Часть 1

Олимпиада: **Физика, 11 класс (1 часть)**

Шифр: **21202681**

ID профиля: **344266**

Вариант 8

ЧИСТОВИК

1

№1.

Дано:

$\cos\alpha = \frac{3}{5}$.

m; $5m$;

H;

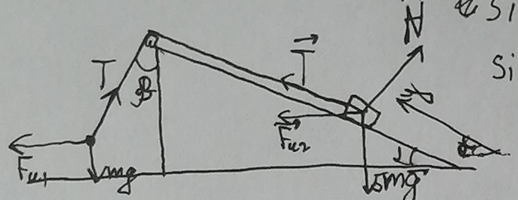
$\cos\beta = \frac{5}{13}$.

1) $a_{кл} = ?$

2) $a_{отн} = ?$

3) $\tau = ?$

Решение:

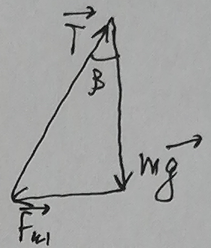


$\sin\alpha = \frac{4}{5}$; $\quad tg\beta = \frac{12}{5}$; $\quad \sin\beta = \frac{12}{13}$;

в с.о., связанной с клином, на шарик действует $F_{ин1}$;

$|F_{и}| = m a_{кл}$.; II з-н Ньютона для шарика отн. клина тогда:

$$0 = m\vec{g} + \vec{T} + \vec{F}_{и1};$$



$$tg\beta = \frac{F_{и1}}{mg} = \frac{m a_{кл}}{mg};$$

$$\cos\beta = \frac{mg}{T};$$

$$T = \frac{mg}{\cos\beta}.$$

$$a_{кл} = g\, tg\beta;$$

$$a_{кл} = \frac{12}{5} g.$$

в с.о., связанной с клином, на брусок действует $F_{и2}$;

$$|F_{и2}| = 5m a_{кл}.;$$

тогда отн. клина II з-н Ньютона для бруска на O_y:

$$5m a_{отн} = T + F_{и2}\cdot\cos\alpha - 5mg\sin\alpha;$$

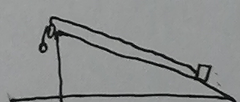
$$5m a_{отн} = \frac{mg}{\cos\beta} + 5m a_{кл}\cos\alpha - 5mg\sin\alpha;$$

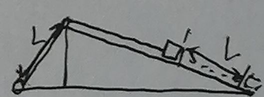
$$a_{отн} = g\left(\frac{1}{5\cos\beta} + tg\beta\cdot\cos\alpha - \sin\alpha\right);$$

$$a_{отн} = g\cdot\frac{29}{25}.$$

в мом., когда шарик достигнет стола, $\cos\beta = \frac{H}{L}$, где L — длина веревки, в этот момент.

L — также длина веревки, на которую ~~уменьшается~~ перемещается брусок, т.е. $L = \frac{a_{отн}\tau^2}{2}$;





$$\frac{H}{\cos\beta} = \frac{a_{отн}\tau^2}{2}; \quad \tau = \sqrt{\frac{2H}{a_{отн}\cdot\cos\beta}};$$

$$\tau = \sqrt{\frac{130H}{29g}}$$

Ответ: $a_{кл} = \frac{12}{5}g$; $a_{отн} = \frac{29}{25}g$; $\tau = \sqrt{\frac{130H}{29g}}$

ЧИСТОВИК

2

№2

Дано:

$C_V = \frac{5}{2}R$;

$\alpha = 22{,}5^0$

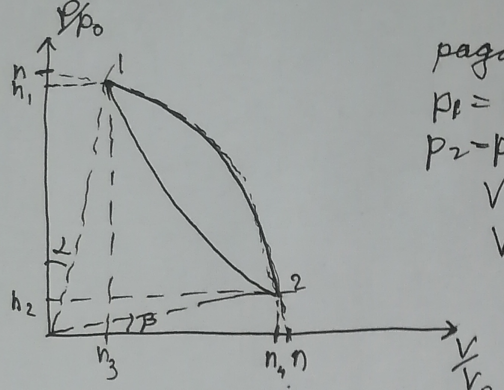
$\beta = 15^0$

1) $\frac{T_1 - T_2}{T_2} = ?$

2) $\varphi = ?$

3) $\eta = ?$

Решение:



радиус ~~окр.~~ – n;

$p_1 = p_0 \cdot n_1$ ~~$= p_0 \cdot n$~~.

$p_2 = p_0 \cdot n_2$;

$V_1 = V_0 \cdot n_3$

$V_2 = V_0 \cdot n_4$.

$n_1 = n\cos\alpha$

$n_2 = n\sin\beta$

$n_3 = n\sin\alpha$

$n_4 = n\cos\beta$

$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$

$\frac{T_1}{T_2} = \frac{p_1 V_1}{p_2 V_2} = \frac{n_1 n_3}{n_2 n_4}$;

$\frac{T_1}{T_2} = \frac{\cos\alpha \cdot \sin\alpha}{\sin\beta \cdot \cos\beta} = \frac{\sin 2\alpha}{\sin 2\beta}$;

$T_1 = \frac{\sin 45}{\sin 30} \cdot T_2$;

$T_1 = \sqrt{2}\, T_2$;

$\frac{T_1 - T_2}{T_2} = \sqrt{2} - 1$.

Ответ: $\frac{T_1 - T_2}{T_2} = \sqrt{2} - 1$.

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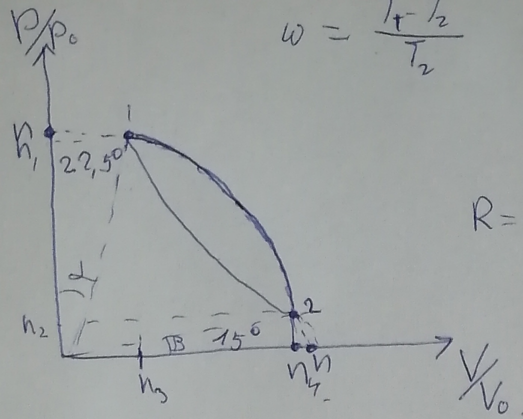
$C_v = \frac{5}{2}R$

$Q_{21}=0$. -адиабата

$\omega = \frac{T_1 - T_2}{T_2}$



$R = n$

$\Delta A = -\Delta U$.

$\Delta U = \frac{5}{2}\nu R \Delta T$.

$\Delta A = \frac{(p_2+p_1)}{2}\cdot(V_2 - V_1)$

$\Delta T = T_2 - T_1$

$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$

$T_2 = T_1 \cdot \frac{p_2 V_2}{p_1 V_1}$

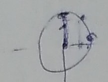
$\Delta T = T_1 \cdot \left(\frac{p_2 V_2}{p_1 V_1} - 1\right) = \frac{p_2 V_2 - p_1 V_1}{\nu_1 R}$

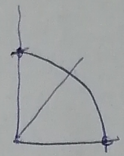
$T_1 = \frac{p_1 V_1}{\nu_1 R}$

$\frac{n_5 \cdot tg\varphi n_6 - n_6 \cdot tg\varphi n_5}{n_6 \cdot tg\varphi n_6 - n_5 \cdot tg\varphi n_5} = 4$

$\cancel{\frac{n_5 n_6 (tg\varphi - tg\varphi)}{n_6^2 tg}}$

$n^2 + n^2 = R^2$





$1^2 + 1^2 = R^2$

$R = 2{,}1$

$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$

$\frac{p_1}{p_2} \cdot \frac{V_1}{V_2} = \frac{T_1}{T_2}$

$= 0$.

$\frac{1}{2}(p_2 + p_1)(V_2 - V_1) = \frac{5}{2}\cdot(p_2 V_2 - p_1 V_1)$

$\frac{p_2 V_2 - p_2 V_1 + p_1 V_2 - p_1 V_1}{p_2 V_2 - p_1 V_1} = 5$

$\frac{p_1 V_2 - p_2 V_1}{p_2 V_2 - p_1 V_1} = 4$

$p_1 V_2 - p_1 V_1 = 0$

$p_2 V_2 - p_1 V_1$

$\frac{p_2 V_2}{p_1 V_1} = 1$

$\cancel{p_2 = p_0 \cdot n \sin\varphi}$

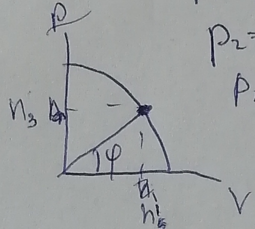
$\cancel{p_1 = p_0 \cdot n \sin}$

$p_2 = p_0 \cdot n_6$

$p_1 = p_0 \cdot n_5$

$V_2 = V_0 \cdot n_8$

$V_1 = V_0 \cdot n_7$



$p_1 = \frac{p}{p_0} \cdot n_1$

$p_2 = p_0 \cdot n_2$

$\frac{p_1}{p_2} = \frac{n_1}{n_2}$

$V_1 = V_0 \cdot n$ $\frac{V_1}{V_2} = \frac{n_3}{n_4}$

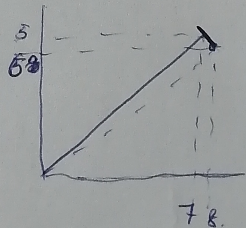
$\frac{T_1}{T_2} = \frac{n_1}{n_2} \cdot \frac{n_3}{n_4}$

$n_1 = n\cos\alpha$.

$n_2 = n\sin\beta$.

$n_3 = n\sin\alpha$

$n_4 = n\cos\beta$.



$\frac{1}{2}p_0(n_5 + n_6)\cdot V_0(n_8 - n_7) =$

$= \frac{5}{2}(p_0 V_0 n_6 n_8 - p_0 V_0 n_5 n_7)$

$(n_5 + n_6)(n_8 - n_7) = 5(n_6 n_8 - n_5 n_7)$

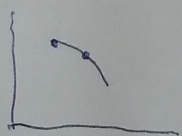
$n_5 n_8 - n_5 n_7 + n_6 n_8 - n_6 n_7 = 5$

$\frac{n_6 n_8 - n_5 n_7 + n_5 n_8 - n_6 n_7}{} = 5$.

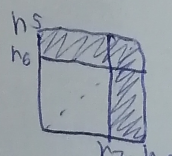
$\frac{T_1}{T_2} = \frac{\cos\alpha}{\sin\beta} \cdot \frac{\sin\alpha}{\cos\beta} = \frac{\frac{1}{2}\sin 2\alpha}{\frac{1}{2}\sin 2\beta} = \frac{\sin 2\alpha}{\sin 2\beta}$

$T_1 = \frac{\sin 45}{\sin 30} \cdot T_2$.

$T_1 = \frac{\sqrt{2}}{2} \cdot \frac{2T}{1} = \sqrt{2}\,T_2$



$\frac{n_5 n_8 - n_6 n_7}{n_6 n_8 - n_5 n_7} = 4$.



$\omega = \frac{T_1 - T_2}{T_2} = \frac{\sqrt{2}\,T_2 - T_2}{T_2} = \frac{(\sqrt{2} - 1)T_2}{T_2} = \sqrt{2} - 1$

$n_5 = n\sin\varphi_1$

$n_6 = n\sin\varphi_2$

$n_7 = n\cos\varphi_1$

$n_8 = n\cos\varphi_2$.

$4 = \frac{\sin\varphi_1 \cdot \cos\varphi_2 - \sin\varphi_2 \cdot \cos\varphi_1}{\sin\varphi_2 \cdot \cos\varphi_2 - \sin\varphi_1 \cdot \cos\varphi_1}$

$A =$

$\eta = \frac{A}{Q_1} = \frac{Q_1 - Q_2}{Q_1}$

$n_2^2 + n_1^2 = n^2$

$tg\varphi = \frac{n_1}{n_2}$

$n_8 = tg\varphi \cdot n_6$

$n_7 = tg\varphi \cdot 5$

$A > -\Delta U$

$A < -\Delta U$

$(p_2 + p_1)(V_2 - V_1) < -5(p_2 V_2 - p_1 V_1)$

$(p_2 + p_1)(V_1 - V_2) > 5(p_2 V_2 - p_1 V_1)$

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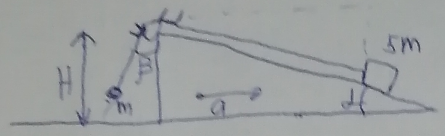
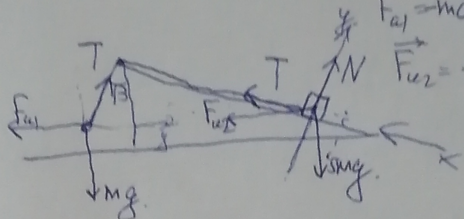
$\cos\alpha = \frac{3}{5}$. $\qquad \cos\beta = \frac{5}{13}$ $\qquad \cancel{tg\beta = \frac{3}{5} \cdot \frac{13}{5}}$

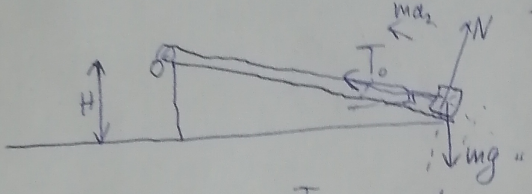
$\sin\alpha = \sqrt{1-\frac{9}{25}} = \frac{4}{5} \qquad \sin\beta = \sqrt{1-\frac{25}{169}} = \frac{12}{13} \qquad tg\beta = \frac{12}{13}\cdot\frac{13}{5} = \frac{12}{5}$

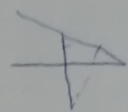


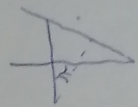


$\vec{F}_{u1} = -m\vec{a}$ $|ma| = F_{u1}$

$\vec{F}_{u2} = -5m\vec{a}$, $|5ma| = F_{u2}$







$0 = \vec{T} + m\vec{g} + \vec{F}_{u1}$.

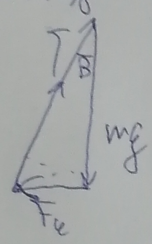
$0 = \vec{T} + 5m\vec{g} + \vec{F}_{u2} + \vec{N}$

$T_0 = mg \cdot \frac{1}{\cos\alpha}$.

O_x:

$0 = T + F_{u2}\cdot\cos\alpha - 5mg\sin\alpha$.

$0 = \vec{T} + m\vec{g}$



$tg\beta = \frac{F_u}{mg} = \frac{ma}{mg}$;

$a = g\,tg\beta$

$\cos\beta = \frac{mg}{T_0}$;

$T_0 = \qquad T_0 = \frac{mg}{\cos\beta}$

$0 = T + 5ma\cos\alpha - 5mg\sin\alpha$.

$T = 5m(g\sin\alpha - a\cos\alpha)$.

$0 = T\sin\beta - ma$

$0 = 5mg\sin\alpha - 5ma\cos\alpha - ma$

$\cancel{a(5\cos\alpha + 1) = 5g\sin\alpha}$.

$$\frac{1}{5\cdot\frac{5}{13}} + \frac{12}{5}\cdot\frac{3}{5} - \frac{4}{5} = \frac{13}{25} + \frac{36}{25} - \frac{20}{25} = \frac{49-20}{25} = \frac{29}{25}$$

$$\frac{2H}{g\frac{29}{25}\cdot\frac{5}{13}} = \frac{2H\cdot 25\cdot 13}{g\cdot 29\cdot 5} = \frac{130H}{29g}$$

$5ma_2 = T_0 - 5mg\sin\alpha + F_{u2}\cdot\cos\alpha$.

$5ma_2 = \frac{mg}{\cos\beta} - 5mg\sin\alpha + 5ma\cos\alpha$.

$5a_2 = \frac{g}{\cos\beta} - 5g\sin\alpha + 5a\cos\alpha$.

$a_2 = \frac{g}{5\cos\beta} - g\sin\alpha + a\cos\alpha$

$a_2 = g\left(\frac{1}{5\cos\beta} - \sin\alpha\right) + a\cos\alpha =$

$= g\left(\frac{1}{5\cos\beta} - \sin\alpha\right) + g\sin\beta =$

$= g\left(\frac{1}{5\cos\beta} - \sin\alpha + \sin\beta\right)$.

$a_2 = g\cdot\left(\frac{1}{5\cdot\frac{5}{13}} - \frac{4}{5} + \frac{12}{13}\right)$

$a_2 = g\left(\frac{13}{25} - \frac{20}{25} + \frac{12}{13}\right)$

$a_2 = g\left(-\frac{7}{25} + \frac{12}{13}\right)$

$\cancel{a_2 = g}\left(\frac{12}{13} - \frac{7}{25}\right) =$

$= \frac{12\cdot 25 - 7\cdot 13}{13\cdot 25} =$

$= \frac{300-91}{13\cdot 25} =$

$= \frac{209}{13\cdot 25} = \frac{209}{325}$

$\cos\beta = \frac{H}{L_1}$

$L_1 = \frac{H}{\cos\beta}$.

$L_2 = L - L_1$.

$L = L_{01} + L_{02}$.

$L = L_{01} + \Delta L + L_{02}\Delta L$

$\frac{a_2\tau^2}{2} = L_1$

$L_1 = \frac{H}{\cos\beta}$.

$\frac{a_2\tau^2}{2} = \frac{H}{\cos\beta}$. $\quad \tau = \sqrt{\frac{2H}{a_2\cos\beta}}$

$a = g\cdot\frac{12}{5}$.

$a_2 = g\cdot\frac{209}{325}$.

$\tau = \sqrt{\frac{2H}{g\frac{209}{325}\cdot\frac{5}{13}}} =$

$= \sqrt{\frac{2H\cdot 325\cdot 13}{g\, 209\cdot 5}}$

$\tau = 65\sqrt{\frac{2H}{1045g}}$

$\sqrt{\frac{2H\cdot 13\cdot 25\cdot 13}{g\cdot 209\cdot 5}} =$

$= 13\cdot 5\sqrt{\frac{2H}{5\cdot 209g}}$.

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$\cancel{n_6 \cdot n_8}$

$$\frac{n_6 \cdot n_8}{n_5 \cdot n_7} = 1$$

$$\frac{\sin\varphi_1 \cdot \cos\varphi_2}{\sin\varphi_1 \cdot \cos\varphi_1} = 1.$$

$$\frac{\sin 2\varphi_2}{\sin 2\varphi_1} = 1$$

$\varphi_2 = \varphi_1.$

21202681 (U344266 M1266742)

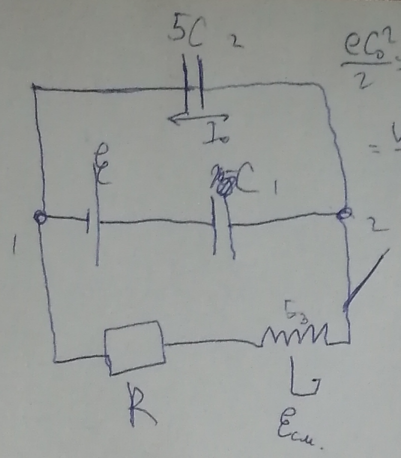
Часть 2

Олимпиада: **Физика, 11 класс (2 часть)**

Шифр: **21202681**

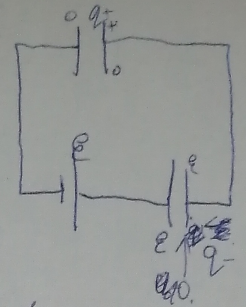
ID профиля: **344266**

Вариант 8



$$\frac{\mathcal{E}C_0^2}{2} = \frac{\mathcal{E}\,25C^2}{2\cdot 36} = \frac{U_1C^2}{2} + \frac{U_2C^2}{2}$$

$$\frac{\mathcal{E}C_0^2}{2}$$



$$\frac{25\mathcal{E}}{36} = U_1 + U_2 = 5U_2$$

$q = CU_1 = 5CU_2$

$U_1 + U_2 = \mathcal{E}$

$U_1 = 5U_2$

$6U_2 = \mathcal{E}$

$U_2 = \frac{\mathcal{E}}{6}$

$U_1 = \frac{5}{6}\mathcal{E}$

$$\frac{1}{C_0} = \frac{1}{C} + \frac{1}{5C}$$

$$\frac{1}{C_0} = \frac{5+1}{5C} = \frac{6}{5C} \qquad C_0 = \frac{5}{6}C$$

$E_2 = \frac{CU_2^2}{2}$

$E_1 = \frac{CU_1^2}{2}$

$E_3 = \frac{LI^2}{2}$

$I_0 = \frac{\Delta q}{\Delta t}$

$\mathcal{E} - \mathcal{E}_{си} = U_0 + IR$

$\mathcal{E} - L I_\theta = U + IR$

$\mathcal{E} - \mathcal{E}_{си} = IR$

$\mathcal{E} - L I_\theta = I_1 R$

$\mathcal{E} - IR = L I_\theta$

$\mathcal{E} - L I_\theta = U_1$

$\mathcal{E} - U_1 = L I_\theta$

$$I_\theta = \frac{\mathcal{E} - \frac{5}{6}\mathcal{E}}{L} = \frac{\mathcal{E}}{6L}$$

$$\boxed{I_\theta = \frac{\mathcal{E}}{6L}}$$

$\varphi_1 - \varphi_2 = 0 = -IR + L\frac{\Delta I}{\Delta t}$

$\mathcal{E} - L\frac{\Delta I}{\Delta t} =$

$\mathcal{E} - \mathcal{E}_c = 0$

$\mathcal{E} - L I_\theta = 0$

$I_\theta = \frac{\mathcal{E}}{L}$

$\mathcal{E} - L\frac{\Delta I}{\Delta t} = \frac{\Delta I}{\Delta t}\cdot\tau\cdot R$

$\mathcal{E} - L I'_\theta = I'R$

$\mathcal{E} - L\frac{\Delta I}{\Delta t} = IR$

$Q = I^2 R\tau$

$$Q = \frac{CU_1^2}{2} + \frac{5CU_2^2}{2}$$

$$\frac{C\,25\mathcal{E}^2}{36\cdot 2}$$

$$\frac{5C\cdot\mathcal{E}^2}{36\cdot 2}$$

$I = \left(\frac{\mathcal{E}}{L}\right)\cdot\tau$, $Q = \frac{\mathcal{E}^2}{L^2}\cdot R\cdot\tau^3$

$$\frac{C\mathcal{E}^2}{2}\cdot\left(\frac{25}{36} + \frac{5}{36}\right) = \frac{30}{36}\cdot\frac{C\mathcal{E}^2}{2} = \frac{5}{6}\,\frac{C\mathcal{E}^2}{2} = \frac{5C\mathcal{E}^2}{12}$$

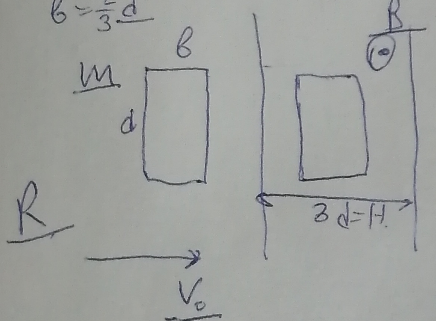
$\vartheta = \vartheta_0 + a\tau$

$\mathcal{E} = \vartheta BL\cdot\sin\alpha$

$m\vartheta_0^2 = m\vartheta^2 + \frac{B^2\vartheta^2 4d^2}{R}\cdot\tau$

$m\vartheta_0^2 = \vartheta^2\left(m + \frac{4B^2d^2}{R}\tau\right)$

$b = \frac{2}{3}d$



$\Phi = B\cdot S = 0$

$\mathcal{E} = \vartheta BL = \vartheta_1$

$I = \frac{\mathcal{E}}{R} = \frac{\Delta q}{\Delta t}$ $F\cdot\vartheta$

$\mathcal{E} = \vartheta B 2d$

$F = BIL$

$F = 2Bd$

$XA = I^2R\tau$

$F = q\vartheta B$

$F = q\vartheta B$

$F = \frac{A}{\frac{7}{3}d}$

$m\frac{7}{3}dq +$

$q = I\cdot\tau$

$F = IU\tau$

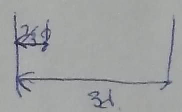
$ma = 2Bd$

$$\boxed{a = \frac{2Bd}{m}}$$

$\mathcal{E} = 2B\vartheta d$

$I = \frac{2B\vartheta d}{R}$

$H = 3d$



$$\frac{m\vartheta_0^2}{2} = \frac{m\vartheta^2}{2} + \frac{\mathcal{E}^2}{R}\cdot\tau$$

$$\frac{m}{2}\left(\vartheta^2 - \vartheta_0^2\right) + \frac{\vartheta^2B^2 4d^2}{R}\cdot\tau = 0$$

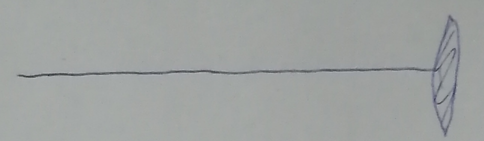
$a = \frac{F}{m}$

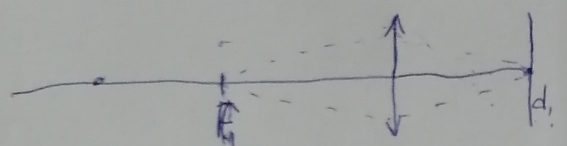
$$\frac{7}{3}d = \frac{\vartheta^2 - \vartheta_0^2}{2a}; \quad \vartheta^2 - \vartheta_0^2 = \frac{14}{3}da$$

$\vartheta = \vartheta_0 + a\tau$

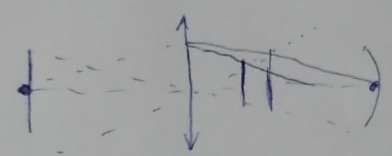
$$a = \frac{2dB\cdot 2B\vartheta d}{mR}$$

$\frac{D_2}{D_1} = 5.$





$F_1 = 25$ см.



$x < 25$ см.

$\frac{F_1}{F_2}$ $\frac{F_2}{F_1} = 5.$

$D_0 + D_2 = \frac{1}{d_1}$

$D_1 + D_0 = \frac{1}{d_1} + \frac{1}{f}.$

$D_0 = \frac{1}{\cancel{x}} + \frac{1}{d_1}$

$\cancel{D_2}$ $\frac{1}{x} + D_2 = 0.$

$D_2 = -\frac{1}{x}.$

$\cancel{x \to \lim_{x \to 2}}$

$D_1 - D_2 = \frac{1}{f}.$

$\frac{D_2}{5} - D_2 = \frac{1}{f}$ $\cancel{4D_2 = \frac{1}{f}}$

$D_2(-\frac{4}{5}) = \frac{1}{f}$ $\cancel{D_2 = \frac{1}{4f}}$

$D_2 = -\frac{5}{4f}$ $\cancel{D_2 =}$

$-4D_1 = \frac{1}{f}$

$D_1 = -\frac{1}{4f}.$

$D_x + D_0 = \frac{1}{d_1} + \frac{1}{f_2}.$

$D_x - D_2 = \frac{1}{f_2}.$

$D_x = \frac{1}{f_2} + D_2 = \frac{1}{2f_1} - \frac{5}{4f_1} = \frac{2-5}{4f_1} = -\frac{3}{4f_1}.$

$D_x = -0{,}03$ м$^{-1}$

$\frac{D_2}{D_1} = 5.$

$\boxed{D_2 = -\frac{5}{4f}.}$

$\underline{D_2 = -0{,}05 \text{ м}^{-1}}$

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№4 Чистовик

②

Ответ: $a = \frac{4B^2d^2v}{mR}$; $v_1 = \sqrt{\frac{36}{3}\frac{B^2d^3v_0}{mR} + v_0^2}$; $v_2 = \sqrt{\frac{72}{3}\frac{B^2d^3v_0}{mR} + v_0^2}$.

№3

Дано:

$C_1 = C$;

$C_2 = 5C$.

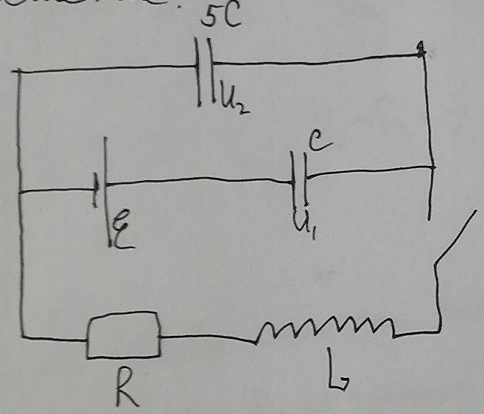
$\mathcal{E}$; R; L;

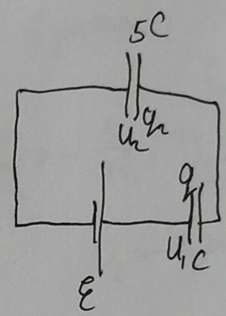
1) $v_B = ?$

2) $Q = ?$

3) U_R при I_0 через C_2.

Решение:





до замык. ключа:

$q_1 = q_2$; $CU_1 = 5CU_2$;

$U_1 = 5U_2$;

$\mathcal{E} = U_1 + U_2$; $\mathcal{E} = 6U_2$;

$U_1 = \frac{5}{6}\mathcal{E}$.

~~После~~ сразу замык.:

$\mathcal{E} - \mathcal{E}_c = U_1$; $\mathcal{E}_c = L v_B$; $U_1 = \frac{5}{6}\mathcal{E}$;

$\mathcal{E} - \frac{5}{6}\mathcal{E} = L v_B$; $v_B = \frac{\mathcal{E}}{6L}$;

$Q = E_1 + E_2 = \frac{CU_1^2}{2} + \frac{5CU_2^2}{2}$; $Q = \frac{5C\mathcal{E}^2}{12}$.

Ответ: $v_B = \frac{\mathcal{E}}{6L}$; $Q = \frac{5C\mathcal{E}^2}{12}$;

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Чистовик

№ 5

Дано:
$f_1 = 25$ см.
$f_2 = 50$ см.
$\frac{D_2}{D_1} = 5.$
1) $x = ?$ $D_2 = ?$
2) $D_3 = ?$

Решение:

①

D_2 – опт. сила для рассм. удален. предмет;
D_1 – опт сила для рассм. предметов на f_1;
D_3 – опт. сила для ~~ррасс~~ рассм. предметов на f_2.
D_0 – опт. сила глаза ;
тогда

$D_0 + D_2 = \frac{1}{d_*} + \frac{1}{f_{уд}}$; $f_{уд} \to \infty$; d_* – расстояние от хрусталика глаза до сетчатки

для дали: $D_0 + D_2 = \frac{1}{d}$;
на f_1: $D_1 + D_0 = \frac{1}{d} + \frac{1}{f_1}$;

$\Rightarrow D_1 - D_2 = \frac{1}{f_1}$; $D_1 = \frac{D_2}{5}$ (по усл.),
$D_2 = -\frac{5}{4f_1}$; $D_2 = -5$ дптр.

$f_2 = 2f_1$;

на f_2: $D_3 + D_0 = \frac{1}{d} + \frac{1}{f_2}$; $D_3 - D_2 = \frac{1}{f_2}$; $D_3 = \frac{1}{f_2} - \frac{5}{4f_1}$; $D_3 = -\frac{3}{4f_1}$.

$D_3 = -3$ дптр.

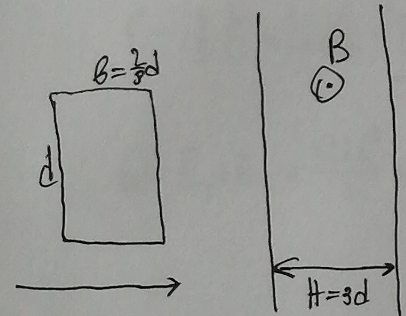
Без очков человек может читать с расстояния $x < 25$ см

Ответ: $x < 25$ см; $D_2 = -5$ дптр; $D_3 = -3$ дптр.

№ 4

Дано:
m; d;
$b = \frac{2}{3}d$;
V_0; R;
B;
$H = 3d$.
1) $a_2 = ?$
2) $V_1 = ?$
3) $V_2 = ?$

Решение:



~~$F = BL\sin\alpha$; $F = BL$;~~
~~$ma = F$; $a = \frac{BL}{m} = \frac{B2d}{m}$; $a = \frac{2Bd}{m}$.~~

$L_2 = 2d$;

сила, действ. на рамку после вхождения всей рамки

$F_2 = BI_2L_2$; $I = \frac{\varepsilon}{R}$; $\varepsilon = BLv = 2Bdv$; $I = \frac{2Bdv}{R}$;

$F_2 = \frac{B \cdot 2d \cdot 2Bdv}{R}$; $F = \frac{4B^2d^2v}{R}$;

$ma_2 = F$; $a_2 = \frac{F}{m} = \frac{4B^2d^2v}{mR}$; $a_2 = \frac{4B^2d^2v}{mR}$.

~~F_1 – сила, действ. вначале на правую сторону рамки, левая пока не вошла~~

~~$F_1 = BI_1L_1 = Bd$~~

$H - \frac{2d}{3} = \frac{v_1^2 - v_0^2}{2a}$; $v_1^2 = \frac{7}{3}d \cdot 2a + v_0^2$; $v_1 = \sqrt{\frac{14}{3}d \cdot \frac{4B^2d^2v}{mR} + V_0^2}$;

$v_1 = \sqrt{\frac{56}{3}\frac{B^2d^3V_0}{mR} + V_0^2}$; $H = \frac{V_2^2 - V_0^2}{2a}$; $V_2 = \sqrt{\frac{72}{3}\frac{B^2d^3V_0}{mR} + V_0^2}$