1. a) Pogoj za konst. interferenco: $d\sin\vartheta = m\lambda$ (5); $m \in \mathbb{Z}$

b) Prva ojačitev: $m = 1$ (3) $\Rightarrow \vartheta_1 = \arcsin\left(\frac{\lambda}{d}\right) = 0{,}0121°$ (2) (1)
ali 0,21 mrad
ak z - potem kot negativen

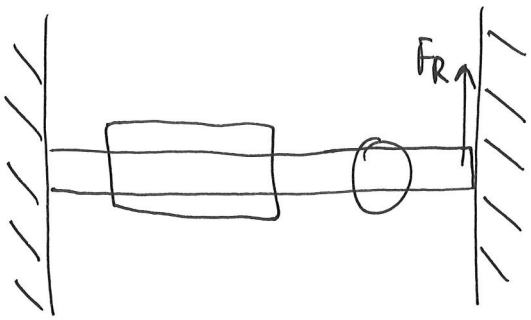
Odmik od sredine: $a_1 = L \cdot \tan\vartheta_1 = 6{,}34\ \mu m$ (4) (1)

c) Pogoj za max. kot: $\tan\vartheta_{max} = \frac{\frac{a}{2}}{L} \Rightarrow \vartheta_{max} = 59{,}036°$ (2) (1)

$m_{max} = \frac{d\sin\vartheta_{max}}{\lambda} = 4070{,}5 = 4070$ (2) (1) (1)
zadnjega ne vidimo

$N = 2 \cdot m_{max} + 1 = 8141$ (1) (1)
+ in −; $m = 0$

2)



Navori okoli levega pritrdišča.

$$F_R \cdot L = m_p \cdot g \cdot \frac{L}{2} + m_b\, g\left(a + \frac{b}{2}\right) + m_m (a+b+c)\, g$$

(2) (2) (2) (2)

$$F_R = 6{,}75\,N \quad (2)$$

$$F_L = g \cdot (m_p + m_b + m_m) - F_R = 8{,}45\,N \quad (2)$$

↑ možen tudi postopek z navori okoli desnega pritrdišča.

b)

$$J_p = \frac{1}{3} m_p L^2 \quad (2)$$

$$J_b = \underbrace{\frac{1}{12} m_b b^2}_{(2)} + \underbrace{m_b \left(a + \frac{b}{2}\right)^2}_{(2)}$$

$$J_m = m_m (a+b+c)^2 \quad (2)$$

$$J_{total} = J_p + J_b + J_m \quad (1)$$

$$M = J\alpha = F_R \cdot L \quad (2)$$

$$\alpha = \frac{F_R L}{J} = 12{,}87\,1/s^2 \quad (2)$$

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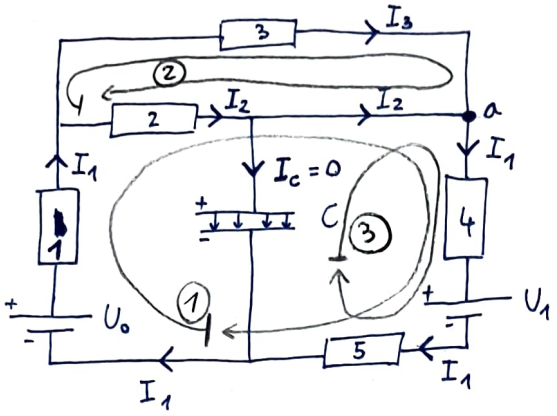
3.



KER VEZJE GLEDAMO PO DOLGEM ČASU JE C NABIT S KONSTANTNIM NABOJEM

$\Rightarrow I_c = 0$ (5)

$\Rightarrow$ TOKOVI V VEZJU SE POSLEDIČNO POENOSTAVIJO V SAMO 3 RAZLIČNE (I_1, I_2, I_3) (GLEJ SKICO)

KIRCHOFFOV ZAKON ZA ZANKO (1):

(3) $U_0 - R_1 I_1 - R_2 I_2 - R_4 I_1 - U_1 - R_5 I_1 = 0$

$U_0 - U_1 - I_1 (R_1 + R_4 + R_5) - R_2 I_2 = 0$

$I_2 = ?$

IZ TOČKE a:

(2) $I_1 = I_2 + I_3$ (1)

IZ ZANKE (2):

$-R_3 I_3 + R_2 I_2 = 0$

(2) $I_3 = I_2 \frac{R_2}{R_3}$

(1) $\Rightarrow I_1 = I_2 + I_2 \frac{R_2}{R_3}$

$I_2 = \frac{I_1}{1 + \frac{R_2}{R_3}}$ (2)

VSTAVIMO (2)

$U_0 - U_1 - I_1 (R_1 + R_4 + R_5) - I_1 \frac{R_2}{1 + \frac{R_2}{R_3}} = 0$

$\tilde{U} = 1\,V$ ↳ ZA MANJ PISANJA

$\frac{R_2}{1 + \frac{R_2}{R_3}} = \frac{1}{\frac{1}{R_2} + \frac{1}{R_3}}$

↓

NADOMESTNI UPOR R_{23}! (4)

↳ LAHKO BI TUDI UPOŠTEVALI ŽE PREJ

REŠEVANJE BREZ NADOMESTNEGA UPORA R_{23}:

$\tilde{U} - I_1 \frac{R_2}{1 + \frac{R_2}{R_3}} = 0$

$I_1 R_2 = \tilde{U} \left(1 + \frac{R_2}{R_3}\right)$

$R_2 \left(I_1 - \frac{\tilde{U}}{R_3}\right) = \tilde{U}$

$R_2 = \frac{\tilde{U}}{I_1 - \frac{\tilde{U}}{R_3}} = 6\,\Omega$ (2) (1)

REŠEVANJE Z NADOMESTNIM UPOROM R_{23}:

$I_1 R_{23} = \tilde{U}$

$R_{23} = \frac{\tilde{U}}{I_1} = 2\,\Omega$

$\frac{1}{R_2} = \frac{1}{R_{23}} - \frac{1}{R_3} \Rightarrow R_2 = 6\,\Omega$

b) IZ (2): $I_2 = \frac{I_1}{1 + \frac{R_2}{R_3}} = 0{,}167\ A$

$P_2 \overset{(3)}{=} R_2 I_2^2 = 0{,}167\ W$ (1)

ALI: $U_2 = U_{23} = R_{23} I_1 = \tilde{U} = 1\ V$

$P_2 \overset{(3)}{=} \frac{U_2^2}{R_2} = 0{,}167\ W$ (1)

c) ZANKA (3) NA SKICI:

$$\frac{e}{C} - I_1 R_4 - U_1 - I_1 R_5 = 0 \quad (3)$$

$e = CU$ (1)

$$e \overset{(2)}{=} C\left[U_1 + I_1 (R_4 + R_5)\right] = 31{,}5\ pAs \quad (1)$$

4) $m_1 = 3\,kg$ $\quad m_2 = 5\,kg$

$v_1 = 7\,\frac{m}{s}$ $\quad v_2 = -2\,\frac{m}{s}$

Ohranitev G: $\quad m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$ (5)

Ohranitev energije $\quad k = 0{,}7$

$$k\left(m_1 \frac{v_1^2}{2} + m_2 \frac{v_2^2}{2}\right) = m_1 \frac{u_1^2}{2} + m_2 \frac{u_2^2}{2}$$ (5)

$$u_1 = v_1 + \frac{m_2}{m_1} v_2 - \frac{m_2}{m_1} u_2$$ (2)

Za podelitev točk morata biti formuli zapisani popolnoma pravilno. Torej pravilni predznaki, zapis ohranitve (ne samo zapis energije) in „k" na pravem mestu.

$$k m_1 \frac{v_1^2}{2} + k m_2 \frac{v_2^2}{2} = m_2 \frac{u_2^2}{2} + \frac{m_1 v_1^2}{2} + \frac{m_2^2}{2m_1} v_2^2 + \frac{m_2^2}{2m_1} u_2^2 + m_2 v_1 v_2 - m_2 v_1 u_2 - \frac{m_2^2}{m_1} v_2 u_2$$

Kvadratna enačba za u_2.

$a = \frac{m_2}{2} + \frac{m_2^2}{2m_1}$ (2)

$b = -m_2 v_1 - \frac{m_2^2}{m_1} v_2$ (2)

$c = \frac{m_2^2}{2m_1} v_2^2 + m_2 v_1 v_2 - k m_1 \frac{v_1^2}{2} - k m_2 \frac{v_2^2}{2}$ (2)

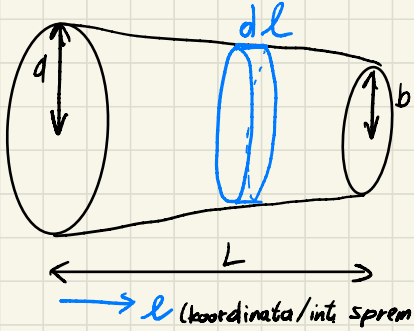
$$u_{2a,b} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ (2)

$u_{2a} = 4{,}14\,\frac{m}{s}$ $\quad u_{1a} = -1{,}39\,\frac{m}{s}$

$u_{2b} = -3{,}23\,\frac{m}{s}$ $\quad u_{1b} = 5{,}97\,\frac{m}{s}$ (2)

Prava rešitev je a. (1)

5.



Razbijemo na kolobarje dolžine dl

Vsak prispeva k upornosti dR.

$$dR = \varrho \frac{dl}{S(l)} \quad (6)$$

$$S(l) = \pi r(l)^2 \; (2); \quad r(l) = a + (b-a)\frac{l}{L} = a + \frac{b-a}{L} l \; (3)$$

$$\hookrightarrow \int_0^R dR = \int_0^L \varrho \frac{dl}{S(l)} \; (2) \quad \text{(meje)}$$

substitucija: (2) $x = a + \frac{(b-a)}{L} l$, $dx = \frac{(b-a)}{L} dl$

Meje: $0 \to a$, $L \to b$

$$\hookrightarrow R = \frac{\varrho}{\pi} \int_0^L \frac{dl}{\left(a + \frac{(b-a)}{L} l\right)^2} = \frac{\varrho}{\pi} \int_a^b \frac{dx}{x^2} \left(\frac{L}{b-a}\right) \; (2)$$

$$\hookrightarrow R = \frac{\varrho L}{\pi(b-a)} \int_a^b \frac{dx}{x^2} = \frac{\varrho L}{\pi(b-a)} \; (3) \left(-\frac{1}{x}\right)\Big|_a^b = \frac{\varrho L}{\pi(b-a)} \left(-\frac{1}{b} + \frac{1}{a}\right) \; (1)$$

$$= \frac{0{,}46\,\Omega\,\text{m} \cdot 0{,}04\,\text{m}}{\pi(0{,}006 - 0{,}017)\,\text{m}} \left(-\frac{1}{0{,}006\,\text{m}} + \frac{1}{0{,}017\,\text{m}}\right) = 57{,}42\,\Omega \; (2) \; (2)$$