Часть 1

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

Шифр: **21203669**

ID профиля: **382217**

Вариант 2

№2

ν;

T_0 ;

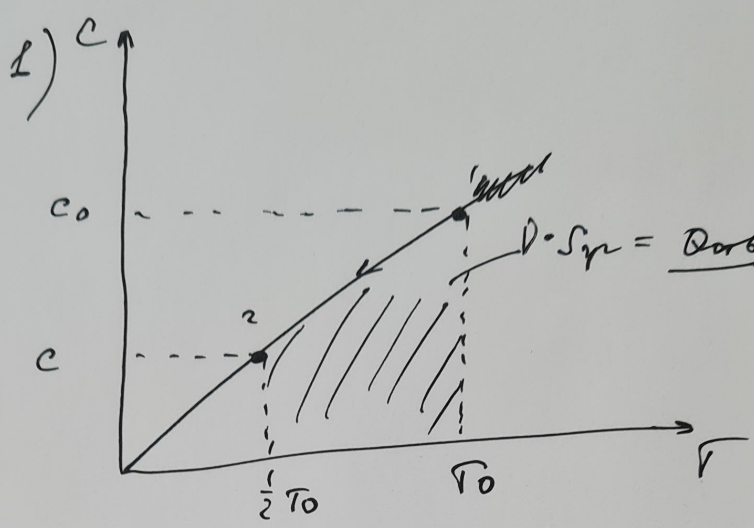
$C(T) = \frac{5}{2} k \frac{T}{T_0}$

1) $Q_{отв}$ от T_0 до $\frac{T_0}{2}$ - ?

2.) T, для A_{min}

3.) A_{min} - ?

1)



$\nu \cdot S_{тр} = \underline{Q_{отв}}$.

$$S_{тр} = \frac{1}{2}(C + C_0)\left(T - \frac{1}{2} T_0\right) = \frac{1}{4}(C + C_0) \cdot T_0 \;;$$

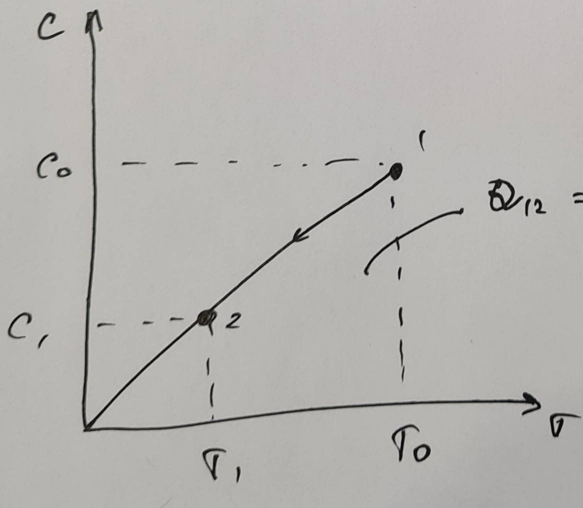
$$C = \frac{5}{2} k \cdot \frac{\frac{1}{2} T_0}{T_0} = \frac{5}{4} k .$$

$$C_0 = \frac{5}{2} k \frac{T_0}{T_0} = \frac{5}{2} k \quad \Big\} \Rightarrow$$

$$\Rightarrow S_{тр} = \frac{1}{4}\left(\frac{10}{4} k + \frac{5}{4} k\right) \cdot T_0 = \frac{15}{16} k T_0 .$$

Таким образом: $Q_{отв} = \nu \cdot S_{тр} = \underline{\frac{15}{16} \nu k T_0}$

2) ~~Процесс~~ Обозначим искомую температуру за T_1, а молярную теплоемкость за C_1 (при этой же T_1).



$Q_{12} = -S_{тр} \cdot \nu$, т.к. ~~тепло~~ тепло отводится.

$C_0 = \frac{5}{2} k$;

$C_1 = \frac{5}{2} k \frac{T_1}{T_0}$;

$$S_{тр} = \frac{1}{2}(C_1 + C_0) \cdot (T_0 - T_1) = \frac{1}{2}\left(\frac{5}{2} k \frac{T_1}{T_0} + \frac{5}{2} k\right) \cdot (T_0 - T_1) =$$

$$= \frac{5}{4} k \left(\frac{T_1}{T_0} + 1\right)(T_0 - T_1) = \frac{5}{4} k \cdot \frac{T_0 + T_1}{T_0} \cdot (T_0 - T_1).$$

$$Q_{12} = -\nu S_{тп} = -\frac{5}{4}\nu R\,\frac{T_0+T_1}{T_0}\cdot(T_0-T_1).$$

По первому началу термодинамики:

$$Q_{12} = \Delta U_{12} + A_{12}; \quad \Delta U_{12} = U_2 - U_1 = \frac{3}{2}\nu R T_1 - \frac{3}{2}\nu R T_0 =$$

$$= -\frac{3}{2}\nu R(T_0-T_1). \Rightarrow A_{12} = Q_{12} - \Delta U_{12} =$$

$$= -\frac{5}{4}\nu R\,\frac{T_0+T_1}{T_0}\cdot(T_0-T_1) + \frac{3}{2}\nu R(T_0-T_1) =$$

$$= \frac{1}{2}\nu R(T_0-T_1)\left(3 - \frac{5}{2}\cdot\frac{T_0+T_1}{T_0}\right) = \quad =$$

$$= \frac{1}{2}\nu R(T_0-T_1)\left(\frac{6T_0-5T_0-5T_1}{2T_0}\right) =$$

$$= \frac{1}{2}\nu R(T_0-T_1)\cdot\frac{T_0-5T_1}{2T_0} = \frac{1}{2}\nu R\,\frac{(T_0-T_1)(T_0-5T_1)}{2T_0} =$$

$$= \frac{1}{2}\nu R\cdot\frac{T_0^2-5T_0\cdot T_1-T_0\cdot T_1+5T_1^2}{2T_0} =$$

$$= \frac{1}{4}\nu R\cdot\frac{5T_1^2-6T_0\cdot T_1+T_0^2}{T_0}.$$

Заметим, что $A_{12} = A_{min}$, если $f(T_1) = 5T_1^2 - 6T_0\cdot T_1 + T_0^2 =$ $= f_{min}(T_1)$; $f'(T_1) = 10T_1 - 6T_0$. Найдем минимум: $10T_1 - 6T_0 = 0 \Rightarrow T_1 = \frac{6}{10}T_0 = \underline{\frac{3}{5}T_0}$.

(он один, т.к. квадратичная f)

3.) $$A = \frac{1}{4}\nu R\cdot\frac{5\cdot\frac{9}{25}T_0^2 - 6T_0\cdot\frac{3}{5}T_0 + T_0^2}{T_0} =$$

$$= \frac{1}{4}\nu R\cdot\frac{\frac{9}{5}T_0^2-\frac{18}{5}T_0^2+\frac{5}{5}T_0^2}{T_0} = \frac{1}{4}\nu R\cdot\frac{-\frac{4}{5}T_0^2}{T_0} =$$

$$= -\frac{1}{4}\nu R\cdot\frac{4}{5}T_0 = \underline{-\frac{1}{5}\nu R T_0}.$$

Чистовик. Стр. 3

Обобщим:

1) $Q_{\text{отв}} = \frac{15}{16} \nu R T_0$

2) $T_1 = \frac{3}{5} T_0$

3) $A_{min} =$ [illegible]

$-\frac{1}{5} \nu R T_0$.

Ответ:

1.) $\frac{15}{16} \nu R T_0$

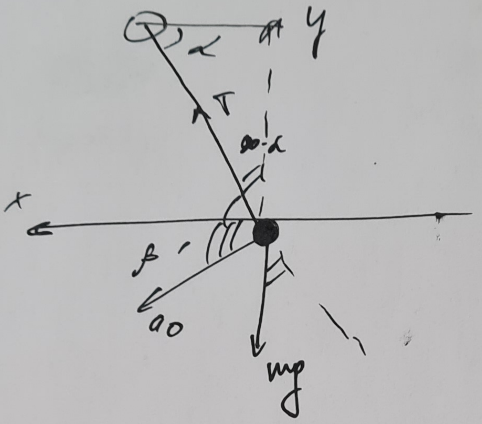
2) $\frac{3}{5} T_0$

3.) $-\frac{1}{5} \nu R T_0$.

Чистовик. Стр. 4.

№1

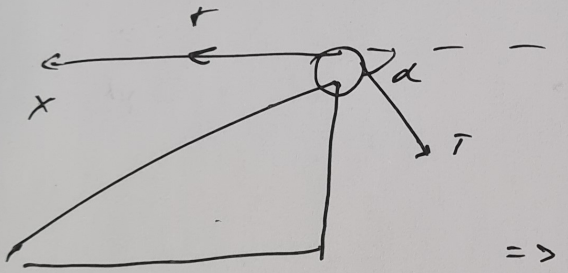
Относительно клина ускорение шара =0 (по горизонтали).



2ЗН: x:

$T\cos\alpha = ma_{кл};$

$\frac{4}{5}T = ma_{кл}$



2ЗН: x: $T - T\cos\alpha = Ma_{кл}.$

$T - \frac{4}{5}T = Ma_{кл}$

$\frac{1}{5}T = Ma_{кл}$ ⇒

⇒ $\frac{m}{M} = 4$.

По y: $mg - T\sin\alpha = m a_y$ ⇒

⇒ $a_y = g - \frac{3}{5}\frac{T}{m}.$ ⇒

$a_x = \frac{4}{5}\frac{T}{m}.$

$$\Rightarrow a_0 = \sqrt{\frac{16}{25}\frac{T^2}{m^2} + \frac{9}{25}\frac{T^2}{m^2} + g^2 - \frac{6}{5}\frac{T}{mg}} =$$

$$= \sqrt{\frac{T^2}{m^2} + g^2 - \frac{6T}{5mg}}$$

Чистовик. Стр. 5.

$$a_0 \cos\beta = \frac{4T}{5m}$$

$$a_0 \sin\beta = g - \frac{3T}{5m}$$

$$\operatorname{ctg}\beta = \frac{\frac{4T}{5m}}{g - \frac{3T}{5m}} = \frac{4T}{5mg - 3T}$$

$$\left(\frac{T^2}{m^2} + g^2 - \frac{6T}{5mg}\right)\cos^2\beta = \frac{\cancel{4T}^2\,16T^2}{25m^2}$$

$$\left(\frac{T^2}{m^2} + g^2 - \frac{6T}{5mg}\right) \cdot \frac{16T^2}{(5mg \cdot 3T)^2 + 1} = \frac{16T^2}{25m^2}$$

$$\frac{T^2}{m^2} + g^2 - \frac{6T}{5mg} = \frac{25mg^2 + 9T^2 - 30mgT + 1}{25m^2}$$

$$25T^2 + \cancel{2m}\ 25m^2g^2 - \frac{30Tm}{g} = 25m^2\rho^2 + \rho T^2 - 30mgT + 1$$

$$16T^2 - \frac{30Tm}{\rho} = 30mgT + 1$$

$$16T^2 - \frac{30m}{g}T - 30mg \cdot T + 1 = 0$$

$$16T^2 - 30m\left(\frac{1}{\rho} - g\right) \cdot T + 1 = 0.$$

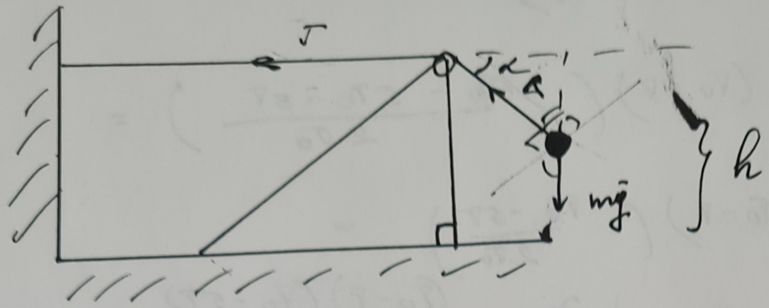
~~$16T^2 - 30m \cdot \frac{99}{100} \cdot \frac{-99}{10} \cdot T + 1 = 0$~~

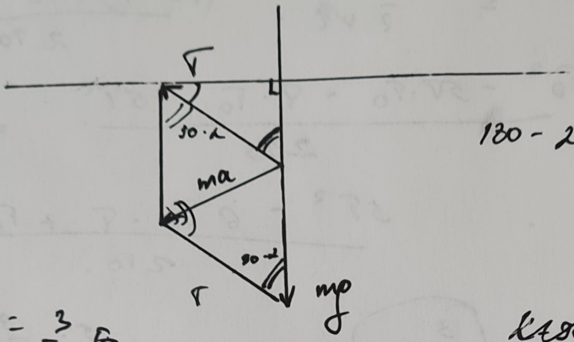
~~$16T^2 + 3 \cdot 99 \cdot m \cdot T + 1 = 0$~~

~~$D = \sqrt{891^2}$~~ ~~$\Rightarrow T =$~~

$$D = 900m^2 \cdot \frac{(1-\rho)^2}{\rho^2} - 64$$

Черновик. Стр ①.





$10T_1 - 6T_0 = 0$

$T_1 = \frac{6}{10} T_0 = \frac{3}{5} T_0$

$180 - 2\alpha + 2\beta = 360$

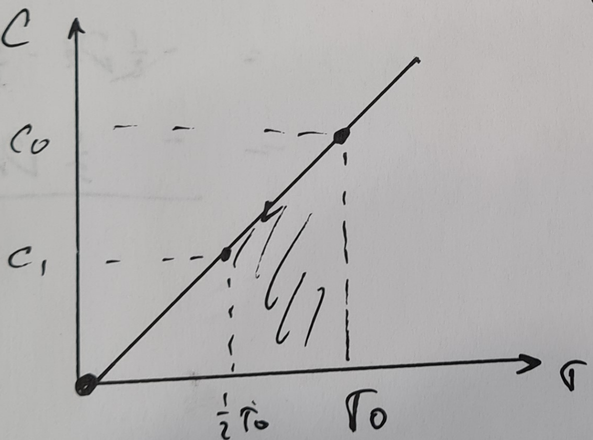
$2 \cdot 180 + 2\alpha = 2\beta$

$\beta = \alpha + 90$

[illegible]

2. ν, T_0, $C(T) = \frac{5}{2} k \frac{T}{T_0}$

1.)



$Q_{отб} = \frac{1}{2}(C_0 + C_1) \cdot \frac{1}{2} T_0 \cdot \nu$

$= \frac{1}{4} T_0 (C_0 + C_1) \cdot \nu$

$C_0 = \frac{5}{2} k \Rightarrow$

$C_1 = \frac{5}{4} k$

$\Rightarrow Q_{отб} = \nu \cdot \frac{1}{4} T_0 \left(\frac{15}{4} k \right) =$

$= \frac{15}{16} \nu k T_0$.

$\frac{4T}{5m}$

$ctg = \frac{\cos}{\sin} \Rightarrow$

~~$ctg^2 \sin^2 + \sin^2 = 1$~~

$\cos^2 = 1 - \frac{1}{ctg^2 + 1} =$

$= \frac{ctg^2}{ctg^2 + 1}$

$\sin^2 = \frac{1}{ctg^2 + 1} \Rightarrow$

$\Rightarrow$

Черновик. Стр 3.

$$\frac{1}{2}Dk(r_0-r)\left(3-\frac{5}{2}\frac{r_0+r}{r_0}\right)=A$$

$$A=\frac{1}{2}Dk(r_0-r)\left(\frac{6r_0-5r_0-5r}{2r_0}\right)=$$

$$=\frac{1}{2}Dk(r_0-r)\left(\frac{r_0-5r}{2r_0}\right)=$$

$$=\frac{1}{2}Dk\cdot\frac{(r_0-r)(r_0-5r)}{2r_0}=$$

$$=\frac{1}{2}Dk\cdot\frac{r_0^2-5r\cdot r_0-r\cdot r_0+5r^2}{2r_0}=$$

$$=\frac{1}{2}Dk\cdot\frac{5r^2-6r_0\cdot r+r_0^2}{2r_0}.$$

$$5\cdot\frac{9}{25}r_0^2-\frac{18}{5}r_0^2+r_0^2=$$

$$-\frac{b}{2a}=\frac{6r_0}{10}=\boxed{\frac{3}{5}r_0}\qquad=\boxed{-\frac{4}{5}r_0^2}$$

$$-\frac{1}{2}Dk\cdot\frac{\frac{4}{5}r_0^2}{2r_0}=-\frac{1}{2}Dk\frac{\frac{4}{5}r}{2}=-\frac{1}{2}Dk\frac{4}{10}r=$$

$$=-\frac{1}{2}Dk\cdot\frac{2}{5}r_0=$$

$$=\underline{-\frac{1}{5}Dkr_0}.$$

Черновик. стр ②

$a = \sqrt{a_y^2 + a_T^2}$

1.) a_y : $mg - T\sin\alpha = 0$

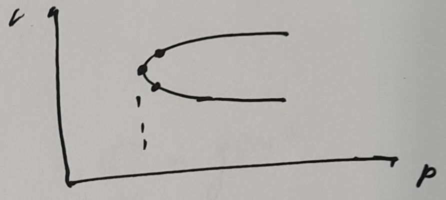
a_T

ВСО [illegible]: $\bar{a}_n = mg\sin\alpha \quad T - mg\sin\alpha.$

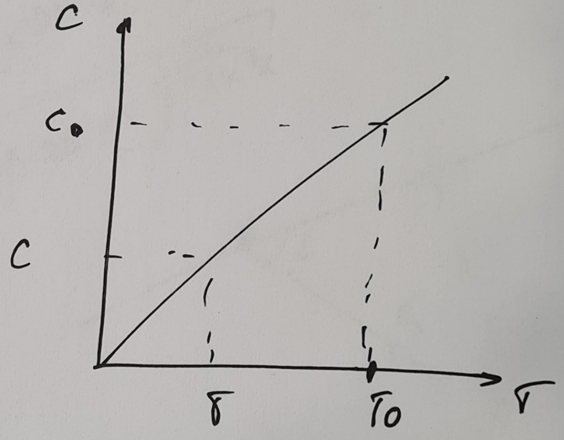
$\overline{a_\tau} = mg\cos\alpha.$

$a_{\text{полн}} = \sqrt{T^2 \, m^3g^2\sin^2\alpha - 2T\,mg\sin\alpha + m^2g^2\cos^2\alpha.}$

$\frac{\Delta V}{V}$ ~~=~~ $\quad p\Delta V = A$



$Q = -$



$Q = -\frac{1}{2}(C_0 + C)\cdot(T_0 - T)\cdot\nu;$

$C_0 = \frac{5}{2}k;$

$C = \frac{5}{2}k\frac{T}{T_0};$

$-\frac{1}{2}\left(\frac{5}{2}k + \frac{5}{2}k\frac{T}{T_0}\right)\cdot(T_0 - T)\cdot\nu =$

$= -\frac{1}{2}\cdot\frac{5}{2}k\left(1 + \frac{T}{T_0}\right)(T_0 - T)\cdot\nu =$

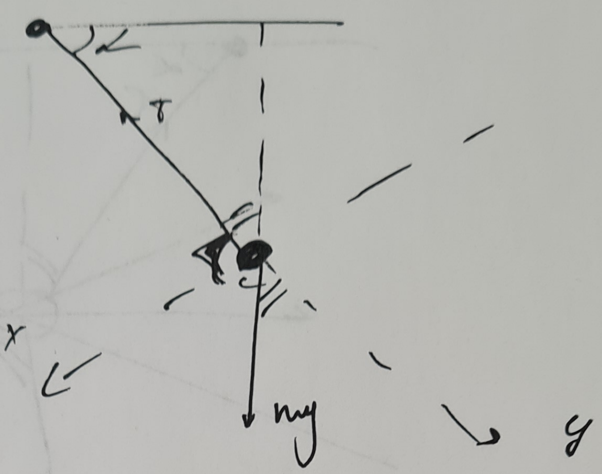
$\Delta U = \frac{3}{2}\nu kT - \frac{3}{2}\nu kT_0 = \quad = -\frac{5}{4}\nu k\,\frac{T_0 + T}{T_0}\cdot(T_0 - T).$

$= \frac{3}{2}\nu k(T - T_0).$

$-\frac{5}{4}\nu k\,\frac{(T_0 + T)(T_0 - T)}{T_0} - \frac{3}{2}\nu k(T - T_0) = A$

$A = \frac{3}{2}\nu k(T_0 - T) - \frac{5}{4}\nu k\,\frac{(T_0 + T)(T_0 - T)}{T_0} = \frac{1}{2}\nu k(T_0 - T)\cdot($

Черновик 6.



$\cancel{m}\ a_x = \cancel{T\cos\alpha} + mg\cos\alpha$

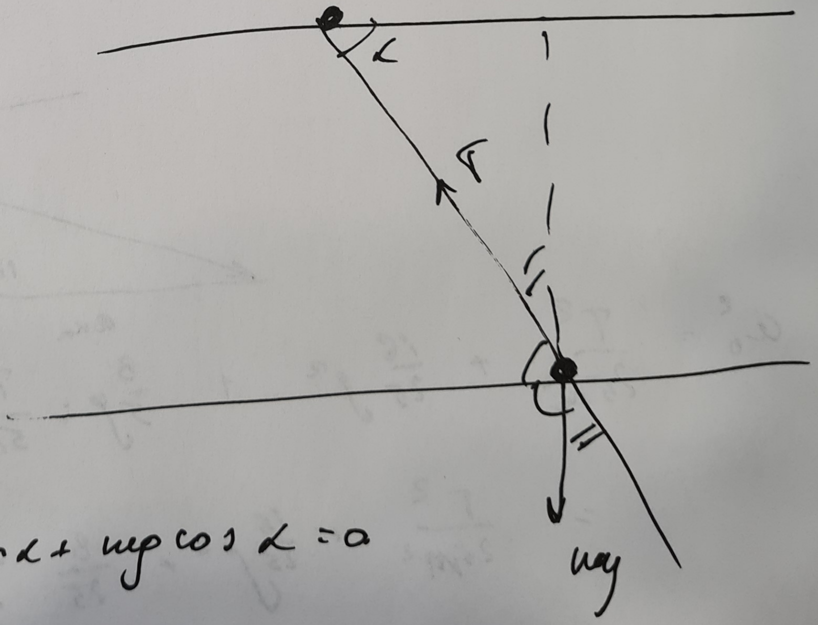
$a_x = g\cos\alpha$

$\cancel{m}\ a_y = mg\sin\alpha$ $\cancel{a_y = g\sin\alpha}$. $a_y = \frac{T}{m} - g\sin\alpha$

$\cancel{a_0 = \sqrt{g^2\cos^2\alpha + g^2\sin^2\alpha}}$ =

=

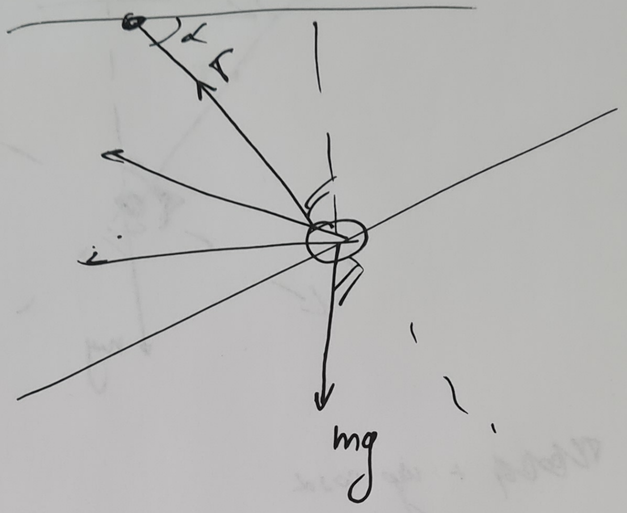
$mg\cancel{h} = mgH =$



$T\cos\alpha + mg\cos\alpha = 0$

Черновик 5.

$T \sin\alpha + mg = N$

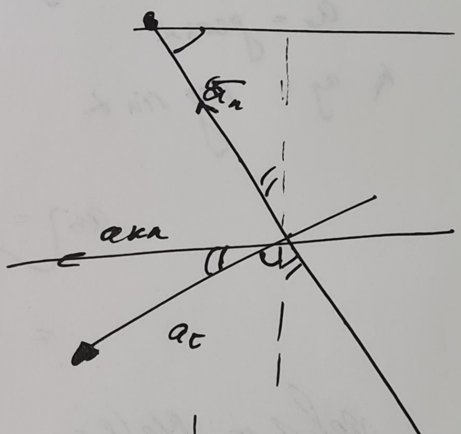


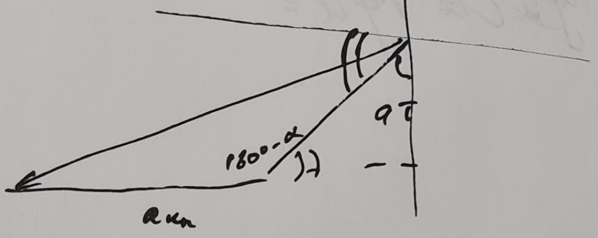
$m a_n = T - mg \sin\alpha = T - \frac{3}{5} mg$

$a_n = \frac{T}{m} - \frac{3}{5} g$

$m a_\tau = mg \cos\alpha$

$a_\tau = \frac{4}{5} g$



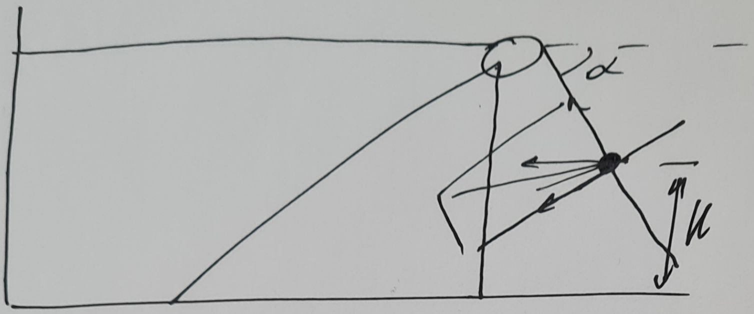


$a_0^2 = \frac{T^2}{25m^2} + \frac{16}{25} g^2 + \frac{8}{5} g \cdot \frac{T}{5m} \cdot \cos\alpha =$

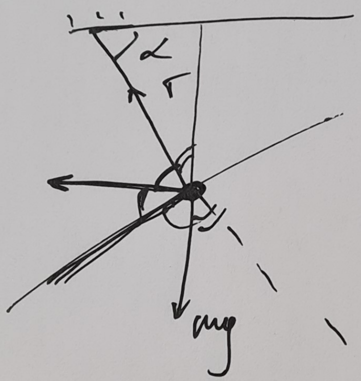
$= \frac{T^2}{25m^2} + \frac{16}{25} g^2 + \frac{8}{25} \frac{T}{mg} \cdot \frac{4}{5} = \frac{T}{5m} \quad \frac{4}{5} g$

$= \frac{T^2}{25m^2} + \frac{16}{25} g^2 + \frac{32}{125} \frac{T}{mg}$

Черновик. Стр. 4.



Относительно клина:



$ma_n = T - mg\,\cancel{\cos}\sin\alpha$

$\cancel{m}a_\tau = \cancel{m}g\cos\alpha$

$a_n = \frac{T}{m} - g\sin\alpha$

$a_\tau = g\cos\alpha. = \frac{4}{5}g$

$a_n = \frac{T}{m} - \frac{3}{5}g.$

$\cancel{a_0 = \sqrt{\frac{T^2}{m^2}}}$

$a_0 = \sqrt{\frac{16}{25}g^2 + \frac{9}{25}g^2 + \frac{T^2}{m^2} - \frac{6}{5}\frac{Tg}{m}}$ -.

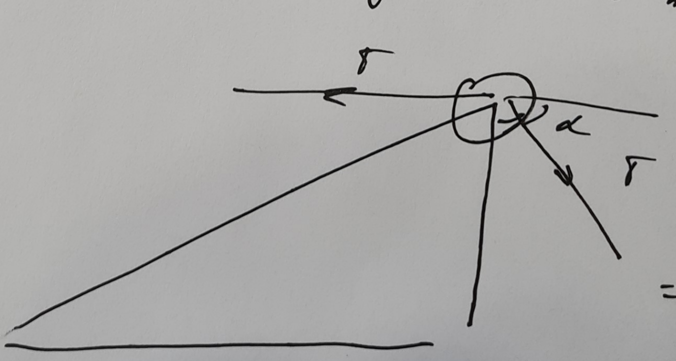
$Ma_{кл} = T$

$a_{кл} = \frac{T}{m}$

$= \sqrt{g^2 + \frac{T^2}{m^2} - \frac{6}{5}\frac{Tg}{m}}.$

←

T.



$T - T\cos\alpha = Ma$

$a_к = \frac{T(1-\cos\alpha)}{m} =$

$= \frac{T}{5m}.$

21203669 (U382217 M1265615)

Часть 2

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

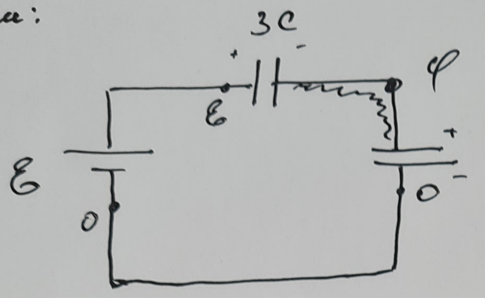
Шифр: **21203669**

ID профиля: **382217**

Вариант 2

№3

0.) Рассмотрим цепь в уст. сост. до замыкания ключа:



Метод потенциалов; Делаем предположение о полярности C_1 и C_2.

По Закону сохр. заряда для из. области (как на рисунке): $-3C(\mathcal{E}-\varphi)+C\varphi=0$, т.к. вначале они не были заряжены. $\Rightarrow -3\mathcal{E}+3\varphi+\varphi=0$

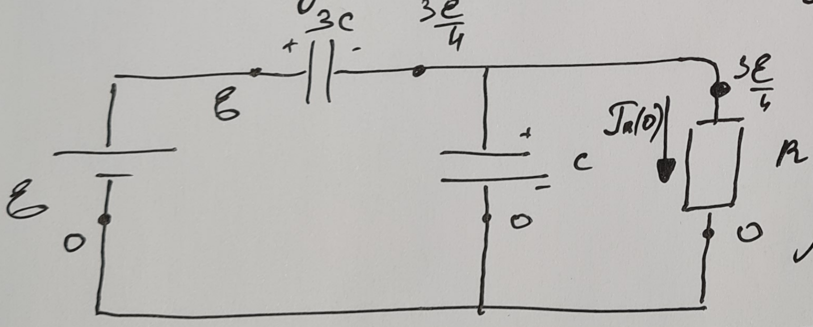
$$\underline{\varphi=\frac{3}{4}\mathcal{E}} \Rightarrow$$

$\Rightarrow$ ~~$U_{C_1}(0)$~~ $U_{C_1}=\mathcal{E}-\frac{3}{4}\mathcal{E}=\frac{1}{4}\mathcal{E}$

$U_{C_2}=\frac{3}{4}\mathcal{E}-0=\frac{3}{4}\mathcal{E}$.

1) Рассмотрим цепь сразу после замыкания ключа. Напряжение на конденсаторах скачком не изменится $\Rightarrow U_{C_1}(0)=U_{C_1}=\frac{1}{4}\mathcal{E}$

$U_{C_2}(0)=U_{C_2}=\frac{3}{4}\mathcal{E}$.



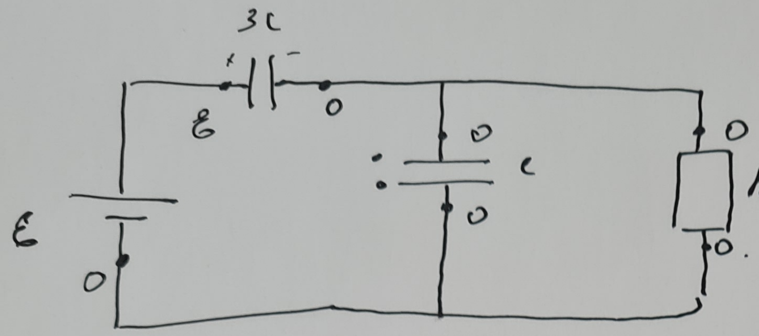
Метод потенциалов

По закону Ома:

$$I_R(0)=\frac{\frac{3\mathcal{E}}{4}-0}{R}=\boxed{\frac{3\mathcal{E}}{4R}}.$$

2) Рассмотрим эту цепь в момент $t_{уст}$. $I_{C_1}=0$; $I_{C_2}=0$, т.к. уст. сост $\Rightarrow$ $\underline{I \text{ в цепи}}=0$.

Чистовик, стр. ②.



Метод потенциалов.
Т.к. тока нет,
$U_R = 0$ =>

=> $U_{c_1}(\underline{t_{уст}}) = \mathcal{E}$; $U_{c_2}(\underline{t_{уст}}) = 0$

3.) Рассмотрим процесс от 0 до $t_{уст}$.

$$W(0) = \frac{3C \cdot U_{c_1}^2(0)}{2} + \frac{C \cdot U_{c_2}^2(0)}{2} =$$

$$= \frac{3C \cdot \frac{1}{16}\mathcal{E}^2}{2} + \frac{C \cdot \frac{9}{16}\mathcal{E}^2}{2} = \frac{3}{32}C\mathcal{E}^2 + \frac{9}{32}C\mathcal{E}^2 =$$

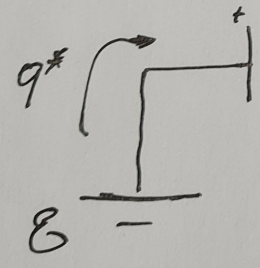
$$= \frac{12}{32}C\mathcal{E}^2 = \frac{6}{16}C\mathcal{E}^2 = \frac{3}{8}C\mathcal{E}^2.$$

$$W(t_{уст}) = \frac{3C \cdot U_{c_1}^2(t_{уст})}{2} + \frac{C \cdot U_{c_2}^2(t_{уст})}{2} = \frac{3C\mathcal{E}^2}{2} + 0 =$$

$$= \frac{3C\mathcal{E}^2}{2}. \Rightarrow \Delta W = \frac{3C\mathcal{E}^2}{2} - \frac{3}{8}C\mathcal{E}^2 = \frac{12}{8}C\mathcal{E}^2 \cdot \frac{3}{8}C\mathcal{E}^2 =$$

$$= \frac{9}{8}C\mathcal{E}^2.$$

Рассмотрим конденсатор 3C:



было $\frac{3}{4}C\mathcal{E}$

стало $\frac{12}{4}C\mathcal{E}$

=> Притек заряд $\frac{9}{4}C\mathcal{E}$ =>

=> $\underline{A_б = \mathcal{E} \cdot q^* = \frac{9}{4}C\mathcal{E}^2}$ =>

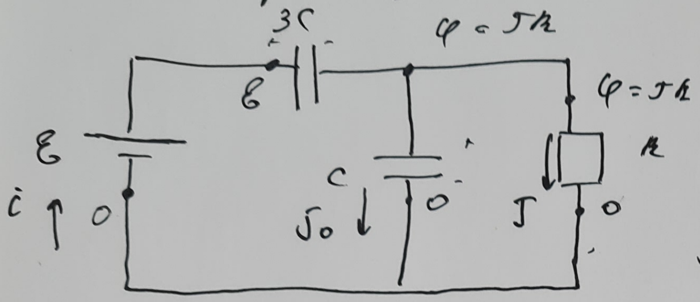
=> ЗСЭ: $A_б = \Delta W + Q$

$$Q = A_б - \Delta W = \frac{9}{4}C\mathcal{E}^2 - \frac{9}{8}C\mathcal{E}^2 =$$

$$= \underline{\frac{9}{8}C\mathcal{E}^2}.$$

Черновик. Стр. ③ Чистовик. Стр. ③

4.) Рассмотрим цепь в момент τ, когда $J_{C_2} = J_0$:



Метод потенциалов

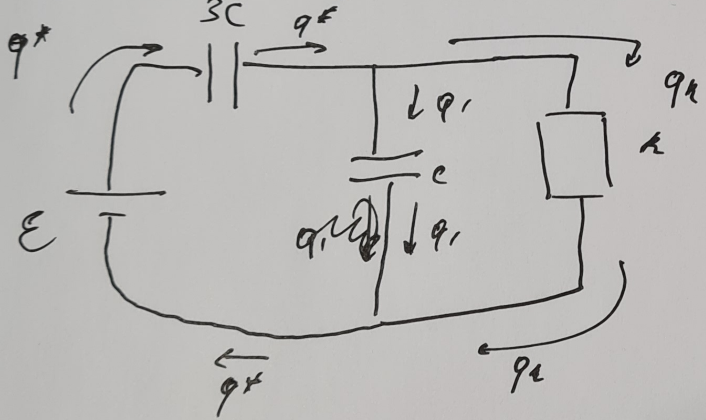
$i = J_0 + J$

$$W(\tau) = \frac{3C\cdot(\varepsilon-\varphi)^2}{2} , \quad \cancel{3C\varphi^2} \quad \frac{C\varphi^2}{2}$$

$$A_б = \varepsilon\cdot\left(3C(\varepsilon-\varphi) - \frac{3}{4}C\varepsilon\right) =$$

$$= \varepsilon(3C\varepsilon - \frac{3}{4}C\varepsilon - 3C\varphi) = \frac{9}{4}C\varepsilon^2 - 3C\varepsilon\cdot\varphi.$$

$Q = \cancel{\varepsilon\ to}\ \varphi q_R =$



$$\left.\begin{aligned} q^* &= 3C(\varepsilon-\varphi) - \frac{3}{4}C\varepsilon \\ q_1 &= -C\varphi + \frac{3}{4}C\varepsilon. \end{aligned}\right\} \Rightarrow$$

$$\Rightarrow q_R = 3C(\varepsilon-\varphi) - C\varphi =$$

$$= 3C\varepsilon - 3C\varphi - C\varphi =$$

$$= 3C\varepsilon - 4C\varphi. \Rightarrow$$

$$\Rightarrow ЗСЭ: \frac{9}{4}C\varepsilon^2 - 3C\varepsilon\cdot\varphi = \frac{3C(\varepsilon-\varphi)^2}{2} + \frac{C\varphi^2}{2} + 3C\varepsilon\varphi - 4C\varphi^2$$

$$\frac{9}{4}C\varepsilon^2 - 6C\varepsilon\cdot\varphi - 4C\varphi^2 = \frac{3C(\varepsilon^2 - 2\varepsilon\varphi + \varphi^2)}{2} + \frac{C\varphi^2}{2}$$

$$\frac{9}{4}\varepsilon^2 - 6\varepsilon\cdot\varphi - 4\varphi^2 = \frac{3}{2}\varepsilon^2 - 3\varepsilon\varphi + \frac{3}{2}\varphi^2 + \frac{\varphi^2}{2}$$

$$\frac{3}{4}\varepsilon^2 - 3\varepsilon\varphi - 6\varphi^2 = 0$$

$$\frac{1}{4}\varepsilon^2 - \varepsilon\varphi - 2\varphi^2 = 0$$

$$4\cdot\ \varepsilon^2 - 4\varepsilon\varphi - 8\varphi^2 = 0$$

$$D = 16 + 32 = 48\varepsilon^2$$

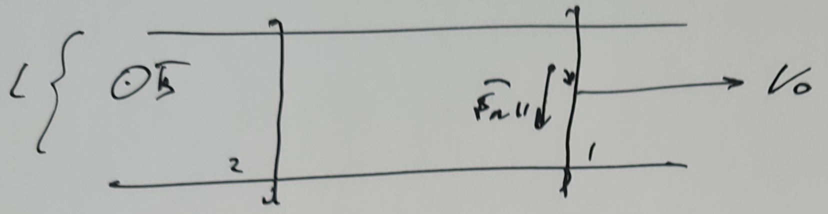
$$\varphi = \frac{4\varepsilon \pm 4\varepsilon\sqrt{3}}{2} =$$

$$= 2\varepsilon \pm 2\varepsilon\sqrt{3} = 2\varepsilon(1 \pm \sqrt{3}).$$

Чистовик. Стр ④

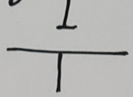
№4

1)

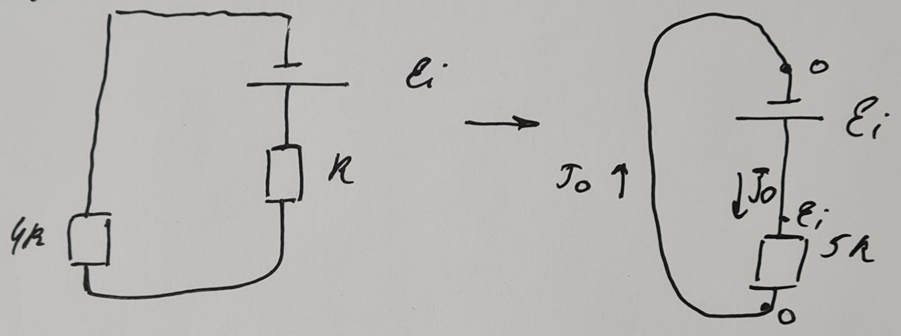


$\vec F_{л\,ц}$ - сост. силы Лоренца, обусловленная движением проводника. По правилу левой руки как на рисунке.

Возникает $\mathcal{E}_i = B v_0 L$ →

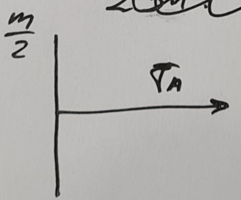

$\mathcal{E}_i$

2) Получаем цепь:



Ток $I_0 = \frac{\mathcal{E}_i - 0}{5R} = \frac{\mathcal{E}_i}{5R} = \frac{B v_0 L}{5R}$.

3.) Пер. 2:



2ЗН:

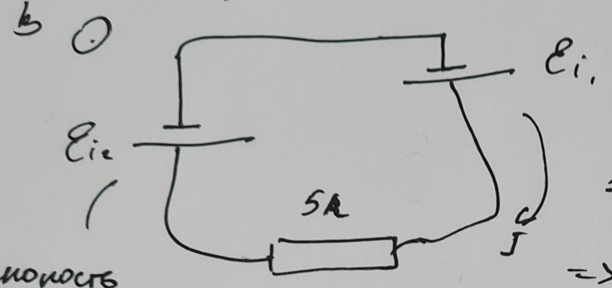
$$\frac{m}{2} a_2 = F_A$$

$$\frac{m}{2} a_2 = BL \cdot \frac{B v_0 L}{5R} = \frac{B^2 L^2}{5R} v_0$$

$$a_2 = \frac{2 B^2 L^2}{5 m R} \cdot v_0 .$$ вправо

Чистовик ⑤

4) Рассмотрим промеж. момент. $v_1 > v_2$ ~~[illegible]~~, т.к v_1 являлась причиной всего этого движения. Тогда получим цепь:



$\mathcal{E}_{i0} = \mathcal{E}_{i1} - \mathcal{E}_{i2} =$

$= B\cancel{2l}(v_1 - v_2) \Rightarrow$

$\Rightarrow J = \frac{Bl(v_1 - v_2)}{5R}$.

скорость вправо, в ин нас ⇒
⇒ батарейка ориентирована таким образом.

2ЗН: 1): $\underset{\text{влево}}{ma_1} = \frac{B^2l^2}{5R}\cdot(v_1 - v_2) =$
$= F_{A,1}$

→ x

2) $\underset{\text{вправо}}{\frac{m}{2}a_2} = \frac{B^2l^2}{5R}(v_1 - v_2) \Rightarrow$

$\Rightarrow \frac{a_2}{2} = -a_1 \Rightarrow a_2 = -2a_1$

$\frac{\Delta v_2}{\Delta t} = -2\frac{\Delta v_1}{\Delta t} \Rightarrow$

⇒ ~~[illegible]~~ для уст. сост: $\cancel{\frac{v}{\Delta t}}$ $v_2 = -2(v_1 - v_0)$

~~$3v = 2v_0$~~

~~$v = \frac{2}{3}v_0$.~~

~~$v_1 = v_2$ в уст сост, т.к $a_1 = a_2 = 0 \Rightarrow$~~

~~$v_2 + 2v_1 = 2v_0$~~

$\Rightarrow J$ ~~$= 0 \Rightarrow v_1 = v_2$.~~

Однако v_2 вуст $= v_1$ вуст, т.к тока нет ⇒ нет F_A ⇒
⇒ нет a. $\Rightarrow v_1 - v_2 = 0 \Rightarrow v_1 = v_2 \Rightarrow 3v = 2v_0$

$v = \frac{2}{3}v_0$.

Чистовик. 4. ⑥

5.)

$$-ma_1 = \frac{B^2l^2}{5R}\cdot(v_1 - v_2) \qquad \longrightarrow x$$

$$-m\frac{\Delta v_1}{\Delta t} = \frac{B^2l^2}{5R}\cdot\left(\frac{\Delta S_1}{\Delta t} - \frac{\Delta S_2}{\Delta t}\right)$$

$$-m\Delta v_1 = \frac{B^2l^2}{5R}\cdot(\Delta S_1 - \Delta S_2) \Rightarrow$$

$$\Rightarrow \Delta S_1 - \Delta S_2 = \frac{-5m\Delta v_1 R}{B^2l^2}$$

$$S_1 - S_2 = \frac{-5m\left(\frac{2}{3}v_0 - v_0\right)\cdot R}{B^2l^2} =$$

$$= \frac{5m\cdot\frac{1}{3}v_0\cdot R}{B^2l^2} = \frac{5mv_0R}{3B^2l^2}.$$

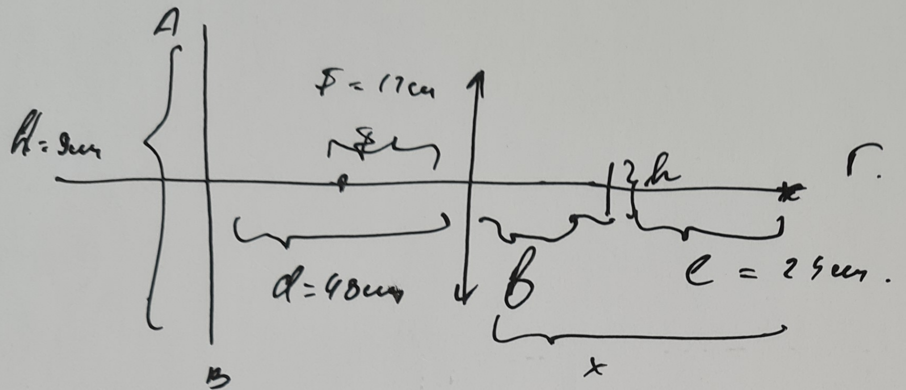
Ответ: 1) $\frac{2B^2l^2}{5mR}v_0$

2) $v_1 = v_2 = \frac{2}{3}v_0$

~~4)~~ 3.) $S_1 - S_2 = \frac{5mv_0R}{3B^2l^2}.$

Чистовик ~~Фи~~ ⑦

№5



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

$$\frac{1}{f} = \frac{1}{12} - \frac{1}{48} = \frac{3}{48} = \frac{1}{16}$$

$$\underline{f = 16\text{см}} \Rightarrow$$

$$\Rightarrow x = f + l = \underline{40\text{см}}.$$

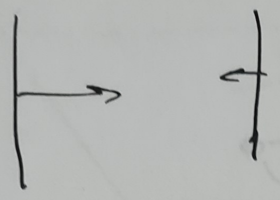
2) $\Gamma = \frac{f}{d} = \frac{16\text{см}}{48\text{см}} = \frac{1}{3} \Rightarrow h = 3\text{см}. \Rightarrow$

$\Rightarrow D_{min} = h = \underline{3\text{см}}$.

Ответ: 1) $f = 16\text{см}$

2) ~~Dm~~ $D_{min} = 3\text{см}$.

Черновик



$$\frac{BL(v_1 - v_2)}{5R}$$

$$ma_1 = \frac{B^2L^2}{5R}(v_1 - v_2)$$ =>

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

=> $$\frac{1}{2}a_2 = a_1$$

$$a_2 = 2a_1$$

~~$v_2 = 2v_1$~~

O.) a.lt $$\frac{\Delta v_2}{\Delta t} = 2\,\frac{\Delta v_1}{\Delta t}$$

$$v - v_0$$

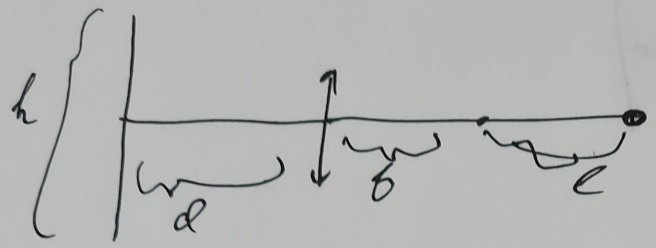
~~$\frac{v}{\Delta t}$~~ $$v = -2(~~[illegible]~~)$$

$$v = -2v + 2v_0$$

$$3v = 2v_0$$

$$v = \frac{2}{3}v_0.$$

Черновик.



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

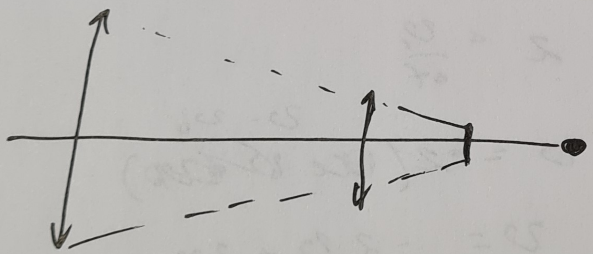
$\frac{1}{f} = \frac{1}{12} - \frac{1}{48} =$

$= \frac{4}{48} - \frac{1}{48} = \frac{3}{48} \Rightarrow \underline{f = 16\text{см}}.$

$x = f + l = 40$см.

$\Gamma = \frac{f}{d} = \cancel{\frac{16}{24}}\ \frac{16}{48} = \boxed{\frac{1}{3}} \Rightarrow$

$\Rightarrow d_0 = 3$см. $= D$м.



$f > x$

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

$\frac{1}{12} - \frac{1}{40} = \frac{1}{d}$

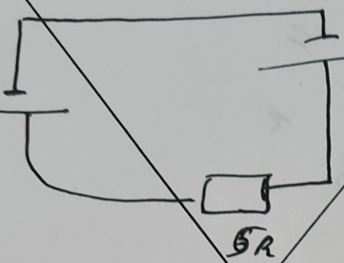
$\frac{10}{120} - \frac{3}{120}$

$\frac{7}{120} \Rightarrow d = \frac{120}{7}$

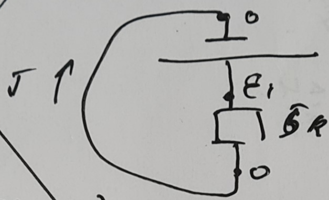
~~Чистовик Стр. 6~~

~~4.) Усложнение~~

~~$\mathcal{E}_{i_2} = BV_2L$~~



~~$\mathcal{E}_{i_1} = BV_1L$. Положим, что $v_1 > v_2$. Тогда цепь принимает вид:~~



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

~~$$\Rightarrow J = \frac{BL(v_1 - v_2)}{5R} \Rightarrow$$~~

~~$\Rightarrow$ 2ЗН для первой:~~

Черновик

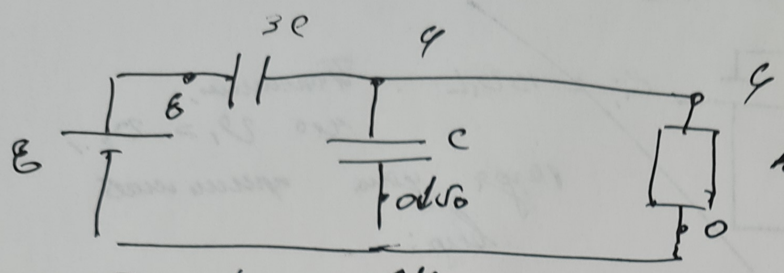
$$-m\frac{\Delta v_1}{\Delta t_1} = \frac{B^2L^2}{5R}\cdot(v_1 - v_2)$$

$$-m\Delta v_1 = \frac{B^2L^2}{5R}\cdot ~~(v_1\Delta t - v_2\Delta t)~~$$

$$-m\Delta v_1 = \frac{B^2L^2}{5R}\cdot(\Delta S_1 - \Delta S_2)$$

$$\Delta S_1 - \Delta S_2 = \frac{5R - m\Delta v_1}{}$$

Черновик.

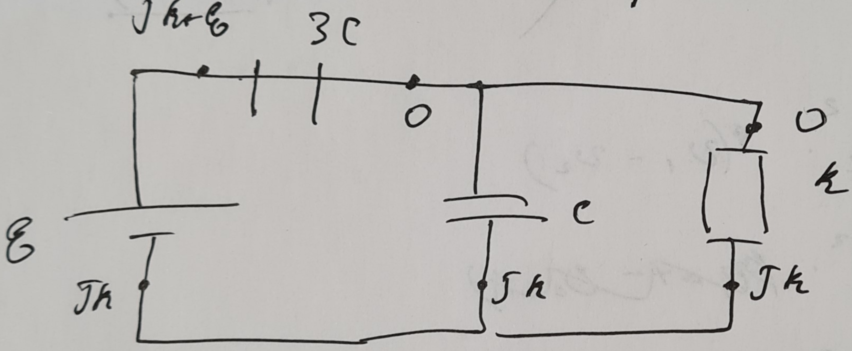


$J_0 = CU' = C\frac{\Delta U_1}{\Delta t}$.

$J_{3C} = 3CU' = 3C\frac{\Delta U_2}{\Delta t}$

$$C\left(\frac{\Delta U_1}{\Delta t} + 3\frac{\Delta U_2}{\Delta t}\right) = \frac{\Delta q}{\Delta t}$$

$C \cdot (\Delta U_1 + 3\Delta U_2) = q$.



$J_0 = C \cdot \frac{\Delta U}{\Delta t}$

$J_0 \Delta t = C \Delta U$

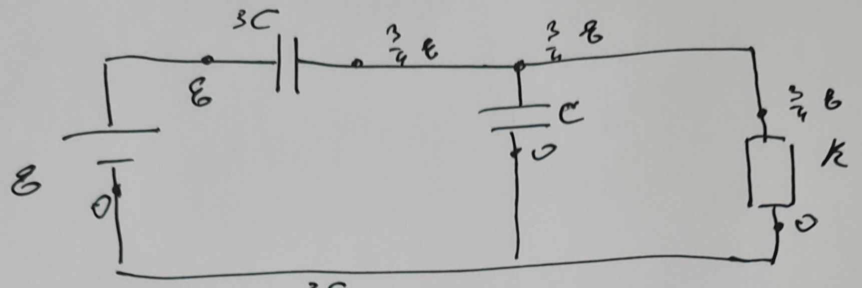
~~[illegible]~~ $q_C = C(\varphi - \frac{3}{4}\mathcal{E})$

$J_0 \tau = C(\varphi - \frac{3}{4}\mathcal{E})$

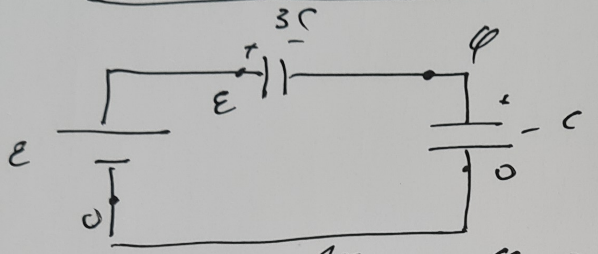
$\frac{\Delta q}{\Delta t} = J_0$

$\frac{q}{\tau} = \frac{C\varphi}{\tau} = J_0$

3.



0)



Ус. сост.

~~$-3C(\varphi + C\varphi = \varphi$~~ ~~$-3\varphi$~~

$$-3C(\mathcal{E}-\varphi) + C\varphi = 0$$

$$-3\mathcal{E} + 3\varphi + \varphi = 0$$

$$4\varphi = 3\mathcal{E}$$

$$\varphi = \frac{3}{4}\mathcal{E} \implies U_{C1} = \frac{1}{4}\mathcal{E}$$

$$\boxed{U_{C2} = \frac{3}{4}\mathcal{E}}$$

$$J_R(0) = \frac{3\mathcal{E}}{4R}.$$

$$Q = J^2 R \Delta t$$

$$Q = UJ\Delta t = Uq$$