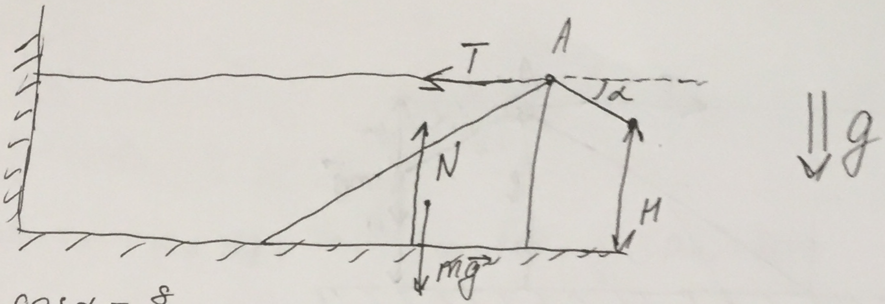
Часть 1

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

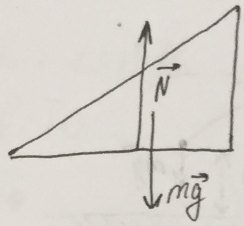
Шифр: **21203696**

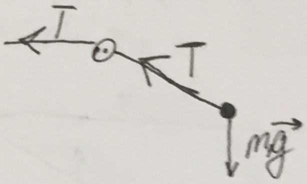
ID профиля: **872959**

Вариант 4

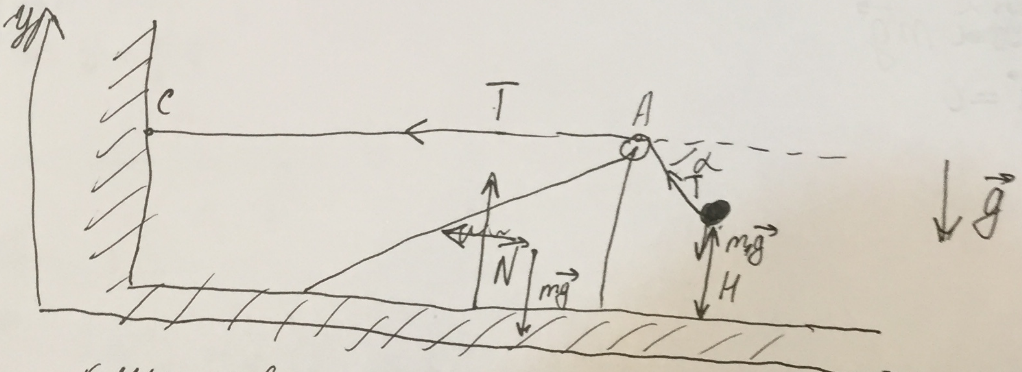


$\cos\alpha = \frac{8}{17}$





~~Шар тянет~~ нить на себя и тем самым ~~перемещает блок~~.



клин двигается влево в результате движения шара

Условие равновесия (покоя):

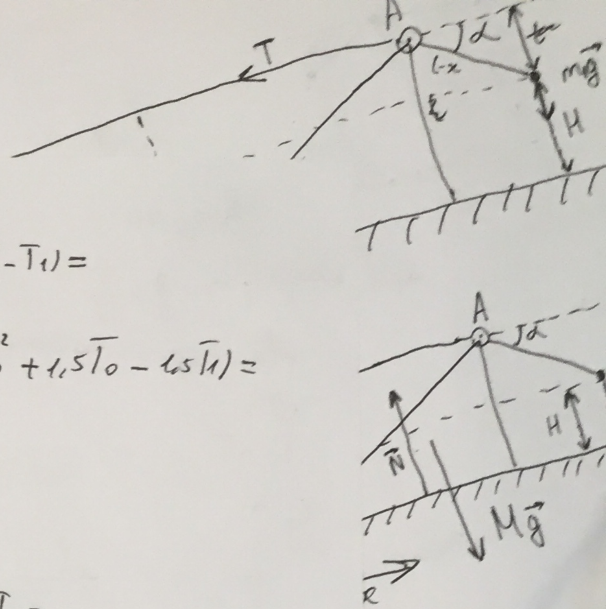
~~$y: N = mg$~~

$x: T - \cos\alpha \cdot m\vec{g} = 0$

$y: N - m\vec{g} - \sin\alpha \, m_1\vec{g} = 0$

$\cos\alpha = \frac{8}{17}$ $\cos^2\alpha + \sin^2\alpha = 1$

$\sin^2\alpha = 1 - \frac{64}{289}$



$A = Q - \Delta U = 1{,}8\, R\upsilon\, \frac{1+\frac{T_1}{T_0}}{2}(T_1 - T_0) -$

$- \frac{3}{2}\upsilon R(T_0 - T_1) = 0{,}9\, R\upsilon\,(T_1 + T_0)(T_1 - T_0) - \frac{3}{2}\upsilon R(T_0 - T_1) =$

$= 0{,}9\,\upsilon R(T_1^2 - T_0)^2 + (1{,}5T_0 - 1{,}5T_1)\upsilon R = \upsilon R(0{,}9T_1^2 - 0{,}9T_0^2 + 1{,}5T_0 - 1{,}5T_1) =$

$= \upsilon R((T_1 - T_0)(0{,}9T_1 - 0{,}9T_0 + 1{,}5))$

Исследуем функцию $f(T_1)$

$f(T_1) = 9T_1^2 - 1{,}5T_1 - 9T_0^2 + 1{,}5T_0$

Найдем точку минимума на промежутке $[0; T_0]$.

$f'(T_1) = 18T_1 - 1{,}5$

$18T_1 - 15 = 0$

$T_1 = \frac{15}{18} = \frac{5}{6}$

$-$ $+$

$\frac{5}{6}$ T_1

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

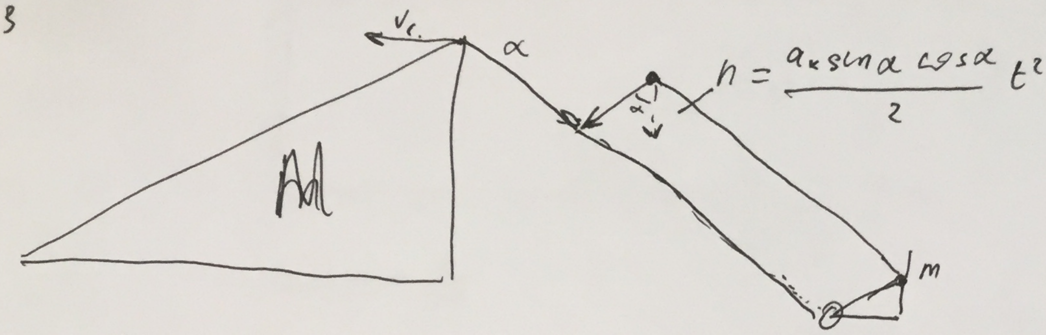
$A = 0{,}1\upsilon R(9(\frac{5}{6}T_0)^2 - 15\cdot\frac{5}{6}T_0 - 9T_0^2 + 15\cdot T_0) = 0{,}1\upsilon R(9\cdot\frac{25}{36}T_0^2 - \frac{75}{6}T_0 - 9T_0^2 +$

$+ 15T_0) = 0{,}1\upsilon R(9\cdot(-\frac{11}{36})T_0^2 + \frac{15}{6}T_0) = 0{,}1\upsilon R(\frac{15T_0}{6} - \frac{11}{4}T_0^2) =$

$= \frac{\upsilon R}{10}(2{,}5T_0 - 2{,}75T_0^2)$

Ответ: 1) $0{,}16875\,\upsilon R T_0$ 2) $\frac{5}{6}T_0$ 3) $\frac{\upsilon R}{10}(T_0\cdot(2{,}5 - 2{,}75T_0)$

1.3

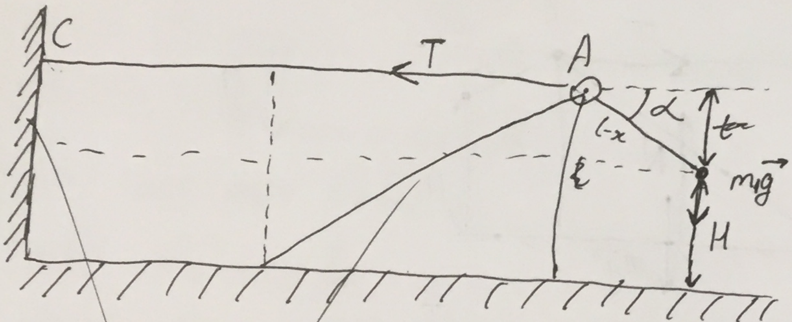


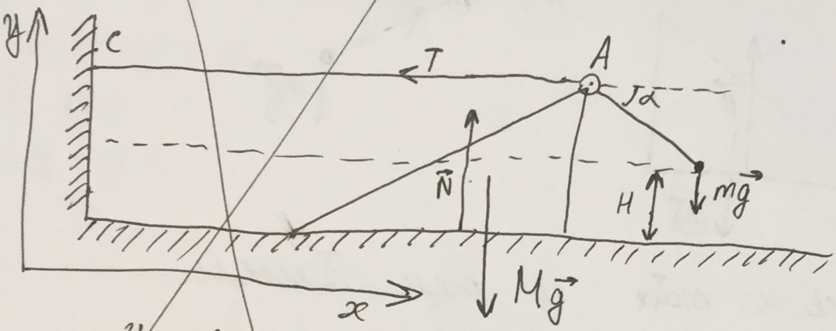
$$\frac{mV_\kappa^2}{2} + \frac{m(V_\kappa \sin\alpha)^2}{2} = M\frac{(a_\kappa t)^2}{2} + \frac{m(a_\kappa \cdot \sin\alpha \, t)^2}{2} =$$

$$= (M + m\sin^2\alpha) \cdot \frac{(a_\kappa t)^2}{2} = mg\,\frac{a_\kappa \sin\alpha \cos\alpha}{2} t^2$$

$$M \cdot a_\kappa + m \cdot a_\kappa \cdot \sin\alpha$$

$(T_1 - T_0) -$

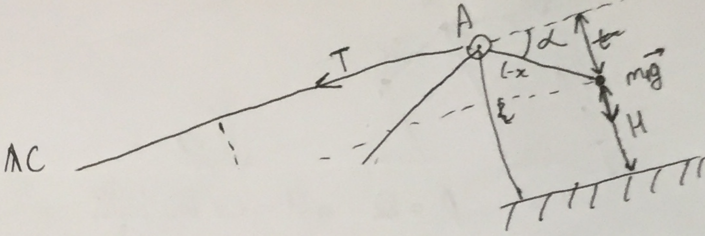


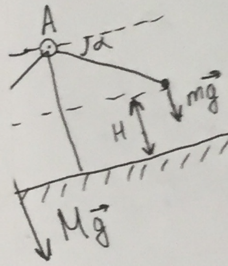


Условие покоя:

$x: \vec{T} = \cos\alpha \, m\vec{g}$

$y: \vec{N} - M\vec{g} = 0$





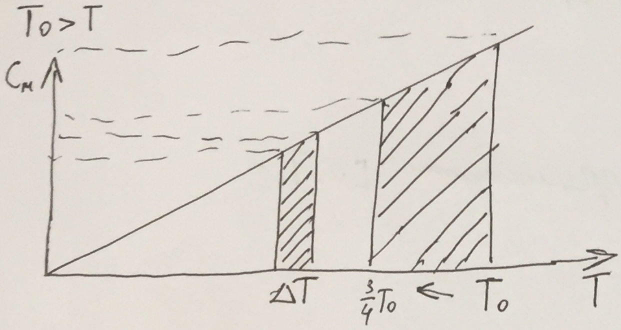
Задача:

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

He − одноатомный.

ν

$T_0 > T$



1) $\Delta T = T - \frac{3}{4}T = \frac{1}{4}T$

$C(\frac{1}{4}T) = \frac{9}{5} \cdot R \cdot \frac{\frac{3}{4}T_0}{T_0} = \frac{27}{20} R = 1,35 R$

$\Delta Q = \nu C \Delta T$

$\Delta Q = \nu \cdot 1,35 R \cdot \frac{1}{4} T_0$

~~$\Delta Q = Q_0 - Q_1$~~

$Q_0 = \nu C_M T$

$Q_0 = \nu \cdot \frac{9}{5} R \cdot 1$

~~ΔQ~~

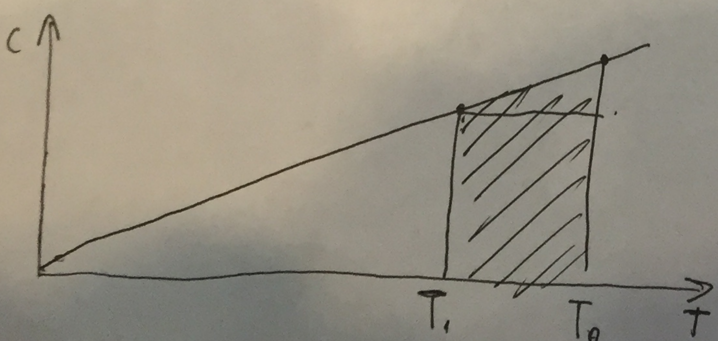
~~$\nu\, 1,35 R \cdot \frac{1}{4} T_0 =$~~

ΔQ = площадь под графиком.

$Q = \nu\left(\frac{1,8R + 1,35R}{2}\right) \cdot \frac{1}{4}T_0 = \frac{1}{8}T_0 \cdot 3,15 R = \underline{0,16875\, \nu R T_0}$

$+\begin{array}{r}1,8\\1,35\\\hline 3,15\end{array}$

2) $Q = A + \Delta U$



$\frac{9}{5} R \frac{R}{T_0} \cdot T = 1,8 \frac{R T_0}{T_0} = 1,8 R$

$\frac{9}{5} \frac{R}{T_0} \cdot T_1 = 1,8 R \cdot \frac{T_1}{T_0}$

21203696 (U872959 M1264397)

Часть 2

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

Шифр: **21203696**

ID профиля: **872959**

Вариант 4

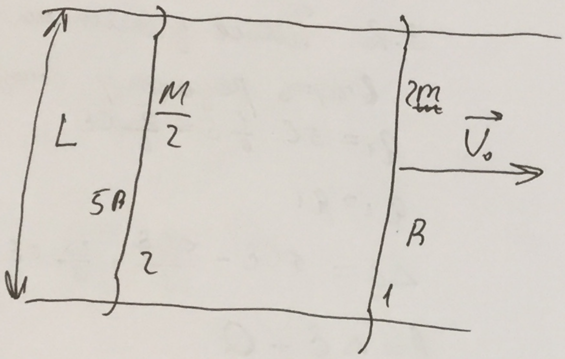
⑥

Чистовик

3.3 В момент, когда через C_2 течёт I_0, через резистор течёт ~~R~~ $= I_0 + 5I_0 = 6I$

Ответ: 1) $\frac{5\mathcal{E}}{6R}$ 2) $\frac{25}{12}C\mathcal{E}^2$ 3) $6I_0$.

4.



4.1. $\mathcal{E}_i = B \cdot V_0 \cdot L \cdot \Delta t$

$I = \frac{\mathcal{E}_i}{6R} = \frac{B V_0 \cdot L}{6R} = \frac{B \cdot V_0 \cdot L}{6R}$

$\Delta t \approx 0$

$\vec{F_A} = \vec{a_1} \cdot 2m \qquad \vec{a_1} = \frac{\vec{F_A}}{2m}$

$\vec{a_1} = \frac{B \cdot \vec{V_0} \cdot L}{6R} \cdot \frac{B \cdot L}{2m} = \frac{B^2 \cdot L^2 \cdot \vec{V_0}}{12mR}$

4.2. $V_2 = 0 + \frac{4a_1 t^2}{2}$

$V_2 = 2a_1 t^2$

$V_2 = \frac{B^2 L^2 t^2 V_0}{3mR}$

$V_1 = \frac{B^2 L^2 t V_0}{24mR} + V_0 t$.

4.3. $a_1 = \frac{F_A}{2m}$

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

$\frac{a_1}{a_2} = \frac{F_A}{2m} : \frac{2F_A}{m} = \frac{F_A \cdot m}{2m \cdot 2F_A} = \frac{1}{4}$.

$a_1 = \frac{a_2}{4}$.

$4a_1 = a_2$.

~~$a = V_2 = V_0 t + \frac{at^2}{2}$~~

~~V_0 для 2 перемычки $= 0$~~

~~$V_2 = \frac{4a_1 t^2}{2}$~~

~~$V_2 = 2$~~

$x_1 = x_{01} + V_0 t + \frac{B^2 L^2 \cdot V_0 \cdot t^2}{24mR}$

$x_2 = x_{02} + V_2 t + \frac{B^2 L^2 t^2 V_0}{3mR}$

расстояние $x = x_1 + x_2$

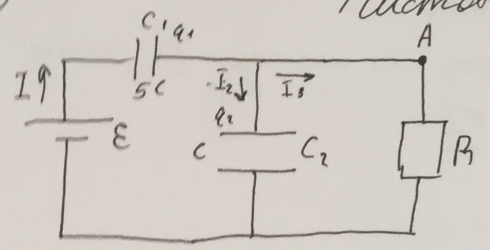
$x = x_{01} + V_0 t + \frac{B^2 L^2 t^2 \cdot V_0}{24mR} + x_{02} + \frac{B^2 L^2 t V_0}{3mR} + \frac{B^2 L^2 t^2 V_0}{3mR}$

Ответ: 1) $\frac{B^2 L^2 V_0}{12mR}$; 2) $V_2 = \frac{B^2 L^2 t V_0}{3mR}$; $V_1 = \frac{B^2 L^2 t V_0}{24mR} + V_0 t$; 3) $x_{01} + V_1 t + x_{02} + V_2 t + \frac{a_2 t^2}{2} + \frac{a_1 t^2}{2}$

Чистовик

Чистовик

(5) Чистовик



3.1 $q = CU$ $\quad U = \frac{c}{q}$

$q_1 = q_2$

$\Downarrow$

$C_1 U_1 = C_2 U_2$

$\Downarrow$

$\frac{U_1}{U_2} = \frac{C_1}{C_2} = \frac{5}{1}$

$U_1 = 5x \quad U_2 = x$

$x + 5x = \mathcal{E}$

$x = \frac{\mathcal{E}}{6}$

$U_1 = \frac{5\mathcal{E}}{6} \quad U_2 = \frac{\mathcal{E}}{6}$

$I = I_3 + I_2$

$\cancel{\varphi A} - I_3 R + \mathcal{E} - \frac{5\mathcal{E}}{6} = \cancel{\varphi A}\, 0$

$I_3 R = \frac{5\mathcal{E}}{6}$

$I_3 = \frac{5\mathcal{E}}{6R}.$

3.2. После замыкания ток через резистор отсутствует.

$q_1 = 5C \cdot \frac{1}{6}\mathcal{E} = \frac{5}{6} C\mathcal{E}$

$q_2 = q_1$

$\Delta q = 5C\mathcal{E} - \frac{5C\mathcal{E}}{6} = \frac{25}{6} C\mathcal{E}$

$A = \Delta\mathcal{E} + Q$

$Q = A - \Delta\mathcal{E} \downarrow$

~~$A = \frac{P}{R} t$~~

~~Q~~

$Q = \Delta q\, \mathcal{E} - \left(\frac{C_1 \mathcal{E}^2}{2} - \frac{C_1 (\frac{1}{6}\mathcal{E})^2}{2} - \frac{C_2 (\frac{\mathcal{E}}{6}\mathcal{E})^2}{2} \right)$

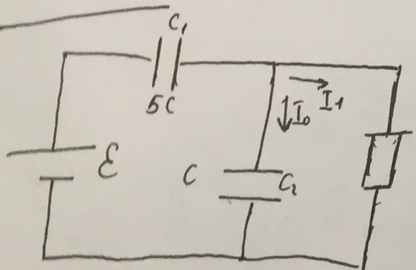
$= \frac{25}{6} C\mathcal{E}^2 - \frac{5C\mathcal{E}^2}{2} + \frac{5C\mathcal{E}^2}{72} + \frac{C\,25\mathcal{E}^2}{72} =$

$= \frac{300}{72} C\mathcal{E}^2 - \frac{180 C\mathcal{E}^2}{72} + \frac{5C\mathcal{E}^2}{72} + \frac{25C\mathcal{E}^2}{72} =$

$= \frac{120 + 30}{72} C\mathcal{E}^2 = \frac{150}{72} \mathcal{E}^2 C =$

$= \frac{50}{24} C\mathcal{E}^2$

3.3.



$q = CU$

$U = \frac{1}{C} \cdot q$

$\Delta U = \frac{1}{C} \cdot \Delta q$

$\Delta U_1 = -\Delta U_0$

$\frac{1}{C_1} \cdot \Delta q_1 = -\frac{1}{C_2} \cdot \Delta q_0$

$\frac{1}{5C} \cdot \Delta q_1 = -\frac{1}{C} \cdot \Delta q_0$

$\Downarrow$

$\frac{\Delta q_1}{\Delta q_0} = -\frac{\frac{1}{5C}}{\frac{1}{C}} \Rightarrow -\frac{1}{5}$ $\qquad \Delta q_0 = -5\Delta q_1$

$\Downarrow$

$|I_0| = 5|I_1|$

(4) Черновик.

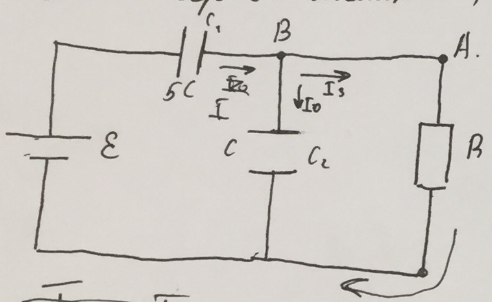
3.2.

$$\Delta \mathcal{E} = \frac{C_1\mathcal{E}^2}{2} - \frac{C_1(\frac{1}{6}\mathcal{E})^2}{2} - \frac{C_2(\frac{5}{6}\mathcal{E})^2}{2} = \frac{5\mathcal{E}^2}{2} - \frac{5C\mathcal{E}^2}{72} - \frac{25C\mathcal{E}^2}{72} = \frac{5\mathcal{E}^2}{2} - \frac{30C\mathcal{E}^2}{72} =$$

$$= \frac{180-30}{72}C\mathcal{E}^2 = \frac{150}{72}C\mathcal{E}^2 = \frac{50}{24}C\mathcal{E}^2.$$

$$Q = \frac{300}{72}C\mathcal{E}^2 - \frac{150}{72}C\mathcal{E}^2 = \frac{150C\mathcal{E}^2}{72} = \frac{50}{24}C\mathcal{E}^2.$$

3.3. ~~черт~~ момент t, ~~q~~ по C_2 течет ток I_0.



~~$I_0 = I_3 + I_2$~~ $\quad I = I_0 + I_3 \quad I_0 = I - I_3$

~~$I_0 = \frac{\mathcal{E}}{R} - \frac{\mathcal{E}}{6R}$~~

$$0\ \varphi_A - I_3 \cdot R + \mathcal{E} - \frac{5\mathcal{E}}{6} = 0$$

$$-I_3R + \frac{\mathcal{E}}{6} = 0$$

$$I_3R = \frac{\mathcal{E}}{6}$$

$$I_3 = \frac{\mathcal{E}}{6R}$$

$$U_2 = \frac{\mathcal{E}}{6}.$$

$$I_0 = \frac{\frac{\mathcal{E}}{6}}{R} = \frac{\mathcal{E}}{6R}$$

$$\varphi B - \frac{\mathcal{E}}{6} + \mathcal{E} - \frac{5\mathcal{E}}{6} = \varphi B.$$

~~$0 = 0$~~

~~I_0~~ $\quad \dot{q} = C\dot{U}$

$$U = \frac{q}{C} = \frac{1}{C}\cdot q.$$

$$\Delta U = \frac{1}{C}\cdot \Delta q.$$

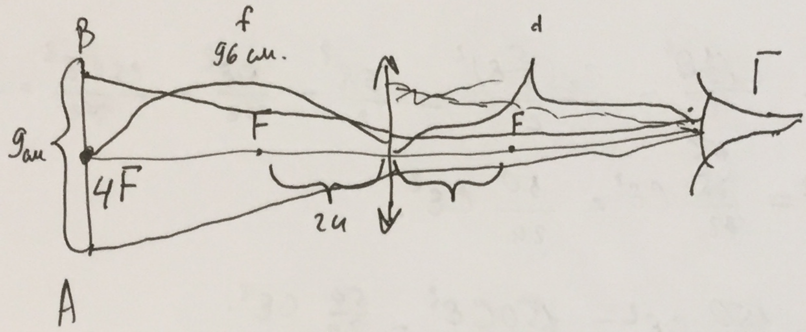
$$\Delta U_1 = -\Delta U_2$$

$$\frac{1}{C_1}\Delta q_1 = \frac{1}{C_2}\cdot \Delta q_2 \qquad \frac{\Delta q_1}{\Delta q_2} = \frac{C_2}{C_1} = -\frac{1}{5}$$

$$\Delta q_1 = -5\Delta q_2 \Rightarrow |I_1| = 5|I_2|$$

Черновик

(3)



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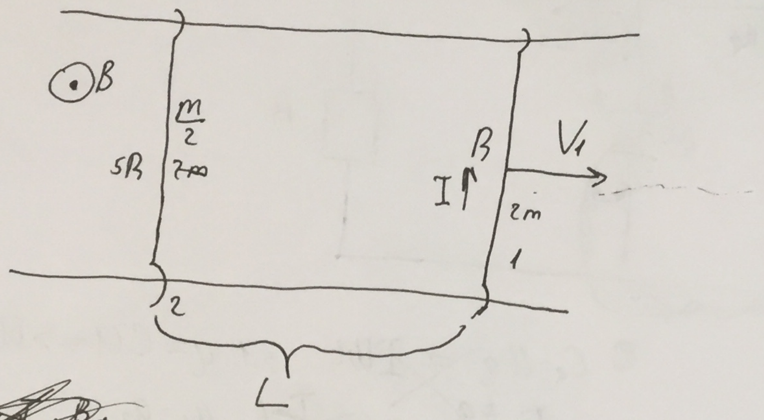
(2) Черновик.



~~На перемычку 1 действует сила Лоренца.~~

$\mathcal{E}_i = B v_0 \Delta t \cdot L$

$I = \frac{\mathcal{E}_i}{6R} = \frac{B v_0 \Delta t \cdot L}{6R \cdot \Delta t} = \frac{B v_0 L}{6R}$

$a = \frac{F_A}{2m} = \frac{B v_0 L \cdot B \cdot L}{6R \cdot 2m} = \frac{B^2 L^2 v_0}{12 m R}$.

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

$a_1 = \frac{F_A}{2m}$

$\frac{a_1}{a_2} = \frac{F_A}{2m} \cdot \frac{m}{2F_A} = \frac{1}{4}$.

$a_1 = 4a_2$