Часть 1

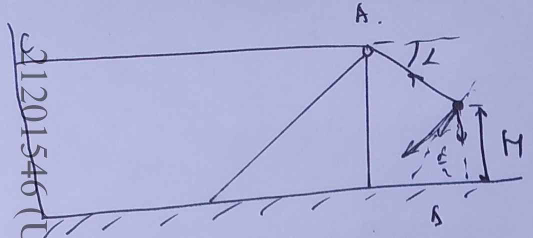
Олимпиада: **Физика, 11 класс (1 часть)**

Шифр: **21201546**

ID профиля: **345172**

Вариант 2

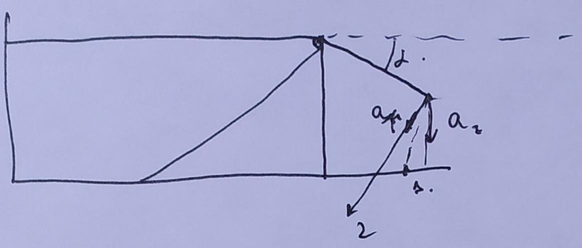
Черновик.



$\cancel{a_{цс} = T-}$ $a_{цс} = \frac{T - T\cos\alpha}{M_{цс}}$

$\Delta = H \cdot \frac{\cancel{\sin\alpha}}{2} \cdot tg\frac{\alpha}{2}$

$Ma_y = T - mg\sin\alpha.$

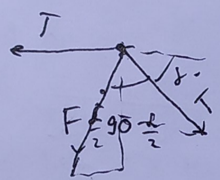


$a_1 = mg\cos\alpha.$

$a_2 = mg\cos\alpha \cdot \sin\alpha.$

$\Delta L = \frac{H}{\cos\alpha} - H\sin(\frac{\alpha}{2})$

a



$M a_{цс} = 2T \cdot \cos(90 - \frac{\alpha}{2}) \cdot \sin\frac{\alpha}{2}$

$\cancel{Ma_{ц}}$ $Ma_y = T - mg\sin\alpha.$

$Ma_z = mg\cos\alpha.$

$T = Ma_y + mg\sin\alpha.$

$T = M(a_y + g\sin\alpha).$

$a_y = \frac{v^2}{R}$ $v \times 2$ раза, $R > 6$ и раза

$a_y = \frac{2gH}{R_{кон}}.$

$a_z = g\cos\alpha.$

$S = a_z \cdot t. = \frac{H}{\cos\alpha} =$

$2aS = v_{к_2}^2.$

$2g\cos\alpha S = v_{к_2}^2$

$2gH = v_к^2$

$v_{к_2} = \sqrt{2gH}$

$t = \frac{H}{\cos\alpha \, g\cos\alpha} = \frac{H}{g\cos^2\alpha}.$

Черновик.

$$ma_0 = T_0 - mg\sin\alpha.$$

$$m\frac{v_{0\tau}^2}{R_0} = T - mg\sin\alpha.$$

$$v_{0\tau} = 0 \Rightarrow T = mg\sin\alpha$$

$$\Delta l = \frac{H}{\cos\alpha}.$$

$$\Delta t = \frac{a_{\kappa\kappa} t^2}{2}.$$

Черновик

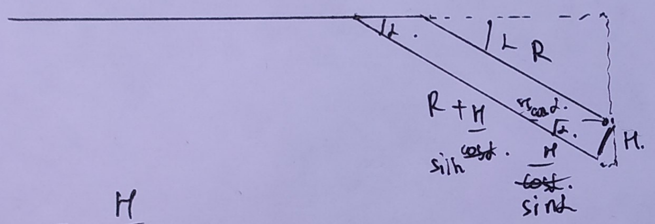
$$ma_\tau = mg\cos\alpha.$$

$$a_\tau = g\cos\alpha.$$

$$m\bar{a}_y = T - mg\sin\alpha.$$

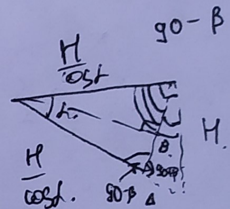
$$a_{y0} = 0.$$

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



$$S_{\kappa\kappa} = \frac{H}{\sin\alpha}.$$

$$\cancel{\frac{H}{\sin\alpha}}\quad \frac{H}{\cos\alpha}$$



$$2\frac{H}{\cos\alpha}\cdot\sin\frac{\alpha}{2}$$

$$\Delta = \frac{H}{\sin\alpha} - \frac{H}{\cos\alpha}$$

$$\angle\beta = \arcsin$$

$$\Delta\cdot\sin\alpha.$$

$$\angle\beta = \arccos\frac{H - \Delta\sin\alpha}{2\frac{H}{\cos\alpha}\cdot\sin\frac{\alpha}{2}}$$

$$H - (\Delta\sin\alpha)$$

$$\angle\beta = \arccos\frac{H - H\left(\frac{1}{\sin\alpha} - \frac{1}{\cos\alpha}\right)\sin\alpha}{2\frac{H}{\cos\alpha}\cdot\sin\left(\frac{\alpha}{2}\right)} = \arccos\frac{H\left(1 - (1 - \operatorname{tg}\alpha\right)}{2\frac{\sin\frac{\alpha}{2}}{\cos\alpha}\cdot H.} =$$

$$= \frac{\operatorname{tg}\alpha}{2\frac{\sin\frac{\alpha}{2}}{\cos\alpha}} = \frac{\sin\alpha}{2\sin\frac{\alpha}{2}} = \frac{2\cos\frac{\alpha}{2}\sin\frac{\alpha}{2}}{2\sin\frac{\alpha}{2}} = \cos\frac{\alpha}{2}$$

$$\angle\beta = \arccos\cos\frac{\alpha}{2} = \frac{\alpha}{2}.$$

№2. черновик

Дано:

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

T_0.

1) Q_1 - ?

$T_0 \to \frac{1}{2} T_0$.

2) T_{min} - ?

3) A_{min}

$C_{нач} = \frac{5}{2} R$.

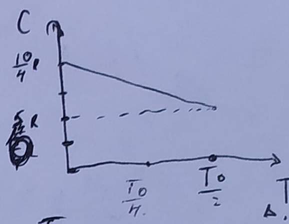
$C_{кон} = \frac{5}{2} R \cdot \frac{0{,}5 T_0}{T_0} = \frac{5}{4} R$.

$Q = \nu C \Delta T = \frac{15}{4} R \nu \frac{T_0}{2} = \frac{15}{8} \nu R T_0$.

C меняется линейно =>

$\Rightarrow C_{ср} = \frac{\frac{5}{2} R + \frac{5}{4} R}{2} = \frac{15}{8} R$.

$\frac{3 T_0}{4 T_0} \Rightarrow \frac{5}{2} \cdot \frac{3}{4} = \frac{15}{8}$.



2). $Q = \Delta U + A$.

$Q = \cancel{\Delta U} + \frac{3}{2} \nu R \Delta T + A$.

$C \nu \Delta T = \frac{3}{2} \nu R \Delta T + A$.

$A = C \nu \Delta T - \frac{3}{2} \nu R \Delta T = \nu \Delta T \cdot \frac{5}{2} R \frac{T}{T_0} - \frac{3}{2} \nu R \Delta T$.

$\cancel{\frac{5}{2} R \frac{T}{T_0}} \quad C = \frac{T_0 - \Delta T}{T_0} \cdot \frac{5}{2} R$.

$A = \nu \Delta T \cdot \frac{5}{2} R \cdot \frac{T_0 - \Delta T}{T_0} - \frac{3}{2} \nu R \Delta T$.

$A = \nu R \Delta T \left(\frac{5}{2} \left(1 - \frac{\Delta T}{T_0}\right) - \frac{3}{2} \right)$

$A = \frac{\nu R \Delta T}{2} \left(5 - 5 \frac{\Delta T}{T_0} - 3 \right)$

$A = \frac{\nu R \Delta T}{2} \left(2 - \frac{5 \Delta T}{T_0} \right)$

$A = 0$.

$2 = \frac{5 \Delta T}{T_0}$

$5 \Delta T = 2 T_0$

$\Delta T = 0{,}4 T_0$.

$T_{кон} = 0{,}6 T_0$.

$A = \frac{5}{4} R \left(2 - \frac{\Delta T}{T_0}\right) \nu \Delta T - \frac{3}{2} \nu R \Delta T$.

$A = \nu R \Delta T \left(\frac{5}{4} \left(2 - \frac{\Delta T}{T_0}\right) - \frac{3}{2} \right) = \nu R \Delta T \left(\frac{5}{2} - \frac{5}{4} \frac{\Delta T}{T_0} - \frac{3}{2} \right) =$

$= \nu R \Delta T \left(1 - \frac{5}{4} \frac{\Delta T}{T_0} \right)$ — менша.

$\cancel{1 =}\ 4 T_0 = 5 \Delta T$.

$\Delta T = \frac{4}{5} T_0 \Rightarrow T_1 = \frac{T_0}{5}$.

~~$M_{кл} Q_{кл} = T = T$~~ Черновик

$2T\sin\left(90 - \frac{\alpha}{2}\right)$

$$\nu R \Delta T - \frac{5 \nu R \Delta T^2}{4T_0} = A.$$

$$-\frac{5 \nu R}{4T_0} \Delta T^2 + \nu R \Delta T - A = 0.$$

$$D = \nu^2 R^2 - 4A \cdot \frac{5}{4} \frac{\nu R}{T_0} = 0.$$

$$4A \cdot \frac{5}{4} \frac{\nu R}{T_0} = \nu^2 R^2.$$

$$\frac{5A}{T_0} = \nu R.$$

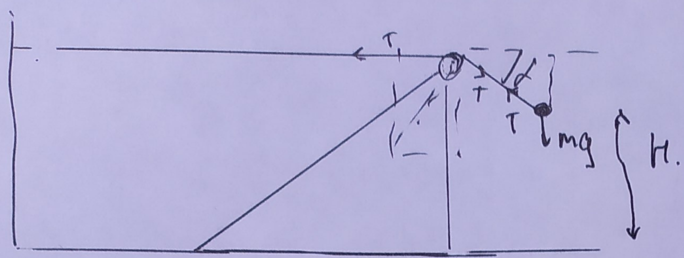
$$5A = \nu R T_0$$

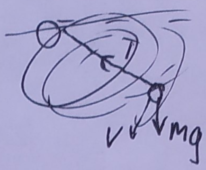
$$A = \frac{\nu R T_0}{5}.$$

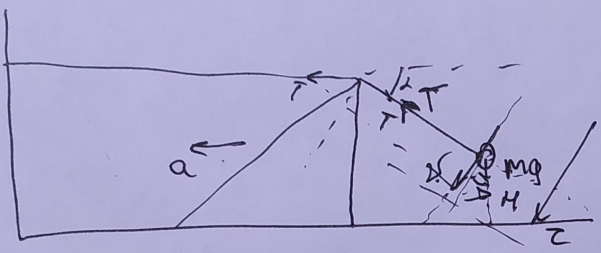
$D = 0.$

$$\Delta T = \frac{-\nu R + 0}{2 \cdot -\frac{5}{4} \frac{\nu R}{T_0}} = \frac{1}{\frac{10}{4} T_0} = \frac{4T_0}{10}. \Rightarrow T_1 = 0{,}6T_0.$$

Черновик
№1.







$$Ma_y = T - mg\sin\alpha.$$

$$m\frac{v_0^2}{R_0} = T - mg\sin\alpha.$$

$$v_{нач} = 0. \Rightarrow T = mg\sin\alpha.$$

$$m\frac{v_{кон}^2}{R_{кон}} = T_{кон.} mg\sin\alpha$$

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

$$M_{кл}\, a_{кл.} = T - T\cos\alpha.$$

$$a_{кл} = \frac{T(1-\cos\alpha)}{M_{кл.}}$$

$$z: Ma_z = mg\cos\alpha.$$

$$S_z = \frac{H}{\cos\alpha}$$

$$a_z = g\cos\alpha.$$

$$S = \frac{a_z t^2}{2}.$$

$$S = \frac{v_{кон}^2}{2a_z}$$

$$v_{кон}^2 = 2a_z S = 2g\cos\alpha \cdot \frac{H}{\cos\alpha} = 2gH.$$

$$v_{кон} = \sqrt{2gH}$$

$\cancel{T_{кон}}$ $\cancel{Ma}$

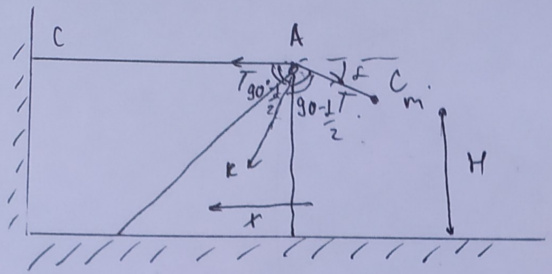
$$m\frac{v_{кон}^2}{R_{кон}} = T_{кон} - mg\sin\alpha.$$

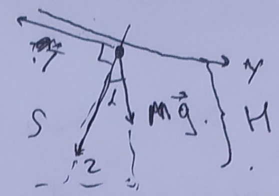
$$R_{кон} = R + \frac{H}{\cos\alpha}.$$

$$\frac{m\cdot 2gH}{R + \frac{H}{\cos\alpha}} = T_{кон} - mg\sin\alpha.$$

$$m\cdot\frac{2gH}{R+\frac{H}{\cos\alpha}} = T_{кон} - T_{нач}.$$

Чистовик №1.





2ЗН:

z: $ma_z = mg\cos\alpha$

$a_z = g\cos\alpha$.

Y: $-T+mg\sin\alpha = 0$.

$T = mg\sin\alpha$.

1) ускорение шара направлено под $\angle = \alpha$.

k: $M a_{кл} = 2T\cos(90-\frac{\alpha}{2})\sin\frac{\alpha}{2}$.

$Ma_{кл} = 2mg\sin\alpha\cdot\sin\frac{\alpha}{2}\cdot\cos(90-\frac{\alpha}{2}) = 2mg\sin\alpha\cdot\sin^2\frac{\alpha}{2}$.

Точка C двигается a_z направленным вниз по оси z => точка A двигается с ускорением a_z => $a_{кл} = a_z\cdot\cos(90-\frac{\alpha}{2}) = \underline{a_z\sin\frac{\alpha}{2}}. = g\overset{0,8}{\cos\alpha}\cdot\overset{0,31}{\sin\frac{\alpha}{2}} = 0{,}25g$

$\frac{M}{m} = \frac{2g\sin\alpha\cdot\sin^2(\frac{\alpha}{2})}{g\cos\alpha} = 2\cdot tg\alpha\cdot\sin^2(\frac{\alpha}{2}) = 2\cdot\overset{1,5}{0{,}75}\cdot\overset{0,1}{\sin^2(\frac{\alpha}{2})} = 0{,}15 =>$

$\frac{m_{ш}}{M_{к}} = \frac{1}{0{,}15} = \underline{6{,}67}$

$S = \frac{a_z t^2}{2} => t = \sqrt{2Sa_z} = \sqrt{2\cdot\frac{H}{\cos\alpha}\cdot g\sin\alpha\cos\alpha} = \sqrt{2gH}$.

Ответ: 1) под углом α.

2) $0{,}25g$

3) $\frac{m_{ш}}{M_{к}} = 6{,}67$.

4) $t = \sqrt{2gH}$

Чистовик Вариант 11-02

№2.

Дано:

ν; T_0.

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

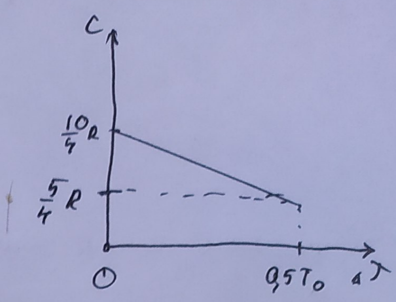
1) Q_1 – ?

2) T_1 – ?

3) A_{min} ~~=0~~ – ?

Решение.

1) $C_{нач} = \frac{5}{2} R$; $C_{кон} = \frac{5}{2} R \cdot \frac{0{,}5 T_0}{T_0} = \frac{5}{4} R$.



Зависимость $C(T)$ линейная. =>

$$\Rightarrow C_{ср} = \frac{\frac{10}{4} R + \frac{5}{4} R}{2} = \frac{15}{8} R$$

$$Q = C_{ср} \nu \Delta T = \frac{15}{8} R \cdot \nu \cdot 0{,}5 T_0 = \frac{15}{16} \nu R \Delta T.$$

2) $Q = \Delta U + A$.

$$A = Q - \Delta U = C_{ср} \nu \Delta T - \frac{3}{2} \nu R \Delta T.$$

$$C_{нач} = \frac{5}{2} R$$

$$C_{кон1} = \frac{5}{2} R \frac{T_0 - \Delta T}{T_0}$$

$$C_{ср1} = \frac{\frac{5}{2} R + \frac{5}{2} R \left(\frac{T_0 - \Delta T}{T_0} \right)}{2} = \frac{5}{4} R + \frac{5}{4} R \left(1 - \frac{\Delta T}{T_0} \right) = \frac{5}{4} R \left(2 - \frac{\Delta T}{\Delta T_0} \right)$$

$$A = \frac{5}{4} R \left(2 - \frac{\Delta T}{T_0} \right) \cdot \nu \Delta T - \frac{3}{2} \nu R \Delta T = \nu R \Delta T \left(\frac{5}{2} - \frac{3}{2} - \frac{5 \Delta T}{4 T_0} \right)$$

$$A = \nu R \Delta T \left(1 - \frac{5 \Delta T}{4 T_0} \right)$$ – минимально

$$\nu R \Delta T - \frac{5}{4} \frac{\nu R}{T_0} \Delta T^2 = A.$$

$$- \frac{5}{4} \frac{\nu R}{T_0} \Delta T^2 + \nu R \Delta T - A = 0.$$

$$D = \nu^2 R^2 - 4A \cdot \frac{5}{4} \frac{\nu R}{T_0} = 0.$$

$$\frac{5A \, \nu R}{T_0} = \nu^2 R^2$$

$$A = \frac{\nu R T_0}{5}.$$

$$\Delta T = \frac{-\nu R + 0}{2 \cdot \left(-\frac{5}{4} \frac{\nu R}{T_0} \right)} = 0{,}4 T_0 \Rightarrow T_1 = 0{,}6 T_0.$$

Ответ: 1) $Q = \frac{15}{16} \nu R \Delta T$; 2) $T_1 = 0{,}6 T_0$; 3) $A = \frac{\nu R T_0}{5}$.

Часть 2

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

Шифр: **21201546**

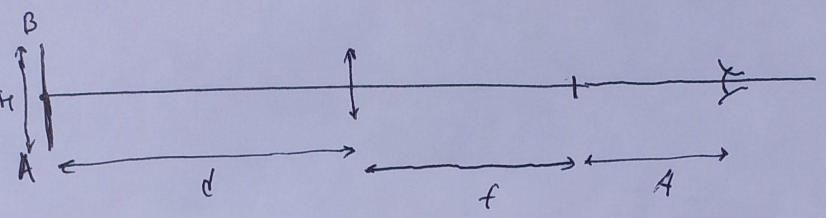
ID профиля: **345172**

Вариант 2

N5 Чистовик.

Дано:
$F = 12$ см
$H = 9$ см
$A = 24$ см
$d = 48$ см

Решение:

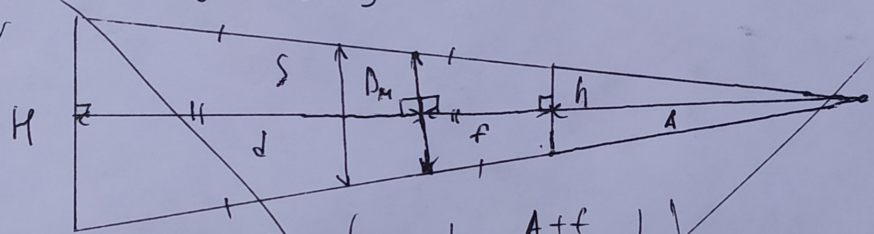


1) $\frac{1}{F} = \frac{1}{d} + \frac{1}{f}$

$f = \frac{dF}{d-F} = \frac{48 \cdot 12}{36} = 16$ см

$x = f + A = 16 + 24 = \underline{40 \text{ см}}$

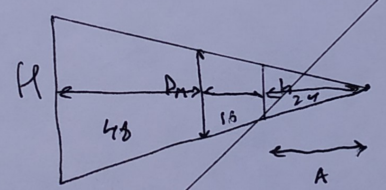
2) $\Gamma = \frac{f}{d} = \frac{16}{48} = \frac{1}{3} \Rightarrow h = H \cdot \Gamma = 3$ см – диаметр изобр.



(По подобию. $\left(D_м = h \cdot \frac{A+f}{A} = \right)$

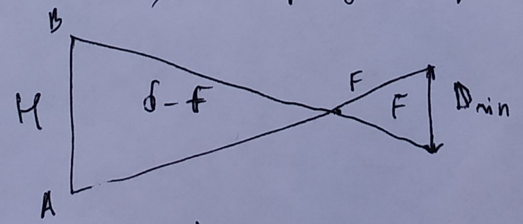
$S = \frac{H+h}{2} = 6$ см

$D_м = \frac{S+h}{2} = \frac{6+3}{2} = 4,5$ см)



$D_м = \frac{f+A}{A} \cdot h = \frac{40}{24} \cdot 3 = 5$ см.

3) на фокусе справа от линзы



$D_м = H \cdot \frac{F}{d-F} = H \cdot \frac{12}{36} = 9 \cdot \frac{1}{3} = 3$ см.

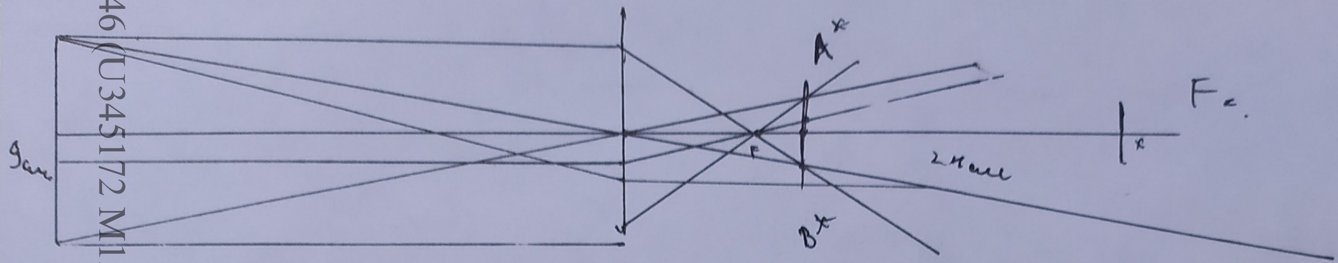
3) на расстоянии 12 см от линзы слева, т.е. на фокусе

Ответ: 1) 40 см ; 2) 3 см ; 3) 12

3) 12 см слева от линзы

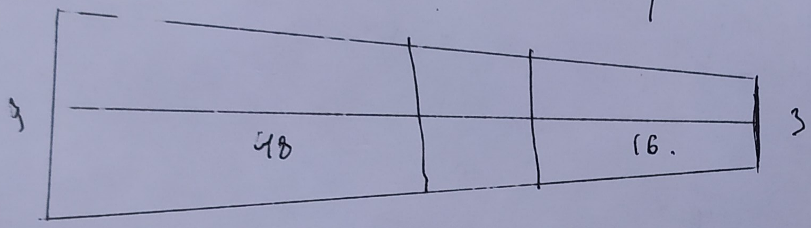
3

Черновик.



$\frac{d}{\Gamma} = 3см.$

$\frac{1}{d} + \frac{1}{f} = \frac{1}{F_л}.$



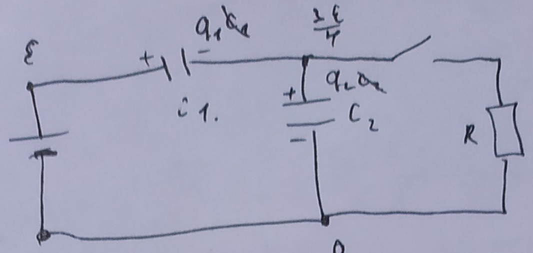
$\frac{3+9}{2} = 6$

$\frac{6+3}{2} = 4{,}5.$

Черновик. Черновик.

№3. Дано: Решение:

$C_2 = C$
$C_1 = 3C.$



$\cancel{q}.\ -C_1 U_1 + \overset{0}{C_2} U_2 = 0.$

$U_1 + U_2 = \varepsilon.;\qquad U_2 = \varepsilon - U_1$

$CU_2 - 3CU_1 = 0.$

$C\varepsilon - CU_1 - 3CU_1 = 0$

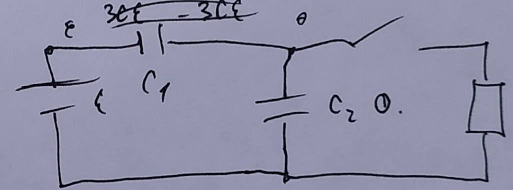
$\varepsilon - 4U_1 = 0.$

$4U_1 = \varepsilon$

$U_1 = \frac{\varepsilon}{4} \Rightarrow U_2 = \varepsilon - \frac{\varepsilon}{4} = \frac{3\varepsilon}{4}.$

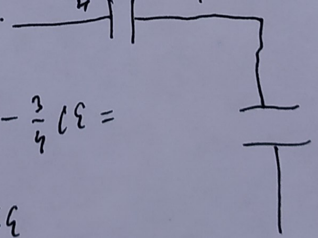
1) $I = \frac{3\varepsilon}{4R}.$

2)



$W_{нач} = \frac{C_1 U_1^2}{2} + \frac{C_2 U_2^2}{2}$

$W_{кон} = \frac{C_1 \varepsilon^2}{2}$



$q_{ист} = 3C\varepsilon - \frac{3}{4}C\varepsilon =$

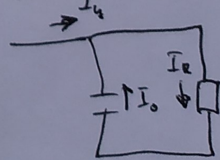
$= \frac{\cancel{N}9}{4}C\varepsilon$

$A_{ист} = \Delta W + Q.$

$\frac{48C\varepsilon^2}{32}\qquad \frac{3}{32}C\varepsilon^2\qquad \frac{9}{32}C\varepsilon^2$

$Q = A_{ист} - \Delta W = \frac{C_1\varepsilon^2}{2} - \frac{C_1 U_1^2}{2} - \frac{C_2 U_2^2}{2} + \frac{9}{4}C\varepsilon^2 = \frac{3C\varepsilon^2}{2} - \frac{3C}{2}\cdot\frac{\varepsilon^2}{16} - \frac{C}{2}\cdot\frac{9\varepsilon^2}{16} + \frac{9}{4}C\varepsilon^2 =$

$= \frac{36C\varepsilon^2}{32} + \frac{72}{32}C\varepsilon^2 = \frac{108}{32}C\varepsilon^2 = \frac{54}{16}C\varepsilon^2 = \frac{27}{8}C\varepsilon^2.$



3) $q = C_2 U_2$

$I = C_2 \frac{U_2}{\Delta t}.$

$U_R = IR.\qquad I_0 = C_2 U_2'\qquad I_R = \frac{U_2}{R}.$

$\cancel{\varepsilon = U_{C1} + U_{C2}}\quad \varepsilon = U_1 + U_2.$

$I_4 = C_1 \frac{U_1}{\Delta t}\qquad I_0 = C_2 \frac{U_2}{\Delta t}\qquad \cancel{= \frac{U_2}{R}}.\qquad I_{общ} = \frac{U_2}{R}.$

Черновик.

$$I_{C1} = C_1 \frac{\varepsilon - U_2}{\Delta t}$$

$$C_1 \frac{\varepsilon - U_2}{\Delta t} + C_2 \frac{U_2}{\Delta t} = \frac{U_2}{R}.$$

$$C_1(\varepsilon - U_2) + C_2 U_2 = \cancel{q_R}\ I_R \Delta t.$$

$$3C\varepsilon - 3CU_2 + CU_2 = I_R \Delta t.$$

$$3C\varepsilon - 2CU_2 = I_R \Delta t. = q_R$$

$$3C\varepsilon - 2CU_2 = 3CU_1 + CU_2$$

$$3C\varepsilon - 2CU_2 = 3C(\varepsilon - U_2) + CU_2.$$

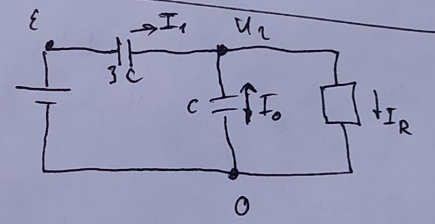
$$3C\varepsilon - 3CU_2 = 3C\varepsilon - 3CU_2.$$

$$\cancel{q_R = C_1 \frac{\varepsilon}{4}}$$

$$q_R = \left(q_{C1} - \left(C_1 \frac{\varepsilon}{4}\right)\right) + \left(q_{C2} - C_2 \frac{3\varepsilon}{4}\right)$$

$$\cancel{q_R = CU_1 + C_1 \frac{\varepsilon}{4}}$$

$$q_R = 3CU_1 + \frac{3C\varepsilon}{4} + CU_2 - \frac{3C\varepsilon}{4}.$$



$$3C \frac{\varepsilon - U_2}{\Delta t} + C \frac{U_2}{\Delta t} = \frac{U_2}{R} \quad | \Delta t$$

$$3C(\varepsilon - U_2) + CU_2 = q_R$$

$$3C\varepsilon - 3CU_2 = -3C\varepsilon + 4CU_2.$$

$$7CU_2 = 6C\varepsilon$$

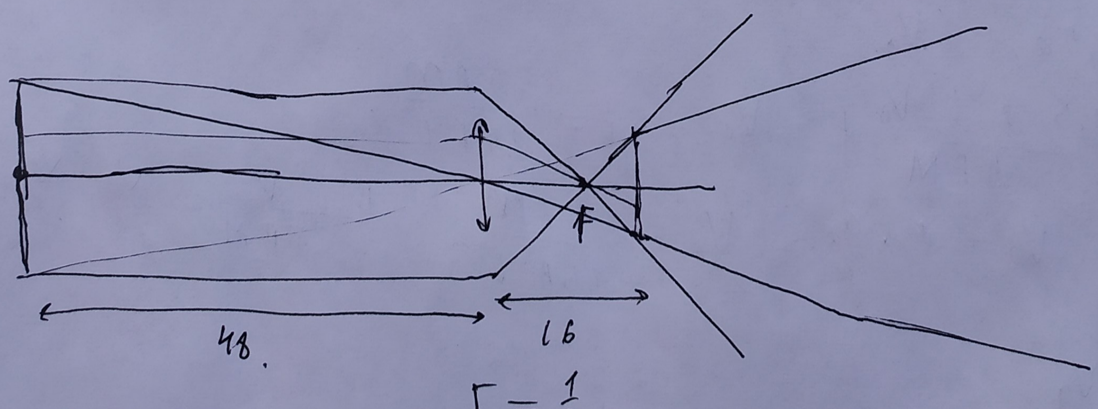
$$U_2 = \frac{6\varepsilon}{7}$$

$$q_R = \left(-3C(\varepsilon - U_2) - \left(-3C\frac{\varepsilon}{4}\right)\right) +$$

$$+ CU_2 - C\frac{3\varepsilon}{4}$$

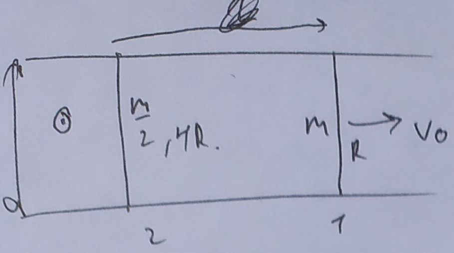
$$q_R = -3C\varepsilon + 3CU_2 + \frac{3}{4}C\varepsilon + CU_2 - \frac{3}{4}C\varepsilon$$

$$q_R = -3C\varepsilon + 4CU_2.$$



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

Черновик.



1) $\mathcal{E} = B S^{*} = BLv$

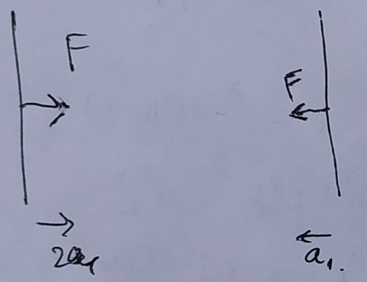
$$I = \frac{\mathcal{E}}{5R} = \frac{BLv}{5R}$$

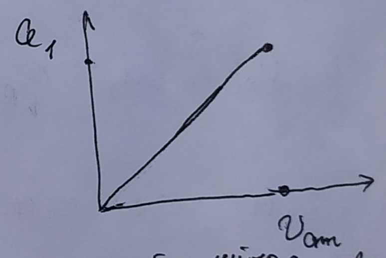
$F = BYL$

$$a = \frac{F}{\frac{m}{2}} = \frac{2BYL}{m} = \frac{2BL\cdot\mathcal{E}}{5Rm} = \frac{2BL}{5Rm}\cdot BLv = \frac{2B^2L^2v_{отн}}{5Rm}.$$

$F = BYL$

$$a_1 = \frac{BYL}{m} = \frac{B^2L^2v_{отн}}{5Rm}.$$





а от V линейная завис.

$$a_{ср} = \frac{a_1}{2}.$$

$3a_1$.

$1{,}5a_1$.

$1{,}5a_1 t = V_0$.

$$\frac{1{,}5\, B^2L^2V_0}{5RM}\, t = V_0 \Rightarrow t = \frac{5RM}{1{,}5B^2L^2}.$$

$$V_{кон} = V_0 - t\cdot\frac{a_1}{2} = V_0 - \frac{5RM}{1{,}5B^2L^2}\cdot\frac{B^2L^2V}{2\cdot 5RM} = V_0 - \frac{V_0}{3} = \frac{2V_0}{3}.$$

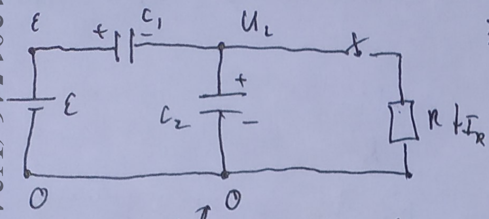
$2\cdot 1{,}5a_1 S = V_0^2$

$3a_1 S = V_0^2$

$$S = \frac{V_0^2}{3\cdot\frac{B^2L^2V_0}{5Rm}} = \frac{5V_0Rm}{3B^2L^2}$$

Чистовик Вариант 11-02

№3.



Метод узловых потенциалов

$I_R = \frac{U_2 - 0}{R} = \frac{3\varepsilon}{4R}$.

До замыкания:

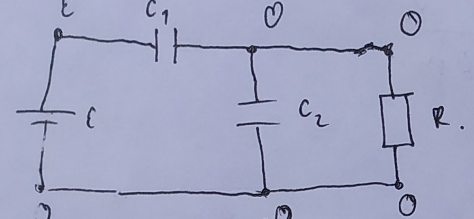
Закон сохранения заряда:

$C_2 U_2 - C_1(\varepsilon - U_2) = 0$

$CU_2 - 3C\varepsilon + 3CU_2 = 0$.

$4U_2 = 3\varepsilon$

$U_2 = \frac{3\varepsilon}{4} \Rightarrow U_1 = \frac{\varepsilon}{4}$.



после замыкания ключа, когда все тепло выделилось. $U_R = 0 \Rightarrow U_{C_2} = 0$.

$W_{кон} = \frac{C_1 \varepsilon^2}{2} = \frac{3C\varepsilon^2}{2}$

$W_{нач} = \frac{C_1 U_1^2}{2} + \frac{C_2 U_2^2}{2} = \frac{3C}{2} \cdot \frac{\varepsilon^2}{16} + \frac{C}{2} \cdot \frac{9\varepsilon^2}{16} = \frac{12}{32} \frac{C\varepsilon^2}{2}$.

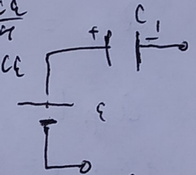
Метод узловых потенциалов:

$\Delta W = \frac{3}{2} C\varepsilon^2 - \frac{12}{32} C\varepsilon^2 = \frac{36}{32} C\varepsilon^2$

$A_{ист} = q_{ист} \varepsilon = \frac{9}{4} C\varepsilon^2$

было $\frac{3C\varepsilon}{4}$

стало $3C\varepsilon$



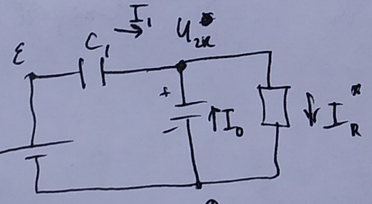
$q_{ист} = 3C\varepsilon - \frac{3}{4} C\varepsilon$

$Q = A_{ист} - \Delta W = \frac{9}{4} C\varepsilon^2 - \frac{36}{32} C\varepsilon^2 =$

$= \frac{36}{32} C\varepsilon^2 = \frac{18}{16} C\varepsilon^2 = \frac{9}{8} C\varepsilon^2$

Закон сохранения заряда

3)



Метод узлов. потенц.

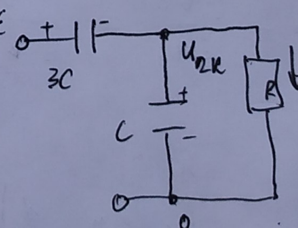
$I_0 = C_2 U_{2к}' = CU_{2к}'$

$I_1 = C_1 U_{1к}' = 3C(\varepsilon - U_{2к})'$

$I_R^* = \frac{U_R}{R} = \frac{U_{2к}}{R}$

$I_0 + I_1 = I_R$

было $-3C\frac{\varepsilon}{4}$; стало $-3C(\varepsilon - U_{2к})$



было $\frac{3C\varepsilon}{4}$ стало $CU_{2к}$.

$q_R = \left(-3C(\varepsilon - U_{2к}) - \left(-3C\frac{\varepsilon}{4}\right)\right) + \left(CU_{2к} - \frac{3C\varepsilon}{4}\right) = -3C\varepsilon + 4CU_{2к}$

$C\frac{U_{2к}^*}{\Delta t} + 3C\frac{(\varepsilon - U_{2к})}{\Delta t} = \frac{U_{2к}}{R} \quad \Big| \cdot \Delta t$

$CU_{2к} + 3C\varepsilon - 3CU_{2к} = \frac{U_{2к}}{R} \cdot \Delta t - q$. (*)

просуммируем (*) за время t от замыкания ключа до I_0

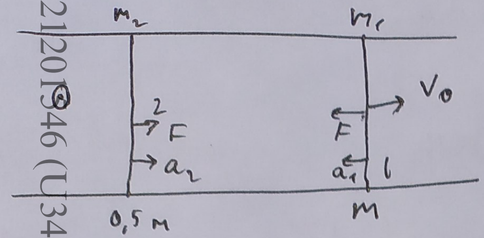
$CU_{2к} + 3C\varepsilon - 3CU_{2к} = q_R$

$-2CU_{2к} + 3C\varepsilon = -3C\varepsilon + 4CU_{2к}$.

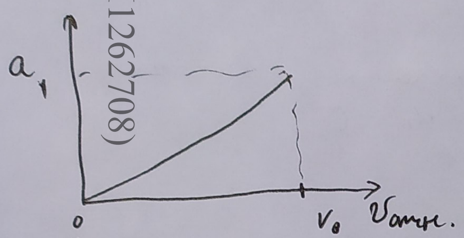
$6C\varepsilon = 6CU_{2к} \Rightarrow U_{2к} = \varepsilon$

Ответ: 1) $\frac{3\varepsilon}{4R}$; 2) $\frac{9}{8} C\varepsilon^2$ 3) $U_{2к} = \varepsilon$

№ 4. Чистовик.



$a_1 = \frac{a_2}{2}$ т.к. $\frac{m_1}{m_2} = 2.$



Линейная зависимость.

1) в контуре возникает $\mathcal{E} = BS' = BlV_{отн.}$

$\mathcal{E} = BlV_0$

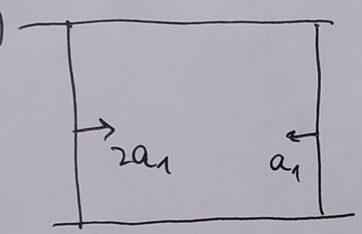
$I = \frac{\mathcal{E}}{5R} = \frac{BlV_0}{5R}$

$F = BIl = \frac{B^2l^2V_0}{5R}$ — на проводники действуют одинаковые силы

$a_2 = \frac{F}{\frac{m}{2}} = \frac{2B^2l^2V_0}{5Rm}.$

$a_1 = \frac{B^2l^2V_0}{5Rm}$

2)



$a_{отн} = 2a_1 + a_1 = 3a_1$ $\qquad a_{1\,\text{сред}} = \frac{a_1}{2}$

$a_{ср} = \frac{3a_1}{2}$

$a_{ср}t = V_0.$

$1{,}5a_1t = V_0.$

$\frac{1{,}5B^2l^2V_0}{5Rm}t = V_0 \Rightarrow t = \frac{5Rm}{1{,}5B^2l^2}$

$V_{кон} = V_0 - t \cdot a_{1\,сред} = V_0 - \frac{5Rm}{1{,}5B^2l^2 \cdot 2} \cdot \frac{B^2l^2V_0}{5Rm} = \frac{2V_0}{3}$ — скорость каждой перемычки

3) $2 \cdot a_{ср}S = V_0^2$

$S = \frac{V_0^2}{3a_1} = \frac{V_0^2}{3\frac{B^2l^2V_0}{5Rm}} = \frac{5V_0Rm}{3B^2l^2}$

Ответ: 1) $a_2 = \frac{2B^2l^2V_0}{5Rm}$; 2) $\frac{2V_0}{3}$

3) $\frac{5V_0Rm}{3B^2l^2}$