Часть 1

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

Шифр: **21203393**

ID профиля: **66081**

Вариант 1

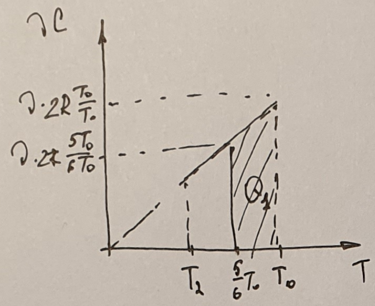
Физика
Вариант 11-01

Чистовик

№2

Дано:
ν
T_0
$C(T) = 2R\frac{T}{T_0}$

1) Q_1
2) T_2
3) A_{min}



1) $\delta Q = \nu_0 T \cdot C(T) = -S_{тр}$ $\quad -\delta Q_1 = -\delta Q = +S_{тр}$

$Q_1 = S_{тр}$

$$Q_1 = \frac{2\nu R\left(\frac{T_0}{T_0} + \frac{5T_0}{6T_0}\right)}{2} \cdot \left(T_0 - \frac{5}{6}T_0\right).$$

$$Q_1 = \frac{11\nu R}{6} \cdot \frac{1}{6}T_0 = \frac{11\nu R T_0}{36}.$$

2) Первый закон термодинамики

$Q = \Delta U + A$

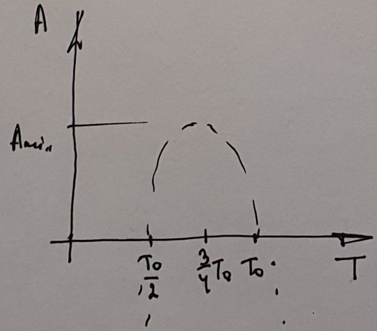
$$\frac{1}{2}(T_2 - T_0)\cdot 2\nu R\left(\frac{T_0}{T_0} + \frac{T_2}{T_0}\right) = \frac{3}{2}\nu R(T_2 - T_0) + A.$$

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

$$\nu R(T_2 - T_0)\left(1 + \frac{T_2}{T_0} - 1{,}5\right) = A$$

$$\nu R(T_2 - T_0)\left(\frac{T_2}{T_0} - 0{,}5\right) = A.$$

$$\nu R\frac{(T_2 - T_0)(2T_2 - T_0)}{2T_0} = \frac{\nu R(2T_2^2 - 3T_2T_0 + T_0^2)}{2T_0} = A.$$



$T_2 - T_0 < 0 \Rightarrow$ в вершине $A = A_{min}$

$$T_2 = \frac{+3T_0}{4} = \frac{3}{4}T_0$$

3) $$A_{min} = A\left(\frac{3}{4}T_0\right) = \frac{\nu R\left(\frac{3}{4}T_0 - T_0\right)\left(\frac{3T_0}{2} - T_0\right)}{2T_0}.$$

$$A_{min} = \frac{\nu R\left(-\frac{T_0}{4}\right)\left(\frac{T_0}{2}\right)}{2T_0} = -\frac{\nu R T_0}{16}$$

$\boxed{\text{Ответ: 1) } Q_1 = \frac{11\nu R T_0}{36} \quad \text{2) } T_2 = \frac{3}{4}T_0 \quad \text{3) } A_{min} = -\frac{\nu R T_0}{16}}$

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Физика

Вариант 11-01

Чистовик

№1

Дано:

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

$(\sin\alpha = \frac{4}{5})$

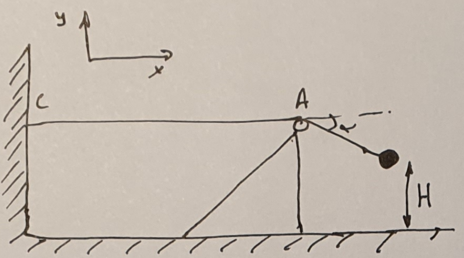
H

1) β

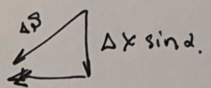
2) $a_{кл}$

3) $\frac{m}{M}$ - ?

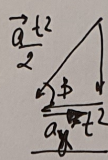
4) t



1) Пусть клин сместился на Δx, тогда шарик сместится на $\Delta x \sin\alpha$ по оси y и на ~~$\Delta x \cos$~~ $\Delta x(1-\cos\alpha)$ по x, т.е.



Учитывая, что $v(0) = 0$ => в треугольнике перемещений:



$\frac{a_y t^2}{2} = \Delta x \sin\alpha$

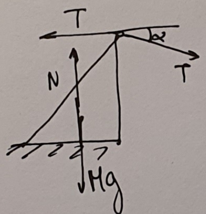
$\frac{a_x t^2}{2} = \Delta x(1-\cos\alpha)$ =>

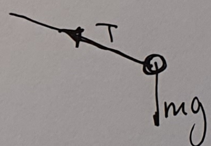
$$\Rightarrow \operatorname{tg}\beta = \frac{\frac{a_y t^2}{2}}{\frac{a_x t^2}{2}} = \frac{\Delta x \sin\alpha}{\cancel{\Delta x}(1-\cos\alpha)} = \frac{\sin\alpha}{1-\cos\alpha} = \frac{\frac{4}{5}}{1-\frac{3}{5}} = \frac{\frac{4}{5}}{\frac{2}{5}} = 2.$$

$\sin\beta = \frac{4}{2\sqrt5} = \frac{2}{\sqrt5}$

$\cos\beta = \frac{2}{2\sqrt5} = \frac{1}{\sqrt5}$

2) II З.Н. для клина.





X: $T - T\cos\alpha = Ma_{кл}$.

II ЗН для шара:

X: $-T\cos\alpha = \cancel{M}\, a_{ш.y}$

$a_{ш_y} = a_{кл}(1-\cos\alpha)$

(из кин. связей перемещений)

$$\begin{cases} T(1-\cos\alpha) = Ma_{кл} \\ T(\cos\alpha) = m \cdot a_{кл}(1-\cos\alpha) \end{cases} \Rightarrow \frac{\cancel{T}(1-\cos\alpha)}{\cancel{T}(\cos\alpha)} = \frac{Ma_{кл}}{\cancel{m a_{кл}}\ (1-\cos\alpha)} =>$$

$$\frac{(1-\cos\alpha)^2}{\cos\alpha} = \frac{M}{m} \Rightarrow \frac{4}{25}\cdot\frac{5}{3} = \frac{4}{15} = \frac{M}{m} \Rightarrow m = \frac{15M}{4}$$

3) ЗСЭ: $mgh = \frac{(m+M)v^2}{2} \Rightarrow \frac{15M}{4}gH = \frac{19M}{4}\cdot\frac{v^2}{2} \Rightarrow v^2 = \frac{30gH}{19}$ (1)

$H = \frac{a_y t^2}{2} \Rightarrow 2H = a_{кл}\cdot\sin\alpha\, t^2 \Rightarrow a_{кл}\cdot t^2 = \frac{2H}{\sin\alpha}$ (2)

$v = a_{кл}\cdot t \Rightarrow v^2 = a_{кл}^2 t^2 \longleftarrow (1); (2)$

$a_{кл}\cdot\frac{2H}{\sin\alpha} = \frac{30gH}{19} \Rightarrow a_{кл} = \frac{15g}{19}\cdot\sin\alpha = \frac{15g}{19}\cdot\frac{4}{5} = \frac{12}{19}g.$

4) $H = \frac{a_{кл}\sin t^2}{2} \Rightarrow \sqrt{\frac{2H}{a_{кл}\sin}} = t = \sqrt{\frac{2H}{\frac{12}{19}\cdot\frac{4}{5}}} \Rightarrow t = \sqrt{\frac{95H}{24g}}$

Ответ: $\operatorname{tg}\beta = 2$, $a_{кл} = \frac{12}{19}g$; $\frac{m}{M} = \frac{15}{4}$; $t = \sqrt{\frac{95H}{24g}}$

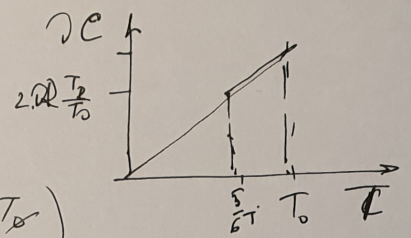
2

21203393 (U66081 M1264999)

Черновик

$C(T) = 2R\frac{T}{T_0}$

ν



$Q = \frac{1}{2}\nu\frac{T_0}{6}\left(\frac{2RT_0}{T_0} + \frac{2R\frac{5}{6}T_0}{T_0}\right)$

$Q = \frac{\nu T_0}{12}\left(2R + \frac{5}{3}R\right) = \frac{11\nu RT_0}{36}$

$\frac{2\nu R\left(1 + \frac{5}{6}\right)}{2} \quad \frac{1}{6}$

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$Q = \frac{1}{2}\nu\Delta T\,\frac{2R}{T_0}(T_1 + T_2) = \frac{3}{2}\nu R(T_2 - T_1) + A.$

$\left(\frac{\nu R}{T_0}(T_1 + T_2) - \frac{3}{2}\nu R\right)(T_2 - T_1) = A.$

$\nu R\left(\frac{2T_1 + 2T_2 - 3T_0}{2T_0}\right)(T_2 - T_1) = A.$

$T_1 + T_2 = \frac{3}{2}T_0 \qquad (T_2 - T_0)\left(\frac{2T_2 - T_0}{2T_0}\right)$

$T_2 = \frac{1}{2}T_0 \qquad (2T_2^2 - 2T_2T_0 - T_2T_0 + T_0^2)$

$Q = \frac{1}{2}\nu(T_2 - T_0)\,2R\left(\frac{T_2}{T_0} + \frac{T_0}{T_0}\right) = \frac{\nu R(T_2 - T_0)(T_2 + T_0)}{T_0}$

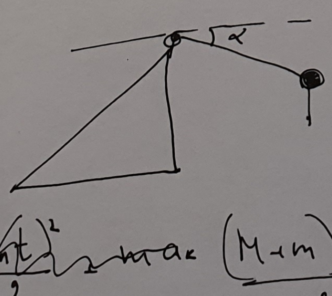
$Q = \frac{3}{2}\nu R(T_2 - T_0) + A$

$\nu R(T_2 - T_0)\left(\frac{2T_2 + 2T_0 - 3T_0}{2T_0}\right) \neq A \Rightarrow \frac{\nu R(T_2 - T_0)(2T_2 - T_0)}{2T_0} \neq A.$

$\frac{\nu R\left(-\frac{T_0}{4}\right)\left(\frac{3T_0}{2} - T_0\right)}{2T_0}$

$\frac{\nu R\,\frac{-T_0}{4}\cdot\frac{T_0}{2}}{2T_0} = A.$

$\nu R \qquad -\frac{3T_0}{4} -$



$mgh = \frac{M(at)^2}{2} = ma = \frac{(M+m)v^2}{2}$

$\frac{15}{4}M = \frac{19}{4}M\frac{v^2}{2} \qquad \frac{30gH}{\sqrt{19}} = v^2$

$v^2 = a^2t^2 = \frac{30gH}{19} = a\cdot 2H \rightarrow a = \frac{19}{30}g.$

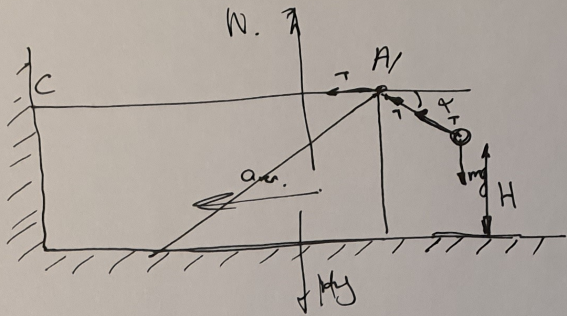
Черновик

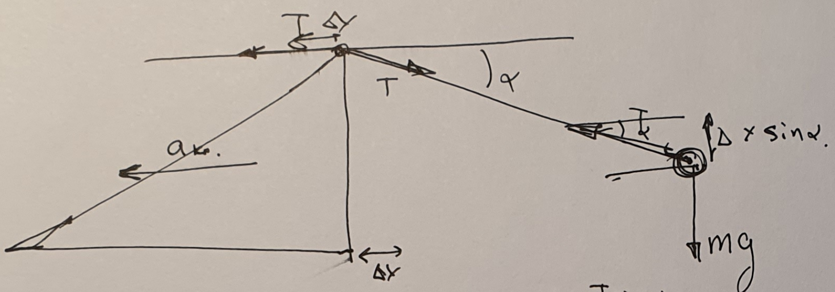
~~В со...~~

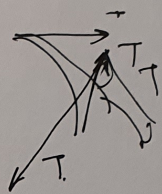
$\cancel{mgH = \frac{m v_{отн}^2}{2}}$

$\frac{a \cdot t^2}{2} =$

$a_y = const.$

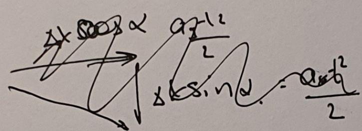


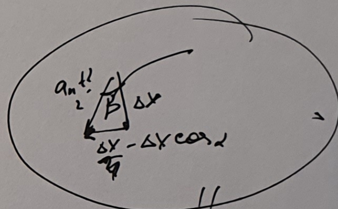


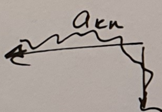


$\alpha = const. - 1$

$a_y = \frac{mg - T\sin\alpha}{m}$ $a_x =$







Шарик пытается двиг по окр с
при этом $a_y = const.$

$M \cdot a_{кл} = T - T\cos\alpha.$

$T\cos\alpha = m\,a_{кл}\,(\cancel{1-\cos\beta})(1-\cos\alpha)$ $\Rightarrow$ $\frac{T\cos\alpha}{1-\cos\alpha} = m a_{кл}$

$T(1-\cos\alpha) = M a_{кл}$

$T \cdot \frac{\cancel{1}}{1-\cos\alpha} = M a_{кл.}$

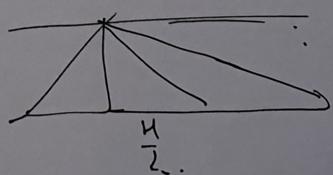
$\frac{M}{m} = (1-\cos\alpha)^2 = \frac{4}{25}.$

$\frac{4}{5} \cdot \frac{25}{4} = \frac{m}{M} = 6.$

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

$\cancel{T - T\cos\alpha}$ $\cancel{T(1-\cos\alpha) = M a_{кл}}$

$\cancel{T\cos\alpha} = \frac{M\cos\alpha}{(1-\cos\alpha)^2}.$



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

$\sqrt{\frac{2H}{a_y}} = t$. $\sqrt{\frac{2H}{a_{кл} \cdot \frac{4}{5}}} = t = \sqrt{\frac{10H}{4_2 a_{кл}}} = t.$

$\frac{H}{2} = \frac{a_{кл}(1-\cos 2\alpha)}{2} t^2$ $\frac{54}{\cdot}$

Часть 2

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

Шифр: **21203393**

ID профиля: **66081**

Вариант 1

Чистовик

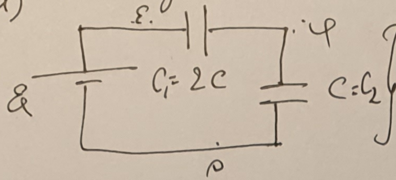
Физика
Вариант 11-01

№3

Дано
$C_2 = C$
$C_1 = 2C$
$\mathcal{E}, R$

1) I
2) Q
3) I_1

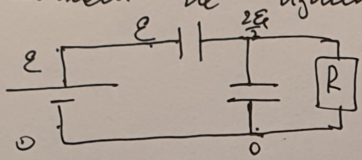
1) До замыкания ключа уст. режим



Метод потенциалов.

$$2C(\mathcal{E}-\varphi) = C\varphi \Rightarrow \varphi = \frac{2\mathcal{E}}{3}$$

2) После замыкания ключа напряжение на конденсаторах скачком не изменится $\Rightarrow$

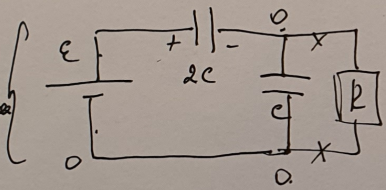


$$I = \frac{2\mathcal{E}}{3R}$$

$$W(0) = \frac{2C\cdot\left(\frac{\mathcal{E}}{3}\right)^2}{2} + \frac{C\left(\frac{2\mathcal{E}}{3}\right)^2}{2} = \frac{C}{2}\left(\frac{2\mathcal{E}^2}{9} + \frac{4\mathcal{E}^2}{9}\right) = \frac{C\mathcal{E}^2}{3}$$

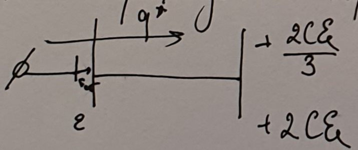
3) Установившийся режим при замкнутом ключе: ток через конденсаторы не идёт $\Rightarrow$ $\Rightarrow$ и через резистор тоже нет тока

метод потенциалов



$$W(t_{уст}) = \frac{2C\cdot\mathcal{E}^2}{2} = C\mathcal{E}^2$$

4) Переходный процесс от замыкания ключа до уст. режима

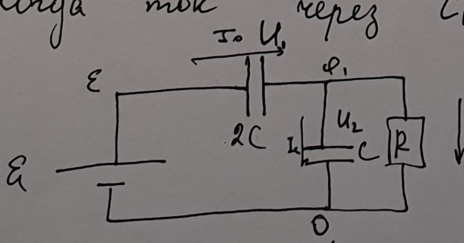


$$q^* = 2C\mathcal{E} - \frac{2C\mathcal{E}}{3} = \frac{4C\mathcal{E}}{3}$$

$$A_б = \frac{4C\mathcal{E}^2}{3}$$

ЗСЭ: $A_б = \Delta W + Q \Rightarrow \frac{4C\mathcal{E}^2}{3} = C\mathcal{E}^2 - \frac{C\mathcal{E}^2}{3} + Q \Rightarrow \frac{5C\mathcal{E}^2}{3} - C\mathcal{E}^2 = Q \Rightarrow Q = \frac{2C\mathcal{E}^2}{3}$

5) Когда ток через $C_1 = 0$.



$$I_0 = I_c + I_1$$

$$I_0 = \dot{q}_1 = 2C\dot{U}_1 \Rightarrow \frac{I_0}{2C} = \dot{U}_1$$

$$\dot{U}_1 = -\dot{U}_2 \Rightarrow \frac{I_0}{2C}\cdot C = I_c \Rightarrow \frac{I_0}{2} \Rightarrow I_0 = \frac{I_0}{2} + I_1 \Rightarrow I_1 = \frac{I_0}{2}$$

$$\boxed{\text{Ответ: } I = \frac{2\mathcal{E}}{3R} \quad Q = \frac{2C\mathcal{E}^2}{3} \quad I_1 = \frac{I_0}{2}}$$

1

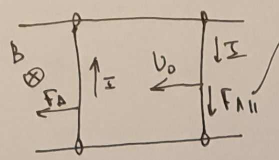
Чистовик

Физика
Вариант 11-01

№4.

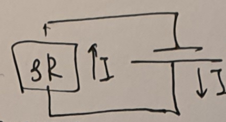
Дано
$v_0; m; L; R;$
B

1) a
2) $u_1; u_2$
3) $S_к; S_{0\,нач.}$

1) 

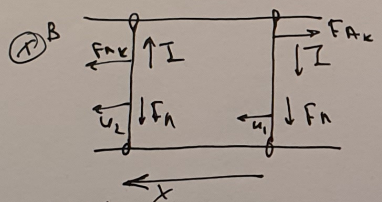
продольная составляющая силы Лоренца, обусловленная движением проводника в магнитном поле.

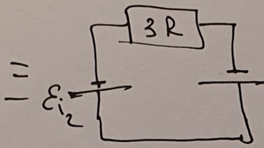
$$\varepsilon_1 = B v_0 L$$

2) $I = \frac{\varepsilon_i}{3R} = \frac{B v_0 L}{3R}$ 

4) II З.Н. для второй перемычки
$$F_A = 2ma$$
$$BIL = 2ma \Rightarrow a = \frac{BIL}{2m} = \frac{B^2L^2v_0}{2m\cdot 3R} = \frac{B^2L^2v_0}{6mR}.$$

2) Через продолжительный промежуток времени.



$=$ 

Спустя долгое время ускорение рамок $= 0 \Rightarrow F_{Aк} = 0 \Rightarrow I = 0 \Rightarrow \varepsilon_{i_2} = \varepsilon_{i_1} \Rightarrow$
$$B u_2 L = B u_1 L \Rightarrow u_2 = u_1 = u$$

ЗСИ: $m v_0 = 2m u_2 + m u_1 \Rightarrow m v_0 = 3 m u \Rightarrow u = \frac{v_0}{3} = u_1 = u_2$

3) $\varepsilon_{i\,экв} = \varepsilon_{i_1}(t) - \varepsilon_{i_2}(t) = BL(v_1(t) - v_2(t)) \Rightarrow I(t) = \frac{BL(v_1(t) - v_2(t))}{3R}$

II З.Н для первой перемычки в промежуточный момент времени

X: $-F_A(t) = m a_x \Rightarrow -\frac{B^2L^2}{3R}(v_1(t) - v_2(t)) = m\frac{\Delta v_x}{\Delta t} \;\Big|\cdot\Delta t$ где $v(t) = \frac{\Delta S}{\Delta t}$

$-\frac{B^2L^2}{3R}(\Delta S_1 - \Delta S_2) = m\Delta v$, просуммируем за всё время передвижения.

$$-\frac{B^2L^2}{3R}(S_1 - S_2) = m\left(\frac{v_0}{3} - v_0\right) \Rightarrow \frac{B^2L^2}{\cancel{3}R}(S_1 - S_2) = \frac{2mv_0}{\cancel{3}}$$
$$S_1 - S_2 = \frac{2mv_0R}{B^2L^2}$$

4) т.к. $S_1 - S_2 > 0 \Rightarrow$ первая перемычка приблизилась ко второй $\Rightarrow$
$$\Rightarrow S_к = S_0 - (S_1 - S_2) = S_0 - \frac{2mv_0R}{B^2L^2}$$

$$\boxed{\text{Ответ: } 1)\ a = \frac{B^2L^2v_0}{6mR} \quad 2)\ u_1 = \frac{v_0}{3} \quad u_2 = \frac{v_0}{3} \quad 3)\ S_к = S_0 - \frac{2mv_0R}{B^2L^2}}$$

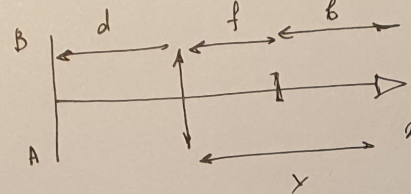
2

Чистовик №5

Физика
Вариант 11-01.

Дано
$F = 9$ см
$H = 9$ см
$d = 36$ см
$b = 24$ см

1) x
2) $D_м$
3) Где экран? c

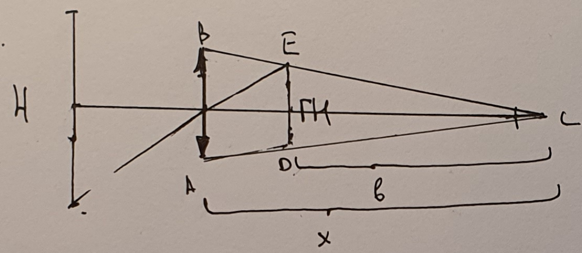
1) 

$$\frac{1}{d}+\frac{1}{f}=\frac{1}{F}$$

Для линзы картина — действительный предмет на $d > F$ => изображение действительное

$$f=\frac{dF}{d-F} \qquad \Gamma=\frac{F}{d-F}=\frac{1}{3}.$$

$$x=b+f=b+\frac{dF}{d-F}=24+\frac{\overset{12}{\cancel{36}}\cdot\cancel{9}}{\cancel{27}_{3}}=36 \text{ см}$$

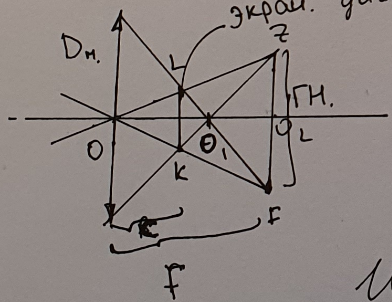
2) 

Размер изображения $=\Gamma H$.
Из подобия
$\triangle ABC \sim \triangle DEC$

$$\frac{b}{x}=\frac{\Gamma H}{D_м} \Rightarrow D_м=\frac{\Gamma\cdot H\cdot x}{b}$$

$$D_м=\frac{\frac{1}{3}\cdot9\cdot36}{24}=\frac{3\cdot\cancel{36}^{3}}{\cancel{24}_{2}}=4{,}5 \text{ см}$$

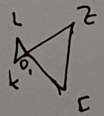
3) Построим ход лучей после линзы.



$$\frac{OO_1}{O_1O_2}=\frac{\Gamma H\cdot x}{b\cdot\Gamma H}=\frac{x}{b}=\frac{36}{24}=\frac{3}{2}.$$

$$OO_1=\frac{3}{5}f \qquad O_1O_2=\frac{2}{5}f$$

Из подобия треугольников $\triangle KLO_1 \sim \triangle OZF$



$$\frac{a}{\Gamma H}=\frac{OO_1-c}{O_1O_2} \Leftrightarrow \frac{a}{\Gamma H}=\frac{\frac{3}{5}f-c}{\frac{2}{5}f}$$

Из подобия $\triangle OZF \sim OLK$ $\frac{a}{\Gamma H}=\frac{c}{f}$ =>

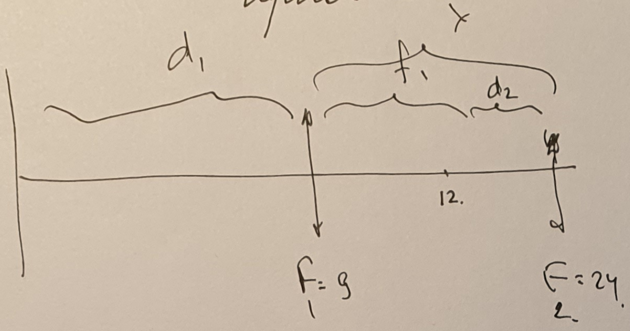
$$\frac{\frac{3}{5}f-c}{\frac{2}{5}\cancel{f}}=\frac{c}{\cancel{f}} \Rightarrow 3f-5c=2c \Rightarrow 3f=7c \Rightarrow c=\frac{3f}{7}=\frac{3dF}{7(d-F)}=\frac{\cancel{3}\cdot36\cdot\cancel{9}}{7\cdot\cancel{27}}$$

$$c=\frac{36}{7}\approx5{,}1 \text{ см.}$$

Ответ: 1) $x = 36$ см 2) $D_м = 4{,}5$ 3) за линзой на 5,1 см

3

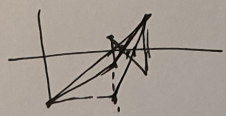
Черновик



$\frac{a}{ГИ} = \frac{OO_1 - c}{O_1O_2}$

$\frac{D_м}{a} = \frac{OO_1}{OO_1 - c}$

$\frac{f}{c} = v$



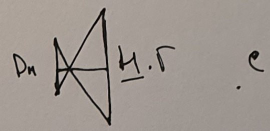
$\frac{c}{f} = \frac{a}{ГИ}$

$f = \frac{dF_1}{d - F_1} = \frac{36 \cdot 9}{27} = 12.$

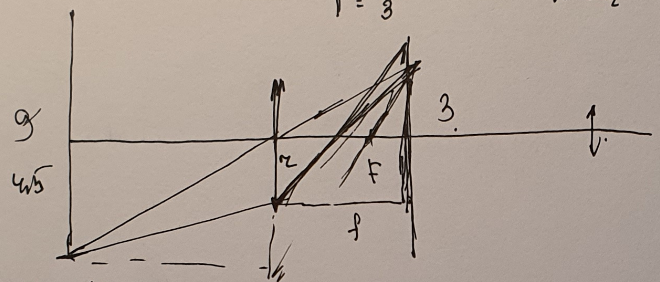
36 см - ?

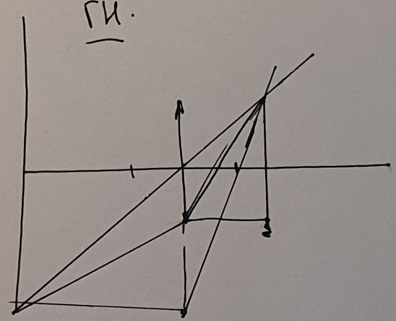
$f_1 + d_2 = x$ - ?

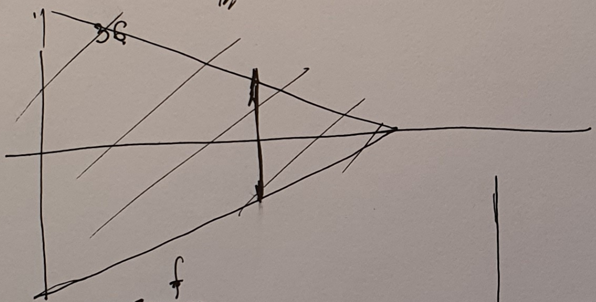
$\Gamma = \frac{1}{3}$

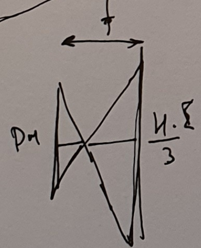


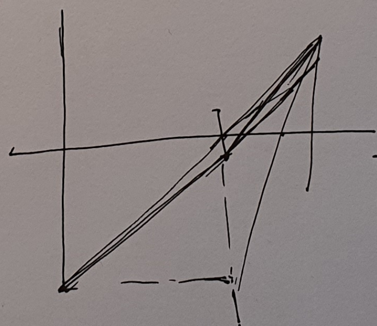
ГИ.

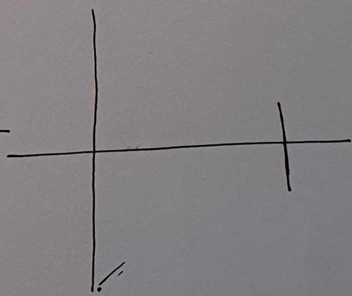








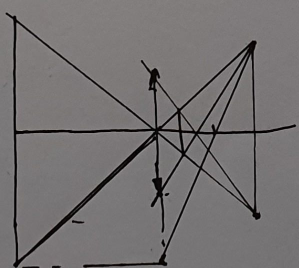


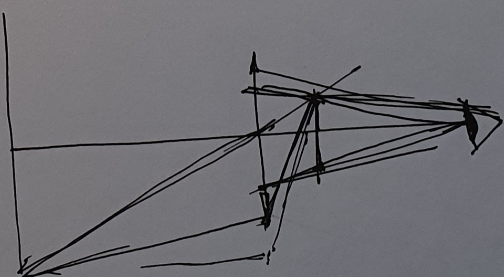


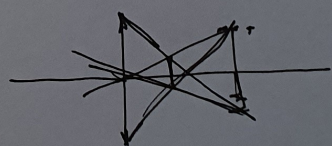
~~$\frac{H}{3} \cdot x + 2D_м \cdot x = 2f_м$~~

$\frac{D_м}{\frac{H}{3}} = \frac{x}{f - x}$ $\quad 3D_м f - 3D_м x = Hx$

$3D_м f = (H + 3D_м)x$







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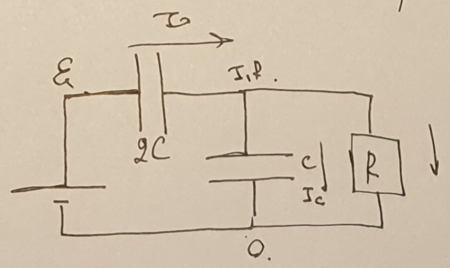
Черновик



$$\frac{2C(\mathcal{E}-\varphi)}{\Delta t} = \frac{C\varphi}{\Delta t} + I$$

$$\frac{2C(\mathcal{E}-\varphi)}{\Delta t} = I_0$$

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

$$\frac{2C(\mathcal{E}-I_1R)}{\Delta t} = I_0 \qquad \frac{2C(\mathcal{E}-I_1R)}{\Delta t} - \frac{I_1RC}{\Delta t} = I_1$$

$$2\mathcal{E} - I_1R = I_0\Delta t$$

$$2C\mathcal{E} - I_0\Delta t = I_1R \cdot 2C \Rightarrow I_1RC = \mathcal{E}C - \frac{I_0\Delta t}{2}$$

$$I_0 - \frac{C\mathcal{E}}{\Delta t}$$

$$\begin{cases} I_0 = \left(\frac{C}{\Delta t}R + 1\right) I_1 \\ I_0 = \frac{2C(\mathcal{E}-I_1R)}{\Delta t} \end{cases}$$

$$I_1 \frac{CR+\Delta t}{\cancel{\Delta t}} = \frac{2C\mathcal{E} - 2CI_1R}{\cancel{\Delta t}}$$

$$CR + \Delta t = \frac{2C\mathcal{E} - 2CI_1R}{I_1}$$

$$\Delta t = \frac{2C\mathcal{E}}{I_1} - 3CR$$

$$I_0 = \frac{2\cancel{C}(\mathcal{E}-I_1R)I_1}{2\cancel{C}\mathcal{E} - 3\cancel{C}RI_1}$$

$$2\mathcal{E}I_0 - 3RI_1I_0 = 2\mathcal{E}I_1 - 2I_1^2R$$

$$2I_1^2R - (3RI_0 + 2\mathcal{E})I_1 + 2\mathcal{E}I_0 = 0$$

$$D = 9R^2I_0^2 + 4\mathcal{E}^2 + 24RI_0\mathcal{E}$$

$$I_0 = \frac{CI_1R}{\Delta t} + I_1$$

$$I_0 = \frac{2C\mathcal{E} - I_1R}{\Delta t}$$

$$CI_1R + I_1\Delta t = 2C\mathcal{E} - I_1$$

$$I_0 = C\frac{dU}{dt} + I_1$$

$$I_0 = \frac{dU_c}{dt}$$

$$\frac{\dot q}{C} = \dot U$$

$$\frac{I_0}{2C} = \dot U \uparrow\uparrow$$

$$\frac{I_0}{2C} \downarrow\downarrow$$

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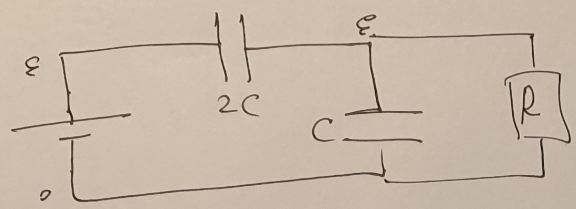
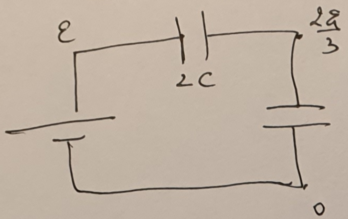
Черновик

№3



напр. на. C ↑ на з.

$$I_0 - \frac{C\varphi_1}{\Delta t} = I$$



$$2C \cdot (\mathcal{E} - \varphi) = C\varphi$$

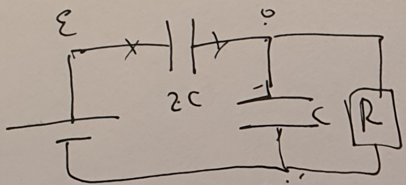
$$2\mathcal{E} = 3\varphi \Rightarrow$$

$$\frac{2\mathcal{E}}{3} = \varphi$$

$$I_0 - \frac{C\mathcal{E}}{\Delta t} + I_0 = I$$

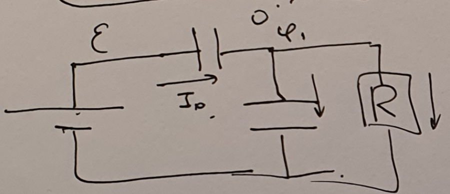
$$I = \frac{2\mathcal{E}}{3R}$$

$$2I_0 - \frac{C\mathcal{E}}{\Delta t} = I.$$



$$\varphi_1 = I_1 R = \frac{q_2}{C}$$

$$(0 - I_1)R =$$



$$C\dot{u} = I_0$$

$$I_1 \cdot R =$$

$$qR = \frac{I}{C}$$

$$\frac{2C(\mathcal{E} - \varphi_1)}{\Delta t} = \frac{C(\varphi_1)}{\Delta t} + I$$

$$\frac{C(\mathcal{E} - \varphi_1)}{\Delta t} = I_0$$

$$\frac{2C\mathcal{E}}{\Delta t} \cancel{- \varphi_1} \frac{3C\varphi_1}{\Delta t} = I$$

$$C\mathcal{E} - \varphi_1 C = I_0 \Delta t$$

$$C\mathcal{E} - I_0 \Delta t = C\varphi_1$$

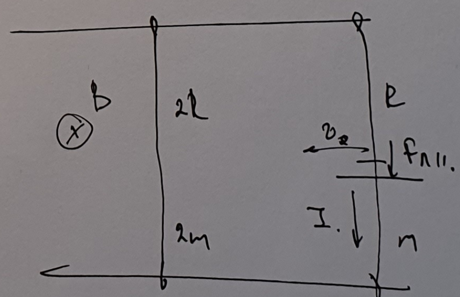
№4.

$$\mathcal{E}_A = BVl$$

$$I = \frac{BVl}{3Rm}$$

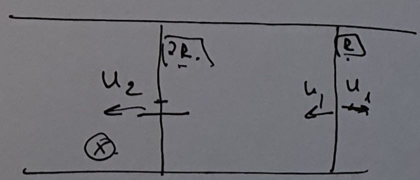
$$2ma = F_A = BIl = \frac{B^2 l^2 v}{3R}$$

$$a = \frac{B^2 l^2 v}{6Rm}$$



$$\mathcal{E}_{i_2} = Bu_2 l \qquad \mathcal{E}_{i_1} = Bu_1 l$$

$$3\dot{u} \quad \frac{v}{3}$$



3) суммир.

$$\mathcal{E}_i = Bu_2 L$$

$$\mathcal{E}_i = Bu_1 L$$