Часть 1

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

Шифр: **21203411**

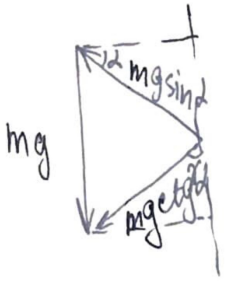
ID профиля: **306868**

Вариант 4

Черновик 2

$\cos\alpha = \frac{8}{17}$

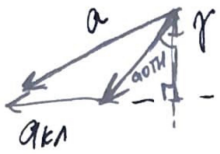
$\sin\alpha = \sqrt{1-\frac{64}{289}} = \sqrt{\frac{289-64}{289}} = \frac{15}{17}$

① 

$mg\sin\alpha\cdot\cos\alpha = mg\,tg\alpha\cdot\sin\gamma$

$\sin\alpha\cdot\cos\alpha = \frac{\cos\alpha}{\sin\alpha}\cdot\sin\gamma$; $\sin\gamma = \sin^2\alpha$

$\sin\gamma = \left(\frac{15}{17}\right)^2$



$a\cdot tg\beta = a_{отн}\cdot\cos\gamma$

$a\cdot\cos\beta = a_{отн}\cdot\cos\gamma$

$ma_y = mg - T\sin\alpha$

$ma_x = T\cos\alpha$; $T = \frac{max}{\cos\alpha}$

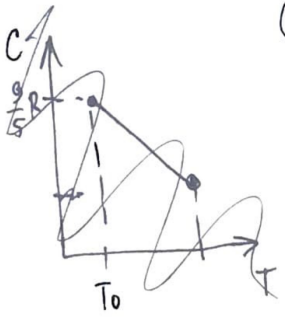
$may = mg - max\,tg\alpha$

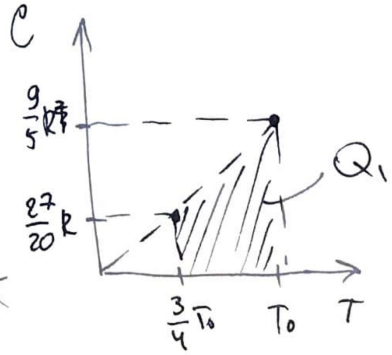
$a_y = g - a_x tg\alpha$

a

② $C(T) = \frac{9}{5}R\frac{T}{T_0}$, J

$C\left(\frac{3}{4}T_0\right) = \frac{9}{5}\cdot R\cdot\frac{3}{4} = \frac{27}{20}R$





1) $Q_1 = \frac{\left(\frac{27}{20}+\frac{9}{5}\right)R}{2}\cdot J\frac{T_0}{4} =$

$= \frac{27+36}{2\cdot 20}R\cdot J\frac{T_0}{4} = \frac{63}{160}RT_0J$

2) При $A = A_{min} = \Delta(pV)$ $pV = JRT$

$\Delta Q = \Delta U + A$

$JC\Delta T = \frac{3}{2}JR\Delta T$

$\Delta(pV) = \Delta(JRT)$ $(JRT)' = 0$ JR

$p_1V_1 = JRT_1$ $(\Delta T)' = 0$

$p_2V_2 = JRT_2$

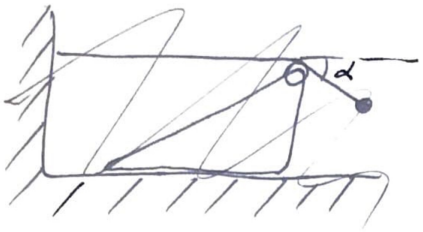
$A = A_{min} - ?$

$\Delta Q = \Delta U + \Delta A$

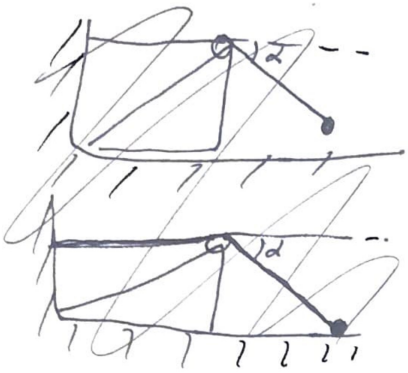
$\frac{9}{5}R\frac{(T_0-T_2)}{T_0} = \frac{3}{2}JR(T_0-T_2) + A$

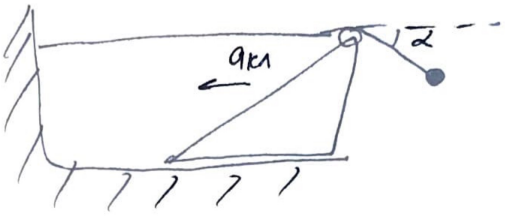
$A_{min} = \Delta(pV) = d(pV)$

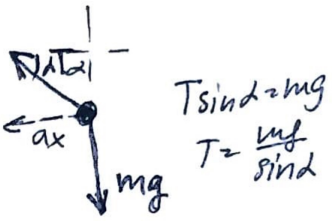
Чертовик 3



1) γ -?
2) $a_{кл}$ -?
3) $\frac{m}{M}$ -?
4) t -?







$T\sin\alpha = mg$

$T = \frac{mg}{\sin\alpha}$

$mg = Const$

$T = Const$

$m\vec{a} = m\vec{g} + \vec{T} = Const$

$Ma_{кл} = T(1-\cos\alpha)$

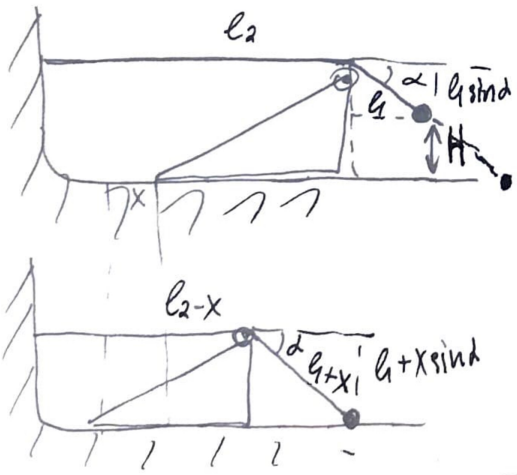
$ma_{кл} = T\cos\alpha$

$\frac{9}{8}ma_{кл} = T(1-\cos\alpha)$

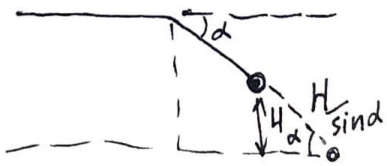
$\frac{9}{8}ma_{кл} = T\cos\alpha$

$ma_x = T\cdot\cos\alpha$

$ma_y = mg - T\sin\alpha$



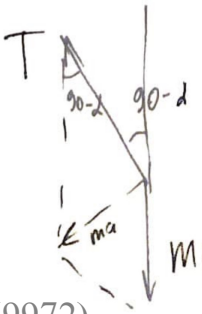
$y = \frac{a_{кл}t^2}{2}$

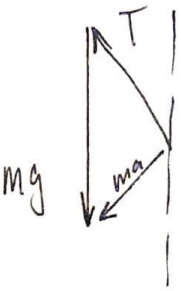


$\frac{H}{\sin\alpha} = \frac{a_{кл}t^2}{2}$

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

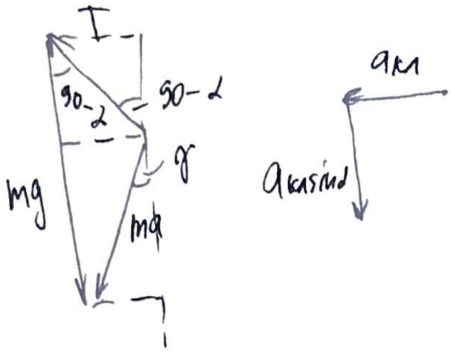
$=$





$a_x = \frac{g - a_y}{tg\alpha}$

Человек 4



$ma\sin\gamma = T$

~~$ma\cos\alpha$~~ $ma\sin\gamma = T\sin(90-\alpha) = T\cos\alpha$

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

---

② ~~$A = \frac{i}{2}\nu R\Delta T$~~ $A = \Delta p \Delta V$ при

$A = \frac{9}{5}\nu R \frac{T}{T_0}\Delta T$

$A = \frac{9}{5}\nu R \frac{T_2}{T_0}$

$\frac{425}{25} = 17$

57

Чистовик

② Дано:

ν, T_0,

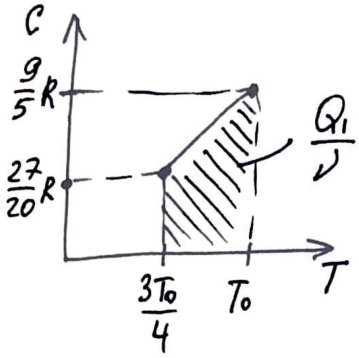
$C(T) = \frac{9}{5}R\frac{T}{T_0}$

1) Q_1 - ? (от T_0 до $\frac{3T_0}{4}$)

2) T_2 - ?

3) A - ?

1) $C(T) = \frac{9}{5}R\frac{T}{T_0}$. Построим график $C(T)$:



$C\left(\frac{3T_0}{4}\right) = \frac{9}{5}R \cdot \frac{3}{4} = \frac{27}{20}R$

$S_{гр} = \frac{Q_1}{\nu}$

$\frac{Q_1}{\nu} = \frac{\frac{27}{20}R + \frac{9}{5}R}{2} \cdot \left(T_0 - \frac{3T_0}{4}\right) = \frac{27+36}{40} \cdot \frac{T_0}{4} = \frac{63T_0}{160}R$

$\boxed{Q_1 = \nu R \cdot \frac{63}{160}T_0}$

2) $A = \Delta p \Delta V$ при $A = A_{min}$ $A' = 0$ $\Delta(pV)' = 0$

$\Delta Q = \Delta U + \Delta A$; $\nu C(T) \cdot \Delta T = \frac{3}{2}\nu R \Delta T + A$; $A = \frac{9}{5}\nu R\frac{T_2}{T_0}(T_0 - T_2) - \frac{3}{2}\nu R(T_0 - T_2)$

$A = \nu R(T_0 - T_2)\left(\frac{9}{5}\frac{T_2}{T_0}^{12} - \frac{3}{2}^{15T_0}\right) = \nu R(T_0 - T_2)\left(\frac{18T_2 - 15T_0}{10T_0}\right) = \frac{3\nu R}{10T_0}(T_0 - T_2)(6T_2 - 5T_0) =$

$= \frac{3\nu R}{10T_0}(6T_2T_0 - 5T_0^2 - 6T_2^2 + 5T_2T_0) = \frac{3\nu R}{10T_0}(11T_2T_0 - 6T_2^2 - 5T_0^2)$

$A' = 0 = \left(\frac{3\nu R}{10T_0}(11T_2 \cdot T_0 - 6T_2^2 - 5T_0^2)\right)' = 0$

$11T_0 - 12T_2 = 0$; $\boxed{T_2 = \frac{11}{12}T_0}$

3) $A = \frac{3\nu R}{10T_0}(T_0 - T_2)(6T_2 - 5T_0) = \frac{3\nu R}{10T_0} \cdot \frac{T_0}{12} \cdot \left(\frac{11}{2}T_0 - \frac{10}{2}T_0\right) =$

$= \frac{3\nu R}{10\cancel{T_0}} \cdot \frac{\cancel{T_0}}{\cancel{12}_4} \cdot \frac{T_0}{2} = \frac{\nu R T_0}{80}$; $\boxed{A = \frac{\nu R T_0}{80}}$

Ответ: $Q_1 = \frac{63}{160}\nu R T_0$, $T_2 = \frac{11}{12}T_0$, $A = \frac{\nu R T_0}{80}$

Чистовик

① Дано:

$\cos\alpha = \frac{8}{17}$

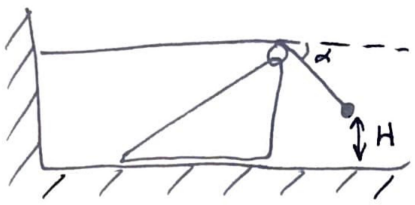
$H, \alpha = const$

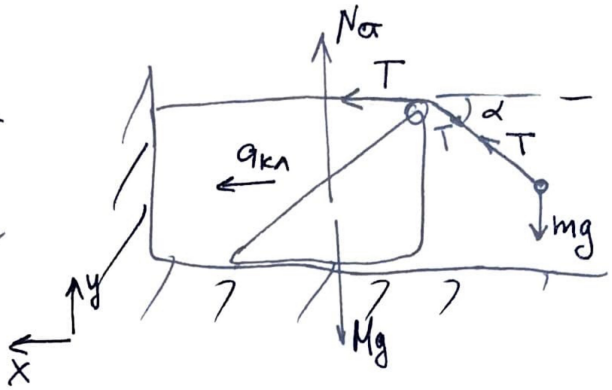
а) γ - ?

б) $a_{кл}$ - ?

в) $\frac{m}{M}$ - ?

г) t - ?



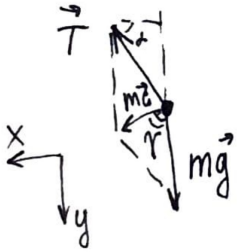


1) II ЗН для клина:

$OX: Ma_{кл} = T - T\cos\alpha = T(1-\cos\alpha)$; $a_{кл} = \frac{T(1-\cos\alpha)}{M}$

$OY: 0 = N_{ст} - Mg - T\sin\alpha$; $N_{ст} = Mg + T\sin\alpha$

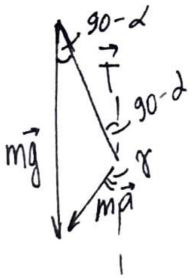
2) Движение шарика состоит из движения вниз по вертикали и по горизонтали ~~вправо~~ влево.



$m\vec{a} = m\vec{g} + \vec{T}$ II ЗН: $OX: ma_x = T\cos\alpha$ (1) ; $a_x = \frac{T\cos\alpha}{m}$

$OY: ma_y = mg - T\sin\alpha$ (2)

Из (1): $T = \frac{ma_x}{\cos\alpha} \rightarrow$ (2): $ma_y = mg - ma_x tg\alpha$

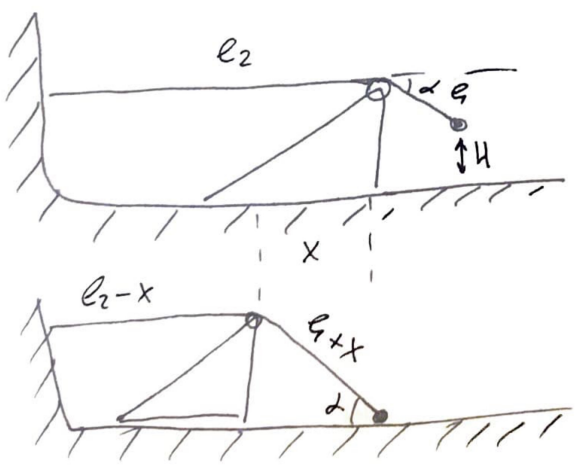


~~$a_x = a_{кл} \rightarrow \frac{T - T\cos\alpha}{M} = T\cos\alpha$~~

По оси OX: $a_x = a_{кл}$, тогда $\frac{T(1-\cos\alpha)}{M} = \frac{T\cos\alpha}{m}$

$$\frac{m}{M} = \frac{\cos\alpha}{1-\cos\alpha} = \frac{8/17}{1-8/17} = \frac{8/17}{9/17} = \frac{8}{9}$$

3)



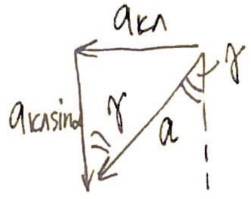
$(\ell + x)\sin\alpha = H + \ell\sin\alpha$

$x\sin\alpha = H$; $x = \frac{H}{\sin\alpha}$ (расстояние, которое прошел клин)

$x = \frac{a_{кл}t^2}{2} = \frac{H}{\sin\alpha}$

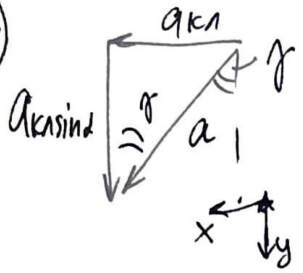
$$t = \sqrt{\frac{2H}{a_{кл}\sin\alpha}} = \sqrt{\frac{2H}{a_y}} \rightarrow$$

$\rightarrow a_y = a_{кл}\sin\alpha$



Чистовик

Продолжение ①

4) 

~~$tg\alpha = \frac{8}{17}$~~ $tg\gamma = \frac{a_{кл}}{a_{кл}\sin\alpha} = \frac{1}{\sin\alpha}$

~~$\cos\alpha = \frac{8}{17}$~~ По условию: $\cos\alpha = \frac{8}{17}$

$\sin\alpha = \sqrt{\frac{17^2-8^2}{17^2}} = \sqrt{\frac{289-64}{289}} = \sqrt{\frac{225}{289}} = \frac{15}{17}$

$$\boxed{tg\,\gamma = \frac{1}{\sin\alpha} = \frac{17}{15}}$$

5) $Uз\ (1)$: $a_x = \frac{T\cos\alpha}{m}$ $Uз\ (2)$: $a_y = g - \frac{T\sin\alpha}{m}$

$a = \sqrt{a_x^2 + a_y^2} = \sqrt{\frac{T^2\cos^2\alpha}{m} + g^2 - \frac{2gT\sin\alpha}{m} + \frac{T^2\sin^2\alpha}{m}}$

$t = \sqrt{\frac{2H}{a_{кл}\sin\alpha}}$ чего найти $a_{кл}$

$a_y = a\cos\gamma$ ~~$a\cos\gamma = \frac{T\cos\alpha}{m}$~~ $a\cos\gamma = g - \frac{T\sin\alpha}{m}$

$a_x = a\sin\gamma$ $a\sin\gamma = \frac{T\cos\alpha}{m}$

~~$tg\gamma = \frac{T\cos\alpha}{mg - T\sin\alpha}$~~ ; $ctg\,\gamma = \frac{mg - T\sin\alpha}{T\cos\alpha}$

$T(\cos\alpha\, ctg\,\gamma + \sin\alpha) = mg$; $T = \frac{mg}{\cos\alpha\, ctg\,\gamma + \sin\alpha}$

6) ~~$a_{кл} = \frac{T(1-\cos\alpha)}{M}$~~ $= \frac{m}{M} \cdot \frac{g(1-\cos\alpha)}{\cos\alpha \cdot ctg\,\gamma + \sin\alpha} = \frac{8}{9} \frac{g(1-\frac{8}{17})}{\frac{8}{17}\cdot\frac{15}{17} + \frac{15}{17}} =$

$= \frac{8}{9} \cdot \frac{\frac{9}{17}}{\frac{8\cdot15+15\cdot17}{17\cdot17}} g = \frac{8}{9} \cdot \frac{9\cdot17}{(8+17)\cdot15} g = \frac{8\cdot17}{25\cdot5} g = \boxed{\frac{136}{125} g}$

Чистовик

7) $t = \sqrt{\frac{2H}{a_{кв} \sin\alpha}} = \sqrt{\frac{2H \cdot M(\cos\alpha \operatorname{ctg}\gamma + \sin\alpha)}{\sin\alpha \cdot mg(1-\cos\alpha)}} = \sqrt{\frac{2H}{\frac{136}{125}g \cdot \frac{15}{17}}} =$

$= \sqrt{\frac{2H \cdot 125 \cdot 17}{136 \cdot 15 g}} = \sqrt{\frac{H \cdot 25 \cdot 17}{68 \cdot 3g}} = \sqrt{\frac{425H}{204g}} = \frac{5}{4}\sqrt{\frac{17}{51}\frac{H}{g}} = \frac{5}{4}\sqrt{\frac{H}{3g}}$

Ответ: $\operatorname{tg}\gamma = \frac{17}{15}$, $a_{кв} = \frac{136}{125}g$, $\frac{m}{M} = \frac{8}{9}$, $t = \sqrt{\frac{425H}{204g}}$

Черновик 1

② ⓪ от T_0

$$c(T) = \frac{9}{5} R \frac{T}{T_0}$$

1) Q_1 – ? от T_0 до $\frac{3}{4} T_0$

~~$Q = \nu C \Delta t = \frac{3}{2}\nu R \Delta T$~~ $A = \nu R T_1 - \nu R T_2$

$$\Delta Q = \Delta U + \Delta A$$

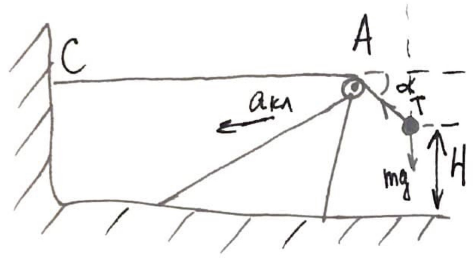
$$\nu C \Delta T = \frac{3}{2}\nu R \Delta T + \Delta(pV)$$

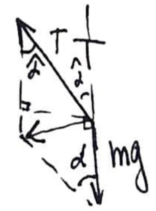
---

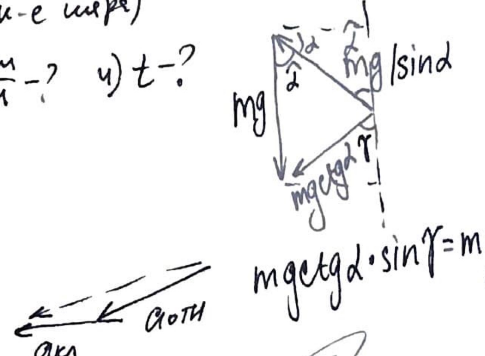
① $\cos\alpha = \frac{8}{17}$

1) $tg\,\gamma$ – ? (уск-е шара)

2) $a_{кл}$ – ? 3) $\frac{m}{M}$ – ? 4) t – ?





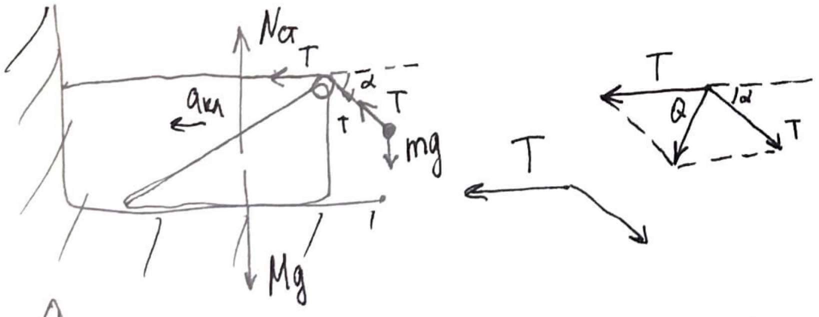


$$mg\,ctg\alpha \cdot \sin\gamma = mg\sin\alpha$$

$$m\,a_{отн} = T\cos\alpha = mg\,ctg\alpha$$

$$T\sin\alpha = mg$$

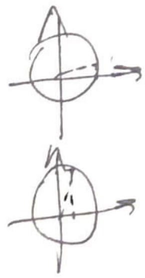
$$a_{отн} = g\,ctg\alpha$$

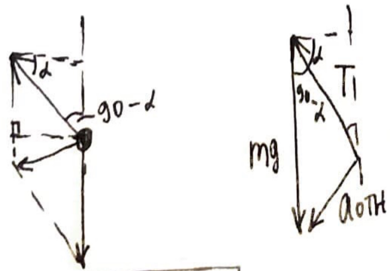


$$M a_{кл} = T(1-\cos\alpha)$$

$$T\sin\alpha = mg$$

$$a_{кл} = \frac{mg}{M\sin\alpha}(1-\cos\alpha)$$





$$m\,a_{отн} = \sqrt{(mg)^2 + \left(\frac{mg}{\sin\alpha}\right)^2 - 2mg\cdot\frac{mg}{\sin\alpha}\cos(90-\alpha)} =$$

$$= \sqrt{(mg)^2 + \left(\frac{mg}{\sin\alpha}\right)^2 - 2\frac{(mg)^2}{\sin\alpha}\cdot\sin\alpha} =$$

$$= \sqrt{(mg)^2 + \left(\frac{mg}{\sin\alpha}\right)^2 - 2(mg)^2} =$$

$$= \sqrt{\frac{(mg)^2}{\sin^2\alpha} - (mg)^2} = \sqrt{(mg)^2\left(\frac{1}{\sin^2\alpha} - 1\right)} =$$

$$= mg\sqrt{\frac{1-\sin^2\alpha}{\sin^2\alpha}} = mg\sqrt{\frac{\cos^2\alpha}{\sin^2\alpha}} = mg\,ctg\alpha$$

Часть 2

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

Шифр: **21203411**

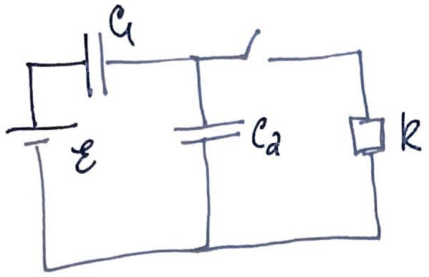
ID профиля: **306868**

Вариант 4

Вариант 11-04

Чистовик

③

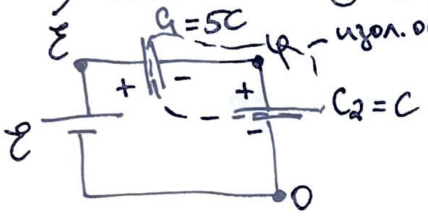


$C_2 = C$, $C_1 = 5C$, I_0

1) I_R – ? (сп К↓)
2) Q – ? (после К↓)
3) I_{R_2} – ? ($I_{C_2} = I_0$)

---

1) Рассм. схему до замык. К.: (Сразу подставим значения C_1 и C_2)



ЗСЗ: $0 = -C_1(\varepsilon - \varphi) + C_2\varphi$; $0 = -5C\varepsilon + 5C\varphi + C\varphi$

~~$0 = -5C\varepsilon + 5C\varphi + C\varphi$~~, ~~$6\varphi$~~ $\quad 6\varphi = 5\varepsilon$

$\varphi = \frac{5\varepsilon}{6}$

$U_1(0) = \varepsilon - \varphi = \frac{\varepsilon}{6}$; $q_1 = \frac{5C\varepsilon}{6}$

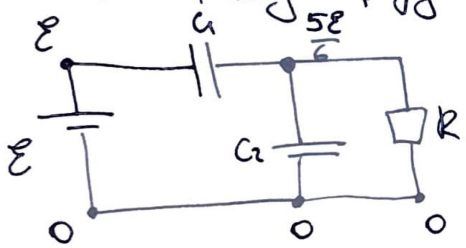
$U_2(0) = \varphi = \frac{5\varepsilon}{6}$ $\quad q_2 = \frac{5C\varepsilon}{6}$

Рассм. схему сразу после К↓: Напряжение на конденс-рах скачком не изменится

↓

$U_1 = \frac{\varepsilon}{6}$

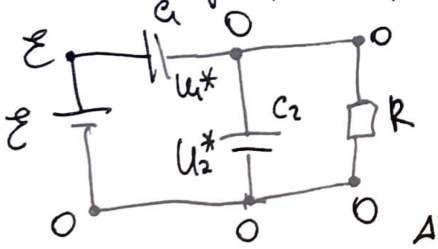
$U_2 = \frac{5\varepsilon}{6}$



метод узловых потенц.

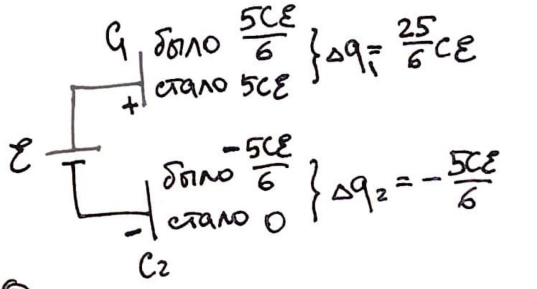
$\frac{5\varepsilon}{6} = I_R \cdot R$; $\boxed{I_R = \frac{5\varepsilon}{6R}}$

2) Рассм. уст. реж. при замкнутом К: $I_R = 0$



$U_2^* = 0 \to q_2^* = 0$

$U_1^* = \varepsilon \to q_1^* = 5C\varepsilon$



$\Delta q_1 = \frac{25}{6}C\varepsilon$

$\Delta q_2 = -\frac{5C\varepsilon}{6}$

$\Delta W_C = \frac{C_1}{2}(U_1^{*2} - U_1^2) = \frac{5C}{2}(\varepsilon^2 - \frac{\varepsilon^2}{36}) =$

$= \frac{5C}{2} \cdot \frac{35\varepsilon^2}{36} = \frac{175}{72}C\varepsilon^2$; $\Delta W_{C_2} = \frac{C_2}{2}(U_2^{*2} - U_2^2) = \frac{C}{2}(0 - \frac{25\varepsilon^2}{36}) = -\frac{25C\varepsilon^2}{72}$

$A_{ист} = \varepsilon(\Delta q_1 + \Delta q_2) = \frac{20}{6}C\varepsilon^2 = \frac{10}{3}C\varepsilon^2$

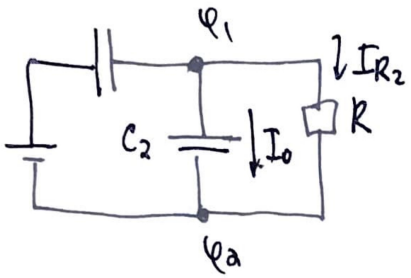
$\Delta W_C = \Delta W_{C_1} + \Delta W_{C_2} = \frac{175C\varepsilon^2}{72} - \frac{25C\varepsilon^2}{72} = \frac{150C\varepsilon^2}{72} = \frac{50}{24}C\varepsilon^2 = \frac{25}{12}C\varepsilon^2$

$A_{ист} = \Delta W_C + Q$; $Q = A_{ист} - \Delta W_C = \frac{10}{3}C\varepsilon^2 - \frac{25}{12}C\varepsilon^2 = \frac{40-25}{12}C\varepsilon^2 = \frac{15}{12}C\varepsilon^2 = \frac{5}{4}C\varepsilon^2$

Чистовик

Продолжение (3)

3)



$\varphi_1 - \varphi_2 = U_C = I_{R_2} \cdot R \rightarrow \frac{q_0}{C} = I_{2R} \cdot R$

$\frac{I_0 \Delta t}{C} = I_{2R} \cdot R$

От времени, когда ток в конд-ре I_0 до УР ток конд-ра меняется от I_0 до , а через резистор от I_{R_2} до 0.

Чистовик

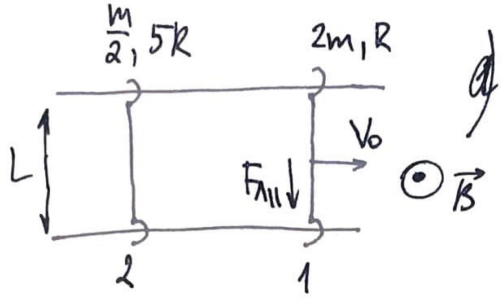
④ Дано:

L, m, R, V_0, B

а) a_{0t} - ?

б) v_1 - ? v_2 - ? (ур)

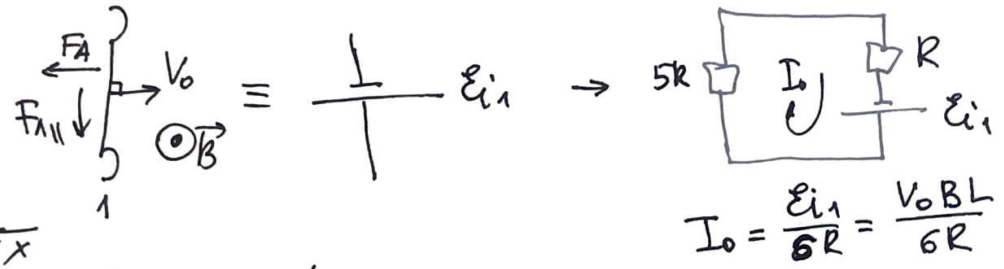
в) Δl - ?



а) Продольная. При движении перемычки появляется $\mathcal{E}_i$, обусловл. продол. составляющей силы Лоренца $F_{Л\parallel}$.

$\mathcal{E}_{i1}(0) = V_0 B L \cdot \sin 90° = V_0 BL$

$\mathcal{E}_{i2}(0) = 0$, т.к. $V_2(0) = 0$



$$I_0 = \frac{\mathcal{E}_{i1}}{6R} = \frac{V_0 BL}{6R}$$

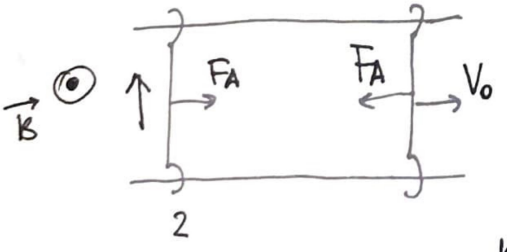
$\leftarrow x$

II ЗН для перемычки 1:

$$ma_{10} = F_A = IBl\sin 90° = IBL = \frac{V_0 B^2 L^2}{6R}$$

$$\boxed{a_{10} = \frac{V_0 B^2 L^2}{6mR}}$$

б) Через перемычку 2 потечет ток → на нее будет дейст. сила Ампера F_A



Пусть до установления скоростей перемычка 1 прошла расстояние l_1, перемычка 2 – l_2. Тогда работа сила Ампера будет равна: $A = F_A \cdot l_1 \cdot \cos 180 + F_A \cdot l_2 \cdot \cos 0° = F_A (\underbrace{l_2 - l_1}_{\Delta l}) = F_A \Delta l$

$$\frac{mV_0^2}{2} = \frac{mV_1^2}{2} + \frac{mV_2^2}{4} + F_A \Delta l \rightarrow$$ отсюда можно найти Δl

В уст. режиме: $\mathcal{E}_1 = BV_1 l$, $\mathcal{E}_2 = BV_2 l$

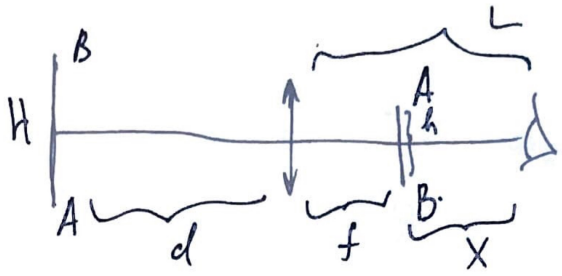
$F_A \neq \text{const}$ $F_A(V) = \frac{B^2 l^2}{6R} V$

Чистовик

(5) Дано:

$F = 24$ см
$H = 9$ см
$d = 96$ см
$X = 24$ см

1) L – ?
2) D_{min} – ?
3) y – ?



1) $\frac{1}{F} = \frac{1}{d} + \frac{1}{f}$; $f = \frac{Fd}{d-F} = \frac{24 \cdot 96}{96-24} = 32$ см

$L = f + X = \frac{Fd}{d-F} + X = \frac{24 \cdot 96}{96-24} + 24 = 32 + 24 = 56$ см

2) $\Gamma = \frac{f}{d} = \frac{32}{96} = \frac{1}{3} \to h = \Gamma H = \frac{H}{3} = 3$ см

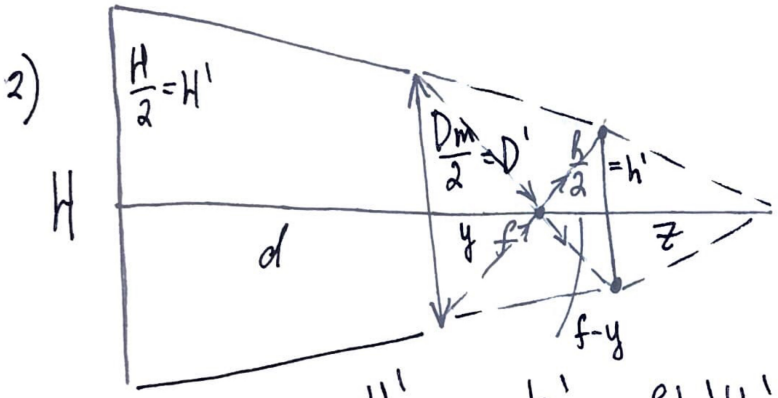


рис. 2

$\frac{h'}{z} = \frac{D'}{f+z}$

$fh' + zh' = D'z$

$z = \frac{fh'}{D'-h'}$

$\frac{H'}{z+f+d} = \frac{h'}{z}$; $\frac{fh'H'}{D'-h'} = h'(f+d) + \frac{fh'^2}{D'-h'}$

$h'(f+d) = \frac{fh'}{D'-h'}(H'-h')$; $D'-h' = \frac{f(H'-h')}{f+d}$; $D' = h' + \frac{f(H'-h')}{f+d}$

$D_m = 2D'$;

$D_m = h + \frac{2f(H'-h')}{f+d} = h + \frac{f \cdot (H-h)}{f+d} =$

$= 3 + \frac{32 \cdot 6}{32+96} = 3 + \frac{192}{128} = 3 + \frac{3}{2} = 4{,}5$ см

3) Из рис. 2 $\frac{y}{D_m} = \frac{f-y}{h}$; $hy = fD_m - D_m y$; $y = \frac{fD_m}{h+D_m} =$

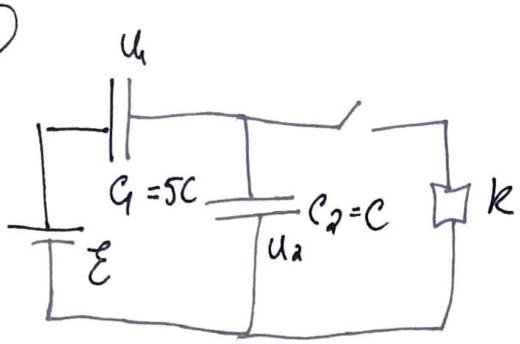
$= \frac{32 \cdot 4{,}5}{3+4{,}5} = \frac{32 \cdot 4{,}5}{7{,}5} = 19{,}2$ см

экран находится м-ду линзой и изображением на 19,2 см от линзы.

Ответ: 56 см; 4,5 см; 19,2 см.

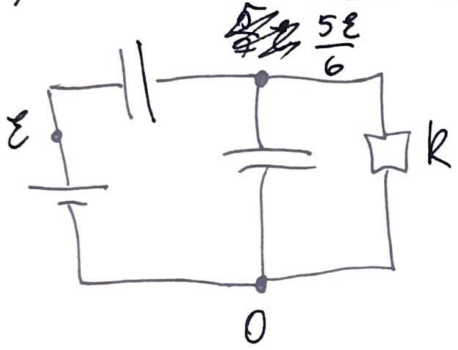
Черновик 1

(3)



1) I_R – ? (сл)

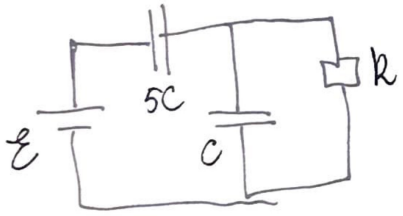
1) сл k ↓ $u_1 = \frac{5}{6}\mathcal{E}$ $u_2(0) = u_2 = \frac{5}{6}\mathcal{E}$



$I_R = \frac{5\mathcal{E}}{6R}$

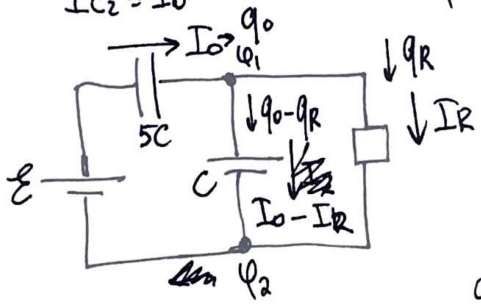
$I_C = C \cdot u'$

2) Q – ?



$A_{ист} = \Delta W_C + Q$

3) I_R – ? $I_{C_2} = I_0$



$q_0 = q_R + q_R \cdot CR \;|:\Delta t$

$I_0 = I_R + CR \cdot I_R$

$I_R = \frac{I_0}{1+CR}$

1) $\mathcal{E}$ k ↓ 

$0 = -5C(\mathcal{E}-\varphi) + C\varphi$

$5C\mathcal{E} = 6C\varphi$; $\varphi = \frac{5}{6}\mathcal{E}$

$q_1 = 5C \cdot \frac{2}{7}\mathcal{E} = \frac{10}{7}C\mathcal{E}$

$q_2 = C\varphi = \frac{5}{7}C\mathcal{E}$

$u_1 = \mathcal{E} - \varphi = \frac{2}{7}\mathcal{E}$

$u_2 = \varphi = \frac{5}{7}\mathcal{E}$

$u_1(0) = \frac{\mathcal{E}}{6}$ $u_2(0) = \frac{5\mathcal{E}}{6}$

$U_C = \frac{q_0}{C}$ $\frac{I_0 \Delta t}{C} = I_{R_2} \cdot R$

$U_C = \frac{q_0}{C}$

$q_0 = I\Delta t$

$\frac{I\Delta t}{C} = I_{R_2} R$

$\varphi_1 - \varphi_2 = U_C = I_R \cdot R$

$\frac{\Delta q}{C} = I_R \cdot R$

$\frac{\Delta I}{C} = R \cdot \Delta q_R$

$\int \frac{\Delta I}{C} = \int R \cdot \Delta q_R$

$\frac{I_0 - I_R}{C} = R \cdot q_R$

$I_2 = CR \cdot q_R$

$\frac{q_1}{q_2} = \text{Const}$

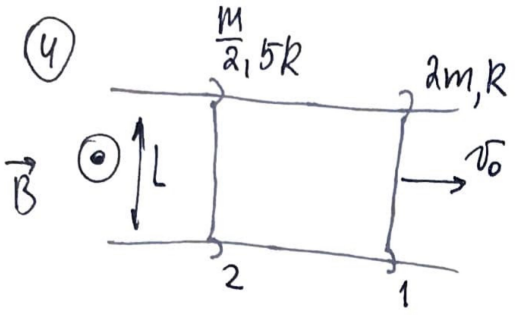
$q = It$

$\frac{5Cu^*}{2} - \frac{5Cu^*}{2} =$

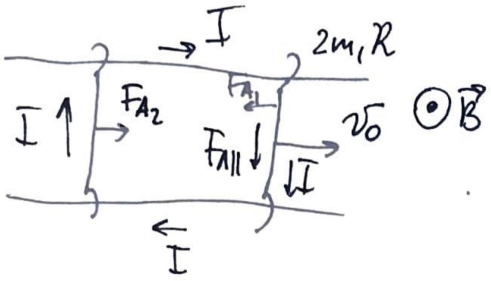
$\frac{5C \cdot \mathcal{E}^2}{2} - \frac{5C \cdot \mathcal{E}^2}{36 \cdot 2} = \frac{180-5}{72}C\mathcal{E}^2 = \frac{175}{72}C\mathcal{E}^2$

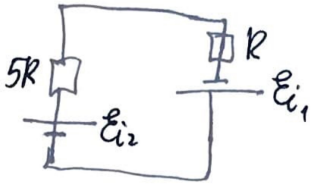
Человек 2

④



1) a_1 -? (в нач. мом)
2) $v_{1уст}$ -? $v_{2уст}$ -?
3) Δl -?





~~$\varepsilon_i = Bv_0 l$~~

$\varepsilon_{i1}(0) = Bv_0 L$

$\varepsilon_{i2}(0) = 0$ $(v=0)$

$2ma = IBl\sin 90° = IBl = \frac{B^2L^2v_0}{6R}$

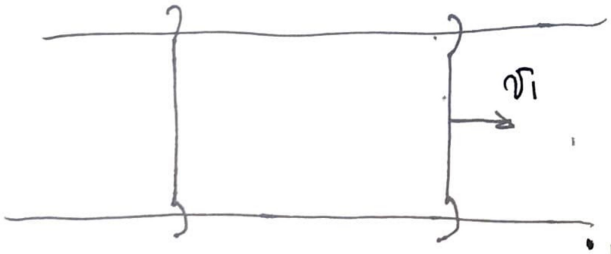
$I = \frac{\varepsilon_{i1}}{R+5R} = \frac{Bv_0L}{6R}$

$$a = \frac{B^2L^2v_0}{12mR}$$

$U_c = \frac{q}{C} = \frac{I\Delta t}{C} = IR$

2) Через продолжительный промежуток времени $a_1 = a_2 = 0$

~~$\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + \frac{mv_2^2}{2} + A_{F_{A1}} + A_{F_{A2}}$~~



~~$mv_0 = mv_1 + mv_2$~~

~~$\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + \frac{mv_2^2}{2}$~~

$v_0 = v_1 + v_2$ $v_0 - v_1 = v_2$

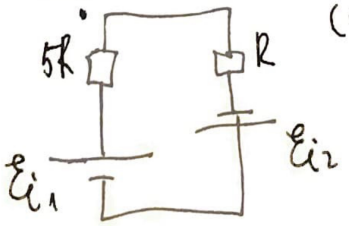
$v_0^2 - v_1^2 = v_2^2$

$(v_0 - v_1)(v_0 + v_1) = v_2^2$

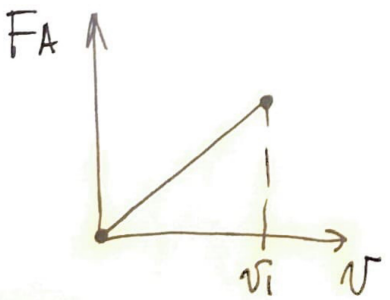
$v_0 + v_1 = v_2$

$v_0 - v_1 = v_2$

$v_0 = v_2$



$a = const$

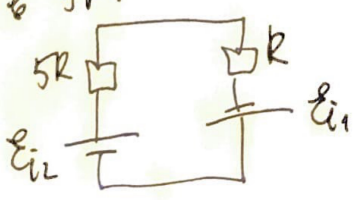


$F_A = \frac{B^2l^2v_0}{6R}$

$\varepsilon_{i1} = Bv_1L$

$\varepsilon_{i2} = Bv_2L$

в ур:



$I =$

Чертовик 3

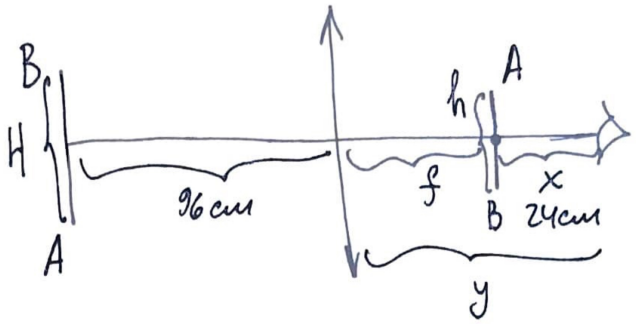
(5)

$F = 24$ см

$H = 9$ см

$d = 96$ см

$x = 24$ см



1) y -? (Г)
2) D_{min} -?
3) где поместить экран -?

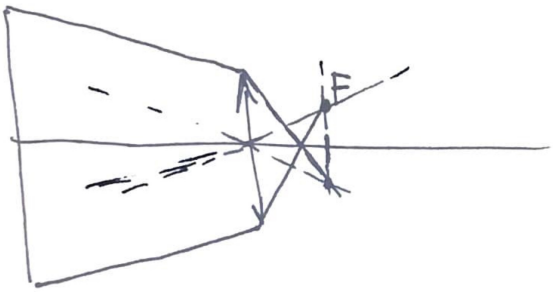
1) $F = 24$ см

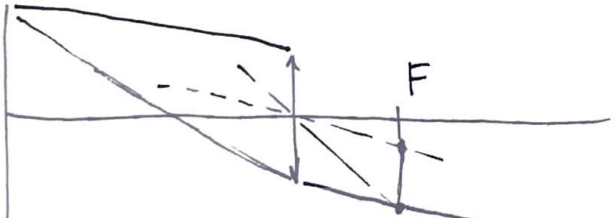
$\frac{1}{F} = \frac{1}{d} + \frac{1}{f}$; $f = \frac{Fd}{d-F}$

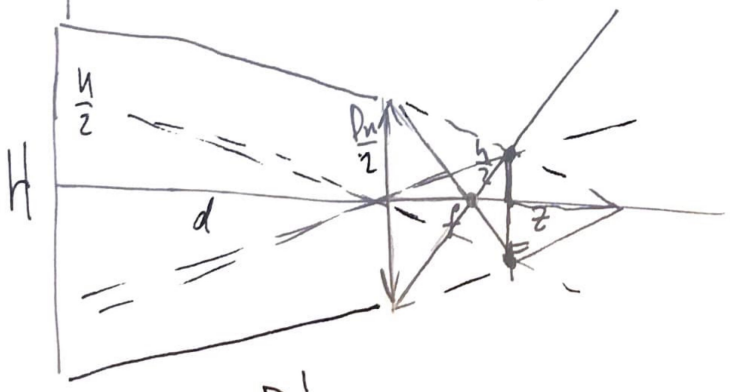
$y = f + x = \frac{Fd}{d-F} + x = \frac{24 \cdot 96}{72} + x = 32 + 24 = 56$ см

$\Gamma = \frac{f}{d} = \frac{32}{96} = \frac{1}{3}$; $h = 3$ см

2)







$\frac{D'}{f+z} =$

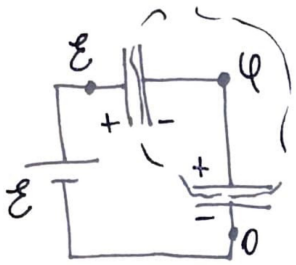
$\frac{z}{\frac{h}{2}} = \frac{z+f}{\frac{D'}{2}}$

$\frac{h'}{z} = \frac{D'}{z+f}$

$h'f + h'z = D'z$

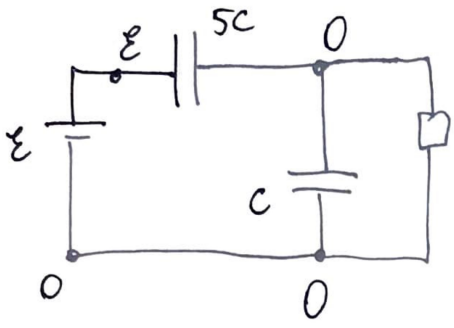
$z = \frac{h'f}{D'-h'}$

Человек 4



ЗСЗ: $0 = -(\mathcal{E}-\varphi)5C + \varphi C$; $5\mathcal{E} = 6\varphi$; $\varphi = \frac{5}{6}\mathcal{E}$

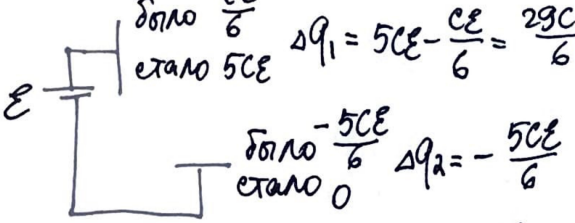
$U_1 = \mathcal{E} - \varphi = \frac{\mathcal{E}}{6}$ $U_2 = \frac{5\mathcal{E}}{6}$ $q_1 = \frac{5C\mathcal{E}}{6}$ $q_2 = \frac{5C\mathcal{E}}{6}$



В ур: ток в цепи $I=0$

$U_2^* = 0$

$U_1^* = \mathcal{E} \to q_1^* = 5C\mathcal{E}$ $q_2^* = 0$



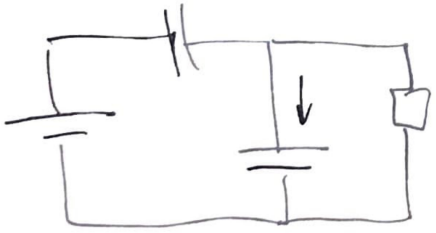
$A_{ист} = \frac{29C\mathcal{E}^2}{6} - \frac{5C\mathcal{E}^2}{6} = \frac{24C\mathcal{E}^2}{6} = 4C\mathcal{E}^2$

$\Delta W_{1C} = \frac{CU_1^{*2}}{2} - \frac{CU_1^2}{2} = \frac{C\mathcal{E}^2}{2} - \frac{C\mathcal{E}^2}{2\cdot 36} = \frac{35C\mathcal{E}^2}{2\cdot 36}$

$\Delta W_{C_2} = \frac{CU_2^{*2}}{2} - \frac{CU_2^2}{2} = 0 - \frac{25C\mathcal{E}^2}{2\cdot 36} = -\frac{25C\mathcal{E}^2}{2\cdot 36}$

$\Delta W_C = \frac{35C\mathcal{E}^2}{2\cdot 36} - \frac{25C\mathcal{E}^2}{2\cdot 36} = \frac{10}{2\cdot 36}C\mathcal{E}^2 = \frac{5}{36}C\mathcal{E}^2$

$Q = A_{ист} - \Delta W_C = 4C\mathcal{E}^2 - \frac{5}{36}C\mathcal{E}^2 = \frac{139}{36}C\mathcal{E}^2$



$\frac{I_0}{I_2} = \text{Const}$