

Αδ. 7.96

500 σπείρες. (K)

$$L = 0,2 \text{ H}$$

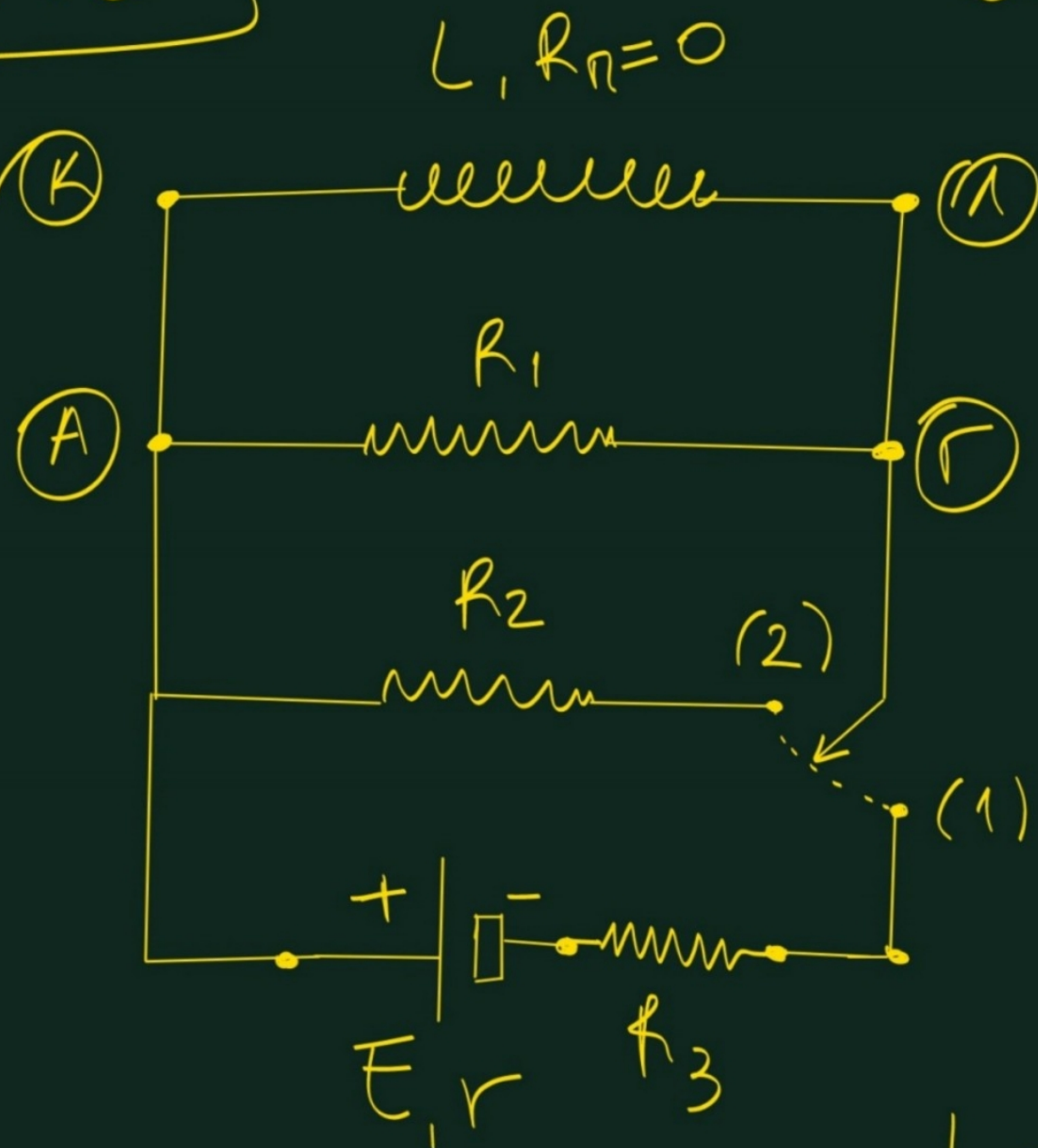
$$R_1 = 30 \Omega$$

$$R_2 = 60 \Omega$$

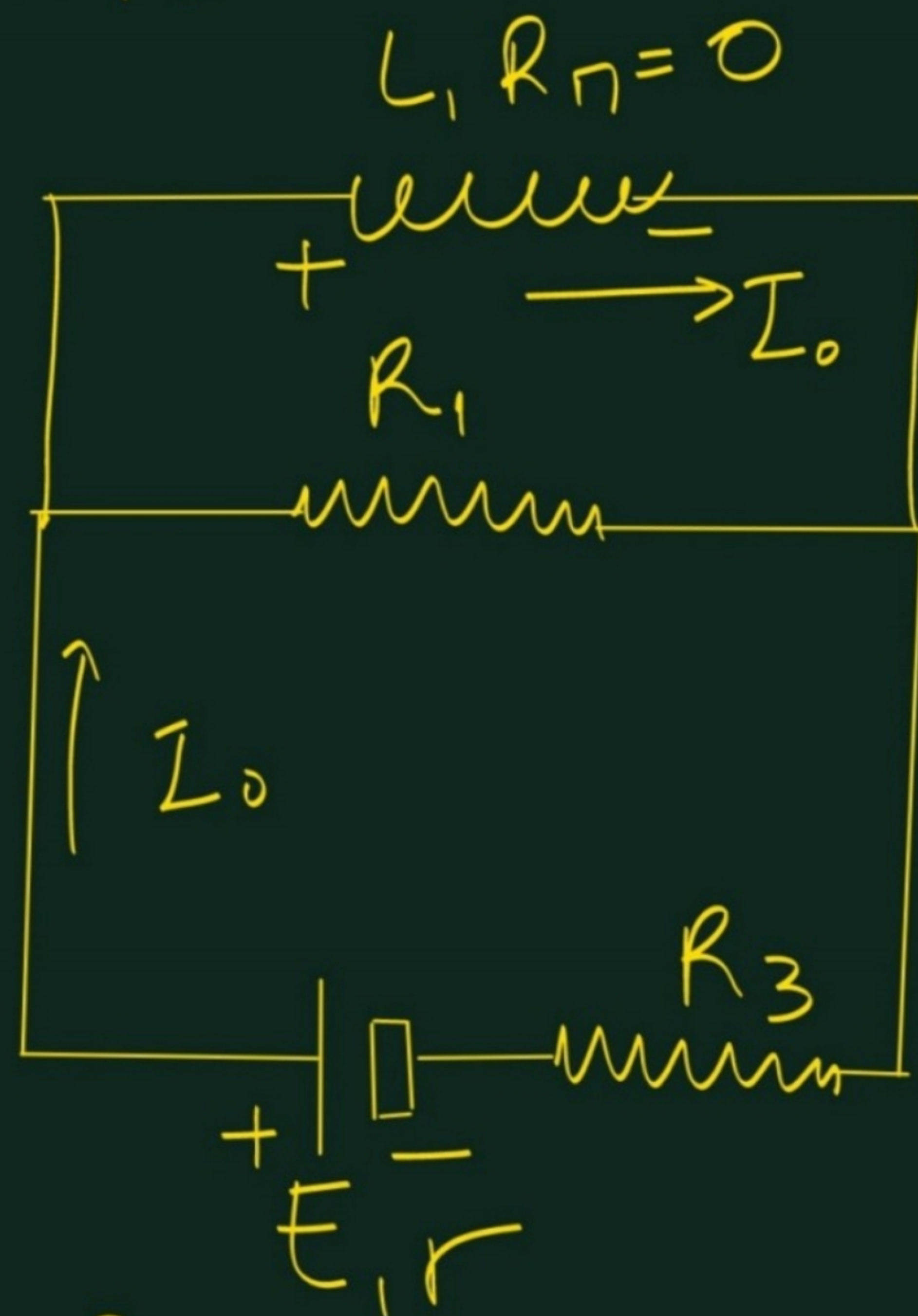
$$R_3 = 30 \Omega$$

$$E = 120 \text{ V.}$$

$$r = 10 \Omega$$



α) Με το κύκλωμα στη θέση (1) έχουμε το κύκλωμα:



Στη θέση (2) έχουμε το κύκλωμα που περιγράφεται σαν βραχυκύκλωμα.

$$I_0 = \frac{E}{R_3 + r} \Rightarrow$$

$$I_0 = \frac{120}{40} = 3 \text{ A}$$

$$L = \mu_0 \mu \frac{N^2}{\ell} A$$

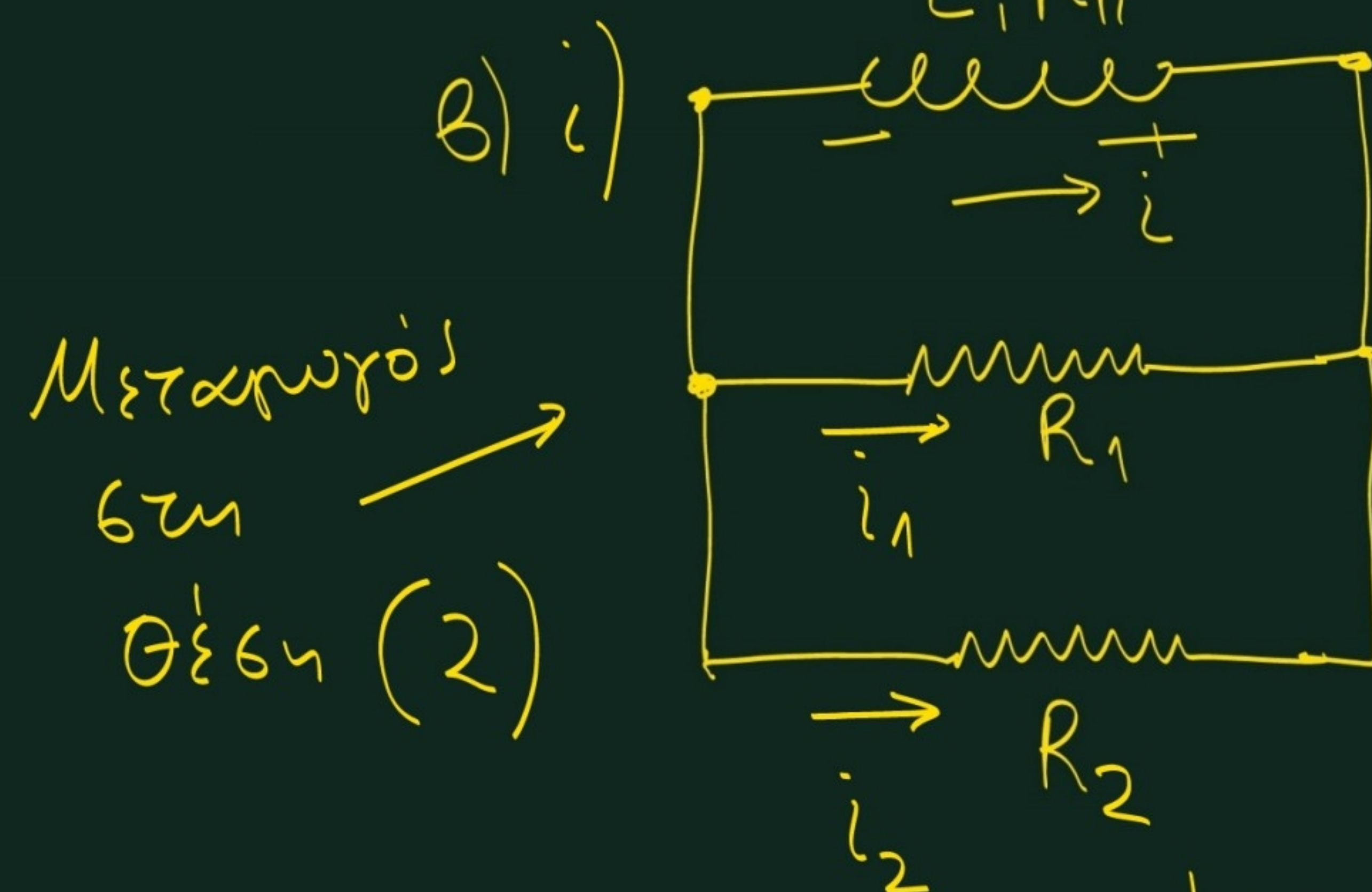
$$\Phi_{\max} = BA = \mu \mu_0 n \bar{I}_0 A = \mu \mu_0 \frac{N}{\ell} \cdot A \cdot \bar{I}_0 = \frac{L \bar{I}_0}{N}$$

$$\text{Αρα: } \Phi_{\max} = \frac{LI_0}{N} = \frac{0,2 \cdot 3}{500} \Rightarrow$$

$$\Phi_{\max} = \frac{0,6}{5 \cdot 10^2} = \frac{6 \cdot 10^{-1}}{5 \cdot 10^2} \Rightarrow$$

$$\Phi_{\max} = 1,2 \cdot 10^{-3} \text{ Wb.}$$

$$L, R_0 = 0$$



$$E_{\text{ωτ}} = i R_{1,2} \Rightarrow$$

$$-L \frac{\Delta i}{\Delta t} = i \frac{R_1 R_2}{R_1 + R_2} \Rightarrow$$

$$L \frac{\Delta i}{\Delta t} = -i \frac{R_1 R_2}{R_1 + R_2}$$

$$\text{Αν } i = \frac{I_0}{2} \text{ έχουμε:}$$

$$V_L = L \frac{\Delta i}{\Delta t} = |E_{\text{ωτ}}| = \frac{I_0}{2} \frac{R_1 R_2}{R_1 + R_2} = \frac{3}{2} \cdot \frac{30 \cdot 60}{30 + 60}$$

$$= \frac{3}{2} \cdot \frac{1800}{90} = \frac{3}{2} \cdot 20 = 30 \text{ Volt}$$

$$|E_{\text{ωτ}}| = \frac{|\Delta \Phi|}{\Delta t} \text{ για όλες τις σπείρες. Αρα για μία σπείρα:}$$

$$8) U_L = \frac{1}{2} L i^2$$

$$\frac{\Delta U_L}{\Delta t} = L i \frac{\Delta i}{\Delta t} = i U_L$$

$$U_L = Q_{R_1} + Q_{R_2} \Rightarrow$$

$$\frac{\Delta U_L}{\Delta t} = \frac{\Delta Q_{R_1}}{\Delta t} + \frac{\Delta Q_{R_2}}{\Delta t} =$$

$$= i_1^2 R_1 + i_2^2 R_2$$

$$\frac{\Delta Q_{R_2}}{\Delta U_L} = \frac{1}{3} \Rightarrow \Delta U_L = 3 \Delta Q_{R_2}$$

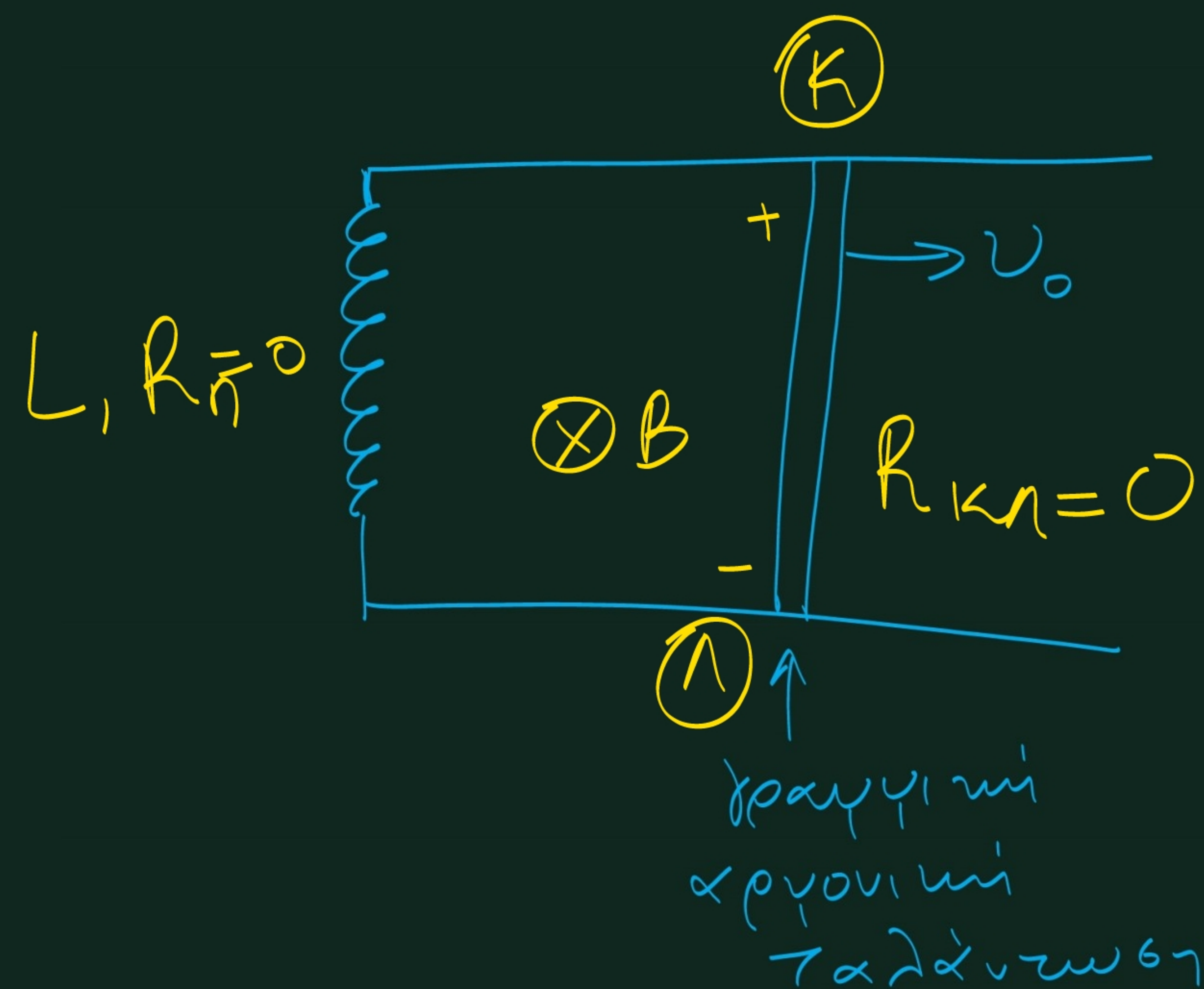
$$i_1 R_1 = i_2 R_2 \Rightarrow 30 i_1 = 60 i_2 \Rightarrow i_1 = 2 i_2$$

$$\begin{aligned} \frac{\Delta Q_{R_2}}{\Delta t} &= \frac{i_2^2 R_2}{i_1^2 R_1 + i_2^2 R_2} \Rightarrow \frac{\Delta Q_{R_2}}{\Delta U_L} = \frac{i_2^2 R_2}{4 i_2^2 R_1 + i_2^2 R_2} = \\ &= \frac{R_2}{4 R_1 + R_2} = \frac{60}{4 \cdot 30 + 60} = \frac{60}{180} = \\ &= \frac{1}{3} \end{aligned}$$

$$\sum \Delta U_L = 3 \sum \Delta Q_{R_2} \Rightarrow$$

$$U_{L, \text{apx}} = 3 Q_{R_2, \text{apx}} \Rightarrow \frac{1}{2} L I_0^2 = 3 Q_{R_2, \text{apx}} \Rightarrow \frac{1}{2} \cdot 0,2 \cdot 3^2 = 3 Q_{R_2, \text{apx}} \Rightarrow$$

$$Q_{R_2, \text{apx}} = 0,3 \text{ Joule.}$$

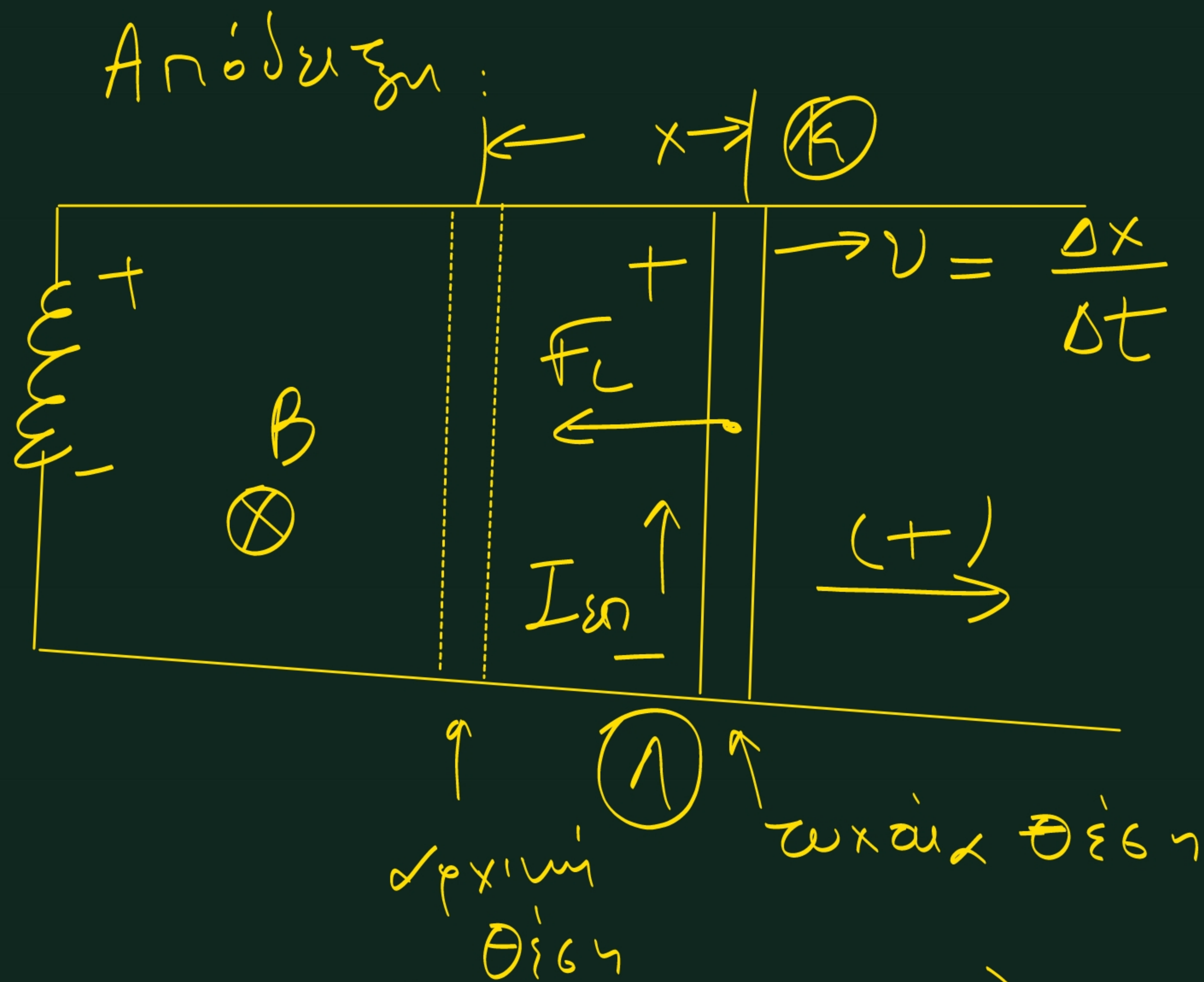


(ψε την προϋπόθεση
να μην υπάρχουν
αντιστάσεις).

Στην τωκία θέση έχουμε:

$$\Sigma F = -F_L = -BI_{\epsilon\eta}l$$

$$V_L = V_{K\Lambda} \Rightarrow L \cdot \frac{\Delta i}{\Delta t} = Bvl \Rightarrow L \cdot \frac{\Delta i}{\Delta t} = B \cdot \frac{\Delta x}{\Delta t} \cdot l$$



(χωρίς ταχύτητα)

$$\text{Αρα: } L \cdot \frac{\Delta i}{\Delta t} = B \cdot \frac{\Delta x}{\Delta t} \cdot l \Rightarrow$$

$$L \cdot \Delta i = B \cdot l \cdot \Delta x \Rightarrow$$

$$L \cdot \sum \Delta i = B l \cdot \sum \Delta x \Rightarrow$$

$$L \cdot I_{\text{ση}} = B l \cdot x \Rightarrow$$

$$I_{\text{ση}} = \frac{B l}{L} \cdot x$$

$$\text{Αρα: } \sum F = -B I_{\text{ση}} \cdot l \Rightarrow$$

$$\sum F = - \frac{B^2 l^2}{L} \cdot x = -D \cdot x$$

Επομένως ο αγωγός ΚΑ συμπερι-
 ζεται ως αρμονική ταλαντώτρια με

$$D = \frac{B^2 l^2}{L}$$

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$$L = 2 \text{ H}$$

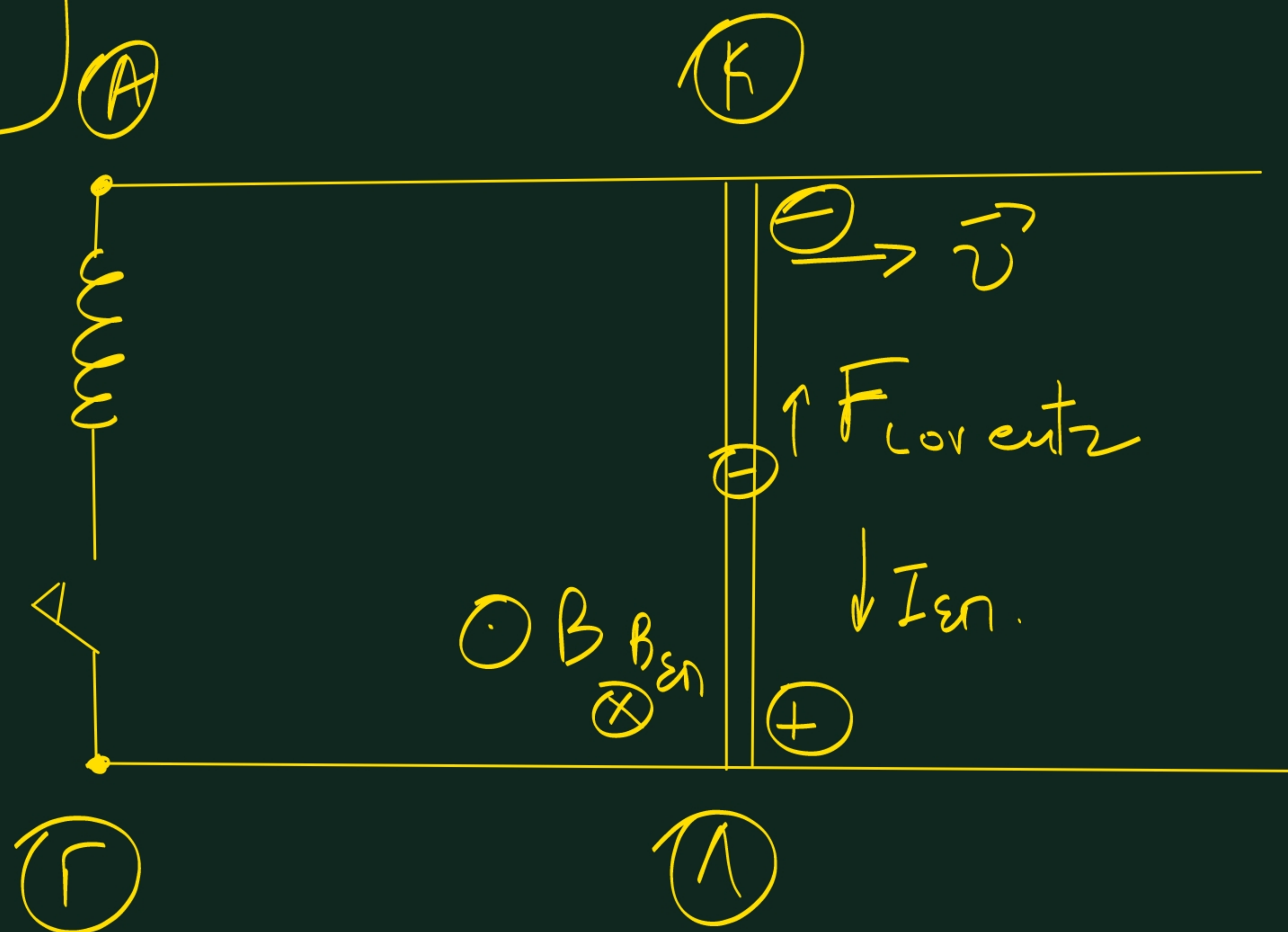
$$l = 2 \text{ m}$$

$$R_K = R = 4 \Omega$$

$$v = 10 \text{ m/s}$$

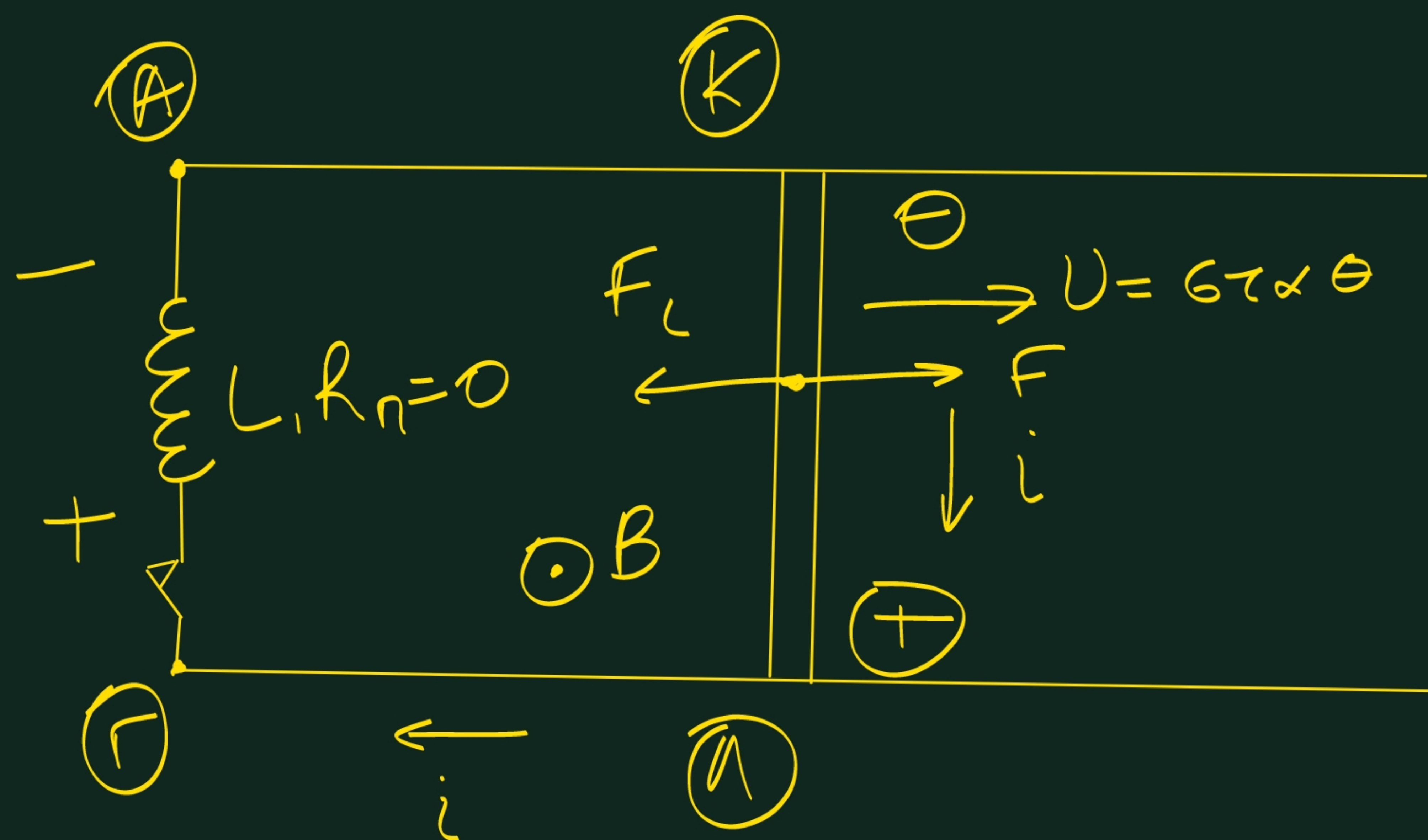
$$B = 1 \text{ T}$$

(S)

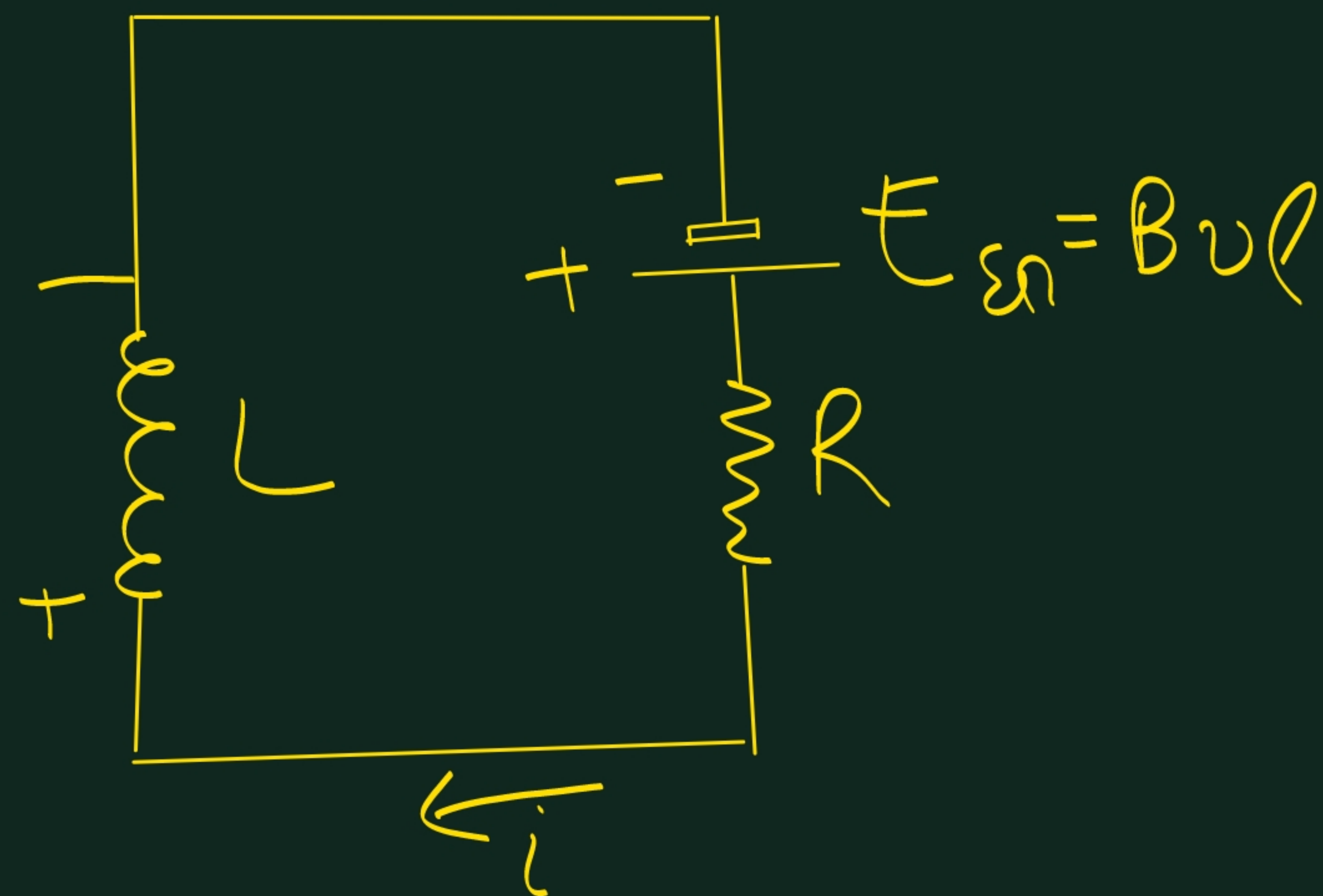


α) Με ανοικτό το διακόπτη
 έχουμε: $V_A - V_K = \mathcal{E}_{\text{ind}} \Rightarrow$

$$V_{AK} = Bvl = 20 \text{ Volt}$$



Ισοδύναμο κύκλωμα:



$$b) i) E_{en} = iR + V_L \Rightarrow$$

$$Bvl = iR + L \cdot \frac{\Delta i}{\Delta t}$$

Το μέγιστο ρεύμα το έχουμε όταν
δίνει $V_L = 0 \Rightarrow \frac{\Delta i}{\Delta t} = 0$. Άρα:

$$Bvl = I_0 \cdot R \Rightarrow I_0 = \frac{Bvl}{R}$$

$$U_{L, \max} = \frac{1}{2} L I_0^2 =$$

$$= \frac{1}{2} L \cdot \left(\frac{Bvl}{R} \right)^2 = \frac{1}{2} \cdot 2 \cdot \left(\frac{1 \cdot 10 \cdot 2}{4} \right)^2 =$$

$$= 25 \text{ Joule.}$$

$$ii) |E_{\omega r}| = V_L = L \cdot \frac{\Delta i}{\Delta t} \quad i = i_1$$

$$A_{\rho x}: Bvl = iR + |E_{\omega r}| \Rightarrow$$

$$Bvl = i_1 R + |E_{\omega r}| \Rightarrow$$

$$20 = 1 \cdot 4 + |E_{\omega r}| \Rightarrow$$

$$|E_{\omega r}| = 16 \text{ Volt.}$$

iii) Η ταχύτητα είναι σταθερή οπότε:

$$F = F_L = Bil$$

$$Bvl = iR + L \cdot \frac{\Delta i}{\Delta t} \Rightarrow$$

$$20 = i_2 \cdot 4 + 2 \cdot 4 \Rightarrow$$

$$4i_2 = 12 \Rightarrow i_2 = 3 \text{ A}$$

$$A_{\rho x}: F = Bi_2 l = 1 \cdot 3 \cdot 2 = 6 \text{ N}$$

$$P_F = \frac{\Delta W_F}{\Delta t} = F \cdot v = 6 \cdot 10 = 60 \text{ J/sec}$$