Часть 1

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

Шифр: **21201931**

ID профиля: **300004**

Вариант 8

№1

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

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

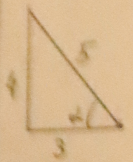
1) a – ?

2) a_1 – ?

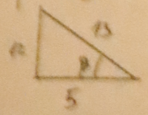
3) t – ?

$F_{ин} = a \cdot m$

$F_{иб} = a \cdot 5m$

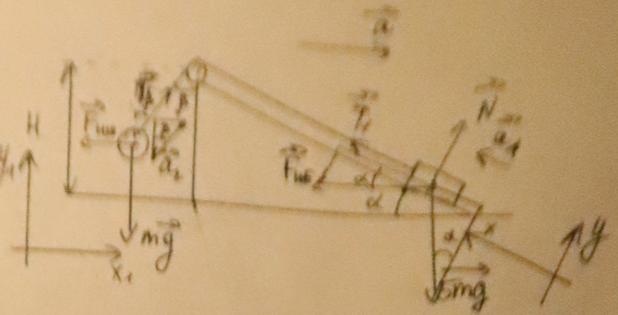


$\sin\alpha = \frac{4}{5}$



$\sqrt{169-25} = 12$

$\sin\beta = \frac{12}{13}$



Т.к. шарик и брусок соединены лёгкой нерастяжимой нитью, $a_1 = a_2$, $T_1 = T$

По II з. Н.: $\vec{T} + \vec{mg} + \vec{ma} = \vec{ma_1}$

$x_1: -ma + T\cdot\sin\beta = -ma_1\cdot\sin\beta$ (1)

$y_1: T\cdot\cos\beta - mg = -ma_1\cdot\cos\beta$ (2)

По II з. Н.: $\vec{T} + \vec{N} + \vec{5mg} + \vec{5ma} = \vec{5ma_1}$

$x: T + 5ma\cdot\cos\alpha - 5mg\cdot\sin\alpha = 5ma_1$ (3)

из (3): $T = 5m(a_1 + g\cdot\sin\alpha - a\cdot\cos\alpha)$ (4)

Подставим (4) в (1) и во (2):

$$\begin{cases} \sin\beta\cdot 5m(a_1 + g\cdot\sin\alpha - a\cdot\cos\alpha) - ma = -ma_1\sin\beta \\ \cos\beta\cdot 5m(a_1 + g\cdot\sin\alpha - a\cdot\cos\alpha) - mg = -ma_1\cos\beta \end{cases}$$

$$\begin{cases} 5a_1\sin\beta + 5g\sin\alpha\cdot\sin\beta - 5a\cos\alpha\cdot\sin\beta - a = -a_1\sin\beta \\ 5a_1\cdot\cos\beta + 5g\sin\alpha\cdot\cos\beta - 5a\cos\alpha\cdot\cos\beta - g = -a_1\cos\beta \end{cases}$$

Подставим значения $\cos\alpha$, $\sin\alpha$, $\cos\beta$, $\sin\beta$ и приведём подобные члены:

$$\begin{cases} a_1\cdot\frac{72}{13} + g\cdot\frac{48}{13} = a\cdot\frac{49}{13} \\ a_1\cdot\frac{30}{13} + g\cdot\frac{7}{13} = a\cdot\frac{15}{13} \end{cases}; \quad \begin{cases} 72a_1 + 48g = 49a \\ 30a_1 + 7g = 15a \end{cases}$$

$$\begin{cases} a = 2a_1 + \frac{7}{15}g \\ 72a_1 + 48g = 49(2a_1 + \frac{7}{15}g) \end{cases}; \quad \begin{cases} a_1 = \frac{377}{390}g \\ a = \frac{7}{15}g + 2\cdot\frac{377}{390}g \end{cases}$$

$$a = g\left(\frac{7}{15} + \frac{377}{195}\right) = g\cdot\frac{1}{15}\left(7 + \frac{377}{13}\right) = g\frac{468}{15\cdot 13} = g\frac{468}{195} = 2{,}4g$$

при $g = 10\frac{м}{с^2}$; $a_1 = \frac{377}{390}\cdot 10\frac{м}{с^2} = \frac{377}{39} \approx 9{,}667\frac{м}{с^2}$ $\left(a_1 = \frac{29}{3}g\right)$

$a = \frac{468}{195}\cdot 10\frac{м}{с^2} \approx 24\frac{м}{с^2}$

3) $y = y_0 + v_{0y}\cdot t + \frac{a_y t^2}{2}$; $0 = H + 0\cdot t - \frac{a_1\cdot\cos\beta\cdot t^2}{2}$

$H = \frac{a_1\cos\beta\cdot t^2}{2}$

$$t = \sqrt{\frac{2H}{a_1\cos\beta}} = \sqrt{\frac{26H}{5a_1}} = \sqrt{\frac{26\cdot 390H}{5\cdot 377g}} = \sqrt{\frac{2\cdot 78}{29}\cdot\frac{H}{g}} = \sqrt{\frac{156}{29}\frac{H}{g}}$$

Ответ: 1) $a = 2{,}4g$ (при $g = 10\frac{м}{с^2}$ $a \approx 24\frac{м}{с^2}$)

2) $a_1 = \frac{29}{3}g$ (при $g = 10\frac{м}{с^2}$ $a_1 \approx 9{,}667\frac{м}{с^2}$)

3) $t = \sqrt{\frac{156}{29}\cdot\frac{H}{g}}$

(№2)

$i=5$

$C_V=\frac{5}{2}R$

$=22{,}5^\circ$

$=15^\circ$

1) $\frac{T_1-T_2}{T_2}$ — ?

2) α — ?

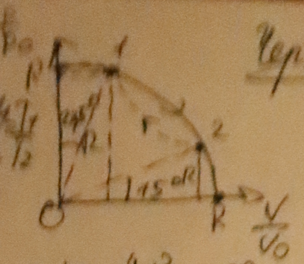
$C=0$

3) η — ?

Черновик

①

1) $\left.\begin{array}{l} p_1V_1 = \nu RT_1 \\ p_2V_2 = \nu RT_2 \end{array}\right\} \Rightarrow \frac{p_1V_1}{p_2V_2} = \frac{T_1}{T_2}$



$\left(\frac{p}{p_0}\right)^2 + \left(\frac{V}{V_0}\right)^2 = R^2$

$\frac{p_1}{p_0} = \cos 22{,}5^\circ \cdot R$

$\frac{p_2}{p_0} = \sin 15^\circ \cdot R$

$\frac{V_1}{V_0} = \sin 22{,}5^\circ \cdot R$

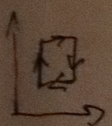
$\frac{V_2}{V_0} = \cos 15^\circ \cdot R$

$$\frac{T_1-T_2}{T_2} = \frac{T_1}{T_2} - 1 = \frac{p_1V_1}{p_2V_2} - 1 = \frac{p_0V_0R^2\cdot\cos 22{,}5^\circ\cdot\sin 22{,}5^\circ}{p_0V_0R^2\cdot\cos 15^\circ\cdot\sin 15^\circ} - 1 =$$

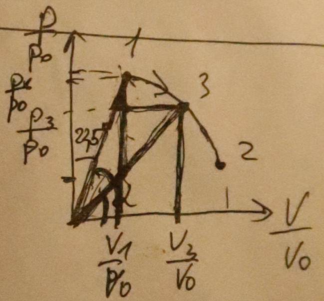
$$= \frac{\frac{1}{2}\cdot\sin 45^\circ}{\frac{1}{2}\cdot\sin 30^\circ} - 1 = \frac{1\cdot 2}{\sqrt{2}\cdot 1} - 1 = \sqrt{2} - 1 \approx 1{,}41 - 1 =$$

$$= 0{,}41$$

$$\boxed{\frac{4}{5}\cdot\frac{0{,}4579 - \frac{1}{2}(0{,}58)\cdot\frac{50{,}79}{0{,}966} + \frac{1}{2}(0{,}38\cdot 0{,}27 + 0{,}259)(0{,}96 - 0{,}38)}{97 - 0{,}5}}$$



2) $Q = \nu C \Delta T = 0$



$A + \Delta U = 0$

$\cancel{A = -\frac{5}{2}\nu R(T_1 - T_3)}$

$\cos\alpha = \frac{V_1/V_0}{x}$

$\operatorname{tg}\alpha = \frac{y}{V_3/V_0}$

$$\Delta U = -\frac{5}{2}\nu R(T_1 - T_3) = -\frac{5}{2}(\nu RT_1 - \nu RT_3) = -\frac{5}{2}(p_1V_1 - p_3V_3) =$$

$$= -\frac{5}{2}(p_0V_0\cdot\cos 22{,}5^\circ\cdot R\cdot\sin 22{,}5^\circ R - p_0V_0R\sin\alpha\cdot\cos\alpha R) =$$

$$= -\frac{5}{4}p_0V_0R^2(\sin 45^\circ - \sin 2\alpha)$$

$$A = p_0V_0\pi R^2\cdot\frac{90^\circ - 22{,}5 - \alpha}{360^\circ} - \frac{1}{2}R\cdot\frac{V_1}{V_0\cdot\cos\alpha}\cdot\sin(90^\circ - 22{,}5^\circ - \alpha) +$$

$$+\left(\frac{V_1}{V_0}\cdot\operatorname{tg}\alpha + \frac{p_3}{p_0}\right)\cdot\frac{1}{2}\left(\frac{V_3}{V_0} - \frac{V_1}{V_0}\right)\Big) = p_0V_0\left(\pi R^2\cdot\frac{67{,}5^\circ - \alpha}{360^\circ} - R^2\cdot\frac{\sin 22{,}5^\circ}{2\cos\alpha}\right.$$

$$\cdot\sin(67{,}5^\circ - \alpha) + R(\operatorname{tg}\alpha\cdot\sin 22{,}5^\circ + \sin\alpha)\cdot\frac{1}{2}R\cdot$$

$$\cdot(\cos\alpha - \sin 22{,}5^\circ)\Big) = p_0V_0R^2\left(\pi\cdot\frac{67{,}5^\circ - \alpha}{360^\circ} - \frac{\sin(67{,}5^\circ - \alpha)\cdot\sin 22{,}5^\circ}{2\cos\alpha}\right.$$

$$+\frac{1}{2}(\operatorname{tg}\alpha\cdot\sin 22{,}5^\circ + \sin\alpha)(\cos\alpha - \sin 22{,}5^\circ)\Big)$$

$$\pi\cdot\frac{67{,}5^\circ - 15^\circ}{360^\circ} - \frac{1}{2}\cdot\sin 22{,}5^\circ\cdot\frac{\sin(67{,}5^\circ - 15^\circ)}{\cos 15^\circ} + \frac{1}{2}(\sin 22{,}5^\circ\cdot\operatorname{tg}15^\circ + \sin 15^\circ)(\cos 15^\circ - \sin\ldots)$$

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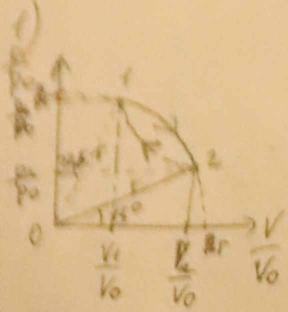
$\frac{4}{5}\cdot\frac{\pi}{\ldots}$ $\frac{1}{16} = \frac{1}{\ldots}$

№ 2
$i = 5$
$C_V = \frac{5}{2} R$

1) $\frac{T_1 - T_2}{T_2}$ - ?
2) α - ?
$C = 0$
3) η - ?

1)



$$pV = \nu RT$$

$$\left.\begin{aligned} p_1 V_1 = \nu R T_1 \\ p_2 V_2 = \nu R T_2 \end{aligned}\right\} \Rightarrow \frac{T_1}{T_2} = \frac{p_1 V_1}{p_2 V_2}$$

Из графика получаем, что:

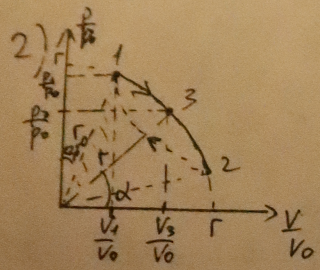
$$\frac{p_1}{p_0} = \cos 22{,}5^\circ \cdot r \qquad \frac{V_1}{V_0} = r \cdot \sin 22{,}5^\circ$$

$$\frac{p_2}{p_0} = \sin 15^\circ \cdot r \qquad \frac{V_2}{V_0} = r \cdot \cos 15^\circ$$

$$\frac{T_1 - T_2}{T_2} = \frac{T_1}{T_2} - 1 = \frac{p_1 V_1}{p_2 V_2} - 1 = \frac{p_0 \cdot \cos 22{,}5^\circ \cdot r \cdot V_0 \cdot r \sin 22{,}5^\circ}{p_0 \sin 15^\circ \cdot r \cdot V_0 \cdot r \cdot \cos 15^\circ} - 1 =$$

$$= \frac{\frac{1}{2} \sin 45^\circ}{\frac{1}{2} \sin 30^\circ} - 1 = \frac{1 \cdot 2}{\sqrt{2} \cdot 1} - 1 = \sqrt{2} - 1 \approx 0{,}41$$

2)



Пусть в точке 3, $C = 0$, тк. (т. 3 лежит на дуге 1-2)

$C = 0$, $Q_{13} = C \nu \Delta T_{13} = 0$

$Q_{13} = A_{13} + \Delta U_{13} \Longrightarrow 0 = A_{13} + \Delta U_{13}$

$-\Delta U_{13} = A_{13}$

Из графика

$\frac{p_3}{p_0} = r \cdot \sin\alpha$

$\frac{V_3}{V_0} = r \cdot \cos\alpha$

$$\Delta U_{13} = \frac{5}{2} \nu R (T_3 - T_1) = \frac{5}{2} (\nu R T_1 - \nu R T_3) = \frac{5}{2} (p_1 V_1 - p_3 V_3) = -\frac{5}{2} p_0 V_0 r^2 \cdot$$

$$\cdot (\sin 22{,}5^\circ \cdot \cos 22{,}5^\circ - \sin\alpha \cos\alpha) = \frac{5}{4} p_0 V_0 r^2 (\sin 2\alpha - \sin 45^\circ)$$

$A = S_{\text{под графиком}}$: $$A_{13} = p_0 V_0 \left(\pi r^2 \cdot \frac{90^\circ - 22{,}5^\circ - \alpha}{360^\circ} - \frac{1}{2} r \cdot \frac{V_1}{V_0 \cdot \cos\alpha} \cdot \sin(90^\circ - 22{,}5^\circ - \alpha) + \frac{1}{2} \left(\frac{V_3}{V_0} - \frac{V_1}{V_0}\right) \cdot\right.$$

$$\left.\cdot \left(\frac{V_1}{V_0} \cdot \operatorname{tg}\alpha + \frac{p_3}{p_0}\right)\right) = p_0 V_0 r^2 \left(\pi \cdot \frac{67{,}5^\circ - \alpha}{360^\circ} - \frac{1}{2} \cdot \frac{\sin 22{,}5^\circ \cdot \sin(67{,}5^\circ - \alpha)}{\cos\alpha} + \frac{1}{2} (\sin 22{,}5^\circ \cdot \operatorname{tg}\alpha +\right.$$

$$\left. + \sin\alpha)(\cos\alpha - \sin 22{,}5^\circ)\right)$$

$$-\frac{5}{4} p_0 V_0 r^2 (\sin 2\alpha - \sin 45^\circ) = p_0 V_0 r^2 \left(\pi \cdot \frac{67{,}5^\circ - \alpha}{360^\circ} - \frac{\sin 22{,}5^\circ \cdot \sin(67{,}5^\circ - \alpha)}{\cos\alpha}\right) + \frac{1}{2} (\sin 22{,}5^\circ \cdot \operatorname{tg}\alpha + \sin\alpha)(\cos\alpha - \sin 22{,}5^\circ)$$

3) $\eta = \frac{\Sigma A}{Q_H}$

$Q_H = Q_{21} = A_{21} + \Delta U_{21}$

$A = A_{12} + A_{21}$

$\Delta U_{21} = \frac{5}{2} \nu R (T_1 - T_2) = \frac{5}{2} (p_1 V_1 - p_2 V_2) = \frac{5}{4} p_0 V_0 r^2 (\sin 45^\circ - \sin 30^\circ)$

Т.к. для 2-1 хар-но пренебрежимо малый теплообмен с окр. ср.

$A_{21} \approx 0$

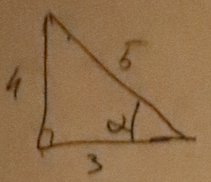
$$\eta = \frac{A_{12}}{\Delta U_{21}} = \frac{p_0 V_0 \left(\pi r^2 \cdot \frac{90^\circ - 22{,}5^\circ - 15^\circ}{360^\circ} - \frac{1}{2} r \cdot \frac{V_1}{V_0 \cdot \cos 15^\circ} \cdot \sin(90^\circ - 22{,}5^\circ - 15^\circ) + \frac{1}{2}\left(\frac{V_2}{V_0} - \frac{V_1}{V_0}\right)\left(\frac{V_1}{V_0} \operatorname{tg} 15^\circ + \frac{p_2}{p_0}\right)\right)}{\frac{5}{4} p_0 V_0 r^2 (\sin 45^\circ - \sin 30^\circ)}$$

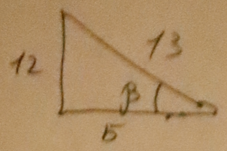
$$= \frac{4}{5} \cdot \frac{\frac{\pi \cdot 52{,}5}{360} - \frac{1}{2} \cdot \sin 22{,}5^\circ \cdot \frac{\sin 52{,}5^\circ}{\cos 15^\circ} + \frac{1}{2} (\sin 22{,}5^\circ \cdot \operatorname{tg} 15^\circ + \sin 15^\circ)(\cos 15^\circ - \sin 22{,}5^\circ)}{\sin 45^\circ - \sin 30^\circ}$$

Ответ: 1) $\sqrt{2} - 1 \approx 0{,}41$; 2) 3)

Вариант 11-08 Черновик (1)

1 2
1) 1)
2) 2)
3) 3.





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

$\sin\beta = \frac{12}{13}$

$\sqrt{169-25} = 12$

№1

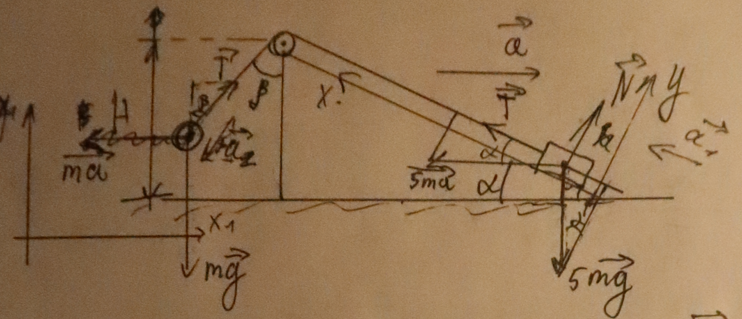
$\cos\alpha = \frac{3}{5}$

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

1) a_{min} ?

2) $a_{1\,бл}$ – ?

3) t – ?



$$\vec{T} + m\vec{g} + m\vec{a} = 0$$

$x_1: -ma + T\cdot\sin\beta = -m\cdot a_2\cdot\sin\beta$

$y_1: T\cdot\cos\beta - mg = -ma_2\cos\beta$

$$\vec{T} + \vec{N} + 5m\vec{g} + 5m\vec{a} = 5m\vec{a}_1$$

$x: T + 5ma\cdot\cos\alpha - 5mg\cdot\sin\alpha = 5ma_1$

$y: N - 5mg\cdot\cos\alpha - 5ma\cdot\sin\alpha = 0$

$72a_1 + 48g = 98a_1 + \frac{343}{15}g$

$26a_1 = \left(26 - \frac{13}{15}\right)g$

$a_1 = \left(1 - \frac{13}{15\cdot 26}\right)g$

$\frac{377}{390}g$ 195

$a =$

$a_1 = a_2$

$T\cdot\sin\beta - ma = -ma_1\cdot\sin\beta$ (1)

$T\cdot\cos\beta - mg = -ma_1\cdot\cos\beta$ (2)

$T + 5ma\cdot\cos\alpha - 5mg\cdot\sin\alpha = 5ma_1$ (3)

(3): $T = 5m(a_1 + g\cdot\sin\alpha - a\cdot\cos\alpha)$

(3) в (1) и во (2):

$$\begin{cases} \sin\beta\cdot 5m(a_1 + g\cdot\sin\alpha - a\cdot\cos\alpha) - ma = -ma_1\cdot\sin\beta \\ \cos\beta\cdot 5m(a_1 + g\cdot\sin\alpha - a\cdot\cos\alpha) - mg = -ma_1\cdot\cos\beta \end{cases}$$

$$\begin{cases} 5a_1\sin\beta + 5g\sin\alpha\cdot\sin\beta - 5a\cdot\cos\alpha\cdot\sin\beta - a = -a_1\sin\beta \\ 5a_1\cos\beta + 5g\sin\alpha\cdot\cos\beta - 5a\cdot\cos\alpha\cdot\cos\beta - g = -a_1\cos\beta \end{cases}$$

$$\begin{cases} a_1\cdot 6\cdot\frac{12}{13} + g\cdot 5\cdot\frac{4}{5}\cdot\frac{12}{13} - a\cdot 5\cdot\frac{3}{5}\cdot\frac{12}{13} - a = 0 \\ a_1\cdot 6\cdot\frac{5}{13} + g\cdot 5\cdot\frac{4}{5}\cdot\frac{5}{13} - a\cdot 5\cdot\frac{3}{5}\cdot\frac{5}{13} - g = 0 \end{cases}$$

$$\begin{cases} a_1\cdot\frac{72}{13} + g\cdot\frac{48}{13} - a\left(\frac{3\cdot 12 + 13}{13}\right) = 0 \\ a_1\cdot\frac{30}{13} + g\left(\frac{20}{13} - 1\right) - a\cdot\frac{15}{13} = 0 \end{cases} \qquad \begin{cases} a_1\cdot\frac{72}{13} + g\cdot\frac{48}{13} = a\cdot\frac{49}{13} \\ a_1\cdot\frac{30}{13} + g\cdot\frac{7}{13} = a\cdot\frac{15}{13} \end{cases}$$

Из Шаблон $H = v_0 t + \frac{a_1\cdot\cos\beta\cdot t^2}{2}$, $v_0 = 0$ $H = \frac{a_1\cdot\cos\beta\, t^2}{2}$

$t^* = \sqrt{\frac{2H}{a_1\cos\beta}} = \sqrt{\frac{26H}{5a_1}}$

Часть 2

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

Шифр: **21201931**

ID профиля: **300004**

Вариант 8

(1) Вариант 11-01 Чистовик Физика, 11кл

№5

$l = 25$ см

$\frac{D_1}{D_2} = 5$

$l_2 = 50$ см

1) x - ?

D_1 - ?

2) D_3 - ?

D_2 - опт. сила очков для чтения с рас l

D_1 - опт. сила очков для рассмат. удал. предметов

D_3 - опт. сила очков для чтения с рас l_2

D_0 - опт. сила глаза

Запишем урав. тонкой линзы (y - рас., где фокусируется изображение, которое глаз видит)

$$D_0 + D_2 = \frac{1}{l} + \frac{1}{y} \quad (1)$$

$$D_0 + D_1 = \frac{1}{\infty} + \frac{1}{y} \quad (2)$$

$$D_0 = \frac{1}{x} + \frac{1}{y} \quad (3)$$

$$D_3 + D_0 = \frac{1}{l_2} + \frac{1}{y} \quad (4)$$

из $\frac{D_1}{D_2} = 5$; $D_2 = \frac{1}{5} D_1$

(2): $D_0 + D_1 = \frac{1}{y}$

$$\begin{cases} D_0 + D_1 = \frac{1}{y} \\ D_0 + \frac{1}{5} D_1 = \frac{1}{l} + \frac{1}{y} \\ D_0 = \frac{1}{x} + \frac{1}{y} \end{cases}; \quad \begin{cases} D_0 + \frac{1}{5} D_1 = \frac{1}{l} + D_0 + D_1 \\ D_0 = \frac{1}{x} + D_0 + D_1 \end{cases}; \quad \begin{cases} -\frac{4}{5} D_1 = \frac{1}{l} \\ -D_1 = \frac{1}{x} \end{cases}$$

$$\begin{cases} D_1 = -\frac{5}{4} \cdot \frac{1}{l} \\ \frac{1}{x} = \frac{5}{4l} \end{cases};$$

$$D_1 = -\frac{5}{4l} = -\frac{5}{4 \cdot 0{,}25\text{м}} = -5 \text{ дптр}$$

$$x = \frac{4}{5} l = \frac{4}{5} \cdot 0{,}25\text{м} = 0{,}2\text{м} = 20\text{см}$$

из (2) и (4): $\begin{cases} D_0 + D_1 = \frac{1}{y} \\ D_3 + D_0 = \frac{1}{l_2} + \frac{1}{y} \end{cases}$

$$D_3 = \frac{1}{l_2} + D_1 = \frac{1}{0{,}5} - 5 = -3 \text{ дптр}$$

Ответ: 1) $x = 20$ см

$D_1 = -5$ дптр

2) $D_3 = -3$ дптр

№3

Чистовик

Физика, 11кл

$C_2=5C$

$C_1=C$

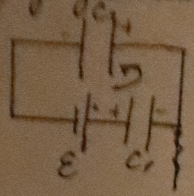
I_0

1) I' - ?

2) Q - ?

3) U_R - ?

1) до замыкания:



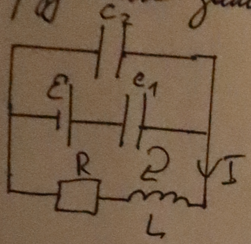
по пр. Кир.: $\mathcal{E}=U_1+U_2$

$$\mathcal{E}=\frac{q}{C}+\frac{q}{5C}$$

$$q=\frac{5}{6}\mathcal{E}C$$

$U_1=\frac{5}{6}\mathcal{E}\ \left(=\frac{q}{C}\right)$; $U_2=\frac{1}{6}\mathcal{E}\ \left(=\frac{q}{5C}\right)$

Сразу после зам.:



$I=0$

$U_{C_1}=U_1=\frac{5}{6}\mathcal{E}$

Из-за катушки ток ещё не течёт, и напряжения на конденсаторах прежние.

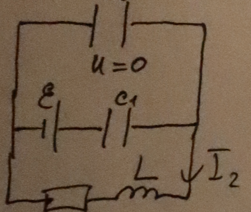
по пр. Кир.: $\mathcal{E}=U_1+\mathcal{E}_{is}$

$$\mathcal{E}=\frac{5}{6}\mathcal{E}+LI'$$

$$I'=\frac{1}{L}\cdot\frac{1}{6}\mathcal{E}=\frac{1}{6}\frac{\mathcal{E}}{L}$$

2) $A=\Delta W+Q$; $Q=A-\Delta W$

В конце:



$U_{C_1}=\mathcal{E}$

~~C_2 разрядится~~

$I_2=0$

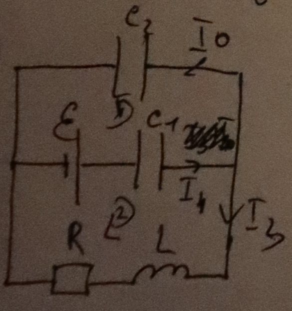
$\frac{q_1}{C}=\mathcal{E}$ $\qquad q_1=\mathcal{E}C$

$$A=\mathcal{E}(q_1-q)=\mathcal{E}\left(\mathcal{E}C-\frac{5}{6}\mathcal{E}C\right)=\frac{1}{6}\mathcal{E}^2C$$

$$\Delta W=\frac{CU_{C_1}^2}{2}-\frac{CU_1^2}{2}-\frac{5CU_2^2}{2}=\frac{C}{2}\left(\mathcal{E}^2-\frac{25}{36}\mathcal{E}^2-\frac{1}{36}\mathcal{E}^2\right)=\frac{5}{36}C\mathcal{E}^2$$

$$Q=\mathcal{E}^2C\left(\frac{1}{6}-\frac{5}{36}\right)=\frac{1}{36}\mathcal{E}^2C$$

3)



$U_R=I_3\cdot R$

$I_0=\frac{q_0}{\Delta t}$; $I_4=\frac{q_4}{\Delta t}$

По правилам Кир.: 1) $\mathcal{E}=U_{C_1}+U_{C_2}$; $U_{C_2}=\mathcal{E}-U_{C_1}$

2) $\mathcal{E}=U_{C_1}+I_3R+\mathcal{E}_{is_2}$

$I_4=I_0+I_3$; $I_3=I_4-I_0$

$$\mathcal{E}=U_{C_1}+I_3R+L\frac{\Delta I}{\Delta t}$$

$$\mathcal{E}=\frac{q_{C_1}}{C}+\left(\frac{q_4}{\Delta t}-\frac{q_0}{\Delta t}\right)R+L\frac{(I_3-0)}{\Delta t}$$

Ответ: 1) $I'=\frac{1}{6}\frac{\mathcal{E}}{L}$; 2) $Q=\frac{1}{36}\mathcal{E}^2C$; 3)

Чистовик

Физика, 11 кл

№4.

$b = \frac{2}{3}d$

$H = 3d$

v_0, B

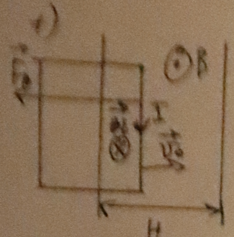
R

1) a – ?

2) v_1 – ?

3) v_2 – ?

1)



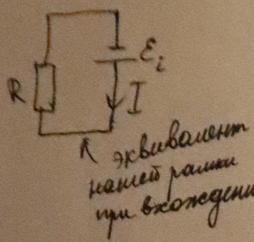
Из-за ~~того~~ возникновения самоиндукции в рамке потечёт ток. $\Delta\Phi\uparrow \Rightarrow$ ... по пр. Ленца

Δt – малый промежуток, такой что v_0 не изменилась

$$\mathcal{E}_i = \frac{|\Delta\Phi|}{\Delta t} = \frac{B \cdot d \cdot v_0 \cdot \Delta t}{\Delta t} = B d v_0$$

$$\mathcal{E}_i = IR$$

$$I = \frac{\mathcal{E}_i}{R} = \frac{Bdv_0}{R}$$



$$ma = F_A$$

$$ma = BI\cancel{b}d$$

$$a = \frac{Bd}{m} \cdot \frac{Bdv_0}{R} = \frac{B^2 d^2 v_0}{mR}$$

2) Пока рамка будет „входить" в поле будет течь в ней ток, т.к. S будет менятся, т.е. на рамку будет действовать F_A. Как только в поле войдёт ~~левый~~ сторона рамки ток прекратит течь, т.к. B и S будут const, а когда ~~правый край~~ сторона начнёт выходить до ~~того~~ момента, когда ~~лев~~ рамка полностью выйдет, ток снова начнёт течь в рамке и снова ~~появится~~ появится F_A. (Это всё возможно т.к. $H > b$ ($3d > \frac{2}{3}d$), т.е. в какой-то момент рамка полностью будет в поле.)

$$\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + A_1$$

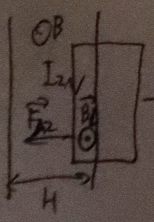
$$\cancel{A_1 = \int F_A s \cdot \cos\alpha = b\int F_A\, dv = b\int_{v_0}^{v_1} BId\, dv = \frac{2}{3}Bd\int_{v_0}^{v_1} \frac{Bdv}{R}\, dv = \frac{2}{3}\frac{B^2d^3}{R}\frac{v^2}{2}\Big|_{v_0}^{v_1} =}$$

$$A_1 = \int F_A \cdot s \cdot \cos\alpha\, dt$$

$$\cancel{= \frac{1}{3}\frac{B^2d^3}{R}(v_1^2 - v_0^2)}$$

$$\cancel{\frac{mv_0^2}{2} + \frac{1}{3}\frac{B^2d^3}{R}v_0 = v_1^2\left(\frac{m}{2} + \frac{1}{3}\frac{B^2d^3}{R}\right)};\quad \cancel{v_1 = v_0}$$

3)



$$\frac{mv_1^2}{2} = \frac{mv_2^2}{2} + A_2$$

$$\cancel{A_2 = \frac{1}{3}\frac{B^2d^3}{R}(v_2^2 - v_1^2)}$$

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

Ответ:
1) $a = \frac{B^2 d^2}{mR} v_0$
2) ~~$v_1 = v_0$~~
3) ~~$v_2 = v_0$~~

21201931 (U300004 M1263604)

Черновик

№4

$b = \frac{2}{3}d$

$H = 3d$

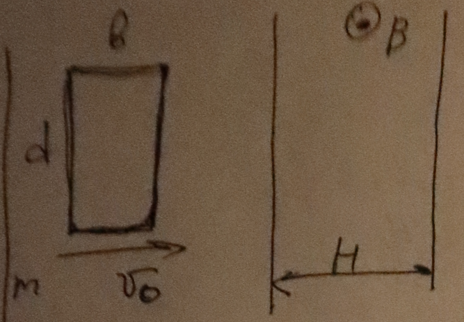
v_0, B

R

1) $a - ?$

2) $v_1 - ?$

3) $v_2 - ?$



$BI\ell$

Bqv

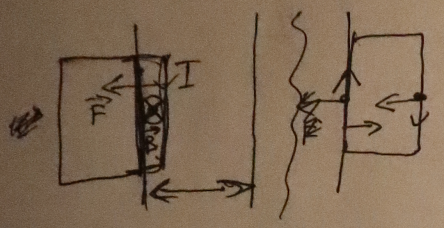
$\mathcal{E}_i = \frac{|\Delta\Phi|}{\Delta t} = \frac{\Delta(B \cdot S \cos)}{\Delta t}$

$R = \rho \frac{\ell}{S} = \frac{(2b+2d)\rho}{S}$

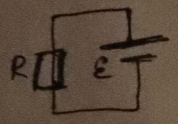
$R_r = \frac{d\,\rho}{S}$

$\frac{R}{R_r} = \frac{2b+2d}{d}$; $R_r = \frac{1}{\frac{4}{3}+2} R = \frac{3}{10} R$

$R_B = \frac{2}{10} R$



$\mathcal{E}_i = \frac{\Delta\Phi}{\Delta t} = B \frac{d\,v_0 \Delta t}{\Delta t} = B \cdot v_0 d$



$\mathcal{E} = IR$; $I = \frac{\mathcal{E}}{R} = \frac{Bv_0d}{R}$

$ma = BI \cdot d$

$a = \frac{Bd}{m} \cdot \frac{Bv_0d}{R} = \frac{B^2d^2v_0}{mR}$

$a = v_0$

$v_0' = v_0 \frac{B^2d^2}{mR}$

$dv_0 = \frac{B^2d^3}{mR} dt$

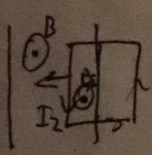
2) $b = \frac{v_1^2 - v_0^2}{-2a}$;

$\frac{2}{3}d \cdot 2a = v_0^2 - v_1^2$

$v_1 = \sqrt{v_0^2 - \frac{4}{3}d \cdot a} =$

$= \sqrt{v_0^2 - \frac{4}{3} \cdot \frac{B^2d^3v_0}{mR}}$

3)



$\mathcal{E}_2 = Bv_0d$

$I_2 = I = Bv$

№5.

$\ell = 25$ см

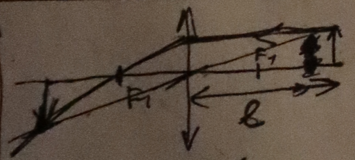
$\frac{D_2}{D_1} = 5$

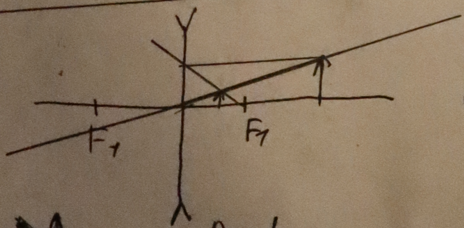
1) $x - ?$

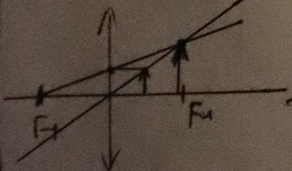
$D_1 - ?$

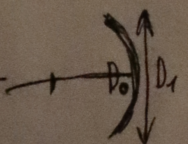
2) $D_3 - ?$

$\ell_2 = 50$ см









$D = \frac{1}{F}$

$D_0 + D = \frac{1}{\ell} + \frac{1}{y}$

$D_0 = \frac{1}{x} + \frac{1}{y}$

$D_0 - D_1 = \frac{1}{\infty} + \frac{1}{y}$

$\begin{cases} 4D_1 = \frac{1}{\ell} \\ 0 = \frac{1}{x} - 4D_1 \end{cases}$; $\begin{cases} -D_1 = -\frac{1}{4\ell} \\ 0 = \frac{1}{x} - \frac{1}{4\ell} \end{cases}$

$\frac{1}{x} = \frac{1}{4\ell}$

$x = 4\ell$

$\begin{cases} D_0 - \frac{1}{5}D_1 = \frac{1}{\ell} + \frac{1}{y} \\ D_0 = \frac{1}{x} + \frac{1}{y} \\ D_0 - D_1 = \frac{1}{y} \end{cases}$

$\frac{1}{5}D = \frac{1}{\ell} + D$

$-\frac{4}{5}D = \frac{1}{\ell}$

$\begin{cases} D_0 - D_3 = \frac{1}{\ell_2} + \frac{1}{y} \\ D_0 - D_1 = \frac{1}{y} \end{cases}$

$D_1 - D_3 = \frac{1}{\ell_2} - D_1$

$D_3 = D_1 - \frac{1}{\ell_2} =$

Черновик

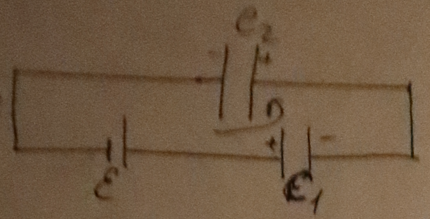
3 4 5

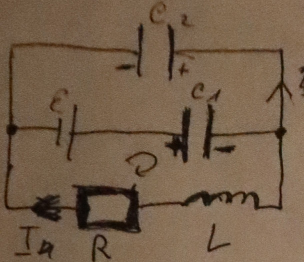
№3 $C_1 = C$
$C_2 = 5C$

1) $I' - ?$

2) $Q - ?$

3) I_0
$U_R - ?$

① 

② 

① $\mathcal{E} = U_1 + U_2$

$\mathcal{E} = \frac{q}{C} + \frac{q}{5C}$

$\mathcal{E} = \frac{6q}{5C}$

$q = \frac{5}{6}\mathcal{E}C$

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

② $I = 0$

$\mathcal{E} = U_1 + \mathcal{E}_{is}$

$\mathcal{E} = \frac{5}{6}\mathcal{E} + L \cdot I'$

$I' = \frac{1}{L} \cdot \frac{1}{6}\mathcal{E} = \frac{1}{6} \cdot \frac{\mathcal{E}}{L}$

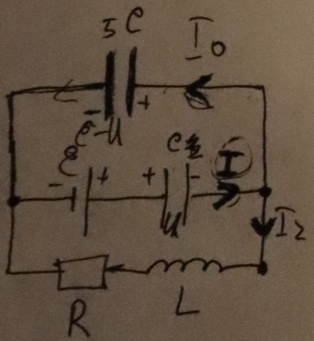
2) $A = \Delta W + Q$

$U_3 = \mathcal{E} - U_2$

~~$Q = W_2 - \frac{CU_1^2}{2} - \frac{CU_2^2}{2} + Q$~~

~~$Q = \frac{CU_1^2}{2} + \frac{CU_2^2}{2}$~~

$\frac{36 - 26}{36} = \frac{10}{36} = \frac{5}{18}$

3) 

$U_R = I_2 \cdot R$

$\mathcal{E} = U_2 + U_R + \mathcal{E}_{is3}$

~~$\frac{1}{6}\mathcal{E} = U_R + \mathcal{E}_{is3}$~~

~~$\frac{1}{6}\mathcal{E} = I_2 \cdot R + L\frac{\Delta I}{\Delta t}$~~

$\mathcal{E} =$

$I_0 = \frac{q_0}{\Delta t}$

$\mathcal{E} = U_R + U + L \cdot I_2'$

$\mathcal{E} = I_2 R + U + L \cdot \frac{I_2}{\Delta t}$

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

q_0

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