Часть 1

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

Шифр: **21203122**

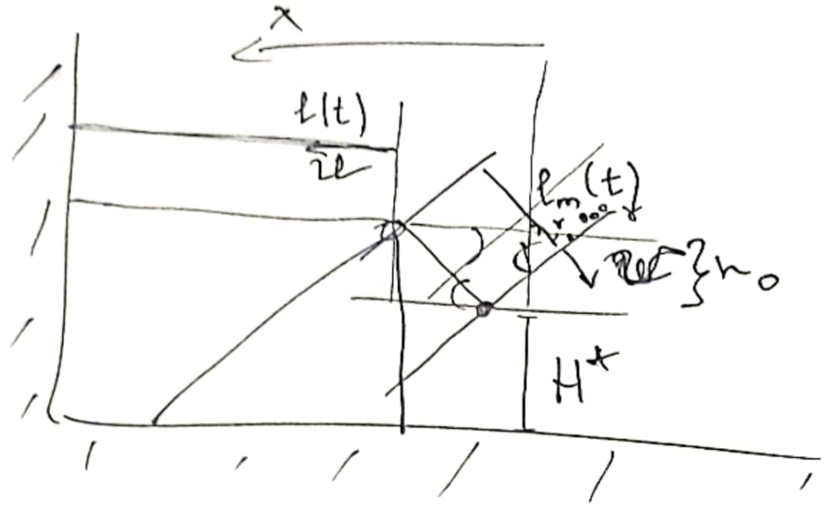
ID профиля: **849478**

Вариант 1

Черновик

$l_m(t)\sin\gamma =$

момент t?



$l(t)+l_m(t)=\text{const}$

$u_x+v_x=0$

$u+(-v\cos\gamma)=0$

$u=v\cos\gamma$

$\vec{v}_{отн}=\vec{v}_{абс}-\vec{v}_{пер}=\vec{v}+(-\vec{u})$

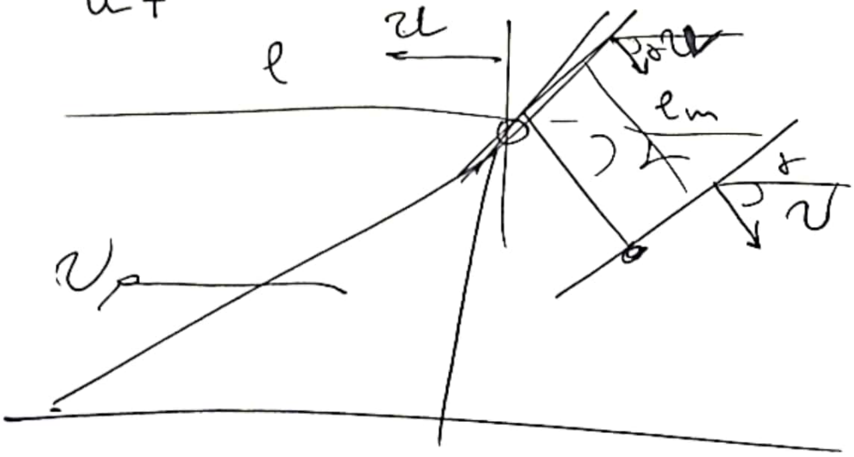
$\vec{v}_{отн}=\vec{v}-\vec{u}$

$0=mv+Mu$ $\quad u-v$ если $u>v$

$l(t)+l_m\cancel{\cos\gamma}(t)=\text{const}$

$AC(t)+Am(t)=\text{const}$

$u+$



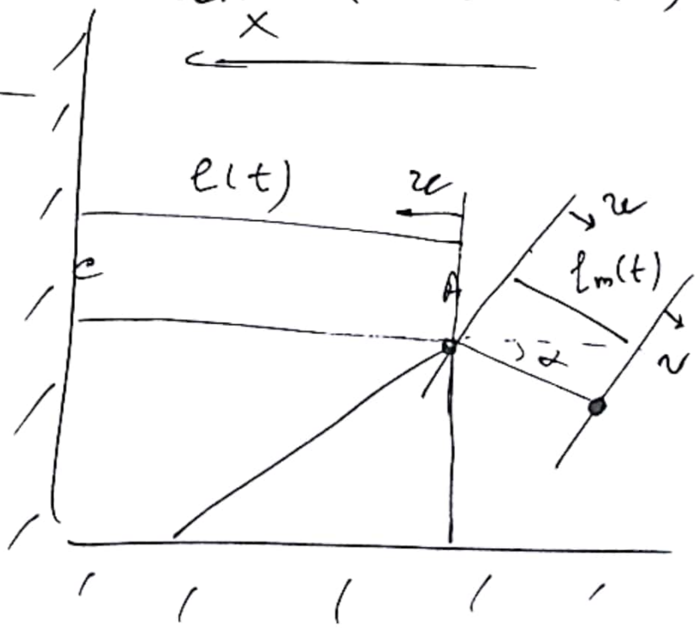
~~$Mu=mv_x$~~

~~$Mu=m$~~

$0=mv\sin\alpha+Mu$

$\vec{v}=\vec{v}_{аб}-\vec{v}_{пер}$

$\vec{v}_{отн}=\vec{u}-\vec{v}=\vec{u}+(-\vec{v})$



$l(t)+l_m(t)=\text{const}$

$u+(-u\cos\gamma-v\cos\gamma)=0$

$u=u\cos\gamma+v\cos\gamma$

~~$l(t)+$~~

~~$l(t)+l_m(t)=\text{const}$~~

~~$u+(v-u)=0$~~

~~$u=u+$~~ $\quad u+v-u=0$

$l_m'(t)>0$

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Черновик

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

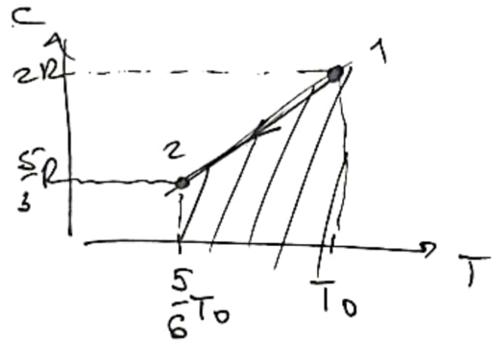
$i=3$

$T_0 \to \frac{5}{6}T_0$

$2R\cdot\frac{\frac{5}{6}\cancel{T_0}}{\cancel{T_0}} = \frac{\cancel{2}\cdot 5R}{\cancel{6}} = \frac{5}{3}R$

$Q = A + \Delta U$

$Q_1 =$



$2R\cdot\frac{\frac{5}{6}\cancel{T_0}}{\cancel{T_0}} =$

$\frac{\cancel{2}R\cdot 5}{\cancel{6}} = \frac{5}{3}R$

$\frac{6}{6} - \frac{5}{6} = \frac{1}{6}$

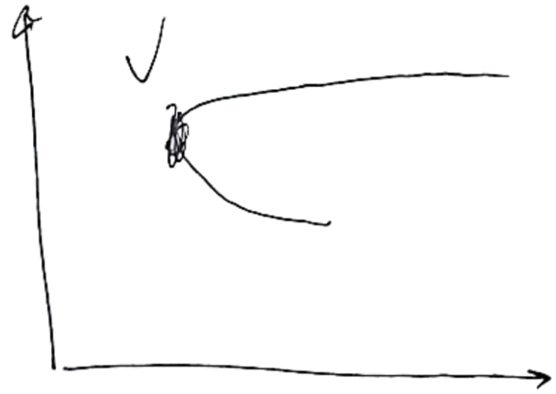
$Q_1 = \frac{11}{36}\nu R T_0$

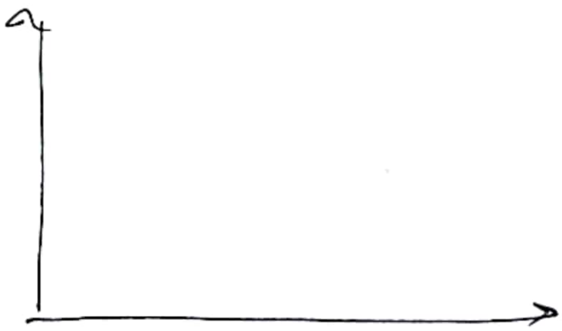
$\frac{5}{3} + 2 = \frac{5+6}{3} = \frac{11}{3}$

$\frac{1}{2}\cdot\frac{11}{3}\cdot\frac{1}{6} = \frac{11}{36}$

$A = p\Delta V$

c

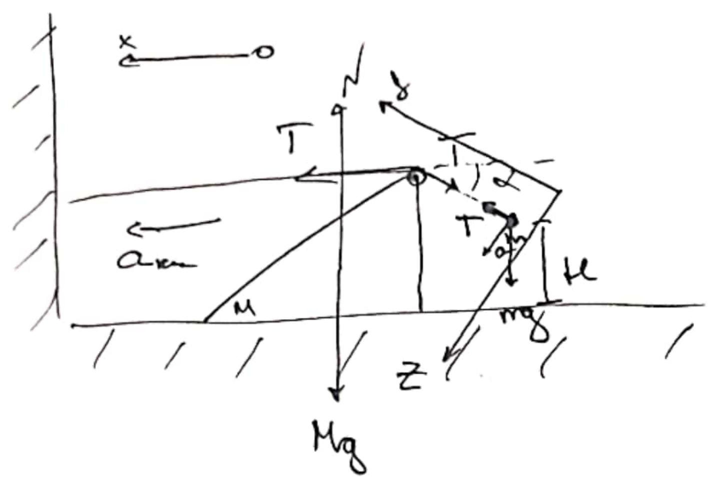




$pV = \nu RT \Rightarrow T = \frac{pV}{\nu R}$ $\quad p_0V_0 = \nu RT_0$

$c(V) = 2R\frac{\frac{pV}{\cancel{\nu R}}}{\frac{p_0V_0}{\cancel{\nu R}}} = 2R\frac{pV}{p_0V_0}$ $\quad T_0 = \frac{p_0V_0}{\nu R}$

3) Рисунок с силами в нач. момент.



для клина ось Ox
для шара оси Oyz

2 ЗН для шара: $O\cancel{z}$: $ma = mg\cos\alpha \Rightarrow \boxed{a = g\cos\alpha}$

Oy: $\boxed{T = mg\sin\alpha}$

2 ЗН для клина: Ox: $Ma_{кл} = T - T\cos\alpha = T(1-\cos\alpha)$

~~$Ma_{кл} = mg\sin\alpha(1-\cos\alpha)$~~

4) $a_{кл} = \frac{a}{2}$

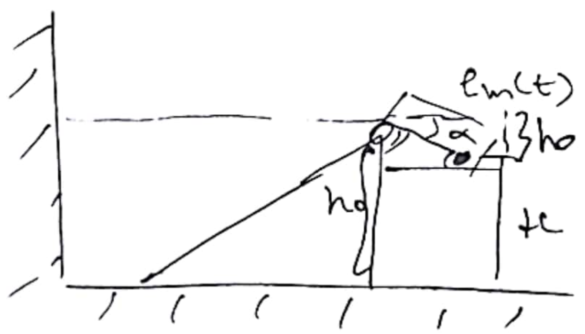
$a_{кл} = \frac{1}{2}g\cos\alpha$

5) $Ma_{кл} = mg\sin\alpha(1-\cos\alpha)$

$M\cdot\frac{1}{2}\cancel{g}\cos\alpha = m\cancel{g}\sin\alpha(1-\cos\alpha)$

$$\frac{m}{M} = \frac{\frac{1}{2}\cos\alpha}{\sin\alpha(1-\cos\alpha)} = \frac{\frac{1}{2}\cdot\frac{3}{5}}{\frac{4}{5}(1-\frac{3}{5})} = \frac{\frac{3}{10}}{\frac{4}{5}\cdot\frac{2}{5}} = \frac{3\cdot5\cdot5}{10\cdot8} = \frac{15}{16}$$

6)



$h = H + l_m(t)\sin\alpha$

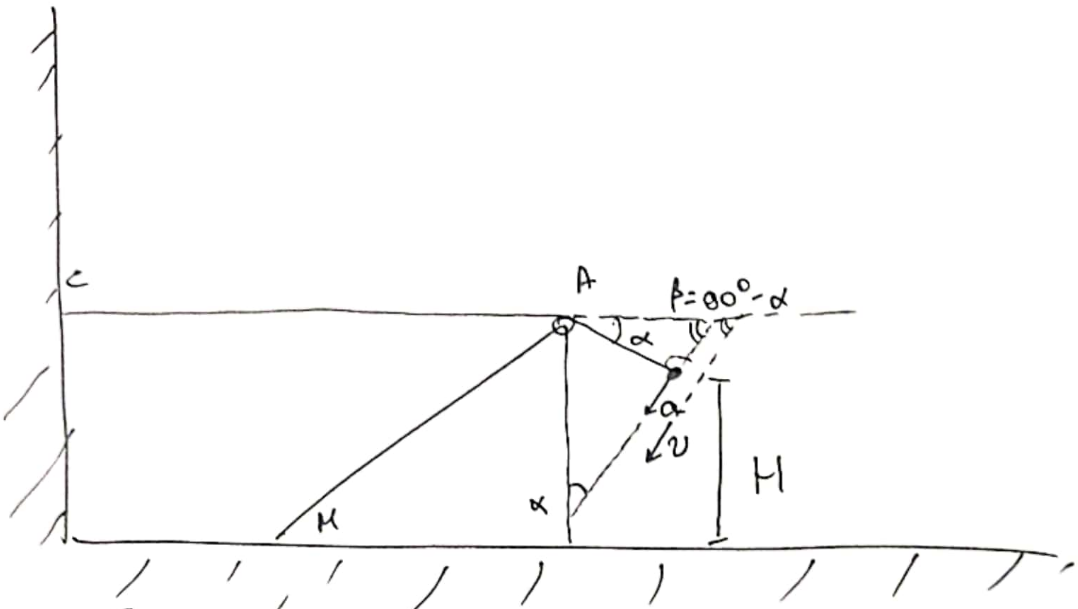
$h' = H' + (l_m(t)\sin\alpha)'$

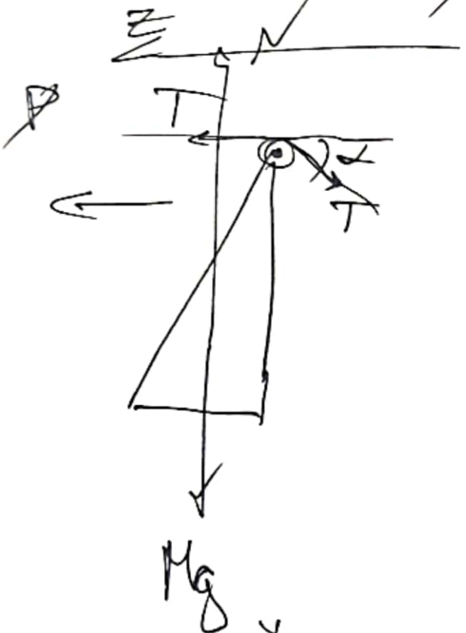
$0 = H' + (v-u)\cos\alpha\cdot\alpha'$

$-H' = (v-u)\cos\alpha\cdot\alpha'$

$-\frac{\Delta H}{\Delta t} = (v-u)\cos\alpha\cdot\frac{\Delta\alpha}{\Delta t}$

β $\cos\beta = \cos(90^\circ - \alpha)$
$= \sin\alpha = \frac{4}{5}$





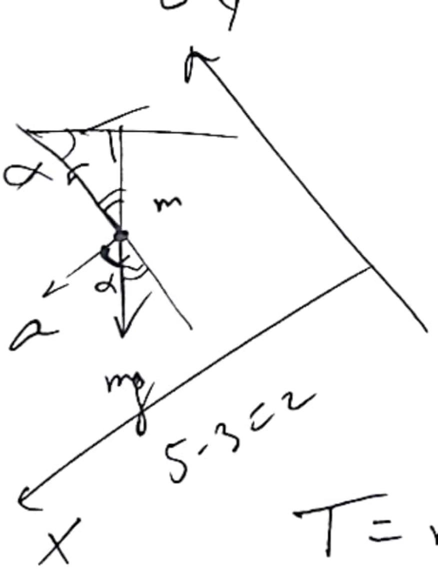
x: $Ma_{rcu} = T - T\cos\alpha = T(1-\cos\alpha)$

$$a_{rcu} = \frac{T(1-\cos\alpha)}{M}$$

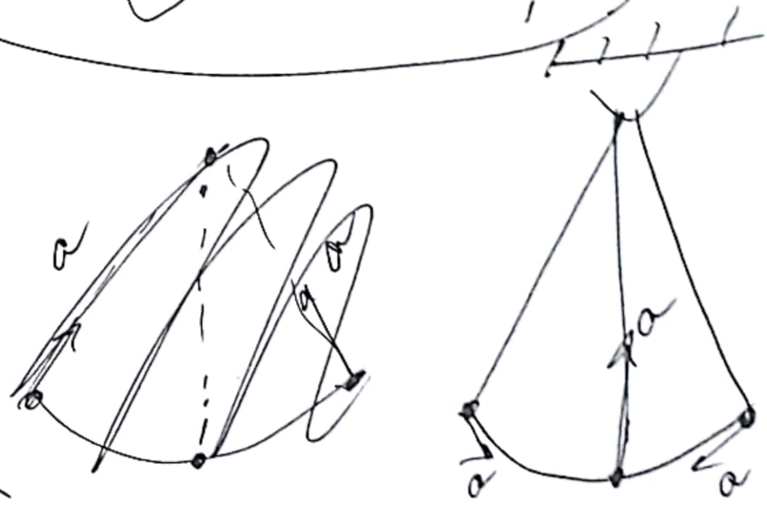
y: $T = mg\sin\alpha$

x: $ma = mg\cos\alpha \Rightarrow a = \cancel{g\sin\alpha}$ $g\cos\alpha$

$$a_{rcu} = \frac{m}{M} g\sin\alpha(1-\cos\alpha)$$



$T = mg\sin\alpha$



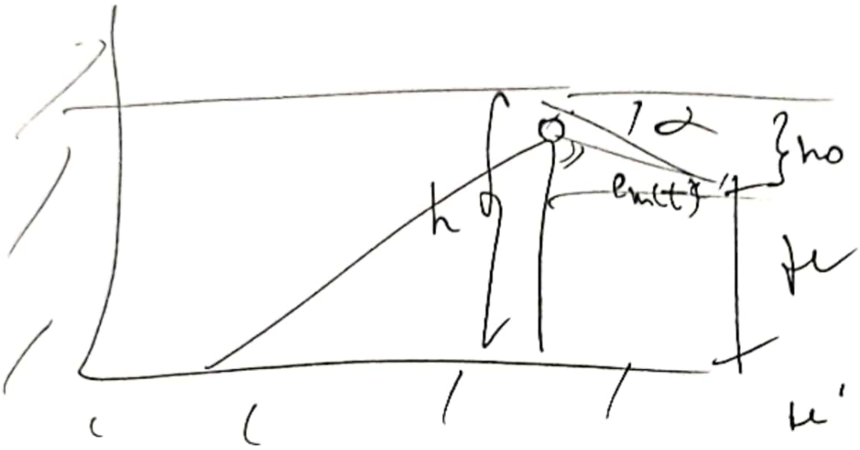
Циркообенс

$v_0 = 0$

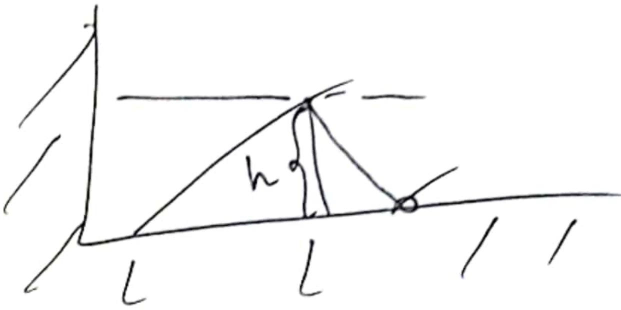
$a \neq const$

$S = H$

$\cancel{l_m(t) \sin\gamma} =$



$H' < 0$



$\frac{h_0}{l_m} \quad \frac{H}{l_m}$

$h = H + l_m(t) \sin\alpha$

$0 = H' + l_m'(t) \cos\alpha$

$\cancel{H' = l_m(t) \cos\alpha \cdot \alpha'}$

$\cancel{\frac{\Delta H}{\Delta t} = l_m(t)}$

$H' = (v - u)\cos\alpha \cdot \alpha'$

$\frac{\Delta H}{\Delta t} = (v - u)\cos\alpha \cdot \alpha'$

$\Delta\alpha = 90 -$

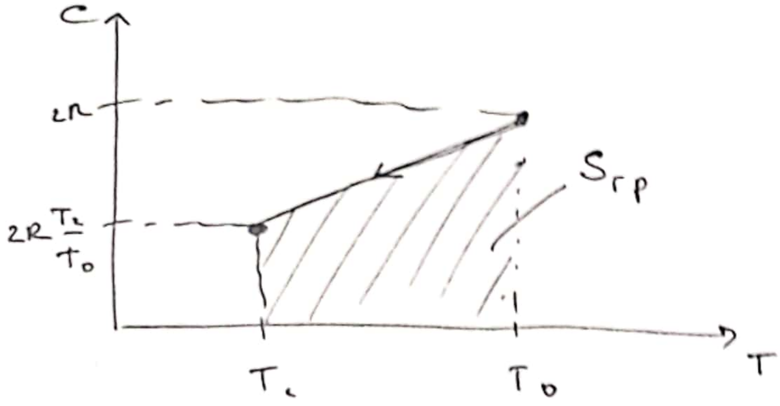
$\Delta H = (v - u)\cos\alpha \cdot \alpha' \cdot \Delta t \quad \Sigma$

$\cancel{H = (v - u)\cos\alpha}$

$\frac{\Delta H}{\cancel{\Delta t}} = (v - u)\cos\alpha \cdot \frac{\Delta\alpha}{\cancel{\Delta t}}$

$\Delta H = (v - u)\cos\alpha \, \Delta\alpha$

$H = (v - u)\cos\alpha \cdot$



т.к. газ охлаждается $Q_2 = -\nu S_{гр}$

$$\nu(-S_{гр}) = \frac{3}{2}\nu R(T_2 - T_0)$$

$$-\nu\left(\frac{1}{2}\left(C(T_0) + C(T_2)\right)(T_0 - T_2)\right) = \frac{3}{2}\nu R(T_2 - T_0)$$

$$-\nu\left(\frac{1}{2}\left(2R + 2R\frac{T_2}{T_0}\right)(T_0 - T_2)\right) = \frac{3}{2}\nu R(T_2 - T_0)$$

$$-\cancel{\nu}\cdot\frac{1}{\cancel{2}}\cdot 2\cancel{R}\cdot(T_0 - T_2)\cdot\left(1 + \frac{T_2}{T_0}\right) = \frac{3}{\cancel{2}}\cancel{\nu}\cancel{R}(T_2 - T_0)$$

$$-2(T_0 - T_2)\left(1 + \frac{T_2}{T_0}\right) = 3(T_2 - T_0)$$

$$2(\cancel{T_2 - T_0})\left(1 + \frac{T_2}{T_0}\right) = 3(\cancel{T_2 - T_0})$$

$$\cancel{2R \cdot 1 + \frac{T_2}{T_0} = \frac{3}{2R}}$$

$$\cancel{\frac{T_2}{T_0} = \frac{3}{}}$$

$$1 + \frac{T_2}{T_0} = \frac{3}{2}$$

$$\frac{T_2}{T_0} = 1{,}5 - 1 = 0{,}5$$

$$T_2 = 0{,}5T_0$$

Ответ: 1) $Q_1 = \frac{11}{36}\nu R T_0$

2) $T_2 = 0{,}5T_0$

3) $A_{min} = 0$

Чистовик (2) вариант 11-01

(N 1)

$\cos\alpha = \frac{3}{5}$

(α)

(м)

---

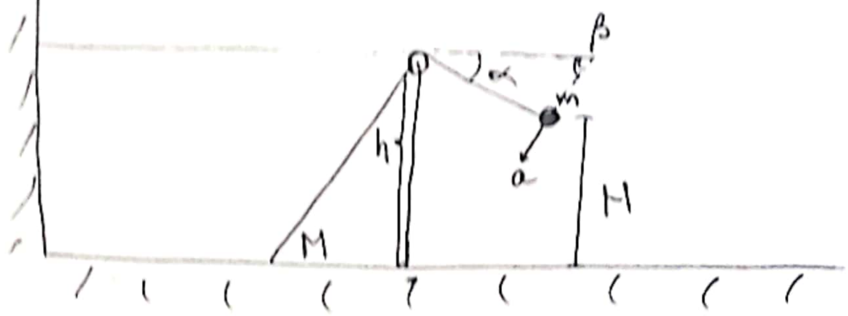
1) $\beta = ?$

2) $a_{кл} = ?$

3) $\frac{m}{M} = ?$

4) $T = ?$

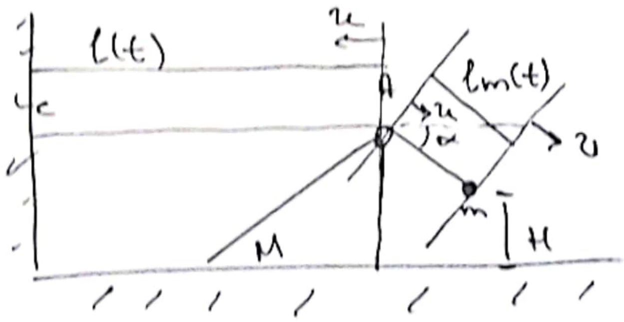
1) Рассм. систему в начальный момент времени



в начальный момент времени ускорение у шарика имеет только касательную составляющую.

$\cos\beta = \cos(90^\circ - \alpha) = \sin\alpha = \frac{4}{5}$ (по ОТТ)

2) Рассм. сист. в начальный момент времени.



$l(t) + l_m(t) = const$, т.к. нить нерастяжима

$l'(t) + l_m'(t) = 0$

$-u + (v - u) = 0$

$v = 2u$, где v - скорость шара
u - скорость клина

$a = 2a_{кл}$

$a_{кл} = \frac{a}{2}$

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Чистовик (3) вариант 11-01

№1 $\Delta H = (v-u)\cos\alpha \cdot \Delta\alpha \quad (*)$

Просуммируем за все время движ. шара

$$\frac{H}{l_m(t)} - \frac{h_0}{l_m(t)}$$

$$\sum_{0-H} \Delta H = (v-u)\cos\alpha \cdot \sum \Delta\alpha$$

$$H = \cancel{(v-u)}\cos\alpha \cdot \frac{H-h_0}{\cancel{l_m(t)}}$$

Ответ: 1) $\cos\beta = \frac{4}{5}$

2) $a_{x} = \frac{1}{2} g\cos\alpha$

3) $\frac{m}{M} = \frac{15}{16}$

Чистовик 1 Вариант 11-01

№2

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

Q

$i = 3$

1) $Q_1 = ?$

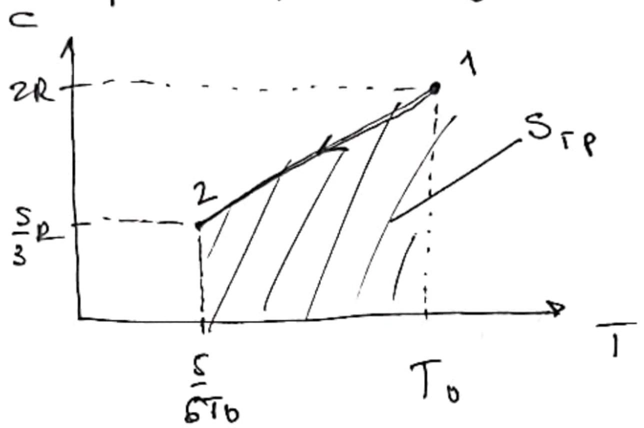
2) $T_2 = ?$

3) $A_{min} = ?$

1) ~~$Q_1 = A_1 + \Delta U$~~,

$Q_1 = \nu(\pm S_{гр})$

Построим график зависимости c от T:



т.к. газ охлаждается $Q_1 = \nu(-S_{гр})$

$Q_1 = \nu\cdot\left(-\left(\frac{1}{2}\left(c(T_0) + c\left(\frac{5}{6}T_0\right)\right)\cdot\left(T_0 - \frac{5}{6}T_0\right)\right)\right) =$

$= \nu\cdot\left(-\left(\frac{1}{2}\left(\frac{5}{3}R + 2R\right)\right)\left(\frac{1}{6}T_0\right)\right) =$

$= \nu\cdot\left(-\left(\frac{1}{2}\cdot\frac{11}{3}R\cdot\frac{1}{6}T_0\right)\right) = -\frac{11}{36}\nu RT_0$

~~2) т.к.~~ газ получит $Q_1 = -\frac{11}{36}\nu RT_0$,

тогда он получит $-Q_1$ теплоты,

значит $Q_1 = \frac{11}{36}\nu RT_0$

2) работа газа минимальна тогда, когда она равна нулю. ~~A_{min}~~ $A_{min} = 0$

$Q_2 = A_2 + \Delta U_2 = \overset{=0}{A_{min}} + \Delta U_2 = \Delta U_2 = \frac{3}{2}\nu R(T_2 - T_0)$

$\nu(\pm S_{гр.}) = \frac{3}{2}\nu R(T_2 - T_0)$

Построим график зависимости c от T:

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Черновик

~~прохождение~~
сам.-поч. · мом. · бу.

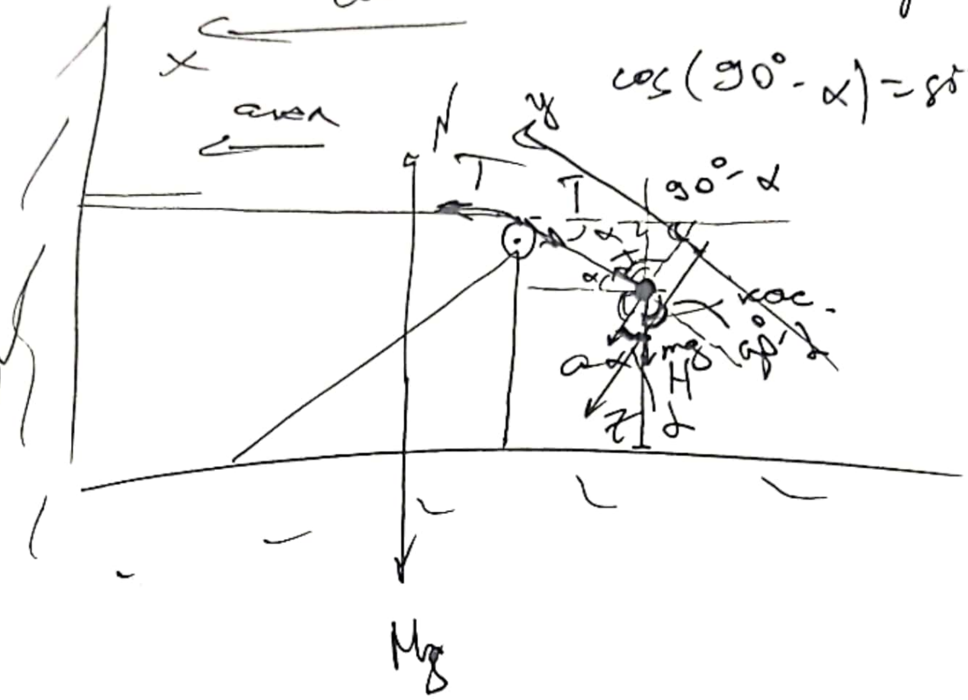
нерастяж.

$\alpha = const$

M

1) ~~cos~~ $\sin\beta = \frac{4}{5}$

2)



2 з-н: $M_{кл} a_{кл} = T - T\cos\alpha$

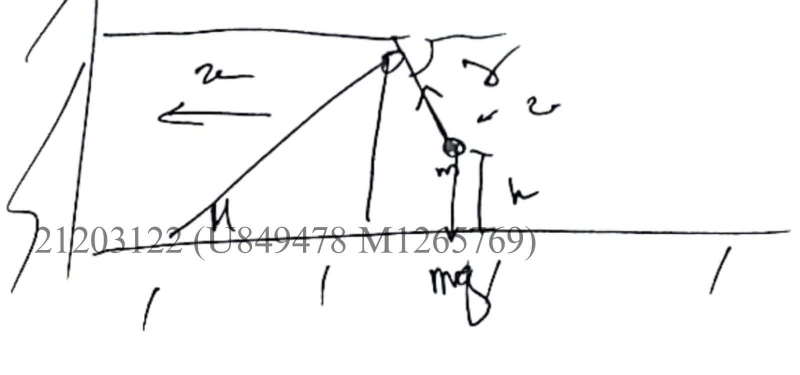
$M_{кл} a_{кл} = T(1 - \cos\alpha)$

~~ma~~ 2 з-н: z: $\cancel{m}a = \cancel{m}g\cos\alpha \Rightarrow a = g\cos\alpha$

y: $T = mg\sin\alpha$

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

3) импульс



~~т.о.~~ по сути i

$$c(V) = 2R\frac{pV}{p_0V_0}\ \text{const}$$

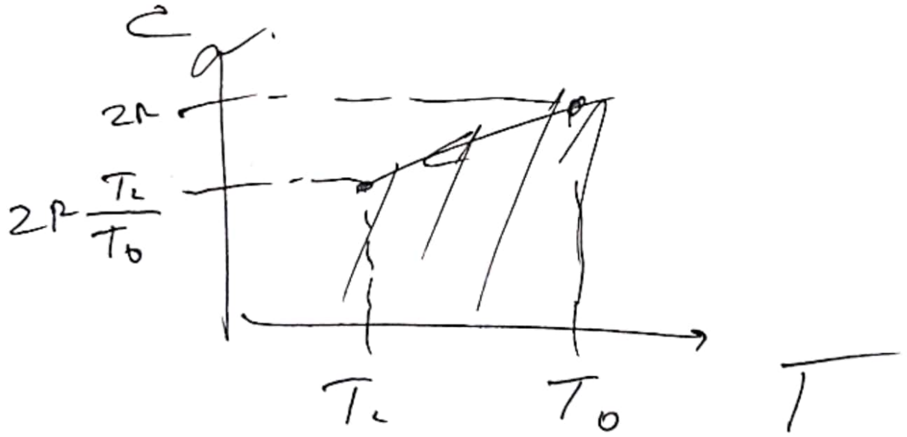
$A_{min} = -\Delta S_{гр\,min}$ по идее $=0$ куда уж меньше чем 0.

$A_{min} = 0$.

$$Q_2 = \Delta U_2 + \underbrace{A_2}_{=0} = \Delta U_2$$

$$Q_2 = \frac{3}{2}\nu R(T_2 - T_0)$$

$$\nu(\pm S_{гр}) = \frac{3}{2}\nu R(T_2 - T_0)$$



$2R$ при T_0

$$2R\frac{T_2}{T_0} < 1$$

$$\nu(-S_{гр}) = \frac{3}{2}\nu R(T_2 - T_0)$$

Тогда $A_{min} = 0$.

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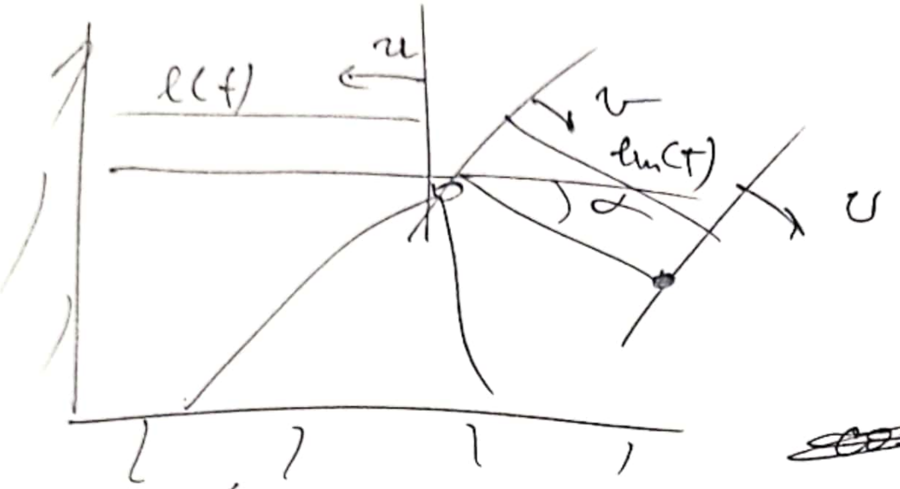
Черновик.



Зм;

① =

~~$\cos\beta = \sin 90°-$~~

$\cos\beta = \cos(90° - \alpha) = \sin\alpha = \frac{4}{5}$

$l_m(t) + l(t) = const$

$l'_m(t) > 0$

$l'(t) < 0$

$\boxed{\cos\beta = \frac{4}{5}}$

$(v - u) + (-u) = 0$

$v - u - u = 0$

$v = 2u$

$a = 2a_{кл} \Rightarrow \boxed{a_{кл} = \frac{a}{2} = \frac{1}{2} g\cos\alpha}$

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

~~$M \frac{1}{2} g \sin$~~

$M \frac{1}{2} g \cos\alpha = mg\sin\alpha(1 - \cos\alpha)$

$\frac{m}{M} = \frac{1}{2}\cos\alpha \Big/ \sin\alpha(1 - \cos\alpha)$

Часть 2

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

Шифр: **21203122**

ID профиля: **849478**

Вариант 1

$$\cancel{v_0^2} = 2v_2^2 + \cancel{v_0^2} + 2\cdot 2v_2 \cdot v_0 + 4v_2^2$$

$$2v_2^2 + 4v_2 v_0 + 4v_2^2 = 0$$

$$6v_2^2 + 4v_2 v_0 = 0$$

$$v_2(6v_2 + 4v_0) = 0$$

$$v_2 = 0 \qquad v_2 = -\frac{2}{3}v_0$$

$$v_1 = v_0 - v_2 = v_0 + \frac{2}{3}v_0 = \frac{5}{3}v_0$$

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Сила Ампера постоянна, т.к. $I = const$.

По з. об изм. кин. энергии:

$$A_{F_A} = \left(\frac{2mV_2^2}{2} + \frac{mV_1^2}{2}\right) - \frac{mV_0^2}{2}$$

$$2(A_{F_{A_1}} + A_{F_{A_2}}) = (2mV_2^2 + mV_1^2) - mV_0^2$$

$$2(F_{A_1} \cdot S_1 + F_{A_2} \cdot S_2) = (2mV_2^2 + mV_1^2) - mV_0^2$$

$$2F_A(S_1 + S_2) = (2mV_2^2 + mV_1^2) - mV_0^2$$

$$2F_A\left(\frac{V_1^2 - V_0^2}{2a_1} + \frac{V_2^2}{2a_2}\right) = 2mV_2^2 + mV_1^2 - mV_0^2, \text{ где } a_1 = \frac{B^2L^2V_0}{3Rm}$$

$$2 \cdot \frac{B^2L^2V_0}{3R}\left(\frac{V_1^2 - V_0^2}{\frac{2B^2L^2V_0}{3Rm}} + \frac{V_2^2}{\frac{2B^2L^2V_0}{6mR}}\right) = 2mV_2^2 + mV_1^2 - mV_0^2$$

$$2\frac{B^2L^2V_0}{3R}\left(\frac{(3Rm)(V_1^2 - V_0^2) + 6mR(V_2^2)}{2B^2L^2V_0}\right) = 2mV_2^2 + mV_1^2 + mV_0^2$$

$$m(V_1^2 - V_0^2) + 2mV_2^2 = 2mV_2^2 + mV_1^2 - mV_0^2$$

$$V_1^2 - V_0^2 + 2V_2^2 = 2V_2^2 + V_1^2 - V_0^2 \quad \Rightarrow 0 = 0$$

т.к. движ равноускор: $V_1 = V_0 + a_1 t = V_0 + \frac{B^2L^2V_0}{3Rm}t$

$V_2 = 0 + a_2 t = 0 + \frac{B^2L^2V_0}{6Rm}t$

Отсюда: $V_1 = V_0 + 2V_2$ (1)

т.к. $0 = 0$ энергия сохраняется

~~Из ЗСИ по оси Ox: $-mV_0$ mV_1 $2mV_2$~~

~~$V_1 = 2V_1 - V_0$~~

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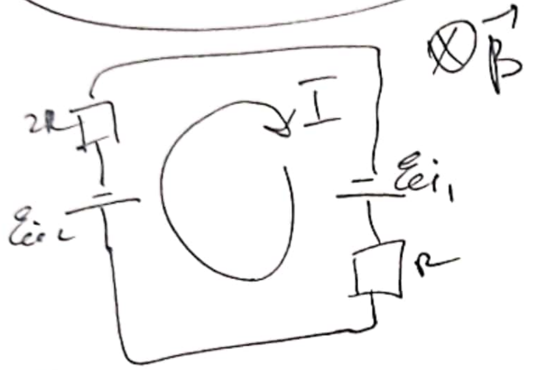
Черновик   6-2=4

9·2=18

$\frac{2\mathcal{E}}{3R}$ — 1 б.   №3

$a_2 = \frac{B^2L^2v_0}{8mR}$ — 1 б.

$\frac{2}{3}C\mathcal{E}^2$ — 2 б.



$I = \frac{|\mathcal{E}_{i_1} - \mathcal{E}_{i_2}|}{3R}$

$= \frac{BL(v_1 - v_2)}{3R}$

~~BIL~~ $F_{A_1} = F_{A_2}$

BIL

$F_A = \frac{B^2L^2(v_1+v_2)}{3R}$

$I_0 = I^* + i^*$

$u = LI'$

$I = Cu'$

$I_0 = 2C \cdot u'_{2c}$

$\Rightarrow u' = \frac{I_0}{2C}$

$\frac{\Delta u}{\Delta t} = \frac{I_0}{2C}$

$I_0 = 2C \cdot u'_{2c}$

$2Cu'_{2c} = I^* + CU'_c$

$I^* = C(2u'_{2c} - u'_c)$

$U_2 = U_c$

$I^* R = U_c$

$I^* = C(2U'_{2c}$

$I^* = \frac{U_c}{R}$

$\cancel{C(2u'_{2c} - u'_c) = \frac{u_c}{R}}$

$I^* R = \varphi$

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Чистовик ② вариант 11-01

№3 Продолжение: $-3C\varphi' = I^*$

7) $I_0 = 2C\,U'_{2C} = 2C(\mathcal{E} - \varphi)' = 2C(0 - \varphi') = -2C\varphi'$

$$-C\varphi' = \frac{I_0}{2}$$

8) Значит: $I^* = 3\cdot(-C\varphi') = 3\cdot\frac{I_0}{2} = \frac{3}{2}I_0$

Ответ: 1) $i = \frac{2\mathcal{E}}{3R}$

2) $Q = \frac{2}{3}C\mathcal{E}^2$

3) $I^* = \frac{3}{2}I_0$

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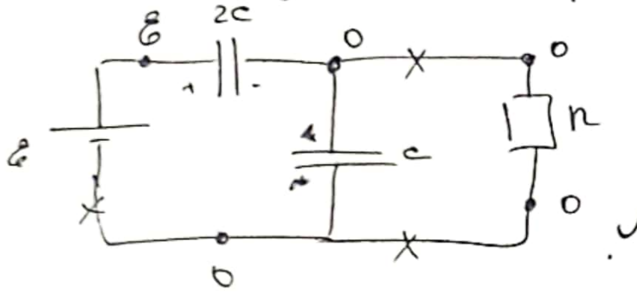
3) Рассм. цепь в уст. сост. при —K. Тока в цепи нет.



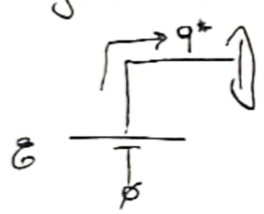
метод потенциалов

$U_{2C}(t_{уст}) = \mathcal{E} - 0 = \mathcal{E}$

$U_C(t_{уст}) = 0 - 0 = 0$

Найдем энергию в конце: $W(t_{уст}) = \frac{2C}{\cancel{2}}(\mathcal{E})^2 + 0 = C\mathcal{E}^2$

4) Найдем $A_б$:



Был заряд $+\frac{2C\mathcal{E}}{3}$

стал заряд $+2C\mathcal{E}$

$$q^* = 2C\mathcal{E} - \frac{2}{3}C\mathcal{E} = \frac{4}{3}C\mathcal{E}$$

$$A_б = \mathcal{E}\cdot q^* = \frac{4}{3}C\mathcal{E}^2$$

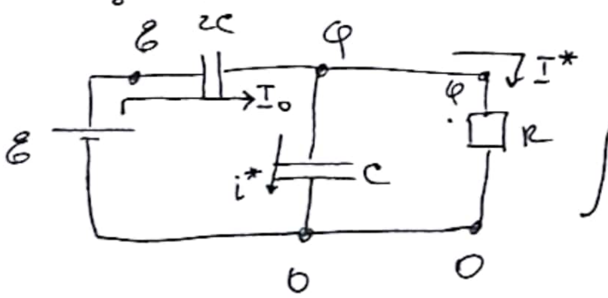
5) Рассм. процесс от $t=0$ до $t=t_{уст}$:

ЗСЭ: $A_б = W(t_{уст}) - W(0) + Q$

$$\frac{4}{3}C\mathcal{E}^2 = C\mathcal{E}^2 - \frac{C\mathcal{E}^2}{3} + Q$$

$$Q = \frac{4}{3}C\mathcal{E}^2 + \frac{C\mathcal{E}^2}{3} - C\mathcal{E}^2 = \frac{5}{3}C\mathcal{E}^2 - \frac{3}{3}C\mathcal{E}^2 = \frac{2}{3}C\mathcal{E}^2$$

6) Рассм. цепь в момент, когда ток через $\overset{2C}{—||—}$ I_0.



метод потенциалов

По ЗСЗ: $I_0 = i^* + I^*$

$$2C(\mathcal{E} - \varphi)' = C\varphi' + I^*$$

$$2C(0 - \varphi') = C\varphi' + I^*$$

$$-2C\varphi' = C\varphi' + I^*$$

Чистовик (4)

№4

$$5)\ \cancel{\begin{cases} v_1 = v_0 + 2v_2 \\ v_1 = 2v_2 - v_0 \end{cases}}$$

$$\text{сложим: } \cancel{2v_1 = 4v_2}$$

$$\cancel{v_1 = 2v_2}$$

~~вычтем~~ $\cancel{0 = v_0 + 2v_2 - 2v_2 + v_0}$

$$\frac{mv_0^2}{2} = \frac{2mv_2^2}{2} + \frac{mv_1^2}{2} \Rightarrow v_0^2 = 2v_2^2 + v_1^2 \quad (2)$$

Подставим (1) в (2) и получим:

$$\boxed{\begin{aligned} v_1 &= \frac{5}{3}v_0 \\ v_2 &= -\frac{2}{3}v_0 \text{ (против оси OX)} \end{aligned}}$$

Чистовик (1) вариант 11-01

№3

$\mathcal{E} = E$

$C_1 = 2C$

$C_1 = C$

$R,\ I_0$

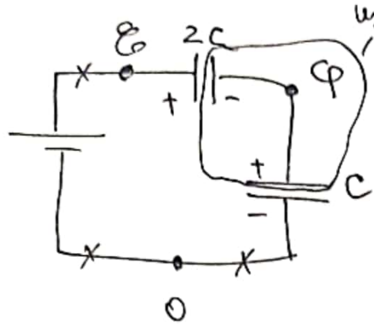
1) $i = ?$

2) $Q = ?$

3) $I^* = ?$

~~1) Рассм. цепь сразу после замыкания ключа~~

0) Рассм. цепь непоср. перед замыканием ключа. Она в уст. сост. Тока нет.



метод потенциалов

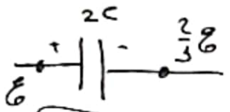
~~3ЗК~~ ЗСЗ: $-2\cancel{C}(\mathcal{E}-\varphi)+\cancel{C}(\varphi-0)=0$

$$-2\mathcal{E}+2\varphi+\varphi=0$$

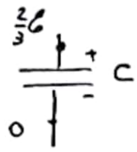
$$2\mathcal{E}=3\varphi$$

$$\varphi=\frac{2}{3}\mathcal{E}$$

Тогда:

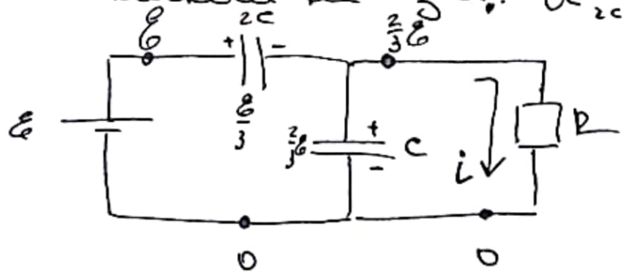


$$\boxed{U_{2C}=\mathcal{E}-\frac{2}{3}\mathcal{E}=\frac{\mathcal{E}}{3}}$$



$$\boxed{U_C=\frac{2}{3}\mathcal{E}-0=\frac{2}{3}\mathcal{E}}$$

1) Рассм. цепь сразу после замык. ключа. Напряжение на —||— скачком не изм.: $U_{2C}(0)=\frac{\mathcal{E}}{3}$ и $U_C(0)=\frac{2}{3}\mathcal{E}$



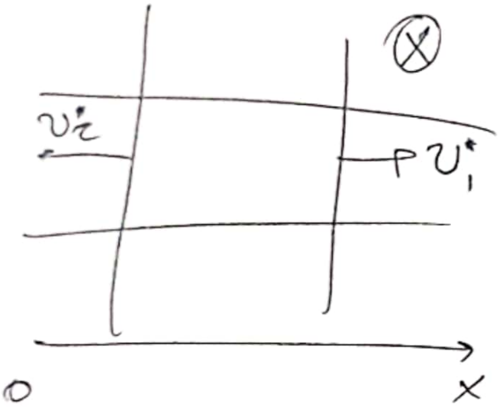
метод потенциалов

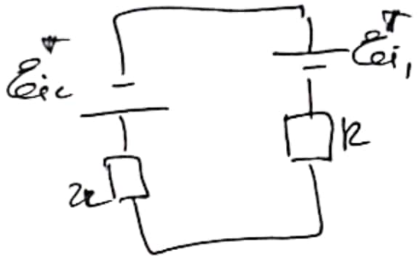
$$i=\frac{\frac{2}{3}\mathcal{E}-0}{R}=\frac{2\mathcal{E}}{3R}$$

2) Найдем энергию в начале: $W(0)=\frac{C}{2}\left(\frac{2}{3}\mathcal{E}\right)^2+\frac{2C}{2}\left(\frac{\mathcal{E}}{3}\right)^2=$

$$=\frac{4C\mathcal{E}^2}{16}+\frac{2C\mathcal{E}^2}{18}=\frac{6C\mathcal{E}^2}{18}=\frac{C\mathcal{E}^2}{3}$$

Черновик





$\downarrow \longrightarrow F_A$

$\rightarrow a_1$

$BIL = ma_1$

$\frac{B^2L^2}{3R}v_0 = ma_1$

$a_1 = \frac{B^2L^2v_0}{3Rm}$

$I = \frac{\mathcal{E}_{i1}^* + \mathcal{E}_{i2}^*}{3R} = \frac{BL(v_1^* + v_2^*)}{3R}$ $\vdots 6$

const $\quad v_0 + a_1t \quad 0 + a_2t$

$F_A = BIL = \frac{B^2L^2}{3R}(v_1^* + v_2^*)$

$v_1 = v_0 + a_1 t$

$v_2 = 0 + a_2 t$

$F_A = \frac{B^2L^2}{3R}(v_0 + a_1t + a_2t) = \frac{B^2L^2}{3R}(v_0 + (a_1 + a_2)t)$

$v_1 + v_2 = \frac{I \cdot 3R}{BL}$

$a_1 + a_2 = \frac{B^2L^2v_0}{3Rm} + \frac{B^2L^2v_0}{6mR} = \frac{1}{2}\frac{B^2L^2v_0}{mR}$

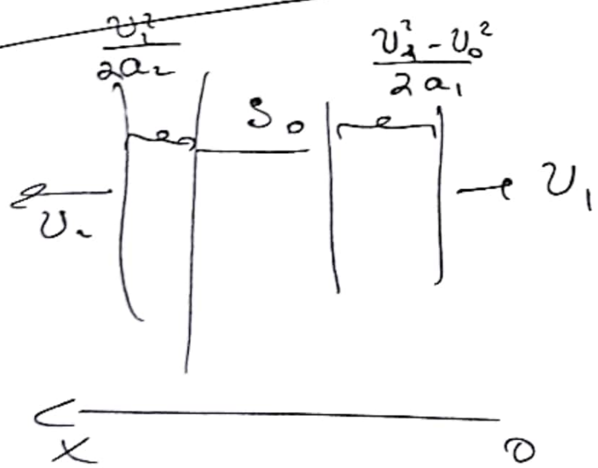
$$\boxed{v_1 = v_0 + \frac{B^2L^2v_0}{3Rm}t \qquad v_2 = \frac{B^2L^2v_0}{6Rm}t}$$

$F_A = \frac{B^2L^2}{3R}\left(v_0 + \frac{B^2L^2v_0}{2mR}t\right)$ - лин зав.

$\cancel{\frac{1}{2}v_1 + v}$

$2a_xS_x = v^2 - v_0^2$

$S = \frac{v_2^2 - 0}{2a_2}$

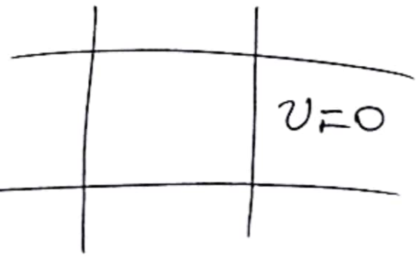


$2(-S)(-a_1) = v_1^2 - v_0^2$

$S = \frac{v_1^2 - v_0^2}{2a_1}$

$\longleftarrow F_A$

$\longrightarrow F_A$



$v_1 = v_0 + \cancel{\frac{B^2L^2v_0}{3Rm}} \cdot \frac{v_2 \cdot \cancel{6Rm}}{\cancel{B^2L^2v_0}}$

$$\boxed{v_1 = v_0 + 2v_2}$$

$F_A = BIL = \frac{B^2L^2v_0}{3R}$

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$v_1 + v_2 =$

(3) Чистовик вариант 11-01

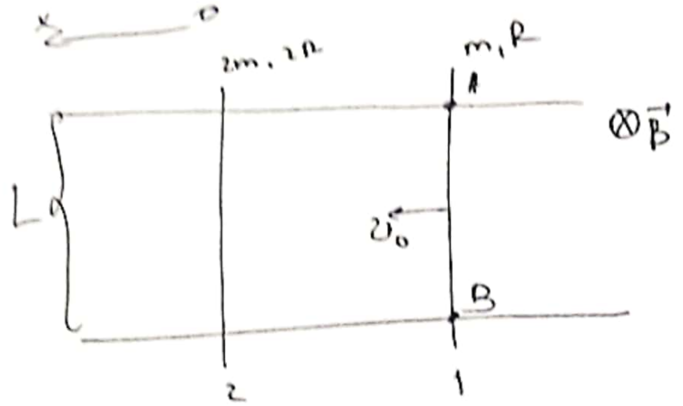
№4

L
m, R
2m, 2R
v_0, S_0

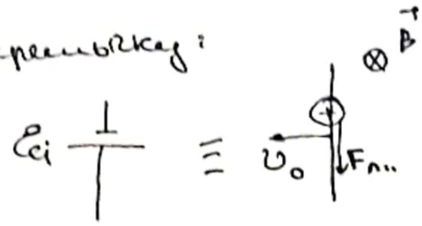
---

1) $a_1 = ?$
2) $v_1 = ?$ $v_2 = ?$
3) $S = ?$

1)



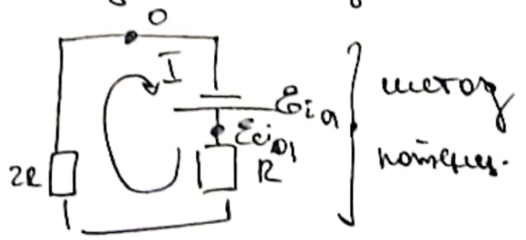
Рассм. первую перемычку:



$F_{л\parallel}$ - продольная составляющая силы Лоренца обусл. движ. проводника

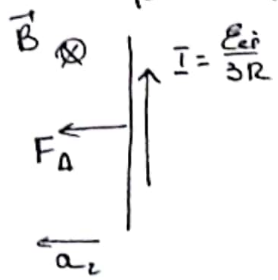
При движении перемычки 1 в МП между т. A и B возникает $\mathcal{E}_i = B v_0 L \sin 90^\circ = B v_0 L = const$

2) Рассм. эл. цепь ~~экв. данны~~ экв. установке:



$I = \frac{\mathcal{E}_{i01}}{3R} = const$

3) Рассм. перемычку 2 в нач. момент. времени:



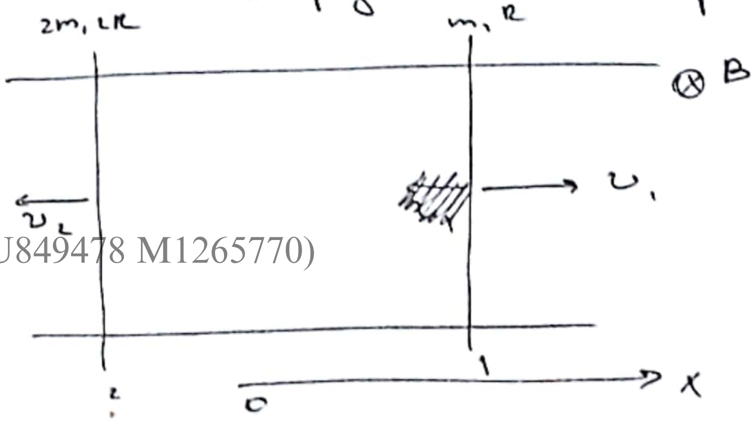
$F_A = 2m a_2$

$B I L \sin 90^\circ = 2m a_2$

$B L \cdot \frac{\mathcal{E}_i}{3R} = 2m a_2$

$$\boxed{a_2 = \frac{B^2 L^2 v_0}{6mR} = const}$$

4) Рассм. цепь через продолжительный промежуток времени:



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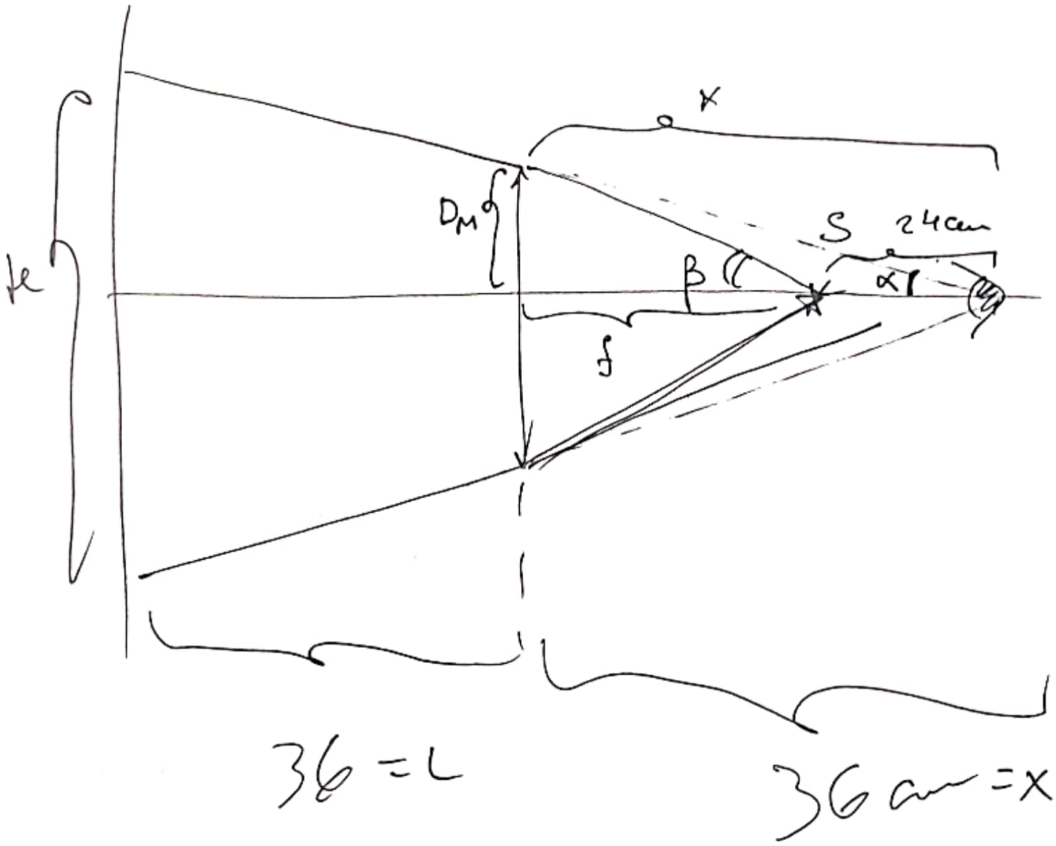

$$\Gamma = 1 = \frac{y}{\cancel{x}} = \frac{f}{d} = 1$$

$$\cancel{tg\beta} \quad tg\beta = \frac{D_M}{f} \qquad tg\alpha = \frac{D_M}{x}$$

$$f\,tg\beta = x\,tg\alpha$$

$$f \cdot \beta = x \cdot \alpha$$

Черновик

$$\boxed{F_A = BIL = \frac{B^2L^2v_0}{3R}}$$

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

$$v_0^2 = 2v_2^2 + v_1^2$$

$$v_1 = v_0 + a_1 t$$
$$v_2 = a_2 t$$
$$\Rightarrow v_1 = v_0 + 2v_2$$

$$m a_1 = F_A \qquad 2m a_2 = F_A$$

$$m\frac{\Delta v_1}{\Delta t} = \frac{B^2L^2v_0}{3R}$$

$$m(v_1 - v_0) = \frac{B^2L^2v_0}{3R}t \qquad v_1 - v_0 = \frac{B^2L^2v_0 t}{3Rm}$$

$$m(v_2 - 0) = \frac{B^2L^2v_0}{3R}t \qquad \overset{=0}{F_A} = A_{ст} + A_A$$

$$A_{F_A} = -A_{ст}$$

$$A_{F_A} = \left(\frac{2mv_2^2}{2} + \frac{mv_1^2}{2}\right) - \frac{mv_0^2}{2}$$

$$-A_{ст} = \left(\frac{2mv_2^2}{2} + \frac{mv_1^2}{2}\right) - \frac{mv_0^2}{2}$$

$$-2(A_{\varepsilon_{i1}} + A_{\varepsilon_{i2}}) = (2mv_2^2 + mv_1^2) - mv_0^2$$

$$F_A\, v_1^2 - v_0$$

$$-mv_0 = mv_1 - 2mv_2$$

$$\cancel{v_1 = 2v_2 - v_0}$$

F_A

BI

A

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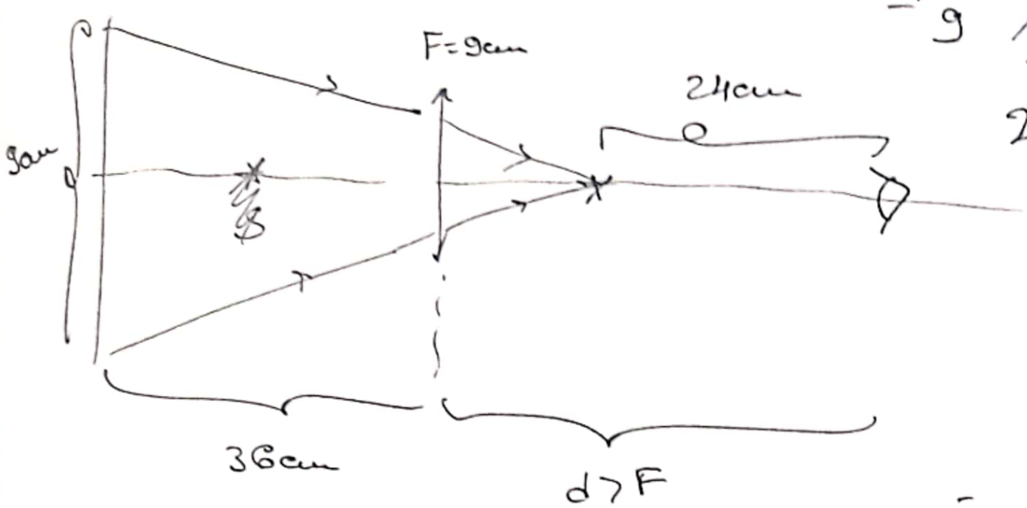
$-\frac{36}{9}$ $\times\frac{3}{9}$ 27 $x = 36cm - 16$



$I_0 = i^* + I^* = i^* + \frac{\varphi}{R}$

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

$2Cu'_{2C} = Cu'_C + I^*$

$2C(\mathcal{E}-\varphi)' = C(\varphi)' + I^*$

$2C(0-\varphi') = C\varphi' = I^*$

$-2C\varphi' - C\varphi' = I^*$

$-3C\varphi' = I^*$

$3(-C\varphi') = I^*$

$3 \cdot \frac{I_0}{2} = I^*$

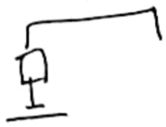
$I^* = \frac{3}{2} I_0$

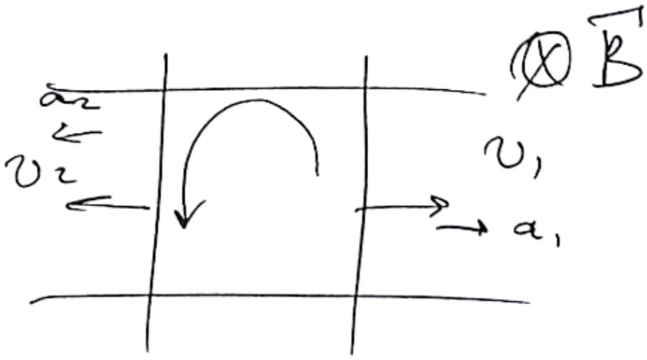
$I_0 = 2C(\mathcal{E}-\varphi)'$

$I_0 = 2C(0-\varphi')$

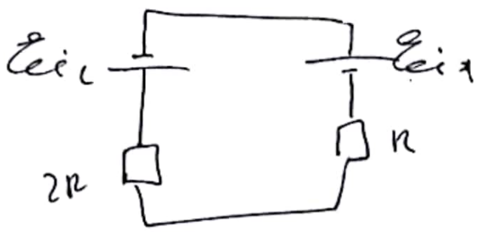
$I_0 = -2C\varphi'$

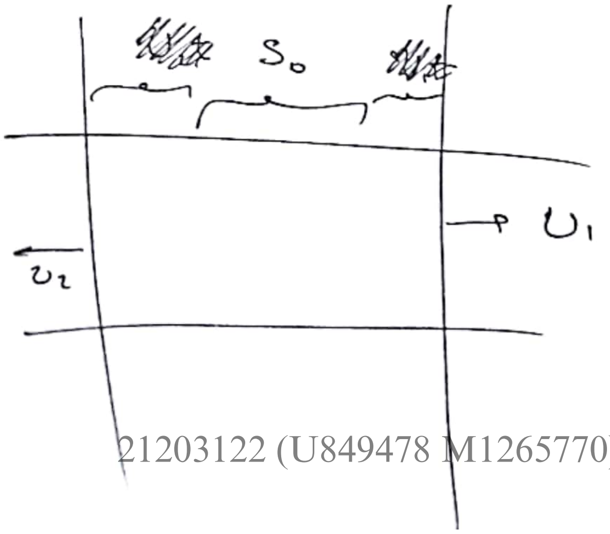
$-C\varphi' = \frac{I_0}{2}$





|||





$I = \frac{\mathcal{E}_{i1} + \mathcal{E}_{i2}}{3R} = \frac{BL(v_1+v_2)}{3R}$

$F_A = BIL = \frac{B^2L^2}{3R}$

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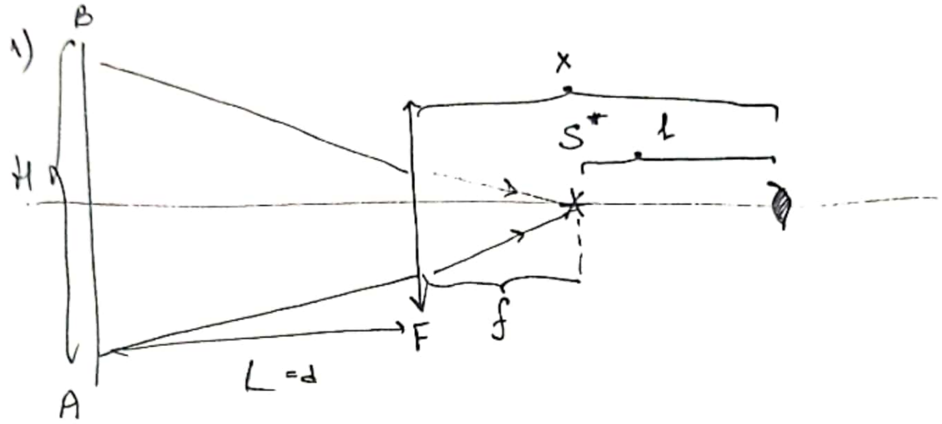
Чистовик 5 вариант 11-01

№5

$F = 9$ см
$H = 9$ см
$L = 36$ см
$l = 24$ см

1) $x = ?$
2) $D_н = ?$
3) $\Delta = ?$

1)



По ф. тонкой линзы:

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

$$f = \frac{FL}{L-F} = \frac{9 \cdot 36}{36 - 9} = \frac{\cancel{9} \cdot \cancel{36}^{12}}{\cancel{27}_{\cancel{3}}} = 12 \text{ см}$$

$$x = f + l = 12\text{ см} + 24\text{ см} = 36\text{ см}$$