1.) $T = 0,29\,s$ $\quad A = 0,010\,m$

$\lambda = 0,040\,m$

a) $v = \lambda \cdot f = \lambda \cdot \frac{1}{T} = 0,20\,m/s$

b) $y = A \sin\left(2\pi f t - \frac{2\pi}{\lambda} x\right)$

$f = \frac{1}{T} = \frac{1}{0,20} = 5\,Hz$

$y = (0,010\,m) \cdot \sin\left(2\pi \cdot 5 \cdot t - \frac{2\pi}{0,040\,m} \cdot x\right)$

$= (0,010\,m) \sin(10\pi t - 50\pi x)$

2.) ~~$v_s = 8,4\,m/s$~~

~~$f = 1,2\,Hz$~~

~~$x = 5,8\,m$~~

~~$v_v = ?$~~

a) $\lambda_A = 2,0\,m$

$\lambda_B = 4,0\,m$

b) $v = 12,0\,m/s$

$f_A = \frac{v}{\lambda_A} = \frac{12}{2} = 6,0\,Hz$

$f_B = \frac{v}{\lambda_B} = \frac{12}{4} = 3,0\,Hz$

$A_A = 0,50\,m$

$A_B = 0,25\,m$

c) $v_{max} = A \cdot \omega \Rightarrow$

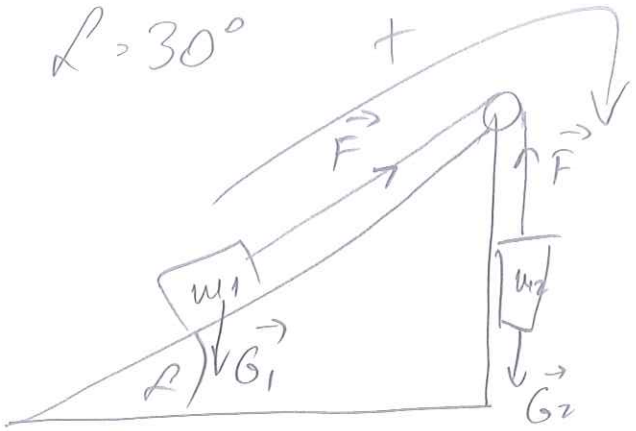
$v_{max_A} = A_A \cdot 2\pi f_A = 19\,m/s$

$v_{max_B} = A_B \cdot 2\pi f_B = 4,7\,m/s$

3.) $\mu = 0{,}0250\ kg/m$

$v_T = 75{,}0\ m/s$

$m_1, m_2 = ?$



$$v_T = \sqrt{\frac{F}{\mu}} \Rightarrow F = v_T^2 \cdot \mu$$

m_1: $F - m_1 g \sin\alpha = 0$

m_2: $m_2 g - F = 0$

$$m_2 g = F$$

$$m_2 = \frac{F}{g} = \frac{v_T^2 \cdot \mu}{g} = 14{,}3\ kg$$

$$F = m_1 g \sin\alpha$$

$$m_1 = \frac{F}{g \sin\alpha} = \frac{\mu \cdot v_T^2}{g \sin\alpha} = 28{,}7\ kg$$

4.) $y = 0{,}012 m \sin(25t - 2{,}0x)$

$\mu = 16{,}0\ g/m = 16{,}0 \cdot 10^{-3}\ kg/m$

$F = ?$

$$v = \sqrt{\frac{F}{\mu}} \Rightarrow F = v^2 \cdot \mu = \lambda^2 f^2 \cdot \mu = 2{,}5\ N$$

$$v = \lambda \cdot f$$

$$25 = 2\pi f \Rightarrow f = \frac{25}{2\pi} = 3{,}98\ Hz$$

$$2{,}0 = \frac{2\pi}{\lambda} \Rightarrow \lambda = \frac{2\pi}{2{,}0} = 3{,}14\ m$$

5.) $Y = 2{,}0 \cdot 10^{11}\ N/m^2$

$\rho = 7860\ kg/m^3$

$t = 20°C$

$v_{zrak} = 343\ m/s$

$v = \sqrt{\frac{Y}{\rho}} = 5{,}0 \cdot 10^3\ m/s$

$\frac{v_{TRAČNICE}}{v_{zrak}} = \frac{5{,}0 \cdot 10^3}{343} = \underline{15}$

6.) $t = 0{,}110\ s$

$t_{emp} = 20°C$

$d_{voda} = ?$

$d_{zrak} = 10\ m$

$v_{voda} = 1482\ m/s$

- put v zraku je $2d_{zrak} = v_{zrak} t_{zrak}$
- put v vodi je $2d_{voda} = v_{voda} t_{voda}$

$$d_{voda} = \frac{v_{voda} \cdot t_{voda}}{2} = \frac{v_{voda} \cdot (t - t_{zrak})}{2}$$

$$= \frac{v_{voda}}{2} \cdot \left(t - \frac{2d_{zrak}}{v_{zrak}}\right) = \frac{1482}{2} \cdot \left(0{,}110 - \frac{20}{343}\right)$$

$d_{voda} = \underline{38\ m}$

7.) $v_{Ne} = 2 v_{Kr}$

$T_{Kr} = 293\ K$

$T_{Ne} = ?$

$v_{PLIN} = \sqrt{\frac{\gamma k T}{m}}$

$\gamma = \frac{c_p}{c_v}$ (količnik za monoatomne plinove)

k - Boltzmannova konst. Γ adijabatska konst.

$$\sqrt{\frac{\gamma k T_{Ne}}{m_{Ne}}} = 2\sqrt{\frac{\gamma k T_{Kr}}{m_{Kr}}} \Rightarrow T_{Ne} = 4 \cdot \frac{T_{Kr}\, m_{Ne}}{m_{Kr}} =$$

$$= 4 \cdot \frac{293 \cdot 20{,}2}{83{,}8} = \underline{283\ K}$$

8.) $D = 1{,}50\,m$

$v = 343\,m/s$

$\Delta t = 1{,}46\,ms$

$L_1, L_2 = ?$

$L_2 - L_1 = v t_2 - v t_1 = v \cdot \Delta t$

$L_2^2 = D^2 + L_1^2$

$L_2 = v \cdot \Delta t + L_1$

$(L_1 + v \cdot \Delta t)^2 = D^2 + L_1^2$

$L_1^2 + 2 L_1 v \Delta t + (v \Delta t)^2 = D^2 + L_1^2$

$2 L_1 v \Delta t + (v \Delta t)^2 = D^2$

$L_1 = \frac{D^2 - (v \Delta t)^2}{2 v \Delta t} = \underline{2{,}00\,m}$

$L_2 = v \Delta t + L_1 = \underline{2{,}50\,m}$

9.) $r_1 = 3{,}8\,m$

$I_{r_1} = 3{,}6 \cdot 10^{-2}\,W/m^2$

$P = ?$

$I = \frac{P}{A} = \frac{P}{4\pi r^2} \Rightarrow$

$P = I \cdot 4\pi r^2 = \underline{6{,}5\,W}$

10.) $P = 2{,}3\,W$

$r_A = 0{,}60\,m$

$r_B = 0{,}80\,m$

a) $I_1, I_2, I_3 = ?$

b) $P_1 = 1{,}8\,\mu W \Rightarrow S_1, S_2, S_3 = ?$

$I = \frac{P}{4\pi r^2}$

a) $I_1 = I_2 = I_A = \frac{P}{4\pi r_A^2} = \underline{0{,}51\,W/m^2}$

$I_3 = I_B = \frac{P}{4\pi r_B^2} = \underline{0{,}29\,W/m^2}$

b) $I = \frac{P}{S} \Rightarrow S_1 = \frac{P_1}{I} = 3{,}5 \cdot 10^{-3}\,m^2 = S_2$

$S_3 = 6{,}2 \cdot 10^{-3}\,m^2,$

11.) $S = 2,2 \cdot 10^{-2}\ m^2$

$m = 0,35\ kg$

$c = 3200\ J/kg \cdot K$

$t = 8,0\ min$

$\Delta T = 72°C = 72\ K$

$I = ?$

$$I = \frac{P}{S} = \frac{\frac{Q}{t}}{S} = \frac{Q}{t \cdot S}$$

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

$$I = \frac{m \cdot c \cdot \Delta T}{t \cdot S} = 2,6\ kW/m^2$$

12.) $S = 1,1\ m \times 0,75\ m$

$L = 95\ dB = \beta$

$E = ?$

$$P = \frac{E}{t} \Rightarrow E = P \cdot t$$

$$I = \frac{P}{S} \Rightarrow P = I \cdot S$$

$t = 1h = 1 \cdot 60 \cdot 60 = 3600\ s$

$E = I \cdot S \cdot t$

$$\beta = 10\,dB \log \frac{I}{I_0}, \quad I_0 = 10^{-12}\ W/m^2$$ (intenzitet zvuka na pragu čujnosti)

$$95 = 10 \log \frac{I}{10^{-12}}$$

$$9,5 = \log \frac{I}{10^{-12}}$$

$$10^{9,5} = \frac{I}{10^{-12}} \Rightarrow I = 10^{9,5} \cdot 10^{-12}$$

$$I = 10^{-2,5} \Rightarrow I = 9,39\ J$$

13.) $t = 9{,}0\,h = 9 \cdot 3600\,s$

$\beta = 90{,}0\,dB$

$S = 2{,}0 \cdot 10^{-4}\,m^2$

$E = ?$

$P = \frac{E}{t} \Rightarrow E = P \cdot t$

$I = \frac{P}{S} \Rightarrow P = I \cdot S$

$E = I \cdot S \cdot t = 6{,}48 \cdot 10^{-3}\,J$

$\beta = 10 \log \frac{I}{10^{-12}}$

$90 = 10 \log \frac{I}{10^{-12}}$

$9 = \log \frac{I}{10^{-12}}$

$10^9 = \frac{I}{10^{-12}} \Rightarrow I = 10^{-3}\,W/m^2$

14.) 15.)

$$f_{PROM} = f_{IZVOR} \cdot \left(\frac{1 \pm \frac{v_{PROM}}{v_{ZVUK}}}{1 \mp \frac{v_{IZVOR}}{v_{ZVUK}}} \right)$$

16.) $y_1 = 24{,}0\,mm \sin(9\pi t - 1{,}25\pi x)$

$y_2 = 35{,}0\,mm \sin(2{,}8\pi t + 0{,}400\pi x)$

$t = 4{,}00\,s$

a) $x = 2{,}16\,m$

b) $x = 2{,}56\,m$

a) $y = y_1 + y_2 =$ (obacimo u svaki zagradi)

$= +13{,}3\,mm$

b) $y = y_1 + y_2 = +48{,}8\,mm$

17.) $l_1 = 50,5\,m$
$l_2 = 26,0\,m$
$v_z = 343\,m/s$

$f_1, f_2 = ?$

konstruktivna interf.

$l_1 - l_2 = n \cdot \lambda$ (razlika u hodu geometrijskih valova)

$l_1 - l_2 = 50,5 - 26 = 24,5\,m = n \cdot \lambda$

$v = \lambda \cdot f \Rightarrow \lambda = \frac{v}{f}$

najkraći zvuk

$24,5 = n \cdot \frac{v}{f} \Rightarrow f = \frac{6 \cdot v}{24,5}$

$n = 1 \Rightarrow f = 14\,Hz$
$n = 2 \Rightarrow f = 28\,Hz$
$n = 3 \Rightarrow f = 42\,Hz$

18.) $T_1 = 273\,K \Rightarrow \vartheta_1 = 15,0°$
$T_2 = 311\,K \Rightarrow \vartheta_2 = ?$

D - širina pukotine

$\sin\vartheta = \frac{\lambda}{D} = \frac{\frac{v}{f}}{D} = \frac{v}{f \cdot D}$

NE

- ako je zrak idealni plin: $v = \sqrt{\frac{\gamma kT}{m}}$

$\sin\vartheta = \frac{1}{fD} \cdot \sqrt{\frac{\gamma kT}{m}}$

$\frac{\sin\vartheta_1}{\sin\vartheta_2} = \frac{\frac{1}{fD}\sqrt{\frac{\gamma kT_1}{m}}}{\frac{1}{fD}\sqrt{\frac{\gamma kT_2}{m}}} = \sqrt{\frac{T_1}{T_2}} \Rightarrow \sin\vartheta_1 = \sin\vartheta_2 \sqrt{\frac{T_1}{T_2}}$

$\sin\vartheta_1 = 0,276$
$\Rightarrow \vartheta = 16,0°$

19.] $f = 3{,}00\,kHz$

$2r = 0{,}175\,m$

$t_1 = 0°C \Rightarrow v_{z_1} = 331\,m/s$

$t_2 = 29°C$

$\Delta\vartheta = ?$

$$v_{zvuk_2} = v_0\sqrt{\frac{T_2}{T_1}}$$

$$v_2 = 331 \cdot \sqrt{\frac{302}{273}} = 348\,m/s$$

$$\sin\vartheta = 1{,}22\,\frac{\lambda}{D}$$

za zvučne

$$\lambda_1 = \frac{v_1}{f} = \frac{331}{3000} = 0{,}1103\,m$$

$$\sin\vartheta_1 = 1{,}22 \cdot \frac{\lambda_1}{D} \Rightarrow$$

$$\vartheta_1 = 50{,}3°$$

$$\lambda_2 = \frac{v_2}{f} = 0{,}116\,m$$

$$\sin\vartheta_2 = 1{,}22 \cdot \frac{\lambda_2}{D}$$

$$\vartheta_2 = 54{,}0°$$

RE

$$\Delta\vartheta = \underline{3{,}7°}$$

20.] $T_1 = 0{,}020\,s \Rightarrow f_1 = \frac{1}{T_1} = 50\,Hz$

$T_2 = 0{,}024\,s \Rightarrow f_2 = \frac{1}{T_2} = 42\,Hz$

$\Delta f = f_{UDAR} = ?$

$$\Delta f = f_1 - f_2 = \underline{8\,Hz}$$

21.] $f_1 = 70\,kHz$

$f_{2min}, f_{2max} = ?$

① ② $20 - 20\,000$

① $f > 70\,kHz \quad f_{UDAR} = f - f_1$

$f_{UDAR} = 20\,kHz \Rightarrow f = 90\,kHz$

$f < 70\,kHz \quad f_{UDAR} = f_1 - f \Rightarrow$

① $f > 20kHz \Rightarrow f_{UDAR} = f - f_1 \Rightarrow f = 20020 Hz$

$f < 20kHz \Rightarrow f_{UDAR} = f_1 - f \Rightarrow f = 69980 Hz$

$f_{2min} = \underline{50kHz}$, $f_{2max} = \underline{90kHz}$

22. $f_s = 395 Hz$

$v_s = 12,0 m/s$

$v_1 = 0$

$v_2 = 343 m/s$

$f_{UDAR} = ?$

$f_{UDAR} = f_0 - f_s$

$f_s = f_0 \left(1 - \frac{v_s}{v}\right)$

$f_{UDAR} = f_s \frac{1}{1 - \frac{v_s}{v}} - f_s =$

$= f_s \left(\frac{1}{1 - \frac{v_s}{v}} - 1\right) = \underline{14 Hz}$

23. $\mu = 8,5 \cdot 10^{-3} kg/m$

$F = 280N$

$\ell = 1,8m$

$v, f, \lambda = ?$

a) $v = \sqrt{\frac{F}{\mu}} = 180 m/s$

b) $\lambda = \frac{2}{3}\ell = 1,2m$

c) $v = \lambda \cdot f \Rightarrow f = \frac{v}{\lambda} = 150 Hz$