1. $\nu = \frac{c}{\lambda} = 50\,Hz$ (5) (1) (1); Valovni vektor: $k = \frac{2\pi}{\lambda} = 20{,}94\,m^{-1}$ (5) (1) (1)

$$y(x,t) = y_0 \cos(kx - \omega t) = 0{,}02\,m \cdot \cos(20{,}94\,m^{-1} \cdot 0{,}14\,m - 2\pi \cdot 50\,s^{-1} \cdot 0{,}2\,s)$$

(6) (2) $\in \mathbb{Z}$

obrnjen predznak (-2)

sin namesto cos (-4) ← brez $\delta = \frac{\pi}{2}$

$= (-)\,0{,}0196\,m$ (3)

narobe predznak (-2)

2) a) $R_{45} = \left(\frac{1}{R_4} + \frac{1}{R_5}\right)^{-1} = 2{,}1\,\Omega$ (2)

$R_{345} = R_3 + R_{45} = 4{,}1\,\Omega$ (2)

$R_{2345} = 2{,}25\,\Omega$ (2)

$R_{12345} = 3{,}25\,\Omega$ (2)

b) $I = \frac{U}{R_{12345}} = 1{,}54\,A$ (2)

c) $U_2 = U_0 - U_1$ (1)

$U_1 = R_1 I_1$ (1)

$U_2 = U_0 - R_1 I_1 = 3{,}46\,V$ (1)

– $I_2 = \frac{U_2}{R_2} = 0{,}69\,A$ (2) $P_2 = I_2 U_2 = 2{,}39\,W$ (2)

ali

– $P_2 = \frac{U_2^2}{R} = 2{,}39\,W$

d) $I_3 = I_1 - I_2 = 0{,}85\,A$ (2)

$U_3 = I_3 R_3 = 1{,}70\,V$ (2)

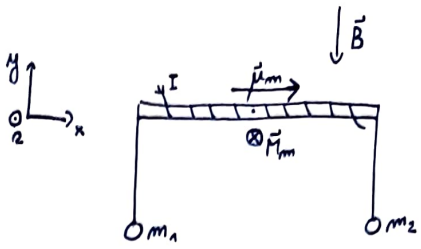
$U_4 = U_5 = U_0 - U_1 - U_3 = 1{,}76\,V$ (2)

$P_4 = \frac{U_4^2}{R} = 1{,}03\,W$ (2) (1,04 W, če je bilo drugače zaokroženo)

3. TULJAVA IMA MAGNETNI DIPOLNI MOMENT

$$\vec{\mu}_m = NI\vec{S} \quad (3)$$

↳ SMER DOLOČIMO S PRAVILOM DESNE ROKE IZ SMERI TOKA



NA $\vec{\mu}_m$ V ZUNANJEM $\vec{B}$ DELUJE NAVOR

$$\vec{M}_m = \vec{\mu}_m \times \vec{B} \xrightarrow{(3)} |\vec{M}_m| = |\vec{\mu}_m||\vec{B}| = NISB$$

$\vec{\mu}_m \perp \vec{B}$

$S = \pi r^2$ (1)

TEHTNICA MIRUJE KO VELJA

$$\sum \vec{M} = 0 \quad (4)$$

↳ x-SMER:

$$M_{1,x} + M_{2,x} + M_{m,x} = 0$$

$$|\vec{F}_{g,1}|\frac{\ell}{2} - |\vec{F}_{g,2}|\frac{\ell}{2} - NISB = 0$$

$$m_1 g \frac{\ell}{2} - m_2 g \frac{\ell}{2} - NISB = 0$$

(3) $$(m_1 - m_2) g \frac{\ell}{2} = NISB$$

(3) $$m_1 - m_2 = \frac{2NISB}{g\ell} = 0{,}2\,g \quad (1)$$

↓

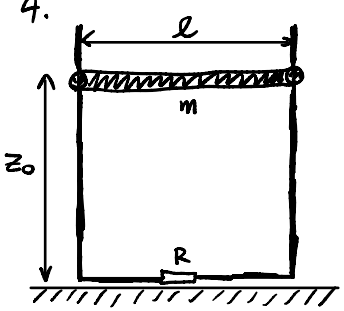
ČE PRAVILNO POSTAVIMO $M_{m,x}$: IZ PREDZNAKA REZULTATA RAZBEREMO, DA JE m_1 TEŽJA. (1)

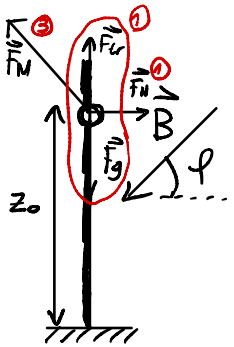
SICER LAHKO IZ SMERI NAVORA $\vec{M}_m$ ARGUMENTIRAMO, DA TEHTNICO OBRAČA "V SMERI UTEŽI m_2", KAR MORA m_1 KOMPENZIRATI.

↓ RAZLAGA (6)

LAHKO TUDI ARGUMENT PREKO $W_m = -\vec{\mu}_m \cdot \vec{B}$, KJER $\vec{M}_m$ ŽELI MINIMIZIRATI ENERGIJO.

4.





Podan $m, B, z_0, l, k_{tr}, \varphi = 45°$

$t = ?$ da pade na tla

$\Sigma F_i = 0$

(skica lahko manjka, če sile ok)

V z smeri: $F_g = F_{tr} + F_m \sin\varphi$ ④ $\quad F_{tr} = k_e F_N = k_e F_m \cos\varphi$

V x smeri: $F_N = F_m \cos\varphi$ ④

(1, če je sin) ②

$\phi_m = \vec{B}\cdot\vec{S} = BS(t)\cos\varphi = Bl(z_0 - vt)\cos\varphi$ ②

$I = \frac{U_i}{R} = \frac{1}{R}\frac{d\phi_m}{dt} = -\frac{Blv}{R}\cos\varphi$ ②

$F_m = -IBl = +\frac{B^2l^2v}{R}\cos\varphi$ ①

z: $mg = k_e F_m \cos\varphi + F_m \sin\varphi$

$\hookrightarrow F_m = \frac{mg}{k_e\cos\varphi + \sin\varphi}$ ①

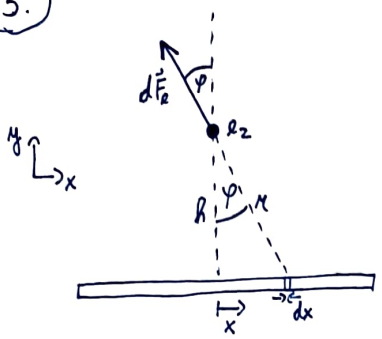
$\frac{B^2l^2v}{R}\cos\varphi = \frac{mg}{k_e\cos\varphi + \sin\varphi}$ ①

$v = \frac{Rmg}{B^2l^2\cos\varphi(k_e\cos\varphi + \sin\varphi)}$ ①

$v = \frac{1{,}5\,\Omega \cdot 0{,}2\,kg \cdot 9{,}81\,\frac{m}{s^2}}{0{,}5^2T^2 \cdot 3^2m^2 \cdot \frac{\sqrt{2}}{2}\left(0{,}2\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}\right)} = 2{,}18\,\frac{m}{s}$

$t = \frac{z_0}{v} = \frac{3}{2{,}18}\,s = 1{,}38\,s$ ①

5.



ZARADI SIMETRIJE BO $F_{e,x} = 0$.

$$|d\vec{F}_e| = \frac{Q_2\, dQ_1}{4\pi\varepsilon_0 r^2} \quad (3) \qquad \frac{Q_1 Q_2}{4\pi\varepsilon_0 r^2}\ (0)\ \text{NI PRAVILNO!}$$

$$\Rightarrow \quad dF_{e,y} = \frac{Q_2\, dQ_1}{4\pi\varepsilon_0 r^2}\cos\varphi \quad (3)$$

$$dQ_1 = \lambda\, dx \quad (3)$$

$$\lambda = \frac{Q_1}{L} \rightarrow \left(\text{ravno ta en. } (1)\right)$$

$$r^2 = R^2 + x^2$$

$$\cos\varphi = \frac{R}{r}$$

$$dF_{e,y} = \frac{Q_2 \lambda\, dx}{4\pi\varepsilon_0 (R^2+x^2)} \frac{R}{\sqrt{R^2+x^2}}$$

$$dF_{e,y} = \frac{Q_2 \lambda R}{4\pi\varepsilon_0} \frac{dx}{(R^2+x^2)^{3/2}}$$

$$\int_0^{F_{e,y}} dF_{e,y} = \frac{Q_2 \lambda R}{4\pi\varepsilon_0} \int_{-\frac{L}{2}}^{\frac{L}{2}} \frac{dx}{(R^2+x^2)^{3/2}} \quad (6)$$

$$F_{e,y} = \frac{Q_2 \lambda R}{4\pi\varepsilon_0} \left(\frac{x}{R^2\sqrt{R^2+x^2}} \right) \Bigg|_{-\frac{L}{2}}^{\frac{L}{2}} \quad (2)$$

$$F_{e,y} = \frac{Q_2 \lambda \cancel{R}}{4\pi\varepsilon_0} \cdot \cancel{2} \frac{L}{\cancel{2} R^{\cancel{2}} \sqrt{R^2 + \frac{L^2}{4}}}$$

$$\lambda L = Q_1$$

$$F_{e,y} = \frac{Q_1 Q_2}{4\pi\varepsilon_0 R \sqrt{R^2 + \frac{L^2}{4}}} \quad (2)$$

KROGLICA MIRUJE:

$$\sum \vec{F} = 0 \quad (1)$$

y: $\quad F_{e,y} - mg = 0 \quad (1)$

$$\frac{Q_1 Q_2}{4\pi\varepsilon_0 R \sqrt{R^2 + \frac{L^2}{4}}} = mg \quad \leftarrow R = ?$$

$$R\sqrt{R^2 + \frac{L^2}{4}} = \frac{Q_1 Q_2}{4\pi\varepsilon_0 mg}$$

$$R\sqrt{R^2 + B^2} = A \,/^2 \qquad A = \frac{Q_1 Q_2}{4\pi\varepsilon_0 mg}, \quad B = \frac{L}{2}$$

(pomožne spremenljivke za manj pisanja)

(1) $\quad R^2(R^2 + B^2) = A^2$

KVADRATNA ENAČBA $\rightarrow \quad R^4 + B^2 R^2 - A^2 = 0$

(1) $\quad R^2 = \dfrac{-B^2 \pm \sqrt{B^4 + 4A^2}}{2}$ $\leftarrow$ SMISELNA SAMO POZITIVNA REŠITEV z ⊕

$$\Rightarrow \quad R = \sqrt{-\frac{L^2}{8} + \frac{1}{2}\sqrt{\frac{L^4}{16} + \frac{1}{4}\left(\frac{Q_1 Q_2}{\pi\varepsilon_0 mg}\right)^2}} = 0{,}29\ \text{m}$$

(1) (1)