Часть 1

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

Шифр: **21202750**

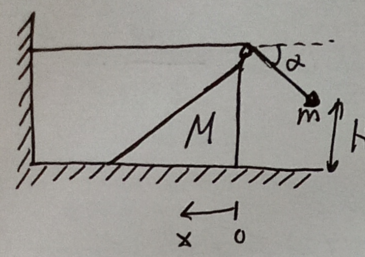
ID профиля: **193682**

Вариант 2

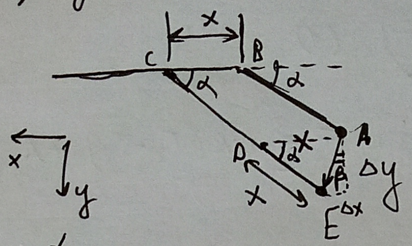
Чистовик

№1

$\cos\alpha = \frac{4}{5}$; $\sin\alpha = \frac{3}{5}$



1) Пусть клин переместился на X влево:



ABCD – параллелограмм;

$AD = DE = x$ (длина нити $= const$)

$\Rightarrow \Delta x = x\cdot(1-\cos\alpha)$

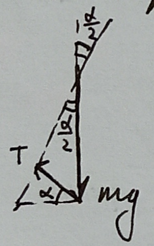
$\Delta y = x\sin\alpha$

$$\beta = 90^\circ - \left(90^\circ - \frac{\alpha}{2}\right) = \frac{\alpha}{2}$$

$$tg\beta = tg\frac{\alpha}{2} = \frac{\Delta x}{\Delta y} = \frac{1-\cos\alpha}{\sin\alpha} = \frac{\frac{1}{5}}{\frac{3}{5}} = \frac{1}{3}; \quad \boxed{\beta = arctg\frac{1}{3}}$$

2) $a_{клина} = \ddot{x}\ \left(= \frac{d^2x}{dt^2}\right)$ – ускорение клина; $\left.\begin{aligned} a_x &= \ddot{x}(1-\cos\alpha) \\ a_y &= \ddot{x}\sin\alpha \end{aligned}\right\}$ – ускорение шара

силы на шар:



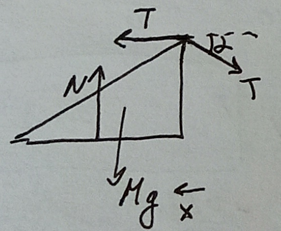
Th. sin: $\frac{T}{\sin\frac{\alpha}{2}} = \frac{mg}{\sin(90^\circ+\frac{\alpha}{2})} = \frac{mg}{\cos\frac{\alpha}{2}} \Rightarrow T = mg\cdot tg\frac{\alpha}{2} = mg\cdot\frac{1-\cos\alpha}{\sin\alpha}$

$$\left.\begin{aligned} a_y &= g - \frac{T}{m}\sin\alpha = g\cos\alpha \ \cancel{= \ddot{x}(1-\cos\alpha)} \Rightarrow \ddot{x}\sin\alpha \\ a_x &= \frac{T}{m}\cos\alpha = g\cdot\frac{(1-\cos\alpha)\cos\alpha}{\sin\alpha} = \ddot{x}(1-\cos\alpha) \end{aligned}\right\} \Rightarrow$$

$$\Rightarrow \ddot{x} = g\cdot\frac{\cos\alpha}{\sin\alpha} \Rightarrow \boxed{a_{клина} = \frac{4g}{3}} \text{ (напр. влево)}$$

3) силы на клин
(трением пренебрегаем)

вдоль OX: $M\ddot{x} = T(1-\cos\alpha)$



$$Mg\cdot\frac{\cos\alpha}{\sin\alpha} = mg\cdot\frac{(1-\cos\alpha)^2}{\sin\alpha}$$

$$\boxed{\frac{m}{M} = \frac{\cos\alpha}{(1-\cos\alpha)^2} = \frac{\frac{4}{5}}{\frac{1}{25}} = 20}$$

4) $a_y = \ddot{x}\sin\alpha = g\frac{\cos\alpha}{\sin\alpha}\cdot\sin\alpha = g\cos\alpha$

$\frac{a_y\tau^2}{2} = H$ $(v(0)=0)$ $\Rightarrow$ $\boxed{\tau = \sqrt{\frac{2H}{g\cos\alpha}} = \sqrt{\frac{10H}{4g}} = \sqrt{\frac{5H}{2g}}}$

Ответ: 1) $\beta = \frac{\alpha}{2} = arctg\frac{1}{3}$

2) $a_{клина} = g\cdot\frac{\cos\alpha}{\sin\alpha} = \frac{4g}{3}$

3) $\frac{m}{M} = \frac{\cos\alpha}{(1-\cos\alpha)^2} = 20$

4) $\tau = \sqrt{\frac{2H}{g\cos\alpha}} = \sqrt{\frac{5H}{2g}}$.

Чистовик

№ 2. $dQ = \nu C(T)\cdot dT$; $\quad Q_{12} = |Q^+| - |Q^-| = \nu \cdot \int\limits_{T_1}^{T_2} C(T)\, dT$

$C(T) = \frac{5}{2}R\cdot\frac{T}{T_0} \Rightarrow Q_{12} = \nu\cdot\int\limits_{T_1}^{T_2}\frac{5}{2}R\frac{T}{T_0}dT = \frac{5\nu R}{2T_0}\int\limits_{T_1}^{T_2} T\,dT = \frac{5\nu R}{2T_0}\cdot\frac{T^2}{2}\Bigg|_{T_1}^{T_2}$

$Q_{1\to2} = \frac{5\nu R}{4T_0}\cdot\left(T_2^2 - T_1^2\right) \quad (1)$

ЗСЭ:

потому что гелий

$Q_{1\to2} = \Delta U + A_{газа} = \frac{3}{2}\nu R(T_2 - T_1) + A_{газа\,1\to2} \quad (2)$

1) $T_1 = T_0$; $T_2 = \frac{1}{2}T_0$

~~$T_1 < T_2$~~ $T_2 < T_1 \Rightarrow$ газ отдаёт тепло: $Q_{1\to2} = -Q_1$

$-Q_1 = \frac{5\nu R}{4T_0}\cdot\left(\frac{T_0^2}{4} - T_0^2\right) = -\frac{15}{16}\frac{\nu R T_0^2}{T_0} = -\frac{15}{16}\nu R T_0$

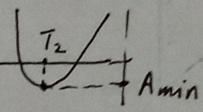
$\boxed{Q_1 = \frac{15}{16}\nu R T_0}$

2) ~~из~~ из формул (1) и (2): $\frac{5\nu R}{4T_0}\left(T_2^2 - T_1^2\right) = \frac{3}{2}\nu R(T_2 - T_1) + A_{газа\,1\to2}$

~~$A_{газа\,1\to2} =$~~ $T_1 = T_0$

$A_{газа\,1\to2} = \frac{5\nu R}{4T_0}\cdot T_2^2 - \frac{3\nu R}{2}T_2 + \frac{\nu R T_0}{4} \quad (3)$

$\frac{5\nu R}{4T_0} > 0 \Rightarrow A_{газа}(T_2)$ – парабола с ветвями вверх:



T_2 – вершина параболы $\left(x_0 = -\frac{b}{2a}\right)$

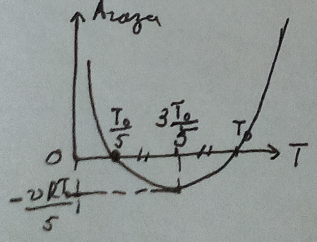
$T_2 = \frac{\frac{3\nu R}{2}}{2\cdot\frac{5\nu R}{4T_0}} = \frac{3}{5}T_0$; $\boxed{T_2 = \frac{3T_0}{5}}$

3) $A_{min} = \frac{5\nu R}{4T_0}\cdot\frac{9T_0^2}{25} - \frac{3\nu R}{2}\cdot\frac{3T_0}{5} + \frac{\nu R T_0}{4} = \frac{9\nu R T_0}{20} - \frac{9\nu R T_0}{10} + \frac{\nu R T_0}{4}$

$= \frac{9\nu R T_0}{20} - \frac{18\nu R T_0}{20} + \frac{5\nu R T_0}{20} = -\frac{4\nu R T_0}{20} = -\frac{\nu R T_0}{5}$; $\boxed{A_{газа\,min} = -\frac{\nu R T_0}{5}}$

Газ совершил суммарную отрицательную работу $-\frac{\nu R T_0}{5}$, то есть над газом суммарно совершена положительная работа $\frac{\nu R T_0}{5}$.

Из уравнения (3) можно также найти температуру, при которой $A_{газа} = 0$: $D = \frac{9\nu^2R^2}{4} - \cancel{4}\cdot\frac{\nu R T_0}{\cancel{4}}\cdot\frac{5\nu R}{4T_0} = \nu^2 R^2$; $T = \frac{\frac{3\nu R}{2} \pm \nu R}{\frac{5\nu R}{2T_0}} = \left[\begin{array}{l} T_0 \\ \frac{T_0}{5}\end{array}\right.$

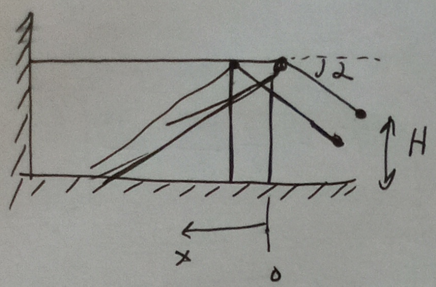


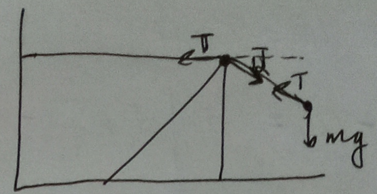
Ответ: 1) $Q_1 = \frac{15}{16}\nu R T_0$

2) $T_2 = \frac{3}{5}T_0$

3) $A_{газа\,min} = -\frac{\nu R T_0}{5}$.

Черновик



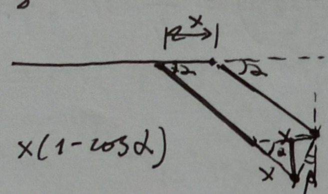


$\frac{mg}{3}$

$g - \frac{g}{8} = \frac{mg}{8}$

$T = \frac{mg}{3}$

$\frac{T}{m} = \frac{g}{8}$ $\quad \frac{T}{m}\sin\alpha = \frac{g}{8}$



$\downarrow x\sin\alpha \qquad \leftarrow x(1-\cos\alpha)$

$\boxed{\beta = 90° - (90° - \frac{\alpha}{2}) = \frac{\alpha}{2}}$

$v_x = \cancel{\dot x \sin\alpha}\ \dot x(1-\cos\alpha)$

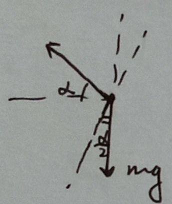
$a_x = \ddot x(1-\cos\alpha)$

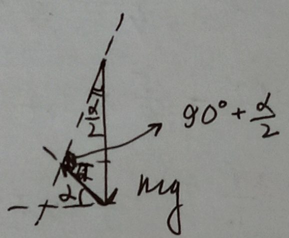
$\operatorname{tg}\frac{\alpha}{2} = \frac{1-\cos\alpha}{\sin\alpha}$

$v_y = \dot x\sin\alpha$

$a_y = \ddot x\sin\alpha$

$\sin(90°+\frac{\alpha}{2}) = \cos\frac{\alpha}{2}$





$\operatorname{tg}\frac{\alpha}{2} = \frac{\sqrt{1-\cos\alpha}}{\sqrt{1+\cos\alpha}} =$

$\frac{3}{9} = \frac{1}{3}$

$= \frac{\sin\alpha}{1+\cos\alpha}$

$a_y = g\cos\alpha$

$\frac{a_y \cdot t^2}{2} = H$

$t = \sqrt{\frac{2H}{a_y}} = \sqrt{\frac{2H}{g\cos\alpha}}$

$\frac{T}{\sin\frac{\alpha}{2}} = \frac{mg}{\sin(90°+\frac{\alpha}{2})} = \frac{mg}{\cos\frac{\alpha}{2}}$

$T = mg\cdot\operatorname{tg}\frac{\alpha}{2} = mg\cdot\frac{1-\cos\alpha}{\sin\alpha}$

$mg - T\sin\alpha = mg\cos\alpha$

$\ddot x\sin\alpha = g\cos\alpha$

$\ddot x = g\frac{\cos\alpha}{\sin\alpha}$

$\ddot x(1-\cos\alpha) = g\frac{\cancel{1-\cos\alpha}}{\sin\alpha\cdot\cancel{\cos\alpha}}$

$= g\cdot\frac{(1-\cos\alpha)\cos\alpha}{\sin\alpha}$

$\boxed{\ddot x = g\cdot\frac{\cos\alpha}{\sin\alpha}}$

$T(1-\cos\alpha) = M\ddot x$

$\cancel{mg}\cdot\frac{(1-\cos\alpha)^2}{\cancel{\sin\alpha}} = Mg\cdot\frac{\cos\alpha}{\cancel{\sin\alpha}}$

$\boxed{\frac{m}{M} = \frac{\cos\alpha}{(1-\cos\alpha)^2}}$

$\nu \quad T_0 \quad C(T) = \frac{5}{2} R \frac{T}{T_0} \quad T_0 \longrightarrow \frac{1}{2} T_0$ черновик

$$C = \frac{dQ}{\nu dT} \qquad dQ = C \nu dT$$

$$-Q_1 = \nu \int_{T_0}^{\frac{1}{2}T_0} \frac{5}{2} R \frac{T}{T_0} dT = \frac{5}{2} \frac{\nu R}{T_0} \int_{T_0}^{\frac{1}{2}T_0} T dT = \frac{5}{2} \frac{\nu R}{T_0} \left. \frac{T^2}{2} \right|_{T_0}^{\frac{1}{2}T_0}$$

$$= \frac{5}{4} \frac{\nu R}{T_0} \cdot \left(\frac{1}{4} T_0^2 - T_0^2 \right) = \frac{5}{4} \nu R T_0 \cdot \left(-\frac{3}{4} \right) = -\frac{15}{16} \nu R T_0$$

$$Q_1 = \frac{15}{16} \nu R T_0$$

$$|Q^+| - |Q^-| = \Delta U + A_{газа}$$

$$\Delta U = \cancel{x} \frac{3}{2} \nu R (T_2 - T_0)$$

$$A_{газа} = \frac{3}{2} \nu R (T_0 - T_2) - \frac{5}{4} \frac{\nu R}{T_0} \cdot (T_0^2 - T_2^2)$$

$$= \frac{3}{2} \nu R T_0 - \frac{3}{2} \nu R T_2 - \frac{5}{4} \nu R T_0 + \frac{5}{4} \frac{\nu R}{T_0} \cdot T_2^2$$

$$= \frac{1}{4} \nu R T_0 + \frac{5}{4} \frac{\nu R}{T_0} T_2^2 - \frac{3}{2} \nu R T_2 = \left(\frac{5 \nu R}{4 T_0} \right) T_2^2 - \left(\frac{3}{2} \nu R \right) T_2 + \left(\frac{\nu R T_0}{4} \right)$$

$$T_2 = \frac{\frac{3}{2} \nu R}{2 \cdot \frac{5 \nu R}{4 T_0}} = \frac{\frac{3}{\cancel{2}} \cancel{\nu R}}{\frac{5}{\cancel{2}} \frac{\cancel{\nu R}}{T_0}} = \frac{3 T_0}{5}$$

$$A_{min} = \frac{\cancel{5} \nu R}{4 \cancel{T_0}} \cdot \frac{9 T_0^{\cancel{2}}}{\cancel{25}_{5}} - \frac{3 \nu R}{2} \cdot \frac{3 T_0}{5} + \frac{\nu R T_0}{4} = \frac{9 \nu R T_0}{20} - \frac{9 \nu R T_0}{10} + \frac{\nu R T_0}{4}$$

$$\cancel{= \frac{14 \nu R T_0}{20} - \frac{54 \nu R T_0}{20} = -2 \nu R T_0} = \frac{14 \nu R T_0}{20} - \frac{18 \nu R T_0}{20} = -\frac{\nu R T_0}{5}$$

$$\frac{9 \nu^2 R^2}{4} - \frac{5 \nu^2 R^2}{4} = \nu^2 R^2$$

$$\frac{\frac{3 \nu R}{2} \pm \nu R}{\frac{5 \nu R}{2 T_0}} \Rightarrow \left[\begin{array}{l} T_0 \\ \frac{T_0}{5} \end{array} \right.$$

$\frac{T_0}{5}$ T_0

$\frac{3T_0}{5}$

Часть 2

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

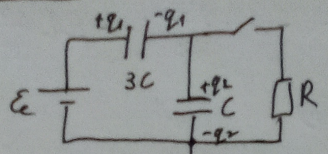
Шифр: **21202750**

ID профиля: **193682**

Вариант 2

Чистовик

№3



$C = \frac{q_2}{U_2}$ $3C = \frac{q_1}{U_1}$

1) до замыкания: ~~$q_1 = U_1 \cdot C$, $q_2 = U_2$~~

$q_1 = U_1 \cdot 3C$, $q_2 = U_2 C$, $q_1 = q_2$, $U_1 + U_2 = \mathcal{E}_e$

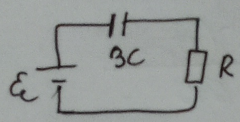
$(\mathcal{E}_e - U_2) \cdot 3C = U_2 \cdot C$

$3\mathcal{E}_e - 3U_2 = U_2 \Rightarrow U_2 = \frac{3\mathcal{E}_e}{4}$

сразу после замыкания ключа: $U_{R0} = U_2 = \frac{3\mathcal{E}_e}{4} \Rightarrow \boxed{I_{R0} = \frac{3\mathcal{E}_e}{4R}}$

(U_2 до зам $= U_2$ сразу после зам.)

2)



через долгое время $I_R = 0 \Rightarrow U_C = 0 \Rightarrow U_{3C} = \mathcal{E}_e$

$$W_0 = \frac{3C}{2} \cdot \frac{\mathcal{E}_e^2}{16} + \frac{C}{2} \cdot \frac{9\mathcal{E}_e^2}{16} = \frac{12C\mathcal{E}_e^2}{2 \cdot 16} = \frac{3C\mathcal{E}_e^2}{8}$$

$$W_1 = \frac{3C}{2} \cdot \mathcal{E}_e^2 = \frac{3C\mathcal{E}_e^2}{2}$$

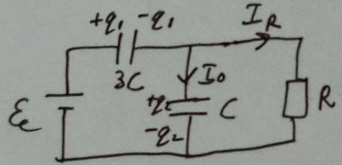
$$A_{ист} = \mathcal{E}_e \cdot \left(3C\mathcal{E}_e - \frac{3C\mathcal{E}_e}{4}\right) = C\mathcal{E}_e^2 \cdot \left(3 - \frac{3}{4}\right) = \frac{9C\mathcal{E}_e^2}{4}$$

ЗСЭ:

$$W_0 + A_{ист} = W_1 + Q \Rightarrow Q = W_0 - W_1 + A_{ист} = \frac{3C\mathcal{E}_e^2}{8} - \frac{3C\mathcal{E}_e^2}{2} + \frac{9C\mathcal{E}_e^2}{4}$$

$$Q = \frac{18C\mathcal{E}_e^2 + 3C\mathcal{E}_e^2 - 12C\mathcal{E}_e^2}{8} = \boxed{\frac{9C\mathcal{E}_e^2}{8}}$$

3)



$I_0 = \frac{dq_2}{dt}$; $I_0 + I_R = \frac{dq_1}{dt}$

$U_C = \frac{q_2}{C} = U_R = I_R \cdot R$

$\mathcal{E}_e = \frac{q_1}{3C} + \frac{q_2}{C} \Rightarrow q_1 + 3q_2 = const$

$\frac{dq_1}{dt} = -3\frac{dq_2}{dt}$

$\Rightarrow \frac{dq_1}{dt} = -3I_0 \Rightarrow I_0 + I_R = -3I_0$

$I_R = -4I_0$

$\Rightarrow |U_R| = R \cdot |I_R| = \boxed{4I_0 R}$

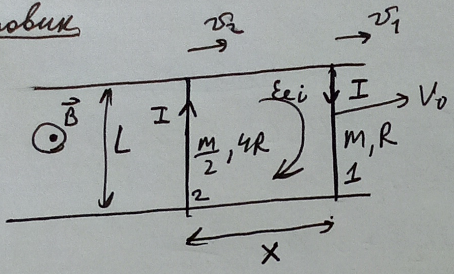
Ответ: 1) $I_{R0} = \frac{3\mathcal{E}_e}{4R}$

2) $Q = \frac{9C\mathcal{E}_e^2}{8}$

3) $U_R = 4I_0 R$.

Чистовик

№ 4



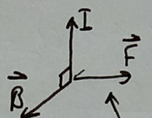
$$\mathcal{E}_i = -\frac{d\Phi}{dt} \overset{(\vec B = const)}{=} -B\cdot\frac{dS}{dt} = -BL\frac{dx}{dt}$$

$$\frac{dx}{dt} = (v_1 - v_2)$$

$$\mathcal{E}_i = -BL(v_1 - v_2)$$

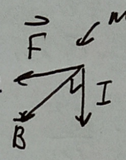
$$I = \frac{|\mathcal{E}_i|}{5R} = \frac{BL(v_1 - v_2)}{5R}$$

$\vec F_A = L\vec I \times \vec B$: **2**:



ускорение

1:



торможение

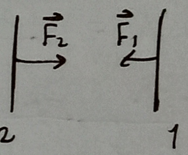
$$|\vec F| = \frac{B^2L^2(v_1 - v_2)}{5R}$$

$\cancel{a_1 = \frac{F}{\frac{m}{2}}}$ $\quad a_1 = -\frac{F}{m} = -\frac{B^2L^2(v_1 - v_2)}{5mR}$; $\quad a_2 = \frac{2F}{m} = \frac{2B^2L^2(v_1 - v_2)}{5mR}$

1) в начальный момент $v_1 = V_0,\ v_2 = 0 \Rightarrow \boxed{a_2(0) = \frac{2B^2L^2V_0}{5mR}}$

2) через $t = \infty$: $\left.\begin{matrix} a_1 = 0 \\ a_2 = 0 \end{matrix}\right\} \Rightarrow v_1 = v_2$

рассмотрим систему из двух перемычек :



$$\left.\begin{matrix} |\vec F_2| = |\vec F_1| = F \\ \cancel{|\vec F_2| = +F} \quad \vec F_2 = +\vec F \\ \cancel{|\vec F_1} \quad \vec F_1 = -\vec F \end{matrix}\right\} \Rightarrow \Delta\vec P = \int \vec F^{\Sigma} dt = \int(\vec F_1 + \vec F_2)dt = 0$$

$$\Rightarrow \text{ЗСИ}: \ mV_0 = \frac{m}{2}v_2 + mv_1$$

$$\left.\begin{matrix} mV_0 = \frac{m}{2}v_2 + mv_1 \\ v_1 = v_2 \end{matrix}\right\} \Rightarrow v_1 = v_2 = \boxed{\frac{2V_0}{3}}$$

3) $$\left.\begin{matrix} \dot v_1 = -\frac{B^2L^2}{5mR}(v_1 - v_2) \\ \dot v_2 = \frac{2B^2L^2}{5mR}(v_1 - v_2) \end{matrix}\right\} \Rightarrow (\dot{v_1 - v_2}) = -\frac{3B^2L^2}{5mR}(v_1 - v_2) \Rightarrow v_1 - v_2 = A\cdot e^{-\frac{3B^2L^2}{5mR}t}$$

$$(v_1 - v_2)(t=0) = V_0 \Rightarrow v_1 - v_2 = V_0\cdot e^{-\frac{3B^2L^2}{5mR}t}$$

$$\Delta x = \int_0^{\infty}(v_1 - v_2)dt = V_0\cdot\int_0^{\infty} e^{-\frac{3B^2L^2}{5mR}t}dt = V_0\cdot\left(-\frac{5mR}{3B^2L^2}\right)\cdot e^{-\frac{3B^2L^2}{5mR}t}\Big|_0^{\infty}$$

$$= \boxed{\frac{5mRV_0}{3B^2L^2}}$$

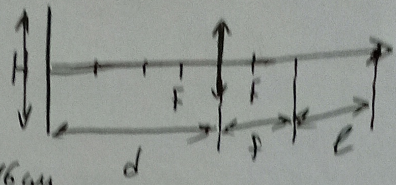
Ответ: 1) $a_2(0) = \frac{2B^2L^2V_0}{5mR}$

2) $\cancel{v_1 =}$ $v_1(t=\infty) = v_2(t=\infty) = \frac{2V_0}{3}$

3) $\Delta x = \frac{5mRV_0}{3B^2L^2}$.

Чистовик

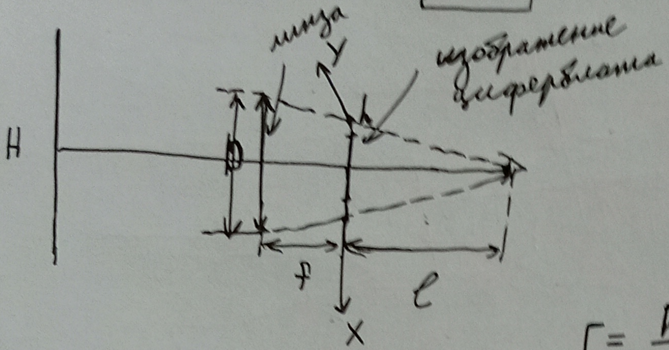
№5. $F = 12$ см; $H = 9$ см; $d = 48$ см; $l = 24$ см



1) $\frac{1}{f} + \frac{1}{d} = \frac{1}{F}$; $\frac{1}{f} = \frac{d-F}{dF}$; $f = \frac{dF}{d-F} = \frac{48 \cdot 12}{12 \cdot 3}$ см $= 16$ см

$x = f + l = 24\text{см} + 16\text{см} = \boxed{40\text{см}}$

2)



чтобы увидеть изображение целиком, необходимо:

$XY \geq h$

$XY = D \cdot \frac{l}{f+l} = D \cdot \frac{24}{16+24} = D \cdot \frac{24}{40} = D \cdot \frac{3}{5}$

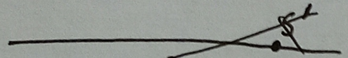
$\Gamma = \frac{h}{H} = \frac{f}{d} = \frac{F}{d-F} = \frac{12}{48-12} = \frac{1}{3}$

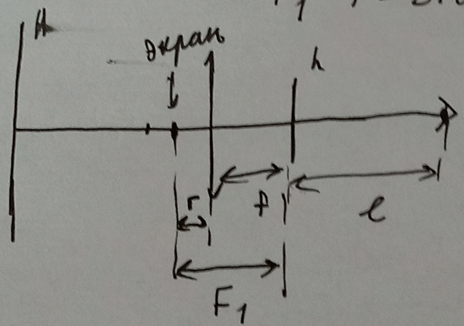
$\Rightarrow h = \frac{H}{3} = 3$см

$D \cdot \frac{l}{f+l} \geq \frac{H}{3}$; $\frac{3D}{5} \geq \frac{H}{3}$; $\boxed{D_m = \frac{5H}{9} = 5\text{см}}$

3) в системе линза-глаз нужно сделать так, чтобы изображение циферблата попало в фокус системы; глаз аккомодирован на $l = 24$см $\Rightarrow F_1 = 24$см – ~~новый~~ фокус системы.

$\Rightarrow r = F_1 - f = 24\text{см} - 16\text{см} = \boxed{8\text{см}}$





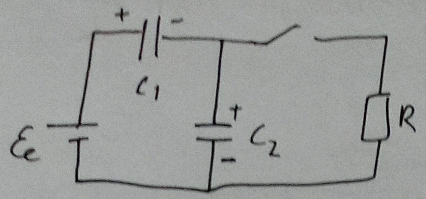
экран нужно поставить на 8 см левее линзы

Ответ: 1) $x = 40$см.

2) $D_m = \frac{5H}{9} = 9$см.

3) 8см; слева от линзы.

№3 Черновик



$C_2 = C;\ C_1 = 3C$ $\quad c = \frac{1}{4}$

$q_1 = U_1 \cdot C_1 \quad q_2 = U_2 C_2$

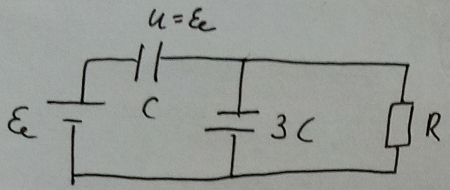
$\cancel{U_1 \cdot C =}\ (\mathcal{E} - U_2) C = 3U_2 C$

$\mathcal{E} - U_2 = 3U_2 \qquad U_2 = \frac{\mathcal{E}}{4} \quad U_1 = \frac{3\mathcal{E}}{4}$

$I_{0R} = \frac{U_2}{R} = \frac{\mathcal{E}}{4R}$

$\cancel{W_0 = \frac{C}{2} \cdot \frac{9\mathcal{E}^2}{16} + \frac{3C}{2}}. \quad q_1 = \frac{3C\mathcal{E}}{4}$

$$W_0 = \frac{C}{2} \cdot \frac{9\mathcal{E}^2}{16} + \frac{3C}{2} \cdot \frac{\mathcal{E}^2}{16} = \frac{12C\mathcal{E}^2}{2 \cdot 16} = \frac{3C\mathcal{E}^2}{8}$$



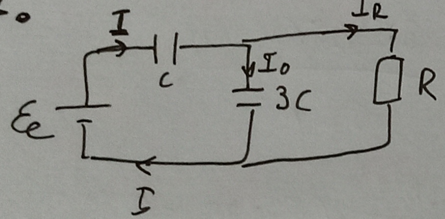
$W_1 = \frac{C\mathcal{E}^2}{2} \qquad q = C\mathcal{E}$

$$A_{ист} = \mathcal{E} \cdot \left(C\mathcal{E} - \frac{3C\mathcal{E}}{4}\right) = \frac{C\mathcal{E}^2}{4}$$

$$W_0 + A_{ист} = W_1 + Q$$

$$Q = W_0 - W_1 + A_{ист} = \frac{3C\mathcal{E}^2}{8} - \frac{C\mathcal{E}^2}{2} + \frac{C\mathcal{E}^2}{4} = \frac{3-4+2}{8} C\mathcal{E}^2 = \frac{C\mathcal{E}^2}{8}$$

$C_2 \mapsto I_0$



$I = \frac{dq}{dt} \qquad q = U \cdot C$

$U = \frac{q}{C} \qquad \frac{dU}{dt} = \frac{1}{C} \cdot \frac{dq}{dt}$

$I = \frac{U}{R}$

$$\mathcal{E} = \frac{q_1}{C} + \frac{q_2}{3C}$$

$$\frac{q_2}{3C} = R \cdot I_R \Rightarrow I_R = \frac{q_2}{3RC}$$

$I = \frac{dq_1}{dt}$

$$\frac{1}{C} I + \frac{1}{3C} I_0 = 0 \qquad I = I_R + I_0$$

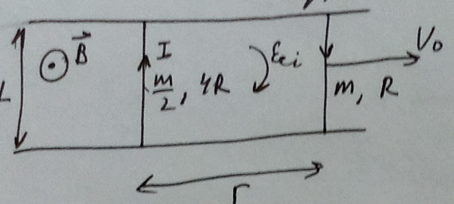
$$\left(\frac{q_2}{3RC} + I_0\right) \cdot \frac{1}{C} + I_0 \cdot \frac{1}{3C} = 0 \quad \Big| \cdot 3C$$

$$3I_0 + \frac{q_2}{RC} + I_0 = 0$$

$$q_2 = -4I_0 RC$$

$$U = \frac{4I_0 R}{3}$$

Черновик.

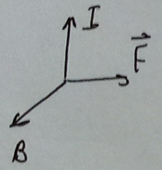


$$\mathcal{E}_i = -\frac{d\Phi}{dt} = -B\cdot\frac{dS}{dt} = -BL\cdot\frac{dr}{dt}$$

$$\mathcal{E}_i(0) = -BLV_0$$

$$I(0) = \frac{BLV_0}{5R}$$

$$\vec{F} = L\vec{I}\times\vec{B}$$



$$F = \frac{B^2L^2V_0}{5R} \qquad a(0) = \frac{F}{\frac{m}{2}} = \frac{2F}{m} = \frac{2B^2L^2V_0}{5mR}$$

$$\mathcal{E}_i = -\frac{d\Phi}{dt} = -B\cdot\frac{dS}{dt} = -BL\cdot(v_1 - v_2)$$

$$\cancel{F_2 =} \quad I = \frac{BL(v_1 - v_2)}{5R}$$

$$\cancel{F_2 =} \quad F = \frac{B^2L^2(v_1 - v_2)}{5R} \qquad a_1 = -\frac{B^2L^2(v_1 - v_2)}{5mR}$$

$$a_2 = \frac{2B^2L^2(v_1 - v_2)}{5mR}$$

$$\dot{v}_1 = -\frac{B^2L^2(v_1 - v_2)}{5mR}$$

$$\dot{v}_2 = \frac{2B^2L^2(v_1 - v_2)}{5mR}$$

$$\cancel{(v_2 - v_1)^{\cdot} = \frac{3B^2L^2(v_2 - v_1)}{5mR}}$$

$$\cancel{(v_2 - v_1)^{\cdot} - \frac{3B^2L^2}{5mR}(v_2 - v_1) = 0}$$

$$(v_1 - v_2)^{\cdot} = -\frac{3B^2L^2}{5mR}(v_1 - v_2)$$

$$\cancel{v_2 - v_1 = A\cdot e}$$

$$v_1 - v_2 = A\cdot e^{-\frac{3B^2L^2}{5mR}t}$$

$$mV_0 = \left(m + \frac{m}{2}\right)v = \frac{3m}{2}v$$

$$A = V_0 \qquad v_1 - v_2 = V_0\cdot e^{-\frac{3B^2L^2}{5mR}t}$$

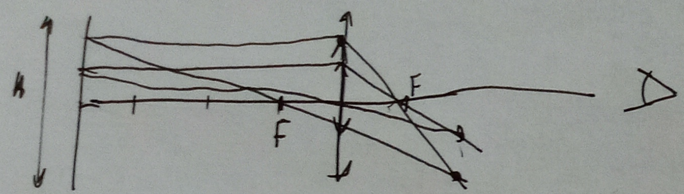
$$v = \frac{2V_0}{3}$$

$$\int_0^\infty V_0\cdot e^{-\frac{3B^2L^2}{5mR}t}\,dt = V_0\cdot\left(-\frac{5mR}{3B^2L^2}\right)\cdot e^{-\frac{3B^2L^2}{5mR}t}\Big|_0^\infty$$

$$= -\frac{5mRV_0}{3B^2L^2}\cdot(0 - 1) = \frac{5mRV_0}{3B^2L^2}$$

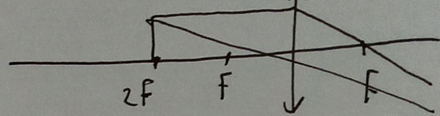
Черновик

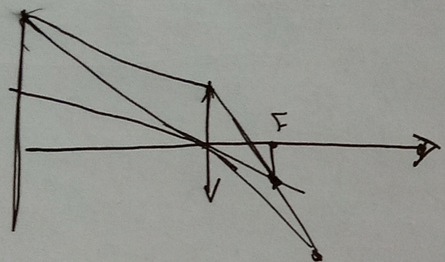
$F = 12$ см $H = 9$ см 48 см

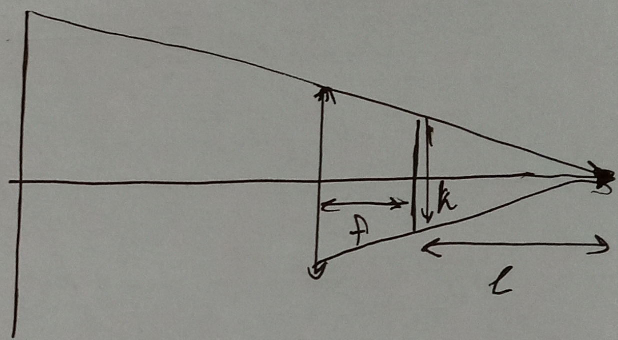


$$f = \frac{Fd}{d-F} = \frac{12 \cdot 48}{48-12}\text{ см} = \frac{\cancel{12} \cdot 48}{3 \cdot \cancel{12}}\text{ см} = 16\text{ см}$$

$16 + 24 = 40$ см $x = 40$ см







$$f = \frac{dF}{d-F} \quad Г = \frac{F}{d-F} = \frac{12}{48-12} = \frac{1}{3}$$