

1. Krajišče napete vrvice niha s frekvenco 2 Hz in amplitudo 0,5 cm. Val, ki potuje po vrvici, naredi v 1 sekundi 4 metre dolgo pot, pri čemer lahko odkim posameznega dela vrvice zapišemo z naslednjo enačbo:  $u = u_0 \sin(\omega t - kx)$ . Kolikšne so konstante  $u_0$ ,  $\omega$  in  $k$ ?

$\lambda = 2 \cdot 0,5 = 1 \text{ m}$   
 $\omega = 2\pi \cdot 2 = 4\pi$   
 $u_0 = 0,005 \text{ m}$   
 $v = c \cdot t = 4 \text{ m}$   
 $t = \frac{\Delta}{c}$

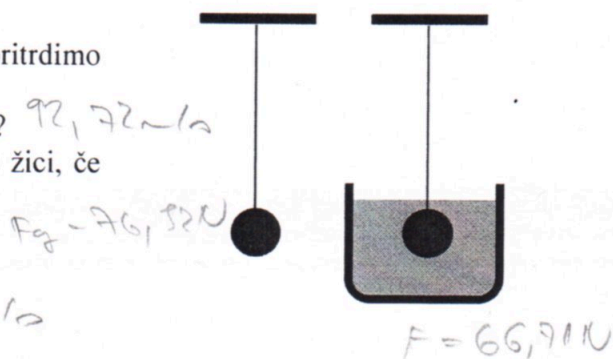
2. Železničar stoji ob progi. V razdalji 500 m od njega nekdo močno udari po tračnici. Koliko časa prej bo železničar zaslišal zvok od udarca, ki je pripotoval po tračnici, od tistega, ki je pripotoval po zraku? Gostota železa je  $7,8 \text{ g/cm}^3$ , prožnostni modul  $2,1 \cdot 10^{11} \text{ N/m}^2$ , temperatura zraka pa  $25^\circ \text{C}$ .

$c_2 = 3430 \text{ m/s}$   
 $c_{\text{zraka}} = 331,7 \text{ m/s}$   
 $\Delta t = 1,36 \text{ s}$   
 $t_1 = 1,460$   
 $t_2 = 0,960$

3. Železno kroglo s prostornino  $1 \text{ dm}^3$  in gostoto  $7,8 \text{ g/cm}^3$  pritrdimo na bakreno žico s presekom  $1 \text{ mm}^2$  in gostoto  $8,9 \text{ g/cm}^3$ .

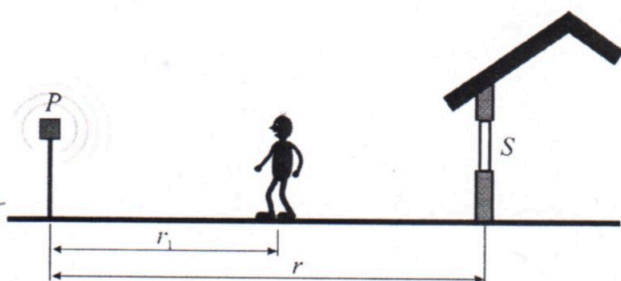
- a) Kolikšna je hitrost transversalnih valov po bakreni žici?  
 b) Za koliko se spremeni hitrost transversalnih valov po žici, če kroglo potopimo v vodo?

$c_2 = 861,58 \text{ m/s}$



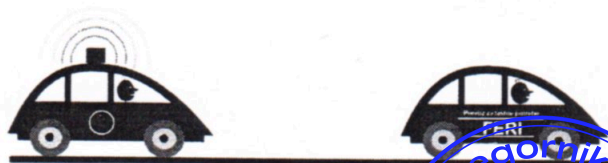
4. Na razdalji  $r=100 \text{ m}$  od hiše se nahaja sirena, ki oddaja zvok v vse smeri. Na razdalji  $r_1=50 \text{ m}$  od sirene je glasnost  $80 \text{ db}$ . Absorpcijo zvoka v zraku zanemarimo.

- a) Kolikšna je gostota zvočnega toka na razdalji  $r_1=50 \text{ m}$  od sirene?  
 b) Kolikšno zvočno moč oddaja zvočnik?  
 c) Kolikšna je gostota zvočnega toka ob hiši?  
 d) Kolikšna zvočna moč prehaja skozi okno v hišo, če je površina okna  $S=2 \text{ m}^2$ ?



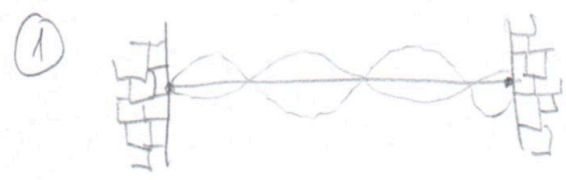
5. Rešilni avtomobil se nam približuje s hitrostjo  $144 \text{ km/h}$ . Vključeno ima sireno, ki oddaja ton s frekvenco  $\nu_0=440 \text{ Hz}$ . Hitrost zvoka v zraku je  $c=340 \text{ m/s}$ .

- a) Kolikšno frekvenco slišimo, če stojimo na mestu?  
 b) Kolikšno frekvenco slišimo, če se peljemo pred rešilnim avtomobilom s hitrostjo  $72 \text{ km/h}$  v isto smer?



$\nu_a = 498,67 \text{ Hz}$   
 $\nu_b = 469,33 \text{ Hz}$





$$u = u_0 \cdot \sin(\omega t - kx)$$

$$v = 2 \text{ Hz}$$

$$u_0 = 0,5 \text{ cm} = 0,005 \text{ m} = \omega_0$$

$$v_0 = 4 \text{ m/s}$$

$$\omega = 2\pi v = 2\pi \cdot 2 \text{ s}^{-1} = \underline{4\pi \text{ s}^{-1}}$$

$$k = \frac{2\pi}{\lambda}$$

$$c = \lambda \cdot v$$

$$\lambda = \frac{v}{v} = \frac{4 \text{ m/s}}{2 \text{ s}^{-1}} = \underline{2 \text{ m}}$$

$$k = \frac{2\pi}{2 \text{ m}} = \underline{1\pi \text{ m}^{-1}}$$

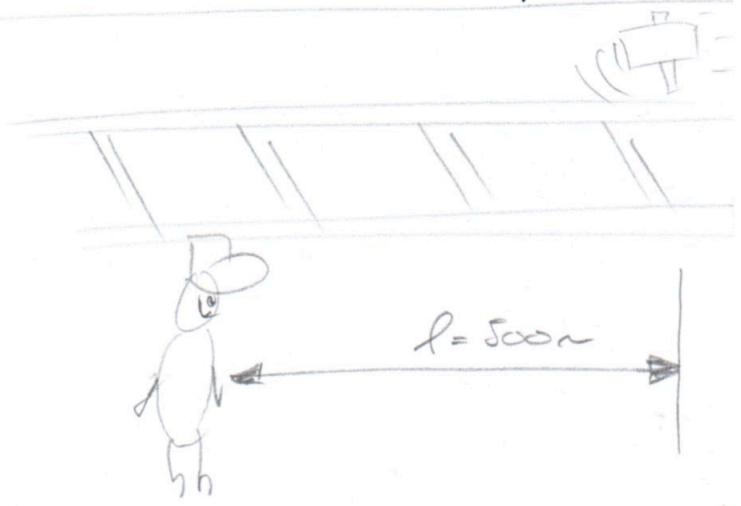
②

$$l = 500 \text{ m}$$

$$\rho_z = 7,8 \text{ g/cm}^3 = 7800 \text{ kg/m}^3$$

$$E = 2,1 \cdot 10^{11} \text{ N/m}^2$$

$$T = 25^\circ \text{C} = 298,15 \text{ K}$$



$\Delta t = ?$

$$c_z = \sqrt{\frac{\gamma R T}{M}} = \sqrt{\frac{1,4 \cdot 8,315 \cdot 298,15}{29}} = \underline{345,95 \text{ m/s}}$$

$$c_{\check{z}e} = \sqrt{\frac{E}{\rho}} = \sqrt{\frac{2,1 \cdot 10^{11}}{7800}} = \underline{5188,75 \text{ m/s}}$$

$$l = c \cdot t$$

$$t = \frac{l}{c}$$

$$t_z = \frac{500 \text{ m}}{345,95} = \underline{1,45 \text{ s}}$$

$$t_{\check{z}e} = \frac{500}{5188,75} = 9,64 \cdot 10^{-2} \text{ s}$$

$\left. \begin{matrix} \Delta t \\ \Delta t \end{matrix} \right\} \begin{matrix} t_2 - t_1 \\ \Delta t \end{matrix}$

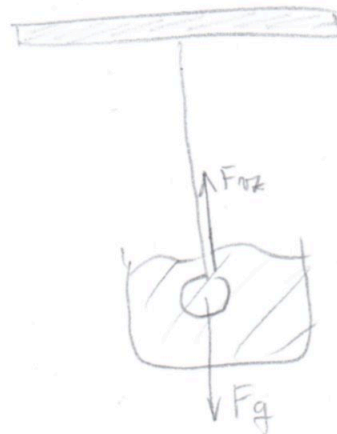
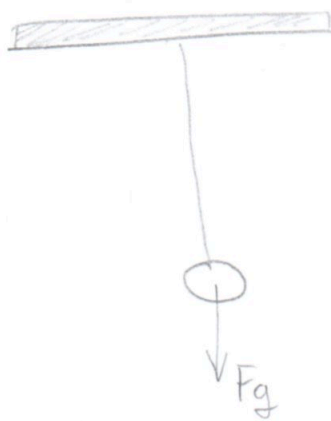
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$$V_k = 1 \text{ dm}^3 = 1 \cdot 10^{-3} \text{ m}^3$$

$$\rho_k = 7,8 \text{ g/cm}^3 = 7800 \text{ kg/m}^3$$

$$S = 1 \text{ cm}^2 = 1 \cdot 10^{-6} \text{ m}^2$$

$$\rho_z = 8,9 \text{ g/cm}^3 = 8900 \text{ kg/m}^3$$



$$F_1 = F_g = V_k \cdot \rho_k \cdot g$$

$$F_g = 1 \cdot 10^{-3} \cdot 7800 \cdot 9,81$$

$$F_g = \underline{\underline{76,52 \text{ N}}}$$

$$F_2 = F_g - F_{Uz}$$

$$F_{Uz} = \rho_{\text{liquid}} \cdot V_k \cdot g$$

$$F_2 = 76,52 - 1000 \cdot 1 \cdot 10^{-3} \cdot 9,81$$

$$F_2 = \underline{\underline{66,71 \text{ N}}}$$

a)  $c = ?$ 

$$c = \sqrt{\frac{F}{\rho S}} = \sqrt{\frac{76,52}{8900 \cdot 1 \cdot 10^{-6}}}$$

$$c_1 = \underline{\underline{92,72 \text{ m/s}}}$$

b)

 $\Delta c = ?$ 

$$c_2 = \sqrt{\frac{F_2}{\rho S}} = \sqrt{\frac{66,71}{8900 \cdot 1 \cdot 10^{-6}}} = \underline{\underline{86,58 \text{ m/s}}}$$

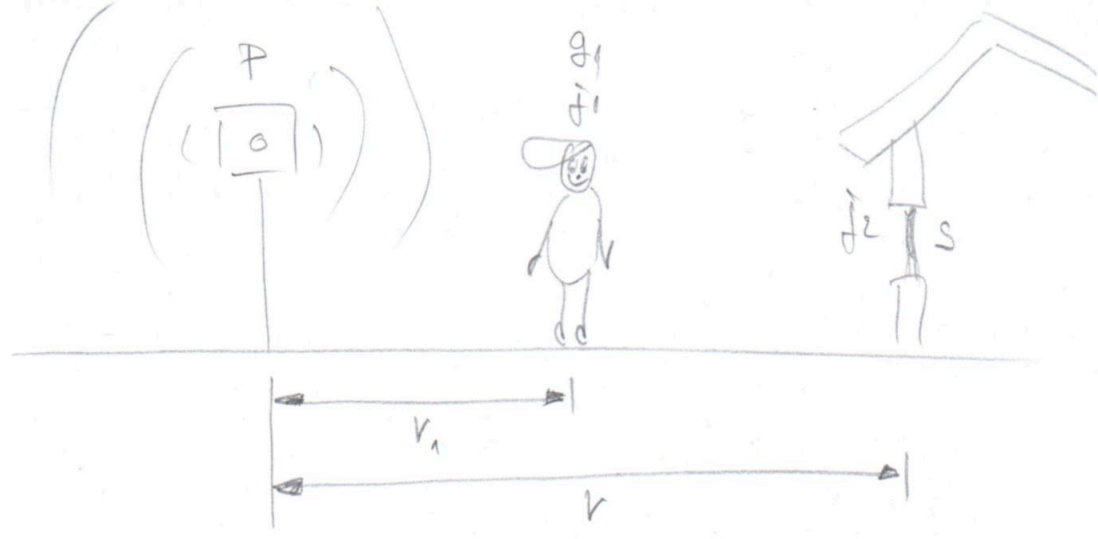
$$\Delta c = c_1 - c_2$$

$$\Delta c = 92,72 - 86,58 = \underline{\underline{6,15 \text{ m/s}}}$$



4

$v = 100 \text{ m}$   
 $v_1 = 50 \text{ m}$   
 $g_1 = 80 \text{ dB}$



a)  $j_1 = ?$

$$g_1 = 10 \log \frac{j_1}{j_0} \Rightarrow j_1 = j_0 \cdot 10^{\frac{g_1}{10}}$$

$$j_1 = 1 \cdot 10^{-12} \cdot 10^{\frac{80}{10}} = \boxed{1 \cdot 10^{-4} \text{ W/m}^2}$$

b)  $P = ?$

$$j_1 = \frac{P}{4\pi v_1^2} \Rightarrow P = j_1 \cdot 4\pi v_1^2$$

$$P = 1 \cdot 10^{-4} \cdot 4\pi \cdot 50^2$$

$$P = \boxed{\frac{3,14 \text{ W}}{(\pi)}}$$

e)  $j_2 = ?$

$$j_2 = \frac{P}{4\pi v_2^2} = \frac{3,14 \text{ W}}{4\pi \cdot 100^2} = \boxed{2,5 \cdot 10^{-5} \text{ W/m}^2}$$

d)  $P_{\text{okras}} = ?$

$$j_2 = 2,5 \cdot 10^{-5} \text{ W/m}^2$$

$$S = 2 \text{ m}^2$$

$$P_{\text{okras}} = j_2 \cdot S = 2,5 \cdot 10^{-5} \cdot 2 = 5 \cdot 10^{-5} \text{ W}$$

$$P_{\text{okras}} = \boxed{5 \cdot 10^{-5} \text{ W}}$$





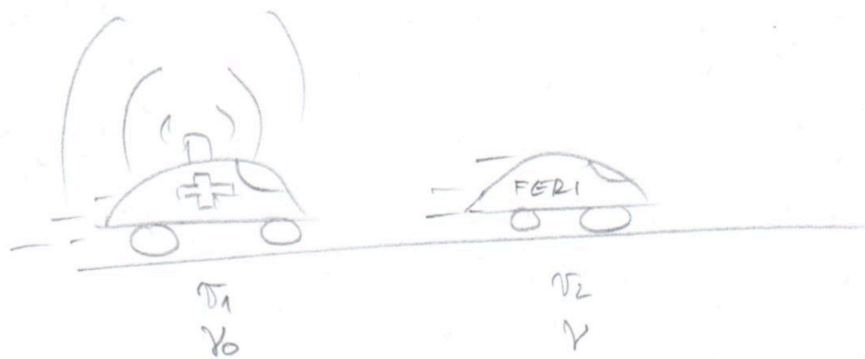
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$$v_1 = 144 \text{ km/h} = 40 \text{ m/s}$$

$$v_2 = 72 \text{ km/h} = 20 \text{ m/s}$$

$$v_0 = 440 \text{ Hz}$$

$$c = 340 \text{ m/s}$$



a)

$$v_2 = \emptyset$$

$$v = ?$$

$$v = \frac{v_0}{1 - \frac{v_1}{c}} = \frac{440 \text{ Hz}}{1 - \frac{40}{340}} = \boxed{498,67 \text{ Hz}}$$

b)

$$v = v_0 \frac{(1 - \frac{v_2}{c})}{1 - \frac{v_1}{c}} = 440 \cdot \frac{1 - \frac{20}{340}}{1 - \frac{40}{340}} = \boxed{469,34 \text{ Hz}}$$