Írita megoldandó példák

2007. szigorlat

25.)

$$J = J_0 \cdot 2^{-\frac{x}{D}}$$

$$0{,}05 J_0 = J_0 \cdot 2^{-\frac{x}{D}} \quad / \lg$$

$$-1{,}3 = 0{,}3 \cdot \left(-\frac{x}{D}\right)$$

$$-4{,}33 = -\frac{x}{D}$$

$$x = 4{,}33\ D$$

26.)

$$J = J_0 \cdot 2^{-\frac{x}{D}}$$

$$J = J_0 \cdot 2^{-3{,}33}$$

$$J = 0{,}1\ J_0 \rightarrow 10\%\text{-ra}$$

8.) 400 nm

$$f = \frac{c}{\lambda} = \frac{3 \cdot 10^8\ m/s}{4 \cdot 10^{-7}\ m} = 7{,}5 \cdot 10^{14}\ \frac{1}{s}$$

$$E_{foton} = h \cdot f = 6{,}6 \cdot 10^{-34}\ Js \cdot 7{,}5 \cdot 10^{14}\ \frac{1}{s} = 4{,}95 \cdot 10^{-19}\ J$$

$$\rightarrow \frac{E_{foton}}{e} = \frac{4{,}95 \cdot 10^{-19}}{1{,}6 \cdot 10^{-19}} = 3{,}1\ eV$$

800 nm

$$\rightarrow \frac{3{,}1\ eV}{2} = 1{,}55\ eV$$

9.) $E_{mol} = 240\ kJ/mol$

$$E_{foton} = \frac{240.000\ J/mol}{6 \cdot 10^{23}} = 4 \cdot 10^{-19}\ J$$

$$E_{foton} = h \cdot f$$

$$f = \frac{E_{foton}}{h} = \frac{4 \cdot 10^{-19}\ J}{6{,}6 \cdot 10^{-34}\ Js} = 6{,}06 \cdot 10^{14}\ \frac{1}{s}$$

$$\lambda = \frac{c}{f} = \frac{3 \cdot 10^{8}\ m/s}{6{,}06 \cdot 10^{14}\ \frac{1}{s}} = \underline{\underline{495\ nm}}$$

19,

$t = 1h = 3600s$

$A = 0{,}8\ m^2$

$T_{test} = 27°C = 300K$

$T_{Zimmer} = 20°C = 293K$

$$\varepsilon = \sigma \cdot T^4 = \sigma \left(T_{test}^4 - T_{Zimmer}^4\right) = 5{,}7 \cdot 10^{-8}\ W/m^2K^4 \cdot$$

$$\cdot\ 7{,}3 \cdot 10^{8} = 41{,}61\ W/m^2$$

$$E = A \cdot t \cdot \varepsilon = 0{,}8 \cdot 3600 \cdot 41{,}61 = \underline{\underline{120\ kJ}}$$

20,

$T_{Zi} = 28°C = 301K$

$$\varepsilon_{Zi} = \sigma \cdot T_{Zi}^4 \longrightarrow \frac{\varepsilon_{Zi}}{\varepsilon'} = 2$$

$$\varepsilon' = \sigma \cdot T'^4 \longrightarrow$$

$$\left(\frac{T_{Zi}}{T'}\right)^4 = 2 \qquad T' = T_{Zi} \frac{1}{\sqrt[4]{2}} = 301 \frac{1}{1{,}189} = 253K \downarrow -20°C$$

13, $P = 20W$

$d = 0{,}1\ mm = 0{,}0001\ m$

$$T_0 = r^2 \pi = 0{,}00005^2 \pi = 7{,}85 \cdot 10^{-9}\ m^2$$

$$J = \frac{20W}{7{,}85 \cdot 10^{-9}\ m^2} = \underline{\underline{2{,}5 \cdot 10^{9}\ W/m^2}}$$

14.)

$\lambda = 10{,}6\,\mu m$

$J = J_0 \cdot 2{,}718^{-\mu x}$

$0{,}1 = 2{,}718^{-800x} \quad / \lg$

$-1 = 0{,}43 \cdot (-800x)$

$-1 = 344\,x$

$x = 0{,}003\,cm = \underline{\underline{0{,}03\,mm}}$

$\lambda = 1{,}06\,\mu m$

$J = J_0 \cdot 2{,}718^{-\mu x}$

$0{,}1 = 2{,}718^{-5{,}7x}$

$-1 = -2{,}45\,x$

$x = 0{,}4\,cm = \underline{\underline{4\,mm}}$

15.) a.) $J = J_0 \cdot 2{,}718^{-10^{-4} \cdot 2{,}5}$

$J = 0{,}99975\,J_0 \rightarrow \underline{\underline{-0{,}025\,\%}}$

b.) $J = J_0 \cdot e^{-\mu x}$

$0{,}5 = 2{,}718^{-330x}$

$-0{,}3 = 0{,}43 \cdot (-330x)$

$-0{,}3 = -143{,}3\,x$

$x = 0{,}0021\,cm = \underline{\underline{0{,}021\,mm}}$

21.) $U_{anód} = 80\,kV = 80.000\,V$

$I_{anód} = 6\,mA = 0{,}006\,A$

a.) $E_{max} = 80.000\,V \cdot 1{,}6 \cdot 10^{-19}\,C = \underline{\underline{1{,}28 \cdot 10^{-14}\,J \Rightarrow 80\,keV}}$

$E_{max} = U_{anód} \cdot e$

b) $\lambda_{min} = \frac{h \cdot c}{e} \cdot \frac{1}{U_{ánód}} = \frac{6{,}6 \cdot 10^{-34}\ J_s \cdot 3 \cdot 10^8\ m/s}{1{,}6 \cdot 10^{-19}\ C} \cdot$

$\cdot \frac{1}{80.000\ V} = 1{,}5 \cdot 10^{-11}\ m = \underline{\underline{15\ pm}}$

c) $P_{rozsug} = c \cdot U^2 \cdot J \cdot Z = 10^{-9}\ \frac{1}{V} \cdot 80.000^2\ V^2 \cdot 6 \cdot 10^{-3}\ A \cdot$

$\cdot 74 = \underline{\underline{2{,}84\ W}}$

d) $\eta = \frac{P_{rozsug}}{P_{bef}} = \frac{2{,}84\ W}{80.000 \cdot 6 \cdot 10^{-3}} \Rightarrow 0{,}6\ \%$

e) $E = P_{bef} \cdot t - P_{rozsug} \cdot t = t\,(P_{bef} - P_{rozsug}) = 60\,s\,(477{,}16) =$

$= \underline{\underline{28{,}6\ kJ}}$

f) $E_{max} = \frac{1}{2}\, m_e\, v_e^2 = \frac{1}{2} \cdot 9{,}1 \cdot 10^{-31} kg \cdot v^2$

$v^2 = \frac{1{,}28 \cdot 10^{-14}}{4{,}55 \cdot 10^{-31}} = 2{,}8 \cdot 10^{16}$

$v = \underline{\underline{1{,}68 \cdot 10^8}}\ m/s$

g) $N_e = \frac{J_{ánód}}{e} = \frac{6 \cdot 10^{-3}\ A}{1{,}6 \cdot 10^{-19}\ C} = \underline{\underline{3{,}75 \cdot 10^{16}\ db}}$

22) $A = 2\,r^2\,\pi = 6{,}28\ m^2$

$P = \frac{U \cdot J \cdot \eta}{A} = \frac{50.000\ V \cdot 0{,}005\ A \cdot 0{,}0037}{6{,}28\ m^2} = \underline{\underline{0{,}147\ W/m^2}}$

23.)

$$\mu = \mu_m \cdot S = 2{,}7 \cdot 10^3\ kg/m^3 \cdot 0{,}171\ cm^2/g \Rightarrow$$

$$2{,}7\ g/cm^3 \cdot 0{,}171\ cm^2/g = 0{,}46\ cm^{-1}$$

$$J = J_0\, e^{-\mu x}$$

$$0{,}1 = 2{,}718^{-0{,}46x}$$

$$-1 = 0{,}43 \cdot (-0{,}46x)$$

$$-1 = -0{,}2x$$

$$x = \underline{\underline{5\ cm}}$$

28.)

$$E_{foton} = \frac{1}{2} m_e \cdot v_e^2 + A + hf'$$

$$0{,}66\,MeV = 660.000\,eV = 50\,eV + \underbrace{\frac{1}{2} \cdot 9{,}1 \cdot 10^{-31} \cdot (6 \cdot 10^7)^2}_{1{,}638 \cdot 10^{-15}} + hf'$$

$$hf' = 659950\,eV$$

$$\xrightarrow{\cdot e} \underline{\underline{1{,}05 \cdot 10^{-13}\ J}}$$

$$f = \frac{1{,}05 \cdot 10^{-13}\ J}{6{,}6 \cdot 10^{-34}\ J\,s\,(h)} = 1{,}6 \cdot 10^{20}\ \frac{1}{s}$$

$$\lambda = \frac{c}{f} = \frac{3 \cdot 10^8}{1{,}6 \cdot 10^{20}} = 1{,}9 \cdot 10^{-12}\ m = \underline{\underline{1{,}9\,pm}}$$

24.)

a.) $J = J_0\, 2^{-\frac{x}{D}}$

$$0{,}1 = 2^{-\frac{x}{3}} \quad / \lg$$

$$-1 = -0{,}1x$$

$$x = \underline{\underline{10\ mm}}$$

b.) $\mu = \ln 2 / D = \ln 2 / 0{,}3\ cm = \underline{\underline{2{,}31\ cm^{-1}}}$

27.) $J = J_0 2^{-\frac{x}{D}}$

$0{,}708 = 2^{-\frac{x}{D}} \quad / \lg$

$-0{,}15 = -0{,}3 \frac{x}{D}$

$0{,}5 = \frac{x}{D} \rightarrow \underline{\underline{2x = D}}$

32.) $A = 2\,MBq \quad {}^{32}P$

$A = A_0 \cdot e^{-\frac{0{,}693}{T} t}$

$100 = 2 \cdot 10^6 \cdot 2{,}718^{-\frac{0{,}693}{14{,}28\,nap} \cdot t}$

$5 \cdot 10^{-5} = 2{,}718^{-\frac{0{,}693}{14{,}28} t} \quad / \lg$

$-4{,}3 = 0{,}43 \cdot (-0{,}0485)\, t$

$t = \underline{\underline{206{,}1\ nap}}$

34.)

$m = 1\,\mu g \quad {}^{131}J$

$N = N_0 e^{-\lambda t}$

$A = \lambda \cdot N$

$N = \frac{m}{M} \cdot 6 \cdot 10^{23} = \frac{10^{-6}\,g}{131\,g/mol} \cdot 6 \cdot 10^{23} = 4{,}6 \cdot 10^{15}$

$\lambda = \frac{\ln 2}{T_{1/2}} = \frac{0{,}69}{8\,nap} = \frac{0{,}69}{8 \cdot 24 \cdot 60 \cdot 60} = 9{,}98 \cdot 10^{-7}\ s^{-1}$

$A = 9{,}98 \cdot 10^{-7} \cdot 4{,}6 \cdot 10^{15} = 4{,}6 \cdot 10^8\ Bq = \underline{4{,}66\,Bq}$

36.) $A = \lambda \cdot N \quad {}^{131}J$

$\lambda = \frac{\ln 2}{T_{1/2}} = 9{,}98 \cdot 10^{-7}\ s^{-1}$

$N = \frac{A}{\lambda} = \frac{2{,}4 \cdot 10^6\,Bq}{9{,}98 \cdot 10^{-7}\,s^{-1}} = \underline{2{,}4 \cdot 10^{12}\ db}$

33.) $A = A_0 \cdot 2{,}718^{-\frac{0{,}693}{T} t}$

$A = 5 \cdot 10^8 \cdot 2{,}718^{-\frac{0{,}693}{15h} t(30h)} = 1{,}25 \cdot 10^8 Bq$

$A_0 = 0{,}125 GBq - 0{,}05 GBq = 0{,}075 GBq$

$50 = 75 \cdot 2{,}718^{\frac{-0{,}693}{15h} t}$

$0{,}67 = 2{,}718^{-0{,}0462 t}$

$-0{,}17 = 0{,}43 (-0{,}0462 t)$

$-0{,}17 = -0{,}02 t$

$t = 8{,}5 h$

$t_{ossz} = 30 + 8{,}5 = \underline{\underline{38{,}5 h}}$

35.) $N = \frac{A}{\lambda}$

$N = \frac{2{,}4 \cdot 10^6 Bq}{9{,}98 \cdot 10^{-7} \frac{1}{s}} = \underline{\underline{2{,}4 \cdot 10^{12}}}$ db

39.) $A = 5 MBq$

$E = 6{,}2 MeV = 9{,}92 \cdot 10^{-13} J$

$m = 0{,}1 kg$

$t = 0{,}5 h$

$\Delta T = ?$

$E = A \cdot t \cdot E = 5 \cdot 10^6 Bq \cdot 1800 s \cdot 9{,}92 \cdot 10^{-13} J$

↳ $9{,}92 \cdot 10^{-16} kJ$

$E = c \cdot m \cdot \Delta T$

$\Delta T = \frac{E}{c \cdot m} = \frac{A \cdot t \cdot E}{c \cdot m} = \frac{5 \cdot 10^6 \cdot 1800 \cdot 9{,}92 \cdot 10^{-16}}{4{,}18 \cdot 0{,}1} =$

$= \underline{\underline{2{,}1 \cdot 10^{-5} K}}$

16.) $t = 12\,cm$

$2 = 36\,cm$

$\frac{1}{f} = \frac{1}{2} + \frac{1}{t} = \frac{1}{36} + \frac{1}{12} = 0{,}0278 + 0{,}0833 = 0{,}1111$

$f = \underline{9\,cm}$

$D = \frac{1}{f} = \frac{1}{0{,}09\,m} = \underline{11{,}1\,dppt}$

$N = \frac{2}{t} = \frac{36}{12} = \underline{3}$

17.)

$$G = 0{,}61\,\frac{\lambda}{n \cdot \sin\omega} = \frac{0{,}61 \cdot 5{,}2 \cdot 10^{-7}\,m}{1{,}5 \cdot \sin 70^\circ} = \underline{2{,}25 \cdot 10^{-7}\,m}$$

18.) a.) $\frac{1}{\sin\beta_a} = \frac{n_2}{n_1} =$ ~~1,4737 = 0,7665~~

$\sin\beta_a =$

96.) $\bar{x} = 18{,}5\,\mu m$

$$s_x = \sqrt{\frac{Q_x}{n-1}} = \frac{0{,}5^2 + 1{,}5^2 + 2{,}5^2 + 0{,}5^2}{3} = \frac{9}{3} = \underline{\sqrt{3\,\mu m}}$$

$$s_{\bar{x}} = \frac{\sqrt{3}}{\sqrt{4}} = \underline{0{,}87}$$

97.) $\bar{x} = 170\,cm$

$s = 8\,cm$

$s_{\bar{x}} = \frac{8}{5} = 1{,}6$

$166{,}8 \;\underline{\quad}\; 173{,}2$

37.) $N = N_0 \cdot e^{-\lambda t}$

$3{,}45 = 6 \cdot 2{,}718^{-\lambda t} \quad / \lg$

$-0{,}24 = 0{,}43 \cdot (-\lambda \cdot 14)$

$\lambda = 0{,}04$

$\lambda T_{eff} = \ln 2$

$T_{eff} = 17{,}33\,nap$

$\frac{1}{T_{eff}} \pm \frac{1}{T_{fiz}} + \frac{1}{T_{biol}} \rightarrow T_{biol} = 21{,}63\,nap$

74.) $\mu = \frac{RT}{zF} \ln \frac{c_1}{c_2} = \frac{8{,}314 \cdot 310}{1 \cdot 96500} \ln \frac{155}{4} = 0{,}098\,V$

70.) $\mu_A = \mu_A^\circ + RT \ln (C_A) = -902{,}5 + 8{,}314 \cdot 298 \cdot \ln 0{,}02 =$

$= -1059{,}48\ kJ/mol$

$G = \mu_A \cdot V_A + \mu_B \cdot V_B = -1059{,}48 \cdot 0{,}004 + \mu_B \cdot V_B =$

$= -42{,}38 + \mu_B \cdot V_B$

5.) $\frac{N_2}{N_1} = e^{-\frac{\Delta E}{RT}}$

$0{,}001 = e^{-\frac{\Delta E}{8{,}314 \cdot 310}} \quad / \lg$

$-3 = 0{,}43 \cdot -\frac{\Delta E}{2577{,}34}$

$6{,}98 = \frac{\Delta E}{2577{,}34} \rightarrow \Delta E = 17980\ J/mol$

$\hookrightarrow : 6 \cdot 10^{23}$

$2{,}99 \cdot 10^{-20}\ J/$

40) $A = \lambda N$ $\qquad 2T = \ln 2$

$2 \cdot 10^8 = 0{,}924\, N$ $\qquad \frac{0{,}69}{7{,}5} = 0{,}924 = \lambda$

$N = 2{,}16 \cdot 10^8$

$E_\beta = 2{,}16 \cdot 10^8 \cdot 0{,}18\,MeV = 3{,}9 \cdot 10^{13}\,eV$

$\downarrow$

$6{,}2 \cdot 10^{-6}\,J$

$D = \underline{\underline{7{,}8 \cdot 10^{-5}\,Gy}}$

42) $\mu = \mu_m \cdot S = 0{,}166 \cdot 1{,}04 = 0{,}173$

$I = I_0 \cdot e^{-\mu x}$

$I = 0{,}5 \cdot 2{,}718^{-0{,}173 \cdot 20}$

$I = 0{,}0159\ W/m^2$

$I_{elnyelt} = 0{,}5 - 0{,}0159 = 0{,}4841\ W/m^2$

$\downarrow \cdot 60\,s$

$29\,\frac{J}{m^2}$

$\downarrow : 0{,}2$

$145{,}23\,\frac{J}{m^3}$

$\downarrow : 1{,}04 \cdot 10^3\,\frac{kg}{m^3}$

$\underline{\underline{0{,}14\,Gy}}$

43.)

$$\Delta E = 4{,}2 \frac{J}{cm^2} \cdot 4000_{cm^3} = 16800\ J$$

$$D = \frac{16800}{70} = 240\ Gy$$

$$\text{dávka} = \frac{D}{\Delta t} = \frac{240\ Gy}{60\ s} = 4\ Gy/s$$

$$\frac{6\ Gy}{4\ Gy/s} = 1{,}5\ s$$

44.)

$$6\ Gy = 6 \frac{J}{kg}$$

$$\Delta T = \frac{6 \frac{J}{kg}}{4000 \frac{J}{kg\,K}} =$$

81.)

$n = 10 \lg K_p$

$13 = 10 \lg K_p$

$1{,}3 = \lg K_p$

$K_p = 20$

$10 = 10 \lg K_{p,V}$

$1 = \lg K_{p,V}$

$K_{p,V} = 10$

$$K_{p,V} = \frac{K_p}{1 + K_v K_p}$$

$$10 = \frac{20}{1 + 20 K_v}$$

$10 + 200 K_v = 20$

$10 = 200 K_v$

$K_v = 0{,}05$

56.) $J_v = \frac{\Delta V}{\Delta t}$

$\Delta V = 5{,}6\,l = 0{,}0056\ m^3$

$\Delta t = 60\ s$

$J_v = \frac{0{,}0056}{60} = 0{,}0000093\ m^3/s$

$A = r^2 \pi = 0{,}01^2 \pi = 0{,}000314\ m^2$

$\bar{v} = \frac{J_v}{A} = 0{,}3\ m/s$

57.) $J_v = -\frac{\pi}{8\eta} R^4 \frac{\Delta p}{\Delta l}$

$4{,}5 \cdot 10^{-6} = -\frac{\pi}{8\eta} \cdot (1{,}8 \cdot 10^{-4})^4 \frac{1{,}05 \cdot 10^3 \cdot 10 \cdot 1{,}3}{0{,}03}$

$$-\frac{\pi}{8\eta} = 95{,}74$$

$$766\,\eta = -\pi \quad \rightarrow \eta = \underline{\underline{4{,}1\ \text{mPas}}}$$

1.)

$$\frac{3}{2}RT = \frac{1}{2} m v^2 \qquad m_{O_2} = \frac{32}{6 \cdot 10^{23}} = 5{,}33 \cdot 10^{-23}\,g$$

O_2

$$\frac{3}{2} \cdot 1{,}38 \cdot 10^{-23} \cdot 273 = \frac{1}{2} \cdot 5{,}33 \cdot 10^{-26} \cdot v^2$$

$$v^2 = 212048{,}7$$

$$v = \underline{\underline{460{,}5\ m/s}}$$

3.)

$$N_2 = N_1 \cdot e^{-\frac{E}{RT}} = N_1 \cdot e^{-\frac{\varepsilon}{2 \cdot T}}$$

$$\frac{N_2}{N_1} = e^{-\frac{E}{RT}}$$

$$\frac{N_2}{\underbrace{N_1 + N_2}_{N}} = \frac{e^{-\frac{E}{RT}}}{1 + e^{-\frac{E}{RT}}}$$

$$N_2 = N \cdot \frac{e^{-\frac{E}{RT}}}{1 + e^{-\frac{E}{RT}}} = 1400 \cdot \frac{2{,}718^{-\frac{18800}{8{,}314 \cdot 310}}}{1 + 6{,}8 \cdot 10^{-4}} = \underline{\underline{0{,}95 \approx 1}}$$

7.)

$$\frac{n(h)}{n(0)} = e^{-\frac{mgh}{RT}}$$

$$0{,}5 = 2{,}718^{-\frac{mgh}{RT}} \quad / \ln$$

$$-0{,}3 = 0{,}43 \cdot \left(-\frac{mgh}{RT}\right)$$

$$h = \underline{\underline{5038\ m}}$$

59.) $d_1 = 4\,mm \rightarrow r_1 = 2\,mm$

$\bar{v}_1 = \frac{v_{krit_1}}{2}$

$d_2 = 2\,mm \rightarrow r_2 = 1\,mm$

$\bar{v}_2 = ?\quad \bar{v}_1 = ?\quad v_{krit_1} = ?\quad v_{krit_2} = ?$

$v_{krit_1} = Re \cdot \frac{\eta}{\rho \cdot r} = 1160 \cdot \frac{4{,}5}{1{,}05 \cdot 10^3 \cdot 2} = \underline{\underline{2{,}486\,m/s}}$

$\bar{v}_1 = \frac{v_{krit_1}}{2} = \underline{\underline{1{,}243\,m/s}}$

$v_{krit_2} = 1160 \cdot \frac{4{,}5}{1{,}05 \cdot 10^3} = \underline{\underline{4{,}97\,m/s}}$

$\bar{v}_2 = 4\,\bar{v}_1 = \underline{\underline{4{,}972\,m/s}}$ → turbulenz

$\bar{v}_1 \cdot 4\pi = \bar{v}_2 \pi$

91.) $E_{cond} = \frac{1}{2} C u^2$

$160 = \frac{1}{2} \cdot 20 \cdot 10^{-6} \cdot u^2$

$u^2 = 1{,}6 \cdot 10^7$

$u = 4000\,V = \underline{\underline{4kV}}$

92.) $R = \frac{u}{I}$

$I = \frac{4V}{800\Omega} = 0{,}005\,A$

$P_{el} = u \cdot I = 0{,}02\,W$

$E = P \cdot t = 0{,}02 \cdot 10^{-3} = 2 \cdot 10^{-5}\,J = \underline{\underline{20\,\mu J}}$

Biofizika II. félév 1. dolgozat

– 1 –

Feladatok

41.) $D_{lev_1} = 444 \frac{\mu Gy \cdot m^2}{GBq \cdot h} \cdot \frac{0{,}68\ GBq \cdot 0{,}0083\ h}{0{,}012\ m^2} =$

$= 25.059\ \mu Gy = \underline{25\ m Gy}$

$D_{lev_2} = 444 \cdot \frac{0{,}68 \cdot 0{,}0083}{0{,}2^2\ m} = \underline{62{,}65\ \mu Gy}$

$D_{lev} = K_\gamma \cdot \frac{A \cdot t}{r^2}$

47.) $D_{lev} = 444 \cdot \frac{0{,}02 \cdot 1}{0{,}4^2} = \underline{55{,}5\ \mu Gy}$

$20 = 55{,}5 \cdot 2{,}718^{-0{,}05 \cdot 11{,}3 x}$

$0{,}36 = 2{,}718^{-0{,}565x}$

$-0{,}44 = (\ln 2{,}718)(-0{,}565x)$

$-1 = -0{,}565x$

$x = \underline{1{,}8\ cm}$

$D = D_0 \cdot e^{-\mu x} \qquad \mu = \mu_m \cdot \rho$

48.)

$20\ \mu Gy = 56 \frac{0{,}56 \cdot 1}{r^2} \qquad r^2 = 1{,}568\ m^2$

$r = \underline{1{,}25\ m}$

49.) $A = 0{,}5\ GBq$

$$D_0 = 444 \cdot \frac{0{,}5 \cdot 1}{0{,}3^2} = 2467\ \mu Gy\ ekv/h$$

$$D_1 = D_0 \cdot e^{-\mu x}$$

$$D_1 = 2467 \cdot 2{,}718^{-0{,}565 \cdot 2}$$

$$D_1 = 797\ \mu Gy\ ekv/h =$$

$$= 0{,}8\ mGy\ ekv/h$$

50.) $1\ mSv = 1\ mGy$

$$1000\ \mu Gy = 160\ \frac{0{,}75 \cdot t}{0{,}32\ m^2}$$

$$\rightarrow t = 0{,}75\ h \rightarrow 45\ perc$$

61.)

$$f_D = \frac{2v}{c} f$$

$$2v = \frac{f_D \cdot c}{f} = \frac{1200\ Hz \cdot 1500\ m/s}{8 \cdot 10^6\ Hz} = 0{,}225\ m/s$$

$$v = 0{,}1125\ m/s = 11{,}25\ cm/s$$

75.) $u_{ki} = \frac{u_{be}}{2}$

$$n_u = 20 \lg \frac{1}{2} = -6\ dB$$

76.)

a) $n_P = 10 \lg \frac{P_{2i}}{P_{2e}}$

$40\,dB = 10 \lg \frac{P_{2i}}{5 \cdot 10^{-12}\ W/m^2}$

$4 = \lg \frac{P_{2i}}{5 \cdot 10^{-12}}$

$10^4 = \frac{P_{2i}}{5 \cdot 10^{-12}}$

$X = 5 \cdot 10^{-8}\ W/m^2$

$J = ?$

$40 = 10 \lg \frac{J}{5 \cdot 10^{-12}}$

$J = 5 \cdot 10^{-8}\ W/m^2$

b)

$J = J_0 \cdot 2^{-\frac{x}{D}}$

$5 \cdot 10^{-12} = 5 \cdot 10^{-8} \cdot 2^{-\frac{x}{D}}$

$10^{-4} = 2^{-\frac{x}{D}}$

$-4 = -\frac{x}{D} \cdot \lg 2$

$\frac{x}{D} = 13{,}33$

c)

$5 \cdot 10^{-12} = 5 \cdot 10^{-8} \cdot e^{-12\mu}$

$\mu = 0{,}77\ 1/cm$

$0{,}77 = \frac{\ln 2}{D} \rightarrow D = 0{,}9\ cm$

77.)

$n = 30\,dB$ $\qquad \Sigma n = 75\,dB$

150

$+45\,dB$

$J_0 = 10^{-12}\ W/m^2$ $\qquad f = 1\,kHz$

$75 = 10 \lg \frac{J}{J_0} \rightarrow 10^{-12}$

$J = 3{,}16 \cdot 10^{-5}\ W/m^2$

$3{,}16 \cdot 10^{-5} = J_0 \cdot 2^{-15}$

$J_0 = 1\ W/m^2$

78.)

$25 = 10 \lg \frac{x}{3 \cdot 10^{-11}}$

$2{,}5 = \lg \frac{x}{3 \cdot 10^{-11}}$

$316{,}23 = \frac{x}{3 \cdot 10^{-11}}$

$x = 9{,}5 \cdot 10^{-9}\ W/m^2$

85.) $f = 5000\ Hz$ $\quad T = \frac{1}{5000}$ ⇒ $T = \frac{1}{f}$

$s = 3\ cm = 0{,}03\ m$

$v = 400\ m/s = \frac{s}{t}$

$t_2 = \frac{s}{v} = \frac{0{,}03\ m}{400\ m/s} = 7{,}5 \cdot 10^{-5}\ s$

$s = v \cdot t = 7{,}5 \cdot 10^{-5}\ s \cdot 1500\ m/s = 11{,}25\ cm$

↳ teljes út oda-vissza

a reflektáló tárgy távolsága: $5{,}625\ cm$

86.) $c = \lambda f$

$\lambda_1 = \frac{c}{f} = \frac{3 \cdot 10^8\ m/s}{27 \cdot 10^6\ Hz} = 11{,}11\ m$

$\lambda_2 = \frac{3 \cdot 10^8}{2{,}37 \cdot 10^9} = 1{,}26\ cm$

87.) $f = \frac{c}{\lambda} = \frac{3 \cdot 10^8}{11} = 27{,}3\ MHz$

88.) $\lambda = \frac{c}{f} = \frac{1500\ m/s}{800.000\ Hz} = 1{,}875\ mm$

$R = \frac{c_1 s_1 - c_2 s_2}{c_1 s_1 + c_2 s_2} = 0{,}33 \rightarrow 33\%$

89,

$$Q = \sigma \cdot V \cdot E^2 \cdot t = 0{,}8 \cdot 6 \cdot 10^{-4} \cdot 10^4 \cdot 1800 =$$

$$= 864\ J$$

$$\downarrow \cdot 0{,}3$$

$$259{,}2\ J$$

$$Q = c \cdot m \cdot \Delta T = 0{,}259 = 3{,}76 \cdot 0{,}624 \cdot \Delta T$$

$$\underline{\underline{\Delta T = 0{,}11\ °C}}$$

98.) $r = 0,6$

$\alpha = 0,05$

H_0 : nincs korrel.

I.

$n_1 = 5 \rightarrow f_1 = n - 2 = 3$

$t_{m_1} = 0,6 - \sqrt{\frac{3}{0,64}} = 1,3$

$t_{kr} = 3,18$

$t_m < t_{kr}$

↳ H_0-t megtartjuk → nincs korrel.
az 5%-os szignifikancia-szinten

II.

$n_2 = 20 \rightarrow f_2 = 18$

$t_{m_2} = 0,6 \cdot \sqrt{\frac{18}{0,64}} = 3,18$

$t_{kr} = 2,1$

↳ elvetjük a nullhipotézist, tehát van korrel. 5%-os szignif. szint mellett

99.) $\mu_0 = 20\%$ H_0 : a hatóanyagtart. 20%

$n = 6 \rightarrow f = 5$ $\alpha = 0,05$

$\bar{x} = 19,76\%$

$s = \sqrt{\frac{0,34^2 + 0,04^2 + 0,06^2 + 0,14^2 + 0,86^2 + 0,44^2}{5}} = 0,46$

$$s_{\bar{x}} = \frac{0,46}{\sqrt{6}} = 0,19$$

$$t_m = \frac{19,76\% - 20\%}{0,19} = -1,26 \rightarrow p \approx 0,3$$

$p > \alpha \Rightarrow$ nem vetjük el H_0-t

nincs szignif. kül.

100.) H_0: a készítményt nem kell átlagban tárolni

$\mu_0 = 20\%$ $n = 6$ $f = 5$

$\bar{x} = 19,46\%$

$$s = \sqrt{\frac{0,14^2 + 0,56^2 + 0,04^2 + 0,64^2 + 0,16^2 + 0,06^2}{5}} = 0,39$$

$$s_{\bar{x}} = \frac{0,39}{\sqrt{6}} = 0,16$$

$$t = \frac{20 - 19,46}{0,16} = 3,375 \Rightarrow p = 0,02$$

$\alpha = 0,05$

$p < \alpha$

↓

elvetjük

101.)

I.)

	beteg	nem lett beteg	
kapott olt.	105 [a]	319 [b]	424
nem kapott	140 [c]	285 [d]	425
	245	604	849

$f = 1$

H_0 = az oltás nem hatásos

$$\frac{5 \cdot 849}{4245} \overset{?}{\leq} \frac{245 \cdot 424}{103\,880}$$

$\Rightarrow \chi^2$ próba elvégezhető

$$\chi^2 = \frac{849\,(105 \cdot 285 - 140 \cdot 319)^2}{245 \cdot 604 \cdot 424 \cdot 425} = 6,91 \rightarrow p = 0,009$$

$p < 1\%$

$\rightarrow$ nullhipot. elvethető

II.

	orvosban	nem	
Rapatt oct.	31	393	424
nem	55	370	425
	86	763	849

H_0: eroltés nem fgt.

$5 \cdot 849 \hat{<} 86 \cdot 424$

$4245 < 36464 \rightarrow \chi^2$ próba elvégezhető

$$\chi^2 = \frac{849(31 \cdot 370 - 55 \cdot 393)^2}{86 \cdot 763 \cdot 424 \cdot 425} = 7{,}39 \rightarrow p = 0{,}006$$

$p < 1\%$

$\rightarrow$ nullhip. elvethető