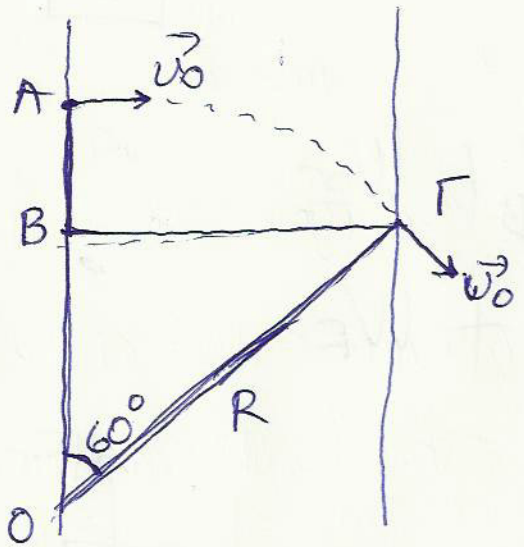
Θεμα Α

A_1 α, A_2 δ, A_3 β, A_4 γ

A_5 1-β, 2-γ, 3-α, 4-γ, 5-ε.

Θεμα Β



$B\Gamma = R\eta\mu 60 \Rightarrow B\Gamma = R\frac{\sqrt{3}}{2}$

$BO = R\sigma\upsilon 60 \Rightarrow BO = \frac{R}{2}$

$AB = R - BO \Rightarrow AB = \frac{R}{2}$

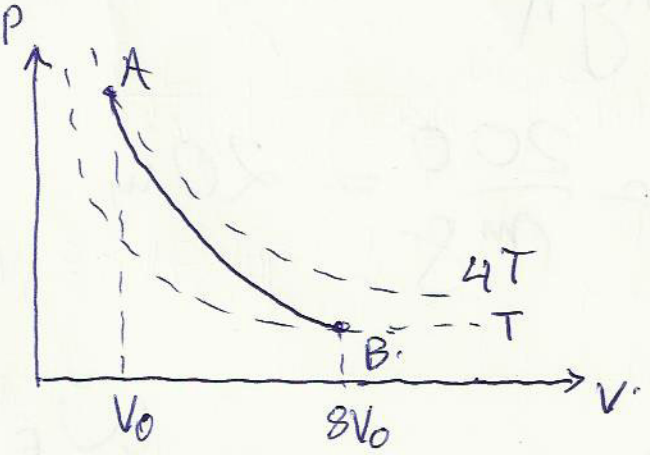
$A\Gamma = \sqrt{AB^2 + B\Gamma^2} = \sqrt{\left(\frac{R}{2}\right)^2 + \left(\frac{R\sqrt{3}}{2}\right)^2}$

$A\Gamma = \sqrt{\frac{R^2}{4} + \frac{3R^2}{4}} = \sqrt{\frac{4R^2}{4}} \Rightarrow$

$A\Gamma = R = \frac{mv_0}{B \cdot q}$.

Β1 σωστο το α.

Β2. σωστο το α.



$P_A V_A^{\gamma} = P_B V_B^{\gamma} \Rightarrow \frac{nRT_A}{V_A} V_A^{\gamma} = \frac{nRT_B}{V_B} V_B^{\gamma} \Rightarrow T_A V_A^{\gamma-1} = T_B V_B^{\gamma-1} \Rightarrow$

$\frac{T_A}{T_B} = \left(\frac{V_B}{V_A}\right)^{\gamma-1} \Rightarrow 4 = 8^{\gamma-1} \Rightarrow 2\ln 2 = (\gamma-1)3\ln 2 \Rightarrow \gamma - 1 = \frac{2}{3} \Rightarrow \gamma = \frac{5}{3}$.

Θεμα Γ

$\nu = \frac{1}{R}$ mol.

(A) $P_A = 2 \cdot 10^5 \frac{N}{m^2}$

$V_A = 10^{-3} m^3$.

AB ισοχ. θερμ. $P_B = 64 \cdot 10^5 \frac{N}{m^2}$.

ΒΓ αδιαβ. εκτ. $P_\Gamma = P_A$

ΓΑ ισοβ.

$C_p = \frac{5}{2}R$, $C_v = \frac{3}{2}R$, $\gamma = \frac{5}{3}$.

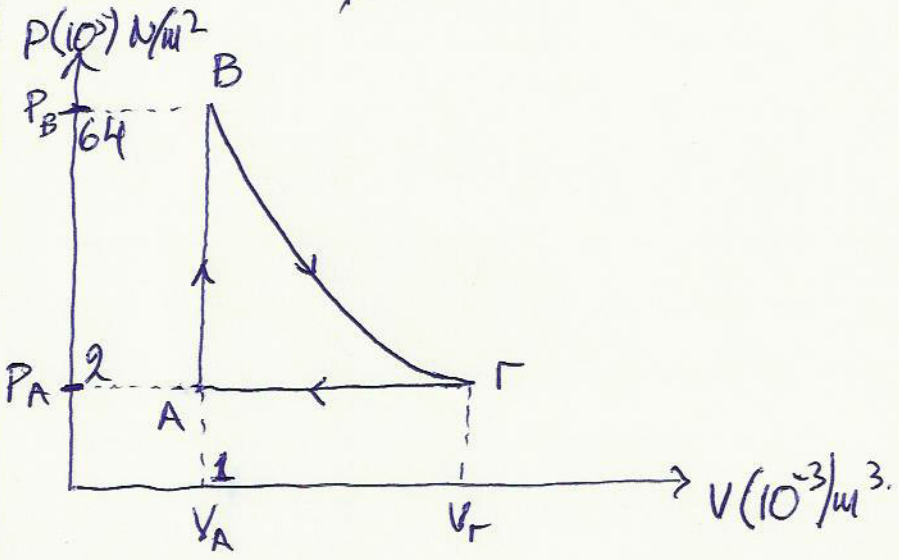
α) $T_A =$; β) $V_\Gamma =$; $U_\Gamma =$;

γ) $Q_{AB} =$; $Q_{\Gamma A} =$;

δ) $e =$;

α) $P_A V_A = \nu R T_A \Rightarrow$

$2 \cdot 10^5 \cdot 10^{-3} = \frac{1}{R} R T_A \Rightarrow T_A = 200 K$.



β) $P_B V_B^\gamma = P_\Gamma V_\Gamma^\gamma \Rightarrow \frac{P_B}{P_A} = \left(\frac{V_\Gamma}{V_A}\right)^\gamma \Rightarrow$

$\frac{V_\Gamma}{V_A} = \left(\frac{P_B}{P_A}\right)^{\frac{1}{\gamma}} \Rightarrow V_\Gamma = V_A \left(\frac{P_B}{P_A}\right)^{\frac{1}{\gamma}} \Rightarrow$

$V_\Gamma = 10^{-3} \left(\frac{64 \cdot 10^5}{2 \cdot 10^5}\right)^{\frac{1}{5/3}} \Rightarrow V_\Gamma = 10^{-3} \cdot 32^{\frac{3}{5}} \Rightarrow$

$V_\Gamma = 10^{-3} \cdot 2^{5 \cdot \frac{3}{5}} \Rightarrow \boxed{V_\Gamma = 8 \cdot 10^{-3} m^3}$

$U_\Gamma = \frac{3}{2} \nu R T_\Gamma \Rightarrow U_\Gamma = \frac{3}{2} P_\Gamma V_\Gamma \Rightarrow U_\Gamma = \frac{3}{2} \cdot 2 \cdot 10^5 \cdot 8 \cdot 10^{-3} \Rightarrow$

$U_\Gamma = 2400 J$.

γ) $Q_{AB} = \nu C_v \Delta T_{AB} = \frac{3}{2} \nu R \Delta T = \frac{3}{2} V \Delta P = \frac{3}{2} V_A (P_B - P_A) \Rightarrow$

$Q_{AB} = \frac{3}{2} 10^{-3} \cdot (64 - 2) \cdot 10^5 \Rightarrow Q_{AB} = 9300 J$.

$Q_{\Gamma A} = \nu C_p \Delta T_{\Gamma A} = \frac{5}{2} \nu R \Delta T = \frac{5}{2} P \Delta V = \frac{5}{2} \cdot 2 \cdot 10^5 (1 - 8) \cdot 10^{-3} \Rightarrow$

$Q_{\Gamma A} = -3500 J$.

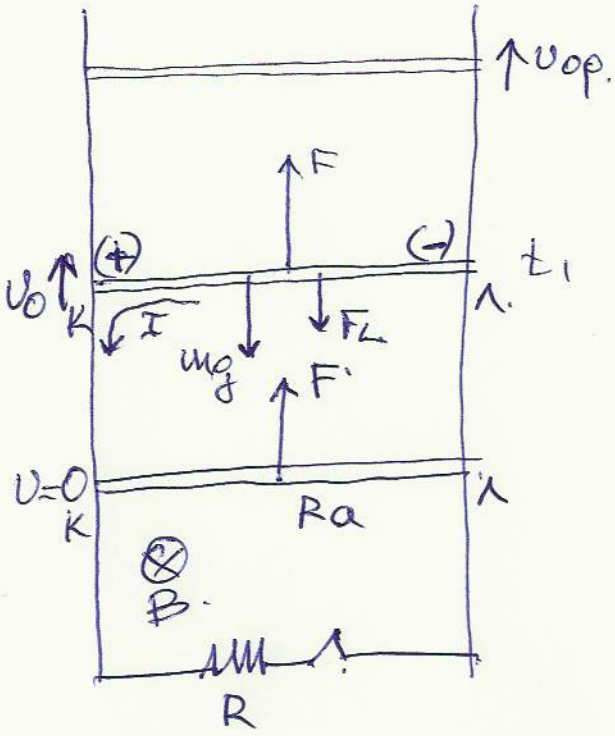
δ) $e = \frac{W}{Q_H} = 1 - \frac{|Q_C|}{Q_H} = 1 - \frac{|Q_{\Gamma A}|}{Q_{AB}} \Rightarrow e = 1 - \frac{3500}{9300} = 1 - 0,38 \Rightarrow$

$\Rightarrow e = 0,62$.

Θέμα Δ.

$L=1m$.
$m=0,1kg$
$R_x=2\Omega$
$F=2N$
$B=1T$
$t_1=2s$.
$R=8\Omega$
$g=10 m/s^2$.

α) $Q=;$ $t_1=2s$.
β) $V=;$
γ) $P_F=;$
δ) $v_{op}=;$
ε) $Q=;$ $H=80m$.



α). Την στιγμή $t=0$ εφαρμ

$F-mg=ma_0 \Rightarrow 2-1=0,1\cdot a_0 \Rightarrow a_0=10 m/s^2$.

Την στιγμή t_1 ισχύει $F-mg-F_L=ma$. (1)

$F_L=BIL \Rightarrow F_L=BL\cdot\frac{BU_0L}{R+Ra}=\frac{B^2L^2\cdot a_0t_1}{R+Ra} \Rightarrow F_L=\frac{10\cdot 2}{10} \Rightarrow$

$F_L=2N$

αφού από (1) $\Rightarrow$. $2-1-2=0,1a \Rightarrow a=-10 m/s^2$.

β). $V_{KA}=I\cdot R.=\frac{BuL}{R+Ra}\cdot R=\frac{BL\cdot a_0t_1}{R+Ra}\cdot R=\frac{20}{10}\cdot 8 \Rightarrow \underline{V_{KA}=16V.}$

γ). $P_F=F\cdot v \Rightarrow P_F=2\cdot 20 \Rightarrow P_F=40 Watt.$

δ). $\Sigma F=0 \Rightarrow F-mg-F_L=0 \Rightarrow F_L=F-mg \Rightarrow BiL=1 \Rightarrow$

$\frac{B\cdot B\cdot v_{op}L\cdot L}{R+Ra}=1 \Rightarrow \underline{v_{op}=10 m/s}.$