Часть 1

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

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Вариант 6

Тестовик N1.

Дано:

α -

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

m

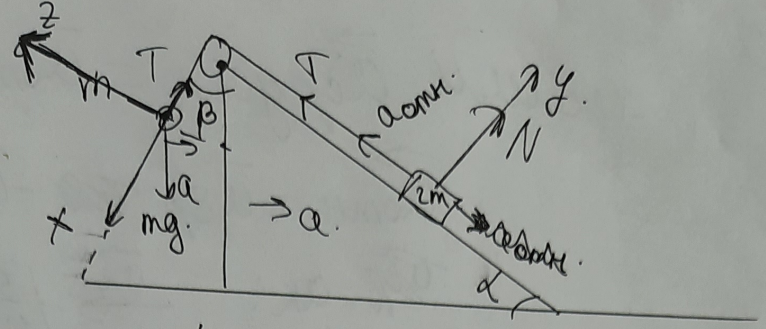
$2m$, β

$\cos\beta = 12/13$

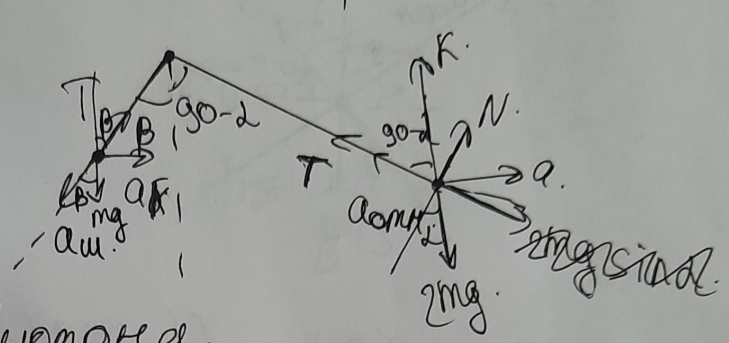
$a_к$ - ?

$a_{отн}$ - ?

t - ?

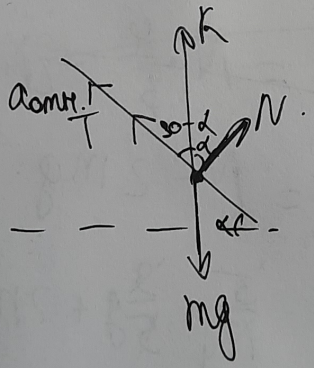


$|a_ш| = |a_{отн}|$



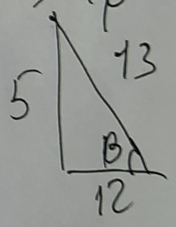
2 З-Н Ньютона.

K: $ma_ш \cdot \cos\beta = mg - T\cos\beta$

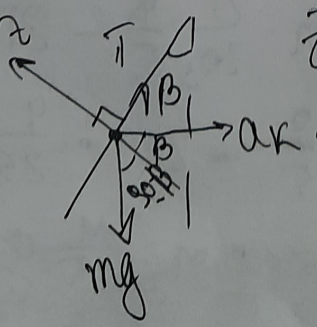


$\sin\alpha = \frac{3}{5}$

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



K: $2ma_{отн} \cdot \sin\alpha = T\sin\alpha + N\cos\alpha - mg$.

Z: 

Z: $ma_к \cdot \cos\beta = mg \cdot \sin\beta$

$a_к = g \cdot tg\beta = \frac{5}{12} g \approx 4{,}16$

$a_к \approx 4{,}17 \frac{м}{с}$

$a_к \cdot \frac{12}{13} = g \cdot \frac{5}{13}$

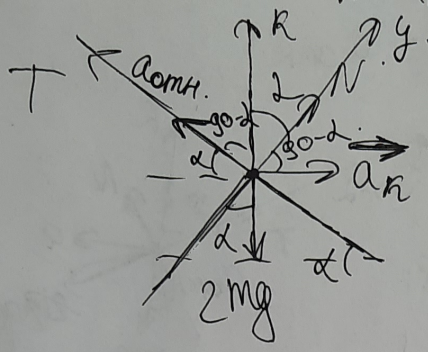
Четвёрка №2.

№1.

разделим $\vec{a}_{бруска} = \vec{a}_{отн} + \vec{a}_к$

$\vec{a}_{отн} = \vec{a}_{бр} - \vec{a}_к$.

$a_к$: $\vec{a}_к \to |\frac{5}{12}\vec{g}| = a_к$.



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

$\frac{5}{20} \times \frac{16}{20}$

y: $2ma_к \cdot \sin\alpha = N - 2mg\cos\alpha$.

$N = 2m(\frac{5}{12}g \cdot \frac{3}{5} + g \cdot \frac{4}{5}) = 2m\frac{21}{20}g = 2{,}1mg$

~~K: $2ma_{отн} \cdot \frac{3}{5} = N \cdot \frac{4}{5} - 2mg = 2m(\frac{21}{20} \cdot \frac{4}{5}g - g)$.~~

y: $2m \cdot a_к \cdot \frac{3}{5} = N - 2mg \cdot \frac{4}{5}$

$N = 2m \cdot \frac{5}{12} \cdot \frac{3}{5}g + 2m\frac{4}{5}g = 2mg \cdot \frac{21}{20}$.

~~y~~ K: $2ma_{отн} \cdot \frac{3}{5} = N \cdot \frac{4}{5} - 2mg + T \cdot \frac{3}{5}$

$2m \cdot a_{отн} \cdot \frac{3}{5} = 2m \cdot \frac{21}{20} \cdot \frac{4}{5} - 2mg + T \cdot \frac{3}{5}$

$2ma_{отн} \cdot \frac{3}{5} = T \cdot \frac{3}{5} - 2m \cdot \frac{4}{25}g$

$2a_{отн} \cdot m = T - 2m \cdot \frac{4}{15}g$.

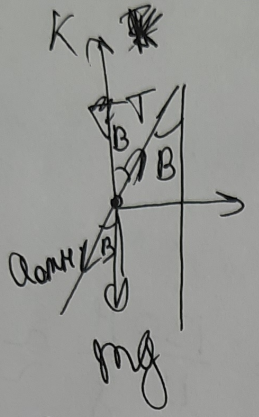
Вариант №3.

№1 - аналогично $\vec{a}_{шара} = \vec{a}_{отн} + \vec{a}_{к}$

$a_{отн} = a_к - a_ш$.

~~$|a_ш| = |a_{бр}|$ т.к. нить~~

$a_{отн} = a_{отн}$ - шара и бруска.



$$\begin{cases} K: \frac{12}{13} m a_{отн} = mg - T \cdot \frac{12}{13} \\ 2 a_{отн} \cdot m = T - m \cdot \frac{8}{15} g. \end{cases}$$

$$m a_{отн} = \frac{T}{2} - m \frac{4}{15} g.$$

$$m a_{отн} = \frac{13}{12} mg - T$$

$$\frac{T}{2} - \frac{4}{15} mg = \frac{13}{12} mg - T$$

$$\frac{3}{2} T = \left(\frac{13}{12} + \frac{4}{15}\right) mg.$$

$$T = \frac{2}{3} \cdot \left(\frac{65 + 16}{60}\right) mg = \frac{81 \cdot 8}{3 \cdot 20 \cdot 3} mg = \frac{9}{10} mg$$

$$a_{отн} = \frac{9}{20} mg - \frac{4}{15} mg = \frac{27 - 16}{60} mg = \frac{11}{60} mg.$$

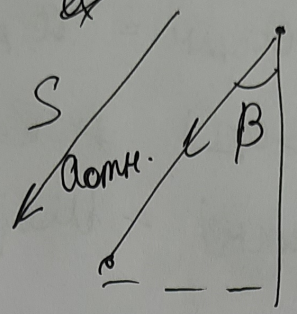
$$a_{отн} = \frac{11}{60} \cdot g \approx 1{,}83 \frac{м}{с^2}.$$

N1.

Чистовик N4.

N1.

t - ?



$\cos\beta = \frac{H}{S}$.

$S = \frac{H}{\cos\beta} = \frac{13}{12} H$.

$\frac{a_{отн} t^2}{2} = \frac{13}{12} H$.

$t^2 = \frac{10}{11g} \cdot \frac{13}{6} H = \frac{130 H}{11 g} \approx 3{,}44 \sqrt{\frac{H}{g}}$

Ответ: 1) $a_к = \frac{5}{12} g$ 2) $\approx 4{,}17 \frac{м}{с^2}$; 2).

$a_{отн} = \frac{11}{60} g \approx 1{,}83 \frac{м}{с^2}$; 3) $t = \sqrt{\frac{130H}{11g}} \approx 3{,}44 \sqrt{\frac{H}{g}}$

Чистовик N5.

N2.

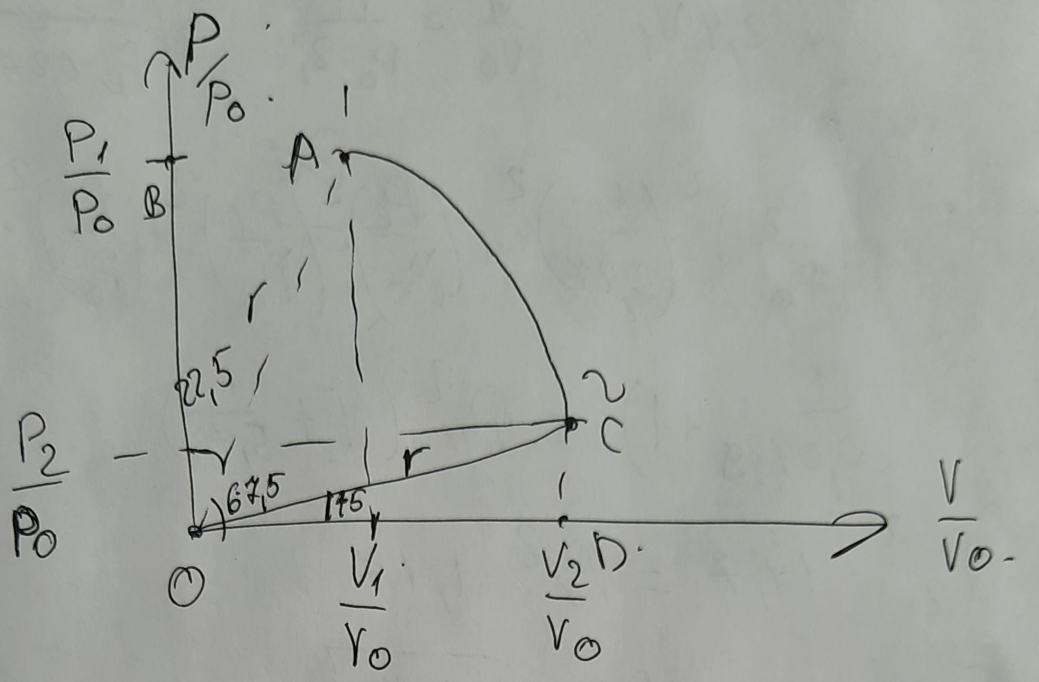
Дано:

$i=5$

$C_V=\frac{5}{12}R$

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

$\alpha-?$



1: $P_1V_1=\nu RT_1$ $\quad \frac{P_1V_1}{V_0P_0}=\frac{\nu RT_1}{V_0P_0}$.

2: $\frac{P_2V_2}{V_0P_0}=\frac{\nu RT_2}{V_0P_0}$ $\quad tg\,15=\frac{P_2V_0}{P_0V_2}=0{,}27$

$tg\,15^\circ=\frac{V_2P_0}{P_2V_0}$ $\quad tg(90-22{,}5)^\circ=\frac{P_1\cdot V_0}{V_1\cdot P_0}=2{,}4$

$\frac{V_2P_0}{P_2V_0}=0{,}27\Rightarrow V_2=0{,}27\cdot\frac{V_0}{P_0}P_2$ $\quad \frac{T_1}{T_2}=\frac{P_1V_1}{P_2V_2}$.

$\triangle OAB$ и $\triangle OCD$ по т. Пифагора.

$$\left(\frac{V_2}{V_0}\right)^2+\left(\frac{P_2}{P_0}\right)^2=\left(\frac{P_1}{P_0}\right)^2+\left(\frac{V_1}{V_0}\right)^2$$

$V_2=0{,}27\cdot\frac{V_0}{P_0}\cdot P_2$ $\quad P_2=\frac{P_0}{V_0}\cdot V_2\cdot 0{,}27$.

Л.р. №4.

Листовка №6.

$P_1 = \frac{P_0}{V_0} \cdot 2{,}4 V_1 \qquad \frac{V_1}{V_0} = \frac{P_1}{P_0 \cdot 2{,}4} \qquad \frac{P_2}{P_0 \cdot 0{,}27} = \frac{V_2}{V_0}$

$\left(\frac{P_2}{P_0}\right)^2 \cdot \left(\frac{1}{0{,}27}\right)^2 + \left(\frac{P_2}{P_0}\right)^2 = \left(\frac{P_1}{P_0}\right)^2 + \left(\frac{P_1}{P_0}\right)^2 \cdot \left(\frac{1}{2{,}4}\right)^2$

$P_2^2 \left(\frac{1}{0{,}0729} + 1\right) = P_1^2 \left(1 + \frac{1}{5{,}76}\right)$

$P_2^2 \cdot 14{,}7 = P_1^2 \cdot 1{,}17$

$\frac{P_1}{P_2} = \sqrt{\frac{14{,}7}{1{,}17}} = 3{,}5$

$P_1 = 3{,}5 P_2 = \frac{P_0}{V_0} \cdot 2{,}4 V_1 = 3{,}5 \frac{P_0}{V_0} \cdot 0{,}27 V_2$

$2{,}4 V_1 = 0{,}95 V_2.$

$2{,}54 V_1 = V_2.$

$\frac{T_1}{T_2} = \frac{3{,}5 P_2 \cdot V_1}{P_2 \cdot 2{,}54 V_1} = 1{,}38$

Ответ: 1,38

2) $C = 0 \Rightarrow \delta Q = 0 = \frac{5}{2} \nu R dT + P dV$

для малого процесса $dT = T$

$\frac{dT}{T} = \frac{dV}{V} + \frac{dP}{P}$

$dT = \frac{T}{V} dV$

$\frac{5}{2} \nu R \frac{T}{V} dV -$

$\frac{dV}{dT} = \frac{V}{T}$

Задача №8.

3) за цикл.

$Q_{12} = \frac{5}{2}\nu R(T_2 - T_1) + A_{12}$

$Q_{21} = 0 = \frac{5}{2}\nu R(T_1 - T_2) + A_{21}$.

$A_{12} + A_{21} = A$ газа.

$C = 0 \Rightarrow P\,dV + \frac{5}{2}\nu R\,dT = 0$.

$\frac{dV}{V} + \frac{dP}{P} = \frac{dT}{dT} = \left(-\frac{2}{5} + 1\right)\frac{dV}{V} = \frac{dT}{T}$

$C = 0 \Rightarrow n = \frac{5+2}{5} = \frac{7}{5}$.

$\frac{dP}{P} = -\frac{7}{5}\frac{dV}{V}$

$-\frac{2}{5}\frac{dV}{dT} = \frac{V}{T} \cdot \frac{dV}{dT} = -\frac{5}{2}$

$0 = P\frac{dV}{dT} + \frac{5}{2}\nu R = 0$.

$\nu R = \frac{PV}{T}$

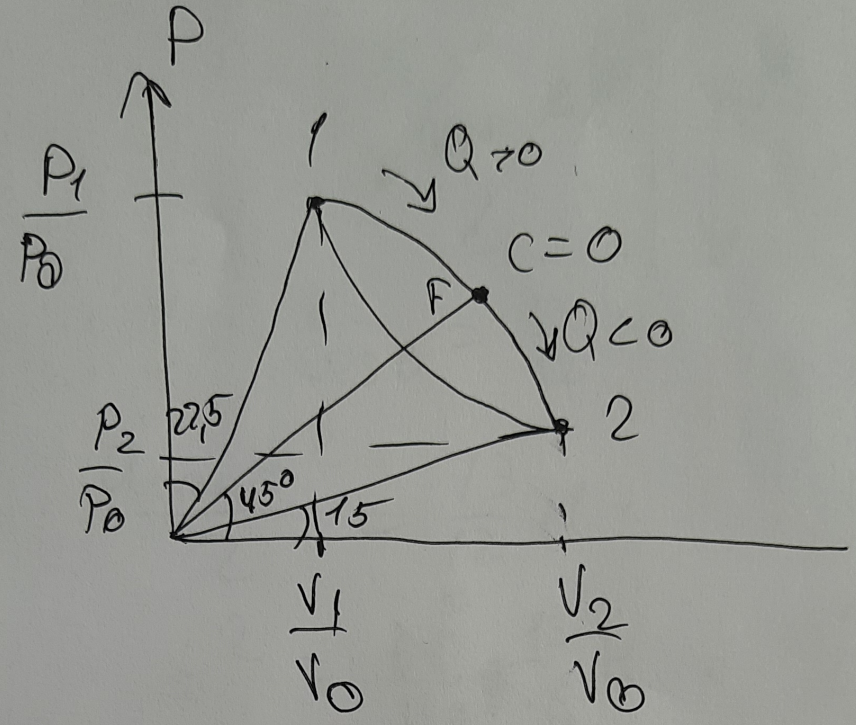
$P \cdot \left(-\frac{2}{5}\right)\frac{V}{T} + \frac{5}{2}\nu R = 0$

$C = 0$, при $\alpha = 45°$ из симметрии и логики.

$\operatorname{tg}\alpha = 1$.

Вариант №9.

3)



Ад 21; $Q=0 \Rightarrow \frac{5}{2}\nu R(T_2-T_1)=|A_{21}|$

$$\eta=\frac{A_{12}-A_{21}}{A_{12}}$$

Ответ: 0,38; 45°

Задача N4.

Задача N7.

$C=0 \Rightarrow Q=0 = \frac{5}{2}\nu R\,dT + P\,dV$ ($dT<0$, $dV>0$)

$\frac{5}{2}\nu R\,dT = -P\cdot dV$

$\frac{5}{2}\nu R \cdot \frac{dT}{P} = -\frac{V}{T}$

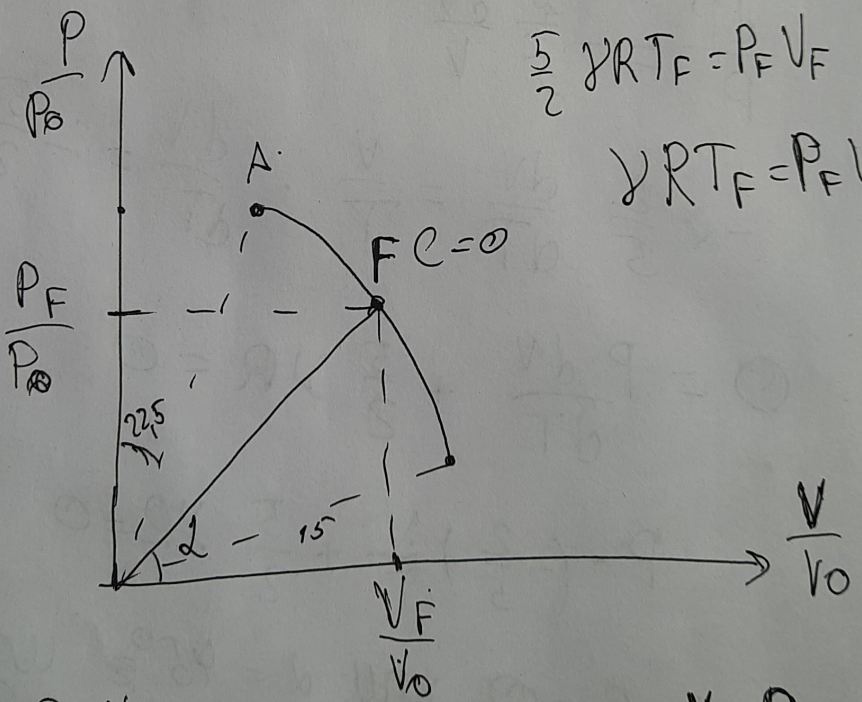
$\frac{5}{2}\nu R T_F = P_F V_F$

$r = \text{const}$

$\text{const} = r^2 = \left(\frac{P}{P_0}\right)^2 + \left(\frac{V}{V_0}\right)^2$

$V_0 P_0 r^2 = V_0^2 P^2 + V^2 P_0^2$

$V_0 \cdot 2P\,dP \cdot P + P_0^2 \cdot 2V\,dV = 0$



$\frac{5}{2}\nu R T_F = P_F V_F$

$\nu R T_F = P_F V_F$

$\operatorname{tg}\alpha = \frac{P_F V_0}{P_0 V_F}$ ... $\operatorname{tg} 22{,}5 = \frac{V_1 \cdot P_0}{V_0 \cdot P_1} = 0{,}4$

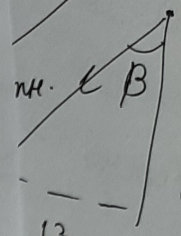
$\sin\alpha = \frac{\frac{P_F}{P_0}}{\sqrt{\frac{P_F^2}{P_0^2} + \frac{V_F^2}{V_0^2}}} = \frac{P_F}{P_0 \sqrt{P_1^2 + \frac{V_1^2 P_0^2}{V_0^2}}}$

$\frac{P_1}{V_1} =$

N1.

черновик.

чистовик



$\frac{13}{12}$ н.

Часть 2

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

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ID профиля: **343696**

Вариант 6

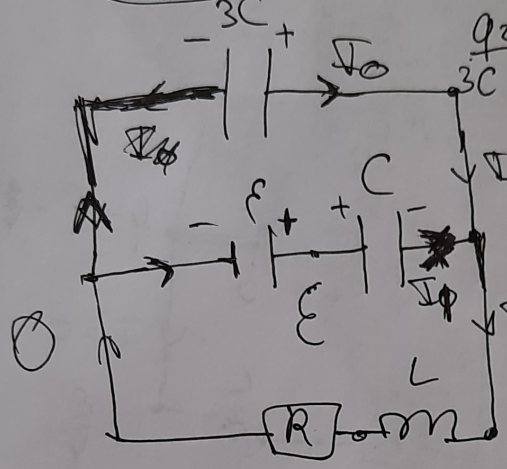
Черновик №2.

q_1 – заряд протекший через $\mathcal{E}$ $q_1 = \mathcal{E}C - \frac{3}{4}\mathcal{E}C = \frac{\mathcal{E}C}{4}$

$W_K = \frac{\mathcal{E}^2 C}{2}$

ЗЗ №1 $A_i = \frac{\mathcal{E}^2 C}{2} - \frac{3\mathcal{E}^2 C}{8} + Q = \frac{\mathcal{E}^2 C}{4}$

$Q = \frac{\mathcal{E}^2 C}{8}$



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

$I_R = I_0 + I_1$

$\mathcal{E} - \frac{q_1}{C} = \frac{q_2}{C}$

$I_R = \frac{q_2}{C} - \mathcal{E}_i = \frac{q_2}{C} - L \cdot \ddot{q}$

$\dot{q}_2 = I_0 = \frac{dq_2}{dt}$

$q_1 + q_2 = \mathcal{E}C \Rightarrow I_1 = -I_0 \Rightarrow I_R = 0 \Rightarrow$

$\mathcal{E} - \frac{q_1}{C} = \frac{q_2}{3C} \Rightarrow 3\mathcal{E}C = q_2 + 3q_1$

$I_2 = -3I_1$

$U_R = \frac{4}{3} I_0 R_0$

$I_1 = \frac{I_0}{3}$

$I_R = \frac{2}{3} I_0 \frac{4}{3}$

$U_R = \frac{4}{3} I_0 R$

Ответ: 1) $\frac{3\mathcal{E}}{4L}$; 2) $Q = \frac{\mathcal{E}^2 C}{8}$; $U_R = \frac{4}{3} I_0 R$

Листовек №3

№4.

Дано:

m

d

$b = \frac{d}{4}$

$V_0 =$

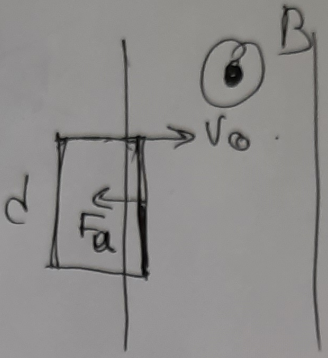
R

B

$H = 2d$

$a - ?$

$V_1 - ?$

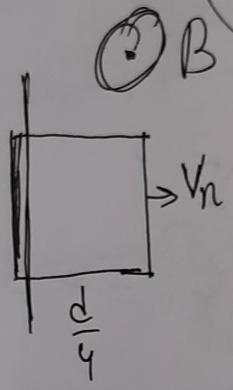


$$\mathcal{E}_i = \frac{d\Phi}{dt} = \frac{B \cdot d}{} V_0$$

$$I = \frac{B d V_0}{R}$$

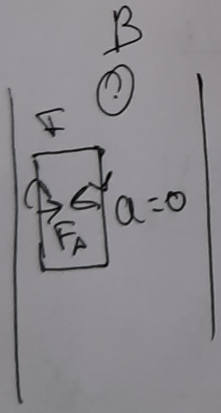
$$F_a = I d \cdot B = \frac{B^2 d^2 V_0}{R}$$

$$a = \frac{B^2 d^2 V_0}{mR}$$



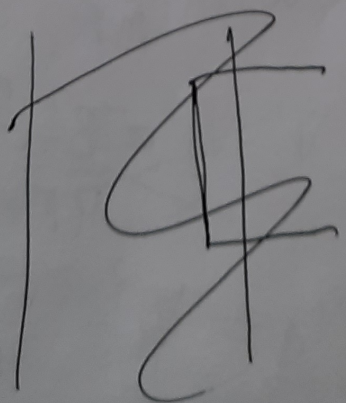
$$V_0^2 - V_n^2 = 2 \cdot \frac{B^2 d^2 V_0^2}{R} \cdot \frac{d}{4}$$

$$V_n^2 = V_0^2 - \frac{B^2 d^3 V_0^2}{2R}$$



$$V_n^2 = V_1^2$$

$$V_1 = V_0 \sqrt{1 - \frac{B^2 d^3}{2R}}$$



$$a = \frac{B^2 d^2 V_0}{mR}$$

$$da = \frac{B^2 d^2}{R} \cdot dV$$

$$a = \frac{B^2 d^2}{R} \cdot (V_0 - V_n)$$

Тестовик №4.

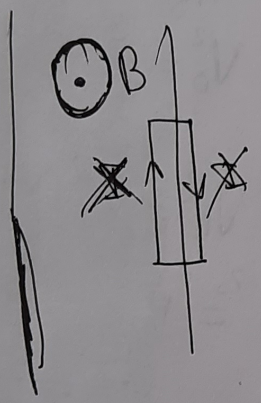
$a\,dt = \frac{B^2 d^2 V\,dt}{mR}$.

~~$\Delta F_A + A_{\varepsilon_i}$~~

суммируем.

$V_0 - V_n = \frac{B^2 d^2 \cdot d}{mR \quad 4}$

$V_n = V_0 - \frac{B^2 d^3}{4Rm} = V_1$.



I

$\varepsilon_i = -Bd\,V_n = Bd\,V_1$.

$I = \frac{Bd V_1}{R}$.

$F_a = \frac{B^2 d^2 V}{R}$

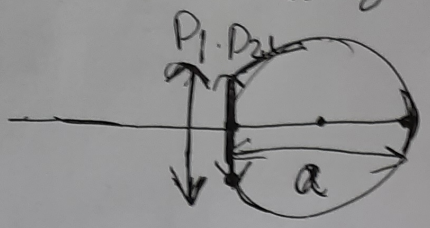
$a = \frac{B^2 d^2 V}{mR}$

~~$V_2 - V_1 = \frac{B^2 d^3}{4mR}$~~ из суммирования:

$V_2 = V_1 - \frac{B^2 d^3}{4mR} = V_0 - \frac{B^2 d^3}{2mR}$

Чистовик N5

N5.



$D_{2л} = D_{глаза}$.

$d_к = 25$ см.

текст:

$D_т = D_1 + D_{2л} = \frac{1}{a} + \frac{1}{d_к}$

тонкая П. Л. $\quad b \to \infty$

$\Rightarrow D_{2л} = \frac{1}{F} = \frac{1}{b} + \frac{1}{a}$

~~$D_{2л} = D_2$~~.

дано:

$D_2 + D_{2л} = \frac{1}{\infty} + \frac{1}{a} = \frac{1}{a}$

$\frac{D_1}{D_2} = \frac{4}{3} \Rightarrow D_1 = \frac{4}{3} D_2$

$D_1 + D_{2л} = \frac{1}{a} + \frac{1}{d_к} = D_2 + D_{2л} + \frac{1}{d_к}$.

$\frac{4}{3} D_2 = \frac{1}{d_к} = \frac{1}{25}$ см

$D_2 = \frac{3}{100}$ см$^{-1}$

$D_1 = \frac{4}{100}$ см$^{-1}$

$D_{2л} = \frac{1}{a} - D_2$

$D_1 + D_{2л} = \frac{1}{a} + \frac{1}{d_к}$

$D_{2л} = \frac{1}{x} + \frac{1}{a}$

$\frac{1}{x} = -D_2 \Rightarrow x = \frac{3}{100}$ см

Вопрос №4.

Листовик №6.

$d = 50$ см

$$\frac{1}{d} + \frac{1}{a} = D_{ал} = \frac{1}{d} - D_2 + D_3$$

$$\frac{1}{d} + \frac{1}{a} = \frac{1}{d} - D_2 + D_3$$

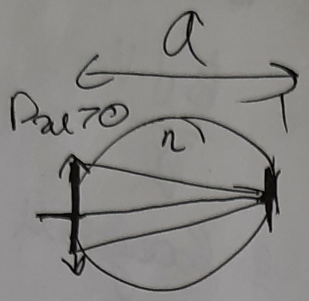
$$\frac{1}{50} = D_3 - \frac{3}{100}$$

$$D_3 = \frac{5}{100} \text{ см}^{-1}.$$

Ответ: 1) $\frac{3}{100}$ см; $\frac{3}{100}$ см 2) $\frac{5}{100}$ см$^{-1}$

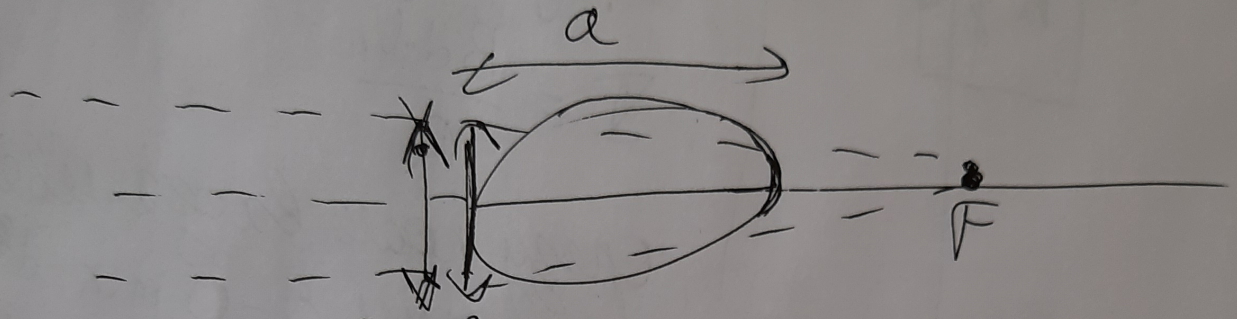
Листовик №8.

№5.



$D_{2л} = \frac{1}{F} = \frac{1}{a} + \frac{1}{b \to 0}$

$F \Rightarrow 0$



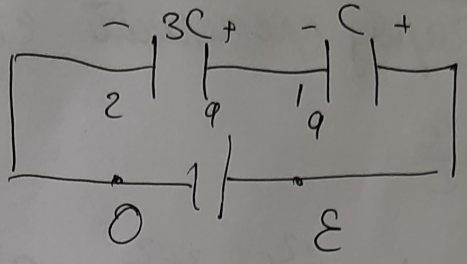
$D_2 > 0$

$D_2 + \frac{1}{F} = \frac{1}{a}$

Черновик.

SOS

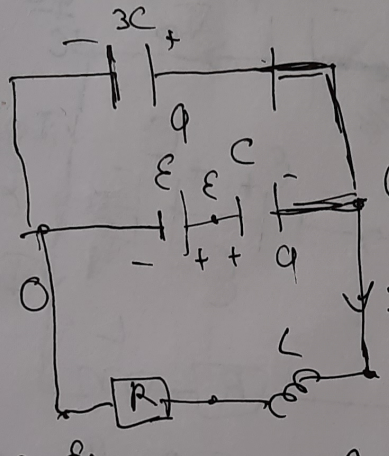
Читаем N1.



$U_2 = \frac{q}{3C}$ $U_1 = \frac{q}{C}$.

$\frac{q}{3C} + \frac{q}{C} = \varepsilon \Rightarrow \frac{4}{3} q = \varepsilon C$

$q = \frac{3}{4} \varepsilon C$.



$q = \varepsilon - \frac{3}{4}\varepsilon = \frac{\varepsilon}{4}$

$I = 0$.

$\varepsilon - \frac{\varepsilon_i}{4} = 0$ $\varepsilon_i = \frac{\varepsilon}{4}$

$\varepsilon_i = L\dot{I}$

$\dot{I} = \frac{\varepsilon}{4L}$

N3.

Дано:

$C_1 = C$

$C_2 = 3C$

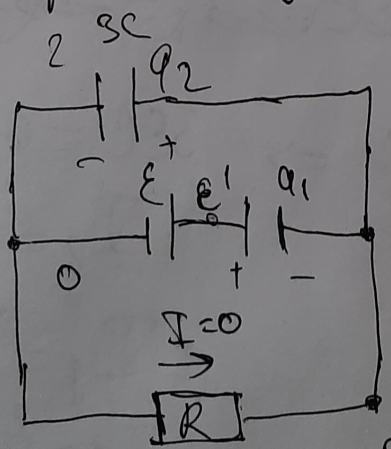
метод узловых потенциалов

$\dot{I}$ - ?

$W_0 = \frac{q \cdot \varepsilon^2 C}{32} + \frac{q \varepsilon^2 \cdot C^2}{32 \cdot 3C} =$

$= \frac{12 \varepsilon^2 C}{32} = \frac{3 \varepsilon^2 C}{8}$

режим уст. после замык.



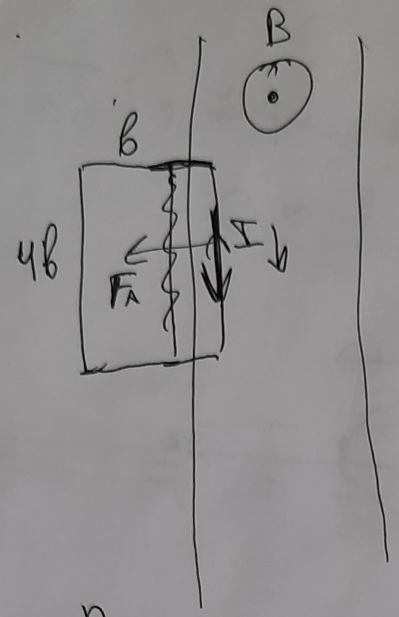
$\frac{q_1}{C} = \varepsilon \Rightarrow q_1 = \varepsilon C$

$0 = q = IR$

$IR = 0$

Листовка 4.

№4.



$\mathcal{E}_i = Bd \cdot V_0$

$I = \frac{Bd \cdot V_0}{R}$.

перед входом левой стороны

$I = \frac{Bd \cdot V_n}{R}$

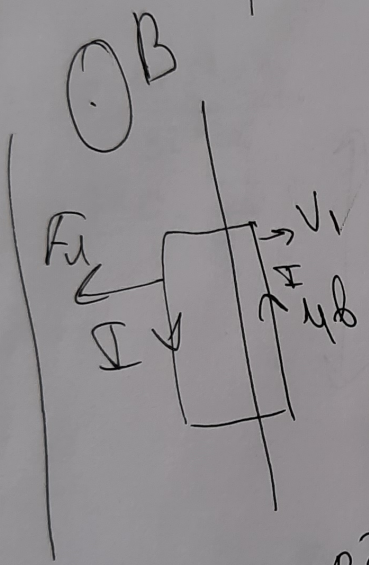
сразу после входа левой стороны $\mathcal{E}_i = 0$, т.к. $d\Phi = 0$ ($L = 0$:)

$\Rightarrow I = 0$

$\Rightarrow a = 0 \Rightarrow V_n = V_1$

в момент выхода

$\frac{d\Phi}{dt} = \mathcal{E}_i = Bd \cdot V_1$



$V_2 = V_1 - \frac{B^2 d^2 V_1}{4mR} = V_0 - \frac{B^2 d^3}{2mR}$

Ответ: $a = \frac{B^2 d^2 V_0}{mR}$; $V_1 = V_0 - \frac{B^2 d^3}{4Rm}$;

$V_2 = V_0 - \frac{B^2 d^3}{2Rm}$