Часть 1

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

Шифр: **21201179**

ID профиля: **803070**

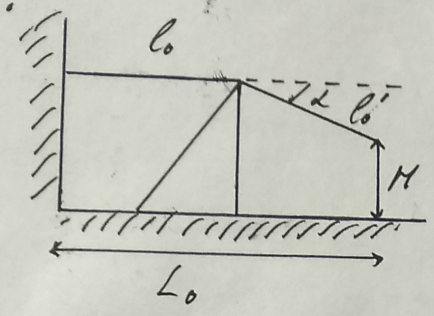
Вариант 1

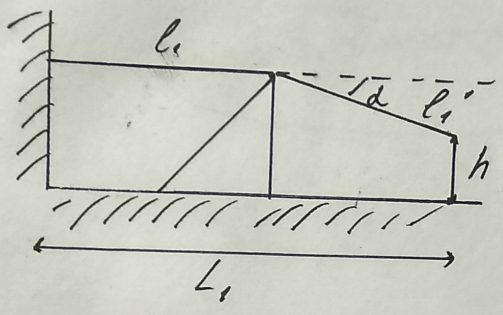
Чистовик.

(1)

№1.

Дано: $\cos\alpha = \frac{2}{5}$; H





1) $l_1 = l_0 - \Delta l$

$l_1' = l_0' + \Delta l$

$L_0 = L_1 + \Delta L$

$L_0 = l_0 + l_0' \cos\alpha$

$L_1 = l_1 + l_1' \cos\alpha = l_0 - \Delta l + l_0' \cos\alpha + \Delta l \cos\alpha =$

$= L_0 + \Delta l(\cos\alpha - 1) = L_0 - \frac{2}{5}\Delta l = L_0 - \Delta L =$

$\Rightarrow \Delta L = \frac{2}{5}\Delta l$ (перемещение влево)

2) $h = H - \Delta h =$

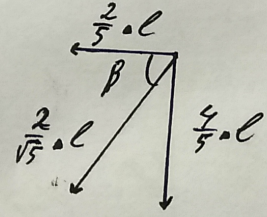
$\Rightarrow \Delta h = l_1' \sin\alpha - l_0' \sin\alpha = \sin\alpha(l_1' - l_0') = \Delta l \sin\alpha \;|=$

$= \Delta h = \Delta l \sin\alpha$

$\sin\alpha = \sqrt{1 - \cos^2\alpha} = \sqrt{1 - \frac{4}{25}} = \frac{4}{5} = \sin\alpha \;|= \Delta h = \frac{4}{5}\Delta l$

(перемещение вниз)

3)

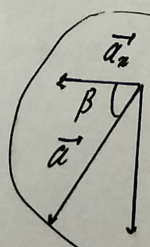


$\sqrt{\left(\frac{2}{5}\right)^2 + \left(\frac{4}{5}\right)^2} = \sqrt{\frac{20}{25}} = \frac{2\sqrt{5}}{5} = \frac{2}{\sqrt{5}}$

$\cos\beta = \frac{2}{5} \cdot \frac{\sqrt{5}}{2} = \frac{\sqrt{5}}{5} = \cos\beta$

$\sin\beta = \frac{4}{5} \cdot \frac{\sqrt{5}}{2} = \frac{2\sqrt{5}}{5} = \sin\beta \;|=$

$\Rightarrow$



$\cos\beta = \frac{\sqrt{5}}{5}$

$\sin\beta = \frac{2\sqrt{5}}{5}$

4)

$\begin{cases} a_n m \cos\beta = T\cos\alpha \\ a_n m \sin\beta = mg - T\sin\alpha \\ a_n \text{ - модуль ускор. шара} \end{cases} \Leftrightarrow \begin{cases} a_n m \frac{\sqrt{5}}{5} = \frac{2}{5}T \\ a_n m \frac{2\sqrt{5}}{5} = mg - \frac{4}{5}T \end{cases} \Leftrightarrow$

$\Leftrightarrow \begin{cases} T = \frac{mg}{2} \\ a_n = \frac{3g}{2\sqrt{5}} \end{cases}$

(2)

5/ $\ell \cdot \frac{2}{5}$ - перемещ. вверх (шара) / перемещ. вверх (клина) $\Big| \Rightarrow a_{кл} = \frac{5}{2} a_{шх}$

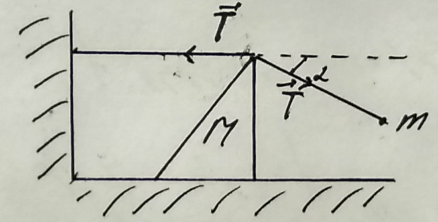
$a_{шх} = a_ш \cdot \cos\beta = \frac{3g}{2\sqrt{5}} \cdot \frac{\sqrt{5}}{5} = \frac{3g}{10} = a_{шх} \Big| \Rightarrow$

$\Rightarrow a_{кл} = \frac{5}{2} \cdot \frac{3}{10} g = \frac{15}{20} g = \frac{3}{4} g = 0{,}75g = a_{кл}$

(ускорение клина)

6/ $Ma_{кл} = T - T\cos 2 = T(1 - \cos 2) = \frac{2}{5} T = \frac{2}{5} \cdot \frac{mg}{2} = \frac{mg}{5} \Rightarrow$

$\Rightarrow \begin{cases} Ma_{кл} = \frac{mg}{5} \\ a_{кл} = \frac{3}{4} g \end{cases} \Rightarrow \frac{3}{4} M = \frac{m}{5} \Rightarrow \frac{m}{M} = \frac{15}{4} = 3{,}75$



7/ $a_{шy} = a_ш \cdot \sin\beta$

$a_ш = \frac{3g}{2\sqrt{5}}$; $\sin\beta = \frac{2\sqrt{5}}{5} \Big| \Rightarrow a_{шy} = \frac{3g}{2\sqrt{5}} \cdot \frac{2\sqrt{5}}{5} = \frac{3g}{5} = a_{шy}$

8/ $H = \frac{a_{шy} t^2}{2} \Rightarrow t = \sqrt{\frac{2H}{a_{шy}}} = \sqrt{\frac{2H}{3g} \cdot 5} = \sqrt{\frac{10H}{3g}} = t$

Ответ: 1/ $\cos\beta = \frac{\sqrt{5}}{5}$

2/ $a_{кл} = 0{,}75g$

3/ $\frac{m}{M} = 3{,}75$

4/ $t = \sqrt{\frac{10H}{3g}}$

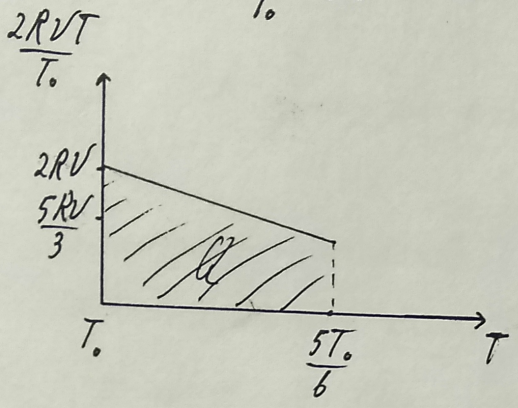
Чистовик

N 2. Дано: ν; T_0; $T\downarrow$

Решение: 1) $dQ = C(T)\,\nu\,dT = 2R\frac{T}{T_0}\nu dT$

$$dQ = \frac{2RT\nu}{T_0}dT$$

2)



$$Q = \frac{\left(2R\nu + \frac{5R\nu}{3}\right)}{2}\cdot\frac{T_0}{6} = \frac{11R\nu}{6}\cdot\frac{T_0}{6} = \frac{11R\nu T_0}{36}$$

$$Q = \frac{11R\nu T_0}{36}$$

3) $dQ = dU + dA'$

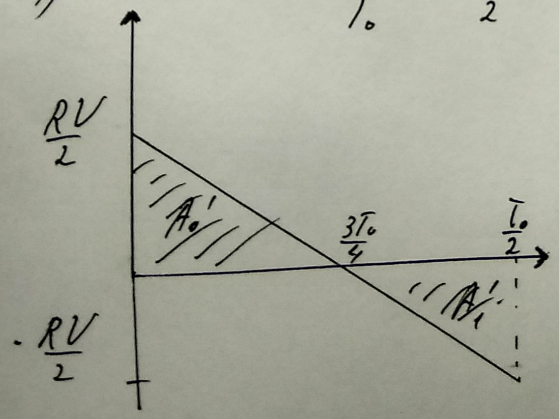
A' - работа газа

$dU = \frac{3}{2}R\nu dT$

$dQ = 2R\frac{T}{T_0}\cdot\nu dT$

$$\Rightarrow dA' = \frac{2RT\nu}{T_0}dT - \frac{3}{2}R\nu dT = R\nu dT\left(\frac{2T}{T_0} - \frac{3}{2}\right) = dA'$$

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



$$\frac{2R\nu T}{T_0} - \frac{3R\nu}{2} = -\frac{R\nu}{2}$$

$$\frac{2T}{T_0} = \frac{3}{2} - \frac{1}{2} = 1 \Rightarrow T = \frac{T_0}{2}$$

$A_0' = -A_1' \Rightarrow A' = 0$

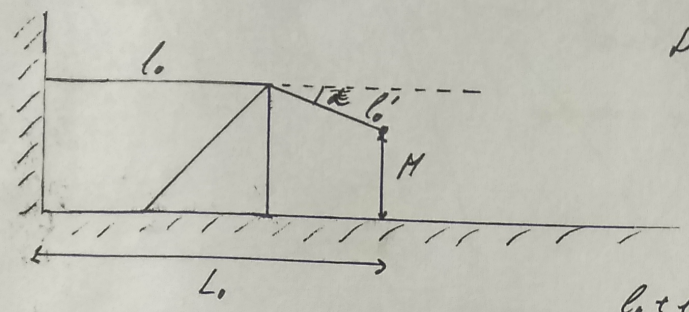
Ответ: 1) $Q = \frac{11R\nu T_0}{36}$

2) $T = \frac{T_0}{2}$

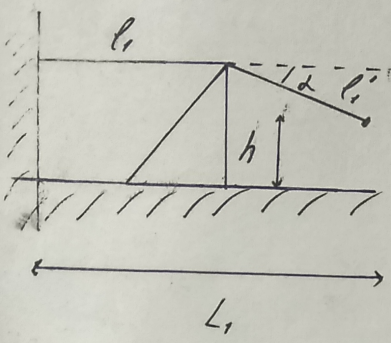
3) $A' = 0$

Черновик.

№1.



Дано: H; $\cos\alpha = \frac{3}{5}$



$l_0 + l_0' = l_1 + l_1'$

$l_0 = l_0 - \Delta l$

$l_1' = l_0' + \Delta l$

1) $L_0 = l_0 + l_0'\cos\alpha$

$L_1 = l_1 + l_1'\cos\alpha = l_0 - \Delta l + (l_0' + \Delta l)\cos\alpha =$

$= l_0 - \Delta l + l_0'\cos\alpha + \Delta l\cos\alpha = l_0 + l_0'\cos\alpha - \Delta l(1-\cos\alpha) =$

$= L_0 - \Delta l(1-\cos\alpha) = L_1$

$-\Delta l(1-\cos\alpha) = -\Delta l \cdot \frac{2}{5}$ - перемещение влево

(ось x направлена вправо)

2) $h = H - \Delta h$

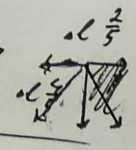
$a_m m = \frac{3}{5}\cdot\frac{mg}{2}\cdot\frac{5}{\sqrt{5}} \Delta h = \frac{l_1'\cos\alpha}{\sin\alpha} - \frac{l_0'\cos\alpha}{\sin\alpha} = \sin\alpha(l_1' - l_0') = \sin\alpha\cdot\Delta l$

$= \frac{3mg}{2\sqrt{5}}$

$\sin\alpha = \sqrt{1 - \frac{9}{25}} = \frac{4}{5}$ $\Rightarrow$

$\Rightarrow \Delta h = \frac{4}{5}\Delta l$ - перемещение вниз

3) $\Rightarrow$



$\cos\beta = \frac{\sqrt{5}}{5}$

$\sin\beta = \sqrt{1 - \frac{5}{25}} = \frac{2\sqrt{5}}{5}$

$\cos\beta = \frac{\sqrt{5}}{5}$

$\sin\beta = \sqrt{1 - \frac{5}{25}} = \sqrt{\frac{20}{25}} = \frac{2\sqrt{5}}{5}$

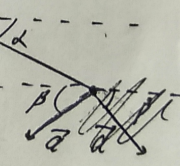
$\sin\beta = \frac{4}{5}\cdot\frac{5}{2\sqrt{5}} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$

$\sqrt{\left(\frac{2}{5}\right)^2 + \left(\frac{4}{5}\right)^2} = \sqrt{\frac{4+16}{25}} = \sqrt{\frac{20}{25}} = \frac{2\sqrt{5}}{5}$

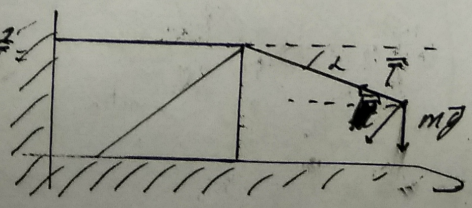
$\cos\beta < \cos\alpha \Rightarrow \beta > \alpha$

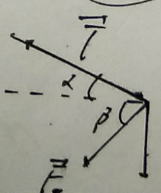
$\sin\beta = \frac{4}{5}\cdot\frac{5}{2\sqrt{5}} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$

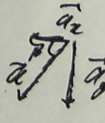
$\cos\beta = \frac{2}{5}\cdot\frac{5}{2\sqrt{5}} = \frac{\sqrt{5}}{5}$ $\Rightarrow$



$\angle\beta = 2$







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

$\begin{cases} x: \frac{\sqrt{5}}{5}am = T\cos\alpha \\ y: \frac{4}{5}am = mg - T\sin\alpha \end{cases} \Leftrightarrow$

$\begin{cases} ma\frac{\sqrt{5}}{5} = \frac{3}{5}T \\ ma\cdot\frac{2\sqrt{5}}{5} = mg - \frac{4}{5}T \end{cases} \Leftrightarrow \begin{cases} \frac{2}{5}ma = T\cdot\frac{3}{5} \\ \frac{4}{5}ma = mg - T\cdot\frac{4}{5} \end{cases} \Leftrightarrow \begin{cases} \frac{4}{5}ma = \frac{6}{5}T \\ \frac{6}{5}T = mg - \frac{4}{5}T \end{cases} \Leftrightarrow \begin{cases} T = \frac{mg}{2} \\ ma = \frac{6}{5}\cdot\frac{mg}{2}\cdot\frac{5}{4} = mg\cdot\frac{6}{8} \end{cases}$

$\Leftrightarrow \frac{2\sqrt{5}}{5}mg = \frac{6}{5}T$

$\frac{6}{5}T = mg - \frac{4}{5}T$

$T = \frac{mg}{2}$

$ma\frac{\sqrt{5}}{5} = \frac{3}{5}\cdot\frac{mg}{2}$

$\begin{cases} a = \frac{3}{4}g \text{ (модуль ускорения шара)} \\ T = \frac{mg}{2} \text{ (сила натяжения нити)} \end{cases}$

$a = \frac{3}{4}g$

$a\frac{\sqrt{5}}{5} = \frac{3}{10}g$

$a = \frac{3}{2\sqrt{5}}g$ ускор шара

$a = \frac{3}{10}\cdot\sqrt{5}g = \frac{3}{2\sqrt{5}}g$

4/ Черновик

$l \cdot \frac{2}{5}$ - перемещение шара вниз

l - перемещение клина вниз

$a = \frac{3}{4}g$ - модуль ускорение шара

$a_{кл} = \frac{2}{5} a_{ш} = \frac{2}{5} \cdot \frac{3}{4} g =$

$= \frac{6}{20} g$

$\frac{2}{5} a_{кл} = a_ш \Rightarrow a_{кл} = \frac{5}{2} a_ш = \frac{5}{2} \cdot \frac{3}{4} g =$

(вдоль оси Ox)

$= \frac{15}{8} g$

$a_{кл} = \frac{15}{8} g$ - модуль ускорения клина

$l \cdot \frac{2}{5}$ - перемещ шара вниз

l - перемещ клина вниз

$a_{кл} = a \cdot \cos\beta = \frac{3}{4} g \cdot \frac{\sqrt{5}}{5} = \frac{3\sqrt{5}}{20} g$ - модуль ускор шара вдоль Ox

$2\sqrt{5}\,g$

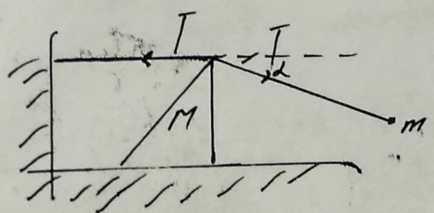
$\frac{3}{2\sqrt{5}} g \cdot \frac{\sqrt{5}}{5} = \frac{3}{10} = 0{,}3g$

$a_{кл} = \frac{5}{2} \cdot \frac{3\sqrt{5}}{20} g = \frac{3\sqrt{5}}{2 \cdot 4} = \frac{3\sqrt{5}}{8} g$

$a_{кл} = \frac{3\sqrt{5}}{8} g$ - модуль ускор клина

$a_{кл} = \frac{5}{2} \cdot \frac{3}{10} g = \frac{15}{20} g = \frac{3}{4} g = 0{,}75g$ клина

5/



$Ma_{кл} = T - T\cos 2\alpha = T(1 - \cos 2\alpha) = \frac{2}{5} T$

$Ma_{кл} = \frac{2}{5} T = \frac{2}{5} \cdot \frac{mg}{2} = \frac{mg}{5}$

$\begin{cases} Ma_{кл} = \frac{mg}{5} \\ ma_{кл} = T\cos 2\alpha = \frac{mg}{2} \cdot \frac{3}{5} = \frac{3mg}{10} \\ ma_{кл} \cdot \cos\beta = \frac{3mg}{10} \end{cases} \Rightarrow$

$a_{кл} = \frac{3}{4} g$

$M \cdot \frac{3}{4} g = \frac{mg}{5}$

$\frac{M}{m} = \frac{4}{15}$

$\frac{m}{M} = \frac{15}{4} = 3{,}75$

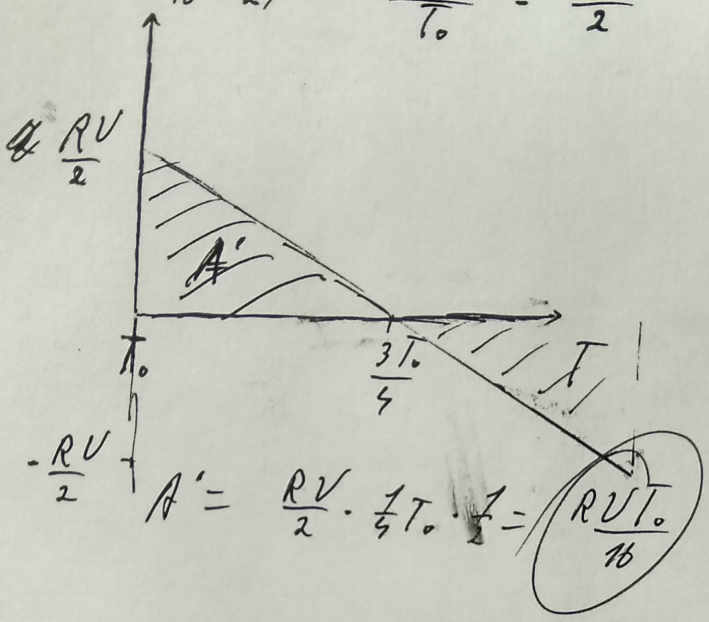
$dA' = RV dT \left(2\frac{T}{T_0} - \frac{3}{2} \right)$ - работа газа Черновик.

$RV\left(2\frac{T}{T_0} - \frac{3}{2}\right) = \frac{2RVT}{T_0} - \frac{3RV}{2}$

$2RV - \frac{3}{2}RV = \frac{RV}{2}$

$\frac{2RVT}{T_0} = \frac{3RV}{2} \Rightarrow$

$\Rightarrow \frac{2T}{T_0} = \frac{3}{2} \Rightarrow T = \frac{3T_0}{4}$



$A' = \frac{RV}{2} \cdot \frac{1}{4}T_0 \cdot \frac{1}{2} = \frac{RVT_0}{16}$

$\frac{2RVT}{T_0} - \frac{3RV}{2} = -\frac{RV}{2} \Rightarrow \frac{2T}{T_0} - \frac{3}{2} = -\frac{1}{2}$

$\frac{2T}{T_0} = 1$

$T = \frac{T_0}{2}$

Часть 2

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

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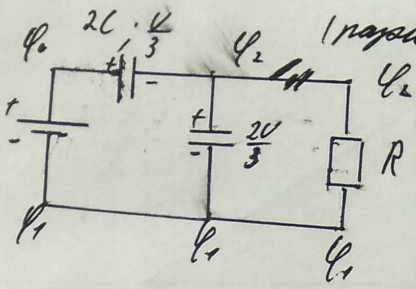
ID профиля: **803070**

Вариант 1

№3. Чистовик. (1)



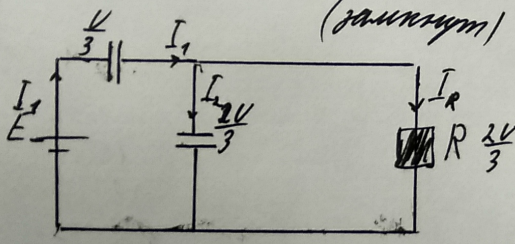
(параллельно)

1/ $\begin{cases} \varphi_0 - \varphi_2 = \frac{Q}{2C} \\ \varphi_2 - \varphi_1 = \frac{Q}{C} \\ \varphi_0 - \varphi_1 = E \end{cases} \Rightarrow$

$\varphi_0 - \varphi_1 = \frac{Q}{C} + \frac{Q}{2C} = \frac{3Q}{2C} = V$ $\Rightarrow$

$\Rightarrow \begin{cases} \frac{Q}{2C} = \varphi_0 - \varphi_2 = \frac{V}{3} \\ \frac{Q}{C} = \varphi_2 - \varphi_1 = \frac{2V}{3} \end{cases}$

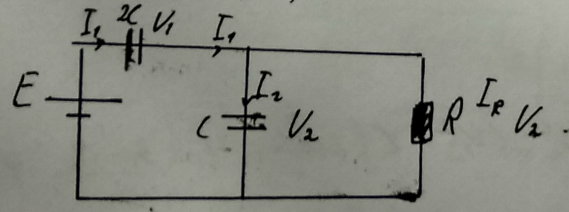
2/



(параллельно)

$\Rightarrow$ $I_R = \frac{2V}{3R}$

3/ $I_1 = I_2 + I_R$; $V_1 + V_2 = V$



$\frac{dQ}{dt} = I = \frac{C dV}{dt} = CV' \Rightarrow$ $I_1 = 2CV_1'$, $I_2 = CV_2'$, $I_R = \frac{V_2}{R}$ $\Rightarrow$

$\Rightarrow I_R = C(2V_1' - V_2')$

$dV_1 = V_{12} - V_{11}$

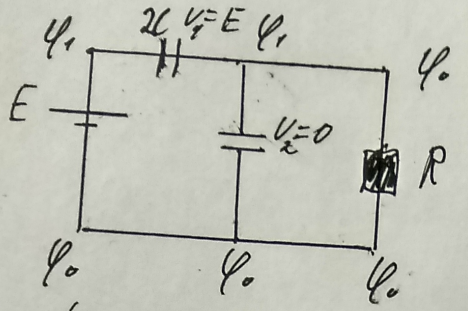
$dV_2 = V_{22} - V_{21}$

$V = V_{12} + V_{22} = V_{11} + V_{21} \Rightarrow V_{22} - V_{21} = V_{11} - V_{12} \Rightarrow dV_2 = -dV_1$ $\Rightarrow$

$\Rightarrow I_R = \frac{C(2dV_1 - dV_2)}{dt} = -\frac{3C dV_2}{dt} = I_R$

4/ $dQ = I_R V_2 dt = -3C dV_2 \cdot V$

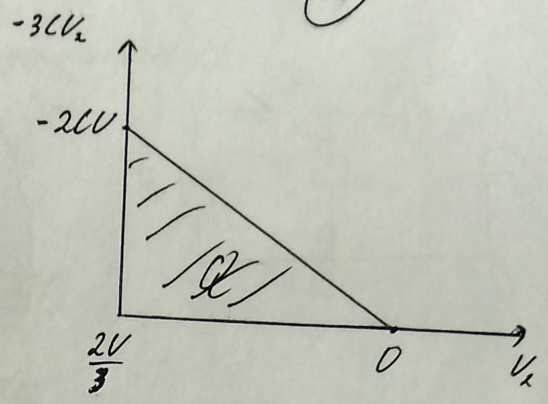
5) $dQ = -3C V_2 dV_2$



(конечное состояние)

Чистовик

(2)

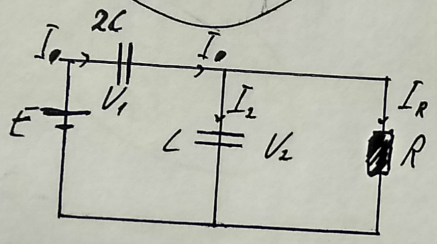


$$Q = \frac{-2CV \cdot \left(0 - \frac{2V}{3}\right)}{2} = \frac{2CV^2}{3} \Big| \Rightarrow$$

$V = E$

$$\Rightarrow \boxed{Q = \frac{2CE^2}{3}}$$

6)



$I_0 = 2CV_1'$

$I_2 = CV_2'$

$$I_R = I_0 - I_2 = 2CV_1' - CV_2' = C(2V_1' - V_2') = \frac{3C dV_1'}{dt} \Big| \Rightarrow$$

$$\Rightarrow I_R = \frac{3}{2} \cdot \frac{2C dV_1}{dt} = \frac{3}{2} I_0$$

$$\boxed{I_R = \frac{3}{2} I_0}$$

Ответ: 1) $I_R = \frac{2E}{3R}$

2) $Q = \frac{2CE^2}{3}$

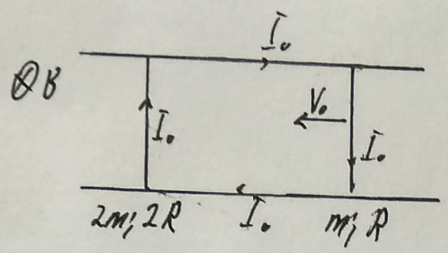
3) $I_R = \frac{3}{2} I_0$

№4. Дано: $B; L; m_1 = m; m_2 = 2m$
$V_1 = V_0; R_1 = R; R_2 = 2R$

Чистяков

(3)

Решение:



1) $\mathcal{E}_0 = V_0 B L$
$I_0 = \frac{\mathcal{E}_0}{3R}$ $\Big| \Rightarrow I_0 = \frac{V_0 B L}{3R}$

2) $2ma = I_0 B L = \frac{V_0 B^2 L^2}{3R} \Rightarrow$

$\Rightarrow a = \frac{V_0 B^2 L^2}{6mR}$

3) $\mathcal{E} = V_1 B L - V_2 B L = BL(V_1 - V_2)$
$F_A = I L B$
$I = \frac{\mathcal{E}}{3R}$ $\Big| \Rightarrow F_A = \frac{B^2 L^2 (V_1 - V_2)}{3R} = \frac{B^2 L^2 V_{отн}}{3R}$

4) Можно сказать, что они будут взаимодействовать с равными силами (из-за тока одинакова) $\Rightarrow$ применим закон сохранения импульса:

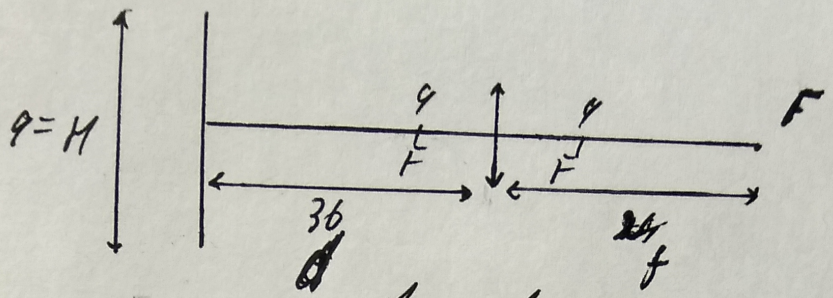
$mV_0 = 3mV_1 \Rightarrow V_1 = \frac{V_0}{3}$

(когда $V_{отн} = 0$, т.к. обе будут иметь скорости $\frac{V_0}{3}$, то $F_A = 0$ и скорости изменяться уже не будут)

Чистовик.

(4)

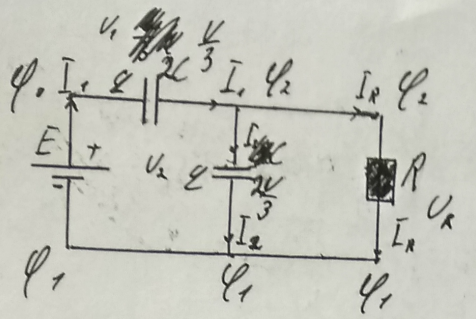
N5.

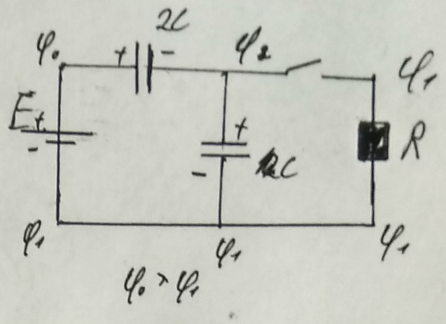


$$\frac{1}{F} = \frac{1}{d} + \frac{1}{f}$$

Черновик.

N3.





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

1) $\begin{cases} \varphi_0 - \varphi_2 = \frac{q}{2C} \\ \varphi_2 - \varphi_1 = \frac{q}{C} = U \Rightarrow \\ \varphi_0 - \varphi_1 = U \end{cases}$

$\varphi_0 - \varphi_1 = \frac{q}{C} + \frac{q}{2C} = U =$

$= \frac{2q+q}{2C} = \frac{3q}{2C} = U \Rightarrow$

$\Rightarrow \frac{q}{C} = \frac{2}{3}U \Big| \Rightarrow$

$\frac{q}{2C} = \frac{U}{3}$

$\Rightarrow \begin{cases} \varphi_0 - \varphi_2 = \frac{U}{3} \\ \varphi_2 - \varphi_1 = \frac{2U}{3} \end{cases}$

2) $\varphi_0 > \varphi_2 > \varphi_1$

$U = \frac{2}{3}U + U_R \Rightarrow U_R + \frac{U}{3} \Rightarrow U = \frac{U}{3} + U_R \Rightarrow$

$\Rightarrow U_R = \frac{2}{3}U \Rightarrow$

$I_R = \frac{U_R}{R} = \frac{U}{3R}$

$\Rightarrow \boxed{I_R = \frac{2U}{3R}} \Rightarrow$

3) $W_0 = \frac{qU}{2} + \frac{qU}{2} = \frac{CU^2}{2} + \frac{CU^2}{2} \Rightarrow$

$\Rightarrow W_0 = \frac{C}{2}\cdot\left(\frac{2}{3}U\right)^2 + \frac{2C}{2}\left(\frac{U}{3}\right)^2 =$

$= C\left(\frac{4U^2}{18} + \frac{U^2}{9}\right) = C\left(\frac{2U^2+U^2}{9}\right) =$

$= \frac{CU^2}{3} = W_0$

$W_0 = \frac{CU^2}{3}$

$W_t =$

$\frac{C}{2}\left(\frac{2U}{3}\right)^2 + \frac{2C}{2}\left(\frac{U}{3}\right)^2 = \frac{C}{2}\cdot\frac{4U^2}{9} + C\frac{U^2}{9} =$

$= \frac{2CU^2+CU^2}{9} = \frac{3CU^2}{9} = \frac{CU^2}{3}$

$\frac{dq}{dt} = \frac{C\,dU}{dt} = CU' = I$

$\frac{dq}{dU} = C \Rightarrow dq = C\,dU$

$q = \frac{U_2^2\,dt}{R}$

$CU_2' = I_2$

$q = I_R^2 R\,dt$

$dq = I_R U_2\,dt =$

$= C(2U_1' - U_2')U_2\,dt =$

$= C\frac{(2dU_1 - dU_2)}{dt}U_2\,dt =$

$= C(2dU_1 - dU_2)U_2$

$I_1 = I_2 + I_R \qquad 2CU_1' = CU_2' + I_R$

$I_2 = CU_2' \qquad I_R = C(2U_1' - U_2')$

$I_2 = CU_2' \qquad I_R = U -$

$I_R = \frac{U_2}{R} \qquad q = \frac{U_2^2}{R}dt \qquad dq = -3C\,dU_2 U_2$

$U_2 + U_1 = U \Rightarrow$

$\Rightarrow U_2 = U - U_1 =$

$\Rightarrow dU_2 = d(U - U_1) =$

$= U_{12} - U_{11} = dU_1$

$U_{22} - U_{21} = dU_2$

$U_{12} = U - U_{22} \Big| \Rightarrow U_{12} - U_{11} =$

$\frac{I_2}{I_R} = \frac{CU_2'}{U_2}R = \frac{CR\,dU}{U_2\,dt} = \frac{I_2}{I_R}$

$\Rightarrow dU_1 = -dU_2 \Rightarrow dq = C(-2dU_2 - dU_2)U_2 =$

$= -C2dU_2 U_2$

$U - U_{22} - U + U_{21} = U_{21} - U_{12} = -dU_2 = dU_1 \Rightarrow$

Чернобыл

2) $\frac{dQ}{dt} = I = \frac{dV \cdot C}{dt} = CV'$

$I_1 = 2CV_1'$

$I_2 = CV_2'$

$I_R = I_1 - I_2$ $\Rightarrow I_R = C(2V_1' - V_2')$

$dV_1 = V_{12} - V_{11}$

$dV_2 = V_{22} - V_{21}$ $\Rightarrow$

$V = V_1 + V_2 =$

$\Rightarrow V = V_{11} + V_{21} = V_{12} + V_{22} \Rightarrow$

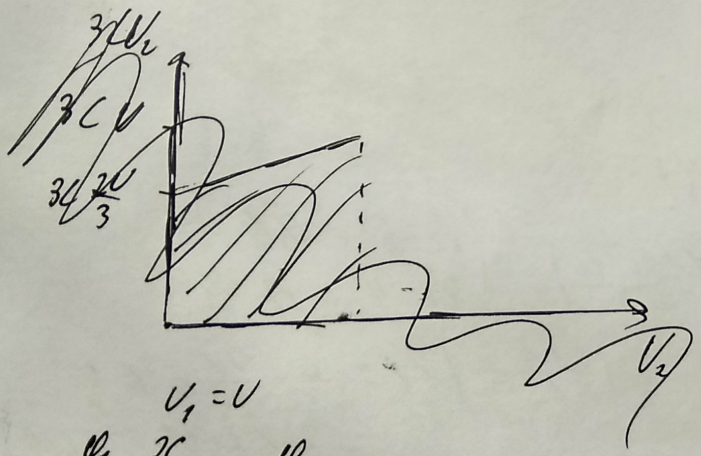
$\Rightarrow \underbrace{V_{22} - V_{21}}_{dV_2} = \underbrace{V_{11} - V_{12}}_{-dV_1} \Rightarrow$

$\Rightarrow -dV_2 = dV_1$

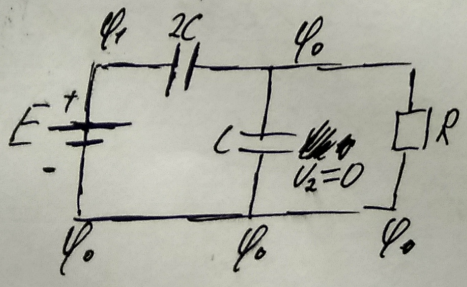
$\Rightarrow$ $2dV_1 - dV_2 = 3dV_1 = -3dV_2$

3) $dQ = I_R V_2 dt = -3dV_2$

$= \frac{C \cdot (-3dV_2)}{dt} V_2 \cdot dt = -3CV_2 dV_2 = dQ$



$V_1 = V$



$\varphi_1 + \varphi_2 = U_2$

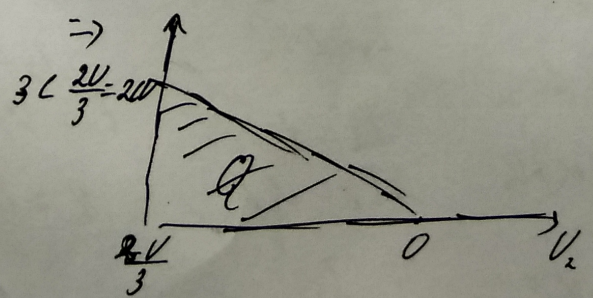
$C = \frac{q}{U} = \frac{q}{V_1} = \frac{q}{V}$

$V_2 \downarrow$ от $\frac{2V}{3}$ до 0 $\Rightarrow$

$dV_2 < 0 \Rightarrow$ можно заменить на плюс $\Rightarrow$

$\Rightarrow 3CV_2 dV_2 = dQ$

$\Rightarrow$



$\frac{\frac{2V}{3} \cdot 2CV}{2} = \frac{4CV^2}{6} = Q = \frac{2CV^2}{3}$

№3. Чернов

$I_1 = 2C U_1' = I_0$

$I_2 = C U_2'$

$I_R = I_1 - I_2 = C(2U_1' - U_2')$

$I_R = I_0 - I_2 = I_0 - CU_2' = C\frac{dU_2}{dt}$

$I_R = I_0 - C\frac{dU_2}{dt}$

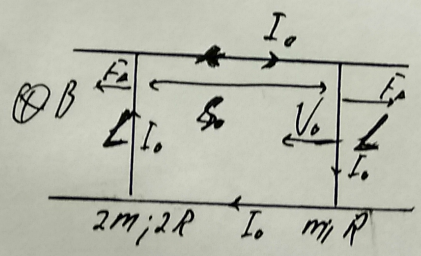
$\frac{U_2}{R} = I_0 - C\frac{dU_2}{dt}$

$I_0 = 2C\frac{dU_1}{dt}$ / $dU_1 = -dU_2$ $\Rightarrow I_0 = -2C\frac{dU_2}{dt}$

$I_R = -2C\frac{dU_2}{dt} - C\frac{dU_2}{dt} = -3C\frac{dU_2}{dt} = 3C\frac{dU_1}{dt} =$

$= \frac{3}{2}\frac{dq}{dt} = \frac{3}{2}C\frac{dU_1}{dt} = \frac{3}{2}I$

№4



1/ $E_0 = V_0 B L$

$I_0 = \frac{E_0}{3R}$ / $\Rightarrow I_0 = \frac{V_0 B L}{3R}$

$2ma = I_0 L B \Rightarrow a = \frac{I_0 L B}{2m} = \frac{V_0 B L}{3R} \cdot \frac{L B}{2m} = \frac{V_0 B^2 L^2}{6mR}$

$\mathcal{E} = V_1 B L - V_2 B L = B L (V_1 - V_2) \Rightarrow I = \frac{B L (V_1 - V_2)}{3R}$

$F_A = I_0 L B = \frac{B L (V_1 - V_2)}{3R} \cdot B L = \frac{B^2 L^2 V_{om}}{3R}$

$2m \cdot mV_1 = 3mV_1 \Rightarrow V_1 = \frac{V_0}{3}$

$2m S_2 = m S_1$