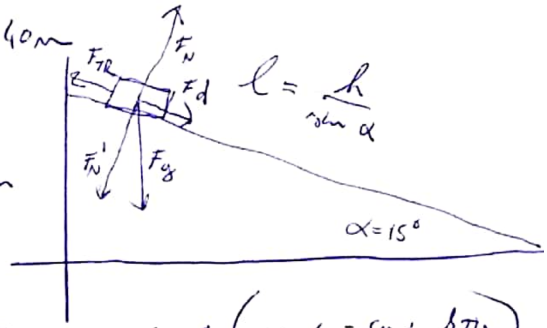
1) $m = 8\,kg$; $k_{tr} = 0{,}15$; $\alpha = 15°$; $h = 40\,m$



a) $t = ?$

$\sum \vec{F} = m\vec{a}$;

$$|\sum\vec{F}|_{\cancel{a}} = F_d - F_{tr} = F_g \sin\alpha - F_g \cos\alpha\, k_{tr} = mg(\sin\alpha - \cos\alpha\, k_{tr})$$

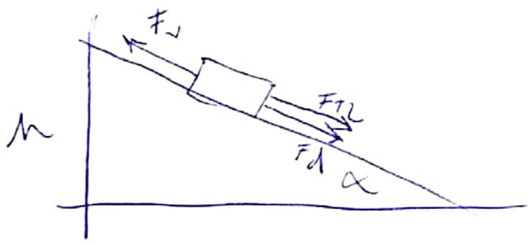
$$a = g(\sin\alpha - \cos\alpha\, k_{tr}) \approx 1{,}1\,m/s^2$$

$$v = \cancel{v_0} + at \quad ; \quad l = \cancel{l_0} + \frac{at^2}{2}$$

$$t^2 = \frac{2l}{a} \quad ; \quad t = \sqrt{\frac{2l}{a}} \approx \underline{16\,s}$$

$$v = at \approx \underline{18\,m/s}$$

b)



$$\frac{dv}{dt} = 0 \Rightarrow \sum\vec{F} = 0$$

$$\Rightarrow F_v = F_{tr} + F_d$$

$$= mg(\sin\alpha + \cos\alpha\, k_{tr})$$

$$\approx \underline{38\,N}$$

2. Sila na premikajoč nabit delec v magnetnem polju: $\vec{F} = e\vec{v} \times \vec{B}$

$\vec{v} \perp \vec{B}$

$|\vec{F}| = e|\vec{v}||\vec{B}|$

Pospešek (centripetalni) krožečega delca: $a = \frac{v^2}{r}$

$$F = evB = ma = m\frac{v^2}{r}$$

$$e\cancel{v}B = \frac{mv^{\cancel{2}}}{r}$$

$$reB = mv$$

$$e = \frac{mv}{Br} = \frac{10^{-9}\,\text{kg} \cdot 10^5\,\text{m/s}}{0{,}5\,\text{T} \cdot 0{,}15\,\text{m}} = \underline{\underline{1{,}3 \cdot 10^{-3}\,\text{As}}}$$

$$F_c = evB = 1{,}3 \cdot 10^{-3}\,\text{As} \cdot 10^5\,\text{m/s} \cdot 0{,}5\,\text{T} = \underline{\underline{66{,}7\,\text{N}}}$$

ALI:

$$F_c = \frac{v^2}{r}m = \frac{(10^5\,\text{m/s})^2 \cdot 10^{-9}\,\text{kg}}{0{,}15\,\text{m}} = 66{,}7\,\text{N}$$

Nabit delec, ki preleti potencial U ima energijo $W_p = Ue$

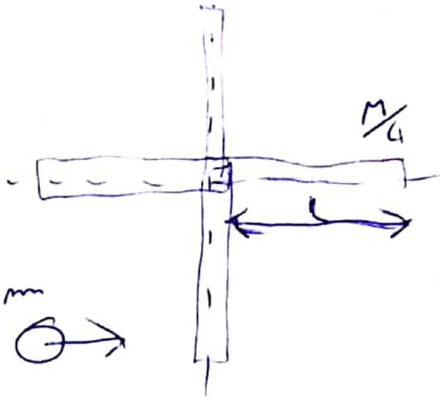
$$Ue = \frac{mv^2}{2} \Rightarrow U = \frac{mv^2}{2e} = \frac{10^{-9}\,\text{kg} \; 10^{10}\,\text{m}^2/\text{s}^2}{2 \cdot 1{,}3 \cdot 10^{-3}\,\text{As}} \doteq \underline{\underline{3{,}8 \cdot 10^3\,\text{V}}}$$

Date: No.

3)

a) PLASTELIN SE ZLEPI

$\Delta \vec{\Gamma} = 0$; $\Delta W \neq 0$! ...



$\vec{\Gamma}_z = \vec{\Gamma}_k$; $R m v_z = \omega_k (\Sigma J)$

$\Sigma J = 4 \cdot J_K + J_m =$

$= \cancel{4} \cdot \frac{\frac{M}{\cancel{4}} R^2}{3} + m R^2 = \frac{M R^2}{3} + m R^2$

$\cancel{R} m v_z = \omega_k R^{\cancel{2}} \left(\frac{M}{3} + m \right)$

$\omega_k = \frac{m v_z}{\frac{M}{3} + m} = \frac{v_z}{R} \frac{1}{\left(1 + \frac{M}{m3}\right)} = 4,8 \, s^{-1}$

$M = 0,8 \, kg$; $m = 0,2 \, kg$, $R = 0,5 \, m$; $v_z = 20 \, km/h = 5,55 \, m/s$

$v_k = 2 \, km/h = 0,55 \, m/s$

b) $\Delta \vec{\Gamma} = 0$ $\Delta W \neq 0$!

$\vec{\Gamma}_z = \vec{\Gamma}_k$ $R m v_z = \omega_k (\Sigma J) + R m (-v_k)$

$\omega_k = \frac{\cancel{R} m (v_z + v_k)}{\cancel{4} \cdot \frac{M}{\cancel{4}} \frac{R^{\cancel{2}}}{3}} = 3 \cdot \frac{m (v_z + v_k)}{M R} = 30,7 \, s^{-1}$

4. Napetost v prvem primeru je enaka napetosti v drugem primeru.

$$U_1 = U_2$$

$$Z_1 I_1 = Z_2 I_2$$

$$(R_1 + i\omega L) I_1 = (R_2 + i\omega L) I_2$$ / vzamemo absolutno vrednost enačbe

$$|R_1 + i\omega L||I_1| = |R_2 + i\omega L||I_2|$$

$$\sqrt{R_1^2 + (\omega L)^2}\, I_{10} = \sqrt{R_2^2 + (\omega L)^2}\, I_{20}$$ / kvadriramo

$$(R_1^2 + (\omega L)^2) I_{10}^2 = (R_2^2 + (\omega L)^2) I_{20}^2$$

$$R_1^2 I_{10}^2 + \omega^2 L^2 I_{10}^2 = R_2^2 I_{20}^2 + \omega^2 L^2 I_{20}^2$$

$$R_1^2 I_{10}^2 \cancel{+} - R_2^2 I_{20}^2 = \omega^2 L^2 I_{20}^2 - \omega^2 L^2 I_{10}^2$$

$$R_1 \text{ — '' — } = L^2 (\omega^2 I_{20}^2 - \omega^2 I_{10}^2)$$

$$L^2 = \frac{R_1^2 I_{10}^2 - R_2^2 I_{20}^2}{\omega^2 (I_{20}^2 - I_{10}^2)} =$$

tu lahko računamo kar z efektivnimi tokovi, ker se $\sqrt{2}$ krajšajo

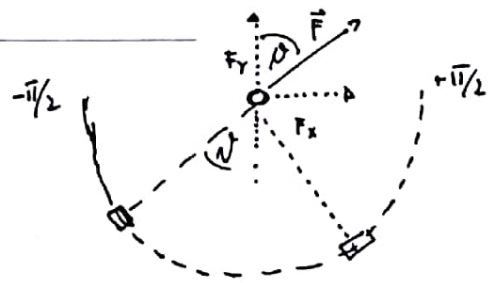
$$= \frac{(100\,\Omega \cdot 0{,}1\,A)^2 - (60\,\Omega \cdot 0{,}15\,A)^2}{(50\,Hz \cdot 2\pi)^2 ((0{,}15\,A)^2 - (0{,}1\,A)^2)} =$$

$$= \underline{\underline{0{,}12\,H}}$$

$$U_{10} = |Z_1| I_{10} = \sqrt{R_1^2 + (\omega L)^2}\, I_{10} = \sqrt{(100\,\Omega)^2 + (2 \cdot \pi \cdot 50\,Hz)^2 \cdot (0{,}12\,H)^2}\; 0{,}1\,A \cdot \sqrt{2} =$$

$$= \underline{\underline{15{,}1\,V}}$$

5. $\vec{F} = m\vec{a}$



Vsaka komponenta F_x se odšteje z enako veliko in nasprotno usmerjeno komponento $-F_x$, ki jo povzroča delček kroga na drugi strani. F_y se seštevajo.

$$F = \int_{-\pi/2}^{\pi/2} dF \cdot \cos\vartheta$$

Polkrog razdelimo na segmente s kotno velikostjo $d\vartheta$ (in dolžino $r\,d\vartheta$). Vsak tak segment deluje s silo $dF = \frac{1}{4\pi\varepsilon_0} \frac{e_1}{r} \cdot \frac{e_2}{\pi} d\vartheta$

e_1 je naboj delca, $e_2 \cdot \frac{d\vartheta}{\pi}$ pa je naboj segmenta polkroga.

$$F = \int_{-\pi/2}^{\pi/2} \frac{1}{4\pi\varepsilon_0} \frac{e_1}{r} \frac{e_2}{\pi} \cdot \cos\vartheta\, d\vartheta = \frac{e_1 e_2}{4\pi^2 \varepsilon_0 r} \int_{-\pi/2}^{\pi/2} \cos\vartheta\, d\vartheta = \frac{e_1 e_2}{4\pi^2 \varepsilon_0 r} \sin\vartheta \Big|_{-\pi/2}^{\pi/2} =$$

$$= \frac{e_1 e_2}{4\pi^2 \varepsilon_0 r} (1 + 1) = \underbrace{\frac{e_1 e_2}{4\pi \varepsilon_0 r}}_{\text{točkasti delec z nabojem } e_2} \underbrace{\frac{2}{\pi}}_{\text{faktor, ki ga dobimo pri polkrogu}} = 2{,}24 \cdot 10^{-3}\,\text{N}$$

$$a = \frac{F}{m} = \underline{\underline{0{,}75\ \text{m/s}^2}}$$

Končna hitrost je enaka začetni kinetični energiji. To hitrost doseže delec ko je od polkroga ~~oddaljen~~ neskončno oddaljen. Ker so vsi deli kroga od delca enako oddaljeni, integriranje ni potrebno. $W_p = \frac{1}{4\pi\varepsilon_0} \frac{e_1 e_2}{r}$

$$W_{pz} + W_{kz} = W_{pk} + W_{kk}$$

$$\frac{1}{4\pi\varepsilon_0} \frac{e_1 e_2}{r} + \emptyset = \emptyset + \frac{m v^2}{2} \Rightarrow v^k = \sqrt{\frac{1}{4\pi\varepsilon_0} \frac{e_1 e_2}{r} \cdot \frac{2}{m}} = \underline{\underline{0{,}182\ \text{m/s}}}$$