Ασκ. 5.219 (Μαθ)

$\ell = OA = 1,6\,m$.

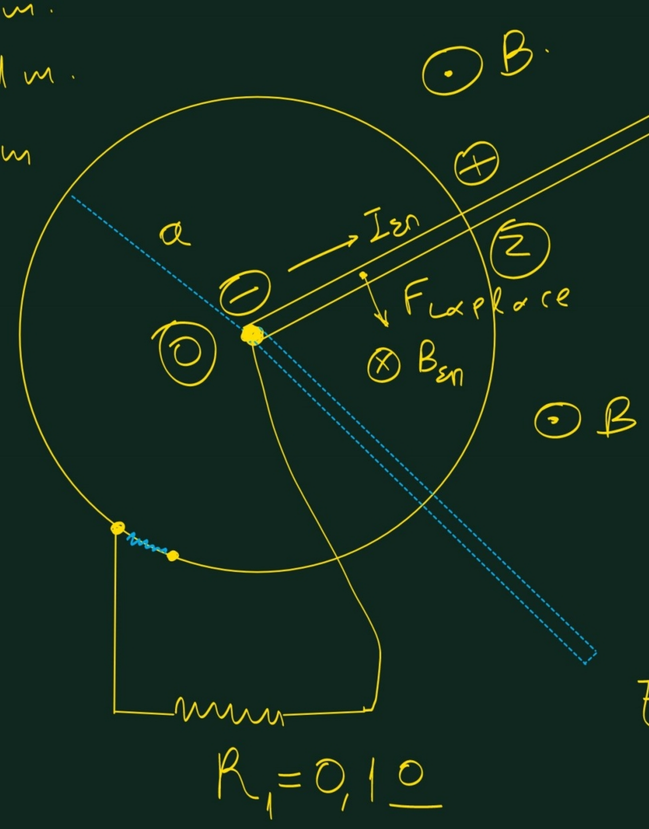
$OZ = a = 1\,m$.

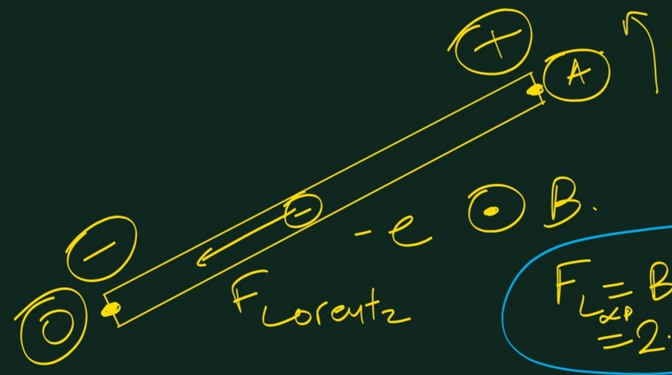
$R^* = 0,4\,\Omega/m$ για τον OA.

$V_1 = 0,2\,V$.

$R_1 = 0,1\,\Omega$

$B = 2\,T$.

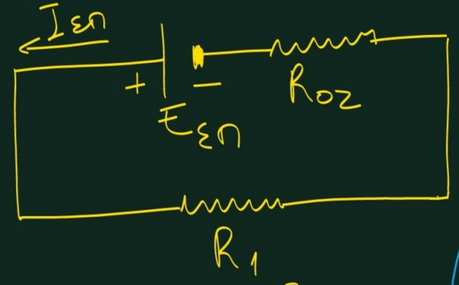




$F_{Lαρ} = B I_{επ} a =$
$= 2 \cdot 2 \cdot 1 \Rightarrow F_{Lαρ} = 4N$

$R_{OZ} = R^* \cdot OZ = R^* \cdot a = 0,4 \cdot 1 = 0,4\,\Omega$

Ισοδύναμο κύκλωμα.



$V_1 = I_{επ} \cdot R_1 \Rightarrow$

$0,2 = I_{επ} \cdot 0,1 \Rightarrow$

$I_{επ} = 2\,A$.

$E_{επ} = I_{επ}(R_1 + R_{OZ}) \Rightarrow$

$E_{επ} = 2 \cdot (0,1 + 0,4) \Rightarrow$

$E_{επ} = 1\,Volt$.

$E_{επ} = \frac{1}{2} B \omega a^2 \Rightarrow 1 = \frac{1}{2} \cdot 2 \cdot \omega \cdot 1^2 \Rightarrow$

$\omega = 1\,rad/sec$

γ) $\omega = 1\ rad/sec \Rightarrow$

$\frac{2\pi}{T} = 1 \Rightarrow T = 2\pi\ sec.$

$Q = I_{\varepsilon\pi}^2 (R_1 + R_{o2}) \cdot t \Rightarrow$

$Q = I_{\varepsilon\pi}^2 (R_1 + R_{o2}) \cdot 10T \Rightarrow$

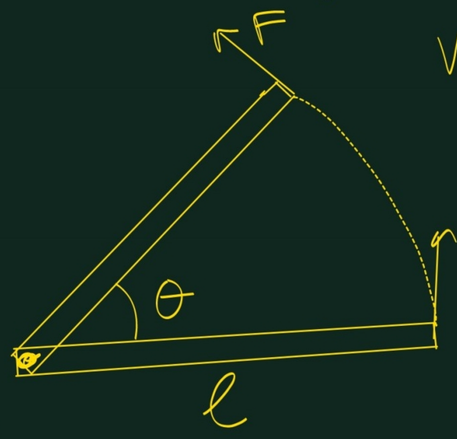
$Q = 2^2 \cdot (0,1 + 0,4) \cdot 10 \cdot 2\pi \Rightarrow$

$Q = 4 \cdot 0,5 \cdot 10 \cdot 2\pi \Rightarrow$

$Q = 40\pi$ Joule

δ) Το έργο της σταθερής δύναμης F που ασκείται κάθετα στο άκρο A του δοκού γίνεται θερμότητα στις αντιστάσεις.

Δηλαδή: $P_F = P_{R_{o2}}$ (εξίσωση ισχύων)



$W_F = F \cdot \ell \cdot \theta \Rightarrow$

$\frac{\Delta W_F}{\Delta t} = F \cdot \ell \cdot \frac{\Delta \theta}{\Delta t} = F \cdot \ell \cdot \omega$

$P_{R_{o2}} = I_{\varepsilon\pi}^2 (R_1 + R_{o2})$

Άρα: $I_{\varepsilon\pi}^2 (R_1 + R_{o2}) = F \cdot \ell \cdot \omega \Rightarrow 2^2 \cdot (0,1 + 0,4) = F \cdot 1,6 \cdot 1 \Rightarrow$

$2 = 1,6F \Rightarrow F = \frac{2}{1,6} \Rightarrow F = 1,25N$

Αθ.Σ.220 (Εξετάσεις 1993)

$L_1 = 1\,m$

$L_2 = 2\,m$

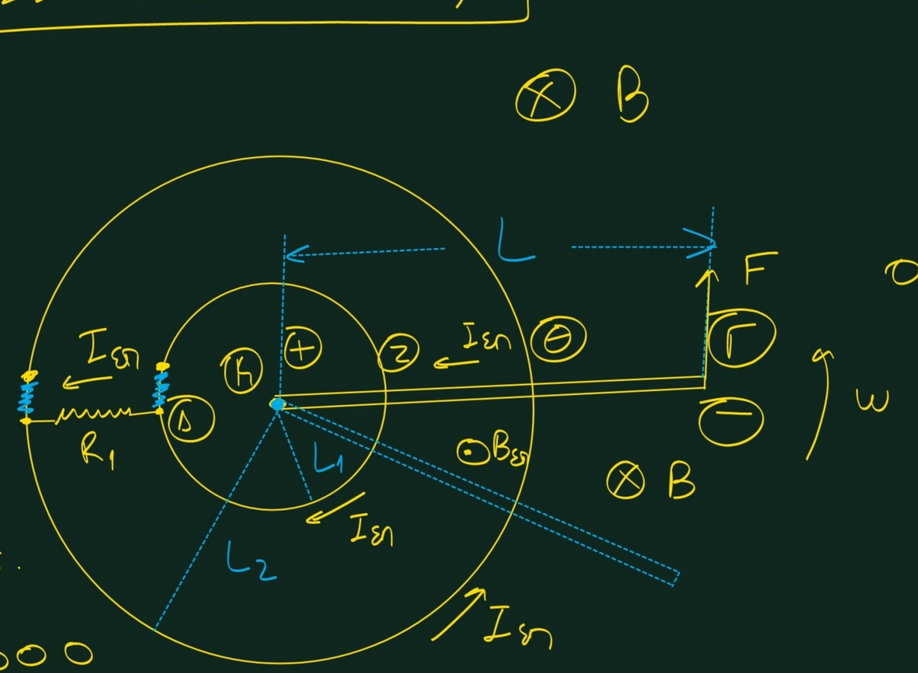
$B = 5\,T$

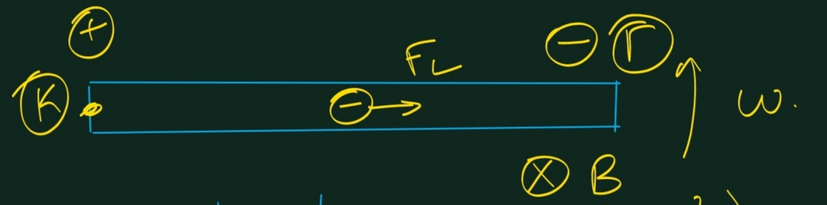
$R_1 = 600\,\Omega$

$L = 2{,}5\,m$

$\omega = 10\,rad/s$

$R_{K\Gamma} = 1000\,\Omega$





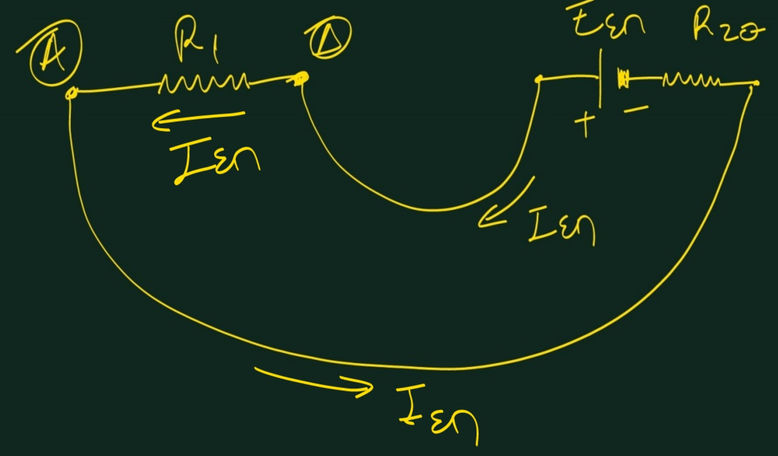
α) $E_{επ} = \dfrac{|\Delta\Phi|}{\Delta t} = \dfrac{B\pi(L_2^2 - L_1^2)}{T} =$

$= \dfrac{B\pi(L_2^2 - L_1^2)}{\frac{2\pi}{\omega}} = \dfrac{1}{2}B\omega(L_2^2 - L_1^2)$

με $V_2 > V_\Theta$

Αρα: $E_{επ} = \frac{1}{2} \cdot 5 \cdot 10 \cdot (4-1) = 25 \cdot 3 \Rightarrow$ **$E_{επ} = 75\,Volt$**

β)



Αφού το $I_{ση}$ έχει φορά από το Δ στο Α και είναι:

$$I_{ση} = \frac{E_{ση}}{R_1 + R_{2\Theta}} \Rightarrow$$

$$I_{ση} = \frac{75}{1000} \Rightarrow$$

$$I_{ση} = 0{,}075\ A.$$

$$R_{2\Theta} = \frac{2\Theta}{K\Gamma} \cdot R_{K\Gamma} \Rightarrow$$

$$R_{2\Theta} = \frac{L_2 - L_1}{L} \cdot R_{K\Gamma} \Rightarrow$$

$$R_{2\Theta} = \frac{2-1}{2{,}5} \cdot 1000 \Rightarrow$$

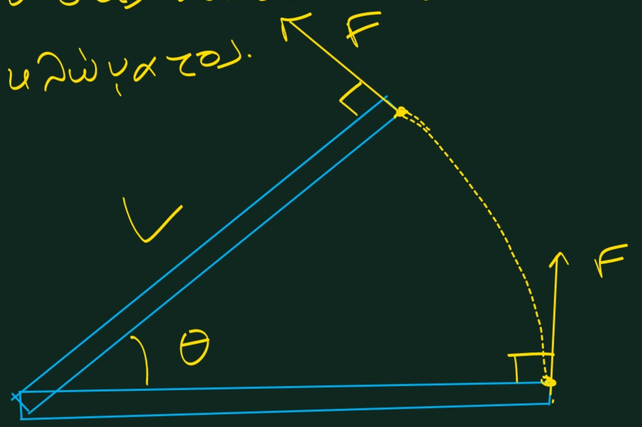
$$R_{2\Theta} = 400\,\Omega$$

γ) $V_\Delta - I_{ση} \cdot R_1 = V_A \Rightarrow$

$$V_A - V_\Delta = -I_{ση} \cdot R_1 \Rightarrow$$

$$V_{A\Delta} = -\frac{75}{1000} \cdot 600 \Rightarrow V_{A\Delta} = -45\ Volt$$

δ) Η ισχύς της δύναμης F είναι ίση με την ηλεκτρική ισχύ στις αντιστάσεις του κυκλώματος.



$$W_F = F \cdot L \cdot \theta$$

$$\frac{\Delta W_F}{\Delta t} = F \cdot L \cdot \frac{\Delta \theta}{\Delta t} \Rightarrow$$

$$P_F = F \cdot L \cdot \omega$$

$$P_F = P_{R_{01}} \Rightarrow$$

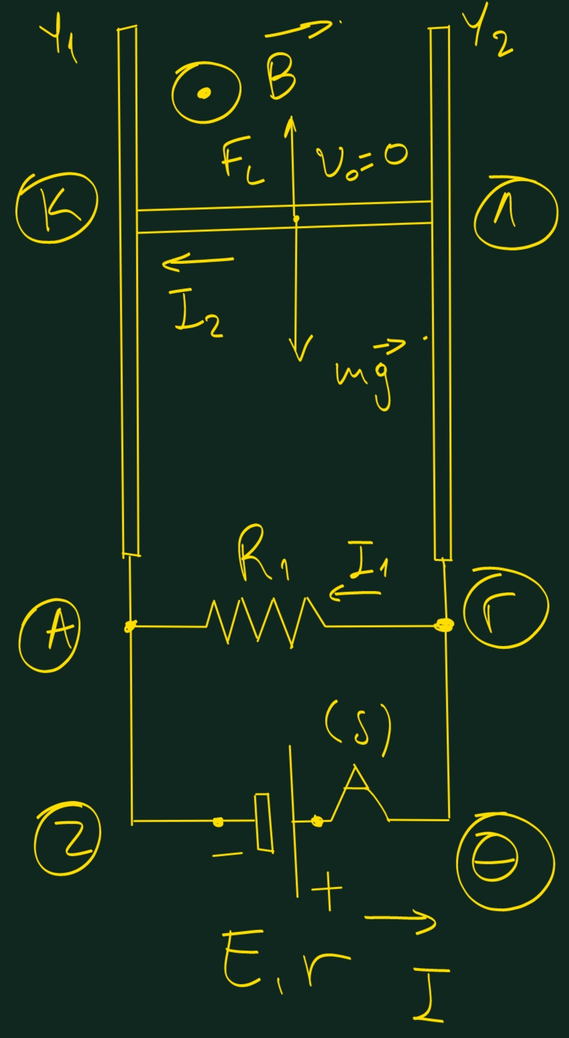
$$F \cdot L \cdot \omega = I_{\varepsilon\pi}^2 (R_{20} + R_1) \Rightarrow$$

$$F \cdot 2,5 \cdot 10 = \left(\frac{75}{1000}\right)^2 \cdot 1000 \Rightarrow$$

$$25F = \frac{75 \cdot 75}{1000} \Rightarrow$$

$$F = \frac{225}{1000} \Rightarrow \boxed{F = 0,225\,N}$$

Ασκ. 5.219 (Μαθ)



$m = 0{,}5\,kg$

$\ell = 1\,m$

$R_{K\Lambda} = R$

ο αγωγός ΚΛ αρχικά ισορροπεί ($\upsilon_0 = 0$)

$\vec{g}$

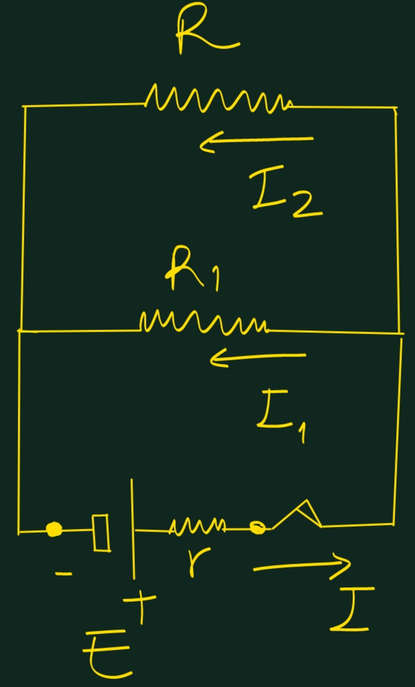
$E = 8\,Volt$

$r = 0{,}4\,\Omega$

$R_1 = 3\,\Omega$

$B = 1\,T$.

α) Το $\vec{B}$ πρέπει να έχει φορά προς τα έξω επειδή η F_L στον αγωγό έχει φορά προς τα πάνω.



$$F_L = mg \Rightarrow$$

$$BI_2\ell = mg \Rightarrow$$

$$1 \cdot I_2 \cdot 1 = 5 \Rightarrow$$

$$I_2 = 5\,A$$

$$I_2 \cdot R = I_1 R_1 \Rightarrow$$

$$5R = I_1 \cdot 3 \Rightarrow$$

$$I_1 = \frac{5R}{3}.$$

$$I = I_1 + I_2 = \left(\frac{5R}{3} + 5\right)$$

$$I = \frac{E}{R_{\sigma\upsilon\nu}} = \frac{E}{r + \frac{R_1 R}{R_1 + R}} = \frac{E(R_1 + R)}{r(R_1 + R) + R_1 R}$$

$$I = \frac{5R}{3} + 5$$

$$I = \frac{E(R_1+R)}{r(R_1+R)+R_1R} = \frac{8(3+R)}{0,45(3+R)+3R}$$

$$\frac{5R+15}{3} = \frac{8(R+3)}{0,45(3+R)+3R} \Rightarrow$$

$$\frac{5\cancel{(R+3)}}{3} = \frac{8\cancel{(R+3)}}{0,45(R+3)+3R} \Rightarrow$$

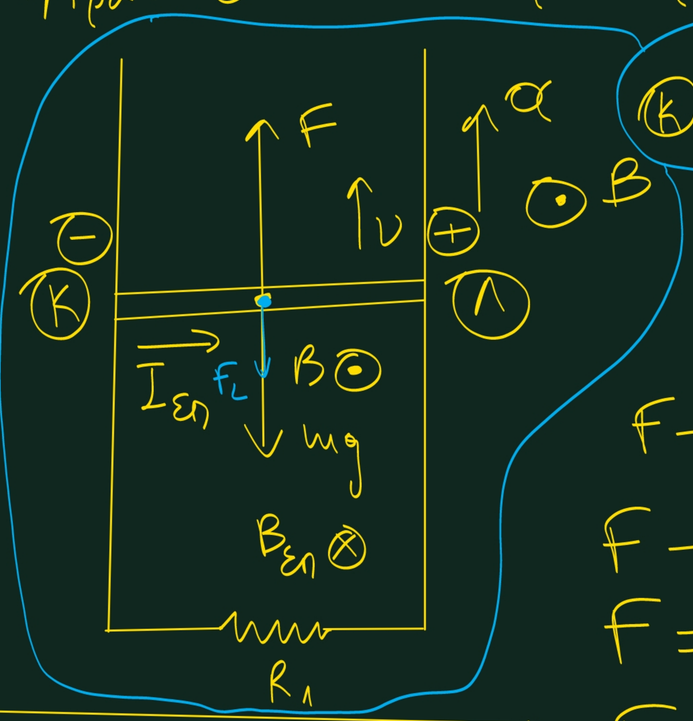
$$2,25\cdot(R+3)+15R = 24 \Rightarrow$$

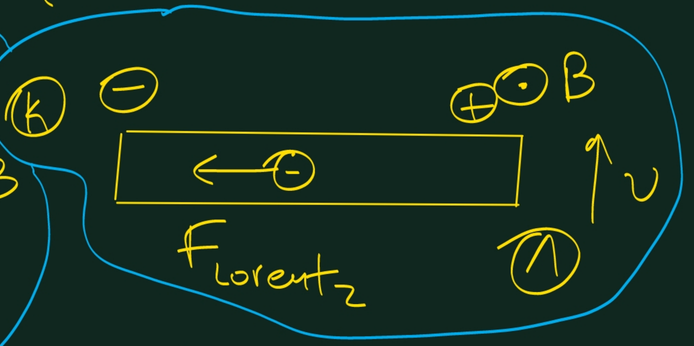
$$17,25R = 24 - 6,75 \Rightarrow 17,25R = 17,25 \Rightarrow R = 1\,\Omega$$

β) i) $\alpha = 2 - 0,5v$ (SI)

Η ταχύτητα γίνεται οριακή και σταθερή όταν γίνει $\alpha = 0$

Άρα: $0 = 2 - 0,5v_{op} \Rightarrow v_{op} = 4\,m/s$ (προς τα πάνω)





$-F_L$

$F - mg = ma \Rightarrow$

$F - 5 = 0,5(2 - 0,5v) \Rightarrow$

$F = 5 + 1 - 0,25v \Rightarrow$

$F = 6 - 0,25v$ (SI)

$P_F = \vec{F} \cdot \vec{v} = F \cdot v$

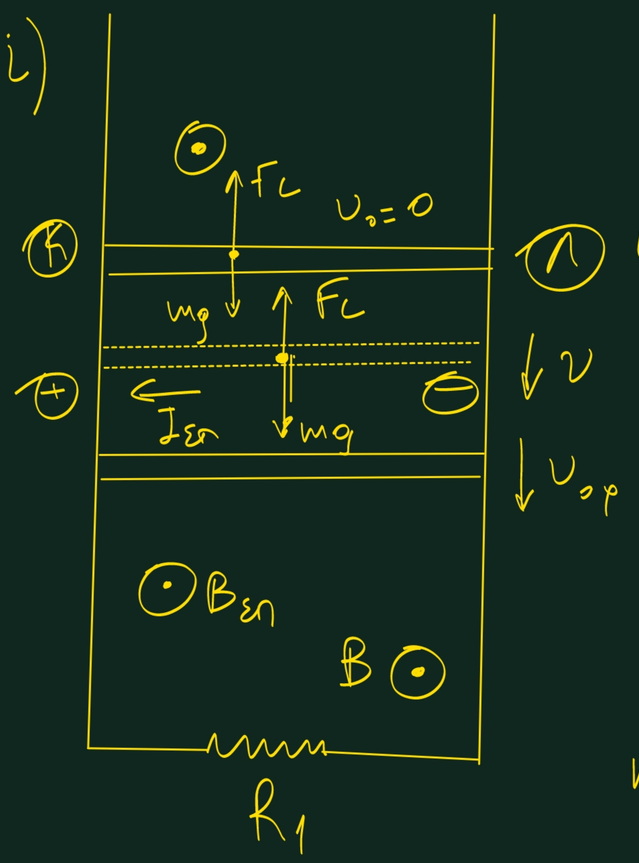
αφού $\vec{F} \uparrow\uparrow \vec{v}$.

Άρα: $P_F = (6 - 0{,}25v) \cdot v$

Άρα για $v = 1\,m/s$ έχουμε:

$P_F = 6 - 0{,}25 \Rightarrow$ **$P_F = 5{,}75\,Watt$.**

γ) i)



Τη στιγμή $t = 0$ ο αγωγός διαρρέεται από το ρεύμα I_2

$F_L = B I_2 \ell = 5N$

$W = mg = 5N$

$mg - F_L = ma \Rightarrow$

$mg - B I_{επ} \ell = ma \Rightarrow$

$mg - B \cdot \dfrac{E_{επ}}{R_1 + R} \ell = ma \Rightarrow$

$mg - \dfrac{B^2 \ell^2 v}{R_1 + R} = ma \Rightarrow$

$5 - \dfrac{v}{4} = 0{,}5a \Rightarrow 0{,}5a = 5 - 0{,}25v \Rightarrow$

$a = 10 - 0{,}5v\,(SI)$

$a = 0 \Rightarrow v = v_{op} = 20\,m/s$

προς τα κάτω

$a = 10 - 0{,}5\,v$

$a = 0 \Rightarrow v = v_{op} = 20\ m/s.$

- $A_C \propto v \in [0, 20]$

$a(0) = 10\ m/s^2$