Часть 1

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

Шифр: **21200823**

ID профиля: **153291**

Вариант 8

Чистовик.
Лист 3.

Задача 1.

Дано:

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

$k = 5$

$\cos\beta = \frac{5}{13}$

g

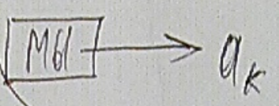
$a_к - ?$

$a_{отн.} - ?$

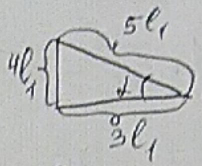
$t - ?$

Решение:

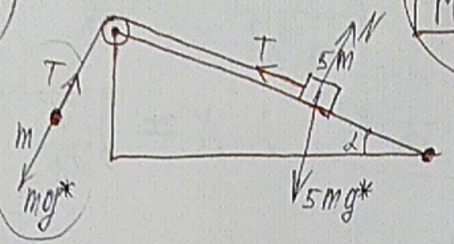
Мы в СО клина



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

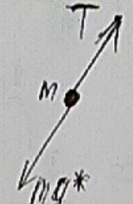


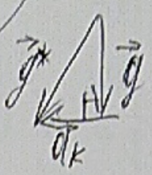
1)



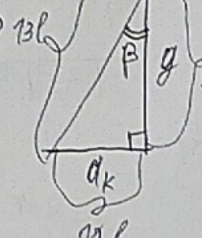
Рассмотрим шарик:

Ускорение клина сонаправлено с его скоростью





$\Rightarrow$

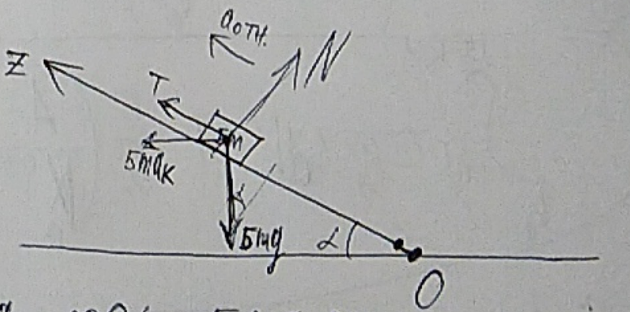


$a_к = tg\beta \cdot g$; $a_к = 2,4g$

$tg\beta = \frac{12}{5} = 2,4$; $g^* = 2,6g$

2) $m \cdot a_{отн.} = mg^* - T$;

$T = mg^* - ma_{отн.}$



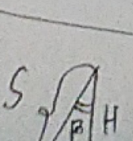
На ось OZ: $5m \cdot a_{отн.} = T + 5ma_к \cdot \cos\alpha - 5mg \cdot \sin\alpha$

$T = mg^* - ma_{отн.} = 5m(a_{отн} + g \cdot \sin\alpha - a_к \cdot \cos\alpha) = m(g^* - a_{отн.})$

$5a_{отн.} + g \cdot \frac{4}{\cancel{5}} \cdot \cancel{5} - 2,4g \cdot \frac{3}{\cancel{5}} \cdot \cancel{5} = g \cdot 2,6 - a_{отн.}$; $6a_{отн.} = 4,8g + 5g - 4g = 5,8g$

$a_{отн.} = \frac{2,9}{3}g = \frac{29}{30}g \approx 0,97g$

3)



$S = \frac{H}{\cos\beta} = a_{отн.} \cdot \frac{t^2}{2} = \frac{H \cdot 13}{5}$; $t^2 = \frac{26H \cdot \cancel{30}^{6}}{5 \cdot 29g}$; $t = \sqrt{\frac{156 \cdot H}{29 \cdot g}} \approx 2,32\sqrt{\frac{H}{g}}$

$V_{нач} = 0$

Ответ: $a_к = 2,4g$; $a_{отн} = \frac{29}{30}g$; $t = \sqrt{\frac{156 \cdot H}{29 \cdot g}}$.

Физика 11 Кл.

Чистовик

Лист 2.

Задача. 2.
(Продолжение)

$$\begin{cases} 1{,}4\cdot A\cdot\sqrt{r^2-x^2}=x^{3,4} \\ \dfrac{A^2}{x^{\frac{14}{5}}}=r^2-x^2 \end{cases} \qquad \begin{cases} r^2-x^2=\dfrac{x^{6,8}}{1{,}4^2A^2} \\ r^2-x^2=\dfrac{A^2}{x^{2,8}} \end{cases} \qquad A=\frac{x^{3,4}}{1{,}4\sqrt{r^2-x^2}} \qquad (r^2-x^2)^2=\frac{x^4}{1{,}4^2}$$

$$r^2-x^2=\frac{x^2}{1{,}4};\quad r^2=x^2\left(\frac{5}{7}+1\right)=\frac{12}{7}x^2;\quad x=\sqrt{\frac{7}{12}}\,r\approx 0{,}764r$$

$$\cos\varphi=\frac{\sqrt{\frac{7}{12}}\,r}{r}=\sqrt{\frac{7}{12}};\quad \varphi=0{,}702\text{ рад};\ \angle\varphi=40{,}2^\circ\approx 40^\circ$$

3)
$$\eta=\frac{A_п}{Q_3}=\frac{\int_{V_1}^{V_2}p_1\cdot dV-\int_{V_1}^{V_2}p\cdot dV}{\int_{V_1}^{\sqrt{\frac{7}{12}}\cdot V_0}p_1\,dV+\Delta U}=\frac{\int_{V_1}^{V_2}\sqrt{r^2-V^2}\cdot dV-\int_{V_1}^{V_2}\frac{A}{V^{\frac{7}{5}}}dV}{\int_{V_1}^{\sqrt{\frac{7}{12}}\cdot V_0}\sqrt{r^2-V^2}\cdot dV+\frac{5}{2}(p_xV_x-p_1V_1)}$$

$V_A\neq const$

$$\eta=\frac{\int_{V_1}^{V_2}\left(\sqrt{r^2-V_A^2}-\frac{A}{V_A^{\frac{7}{5}}}\right)\cdot dV}{\int_{V_1}^{\sqrt{\frac{7}{12}}V_0}\sqrt{r^2-V_A^2}\cdot dV+\frac{5}{2}\left(\frac{A}{V_A^{0,4}}-p_1V_1\right)};\quad A=\frac{V^{3,4}}{1{,}4\sqrt{r^2-V^2}};\quad r=\sqrt{\frac{12}{7}}V$$

Ответ: $\dfrac{|\Delta T_{12}|}{T_2}=0{,}414$; $\varphi=40^\circ$; η.

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Черновик.

$y=\sqrt{x}$; $y'=\frac{1}{2}\cdot x^{-0,5}=\frac{1}{2\sqrt{x}}$

$\boxed{Q=mc\Delta t}$

$y=\sqrt{r^2-x^2}$; $y'=-\cancel{2}x\cdot\frac{1}{\cancel{2}\sqrt{r^2-x^2}}$

$y=\frac{A}{x^{\frac{7}{5}}}=A\cdot x^{-\frac{7}{5}}$; $y'=A\cdot-\frac{7}{5}\cdot x^{\frac{-12}{5}}$

$\frac{360^\circ}{2\pi}$

Физика 11 Кл.

Чистовик.
лист 1.

Задача 2.

Дано:
$i = 5$
$\alpha = 22{,}5^\circ$
$\beta = 15^\circ$

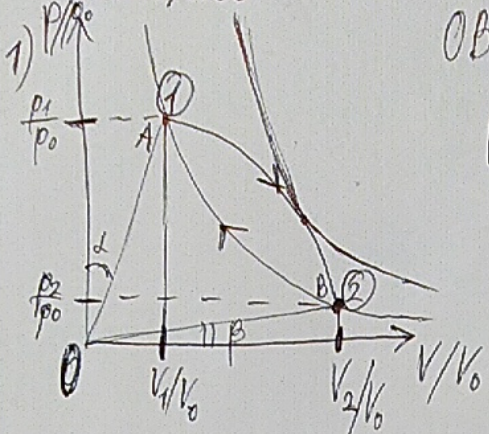
$\frac{|\Delta T_{12}|}{T_2}$ — ?

φ — ?

η — ?

Решение:

1)



$OB = OA = R$; $p_1 = R \cdot \cos\alpha \cdot p_0/l$

$p_2 = R \cdot \sin\beta \cdot p_0/l$

$$p_1 = \frac{\cos\alpha}{\sin\beta} p_2.$$

$V_1 = \frac{R}{l} \cdot \sin\alpha \cdot p_0$; $V_1 = \frac{\sin\alpha}{\cos\beta} V_2.$

$V_2 = \frac{R}{l} \cdot \cos\beta \cdot p_0$

$p_1 V_1 = \nu R T_1$
$p_2 V_2 = \nu R T_2$

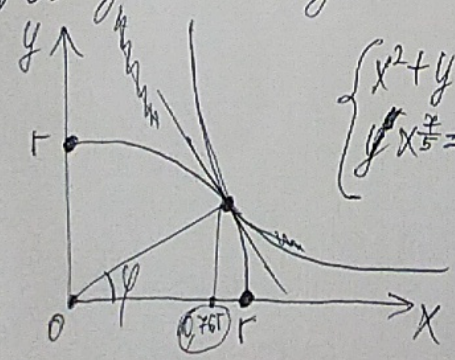
$$\frac{T_1}{T_2} = \frac{p_1 V_1}{p_2 V_2} = \frac{\cos\alpha \cdot \sin\alpha \cdot 2}{\sin\beta \cdot \cos\beta \cdot 2} = \frac{\sin 2\alpha}{\sin 2\beta} = \frac{\sin 45^\circ}{\sin 30^\circ}$$

$$\frac{|\Delta T_{12}|}{T_2} = \frac{|T_2 - T_1|}{T_2} = \left| \frac{\overset{1/\sqrt{2}}{\sin 45^\circ} - \overset{0,5}{\sin 30^\circ}}{\sin 30^\circ} \right| = |\sqrt{2} - 1| \approx 0{,}414$$

2) $c = 0$; $pV^n = const$; $n = \frac{c_p - c}{c_V - c} = \frac{\frac{7}{2}R}{\frac{5}{2}R} = \frac{7}{5}$

$Q = mc\Delta t$, $c = 0$ значит при изменении Δt Q — не меняется

Найдём эту точку:



$$\begin{cases} x^2 + y^2 = r^2 \\ y x^{\frac{7}{5}} = A \end{cases}$$

Сами функции равны и равны их произв.

$$\begin{cases} y' = -2x \cdot \frac{1}{2\sqrt{r^2 - x^2}} = -\frac{x}{\sqrt{r^2 - x^2}} \\ y' = A \cdot \left(-\frac{7}{5}\right) \cdot x^{-\frac{12}{5}} \end{cases}$$

$$\begin{cases} +\frac{7}{5}A = x^{\frac{12}{5}} \cdot x \cdot \left(+\frac{1}{\sqrt{r^2 - x^2}}\right) = x^{\frac{17}{5}} \left(\frac{1}{\sqrt{r^2 - x^2}}\right) \\ x^2 + \frac{A^2}{x^{\frac{14}{5}}} = r^2 \end{cases}$$

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Часть 2

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

Шифр: **21200823**

ID профиля: **153291**

Вариант 8

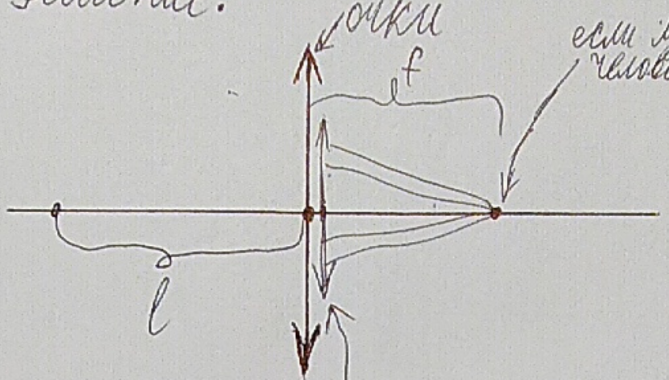
Чистовик.
Лист 4.

Задача 5.

Дано:
$l = 25$ см $= 0{,}25$ м
$D_1 = 5 D_2$
$d = 50$ см $= 0{,}5$ м

$X - ?$
$D_к - ?$
$D_2 - ?$

Решение:



$F_2 > F_1 > 0$

$D_{общ\,2} < D_{общ\,1}$

Уравнение ①: $\frac{1}{F_1} = \frac{1}{l} + \frac{1}{f} = D_{общ\,1} = D_г + D_1$

Уравнение ②: $\frac{1}{F_2} = \frac{1}{L_\infty} + \frac{1}{f} = D_{общ\,2} = D_г + D_2$; $L_\infty = \infty$

② $\frac{1}{f} = D_г + D_2$; $D_1 = 5 D_2$; $D_1 > D_2$

② в ① : $\frac{1}{l} = D_г + D_1 - D_г - D_2 = D_1 - D_2 = 4 D_1$; $D_1 = \frac{1}{4l} = 1$

$D_2 = 0{,}2 \cdot D_1 = 0{,}2$ диоптрий ;

1) $\boxed{\frac{1}{l_{без}} + \frac{1}{f} = D_г}$; $\frac{1}{l_{без}} = D_г - D_г - D_2 = -0{,}2$

$l_{без} = -5$ метров

$X = 0$ метров

2) $D_к = \frac{1}{d} + \frac{1}{f} = \frac{1}{0{,}5} + D_г + D_2 = 2{,}2 + D_г = 2 + \frac{1}{f}$

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Физика 11 кл.

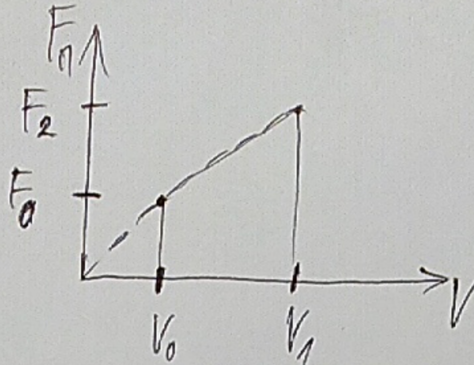
Чистовик

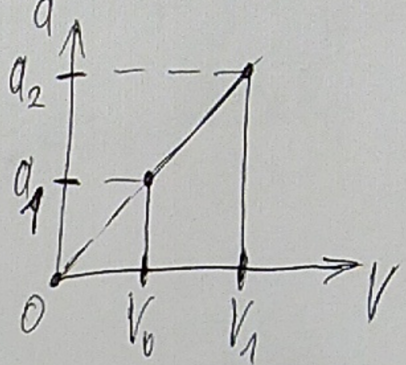
Лист 3.

Задача 4.
(Продолжение).

1) $F_п = Bd \cdot I_Δ = Bd \cdot \frac{|\varepsilon_Δ|}{R} = Bd \frac{\Delta\Phi}{\Delta t \cdot R} = \frac{Bd}{R} \cdot \frac{B \cdot \Delta S}{\Delta t} = \frac{B^2}{R} \cdot d \cdot \frac{d\,\Delta x_Δ}{\Delta t}$

$F_{пΔ} = \frac{B^2 d^2}{R} \cdot V_Δ$;





$F_{пΔ} = a_Δ m$

$m a_1 = F_1 = \frac{B^2 d^2}{R} \cdot V_0$; $a_1 = \frac{B^2 d^2 V_0}{mR}$

2) $m a_Δ = F_{пΔ} = \frac{B^2 d^2}{R} V_Δ$; $m a_Δ \cdot \Delta t = \frac{B^2 d^2}{R} \cdot V_Δ t$

$m \cdot V_Δ = \frac{B^2 d^2}{R} \cdot l$

$V_Δ = \frac{B^2 d^2}{mR} \cdot l$; $V_0 = \frac{B^2 d^2}{mR} \cdot l_0$; $V_1 = \frac{B^2 d^2}{mR} \cdot l_1$; $l_1 = l_0 + \frac{2}{3} d$

$V_1 = V_0 + \frac{B^2 d^2}{mR} \cdot \frac{2}{3} d = V_0 + \frac{2}{3} \cdot \frac{B^2 d^3}{mR}$

3) $V_2 = \frac{B^2 d^2}{mR} l_2 = V_1 - \frac{2}{3} \frac{B^2 d^3}{mR} = V_0$

Ответ: $a_1 = \frac{B^2 d^2 V_0}{mR}$; $V_1 = V_0 + \frac{2}{3} \cdot \frac{B^2 d^3}{mR}$; $V_2 = V_0$.

Физика 11 кл.

Чистовик.
Лист 2.

Задача №4.

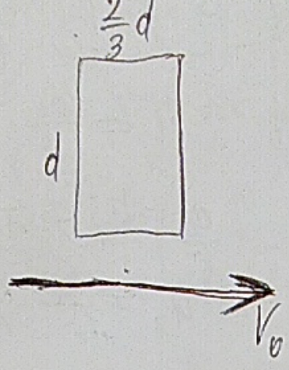
Дано: m, d, v_0, R, B

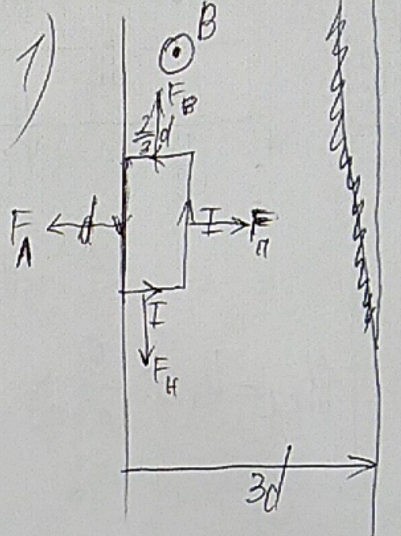
$a_1 - ?$

$v_1 - ?$

$v_2 - ?$

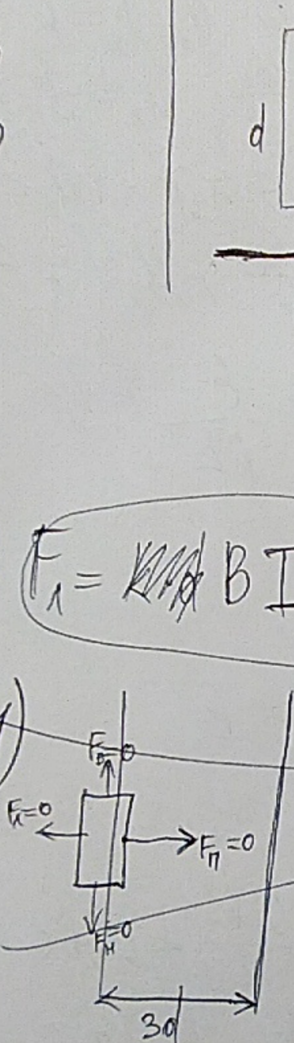
Решение:





$F_Л = BId = F_П$; $F_В = F_Н = \frac{2}{3}BId$ $\Rightarrow F_р = 0 \Rightarrow a_0 = 0$

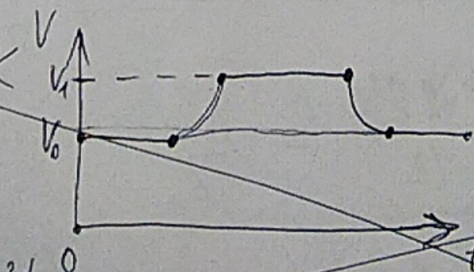
$F_р = m a_0$



~~$F_П = B I_A d$; $I_A = \frac{|\varepsilon_A|}{R}$; $\varepsilon_A = -N\cdot\frac{\Delta\Phi}{\Delta t}$; $N=1$; $\Delta\Phi = 0$; $\Delta\Phi = B\cdot\Delta S$~~

~~$\varepsilon_A = 0$; $I_A = 0$; $F_П = 0$; $F_П = m a_x$;~~

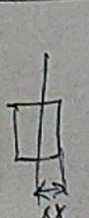
2)

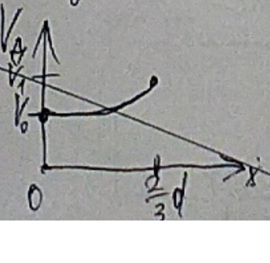


~~Ускорение~~ З.С.Э. $\frac{mV_0^2}{2} + W = \frac{mV_1^2}{2}$

$W = \int_0^{\frac{2}{3}d} F_П \cdot dx = \int_0^{\frac{2}{3}d} Bd\,\frac{B\cdot\Delta S}{R\Delta t}\cdot dx$

$W = \int_0^{\frac{2}{3}d} \frac{B^2d^2}{R}\cdot V_A\cdot dx = \frac{B^2d^2}{R}\int_0^{\frac{2}{3}d} V_A \cdot dx$





Задачи 11 кл.

Чистовик.
Лист 1.

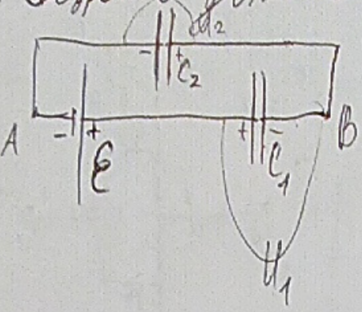
Задача 3.

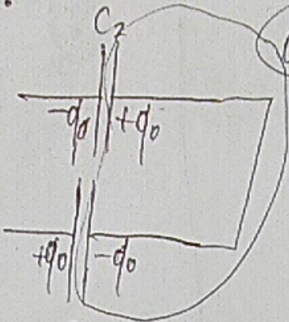
Дано:
$C_1 = C$
$C_2 = 5C$
$C, R, \mathcal{E}, L, I_0$

$V_I - ?$
$W - ?$
$U_R - ?$

Решение:

1) Режим установился:





$0 = +q_0 - q_0 = 0$

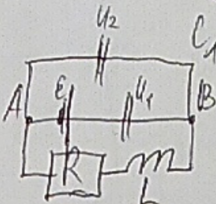
$U_1 + U_2 = \mathcal{E}$

$U_1 = \frac{q_0}{C}$; $U_2 = \frac{q_0}{5C}$

$\frac{q_0}{C} = U_1 = 5U_2$; $6U_2 = \mathcal{E}$

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

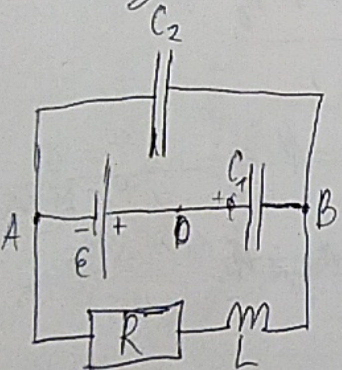
$U_{BA} = U_2 = \frac{\mathcal{E}}{6}$



$V_I = \frac{\Delta I}{\Delta t} = \frac{U_{AB}}{L} = \frac{\mathcal{E}}{6L}$;

$V_I = \frac{\mathcal{E}}{6L}$

2) После замыкания K:



$U_{AB} = 0 \Rightarrow \varphi_A = 0; \varphi_B = 0; \varphi_D = \mathcal{E}; U_{DB} = \mathcal{E}$

$\| C_2$ – не заряжен ; $\| C_1$ – заряжен

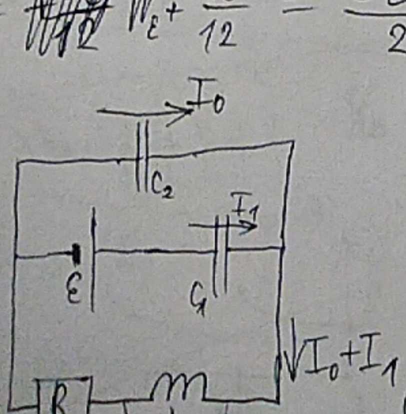
З.С.Э.: $W_\mathcal{E} + \frac{C_2 \frac{\mathcal{E}^2}{6^2}}{2} + \frac{C_1 \cdot \frac{25}{36}\mathcal{E}^2}{2} = W + \frac{C_1\mathcal{E}^2}{2} + 0 + 0$

$W = \frac{5C \cdot \frac{\mathcal{E}^2}{36} + C\mathcal{E}^2 \cdot \frac{25}{36} - C\mathcal{E}^2 \cdot \frac{36}{36} + W_\mathcal{E}}{2} = W_\mathcal{E} + \frac{6}{72}C\mathcal{E}^2$

$\Sigma q = |q_0 - \mathcal{E}C| = \frac{1}{6}\mathcal{E}C$, где $q_0 = \frac{5}{6}\mathcal{E}C$

$W = W_\mathcal{E} + \frac{C\mathcal{E}^2}{12} = \frac{\mathcal{E} \cdot \Sigma q}{2} + \frac{\mathcal{E}^2 C}{12} = \frac{2\mathcal{E}^2 C}{12} = \frac{\mathcal{E}^2 C}{6}$

3)



$U_R = R(I_0 + I_1)$; $q_0 = \frac{5}{6}\mathcal{E}C$; $q_H = \mathcal{E}C$

$\frac{q_H - q_0}{q_0} = \frac{\frac{1}{6}\mathcal{E}C}{\frac{5}{6}\mathcal{E}C} = \frac{I_1}{I_0} = \frac{1}{5}$; $I_1 = 0{,}2 I_0$

$U_R = 1{,}2 R I_0$

Ответ: $V_I = \frac{\mathcal{E}}{6L}$; $W = \frac{\mathcal{E}^2 C}{6}$; $U_R = 1{,}2 R I_0$.

Черновик.

$$W = \frac{RI^2}{2}t = \frac{LI^2}{2}; \quad L = Rt; \quad L = \frac{U \Delta t}{\Delta I}; \quad \frac{\Delta I}{\Delta t} = \frac{U}{L} \quad W = \frac{mv^2}{2} = mgh$$

$$W_k = \frac{q^2}{2C} = \frac{q \cdot U}{2} = \frac{U^2 C}{2}$$

$$F = B \cdot v \cdot q; \quad F = B \cdot I \cdot l$$

$$\Delta \Phi = B \cdot S$$

$$W_\varepsilon = \frac{\varepsilon I}{2} t$$

$$W = F \cdot \frac{2}{3} d = BId \cdot \frac{2}{3} d \quad \Delta S = d \cdot \frac{\Delta d}{\Delta t}$$

$$F_п = B \cdot d \cdot \frac{B \cdot \Delta S}{R \Delta t}$$

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