# Часть 1

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

Шифр: **21201965**

ID профиля: **853480**

Вариант 1

Чистовик

№2

Дано:

$\nu, T_0, Q_1 > 0$

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

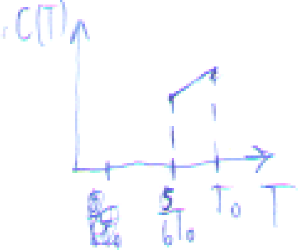
$T_1 = \frac{5}{6}T_0$

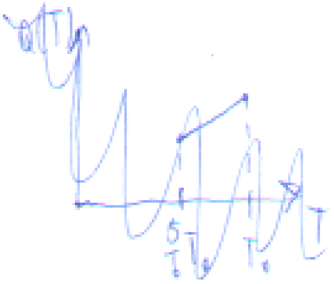
$Q_1 - ?$

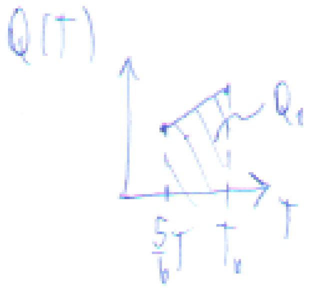
$T_{мин} - ?$

$A_{мин} - ?$

Решение:







$\cancel{Q_1 = C\Delta T = C}$

$Q = C\nu\Delta T$

$\cancel{C\Delta T \Rightarrow Q_1} \; Q(T) = C$

$C(T) = 2R\frac{T}{T_0} \Rightarrow \cancel{Q(T) = 2R\nu \frac{\frac{5}{6}T_0 + T_0}{2} \cdot (T_0 - \frac{5}{6}T_0)}$

$\Rightarrow Q(T) = 2R\frac{T}{T_0}\nu\Delta T \Rightarrow$

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

$= \frac{R\nu \cdot T_0^2 \cdot \frac{1}{6}\cdot\frac{11}{6}}{T_0} = \frac{11R\nu T_0}{36}$

$Q = \Delta U + A_1$ $\quad A_1 \neq p$

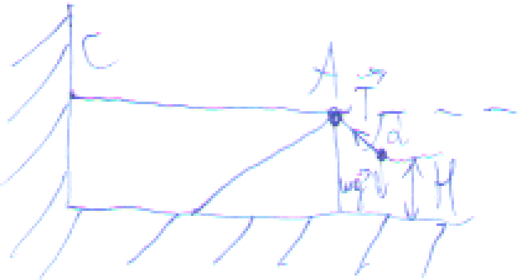
$\frac{2R\nu\Delta T}{T_0}\cdot T = \frac{3}{2}\nu R\Delta T + A_1$

$A_2 = \nu R\Delta T\left(\frac{2T}{T_0} - \frac{3}{2}\right)$

$\cancel{A_2 = \nu R(T_0 - T)}$

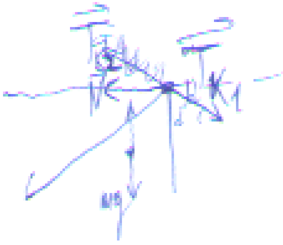
Ответ: $Q_1 = \frac{11R\nu T_0}{36}$

Черновик




$|T_{\text{гор}}| = T_{\text{н}} \cdot \cos\alpha$

$a_x = \frac{T_{\text{н}} \cos\alpha}{M}$




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

$F_y =$

$1 + \frac{1}{tg^2} = \frac{1}{\sin^2}$

$m a_{x} = \cos\alpha \cdot T$

$m a_{y} = mg - \sin\alpha \cdot T$

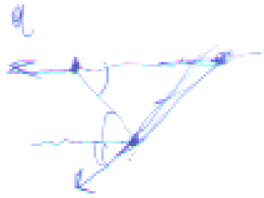
$\sin^2 + \cos^2 = 1$

$tg^2 + 1 = \frac{1}{\cos^2}$

$\cos = \sqrt{\frac{1}{tg^2+1}}$

$\sin = \frac{tg}{\sqrt{1+tg^2}}$

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



$S_x(t) = \frac{a_x t^2}{2}$

$S_ш(t) = \frac{a_ш t^2}{2}$

$\frac{S_ш}{S_x} = \frac{a_ш}{a_x}$

$\frac{6 \cdot 5}{10 \cdot 2} = \frac{30}{20} = \frac{3}{2} = 1{,}5$

$\frac{a}{c} = \sin$

$c = \frac{a}{\sin}$

$\frac{1}{3} : \sqrt{1+\frac{1}{9}}$

$\frac{1}{3} : \frac{\sqrt{10}}{3}$

$\frac{1}{9} + 9$

$\frac{\sqrt{10}}{10}$ $\frac{\sqrt{10}}{3}$

$\frac{9}{25} + \sin^2 = 1$

$\sin^2 = \frac{16}{25}$

$\sin = \frac{4}{5}$

$\frac{2}{10 \cdot \frac{1}{5}} =$

$\frac{1}{\cos\alpha} - tg\alpha = \frac{5}{3} - \frac{4}{3} = \frac{1}{3}$

$\frac{1}{3} : \sqrt{1+\frac{1}{9}}$

$\frac{9+1}{9}$ $\frac{\sqrt{10}}{3}$

$\frac{4}{5} : \frac{3}{5}$

$\frac{1}{\sqrt{10}}$

$Q = cm\Delta T$

$Q = c\Delta T$

21201965 (U853480 M1266151)

Чистовик

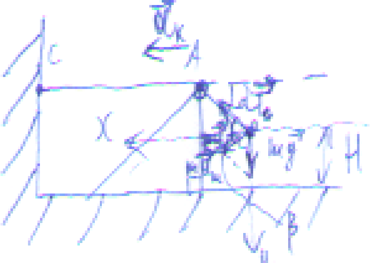
№ 1

Дано:
$\cos\alpha = \frac{3}{5}$
$g \approx 10$ м/с²

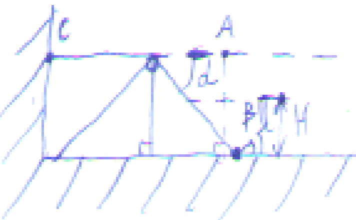
1) $\beta$ - ?
2) $a_к$ - ?
3) $\frac{m}{M}$ - ?
4) $\tau$ - ?

Решение:

1. $t = 0$:



$t = \tau$:



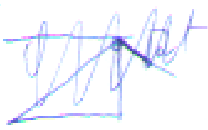
$\sin^2\alpha + \cos^2\alpha = 1$
$\sin^2\alpha + \frac{9}{25} = 1$
$\sin\alpha = \frac{4}{5}$
$tg\,\alpha = \frac{\sin\alpha}{\cos\alpha} = \frac{4}{3}$

$\alpha = const$
$mg = const$ $\Rightarrow \beta = const$
$\vec{T} + m\vec{g} = m\vec{a}_м$

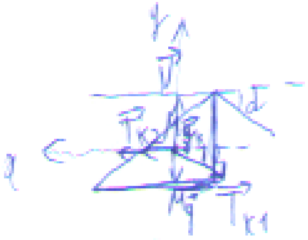
$T = mg$
$ma_{мx} = \cos\alpha \cdot T$
$ma_{мy} = mg - \sin\alpha T$
$tg\,\beta = \frac{a_{мy}}{a_{мx}} = \frac{mg - \sin\alpha T}{\cos\alpha T} = \frac{1-\sin\alpha}{\cos\alpha} = \frac{1-\frac{4}{5}}{\frac{3}{5}} = \frac{1}{3} \approx 0{,}33$

[illegible]

$ma_м = \frac{mg - \sin\alpha T}{\sin\beta} \Rightarrow$
$\Rightarrow a_м = \frac{g(1-\sin\alpha)}{\sin\beta} = \frac{10\text{ м/с}^2 \cdot (1-\frac{4}{5})}{\frac{1}{\sqrt{10}}} = 2\sqrt{10}$ м/с²



~~$\alpha = const$~~
$\beta = const$
$\angle \vec{a}_м, \vec{a}_к = \beta$ $\Rightarrow \frac{a_к}{a_м} = \cos\beta$
$a_к = a_м \cdot \cos\beta = a_м \cdot \frac{1}{\sqrt{tg^2\beta + 1}} = \frac{2\sqrt{10}\text{ м/с}^2 \cdot 3}{\sqrt{10}} = 6$ м/с²



$T_{к1} = T_{к2} = T = mg$

$y$: $T_{к1y} + Mg_y + N_y = 0$
$x$: $Ma_к = T_{к2x} - T_{к1x}$
$Ma_к = T - T\cdot\cos\alpha$
$Ma_к = mg(1-\cos\alpha)$
$\frac{m}{M} = \frac{a_к}{g(1-\cos\alpha)} = \frac{6\text{ м/с}^2}{10\text{ м/с}^2(1-\frac{3}{5})} = 1{,}5$

$H = \frac{|a_{мy}| \cdot \tau^2}{2}$
$\tau = \sqrt{\frac{2H}{|a_{мy}|}} = \sqrt{\frac{2H}{\frac{mg - T\sin\alpha}{m}}} = \sqrt{\frac{2H}{g(1-\sin\alpha)}} = \sqrt{\frac{2H}{10\text{ м/с}^2 \cdot (1-\frac{4}{5})}} = \sqrt{H}$ с

Ответ: $tg\,\beta \approx 0{,}33$; $a_к = 6$ м/с²; $\frac{m}{M} = 1{,}5$; $\tau = \sqrt{H}$

# Часть 2

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

Шифр: **21201965**

ID профиля: **853480**

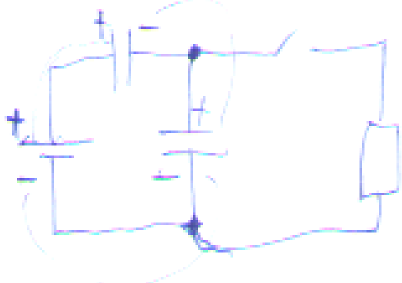
Вариант 1

Черновик

$C,\ 2C \qquad W = \frac{CU^2}{2}$

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

$q = CU$



E

R

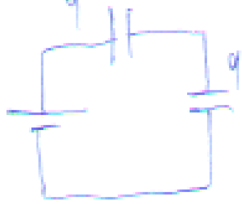
C

$I = \frac{U}{R} \qquad \frac{q}{C} = IR \qquad \frac{CE^2}{2}$

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

$U_2 = \frac{q}{2C} \qquad \frac{CE^2}{2 \cdot 9}$

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



$U_k = \frac{q}{C} \qquad 2U = U_1$

$qvBL = qU \qquad 3U = E$

$\Delta\frac{q}{t} = BIl \qquad I_0 = \qquad q = 2CE \qquad 2CE$

$I_{C_2} + I_R = I_0 \qquad q = \frac{E}{3} 2C \qquad \frac{2}{3} CE$

$I_R = \frac{2}{3} \frac{E}{R}$

$\frac{E}{I_R} = ?$

$U = IR$

$U = I_R R$

3.

$I_{R_0} + I_{C_{2}0} = I$

$U_2' = 0$

$2 \quad \frac{2}{9}$

$\frac{2}{9} - \frac{1}{9} + \frac{9}{9} =$

$= \frac{10}{9}$

21201965 (U853480 M1266152)

Чистовик

№5

$F = 9$ см

$H = 9$ см

$d = 36$ см

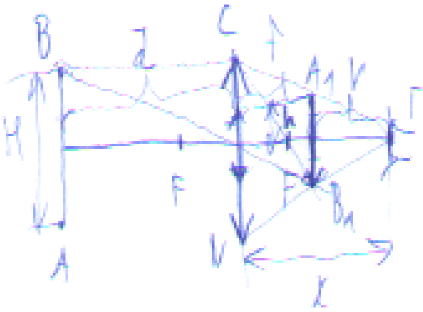
$r = 24$ см

$x$ - ?

$D_м$ - ?

в ... $d_э$ - ?

Решение:




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

$$f = \frac{Fd}{d-F} = \frac{9 \times 36\text{ см}}{36\text{ см} - 9\text{ см}} = \frac{9 \cdot 36}{27}\text{ см} = 12\text{ см}$$

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

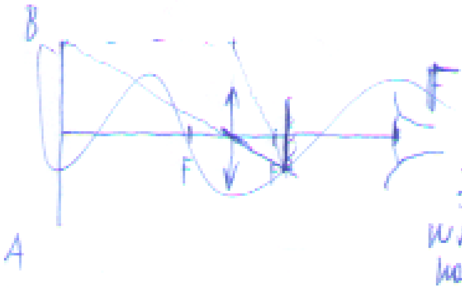
$$\frac{h}{\frac{H}{2}} = \frac{f}{d}$$

$$h = \frac{Hf}{2d}$$

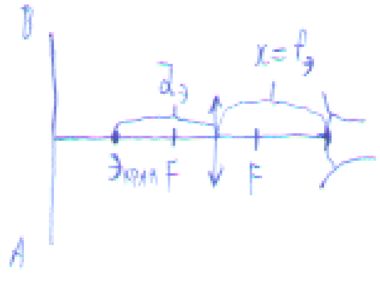
$\Delta N\Gamma L \sim \Delta A_1B_1\Gamma \Rightarrow$

$$\Rightarrow \frac{D_м}{h \cdot 2} = \frac{x}{r}$$

$$D_м = \frac{h \cdot 2 \cdot x}{r} = \frac{Hfx}{dr} = \frac{9\text{ см} \cdot 12\text{ см} \cdot 36\text{ см}}{36\text{ см} \cdot 24\text{ см}} = 4{,}5\text{ см}$$




Экран должен стоять между картиной и линзой, чтобы его изображение в линзе появилось прямо перед глазом и загородило обзор.




$$\frac{1}{F} = \frac{1}{f_э} + \frac{1}{d_э}$$

$$\frac{1}{F} = \frac{1}{x} + \frac{1}{d_э}$$

$$d_э = \frac{F \cdot x}{x - F} = \frac{9\text{ см} \cdot 36\text{ см}}{36\text{ см} - 9\text{ см}} = \frac{9 \cdot 36}{27}\text{ см} = 12\text{ см}$$



Ответ: $x = 36$ см; $D_м = 4{,}5$ см; $d_э = 12$ см

Чистовик

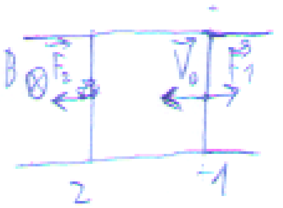
№ 4

Дано:
$B, L, m, R, V_0, S_0$
$m_2 = 2m, R_2 = 2R$

---

$a_{02}$ – ?
$V_1, V_2$ – ?
$S_{12}$ – ?

Решение:




В начальный момент:

$$\mathcal{E}_0 = \frac{|\Delta\Phi|}{\Delta t} = \frac{BL\Delta S}{\Delta t} = BLV_0$$

$$F_{02} = BI_{02}L = \frac{B\mathcal{E}_0 L}{R_2} = \frac{B^2L^2V_0}{2R}$$

$$a_{02} = \frac{F_{02}}{m_2} = \frac{B^2L^2V_0}{4Rm}$$

~~Силы, ускор сообщающие стержням перемычкам ускорение пропадут, когда стержни скорость перемы~~
~~Силы будут изменять скорость~~

~~$V_1 = V_2$~~ Когда $\vec{V}_1$ станет равна $\vec{V}_2$, то $\Delta\Phi = 0 \Rightarrow$ пропадут силы, действующие на перемычки со стороны магнитного поля $\Rightarrow a_1 = a_2 = 0 \Rightarrow$
$\Rightarrow \vec{V}_1 = \vec{V}_2 = const$

~~$V_1 = V_0 - \Delta V_1 = V_0 - a_1 t = V_0 -$~~

Ответ: $a_{02} = \dfrac{B^2L^2V_0}{4Rm}$

Чистовик

№ 3

Дано:

$E, R, I_0, C,$

$C_1 = 2C, C_2 = C$

$I_{R_0}$ - ?

$Q$ - ?

$I_{R_1}$ - ?

Решение:

Ключ разомкнули:


$q_1 = q_2 = q$

$U_1 + U_2 = E$

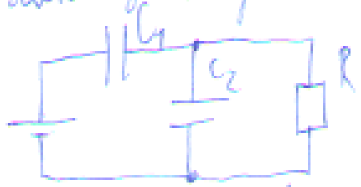
$U_1 = \frac{q}{2C}$ $U_2 = \frac{q}{C}$

$\Rightarrow U_2 = 2U_1$

$\frac{U_2}{2} + U_2 = E$

$U_2 = \frac{2}{3}E$

Ключ замкнули:




$U_2 = U_R$

$t = 0$:

$\frac{2}{3}E = I_{R_0} \cdot R$

$I^*_{R_0} = \frac{2E}{3R}$

прошло много времени:

$\cancel{U_2' = 0 \Rightarrow Q = \frac{C_2 U_2^2}{2} = \frac{C\,4E^2}{9 \cdot 2} = \frac{2CE^2}{9}}$

~~когда ток через $C_1$ равен $I_0$:~~

$\cancel{I_{C_2} + I_R = I_0}$

$\left.\begin{matrix} U_2' = 0 \\ U_1' = E \end{matrix}\right\} \Rightarrow Q = |\Delta W_2| + |\Delta W_1| = \frac{C_2 U_2^2}{2} + \frac{C_1 E^2}{2} - \frac{C_1 U_1^2}{2}$

$= \frac{C\frac{4}{9}E^2 + 2CE^2 - 2C\frac{1}{9}E^2}{2} = CE^2 \cdot \frac{5}{9}$

Ответ: $I_{R_0} = \frac{2E}{3R}$; $\cancel{Q = \frac{2CE^2}{9}}$ $Q = CE^2 \cdot \frac{5}{9}$