Часть 1

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

Шифр: **21200167**

ID профиля: **355206**

Вариант 5

Чистовик Вариант 11-05

(1)

Задача №1).

Дано:

$\cos\alpha = \frac{12}{13}$

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

$m_ш = m$

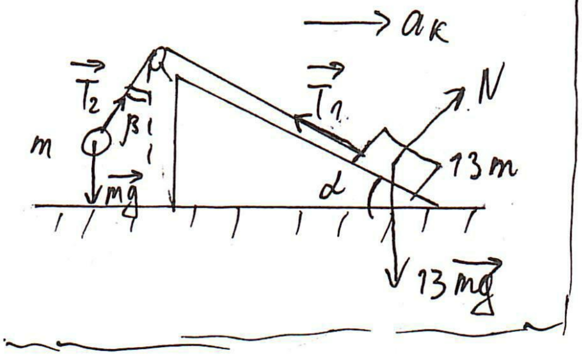
$m_б = 13m$

Найти:

1). $a_к = ?$

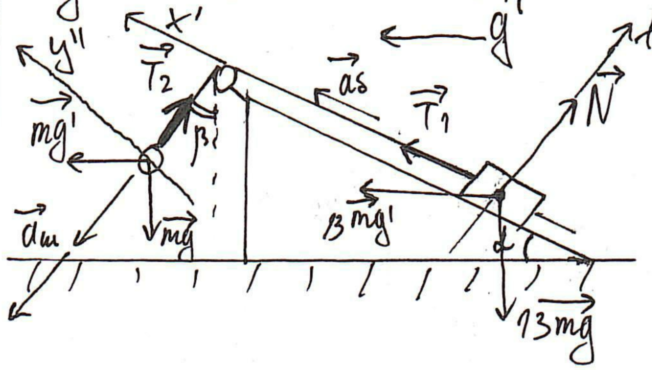
2). $a_б = ?$

3). $T = ?$



Перейдём в систему отсчета, связанную с клином:

$\vec{g'} = -\vec{a_к}$



II закон Ньютона:

Для бруска: $13\vec{mg} + 13\vec{mg'} + \vec{N} + \vec{T_1} = 13m\vec{a_б}$

Для шарика: $\vec{mg} + \vec{mg'} + \vec{T_2} = m\vec{a_ш}$

Ox': $13ma_б = T_1 + 13mg'\cdot\cos\alpha - 13mg\cdot\sin\alpha$

Oy': $0 = N - 13mg'\cdot\sin\alpha - 13mg\cdot\cos\alpha$

Ox'': $ma_ш = -T_2 + mg\cdot\cos\beta + mg'\cdot\sin\beta$

Oy'': $0 = mg'\cdot\cos\beta - mg\cdot\sin\beta$

т.к. нить нерастяжимая $\Rightarrow$ $T_1 = T_2 = T$; $a_б = a_ш = a$

$$\begin{cases} 13ma = T + 13mg'\cdot\cos\alpha - 13mg\cdot\sin\alpha & (1) \\ ma = -T + mg\cdot\cos\beta + mg'\cdot\sin\beta & (2) \\ 0 = mg'\cdot\cos\beta - mg\cdot\sin\beta & (3) \end{cases}$$

Из (3): $g' = g\cdot\operatorname{tg}\beta$

$\cos\alpha = \frac{12}{13}$; $\alpha < 90°$; $\cos^2\alpha + \sin^2\alpha = 1 \Rightarrow \sin\alpha = \frac{5}{13}$

$\cos\beta = \frac{4}{5}$; $\beta < 90°$; $\cos^2\beta + \sin^2\beta = 1 \Rightarrow \sin\beta = \frac{3}{5}$

$\operatorname{tg}\beta = \frac{\sin\beta}{\cos\beta} = \frac{3\cdot5}{5\cdot4} = \frac{3}{4}$

Чистовик Вариант 11-05 ②

Задача №1 (продолжение)

(1) и (2) с учётом $g' = g \cdot tg\,\beta$; и $\cos\alpha = \frac{12}{13}$; $\cos\beta = \frac{4}{5}$

$\sin\alpha = \frac{5}{13}$ $\quad \sin\beta = \frac{3}{5}$

$(g' = g \cdot tg\,\beta = \frac{3}{4} g)$ $\quad tg\,\beta = \frac{3}{4}$

$$\begin{cases} 13\,ma = T + 13 \cdot mg \cdot \frac{3}{4} \cdot \frac{12}{13} - 13 \cdot mg \cdot \frac{5}{13} \\ ma = -T + mg \cdot \frac{4}{5} + m \cdot g \cdot \frac{3}{4} \cdot \frac{3}{5} \end{cases}$$

$$\begin{cases} 13\,ma = T + 9mg - 5mg \\ ma = -T + \frac{4}{5} mg + \frac{9}{20} mg \end{cases}$$

Сложим уравнения:

$$14\,ma = 9mg - 5mg + \frac{4}{5} mg + \frac{9}{20} mg = \left(4 + \frac{4}{5} + \frac{9}{20}\right) mg = \frac{80 + 16 + 9}{20} mg$$

$$14\,ma = \frac{105}{20} mg$$

$$14a = \frac{105}{20} g \qquad a = \frac{105}{14 \cdot 20} g = \frac{21}{14 \cdot 4} g = \frac{3}{2 \cdot 4} g = \frac{3}{8} g$$

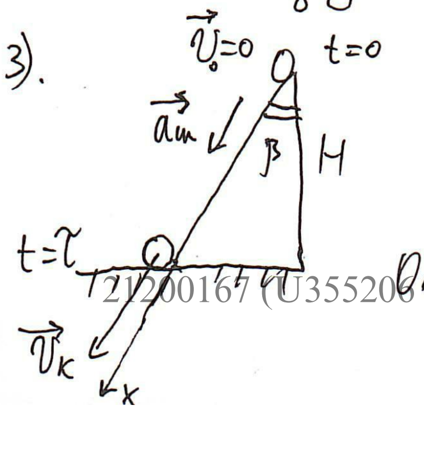
1). $\vec{a_к} = -g'$

$|\vec{a_к}| = |\vec{-g'}|$ $\quad a_к = g' = g \cdot tg\,\beta = \frac{3}{4} g$

$a_к = \frac{3}{4} g$

2). $a_б = a = \frac{3}{8} g$

3).



$$\begin{cases} v = v_0 + at \\ s = v_0 t + \frac{at^2}{2} \end{cases}$$

$$Ox: \begin{cases} v_к = a_m \tau \\ S_x = \frac{a_m \tau^2}{2} \end{cases}$$

Задача №1 (продолжение):

$\cos\beta = \frac{H}{S_x}$ $S_x = \frac{H}{\cos\beta}$; $\cos\beta = \frac{4}{5}$

$S_x = \frac{a_т \cdot \tau^2}{2}$

$\frac{H}{\cos\beta} = \frac{a_т \tau^2}{2}$

$\tau^2 = \frac{2 \cdot H}{a_т \cdot \cos\beta}$ / $a_т = a_б = a = \frac{3}{8} g$; $\cos\beta = \frac{4}{5}$

$\tau^2 = \frac{2 \cdot H}{\frac{3}{8} g \cdot \frac{4}{5}} = \frac{2 H \cdot 8 \cdot 5}{3 \cdot 4 \cdot g} = \frac{2 \cdot 2 \cdot 5}{3} \frac{H}{g} = \frac{20}{3} \frac{H}{g}$

$\tau = \sqrt{\frac{20 \cdot H}{3 \cdot g}} = 2\sqrt{\frac{5 H}{3 g}}$ с

Ответ: 1). $a_к = \frac{3}{4} g$

2). $a_б = \frac{3}{8} g$

3) $\tau = 2\sqrt{\frac{5 \cdot H}{3 \cdot g}}$ с

Чистовик Вариант 11-05 (4)

Задача №2).

Идеальный одноатомный газ

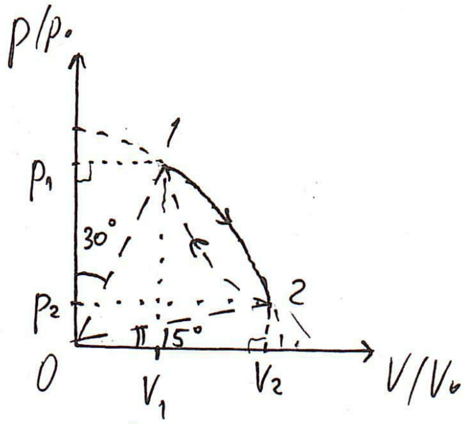
$\alpha = 30^\circ$

$\beta = 15^\circ$

1). $\frac{T_1}{T_2} = ?$

2). φ – ? $(C=0)$

3). $\frac{A_{24}}{A_{12}} = ?$



$p_1V_1 = \nu RT_1$
$p_2V_2 = \nu RT_2$ $\Longrightarrow$ $\frac{T_1}{T_2} = \frac{p_1V_1}{p_2V_2}$

r – радиус окружности на графике

$r^2 = p_1^2 + V_1^2 = p_2^2 + V_2^2$

Из треугольников (прямоугольных): $\frac{V_1}{p_1} = tg\,30^\circ \approx 0{,}58$

$\frac{p_2}{V_2} = tg\,15^\circ \approx 0{,}27$

$V_2 = \frac{p_2}{0{,}27}$ $V_1 = 0{,}58 \cdot p_1$

$$\frac{T_1}{T_2} = \frac{p_1V_1}{p_2V_2} = \frac{p_1 \cdot 0{,}58 \cdot p_1}{p_2 \cdot \frac{p_2}{0{,}27}} = \frac{p_1^2}{p_2^2}\,0{,}58 \cdot 0{,}27 = \frac{p_1^2}{p_2^2} \cdot 0{,}1566$$

$$p_1^2 + V_1^2 = p_2^2 + V_2^2$$

$$p_1^2 + 0{,}58^2 p_1^2 = p_2^2 + \frac{p_2^2}{0{,}27^2}$$

$$p_1^2(1+0{,}58^2) = p_2^2 \cdot \left(1 + \frac{1}{0{,}27^2}\right)$$

$$\frac{p_1^2}{p_2^2} = \frac{1 + \frac{1}{0{,}27^2}}{1+0{,}58^2} = \frac{0{,}27^2+1}{(1+0{,}58^2)\cdot 0{,}27^2} = \frac{1+0{,}0729}{(1+0{,}3364)\cdot 0{,}0729} = \frac{1{,}0729}{1{,}3364 \cdot 0{,}0729} =$$

$$= \frac{1{,}0729}{0{,}09742356} \approx 11{,}01 \approx 11$$

$$\frac{T_1}{T_2} = \frac{p_1^2}{p_2^2} \cdot 0{,}1566 \approx 11 \cdot 0{,}1566 \approx 1{,}72$$

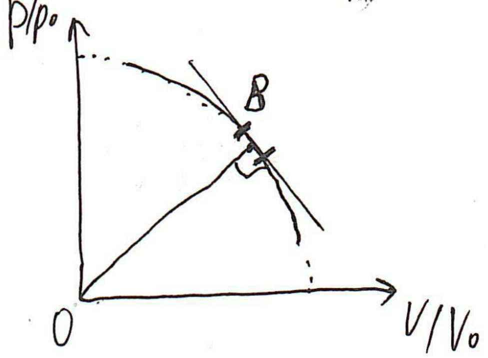
Задача №2 (продолжение)

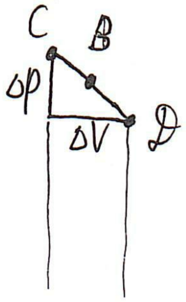
$C = \frac{\delta Q}{\cdot \delta T}$ $\quad C = 0 \Rightarrow \delta Q = 0$ (адиабатический процесс)

$\delta Q = \delta U + A = 0$

$A = -\delta U$

Рассмотрим процесс в окрестности точки (B) с $C = 0$:





$\delta p \to 0; \ \delta V \to 0$

$A = -\delta U$

$A = p_D \delta V + \frac{\delta p \cdot \delta V}{2}$

$-\delta U = \nu R T_C - \nu R T_D = p_C V_C - p_D V_D$ // $V_D = V_C + \delta V$, $p_C = p_D + \delta p$

$-\delta U = (p_D + \delta p) V_C - p_D (V_C + \delta V) = p_D V_C + \delta p V_C - p_D V_C - p_D \delta V = p_D V_C - p_D \delta V$

$A = -\delta U$

$p_D \delta V + \frac{\delta p \delta V}{2} = p_D \delta V - p_D V_C$

$\frac{\delta p \delta V}{2} = -p_D V_C = -(p_C - \delta p) \cdot V_C = -p_C V_C + \delta p V_C$

$p_C V_C = \delta p V_C - \frac{\delta p \delta V}{2} = \delta p \left(V_C - \frac{\delta V}{2}\right)$

т.к. $\delta p \to 0$, $\delta V \to 0 \Rightarrow p_C V_C \to 0 \Rightarrow p_C \approx$

Чистовик Вариант 11-05 (6)

Задача №2 (продолжение).

$A = -\Delta U$

$p_D \Delta V + \frac{\Delta p \Delta V}{2} = p_D V_c - p_D \Delta V$

$2 p_D \Delta V + \frac{\Delta p \Delta V}{2} = p_D V_c \quad // \quad V_c = V_D - \Delta V$

$2 p_D \Delta V + \frac{\Delta p \Delta V}{2} = p_D V_D - p_D \Delta V$

$3 p_D \Delta V = p_D V_D - \frac{\Delta p \Delta V}{2}$ $\qquad \frac{\Delta p \Delta V}{2} \approx 0$, т.к. $\Delta p \to 0$, $\Delta V \to 0$

$3 p_D \Delta V = p_D V_D$

$V_D = 3 \cdot \Delta V$

21200167 (U355206 M1263797)

Черновик

1).

$\cos\alpha = \frac{12}{13}$

$m_{ш} = m$

$m_{б} = 13m$

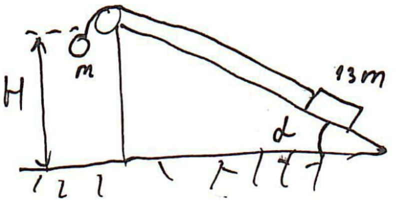
$\cos\beta = \frac{4}{5}$

1). $a_к = ?$

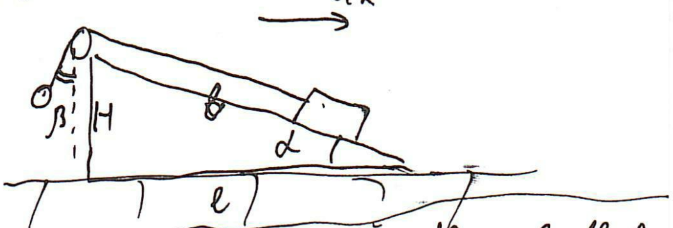
2). $a_б$ (отн. клина)

3). $\tau = ?$

1). Вначале:



2). Движение



$\cos\alpha = \frac{l}{b} = \frac{12}{13}$ $\quad l = \frac{12}{13}\cdot b$

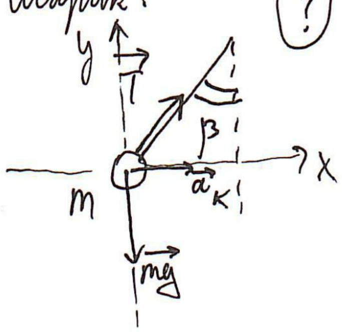
$H^2 + l^2 = b^2$

$H^2 + \frac{144}{169}b^2 = b^2$ $\quad H^2 = \frac{25}{169}b^2$

$H = \frac{5}{13}b$

$\sin\alpha = \frac{5}{13}$

1). Шарик:



(?) можно ли так?

$m\vec{a_к} = m\vec{g} + \vec{T}$

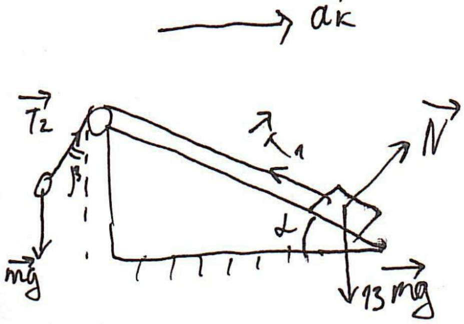
$OX: \; m a_к = T\cdot\sin\beta$

$Oy: -mg + T\cdot\cos\beta = 0$

$T = \frac{mg}{\cos\beta}$

$m a_к = \frac{mg\cdot\sin\beta}{\cos\beta} =$

$a_к = g\cdot tg\beta$



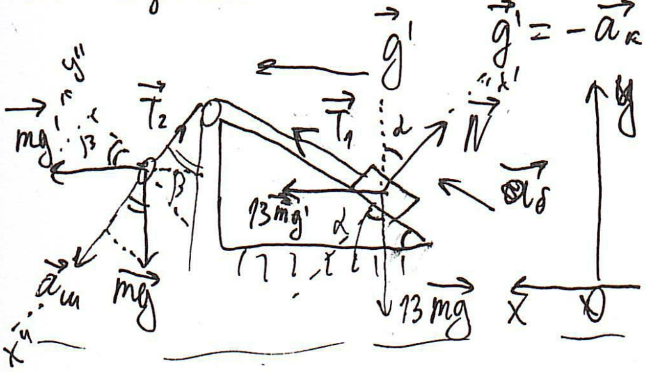
$OX: \begin{cases} 13mg' + T_1\cdot\cos\alpha - N\cdot\sin\alpha = 13m\,a_б\cdot\cos\alpha \\ mg' - T_2\cdot\sin\beta = m\,a_ш\cdot\sin\beta \end{cases}$

$Oy: \begin{cases} -13mg + N\cdot\cos\alpha + T_1\cdot\sin\alpha = 13m\cdot a_б\cdot\sin\alpha \\ -mg + T_2\cdot\cos\beta = -m\,a_ш\cdot\cos\beta \end{cases}$

$T_1 = T_2$

$a_б = a_ш$

СО связанная с клином:



$x'Oy' \begin{cases} 13m\,a_б = T_1 + 13\cdot mg'\cdot\cos\alpha - 13\cdot mg\cdot\sin\alpha \\ 0 = N - 13mg'\cdot\sin\alpha - 13mg\cdot\cos\alpha \end{cases}$

$\begin{cases} 13m\vec{g} + 13m\vec{g'} + \vec{N} + \vec{T_1} = 13m\vec{a_б} \\ m\vec{g} + m\vec{g'} + \vec{T_2} = m\vec{a_ш} \end{cases}$

$|a_ш| = |a_б|$

$x''Oy'' \begin{cases} m a_ш = -T_2 + mg\cdot\cos\beta + mg'\cdot\sin\beta \\ 0 = mg'\cdot\cos\beta - mg\cdot\sin\beta \end{cases}$

$T_1 = T_2$

$a_б = a_ш$

21200167 (U355206 M1263797)

$a_б = a_м = a$ $T_1 = T_2 = T$ Черновик.

II). $\begin{cases} 13 \, m a_б = T_з + 13 mg' \cdot \cos\alpha - 13 \cdot mg \cdot \sin\alpha \\ m a_м = -T + mg \cdot \cos\beta + mg' \cdot \sin\beta \\ 0 = mg' \cdot \cos\beta - mg \cdot \sin\beta \end{cases}$

$mg' \cdot \cos\beta = mg \cdot \sin\beta$

$g' = g \cdot \frac{\sin\beta}{\cos\beta} = g \cdot tg\,\beta$

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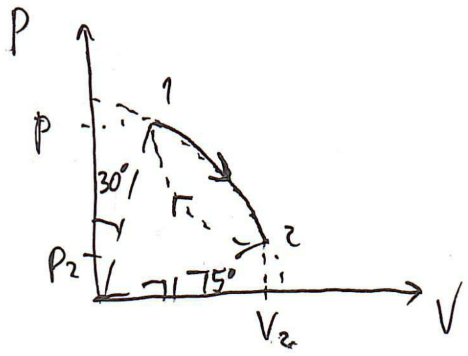
2).

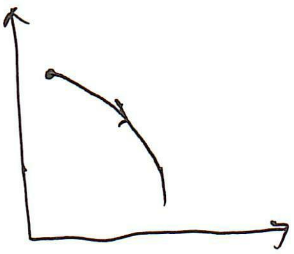


$\frac{T_1}{T_2} - ?$

$p_1 V_1 = \nu R T_1$

$p_2 V_2 = \nu R T_2$

$\frac{T_1}{T_2} = \frac{p_1 V_1}{p_2 V_2}$



$R^2 = p_2^2 + V_2^2 = p_1^2 + V_1^2$

$p_2^2 + V_2^2 = p_1^2 + V_1^2$

$p_1^2 - p_2^2 = V_2^2 - V_1^2$

$30°: \; V_1 = \frac{1}{2} R$ $\quad 75°: \; V_2 = R \cdot$

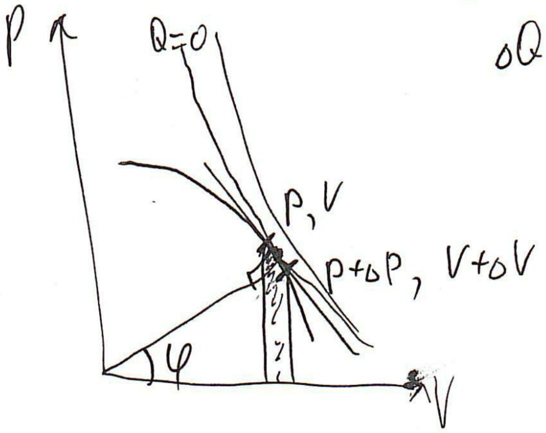
$p_1 = \frac{\sqrt{3}}{2} R$

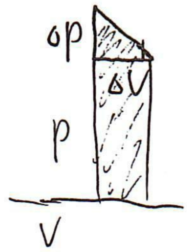
$\frac{V_1}{p_1} = tg\,30°$ $\quad \frac{p_2}{V_2} = tg\,15°$

$tg\,75° = \frac{\sin 75°}{\cos 75°}$

$p \Delta V + \frac{\Delta p \Delta V}{2} = \Delta p V + \Delta p_0 V - p_0 V$ $\quad 2 p \Delta V = \Delta p V -$

$\Delta Q = 0 = \Delta U + A$ $\quad A = -\Delta U$ $\quad f' = \frac{\Delta p}{\Delta V} = 2 \frac{p}{V}$





$A = \Delta p V + p \Delta V$ $\quad \Delta p \to 0$, $\Delta V \to 0$

$A = S = p \cdot \Delta V + \frac{\Delta p \cdot \Delta V}{2} \approx p \Delta V$

$\Delta U = \Delta p V_1 + p_1 \Delta V - p_0 V$

$\Delta U = \nu R T_2 - \nu R T_1 = p_2 V_2 - p_1 V_1 =$

$= (p_1 + \Delta p)(V_1 + \Delta V) - p_1 V_1 = -\Delta p V_1 + p_1 \Delta V - p_0 V_0$

Часть 2

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

Шифр: **21200167**

ID профиля: **355206**

Вариант 5

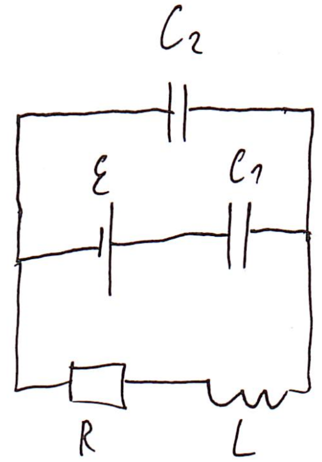
Чистовик

Вариант 11-05

(1)

Задача №3).

$C_1 = C$
$C_2 = 2C$
$\mathcal{E}$
L
R

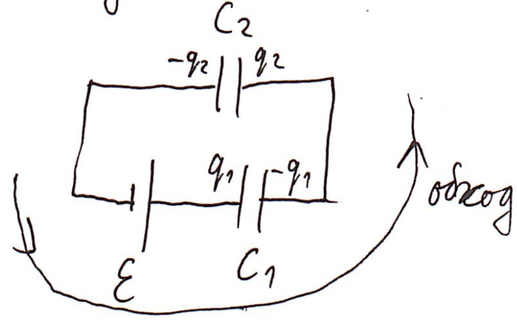


1). $\frac{dI}{dt} = ?$

2) $Q = ?$

3). $I_L = ?$ (через C_1 I_0)

1). До замыкания ключа:



~~Состояние Установленное сос~~

Установившееся состояние $\Rightarrow$ $I = 0$; $q_1 = const$, $q_2 = const$

Обобщённый закон Ома:

$$\frac{q_1}{C_1} + \frac{q_2}{C_2} = \mathcal{E}$$

по Закону сохранения электрического заряда

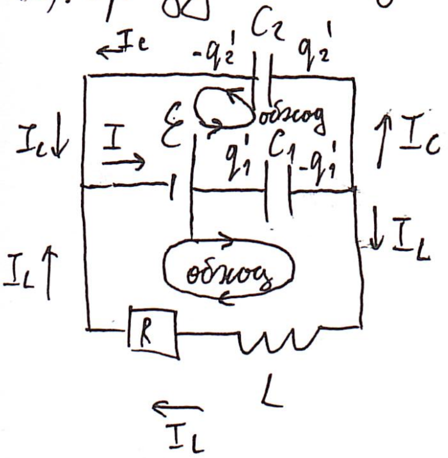
$-q_1 + q_2 = 0$ (т.к. вначале конденсаторы были не заряжены).

$q_1 = q_2 = q_0$

$$\frac{q_0}{C_1} + \frac{q_0}{C_2} = \mathcal{E} \qquad \frac{q_0}{C} + \frac{q_0}{2C} = \mathcal{E} \qquad \frac{2q_0 + q_0}{2C} = \mathcal{E} \qquad \frac{3q_0}{2 \cdot C} = \mathcal{E}$$

$$q_0 = \frac{2}{3} C \cdot \mathcal{E} = q_1 = q_2$$

2). Сразу после замыкания ключа.



$I = I_L + I_C$

т.к. до замыкания ключа тока через катушку не было, то и сразу после замыкания тока не будет $\Rightarrow I_L = 0$

$$\frac{q_1'}{C_1} = \mathcal{E} - L\frac{dI_L}{dt}$$

$$\frac{q_1'}{C_1} + \frac{q_2'}{C_2} = \mathcal{E}$$

по ЗС электрического заряда

$q_1' = q_2' = q'$

Чистовик. Вариант 11-05 ②

задача №3).

$$\frac{q'}{C} = \mathcal{E} - L\frac{dI_L}{dt} \rightarrow L\frac{dI_L}{dt} = \mathcal{E} - \frac{q'}{C}$$

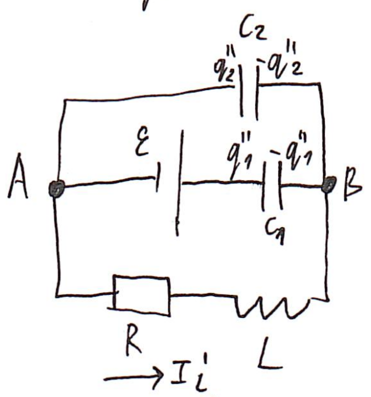
$$\frac{q'}{C} + \frac{q'}{2C} = \mathcal{E} \rightarrow \frac{3q'}{2\cdot C} = \mathcal{E} \qquad \frac{q'}{C} = \frac{2}{3}\cdot\mathcal{E}$$

т.к. $\frac{3\cdot q'}{2C} = \mathcal{E}$ и $\frac{3\cdot q_0}{2\cdot C} = \mathcal{E}$ $\Rightarrow q' = q_0$

$$L\frac{dI_L}{dt} = \mathcal{E} - \frac{q'}{C} = \mathcal{E} - \frac{2}{3}\mathcal{E} = \frac{1}{3}\mathcal{E}$$

$$\boxed{\frac{dI_L}{dt} = \frac{1}{3}\cdot\frac{\mathcal{E}}{L}}$$

3). Некоторый момент времени, установившееся состояние:



~~Цепь без конденсатора C_2 — это колебательный контур~~

$$\varphi_A - \varphi_B = 0 \Rightarrow \varphi_A = \varphi_B$$

Значит $\frac{q_2''}{C} = \varphi_A - \varphi_B = 0 \Rightarrow q_2'' = 0$

$$\frac{q_1''}{C} = \mathcal{E} + \varphi_A - \varphi_B \qquad \frac{q_1''}{C} = \mathcal{E} \Rightarrow q_1'' = \mathcal{E}\cdot C$$

$$I_L'\cdot R = \varphi_A - \varphi_B - L\frac{dI_L'}{dt} \qquad I_L' = 0;\ \frac{dI_L'}{dt} = 0$$

Закон сохранения энергии:

$$A_{ист} = \Delta W + Q$$

$$A_{ист} = q_{ист}\cdot\mathcal{E} = (q_1'' - q_1)\cdot\mathcal{E} = \left(\mathcal{E}\cdot C - \frac{2}{3}\mathcal{E}\cdot C\right)\mathcal{E} = \frac{\mathcal{E}^2 C}{3}$$

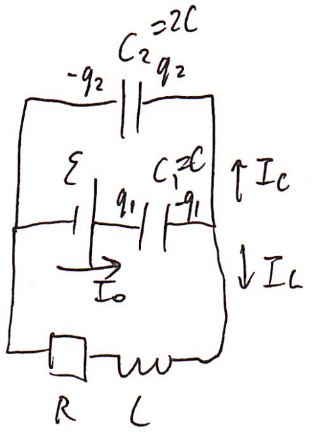
$$\Delta W = W_K - W_H = \frac{q_1''^2}{2C} - \frac{q_2^2}{2\cdot 2C} - \frac{q_1^2}{2C} = \frac{\mathcal{E}^2 C}{2} - \frac{4}{2\cdot 2\cdot 9}\mathcal{E}^2 C - \frac{4}{2\cdot 9}\mathcal{E}^2 C =$$

$$= \mathcal{E}^2 C\left(\frac{1}{2} - \frac{2}{2\cdot 9} - \frac{4}{2\cdot 9}\right) = \mathcal{E}^2 C\,\frac{9-2-4}{2\cdot 9} = \mathcal{E}^2 C\,\frac{3}{2\cdot 9} = \frac{\mathcal{E}^2 C}{6}$$

$A_{ист} = \Delta W + Q$

$$Q = A_{ист} - \Delta W = \frac{\mathcal{E}^2 C}{3} - \frac{\mathcal{E}^2 C}{6} = \frac{\mathcal{E}^2 C}{6}$$

4).



$$\begin{cases} \frac{q_1}{C} + R\cdot I_L = \mathcal{E} - L\frac{dI_L}{dt} \\ \frac{q_1}{C} + \frac{q_2}{2C} = \mathcal{E} \\ I_0 = \frac{dq_1}{dt} \\ I_C = \frac{dq_2}{dt} \\ I_0 = I_L + I_C \end{cases}$$

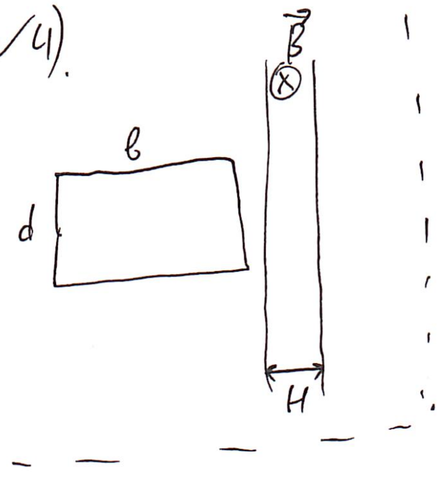
Ответ: 1). $\frac{dI}{dt} = \frac{\mathcal{E}}{3L}$ 2). $Q = \frac{\mathcal{E}^2 C}{6}$

Чистовик Вариант 11-05

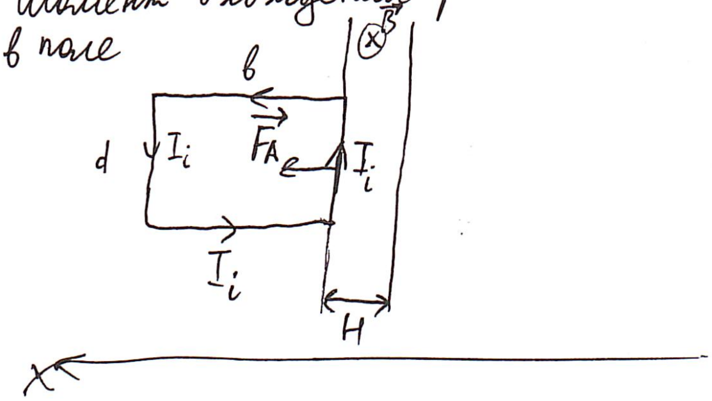
Задача №4).

Дано:
m
d
V_0
R
B
$b = 2 \cdot d$
$H = \frac{d}{3}$

1). $a = ?$
2). $V_1 = ?$
3). $V_2 = ?$



Момент вхождения рамки в поле



$$\mathcal{E}_i = -\frac{d\Phi}{dt} \qquad \Phi = B \cdot S \cdot \cos\alpha; \quad \cos\alpha = 1, \text{ т.к. } \alpha = 0°$$

$$S = d \cdot V_0 \cdot t$$

$$\mathcal{E}_i = -\frac{d\Phi}{dt} = -\frac{d(B \cdot d\, V_0 \cdot t)}{dt} = -B \cdot d \cdot V_0$$

$$I_i = \frac{|\mathcal{E}_i|}{R} = \frac{B d V_0}{R}$$

$$F_A = B \cdot I_i\, l \cdot \sin\beta = B I_i d \qquad (\sin\beta = 1, \text{ т.к. } \beta = 90°; \; \beta = (\widehat{B; I_i}))$$

II закон Ньютона:

$$m\vec{a} = \vec{F_A}$$

$$OX: \; ma = F_A$$

$$a = \frac{F_A}{m} = \frac{B I_i d}{m} = \frac{B \cdot B d V_0 \cdot d}{R \cdot m} = \frac{B^2 d^2 V_0}{R \cdot m}$$

$$a = \frac{B^2 d^2 V_0}{R \cdot m}$$

$$\begin{cases} V = V_0 + at \\ S = V_0 t + \frac{at^2}{2} \end{cases}$$

~~$OX: V_{1x} = V_0 - a_x t$~~

Закон изменения кинетической энергии:

$$\Delta E_K = A_{внс.} = F_A S$$

Закон изменения импульса: $\Delta p = F \cdot \Delta t$ / Ответ: $a = \frac{B^2 d^2 V_0}{R \cdot m}$

Чистовик Вариант 11-05 (5)

Задача 5.

$\frac{D_1}{D_2} = 2$

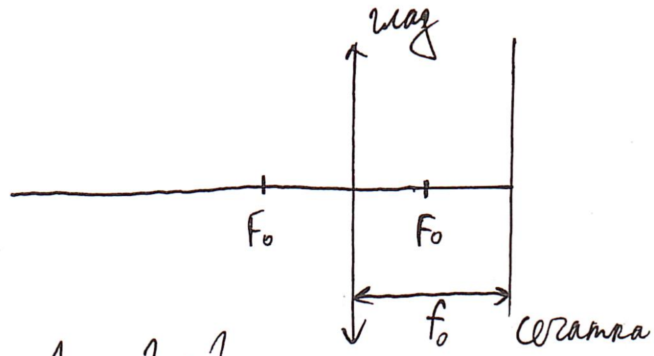
$l_2 = 25$ см

$l_3 = 50$ см

1) $x = ?$

$F_1 = ?$

2). $F_3 = ?$



$$\frac{1}{F_0} = \frac{1}{x} + \frac{1}{f_0}$$

~~очки — собирающие линзы~~

очки — рассеивающие линзы

$$-\frac{1}{F_2} = \frac{1}{l_2} - \frac{1}{f_2} \quad и \quad \frac{1}{F_0} = \frac{1}{f_2} + \frac{1}{f_0} \qquad f_2 = x$$

$$-\frac{1}{F_1} = \frac{1}{l_1} - \frac{1}{f_1} \quad и \quad \frac{1}{F_0} = \frac{1}{f_1} + \frac{1}{f_0} \qquad f_1 = x$$

$$\begin{cases} D_2 = \frac{1}{F_2} = \frac{1}{x} - \frac{1}{l_2} = \frac{l_2 - x}{l_2 \cdot x} & (1) \\ D_1 = \frac{1}{F_1} = \frac{1}{x} - \frac{1}{l_1} = \frac{l_1 - x}{l_1 \cdot x} & (2) \\ \frac{1}{F_0} = \frac{1}{x} + \frac{1}{f_0} & (3) \end{cases}$$

(1) : (2)

$$\frac{F_1}{F_2} = \frac{(l_2 - x)\, l_1 \cdot x}{l_2 \cdot x\,(l_1 - x)} = \frac{(l_2 - x) \cdot l_1}{(l_1 - x) \cdot l_2} = \frac{l_1 \cdot l_2 - l_1 x}{l_1 \cdot l_2 - l_2 x}$$

$$\frac{D_1}{D_2} = \frac{F_2}{F_1} = \frac{l_1 l_2 - l_2 x}{l_1 l_2 - l_1 x} = 2$$

~~$l_1 l_2 - l_1 x = 2 l_1 l_2 - 2 l_2 x$~~

~~$l_1 l_2 = x \cdot (2 l_2 - l_1)$~~

$$l_1 l_2 - l_2 x = 2 l_1 l_2 - 2 l_1 x \qquad l_1 l_2 = x (2 l_1 - l_2)$$

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Задание 5.

т.к. предел аккомодации практически нулевой $\Rightarrow X \to 0$

$\Rightarrow \frac{1}{X} \to \infty \Rightarrow \frac{1}{F_0} = \frac{1}{x_0} + \frac{1}{f_0}$ $\frac{1}{F_0} \to \infty$ $F_0 \to 0$

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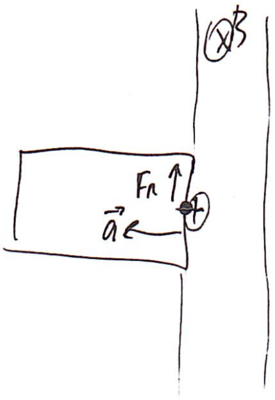


Черновик

$\mathcal{E}_i = -\frac{d\Phi}{dt}$ $\Delta\Phi = B \cdot \Delta S = B \cdot d \cdot$

$F_л = qvB \cdot \sin\alpha$

$\frac{\mathcal{E}_i}{R} = I$ $F_A = BI \cdot l \cdot \sin\alpha$

$\frac{mv_0^2}{2} =$

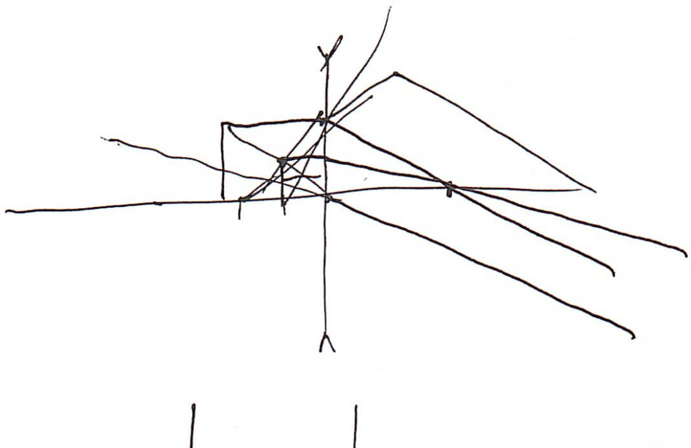
$\Delta E_к = A_{вн.с}$

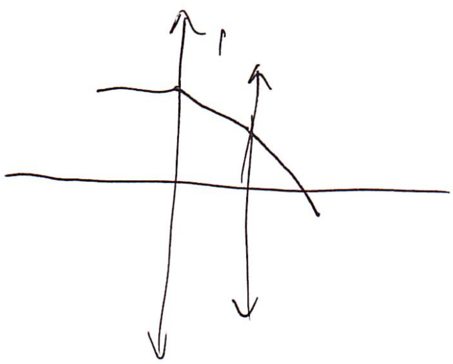
$A_{вн.с} = F_A \cdot s$

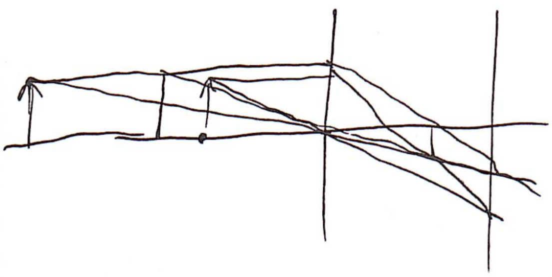
$\Delta p = F \cdot \Delta t$

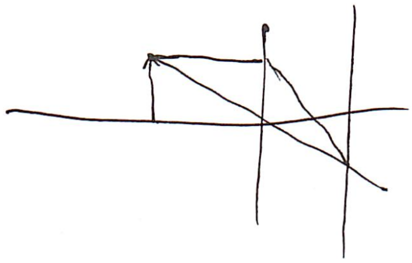
$mv_1 - mv_0 = F_A \cdot \Delta t$

$m(v_1 - v_0) =$



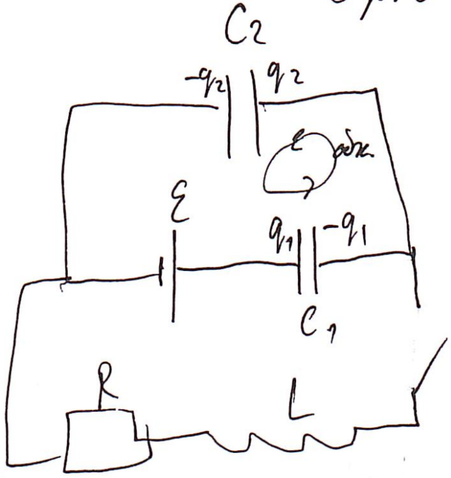


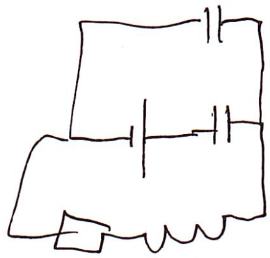




Черновик

3).





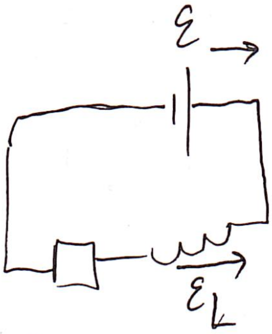
$\frac{dq_1}{dt} = \frac{dq_2}{dt} + I_L$

$\frac{q_1}{C} = \mathcal{E} - L\frac{dI_L}{dt}$

$\frac{q_1}{C} + \frac{q_2}{2C} = \mathcal{E}$ ⇓

$$\begin{cases} 2q_1 + q_2 = 2C\mathcal{E} = const \\ \frac{dq_1}{dt} = \frac{dq_2}{dt} + I_L \\ \frac{q_1}{C} = \mathcal{E} - L\frac{dI_1}{dt} \end{cases}$$

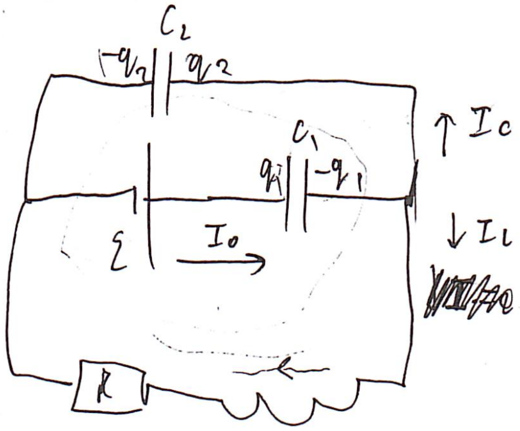
1) $\frac{dI}{dt}$ $(t=0)$



$0 = \mathcal{E} - L\frac{dI}{dt}$ $\qquad \mathcal{E} = L\frac{dI}{dt}$

$\frac{q}{C} = \frac{2}{3}\mathcal{E}$

$\frac{q}{2C} = \frac{1}{3}\mathcal{E}$



$$\begin{cases} I_C = \frac{dq_2}{dt} \\ I_0 = I_C + I_L \\ I_L R + \frac{q_1}{C} = \mathcal{E} - L\cdot\frac{dI_C}{dt} \\ \frac{q_1}{C} + \frac{q_2}{2C} = \mathcal{E} \\ I_0 = \frac{dq_1}{dt} \end{cases}$$

$\frac{q_2}{2C} = L\frac{dI_L}{dt}$

$\varphi_A - \varphi_B = 0$

$\varphi_A = \varphi_B$

$\Rightarrow q_2 = 0$

$\frac{q_1}{C} = -\mathcal{E}$

$q_1 = -C\mathcal{E}$

$I_0 = I_C + I_L$

$\frac{q_2}{2C} = L\frac{dI_C}{dt} = \mathcal{E} - \frac{q_1}{C}$

$I_0 = \frac{dq_1}{dt}$

$$\begin{cases} I_0 = I_C + I_L \\ L\frac{dI_C}{dt} = \mathcal{E} - \frac{q_1}{C} \\ I_0 = \frac{dq_1}{dt} \end{cases}$$

$I_L R$

$I\cdot R + \frac{q}{C} = -L\frac{dI}{dt}$

$\frac{dI}{dt} = I\cdot R - \frac{q}{CL}$

$\frac{dI}{dt} = IR - \frac{q}{CL} = $

$q = 0$