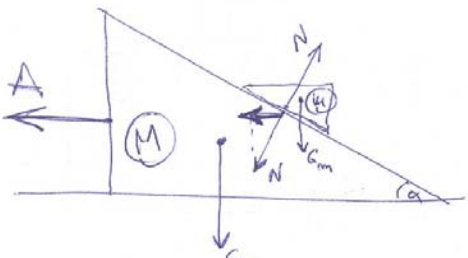
Rezolvare Fizică FA Varianta D Admitere UPB 18.07.2022 S.S.Ciobanu 4.8.2022

(1) $\eta = 1 - \frac{T_{min}}{T_{mare}} = 1 - \frac{3}{5} = 0,4 = 40\,\%$ (c)

(2)




Nu mai facem semnul de vector pentru N pt a nu introduce $\vec{N}_M = -\vec{N}_m$

Pt G putem adăuga semnul de vector anume $\vec{G}_M$ și $\vec{G}_m$ dar nu o facem

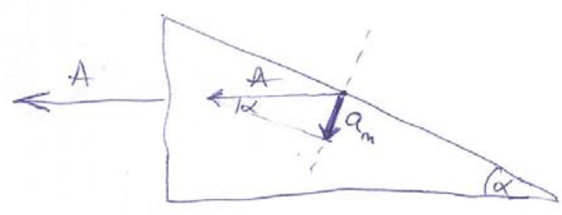
Lucrăm în SRI al laboratorului. Prisma M are accelerația A (evident orizontală) $MA = N\sin\alpha$

Prisma m are o accelerație $a_n$ normală pe plan

$$m a_n = G_m \cos\alpha - N$$

iar din geometrie (cinetică)

$$a_n = A \sin\alpha$$




Deci (1) $MA = N\sin\alpha$

(2) $mA\sin\alpha = mg\cos\alpha - N$ ← înmulțim cu $\sin\alpha$

(3) $mA\sin^2\alpha = mg\sin\alpha\cos\alpha - N\sin\alpha$ și adunăm (1) cu (3)

$$(M + m\sin^2\alpha)A = mg\sin\alpha\cos\alpha \Rightarrow A = g\,\frac{m\sin\alpha\cos\alpha}{M + m\sin^2\alpha} =$$

$$= 10 \cdot \frac{0,5 \cdot \frac{1}{2}}{1,75 + 0,5\cdot\frac{1}{2}} = 10 \cdot \frac{0,25}{2} = 1,25\ m/s^2 \quad (c)$$

(3) $\mathcal{L} = p\Delta V = \nu R \Delta T$

$$p_0V_0 = \nu R T_0 \Rightarrow \nu R = \frac{p_0V_0}{T_0} \Rightarrow \mathcal{L} = \frac{p_0V_0}{T_0}\Delta T$$

$$\Rightarrow \Delta T = \frac{\mathcal{L}T_0}{p_0V_0} = 200 \cdot \frac{300}{5\cdot10^{-3}\cdot 2\cdot 10^{5}} = 60\,K \quad (d)$$

(4.) $P_{tot} = 40W = \underbrace{P_1 + P_2}_{40W} = \underset{\uparrow 4\Omega}{R} I^2 + \underset{\uparrow 12V}{U} I$

$4I^2 + 12I - 40 = 0 \qquad I^2 + 3I - 10 = 0 \qquad I_{1,2} = \dfrac{-3 \pm \sqrt{49}}{2}$

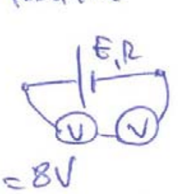
$= \dfrac{-3 \pm 7}{2} \begin{cases} -5A \\ 2A \end{cases}$

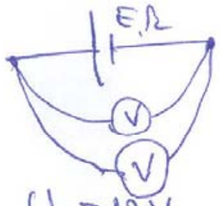
Singura valoare acceptabilă pt $I$ este 2A. (b)

Recomand o scurtă reflecție de ce valoarea de $-5A$ nu are sens!

(5.) $P = RI^2 = R\left(\dfrac{E}{R+r}\right)^2 = 3\left(\dfrac{24}{4}\right)^2 = 108\,W$ (a)

(6) $\underset{\text{în mărime}}{\underline{F = kx}} \Rightarrow k = \dfrac{F}{x} = \dfrac{10}{5 \cdot 10^{-2}} = 200\,\dfrac{N}{m}$ (f)

(7.) 


$U_1 = 8V$

$\cancel{2}U_1 = \cancel{2}R_V \dfrac{E}{2R_V + r}$

$\Downarrow$

$\dfrac{E}{U_1} = 2 + \dfrac{r}{R_V}$

$U_2 = 12V$

$U_2 = \dfrac{R_V}{2} \dfrac{E}{\frac{R_V}{2} + r}$

$\Downarrow$

$\dfrac{E}{U_2} = 1 + \dfrac{2r}{R_V}$

$\dfrac{E}{U_2} = 1 + 2\left(\dfrac{E}{U_1} - 2\right) \Rightarrow E\left(\dfrac{2}{U_1} - \dfrac{1}{U_2}\right) = 3$

$E\,\dfrac{2U_2 - U_1}{U_1 U_2} = 3$

$E = \dfrac{3U_1U_2}{2U_2 - U_1} = \dfrac{3 \cdot \cancel{8} \cdot 12}{\cancel{16}\,2} = 18V$ (c)

(8) $|a_u| = g(\sin\alpha + \mu\cos\alpha)$

$a_c = g(\sin\alpha - \mu\cos\alpha)$

$s = v_0 t_u - |a_u| t_u^2/2 = |a_u| t_u^2/2$

$t_u = \dfrac{v_0}{|a_u|}$

$s = a_c t_c^2/2$

$$3 = \frac{t_c^2}{t_u^2} = \frac{|a_u|}{a_c} = \frac{\sin\alpha + \mu\cos\alpha}{\sin\alpha - \mu\cos\alpha} = \frac{1+\mu\,\mathrm{ctg}\,\alpha}{1-\mu\,\mathrm{ctg}\,\alpha} = \frac{1+\mu}{1-\mu}$$

$$3 - 3\mu = 1+\mu \Rightarrow 2 = 4\mu \Rightarrow \mu = 0{,}5 \quad b$$

9 $$\gamma = \frac{c_p}{c_V} \Rightarrow C_V = \frac{R}{\gamma - 1} = \frac{R}{0{,}4} = 2{,}5R = \frac{5}{2}R \quad e$$

$$c_p = C_V + R$$

10 $$s_0 = v_0 t_0 - \frac{|a| t_0^2}{2}$$

$$t_0 = \frac{v_0}{|a|} \Rightarrow s_0 = \frac{|a| t_0^2}{2}; \quad |a| = \mu g \Rightarrow$$

$$\Rightarrow t_0 = \sqrt{\frac{2 s_0}{\mu g}} = \sqrt{\frac{8}{2}} = 2\,s \quad e$$