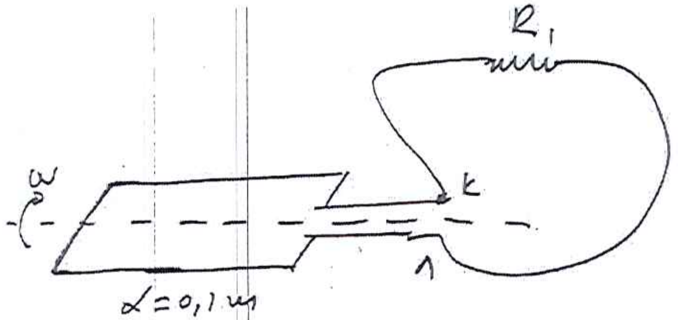
ΑΣΚ. 33



$R_{\pi} = 1\,\Omega$

$N = 100$

$R_1 = 2\,\Omega$

$U_{\kappa\lambda} = 12 \cdot \eta\mu\, 18t$

α) $V_{o(\kappa\lambda)} = \mathcal{E}_o - I_o \cdot R_{\pi}$

$12 = \mathcal{E}_o - \dfrac{\mathcal{E}_o}{R_{\pi} + R_1} \cdot R_{\pi}$

$\mathcal{E}_o = \ldots \Rightarrow B = \ldots$

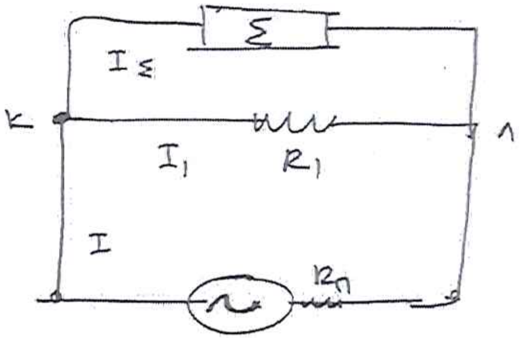
β) $\dfrac{P_{max}}{\bar{P}} = \dfrac{I_o^2 \cdot R_1}{I_{\varepsilon\nu}^2 \cdot R_1}$

γ) $Q = I_{\varepsilon\nu}^2 R_{o\lambda} (T)$ → 3 διαδοχικοί μηδενισμοί σε χρόνο T

δ) $\mathcal{E}_{\varepsilon\pi} = -\left(\dfrac{\Delta\Phi}{\Delta t}\right) N = \mathcal{E}_o'' \, \eta\mu\, 18t$ (18ν)

$V_{\kappa\lambda} = 12 \, \eta\mu\, 18t = 6\nu$

ε)



$P_\Sigma = 300\,W$

$V_\Sigma = 10\sqrt{2}\,V$

$P_\Sigma = V_\Sigma \cdot I_\Sigma \rightarrow I_\Sigma = \ldots$

$R_\Sigma = \dfrac{V_\Sigma}{I_\Sigma} \rightarrow R_\Sigma = \ldots$

$I_o' = \dfrac{\mathcal{E}_o}{R_{o\lambda}}$ $\quad R_{o\lambda} = R_{\pi\lambda} + R_{1,\Sigma}$

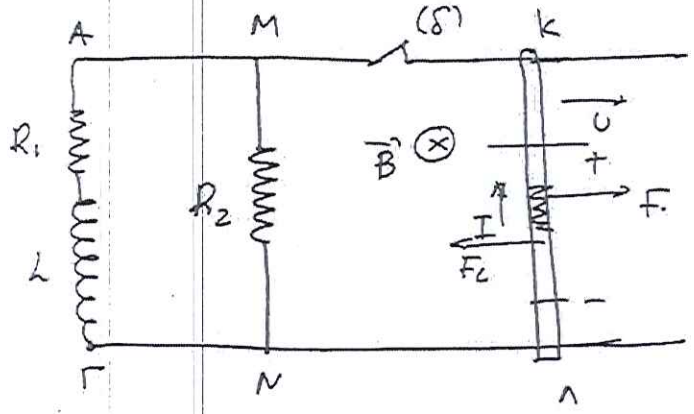
$V_{o\,\kappa\lambda} = I_o' \cdot R_{1,\Sigma}$

$V_\Sigma = V_{\varepsilon\nu\,\kappa\lambda} = \dfrac{V_{o\kappa\lambda}}{\sqrt{2}} = \ldots = 3\sqrt{2}\,V$

ΑΡΑ ΔΕΝ ΛΕΙΤΟΥΡΓΕΙ ΚΑΝΟΝΙΚΑ

$P_\Sigma = \dfrac{V_{\varepsilon\nu(\Sigma)}^2}{R_\Sigma} = 27\,W$

ΑΣΚ. 34.



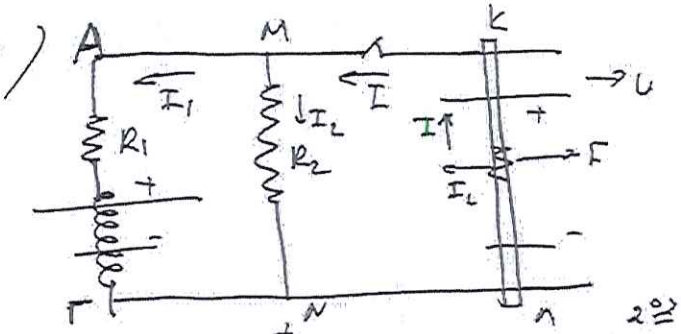
$\ell = 1\ m$
$R_1 = 3\ \Omega$
$L = 0,2\ H$
$R_2 = 6\ \Omega$
$m = 0,3\ kg$
$R_{\kappa\nu} = 2\ \Omega$
$B = 1\ T$
$F = 3\ N$

α) $F = B\,I\,\ell$

$$I = \frac{B U \ell}{R_{1,2} + R_{\kappa\nu}}$$

• ΟΤΑΝ U → ΣΤΑΘΕΡΟ ΤΟ ΦΑΙΝΟΜΕΝΟ ΕΠΑΓΩΓΗΣ

ε)



Τιν $t=0^+$ $I_1 = 0$

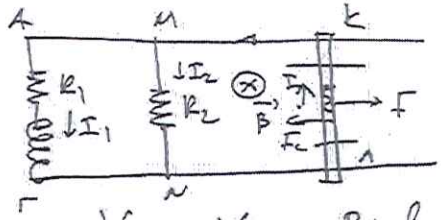
Αρα $I = I_2 = \frac{B U \ell}{R_2 + R_{\kappa\nu}}$

2ος κανόνας Kirchhoff (ΚΑΤΑ ΛΑΟ)

$E_{\epsilon\pi} - I \cdot R_{\kappa\nu} - |E_{\alpha\upsilon\tau}| = 0$

και $|E_{\alpha\upsilon\tau}| = L \cdot \frac{\Delta I}{\Delta t}$

γ) Τιν t_1



$$I = \frac{B U \ell}{R_{\kappa\nu} + R_{1,2}}$$

$V_{AT} = V_{K\Lambda} = B U \ell - I \cdot R_{\kappa\nu}$

και $I_1 = \frac{V_{AT}}{R_1}$

$\Phi = B_{\Sigma\varepsilon\pi} \cdot A$ $\quad \left(L = \mu_0 \frac{N^2 \cdot A}{\ell} \right)$

$B_{\Sigma\varepsilon\pi} = \mu_0 I_1 \cdot \frac{N}{\ell}$

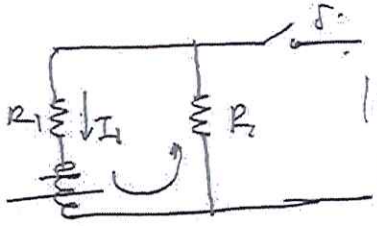
$U_L = \frac{1}{2} L I_1^2$

$\frac{L}{B} = \frac{N \cdot A}{I_1}$

$B \cdot A = \frac{L I_1}{N}$

δ) $q = I_2 \cdot \Delta t$

$Q_L = I_2^2 R_2 \cdot \Delta t$ $\quad \left(I_2 = \frac{V_{\kappa\nu}}{R_2} \right)$



$|E_{\alpha\upsilon\tau}| = I_1 \cdot (R_1 + R_2)$

$|E_{\alpha\upsilon\tau}| = L \left| \frac{\Delta i}{\Delta t} \right|$

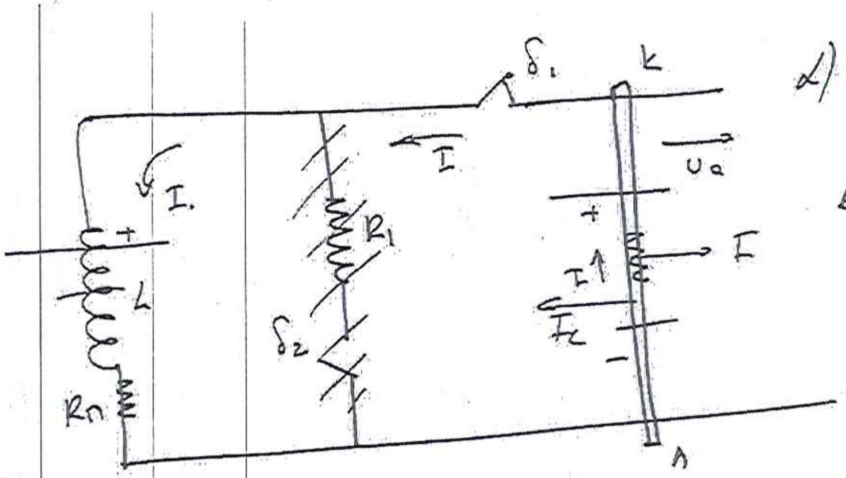
$\frac{\Delta i}{\Delta t} = - \ldots$

$Q_{o\lambda} = \frac{1}{2} L I_1^2$

$Q_{o\lambda} = Q_{R_1} + Q_{R_2}$ (ΚΑΤΑ)

$\frac{Q_{R_1}}{Q_{R_2}} = \frac{R_1}{R_2}$

ΑΣΚ. 36



$\ell = 1\,m$
$L = 1\,H$
$R_\pi = 2\,\Omega$
$R_1 = 1\,\Omega$
$m = 0{,}5\,kg$
$\ell = 1\,m$
$R_{\kappa\alpha} = 2\,\Omega$
$B = 1\,T$

α) Το I ↗ άρα το ωθ. νιο αντίδρ. ($E_{αυτ.}$)

β) $|E_{αυτ}| = L \cdot \frac{\Delta i}{\Delta t}$ $\left(\begin{array}{l} i = 2 + 2t \\ \frac{\Delta i}{\Delta t} = 2\,A/s \end{array} \right)$

γ) $i = \frac{B u \ell - E_{αυτ}}{R_{\kappa\alpha} + R_\pi} \Rightarrow 2 + 2t = \frac{u - 2}{4} \Rightarrow u = 10 + 8 \cdot t$ (u_0, α)

δ) $P_F = F_{t_1} \cdot u_{t_1}$ $\quad \Sigma F = m \cdot \alpha \Rightarrow F_{t_1} - B i_{t_1} \ell = m \cdot \alpha$

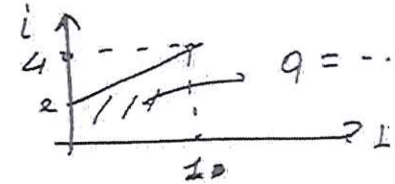
$u = 10 + 8 \cdot t_1 = \ldots$

$\frac{\Delta U_L}{\Delta t} = E_{\varepsilon\pi} \cdot i_{t_1} - i_{t_1}^2 (R_\pi + R_{\kappa\alpha})$, $E_{\varepsilon\pi} = B u_{t_1} \ell$

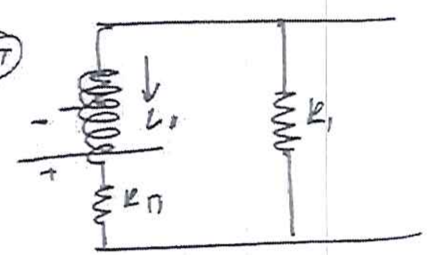
ή

$\frac{\Delta U_L}{\Delta t} = E_{αυτ.(t_1)} \, i_{t_1}$

ε)



$q = \ldots$



$i_{t_1} = 4\,A$.

$|E_{αυτ}| = L \cdot \left|\frac{\Delta i}{\Delta t}\right| \Rightarrow \frac{\Delta i}{\Delta t} = \ldots$

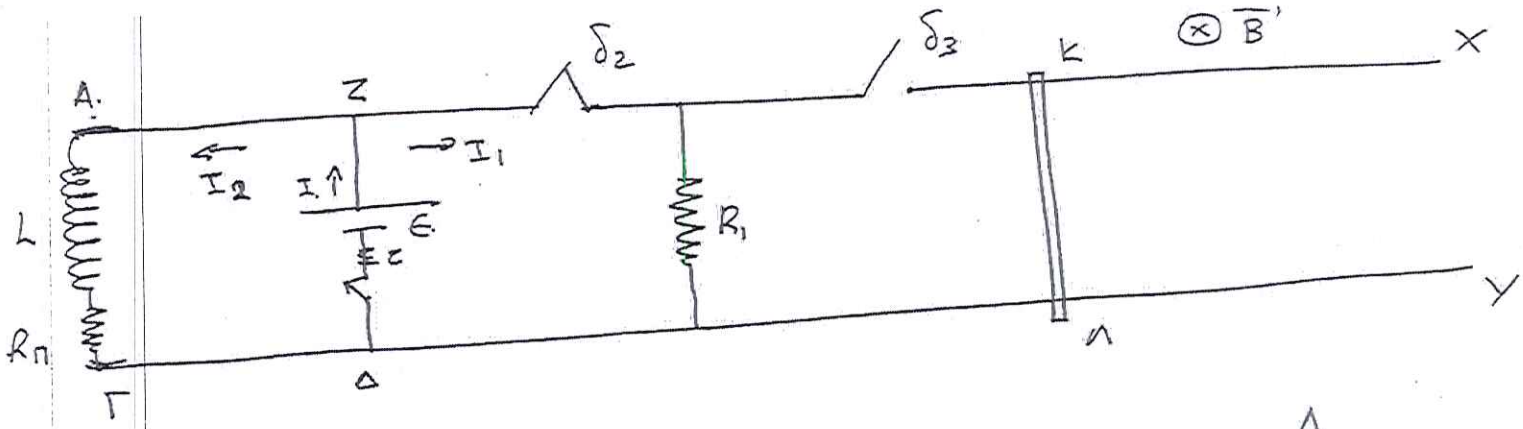
$|E_{αυτ}| = i_1 \cdot (R_1 + R_\pi)$

(ζ) $V_{πηνίου} = i_2 R_1$

$Q_{ολικό} = \frac{1}{2} L I_1^2 - \frac{1}{2} L I_2^2$ και $Q_{ολ} = Q_{R_1} + Q_{R_\pi}$

$\frac{Q_{R_1}}{Q_{R_\pi}} = \frac{R_1}{R_\pi}$

ΑΣΚ 37



$\ell = 2\,m$

$\lambda = 0,4\,H$

$R_\Pi = 15\,\Omega$

$N = 1000$ σπ

$E = 32\,V$

$r = 2\,\Omega$

$R_1 = 10\,\Omega$

$m = 1$ kg $\quad \ell = 2\,m$

$R_{\kappa\alpha} = 10\,\Omega$

$B = 1\,T.$

α) Όταν τα ρεύματα είναι σταθερά το πλαίσιο συμπεριφέρεται ως κυτίο σταθερής

$$I = \frac{\mathcal{E}}{R_{\pi,1} + r}, \quad V_{Z\Delta} = E - I \cdot r$$

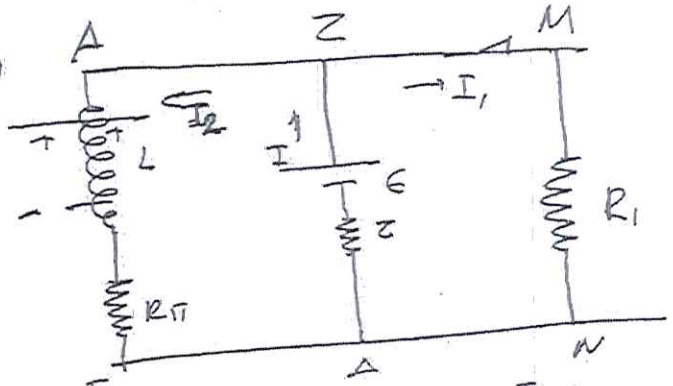
$$V_{Z\Delta} = V_{AT} = I_2 \cdot R_\Pi \rightarrow I_2 = \dots$$

$$B_{\Sigma\pi} = \mu_0 I_2 \frac{N}{\ell}$$

$$\frac{\Phi}{\lambda} = \frac{B \cdot A}{\lambda} = \frac{\mu_0 I_2 \frac{N}{\ell} \cdot A}{\mu_0 \frac{N^2}{\ell} \cdot A}$$

$\Rightarrow \dots \quad \Phi = \dots$

γ)



$V_{R_1} = I_1 \cdot R_1 \rightarrow I_1 = \dots$

$V_{K_1} = V_{Z\Delta} = E - I \cdot r \Rightarrow I = \dots$

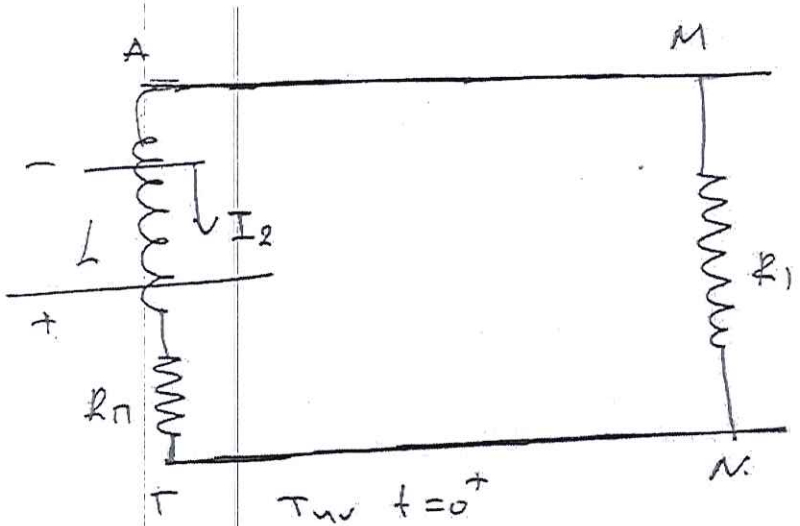
$I = I_1 + I_2 \rightarrow I_2 = \dots$

2ος κανόνας Kirchhoff (ΝΜΑΤΝ)

$+ I_1 R_1 - \lambda \frac{\Delta i'}{\Delta t} - I_2 R_\Pi = 0$

ΑΣΚ 37

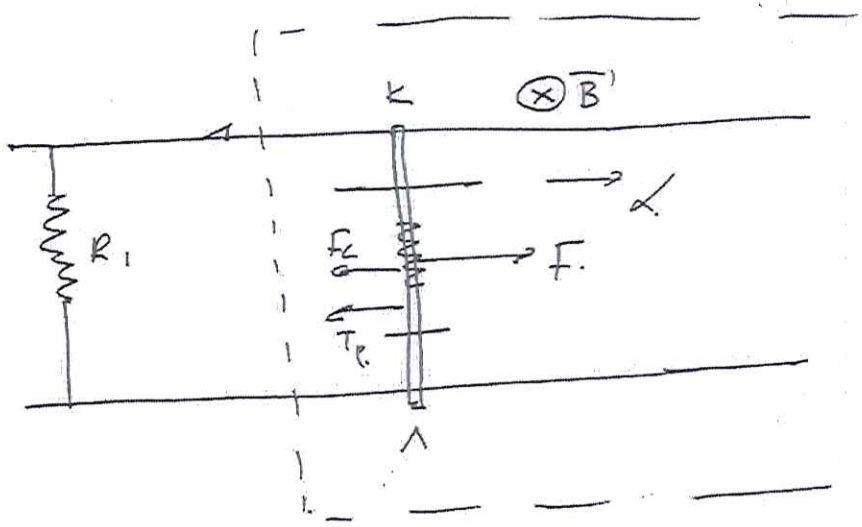
Συνέχεια



$\mathcal{E}_{\delta\iota\tau} = I_2 \cdot (R_\Pi + R_1) = L \cdot \frac{\Delta I}{\Delta t} = \dots$

(I_2 → το σταθερό ρεύμα που υπολογίσαμε στο α. Ερώτημα)

$Q = \frac{1}{2} L I_2^2 = \dots$

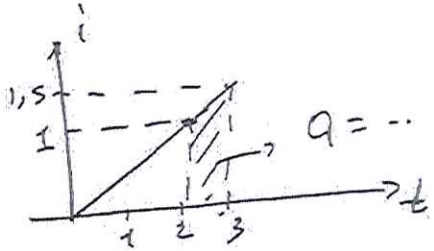


$P_F = F \cdot U$

• $U = \alpha \cdot t$

$\Sigma F = m \cdot \alpha \Rightarrow F - B I \ell - T = m \cdot \alpha$

$I = \frac{B U \ell}{R_1 + R_{\kappa\alpha}} = \frac{1 \cdot U \cdot 2}{10 + 10} = 0,5 \cdot t$



$q = \dots$

• Θ.Μ.Κ $2 \to 3$ sec $\quad Q_{\text{τριβ}}$

$\frac{1}{2} m U_3^2 - \frac{1}{2} m U_2^2 = W_F - W_{F_L} - W_T$

$U_3 = \alpha \cdot t_3 \qquad W_T = T \cdot \Delta x_{2,3} = T \cdot \left(\frac{1}{2} \alpha t_3^2 - \frac{1}{2} \alpha t_2^2\right)$

$U_2 = \alpha t_2$

ΑΣΚ 38

$\ell = 1,25\,cm$

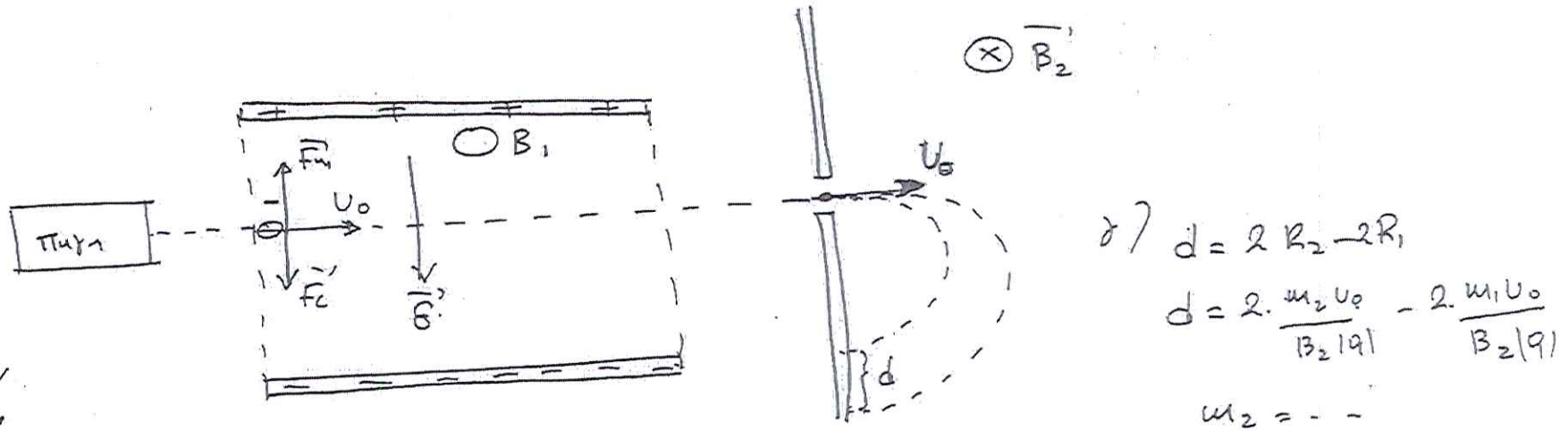
$\epsilon = 3,5 \cdot 10^3\ V/m$

$U_0 = 1.25 \cdot 10^4\ m/s$

$B_2 = 0,1\ T.$

$d = 5\ mm$

$y = 5\ mm$

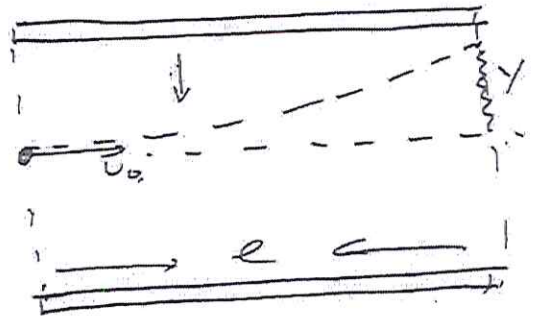


α) $\vec{B_1}$ ⊗ Συμφωνα με τον $\vec{F_L}$

$\Sigma F = 0 \Rightarrow \epsilon \cdot |q| = B_1 U_0 |q|$

$B_1 = \dots$

β)



$\ell = U_0 \cdot t$

$y = \frac{1}{2} a \cdot t^2$

$a = \frac{\epsilon \cdot |q|}{m_1} \rightarrow m_1 = \dots$

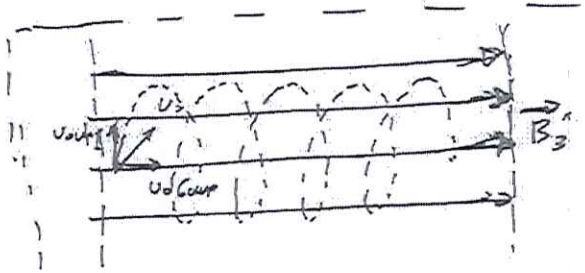
γ) $d = 2R_2 - 2R_1$

$d = 2 \cdot \frac{m_2 U_0}{B_2 |q|} - 2 \cdot \frac{m_1 U_0}{B_2 |q|}$

$m_2 = \dots$

δ)

$\Delta t = \left| \frac{T_2}{2} - \frac{T_1}{2} \right|$



$T = \frac{2\pi m_1}{B_3 |q|}$

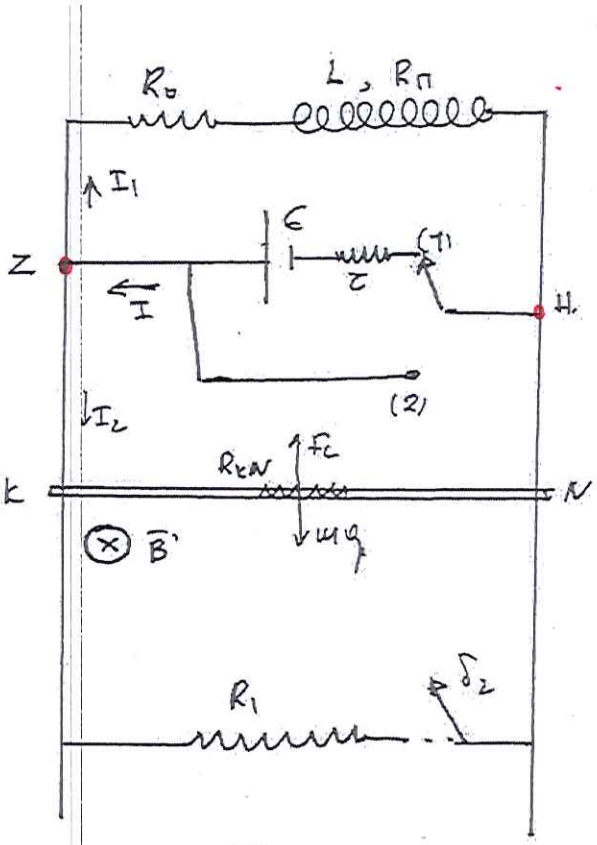
$\text{διαφ} = U_0 \cos\varphi \cdot T.$

$L = N \cdot \text{διαφ}$

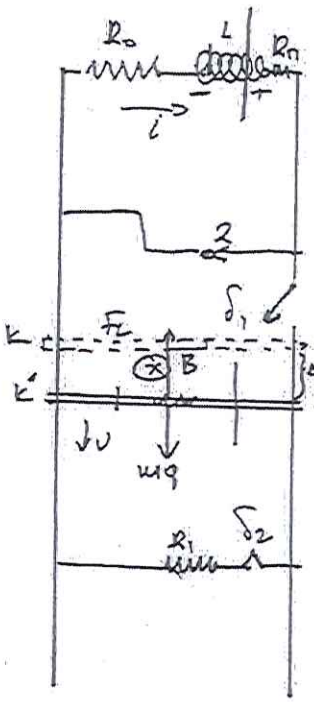
↓

σχοροδ!

ΑΣΚ. 43



Γ2.



$P_{R_0} = i^2 \cdot R_0 \rightarrow i = \dots$

$Q = \frac{1}{2} L I_1^2 - \frac{1}{2} L i^2$

- $\mathcal{E}_{\text{αυτ}} = i (R_0 + R_\Pi) \Rightarrow L \left| \frac{\Delta i}{\Delta t} \right| = i (R_0 + R_\Pi)$

Στον χρόνο t_1 η ράβδος (ΚΝ) κάνει εναλλασσόμενη πτωση $U = g t_1$ (1)

Κατι τον t_1 $\Sigma F_{KN} = 0 \Rightarrow mg = F_L \Rightarrow$

$mg = B \cdot \frac{BU\ell}{R_1 + R_{KN}} \cdot \ell \rightarrow U = \dots$

Από την (1) $\rightarrow t_1 = \dots$

- Στον χρόνο t_1 $\Delta y_{\text{ράβδου}} = \frac{1}{2} g t_1^2$

$\Delta \Phi = B \cdot \Delta A = B \cdot \ell \Delta y$

- $q_{0 \rightarrow t_2} = q_{t_1 \rightarrow t_2} = I \cdot \Delta t = \frac{BU\ell}{R_1 + R_{KN}}$ (1)

$R_0 = 4\,\Omega$

$R_1 = 1\,\Omega$

$L = 0,5\,H$

$\nu = 1000\pi\ cm/s$

$\mathcal{E} = 35\,V$

$r = 2,5\,\Omega$

$m = 0,5\,kg$

$R_{KN} = 3\,\Omega$. $B = 1\,T$

$g = 10\,m/s^2$

Γ1.ο

$\Sigma F = 0 \Rightarrow$

$F_L = m \cdot g \Rightarrow$

$B I_2 \ell = m \cdot g$

$V_{KN} = I_2 R_{KN}$

$V_{KN} = V_{ZH} = \mathcal{E} - I \cdot r$

$I = I_1 + I_2 \rightarrow I_1 = \dots$

$B = \mu_0 I_1 \left(\frac{N}{\ell}\right)$

$V_{ZH} = I_1 (R_0 + R_\Pi)$

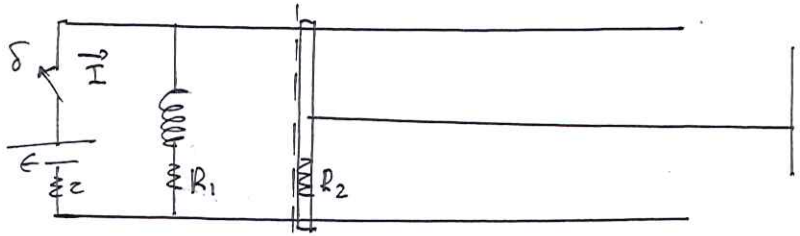
$R_\Pi = -$

$t = 0 \rightarrow t_2$ (3 sec)

$\Delta y = \frac{1}{2} g t_1^2 + U \cdot \Delta t$

$\frac{\Delta K}{\Delta U} = \frac{\frac{1}{2} m U^2 - 0}{-mg(\Delta y)}$

ΑΣΚ 44.



$\ell = 1\,m$

$\varepsilon = 3,6\,V$

$r = 0,6\,\Omega$

$L = 0,8\,H$

$R_1 = 0,4\,\Omega$

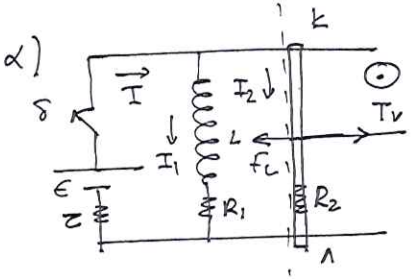
$m = 1,25\,kg$

$\ell = 1\,m$

$R_2 = 1,2\,\Omega$

$B = 1\,T$

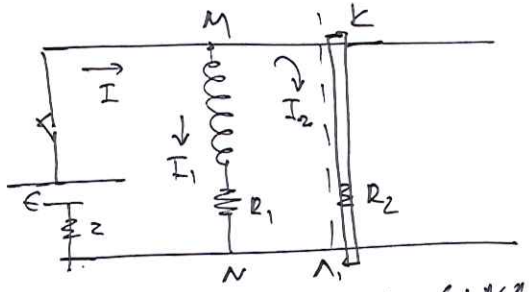
α)



ΑΚΡΙΒΩΣ ΜΕΤΑ.

$I_1 = 0$, $I = I_2 = \frac{\varepsilon}{R_2 + r} = \frac{3,6}{1,8} = 2A$

$\Sigma F = 0 \Rightarrow T_v = B I_2 \ell = 2\,N.$



$V_{KM} = V_{\pi o_1} = \varepsilon - I \cdot r = 1,2\,V.$

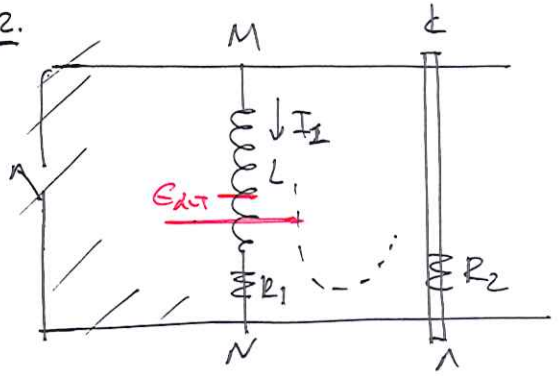
$I_2 R_2 = 1,2\,V \Rightarrow I_2 = 1\,A$

$\Sigma F = 0 \Rightarrow T_v = B I_2 \ell = 1\,N.$

ΟΤΑΝ ΤΑ ΡΕΥΜΑΤΑ ΕΙΝΑΙ ΣΤΑΘΕΡΑ ΤΟ ΠΗΜΙΟ ΣΥΜΠΕΡΙΦΕΡΕΤΑΙ ΩΣ ΑΓΩΓΟΣ

$I = \frac{\varepsilon}{R_{ολ}} = \frac{\varepsilon}{R_{1,2} + r} = \frac{3,6}{0,9} = 4A.$

Α2.



ΑΚΡΙΒΩΣ ΜΕΤΑ ΤΟ ΑΝΟΙΓΜΑ ΤΟΥ ΔΙΑΚΟΠΤΗ (δ)

$I_{πιηνο} = I_1 = 2A.$

ΚΑΙ ΜΕΙΩΝΕΤΑΙ ΑΡΑ ΑΝΑΠΤΥΣΣΕΤΑΙ ΕΑΥΤΗ ΓΙΑ ΝΑ ΤΟ ΣΥΝΤΗΡΗΣΕΙ

$P_{R_2} = I^2 \cdot R_2$

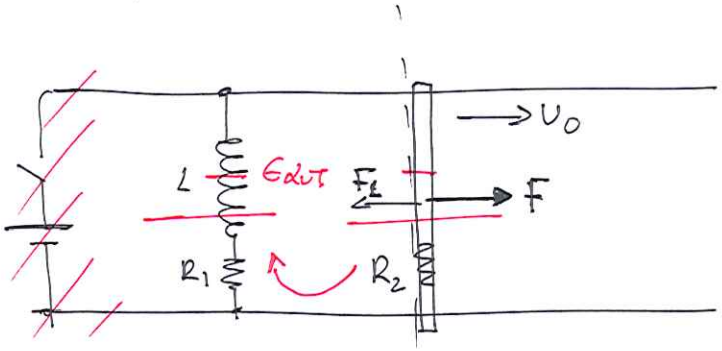
$I = \frac{|\varepsilon_{αυτ}|}{R_1 + R_2} \Rightarrow \dots \left|\frac{\Delta i'}{\Delta t}\right| = \dots$

ΚΑΙ $\frac{\Delta U_L}{\Delta t} = \varepsilon_{αυτ} \cdot i'$

$Q_{R_{ολ}} = U_L = \frac{1}{2} L I_1^2$

ΑΣΚ 44

Συνέχεια



$i = 0,5t + 1 \Rightarrow \frac{\Delta i}{\Delta t} = 0,5\ A/s$

$i = \frac{\mathcal{E}_{\epsilon\varphi} - |\mathcal{E}_{\alpha\upsilon\tau}|}{R_{o\lambda}} \Rightarrow$

$0,5t + 1 = \frac{B\upsilon\ell - |\mathcal{E}_{\alpha\upsilon\tau}|}{R_{o\lambda}}$

$0,5t + 1 = \frac{\upsilon - 0,8 \cdot 0,5}{1,6}$

$0,8t + 1,6 = \upsilon - 0,4 \Rightarrow$

$\upsilon = 0,8t + 2$ $\left.\begin{matrix} \\ \\ \end{matrix}\right\}$ $\upsilon_0 = 2\ m/s$, $\alpha = 0,8\ m/s^2$

δη. Τη1 μορφη, $\upsilon = \upsilon_0 + \alpha \cdot t$

$P_{F\ t=1sec} = F \cdot \upsilon$ (1)

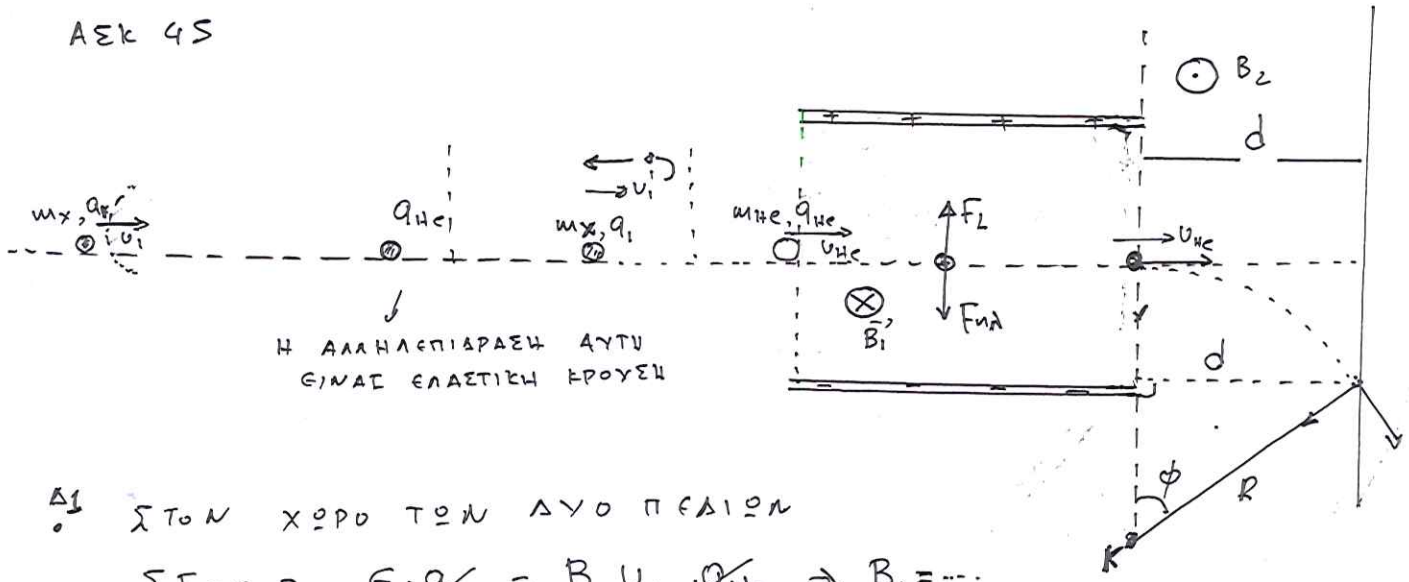
$\cdot \Sigma F = m \cdot \alpha \Rightarrow F - B i \ell = m \alpha$

$\Rightarrow F = B i \ell + m \cdot \alpha = 1,5 + 1,25 \cdot 0,8$

$i = 0,5 \cdot (1) + 1 = 1,5$

(1) $P_F = \dots = 7\ J/s$

Ασκ 45



Δ1. ΣΤΟΝ ΧΩΡΟ ΤΩΝ ΔΥΟ ΠΕΔΙΩΝ

$\Sigma F = 0 \Rightarrow \quad \epsilon \cdot q_{He} = B_1 v_{He} \cdot q_{He} \Rightarrow B_1 = \dots$

- $\frac{1}{2} m_1 v_1'^2 = \frac{36}{100} \frac{1}{2} m_1 v_1^2 \Rightarrow \quad v_1' = \pm \frac{6}{10} v_1$

$(m_1 < m_2 \quad \Rightarrow \quad v_1' = -\frac{6}{10} v_1)$

και $\quad v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1 \Rightarrow -\frac{6}{10} v_1 = \frac{m_1 - m_2}{m_1 + m_2} v_1$

$\Rightarrow m_1 = \frac{1}{4} m_2 = \frac{1}{4} \cdot 4 m_p \Rightarrow \underline{m_1 = m_p}$

ΑΡΑ ΤΟ ΣΩΜΑΤΙΔΙΟ (1) ΕΙΝΑΙ ΠΡΩΤΟΝΙΟ

$m_1 = m_p$

$q_1 = q_p$

- Α.Δ.Ο. ; $m_1 v_1 = m_1 v_1' + m_{He} v_{He}$

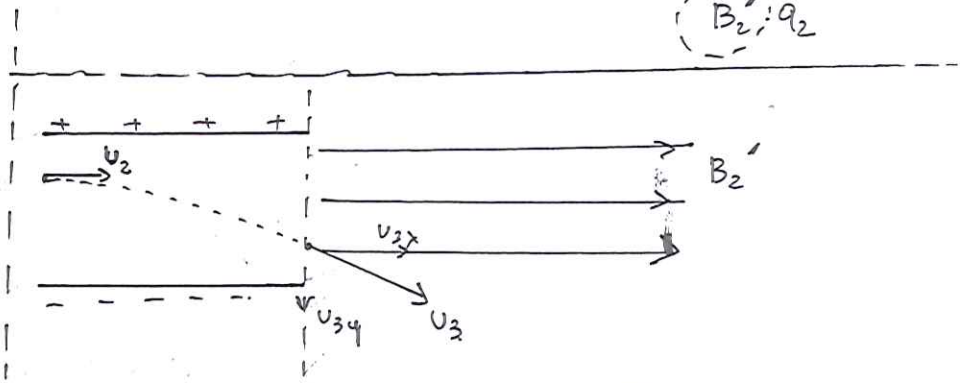
$m_p v_1 = m_p (-\frac{6}{10} v_1) + 4 m_p \cdot 2 \cdot 10^4 \Rightarrow v_1 = \dots$

- $R = \frac{m_{He} \cdot v_{He}}{B_2 \, q_{He}} = \frac{4 \cdot m_p \cdot v_2}{B_2 \cdot 2 \cdot q_p}$

- $\eta\mu\phi = \frac{d}{R} = \dots$

- $\hat{\phi} = \omega \cdot \Delta t = \frac{B_2 q_2}{m_2} \cdot (\Delta t)$

- Για να βγει εξερχεται οριακά πρωτον. $R = d \Rightarrow \frac{m_2 v_2}{B_2' q_2} = d$



- ΣΤΟ ΗΛ. ΠΕΔΙΟ $\quad v_3 = \sqrt{v_{3x}^2 + v_{3y}^2} = \dots$

$L = v_2 \cdot \Delta t_1$

$v_{3y} = \alpha \cdot \Delta t_1$

$\Delta S = v_3 \cdot \Delta t$

$\alpha = \frac{\epsilon \cdot q_2}{m_2}$

ΑΣΚ 46

$\lambda = 500\,nm$

$P = 0,99\,W$

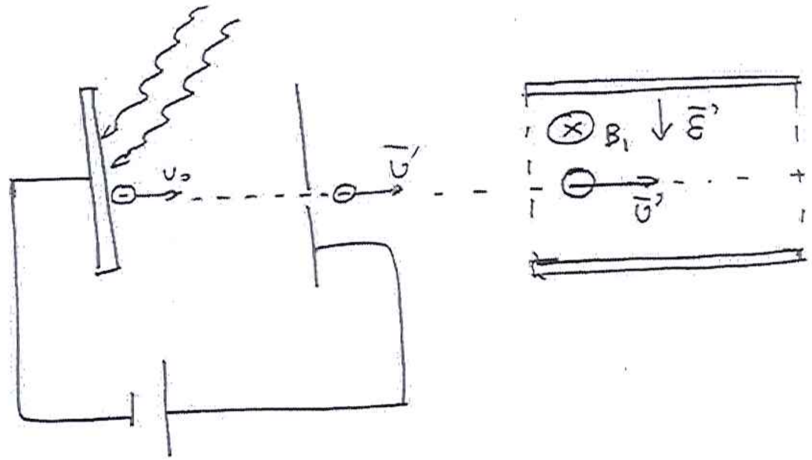
$\Delta V = V_K - V_k = 6,125V$

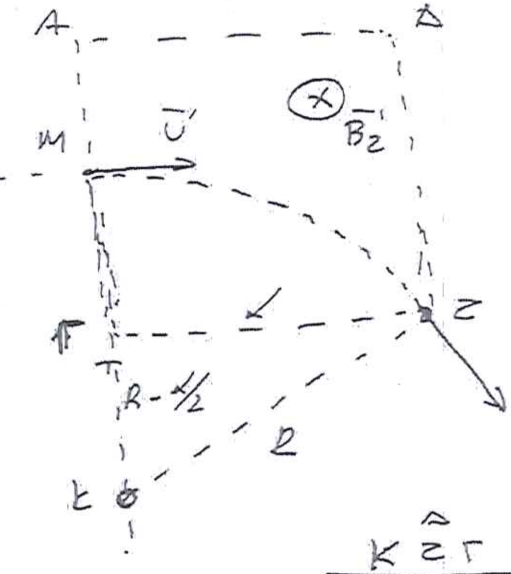
$E = 3200\,N/C$

$B_1 = 2 \cdot 10^{-3}\,T$

$\alpha = 2,4\,mm$

$B_2\,,\ \vec{u}$





α) $P = \frac{u}{\lambda}$ $\quad E_\varphi = h \cdot f$

β) $P_{\text{ακτ}} = \frac{N_\varphi E_\varphi}{t} \Rightarrow \frac{N_\varphi}{t} = \ldots = \frac{N_{e^-}}{t}$

γ) Στο φίλτρο ταχυτήτων

$\Sigma F = 0 \Rightarrow E \cdot q_e = B_1 \cdot u \cdot q_e \Rightarrow u = \ldots$

Θ.Μ.Κ.Ε. καθόδου-ανόδου: $\frac{1}{2}mu^2 - \frac{1}{2}mu_0^2 = (-6,125V)(-e)$

$\cdot\ \frac{1}{2}mu_0^2 = h \cdot \frac{c}{\lambda} - \Phi$

και $V_0 = \frac{K_0}{|e|} = \frac{\frac{1}{2}mu_0^2}{|e|}$

$\widehat{KZT}$

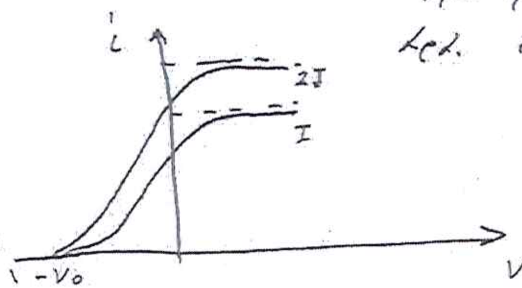
δ) $R^2 = \alpha^2 + (R - \frac{\alpha}{2})^2$

$R = \ldots$

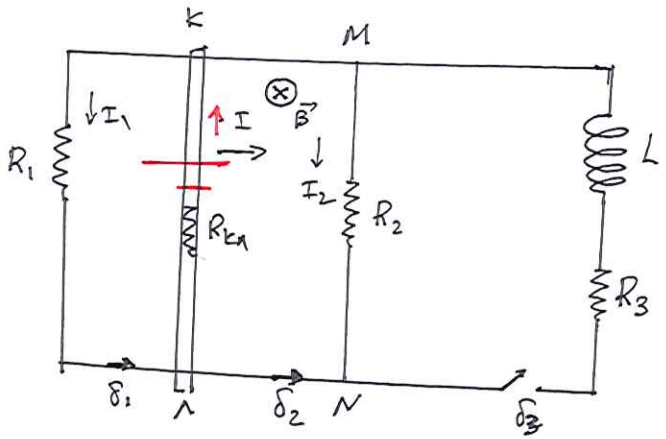
$R = \frac{mu}{B_2 |q|} \longrightarrow B_2 = \ldots$

ε) $I = \frac{N \cdot h \cdot c/\lambda}{\Delta A \cdot \Delta t}$

Διπλασιάζοντας την ένταση διπλασιάζεται το $\frac{N}{\Delta t}$. Δεν αλλάζει γιατί τα λ, f και 100% απόδοση



ΑΣΚ. 48



$R_1 = 6\,\Omega$

$L = 0{,}2\ H$

$R_3 = 6\,\Omega$

$R_2 = 3\,\Omega$

$m = 0{,}5\ kg$

$\ell = 1\ m$.

$R_{κιν} = 2\,\Omega$

$\alpha = 4\ m/s^2$

$B = 1\ T$.

α) $I = \dfrac{\mathcal{E}_{επ}}{R_{ολ}} = \dfrac{4\,t.}{4} = 1\cdot t.$

$R_{ολ} = \dfrac{R_1 \cdot R_2}{R_1 + R_2} + R_{κιν}$

$\mathcal{E}_{επ} = B\,U\,\ell = B(\alpha\cdot t)\,\ell$

$V_{κιν} = +\left(\mathcal{E}_{επ} - I\cdot R_{κιν}\right)$

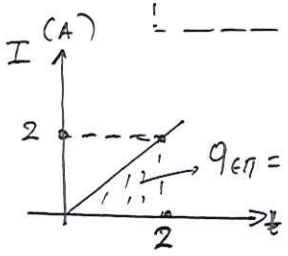
ή

$V_{κιν} = I\cdot R_{1,2} = 2\,t.$

$t = 2\ sec \rightarrow V_{κιν} = 4\ V.$

β) $I_1 = \dfrac{V_{κιν}}{R_1} = \dfrac{4\,V}{6\,\Omega} = \dfrac{2}{3}\ A$

$P_{R_1} = I_1^2 \cdot R_1 = \dfrac{8}{3}\ W.$



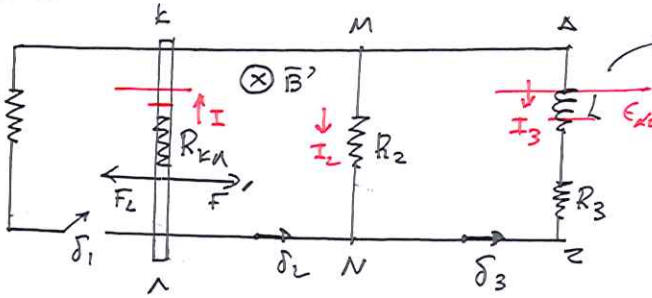
· $t = 3\ sec$

$\Sigma F = m\cdot\alpha \Rightarrow \quad F - B\,I\,\ell = m\cdot\alpha \Rightarrow$

$\Rightarrow F = B\,I_{\substack{t=3\\ \mathcal{E}=3}}\cdot\ell + m\cdot\alpha = 5.N.$

$U \rightsquigarrow U_{op}$ ΟΤΑΝ $\Sigma F_{κιν} = 0 \Rightarrow$

$F = B\,\dfrac{B\,U\,\ell}{R_{ολ}}\cdot\ell \Rightarrow U_{op} = 20\ m/s$



Το I_3 → αυξάνεται Αρα η $\mathcal{E}_{αυτ}$ έχει τέτοια πολικότητα ώστε να διαφέρει στην αυξηση

ΑΚΡΙΒΩΣ ΜΕΤΑ

$I_3 = 0$

$I = I_2 = \dfrac{\mathcal{E}_{επ}^{(κιν)}}{R_{ολ} + R_2} = \dfrac{20}{5}\ A. = 4\ A$

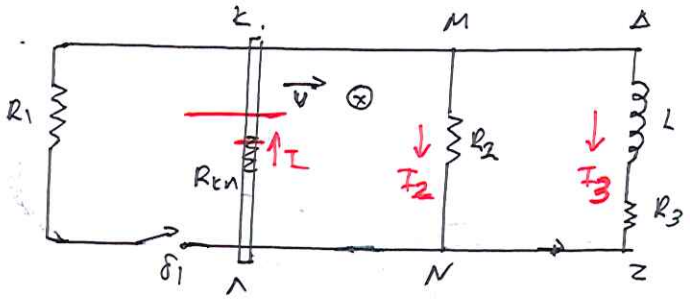
· ΓΙΑ ΤΟΝ $\dfrac{\Delta i}{\Delta t}$ → 2ο ΚΑΝΟΝΑ ΚΙΡΧΧΟΦ (ΝΜΛΖΝ)

$+I_2 R_2 - \mathcal{E}_{αυτ} - I_3 R_3 = 0$ ($I_3 R_3 = 0$)

$\Rightarrow L\cdot\dfrac{\Delta i}{\Delta t} = I_2 R_2 \Rightarrow$

$\dfrac{\Delta i}{\Delta t} = 60\ A/s$

ΑΣΚ 4β (ΣΥΝΕΧΕΙΑ)



→ ΟΤΑΝ ΤΑ ΡΕΥΜΑΤΑ ΕΙΝΑΙ ΣΤΑΘΕΡΑ.

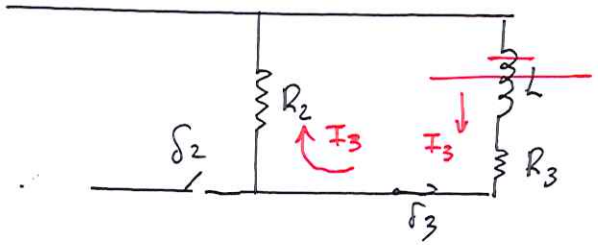
$$I = \frac{\mathcal{E}_{\varepsilon\eta}}{R_{o\lambda}} = \frac{20}{4} = 5\,A.$$

$$V_{K\Lambda} = \mathcal{E}_{\varepsilon\eta} - I \cdot R_{K\eta} = 10\,V.$$

$$I_3 = \frac{V_{\Delta Z}}{R_3} \overset{(V_{K\Lambda})}{=} \frac{10V}{6\Omega} = \frac{5}{3}\,A$$

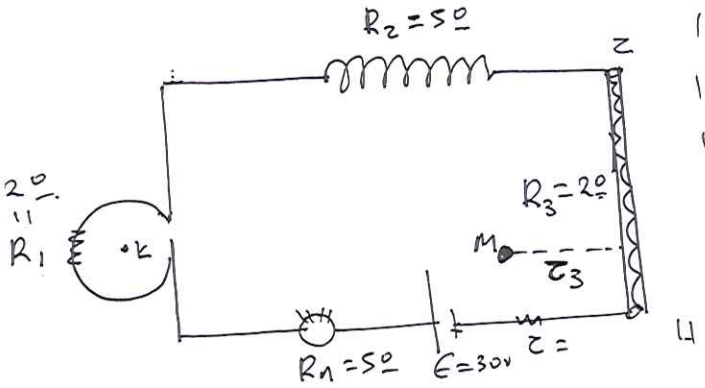
$$I_2 = \frac{V_{MN}}{R_2} \overset{(V_{K\Lambda})}{=} \frac{10V}{3\Omega} = \frac{10}{3}\,A$$

ΑΝΟΙΓΟΥΜΕ ΤΟΝ δ_2
ΑΚΡΙΒΩΣ ΜΕΤΑ



$$Q = U_L = \frac{1}{2} L \cdot I_3^2 = \frac{5}{18}\,J.$$

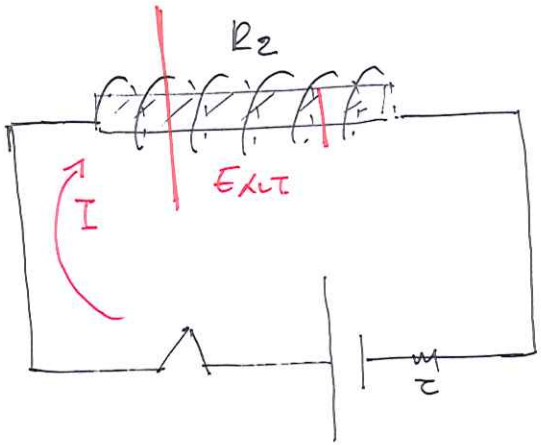
ΑΣΚ 5!



ΛΑΜΠΤΗΡΑΣ
- $P_A = 20W$
- $V_A = 10V$

$P_A = V_A \cdot I_A \Rightarrow I_A = 2A$

$R_A = \frac{V_A}{I_A} = 5\Omega$



α) $I = \frac{\mathcal{E}}{R_{ολ}}$, $I = I_A = 2A$ $\Rightarrow r = 0$

β) $B_K = \frac{\mu_0 I}{2 r_1}$

$B_\Sigma = \mu_0 I \left(\frac{N_2}{\ell}\right)$

$B_M = \frac{\mu_0 I}{2\pi r_3}$

γ) $L = \frac{\mu_0 N_2^2 (\pi r_2^2)}{\ell}$

$U_L = \frac{1}{2} L \cdot I^2$

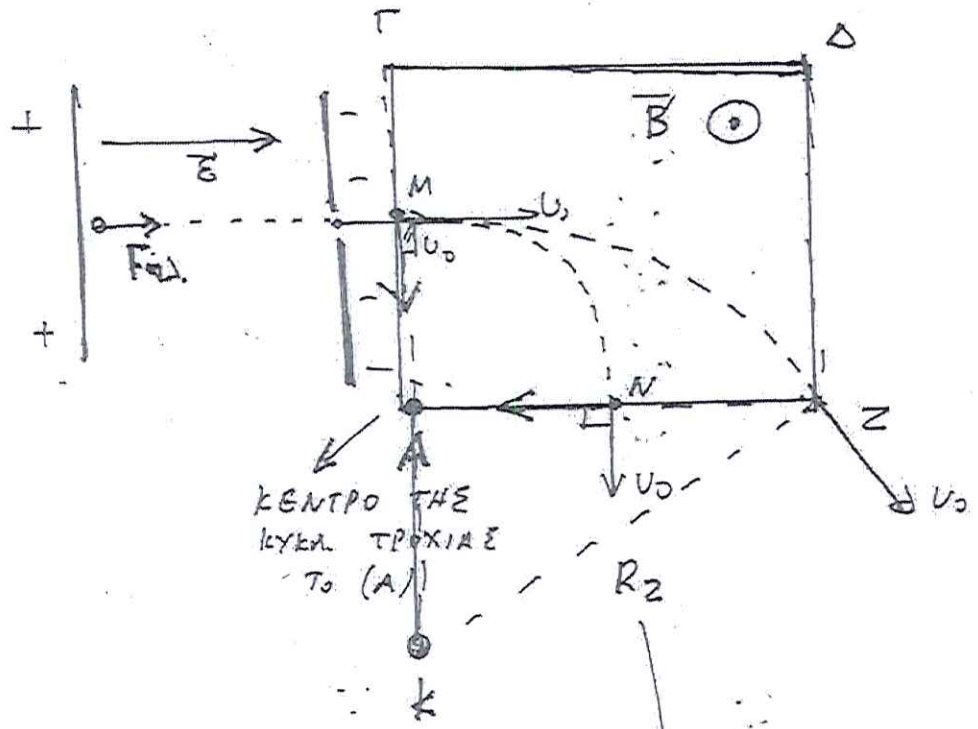
$L' = \mu_0 L$

δ) $I_{τελικό} = \frac{\mathcal{E}}{R_2 + r}$

ΚΑΘΕ ΣΤΙΓΜΗ Η ΙΣΧΥΣΗ ΣΤΟ ΣΩΜΑ ΤΗΣ ΠΗΝΕΙ $I_{τελικό}$)

- $i = \frac{\mathcal{E} - L' \frac{\Delta i'}{\Delta t}}{R_{ολ}}$

ΑΣΚ 54



$\frac{1}{2} m U_0^2 = V.\ q$

≡

• στην βγαίνει κάτω το (Ν)

$R_1 = (AM) = (AN)$

↓ (1)

2 cm

↓

$R_1 = \frac{m \cdot U_0}{B \cdot q}$

↓

$B = \ldots$

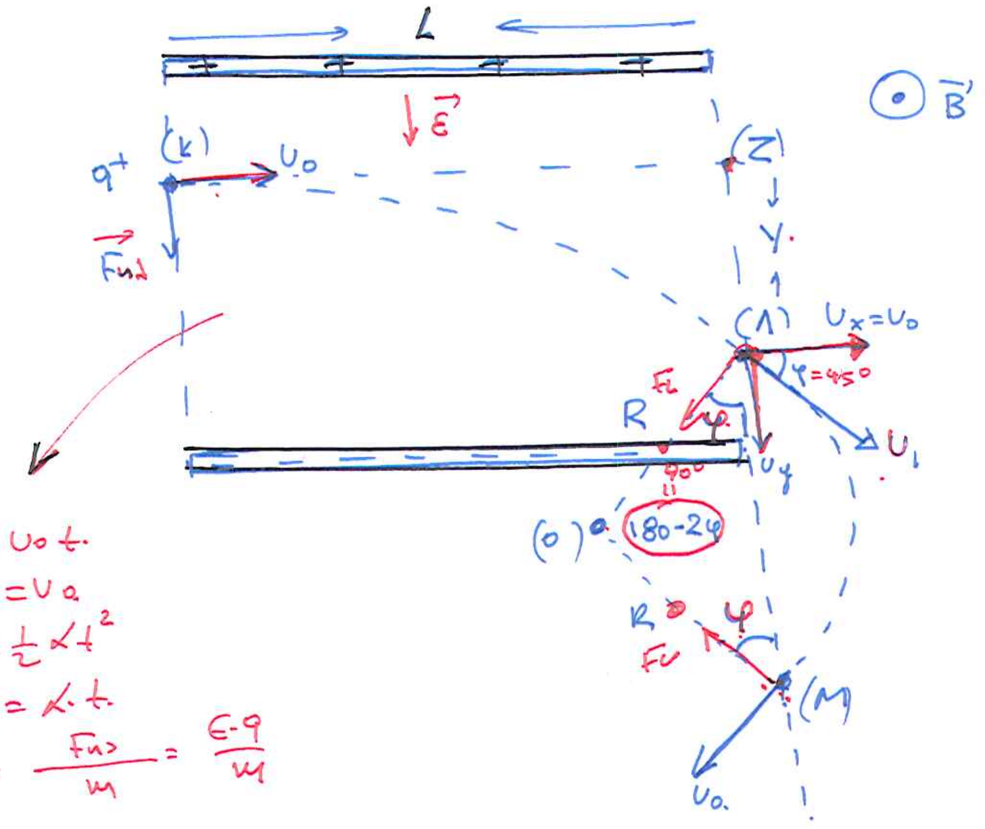
Από το $A\hat{Z}K$ Δ $\longrightarrow$ $R_2 = \ldots$

↓

$B_2 = \ldots$

(Ε) • πρώτη $\Delta f = 0 \Rightarrow F_{\alpha\lambda} = F_L$

Ασκ 55 $m, q, \upsilon_0, E, L, B$



$x = \upsilon_0 t$

$\upsilon_x = \upsilon_0$

$y = \frac{1}{2}\alpha t^2$

$\upsilon_y = \alpha \cdot t$

$\alpha = \frac{F_{ηλ}}{m} = \frac{E \cdot q}{m}$

α) $\upsilon_1 = \sqrt{\upsilon_0^2 + (\alpha t)^2} = \ldots$

$\alpha = \frac{E \cdot q}{m}$ $\quad t_{κλ} = \frac{L}{\upsilon_0}$

$εφφ = \frac{\upsilon_y}{\upsilon_0} \Rightarrow \varphi = \ldots = 45^0$

β) $R = \frac{m\,\upsilon_1}{B \cdot q}$

γ) $(ZM) = (ZΛ) + (ΛM)$

$(ZΛ) = Y = \frac{1}{2}\alpha\, t^2_{ηλ.πεδίο} = \ldots$

$(ΛM) \Rightarrow$ Από το τρίγωνο $(OΛM)$

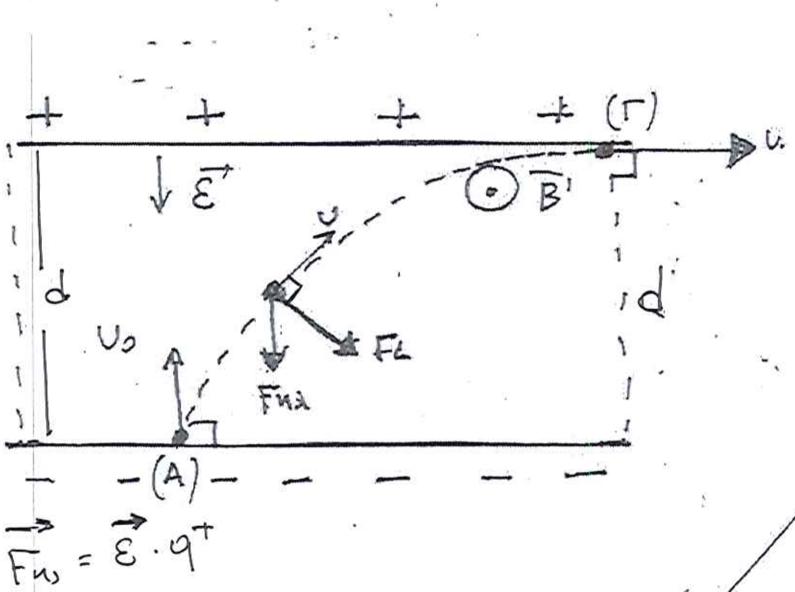
$(ΛM)^2 = R^2 + R^2 - 2R \cdot R\,συν(180 - 2\varphi)$ [$180-2\varphi = 90^0$]

δ) $t_{ολ} = t_{KΛ} + t_{ΛM}$

$t_{KΛ} = L/\upsilon_0$

$t_{ΛM}$ → από την γωνία $(180 - 2\varphi)$ [$= 90^0$] $= T/4$

Ασκ 56



$\vec{F}_{ηλ} = \vec{E} \cdot q^+$

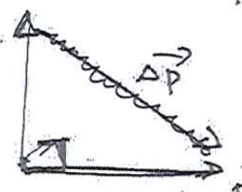
β) Θ.Μ.Κ.Ε. Α → Γ

$\frac{1}{2} m v^2 - \frac{1}{2} m v_0^2 = W_{F_{ηλ}} + W_{F_L}$ (→ 0)

$W_{F_{ηλ}} = - F_{ηλ}\, d$

γ) $\vec{\Delta P} = \vec{P}_{τελ} - \vec{P}_{αρχ}$

$P_{αρχ} = m \cdot v_0$

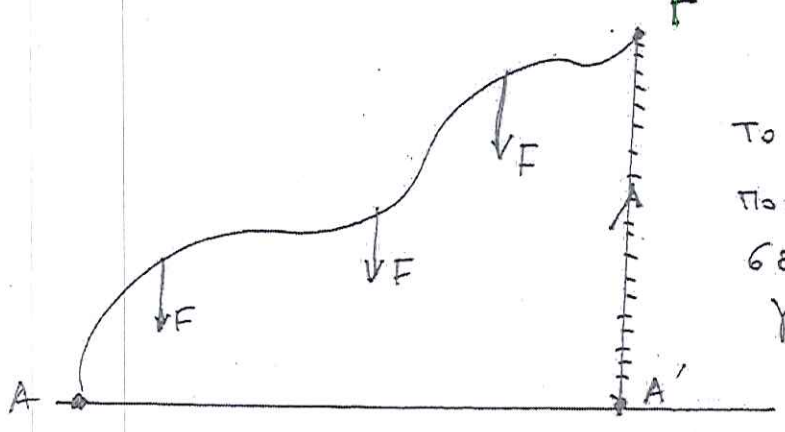


$\vec{P}_{τελ} = (mv)$

• $|\vec{\Delta P}| = \sqrt{P_{αρχ}^2 + P_τ^2}$

δ) $\Sigma \vec{F} = \vec{F}_{ηλ} + \vec{F}_L$
($\vec{F}_{ηλ}$ → σταθερή, $\vec{F}_L$ → αλλάζει)

⇒ Άρα $\Sigma \vec{F}$ → μεταβλητής και επομένως δεν είναι παραβολή.



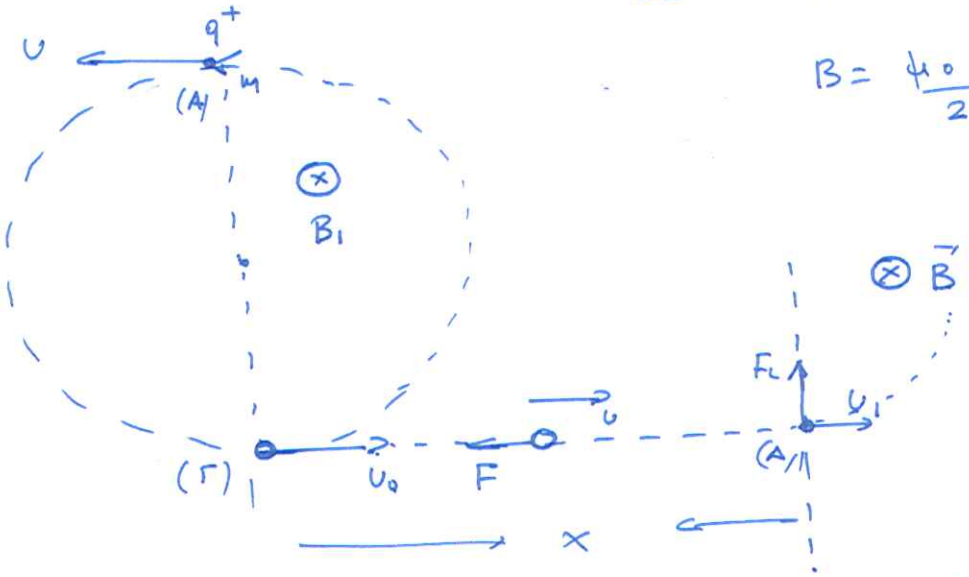
Το έργο μιας σταθερής δύναμης $\vec{F}$ που μετατοπίζει το σημείο εφαρμογής της σε τυχαία τροχιά είναι ίσο με το γινόμενο του μέτρου της δύναμης επί την προβολή της τροχιάς σε άξονα παράλληλο στην δύναμη.

$W_F = -F \cdot (A'Γ)$ είναι θετικό όταν $\vec{F}$, $\vec{Δy}$ ομόρροπα, αρνητικό όταν $\vec{F}$, $\vec{Δy}$ αντίρροπα.

ΑΣΚ 57

$$i = \frac{\Delta q}{\Delta t} = \frac{q}{T} \qquad T = \frac{2\pi R}{U_0}$$

α)



$$B = \frac{\mu_0 I}{2R} = \dots$$

Γ → Δ : Το σωματίδιο κάνει ευθύγραμμη κίνηση

$$U_1 = U_0 - |\alpha| \Delta t$$

$$\alpha = \frac{-F}{m_1}$$

$$x = U_0 t - \frac{1}{2} |\alpha| \cdot \Delta t^2$$

ή

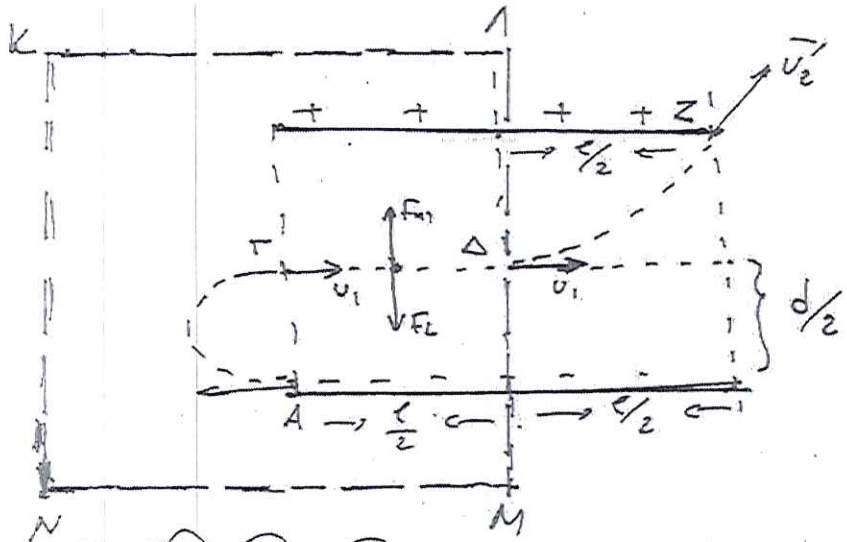
Θ.Μ.Κ.Ε. $\frac{1}{2} m U_1^2 - \frac{1}{2} m_1 U_0^2 = -F \cdot x$

$$R = \frac{m_1 \cdot U_1}{B \cdot q}$$

• $T = \frac{2\pi m_1}{B \cdot q}$ → κυκλική συχνότητα του ταλαντωτή → αντίστροφη κυκλική του $\vec{B}$

• $\Sigma F = 0 \Rightarrow E \cdot q = B \cdot U_1 \cdot q$

ΑΣΚ 58



α) Αω₀ την τροχιά ΔΖ → (q⁻)

β) $v_0 = v_1$

γ) $R = \frac{m v_0}{B \cdot q}$

δ) $\Sigma F_{\Gamma \to \Delta} = 0 \rightarrow E \cdot q = B \cdot v_1 \cdot q$

ε) $\Delta t = \frac{T}{2}$

στ) $\Delta t_{\Gamma \to Z} = \Delta t_{\Gamma \to \Delta} + \Delta t_{\Delta \to Z}$

$\Delta t_{\Gamma \to \Delta} = \frac{\ell/2}{v_0}$

* $\frac{d}{2} = 2R \Rightarrow d = \ldots$

*

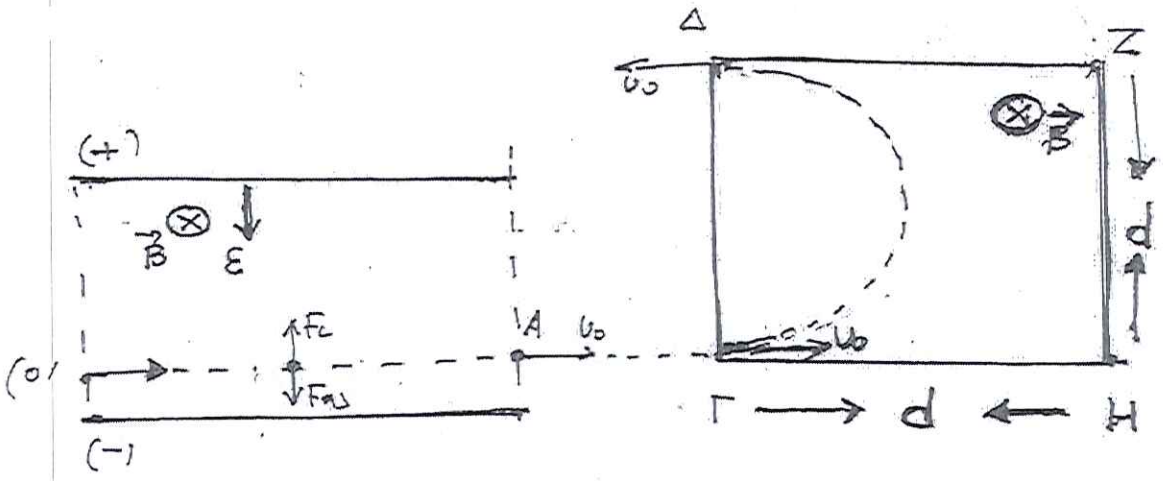
Σ την ΔΖ (κίνηση)

$\frac{\ell}{2} = v_0 \cdot \Delta t_{\ldots} \Rightarrow \ell = \ldots$

κλ)

$\frac{d}{2} = \frac{1}{2} \alpha \cdot \Delta t^2 \rightarrow \Delta t = \ldots$
ΔΖ

ΑΣΚ 59



μονοσθενή θετικά ιόντα

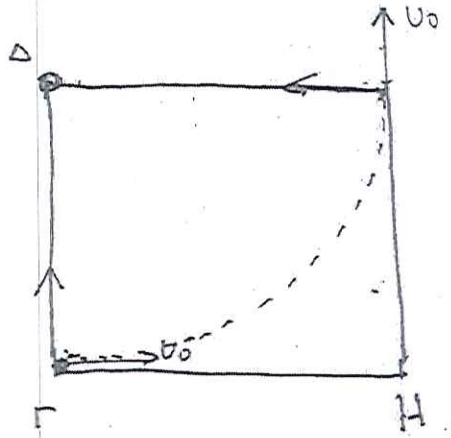
$q = +e = +1{,}6 \cdot 10^{-19}$ C

α) Στο φίλτρο ταχυτήτων $\Sigma F = 0 \Rightarrow E \cdot q = B v_0 \cdot q$

β) $R = \frac{d}{2} \Rightarrow \frac{m v_0}{B' q} = \frac{d}{2} \rightarrow m = .$

$\Delta t = T/2$

γ) $\Delta K = 0$, $\vec{\Delta P}_{\Gamma,\Delta} = \vec{P}_{\Delta} - \vec{P}_{\Gamma} = P - (-P)$

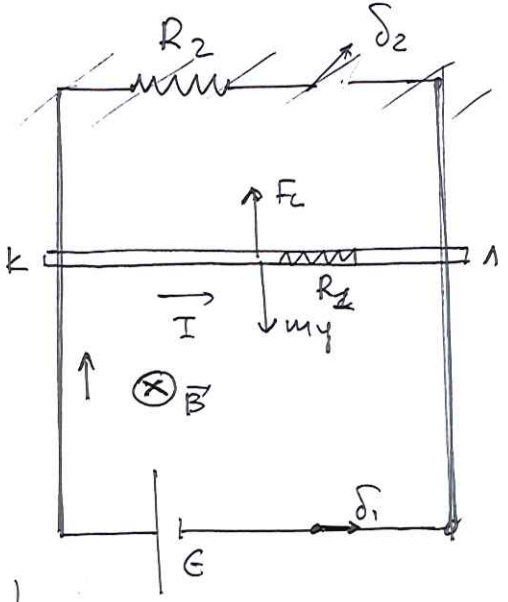


δ) Το κέντρο του κυκλου τωρα ειναι το (Δ)

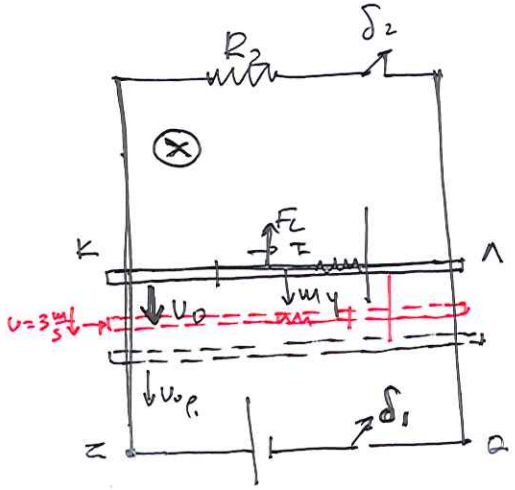
αρα $R = d \rightarrow B'' = .$

* Την στροφορμη που δεν. εχασε την ν.

ΑΣΚ 6.1.



α) $\Sigma F = 0 \Rightarrow B \frac{\mathcal{E}}{R_1} \ell = m \cdot g$ (1)



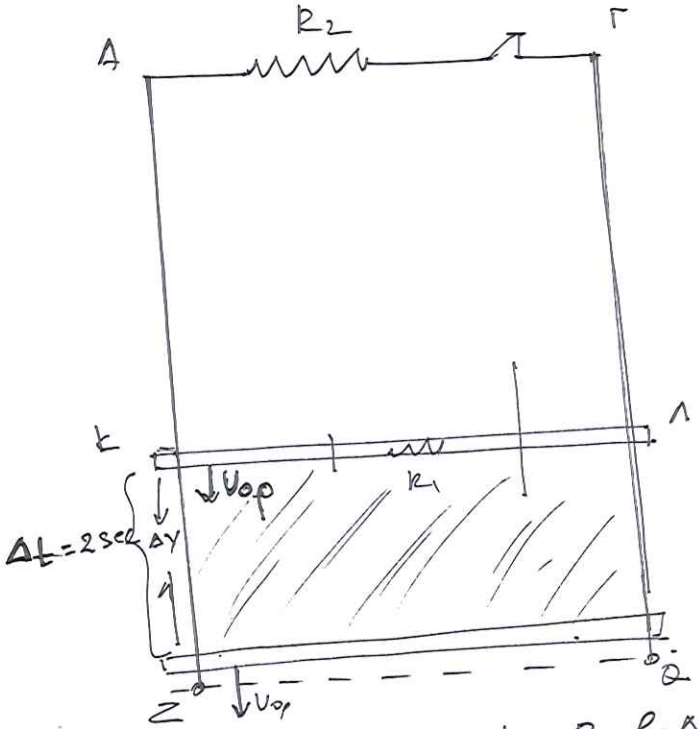
β) Την $t = 0^+$ $\Sigma F = mg - B \cdot \left(\frac{B U_0 \ell}{R_1 + R_2}\right) \ell < 0$.

ΑΡΑ ΘΑ ΚΑΝΕΙ ΕΠΙΒΡΑΔΥΝΟΜΕΝΗ ΚΙΝΗΣΗ ΘΑ ΑΠΟΚΤΗΣΕΙ U_{op} ΟΤΑΝ

$\Sigma F = 0 \Rightarrow mg - \frac{B^2 \upsilon \ell^2}{R_1 + R_2} = 0 \Rightarrow \dots U_{op} = \cdot$

γ) • ΟΤΑΝ $\upsilon = 3\ m/s$

$\frac{\Delta P}{\Delta t} = \Sigma F = mg - B \frac{B \upsilon \ell}{R_1 + R_2} \ell$



δ)

• $\Delta\Phi = B \cdot \ell \cdot \Delta y = B \ell \cdot U_{op} \cdot \Delta t$

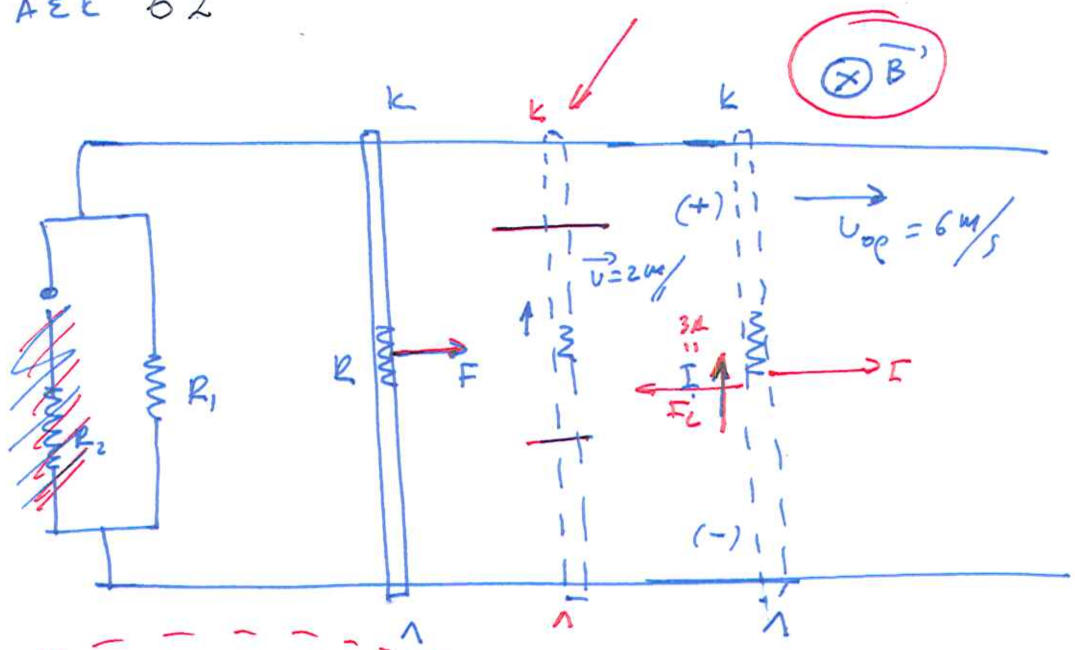
• $q = I \cdot \Delta t$

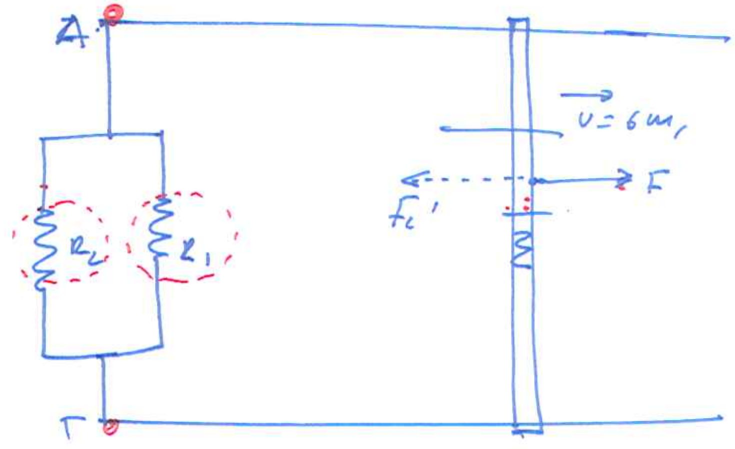
• $Q = I^2 R_{ολ} \cdot \Delta t$

• $V_{KΛ} = \mathcal{E}_{επ} - i \cdot R_1$

$V_{KΛ} = B \upsilon \ell - \frac{B \upsilon \ell}{R_1 + R_2} \cdot R_1$

ΑΣΚ 62





• $W_F = K_{ιv} + Q_{R_{ολ}}$

$I = \frac{B v \ell}{R_1 + R} \Rightarrow U_{op} = 6\,m/s$

$F = B I \cdot \ell \Rightarrow B = 1\,T$

$V_{KΛ} = B v \ell - I_1 R = 4 - 1 = 3\,V$

$I_1 = \frac{B v \ell}{R_{ολ}} = 1A$

• $\frac{\Delta K}{\Delta t} = \Sigma F \cdot U = (F - F_L) \cdot U = (6-2) \cdot 2 = 8\,J/s$

$F_L = B I \ell = 2N$

$I' = \frac{B v \ell}{R_{ολ}} = \frac{12}{3} = 4A$

$\Sigma F = F - F_L = 6N - 8N = -2N$ (επιβραδυνόμενη κίνηση)

• $P_{R_1} = I_1^2 R_1$ min στην $I_1, I_2 = min$

• $P_{R_2} = I_2^2 R_2$ δηλ. στην $I \to min$

στην U_{min} δηλ. στην $\Sigma F = 0$

$U \to U_{op}$ στην $\Sigma F = 0 \Rightarrow F = F_L' \Rightarrow$

$6 = B \cdot I \cdot \ell \Rightarrow I = 3A$

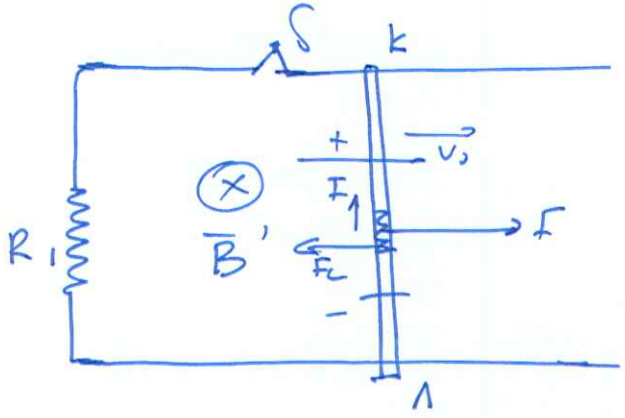
$V_{ΑΓ} = I \cdot R_{1,2} = 6\,V$

• $I_1 = \frac{V_{ΑΓ}}{R_1} = 2A$ $P_{R_1} = I_1^2 R_1 = 12W$

• $I_2 = \frac{V_{ΑΓ}}{R_2} = 1A$ $P_{R_2} = I_2^2 R_2 = 6W$

$P_{R_1,R_2} = 18\,W$

ΑΣΚ 64



$\ell = 1\,m$

$m = 0,5\,kg$

$R_2 = 0,1\,\Omega$

$B = 1\,T$

$U_0 = 2\,m/s$

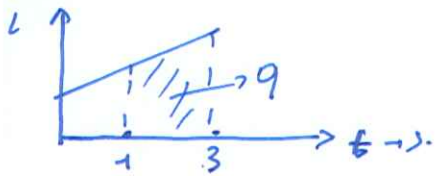
$\alpha = 1\,m/s^2$

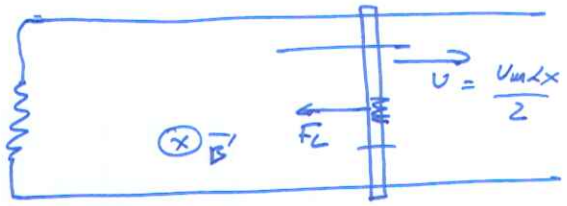
α) $\Sigma F = m \cdot \alpha \Rightarrow F - F_L = m \cdot \alpha$

$\Rightarrow F - B \cdot \frac{B\upsilon\ell}{R_{ολ}} \cdot \ell = m \cdot \alpha$

$\Rightarrow F = \frac{B^2\ell^2}{R_{ολ}}(U_0 + \alpha t) + m \cdot \alpha$

β) $i' = \frac{\mathcal{E}_{επ}}{R_{ολ}} = \frac{B \cdot \ell (U_0 + \alpha t)}{R_{ολ}}$





$U_{max} = U_{t=3sec} = U_0 + \alpha \cdot t = 2 + 1 \cdot 3 = 5\,m/s$

όταν $U = \frac{U_{max}}{2} = 2,5\,m/s$

$\frac{\Delta p}{\Delta t} = \Sigma F = -F_L = -B \cdot I \cdot \ell = -B\frac{B\upsilon\ell}{R_{ολ}} \cdot \ell$

$Q = \frac{1}{2} m U_{max}^2$

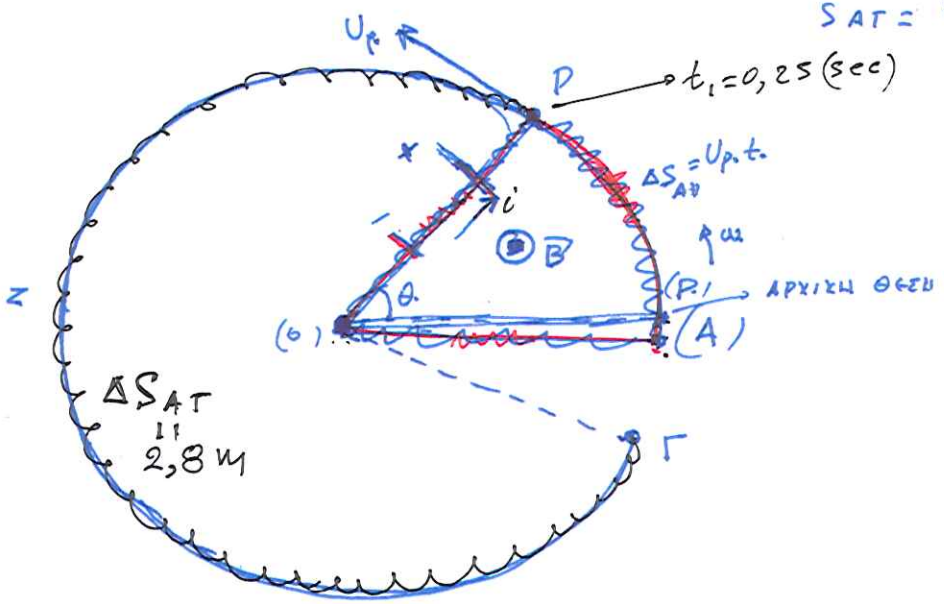
όλη η κινητική ενέργεια του αγωγού έχει διαρρεύσει στις αντιστάσεις.

ΑΣΚ 66

$R = 50\,cm$, $\alpha = 0,5\,m$

$B = 0,5\,T$, $\omega = 2\ rad/s$

$S_{AT} = 2,8\,m$



$* R_{(OA)} = R^* \cdot (\alpha)$

$* R_{(AP)} = R^* \cdot (\Delta S_{AP}) = R^* \cdot U_p \cdot \Delta t$

$* R_{(PO)} = R^* \cdot (\alpha)$

α) $U_p = \omega \cdot \alpha = 1\ m/s$ (ΑΚΡΟΥ)

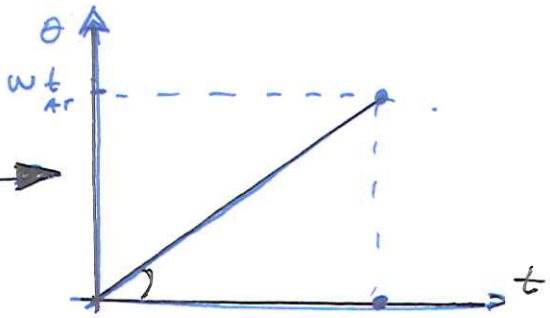
$\mathcal{E}_{επ} = \frac{B\omega\alpha^2}{2}$ $\left(\mathcal{E}_{επ} = \frac{\Delta\phi}{\Delta t} = \frac{B \cdot \Delta A}{\Delta t} = \frac{B \cdot \ell^2 \Delta\theta/2}{\Delta t} = \frac{B\omega\ell^2}{2} \right)$

β) $I = \frac{\mathcal{E}_{επ}}{R_{ολ}} = \frac{\mathcal{E}_{επ}}{R^*(\alpha + \alpha + \Delta S_{AP})}$

$R_{ολ} = R_{OA} + R_{AP} + R_{PO}$

$\Delta S_{AP} = U_p \cdot t$

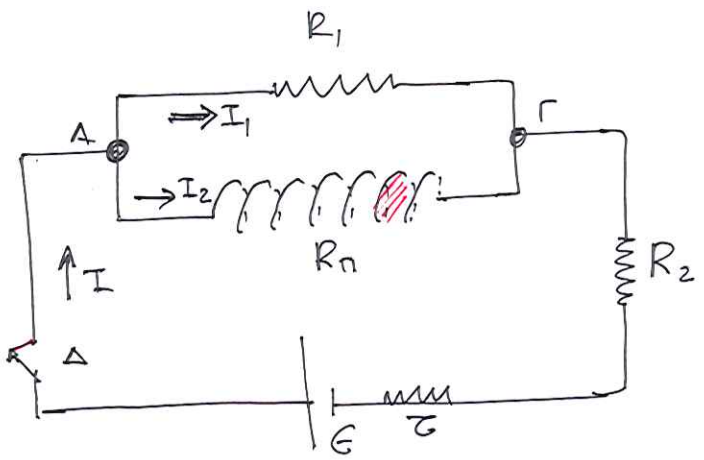
γ) $\theta = \omega \cdot t$



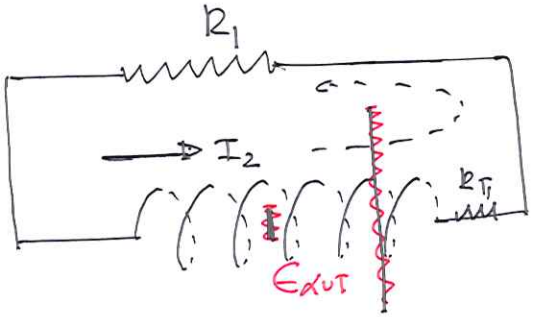
$t_{AT} = \frac{\Delta S_{AT}}{U_p} = \frac{2,8}{1} = 2,8\,sec$

δ) $i = \frac{\mathcal{E}_{επ}}{R^*(\alpha + \alpha + U_p \cdot t)}$, $i_{min} = \frac{\mathcal{E}_{επ}}{R^*(\alpha + \alpha + S_{AT})}$

ΑΣΚ 68



ΑΚΡΙΒΩΣ ΜΕΤΑ



$$|\varepsilon_{\alpha\upsilon\tau}| = L\left|\frac{\Delta i}{\Delta t}\right| \Rightarrow \frac{\Delta i}{\Delta t} = (-)\ldots\ldots$$

α) $L = \mu_0 \dfrac{N^2 (\pi \delta^2)}{\ell}$

• $Q_{\text{ολικό}} = U_L = \dfrac{1}{2} L I_2^2$

β) $I = \dfrac{\varepsilon}{R_{ολ}}$

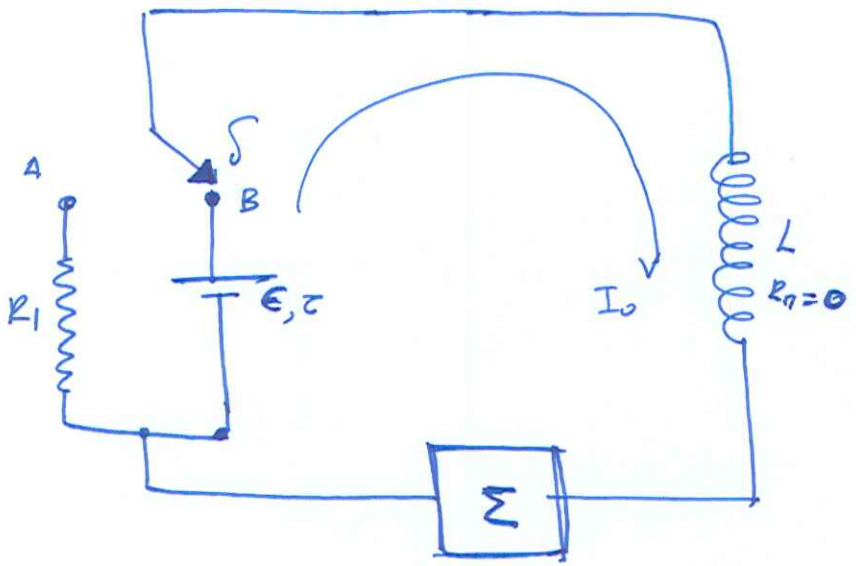
$B_{\text{πηνίο}} = \mu_0 I_2 \dfrac{N}{\ell}$

$R_{ολ} = R_{1,\pi} + R_2 + \tau$

$V_{AT} = I \cdot R_{1,\pi}$

$I_1 = \dfrac{V_{AT}}{R_1}$, $I_2 = \dfrac{V_{AT}}{R_\pi}$

ΑΣΚ 69

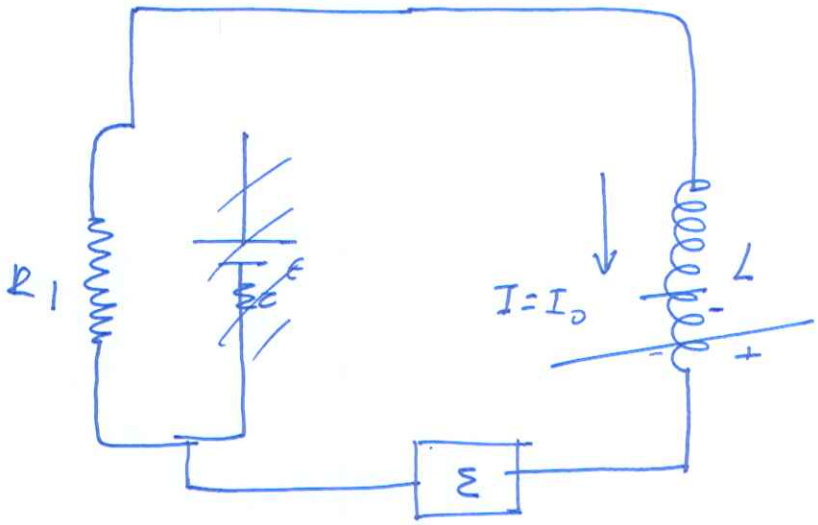


α) $L = \mu_0 \frac{N^2}{\ell} A$

β) $I_\Sigma = \frac{P_\Sigma}{V_\Sigma}$

ΚΑΙ

$I = \frac{\epsilon}{R_{ολ}} = \frac{\epsilon}{R_\Sigma + r}$



γ) $i' = \frac{\epsilon_{επ.}}{R_{ολ}'} = \frac{L \cdot \left|\frac{\Delta i'}{\Delta t}\right|}{R_1 + R_\Sigma} \Rightarrow$

$\Rightarrow \frac{\Delta i'}{\Delta t} = (-) \cdots$

δ) $Q_{ολ} = \frac{1}{2} L I_0^2$

$Q_{ολ} = Q_1 + Q_\Sigma$

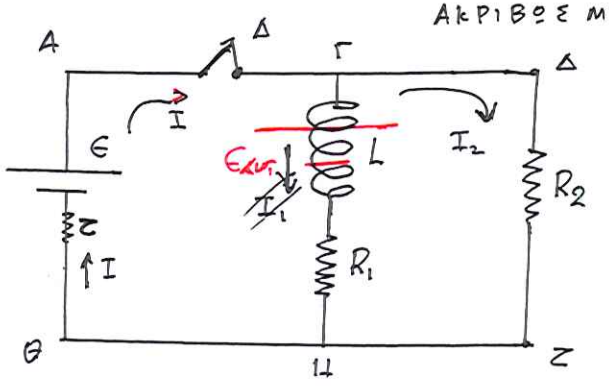
ΚΑΙ

$\frac{Q_1}{Q_\Sigma} = \frac{R_1}{R_\Sigma}$

$Q_1 = \cdots$

$Q_\Sigma = \cdots$

ΑΣΚ #1



ΑΚΡΙΒΩΣ ΜΕΤΑ $\rightarrow I_1 = 0$

$I = I_2$

2ο ΚΑΝΟΝΑ KIRCHOFF (ΑΓΔΖΗΘΑ)

$-I_2 R_2 - I r + E = 0$

$\Rightarrow I = \frac{E}{R_2 + r} = 2A$

$I_2 = I = 2A.$

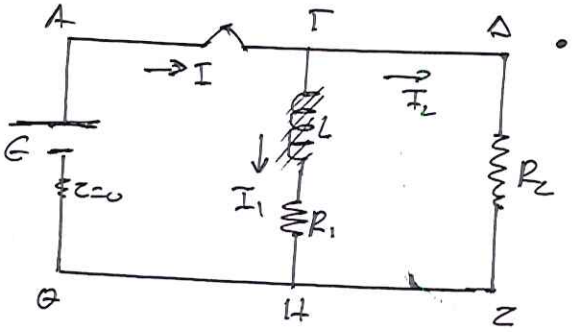
$E = 12V$

$r = 0\Omega$

$R_1 = 3\Omega$

$R_2 = 6\Omega$

$L = 0,2H$

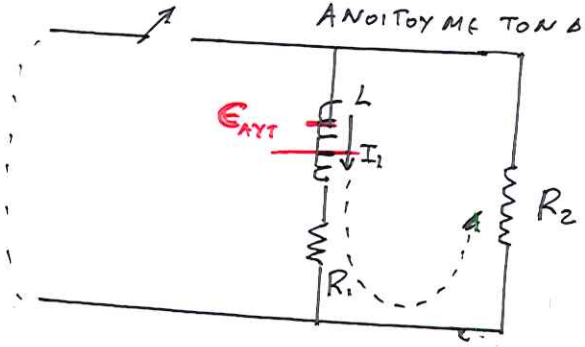


• ΟΤΑΝ ΤΑ ΡΕΥΜΑΤΑ ΕΙΝΑΙ ΣΤΑΘΕΡΑ,

$\bullet I = \frac{E}{R_{1,2}} = 6A.$

$I_1 = \frac{V_{TH.}}{R_1} = \frac{E}{R_1} = 4A.$

$I_2 = \frac{V_{\Delta Z}}{R_2} = \frac{E}{6} = 2A$



↓

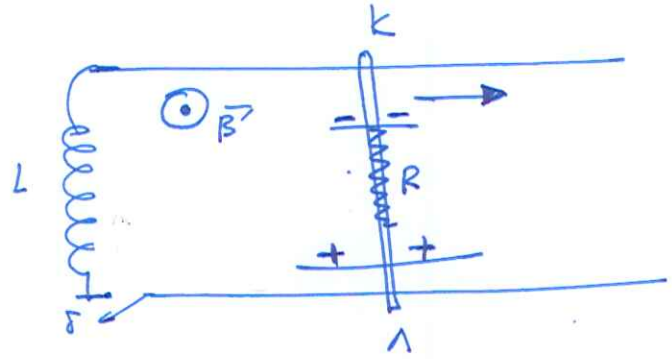
ΑΚΡΙΒΩΣ ΜΕΤΑ

$I_{ΠΗΝΙΟ} = I_1 = 4A$ ΚΑΙ ΜΕΙΩΝΕΤΑΙ ΑΡΑ ΑΥΞΗΤΙΚΗ ΕΛΚΤ. ΓΙΑ ΝΑ ΤΟ ΣΥΝΤΗΡΗΣΕΙ.

$\bullet Q = |\Delta U_L| = |U_L^{\text{τελ}} - \frac{1}{2} L I_1^2|$

$Q = 1,6\,J.$

ΑΣΚ 13



$L = 2\,H$

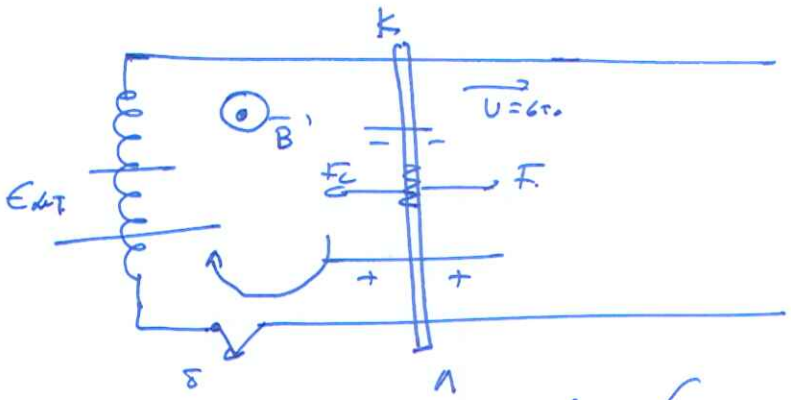
$\ell = 2\,m$

$R = 4\,\Omega$

$U = 10\,m/s$

$B = 1\,T$

α) $V_{K\Lambda} = E_{επ} = B U \cdot \ell$



γ) $i' = \dfrac{B U \ell - E_{ωτ.}}{R_{ολ}}$

β) $U_L^{max} = \frac{1}{2} L I_0^2 \quad \left(I_0 = \dfrac{B U \ell}{R_{ολ}}\right)$

όταν σταθεροποιηθεί το ρεύμα

δ) όταν $\dfrac{\Delta i'}{\Delta t} = 4\,A/s$ $\quad i' = \dfrac{B U \ell - L\frac{\Delta i'}{\Delta t}}{R_{ολ}}$

και $F = F_L = B I \cdot \ell = \dots$