}))c^2$$

$$mc^2 = 931,5 \text{ MeV}$$

$$Q = (m(^{24}\text{Na}) - m(^{24}\text{Mg})) 931,5 \text{ MeV}$$

Jätane ^{24}Na ja ^{24}Mg massid selleks kuna neid pole antud.

$$Q = K_e + E_\nu$$

$$K_e = 3,5 \text{ MeV}$$

$$E_\nu = (m(^{24}\text{Na}) - m(^{24}\text{Mg})) 931,5 \text{ MeV} - 3,5 \text{ MeV}$$

- b) elektrooni reaktsiooniline kontaktiline energia
on kui $E_\nu = 0$

$$Q = K_e K_e$$

Übungsaufgabe

$$\frac{N_j}{N_i} = \frac{\tau_{1/2j}}{\tau_{1/2i}} = \frac{\lambda_i}{\lambda_j}$$

$$\lambda = \frac{\ln(2)}{\tau_{1/2} \cdot \ln(2)}$$

$$\log \cdot 10^{-3} = \frac{1590 \text{ a}}{0,38764 \text{ a}}$$

$$\lambda = \frac{0,69}{0,38764}$$

$$x = 0,38764 \cdot 10^{-3} \text{ a} \quad \lambda = 1,788$$

$$x = \frac{3,8764}{1590} = 0,0024 \cdot 10^{-3} \text{ a}$$

$$N_{p_0} = \frac{0,0024 \text{ g}}{210 \text{ g/mol}} \cdot 6,02 \cdot 10^{23} = 6,88 \cdot 10^{15}$$

$$D = \lambda N \quad R = 1,788 \cdot 6,88 \cdot 10^{15} \\ = 1,23 \cdot 10^{16}$$

Übungsaufgabe 7

Berechne die Volumen-

$$Q = mc^2$$

$$Q = (m(^{234}\text{U}) - m(^{230}\text{Th}) - m(^{4}\text{He})) \cdot c^2$$

$$\underline{Q} = \underline{(234 - 230 - 4,001506)} \underline{931,5}$$

$$\underline{Q} = \underline{-0,00}$$

$$230,03313$$

$$Q = (234,04095 - 231,01095 - 4,001506) 931,5$$

$$Q = 6,314 \cdot 10^{-3} \cdot 931,5 \text{ MeV}$$

$$Q = 5,88 \text{ MeV}$$

Berechne

$$K_{\alpha} = Q \frac{230}{234} = 5,88 \text{ MeV}$$

$$= 5,78 \text{ MeV}$$

Übersetzung 8

Combinatorics

$$N = \frac{M}{M} \cdot A$$

$$N = \frac{3 \cdot 10^6}{197} \cdot 6,02 \cdot 10^{23}$$

$$N = 9,17 \cdot 10^{15}$$

$$R = 1 \text{ M}$$

$$\lambda = \frac{R}{N} \quad \lambda = \frac{5,9 \cdot 10^{12}}{9,17 \cdot 10^{15}} = 6,43 \cdot 10^{-4}$$

$$\text{Mit } \lambda \quad T = \frac{1}{\lambda}$$

$$T = 1554 \text{ sekundit}$$

Übungsaufgabe 9

$$m = 80 \text{ kg}$$

$$80 \text{ kg} \cdot 0,01 \cdot 0,003 \cdot 0,000012 = 2,88 \cdot 10^{-5} \text{ kg}$$

$$2,88 \cdot 10^{-5} \text{ kg} = 2,88 \cdot 10^{-2} \text{ g}$$

$$N = \frac{m}{M} A = \frac{2,88 \cdot 10^{-2} \text{ g}}{6,02 \cdot 10^{23} \text{ mol}} \\ = 4,7344 \cdot 10^{20}$$

$$R_A \cdot \lambda = \frac{1}{t} \quad \lambda = \frac{1}{1,8 \cdot 10^9} = 5,5 \cdot 10^{-10}$$

$$R = \lambda N$$

$$R = 4,7344 \cdot 10^{20} \cdot 5,5 \cdot 10^{-10} = 2,38 \cdot 10^{11} \text{ Rayleigh} \frac{\text{asakent}}{\text{meters}}$$