Часть 1

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

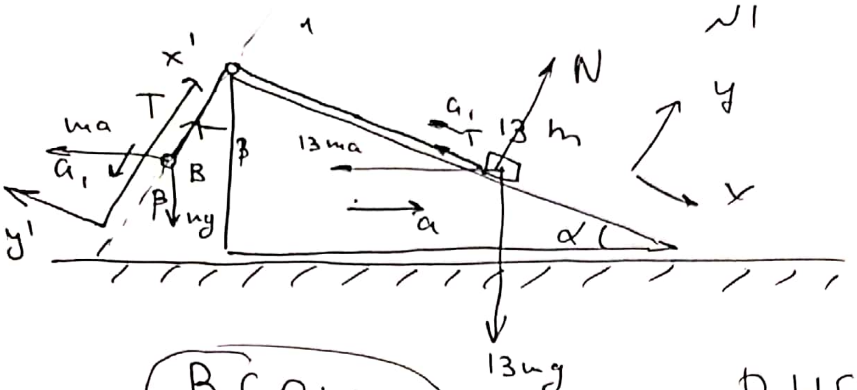
Шифр: **21201734**

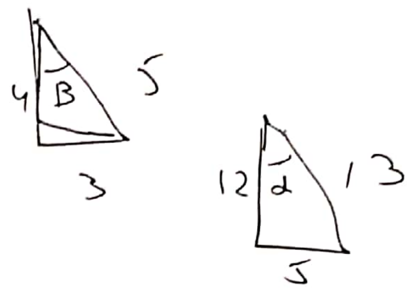
ID профиля: **320136**

Вариант 5

~~3) Решение 8.1~~

писали.





В С.О. клина

ВНЕ И.С.О. клина

1) Шарик двигается вдоль прямой (1) с постоянным ускорением a_1. Из кин. связи „нитка" такое же ускорение и у бруска,

2) По 2 з Н (В неисо клина)

Брусок: (O_x):

$$13ma_1 = 13ma\cos\alpha - 13mg\sin\alpha + T \;|\cdot(-1)$$

Шарик: $(O_{x'})$: $ma_1 = mg\cos\beta + ma\sin\beta - T$

$(O_{y'})$: $\cancel{mg\sin\beta = ma\cos\beta}$

$mg\sin\beta = ma\cos\beta$ => $\cancel{a = g\,ctg}$

$$\boxed{a = g\,tg\beta \quad (1)}\ !$$

3) $T = mg\cos\beta + mg\frac{\sin^2\beta}{\cos\beta} - ma_1$,

$T = 13ma_1 + 13mg\sin\alpha - 13mg\,tg\beta\cos\alpha$

$mg\cos\beta + mg\,tg\beta\sin\beta - ma_1 = 13ma_1 + 13mg\sin\alpha - 13mg\,tg\beta\cos\alpha$

$$\boxed{\frac{g(\cos\beta + tg\beta\sin\beta - 13\sin\alpha + 13\,tg\beta\cos\alpha)}{14} = a_1}$$

[illegible]

[illegible]

$$a_1 = \frac{9}{14}\left(\frac{4}{5} + \frac{3}{4}\cdot\frac{3}{5} - \frac{\cancel{\sqrt{3}}\cdot 5}{\cancel{\sqrt{3}}} + \cancel{\sqrt{3}}\cdot\frac{3}{4}\cdot\frac{\cancel{12}}{\cancel{\sqrt{3}}}\right) =$$

$$= \frac{10}{14}\left(0.8 + \frac{9}{20} - \cancel{5+9}\right) =$$

$$= \frac{10}{14}\left(0.8 + \frac{45}{100} + 4\right) = 3.75\ \frac{м}{с^2}$$

б)

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

$$S = \frac{a_1 t^2}{2} \Rightarrow t = \sqrt{\frac{2S}{a_1}} =$$

$$= \sqrt{\frac{2\frac{H}{\cos\beta}}{a_1}} = \sqrt{\frac{\frac{2H}{4}\cdot 5}{3.75}}\ [c] =$$

$$= \sqrt{H}\,\sqrt{0.66} = 0.82\sqrt{H}\ [c]$$

Ответ:

1) $a = g\,\mathrm{ctg}\,\beta = g\cdot\frac{4}{3} = \frac{4}{3}g = 13.3\ \frac{м}{с^2}$

2) $a_1 = 3.75\ \frac{м}{с^2}$, вниз по накл.

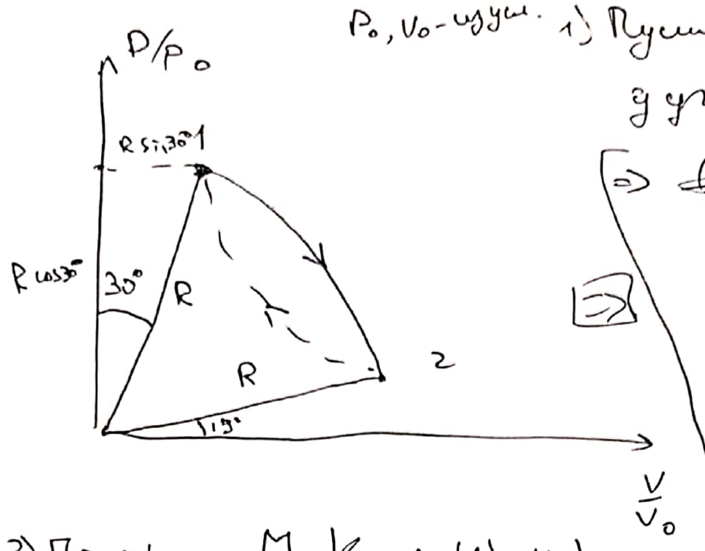
3) $t = 0.82\sqrt{H}\ [c]$

№ 2

P.S. P_i, V_i – давление и объем в точке i

P_0, V_0 – изуч. числовые

1) Пусть R – радиус окр-и дуги (1-2): $\boxed{\Rightarrow}$



$\Rightarrow$ ~~(P_1, V_1)~~ $=$

$$\frac{P_1}{P_0} = R\cos 30^\circ$$

$$\frac{V_1}{V_0} = R\sin 30^\circ$$

$\Rightarrow$ $$\frac{P_2}{P_0} = R\sin 15^\circ$$

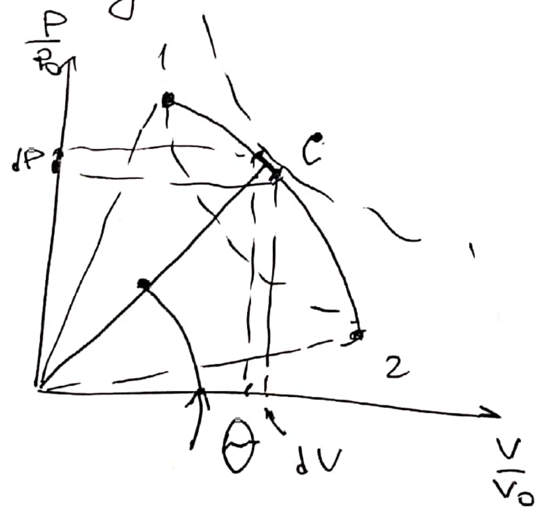
$$\frac{V_2}{V_0} = R\cos 15^\circ$$

2) По ур-ю М-К для (1), (2)

$$\left.\begin{aligned} \nu R T_1 &= P_1 V_1 \\ \nu R T_2 &= P_2 V_2 \end{aligned}\right\} \Rightarrow \frac{T_1}{T_2} = \frac{P_1V_1}{P_2V_2} = \frac{\cancel{P_0V_0}}{\cancel{P_0V_0}} \cdot \frac{\cos 30^\circ \sin 30^\circ}{\cos 15^\circ \sin 15^\circ} \cdot 1$$

$$= \frac{\frac{1}{\cancel{2}} \cdot \frac{\sqrt{3}}{2}}{\frac{1}{\cancel{2}} \cdot \sin 30^\circ} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \boxed{\sqrt{3}}\ ! \quad (1)$$

3) Пусть Θ – искомый угол



Ур-е (1-2):

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

В точке C $\quad c = 0 \Rightarrow$

$\Rightarrow Q = c\nu\Delta t_{окр} = 0$

$$Q = A + \Delta U =$$

$$P_c dV_c \qquad \frac{3}{2}[P_c dV_c + V_c dP]$$

$$0 = \frac{5}{2} P_c dV_c + \frac{3}{2} V_c dP$$

$P > 0$

4) $$P = \oplus P_0 \cdot \sqrt{R^2 - \left(\frac{V}{V_0}\right)^2} \quad (10)$$

$$\frac{dP}{dV} = P_0 \cdot \frac{1}{\cancel{2}\sqrt{R^2 - \left(\frac{V}{V_0}\right)^2}} \cdot \left(-\cancel{2} \cdot \frac{1}{V_0^2} V\right)$$

3

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численно.

5) $0 = 5P_c dV_0 + 3V_c dP \;\Big|\; : dV$

$0 = 5P_c + 3V_c\left(\frac{dP}{dV}\right)$ //Подставим из п. 4

$5P_c = 3V_c \cdot \frac{P_0}{\sqrt{R^2 - \left(\frac{V_c}{V_0}\right)^2}} \cdot \frac{1}{V_0^2} V_c$

6) По Th Пифагора $R^2 = \left(\frac{V_c}{V_0}\right)^2 + \left(\frac{P_c}{P_0}\right)^2$

$5P_c^2 = \frac{3V_c^2 P_0^2}{V_0^2}$.

$\cancel{\frac{P_c^2}{V_c^2}} = \frac{\left(\frac{P_c^2}{(P_0)^2}\right)}{\left(\frac{V_c^2}{V_0^2}\right)} = \frac{3}{5}$

$tg\,\theta = \sqrt{\frac{3}{5}} \Rightarrow \boxed{\theta = arctg\sqrt{\frac{3}{5}}}$ (2) !

7) Т.к. $Q_{21} << A_{внеш}$ // ~~тогда~~ малый теплообмен

⇓

По 2 н.т. для 2-1

$Q_{21} = 0 = \Delta U_{21} + A_{21} \Rightarrow$.

$A_{21} = -\Delta U_{21} = -\frac{3}{2}\nu R(T_1 - T_2) =$

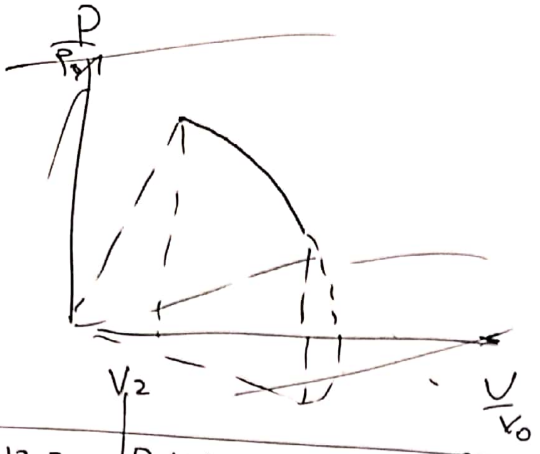
$= -\frac{3}{2}\left(\frac{P_1V_1}{P_0V_0} - \frac{P_2V_2}{P_0V_0}\right)P_0V_0$

$\frac{S_1}{2}$ $\frac{S_2}{2}$

4

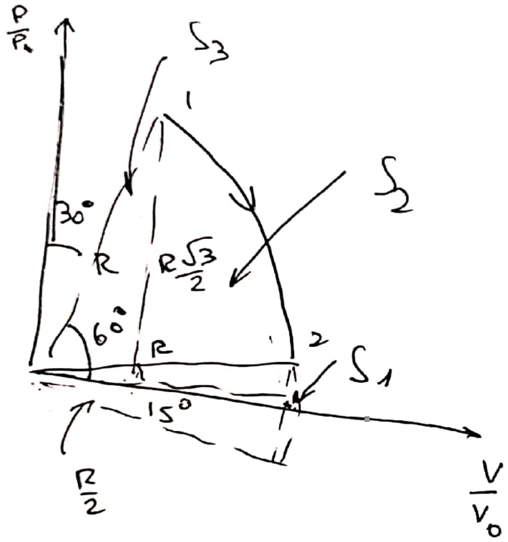
~~б) Работу в 1-2 можно посчитать как $S_{сек} - S_\Delta$~~

писать



~~в) $A_{12} = \int_{V_1}^{V_2} P\,dV = P_0 \int \sqrt{R^2 - \left(\frac{V}{V_0}\right)^2}\,dV$~~

б) Работу (1-2) посчитаем из геометрии



$$S_{12} = S_2 - S_3 - \frac{1}{2}\cdot S_1$$

$$S_2 = \frac{R^2 \cdot \frac{\pi}{3}}{2} = \frac{\pi R^2}{6} \quad (+)$$

$$S_3 = \frac{1}{2} R^2 \cdot \frac{\sqrt{3}}{4} = \frac{R^2\sqrt{3}}{8}$$

$$S_1 = \frac{R^2 \cdot \frac{\pi}{6}}{2} - \frac{1}{2} R^2 \cdot \frac{1}{2}$$

$$S_{12} = \frac{4\pi R^2}{6} - \frac{R^2\sqrt{3}}{8} - \frac{\pi R^2}{24} + \frac{R^2}{8}$$

$$A_{12} = S_{12} \cdot P_0 V_0 =$$

$$= P_0 V_0 \left(\frac{\pi R^2}{8} - \frac{R^2}{8}(\sqrt{3} - 1) \right)$$

числен.

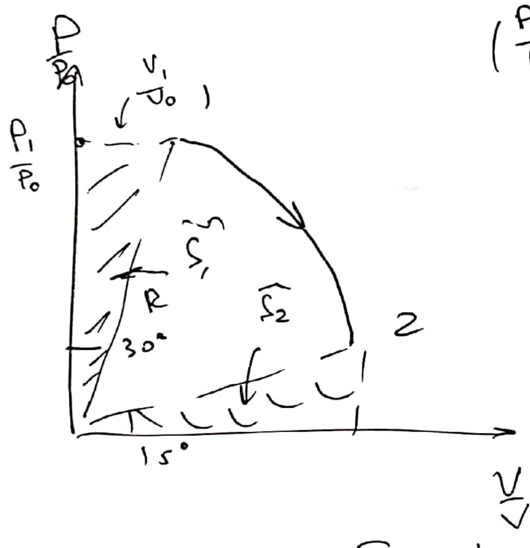
3) Искомое отношение

$$\varepsilon = \frac{A_{цикл}}{A_p} = \frac{A_{12} + A_{21}}{A_{12}} = 1 + \frac{A_{21}}{A_{12}} =$$

$$= 1 - \frac{\frac{3}{2}\left(\frac{\left(\frac{P_1}{P_0}\right)\left(\frac{V_1}{V_0}\right)}{2} - \frac{\left(\frac{P_2}{P_0}\right)\cdot\left(\frac{V_2}{V_0}\right)}{2}\right)}{\frac{\pi R^2}{8} - \frac{R^2}{8}(\sqrt{3}-1)}$$

Заметим то, что $\left(\frac{P_1}{P_0}\right)\left(\frac{V_1}{V_0}\right) = \tilde{S}_1 = R^2 \sin 30^\circ \cdot \cos 30^\circ$

$\left(\frac{P_2}{P_0}\right)\left(\frac{V_2}{V_0}\right) = \tilde{S}_2 = \frac{R^2 \sin 30^\circ}{2}$



Получаем:

$$\varepsilon = 1 - \frac{3\left(\cancel{R^2}\cos 30^\circ - \frac{R^2}{2}\right)\cdot \sin 30^\circ}{\cancel{R^2}\left(\frac{\pi - (\sqrt{3}-1)}{8}\right)}$$

$$\varepsilon = 1 - \frac{3\left(\frac{\sqrt{3}}{2} - \frac{1}{2}\right)\cdot\frac{1}{2}}{\pi - \sqrt{3} + 1}\cdot 8 = 1 - \frac{4.8}{2.42} =$$

$$= -0.73$$

Ответ:

1) $\sqrt{3}$

2) $\operatorname{tg}\theta = \sqrt{\frac{3}{5}}$

3) -0.73

6

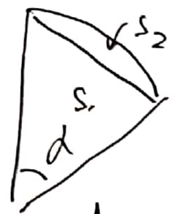
10) $A_{21} = -\Delta U_{21} = -\frac{3}{2}\left(\frac{P_1V_1}{P_0V_0} - \frac{P_2V_2}{P_0V_0}\right)P_0V_0 =$

$$= -\frac{3}{2}\left(\frac{R^2\sin 60^\circ}{2} - \frac{R^2\sin 30^\circ}{2}\right)P_0V_0 =$$

$$= -\frac{3}{2}R^2(\sin 60^\circ - \sin 30^\circ)P_0V_0 =$$

$$= -\frac{3}{4}R^2(\sqrt{3}-1)$$

11)



$$S_1 = \pi R^2 \cdot \frac{\alpha}{2\pi} = \frac{R^2\alpha}{2}$$

$$S_2 = S_1 - \frac{1}{2}R^2\sin\alpha = \frac{R^2\alpha}{2} - \frac{R^2\sin\alpha}{2}$$

11) $A_{12} = P_0V_0 \cdot S_{\text{подгр}};$

$$S_{\text{подгр}} = \frac{R^2\cdot\frac{\pi}{3}}{2} - \frac{R^2\sqrt{3}}{8} - \frac{R^2\pi}{24} + \frac{R^2\cdot\frac{1}{2}}{4} =$$

$$= \frac{\pi R^2}{8} - \frac{R^2\sqrt{3}}{8} - \cancel{\frac{\pi R^2}{24}} + \frac{R^2}{8} =$$

?

$$= \frac{\pi R^2}{8} + \frac{R^2}{8}(1-\sqrt{3})$$

12) $\varepsilon = \frac{A_{12}+A_{21}}{A_{12}} = 1 + \frac{A_{21}}{A_{12}} = 1 - \frac{\frac{3}{2}\left(\frac{\sqrt{3}}{2}-\frac{1}{2}\right)8}{\pi + 1 - \sqrt{3}}$

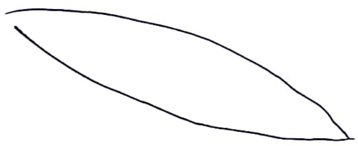
(черновик)

$$A_{21} = -\frac{3}{\cancel{R}}\left(\frac{P_1 V_1}{P_0 V_0\, 2} - \frac{P_2 V_2}{P_0 V_0\, 2}\right) =$$

$$= -3\left(\frac{R^2}{2}\sin 30^\circ \cancel{\cos 30^\circ} - R^2 \sin 30^\circ\right)$$

$$= -\frac{3}{2}R^2\left(\sin 60^\circ - \sin 30^\circ\right) =$$

$$= -\frac{3}{4}R^2\left(\sqrt{3} - 1\right)$$



$$\Delta U = \frac{3}{2}\left[(P_c + dP)(V_c + dV) - P_c V_c\right] =$$

$$= \frac{3}{2}\left[P_c dV + dP V_c\right]$$

$$\left(\frac{P}{P_0}\right)^2 = R^2 - \left(\frac{V}{V_0}\right)^2$$

$$\frac{5}{2} P_c dV_c + \frac{3}{2} V_c dP = 0$$

$$\frac{P}{P_0} = \sqrt{R^2 - \left(\frac{V}{V_0}\right)^2}$$

$$\frac{dP}{dV} = \frac{1}{\cancel{2}\sqrt{R^2 - \left(\frac{V}{V_0}\right)^2}} \cdot \left(-\frac{1}{V_0^2} \cdot \cancel{2}V\right)$$

$$0 = \frac{5}{2} P_c dV_c + \frac{3}{2} V_c dP \quad / : dV$$

$$5 P_c = 3 V_c \frac{1}{\sqrt{R^2 - \left(\frac{V_c}{V_0}\right)^2}} \frac{V_c}{V_0^2}$$

$$R^2 = \left(\frac{P_c}{P_0}\right)^2 + \left(\frac{V_c}{V_0}\right)^2$$

$$5 P_c = \frac{3 V_c^2}{V_0^2} \cdot \frac{1}{}$$

$$\frac{P_0}{\sqrt{R^2 - \left(\frac{V}{V_0}\right)^2}} \cdot \frac{1}{V_0^2} V$$

$$A_{21} = \frac{A_{\text{цикл}}}{\alpha P_0 V_0} = \frac{\cancel{\alpha P_0 V_0} - \frac{3}{2}\left(\frac{P_2 V_2}{P_0 V_0} - \frac{P_1 V_1}{P_0 V_0}\right)}{\cancel{}} =$$

$$= 1 - \frac{\frac{3}{2}(\dots)}{\alpha}$$

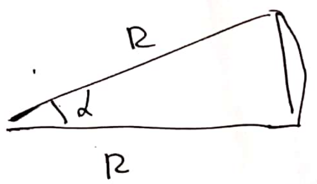
$$R^2 = \frac{P_1^2}{P_0^2} + \frac{V_1^2}{V_0^2}$$

$$\frac{P_2^2 \operatorname{ctg} 15^\circ}{P_0 V_0} - \frac{P_1^2 \operatorname{tg} 30^\circ}{P_0 V_0}$$

$$\frac{P_1}{V_1} = \operatorname{ctg} 30^\circ$$

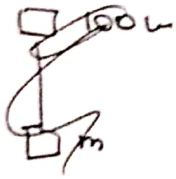
$$\frac{P_2}{V_2} = \operatorname{tg} 15^\circ$$

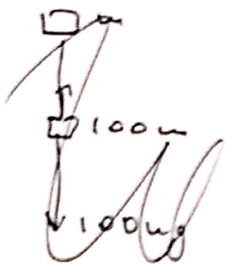
$$\Rightarrow \left(\frac{P_1}{P_0}\right)\left(\frac{V_1}{V_0}\right) - \left(\frac{P_2}{P_0}\right)\left(\frac{V_2}{V_0}\right)$$



$$\frac{\pi R^2 \cdot \alpha}{2\pi} = \frac{R^2 \alpha}{2}$$

$$\frac{R^2 \alpha}{2} - \frac{1}{2} R^2 \sin \alpha$$





чернови.

[illegible]

[illegible] ([illegible] 21)

[illegible] 23.6

$$\sqrt{\frac{25}{9}} = \frac{5}{3}$$

чистовик

1 $\cos\alpha = \frac{12}{13}$

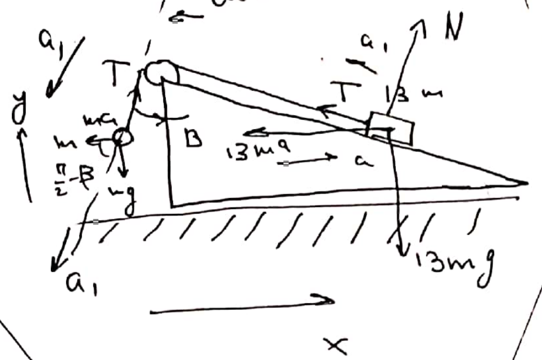
m, $13m$

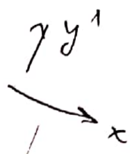
$\cos\beta = \frac{4}{5}$

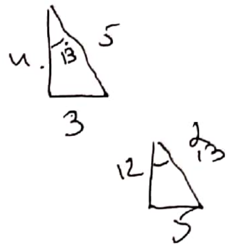
1 $\swarrow$ пенал

Трение?

$\frac{-169}{144}{25}$







~~1) По 2 з Н~~

~~(m): $2T\sin\beta = ma$~~

1) шарик движется вдоль линии (1) с ускорением a_1 (о-о бруска) клина.

2) из кин. связи на нить, такое же ускорение у бруска (о-о клина)

3) По 2 з Н для шарика (В НЕ И.С.О)!!!

$(O_{y'})$: $-T + mg\cos\beta + ma\sin\beta = ma_1$

$(O_{x'})$: $\cancel{m}a\sin\beta = \cancel{m}g\cos\beta \Rightarrow \boxed{a = g\,\mathrm{ctg}\beta}$ (1)!

4) Для бруска, аналогично

$(O_{x'})$: $+13ma_1 = 13ma\cos\alpha - 13mg\sin\alpha + T$ | $\cdot(-1)$

5) $\begin{cases} -T + mg\cos\beta + mg\cos\beta = ma_1 \\ T = 13ma_1 - 13mg\,\mathrm{ctg}\beta\cos\alpha + 13mg\sin\alpha \end{cases}$

$\Downarrow$

$a_1 = 2g\cos\beta - 13a_1 + 13g\,\mathrm{ctg}\beta\cos\alpha + 13g\sin\alpha$.

$a_1 = \frac{2g\cos\beta + 13g\,\mathrm{ctg}\beta\cos\alpha + 13g\sin\alpha}{14}\cdot g$

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[illegible] | [illegible] ([illegible]?)

$$\xi = 1 - \frac{3(S_1 - S_2)}{R^2\left(\frac{\pi - \sqrt{3} + 1}{8}\right)} =$$

$$= 1 - \frac{3\cancel{R^2}\left(\frac{\sin 60^\circ}{2} - \frac{\sin 30^\circ}{2}\right) \cdot 8}{\cancel{R^2}(\pi - \sqrt{3} + 1)} =$$

$$= 1 - \frac{24\left(\frac{0.86}{2} - \frac{1}{4}\right)}{3.14 - 1.7 + 1} = 1 - \frac{4.39}{2.44}.$$

Часть 2

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

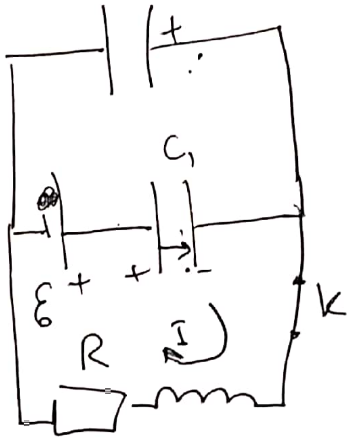
Шифр: **21201734**

ID профиля: **320136**

Вариант 5

№3 Чистовик

$C_i = iC$



1) $\left.\frac{dI}{dt}\right|_{t=0} = ?$

2) $Q = ?$

~~3) $I_1 = I_0$~~

3) $\tau: I_1 = I_0$; $I_L = ?$

Решение: 0) Пусть $t=0$ соотв. моменту замыкания ключа.

1) Уст. режим до

$\mathcal{E} = U_1 + U_2$; по ЗСЗ $\cancel{C}U_1 = 2\cancel{C}U_2$

$\mathcal{E} = 3U_2 \Rightarrow U_2 = \frac{\mathcal{E}}{3} \Rightarrow \boxed{U_1 = \frac{2}{3}\mathcal{E}} \Rightarrow q_1 = \frac{2}{3}\mathcal{E}C$

2) Т.к. Ф$_{\text{вн}}$ ч/з катушку не может меняться быстро $\left.I_L\right|_{t=0} = 0 \Rightarrow I_R = I_L = 0 \Rightarrow$

$\Downarrow$

$U_R = 0$

$\Rightarrow$ Из обхода I по 2п.К.

$\mathcal{E} = U_1 + L\dot{I} \Rightarrow \boxed{\frac{\mathcal{E}}{3L} = \dot{I}}$ (1) !

3) В уст. режим (после) $t \to \infty$ $I_{C_1} = I_{C_2} = 0 \Rightarrow I_L = 0$

Пусть $\tilde{U}_1$, $\tilde{U}_2$ – уст. напр. на конденсаторах

$\Rightarrow \tilde{U}_1 = +\mathcal{E} \Rightarrow \tilde{q}_1 = C\mathcal{E} \Rightarrow \boxed{\Delta q_{\mathcal{E}} = \frac{\mathcal{E}C}{3}}$

$\tilde{U}_2 = 0$

4) По ЗСЭ.

$W_1 + A_{\mathcal{E}} = W_2 + Q$; $I_L = 0 \Rightarrow W_L = 0$

$\frac{C_1U_1^2}{2} + \frac{C_2U_2^2}{2} + \mathcal{E}\Delta q = \frac{C\tilde{U}_1^2}{2} + \frac{C_2\tilde{U}_2^2}{2} + Q$

(1)

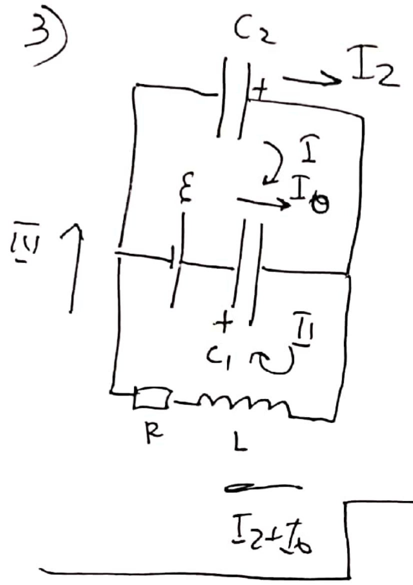
чистовик

$$\frac{C\left(\frac{2}{3}\mathcal{E}\right)^2}{2} + C\left(\frac{\mathcal{E}}{3}\right)^2 + \frac{\mathcal{E}^2 C}{3} - \frac{C\mathcal{E}^2}{2} = Q$$

$$\frac{2C\mathcal{E}^2}{9} + \frac{C\mathcal{E}^2}{9} + \frac{3\mathcal{E}^2}{9} - \frac{4.5\,C\mathcal{E}^2}{9} = Q$$

$$\boxed{\frac{1.5}{9}C\mathcal{E}^2 = Q}$$ (2) !

3)



Пусть U_1, U_2 – напр. на конд. C_1 и C_2

По з-н К.

(I): $\mathcal{E} = U_1 = U_2$ (1)

(II) $\mathcal{E} - U_1 = (I_0 + I_2)R + L\left(\frac{dI_2}{dt} + \frac{dI_0}{dt}\right)$

(III): $-U_2 + L\left(\frac{dI_2 + dI_1}{dt}\right) + (I_2 + I_0)R = 0$ (3)

По опр-ю

$$I_0 = \frac{dq_1}{dt} = \frac{C\,dU_1}{dt}; \quad I_2 = \frac{-C\,dU_2}{dt}$$

~~(10) → $\mathcal{E}$~~

~~(10), (20) → $\mathcal{E} - \mathcal{E} + U_2 = ($~~

см оборот

2

черновик

$\cancel{\mathcal{E} - U_1} =$

$\cancel{\mathcal{E} - U_1 - U_2 + L\dot{I}_L + (I_2 + I_0)R)} = \dots$

$$\mathcal{E} - U_1 = \left(\frac{C\, dU_1}{dt} - \frac{2C\, dU_2}{dt}\right) R + L\, 2\dot{C}$$

$$\mathcal{E} - U_1 = (\underbrace{\dot{q}_1}_{=I_0} - \dot{q}_2) R + L \underbrace{(\ddot{q}_1 - \ddot{q}_2)}_{= \dot{I}_L}$$

Подсз $\boxed{\cancel{q_1 + q_2 = 0}}$

$\cancel{\dot{q}_1 + \dot{q}_2 = 0}$

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

$0 = \frac{\dot{q}_1}{C} + \frac{\dot{q}_2}{2C}$

$0 = \frac{\ddot{q}_1}{C} + \frac{\ddot{q}_2}{2C} \Rightarrow$

$\Rightarrow \boxed{\ddot{q}_1 = -\frac{\ddot{q}_2}{2}}$; $\dot{q}_1 = -\frac{\dot{q}_2}{2} \Rightarrow // \text{т.к. } \dot{q}_2 = -I_2$

$\Rightarrow \mathcal{E} - U_1 = ($

$\Rightarrow \cancel{I_2 = \frac{I_0}{2}} \Rightarrow I_1 = \frac{I_2}{2}$

$\Rightarrow \boxed{\cancel{I_L = \frac{3}{2} I_2}}$ $\Rightarrow \boxed{I_L = 3 I_0}$

Ответ:

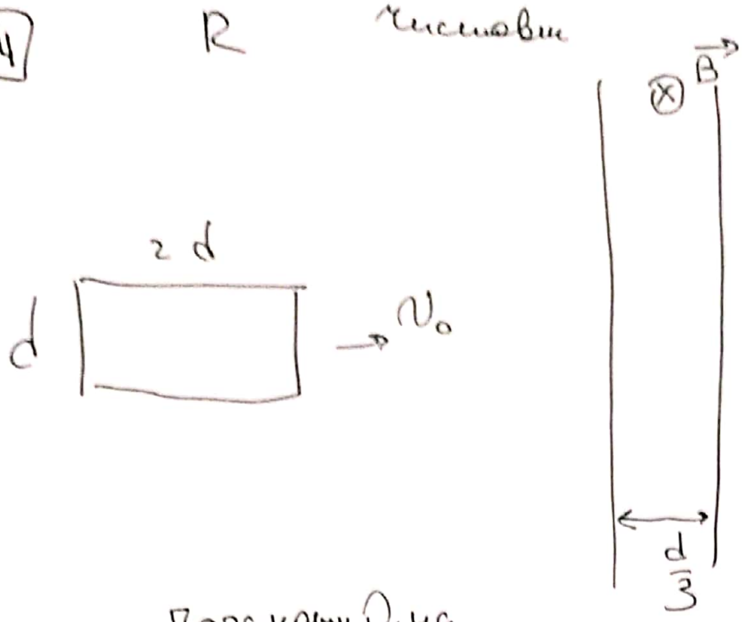
1) $\dot{I} = \frac{\mathcal{E}}{3L}$

2) $Q = \frac{1.5}{9} C\mathcal{E}^2 \simeq 1.67\, C\mathcal{E}^2$

3) $I_L = \frac{3}{\,} I_0$

(3)

№4 R чистовик $m, d, V_0, R, 13$



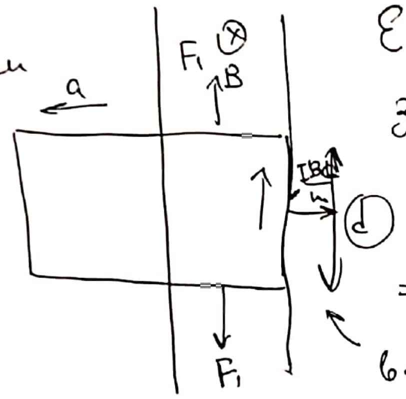
По закону Ома

1) $I = \frac{\mathcal{E}_{in}}{R} = \frac{v_0 B d}{R} \Rightarrow F_a = ma \Rightarrow$

$$\Rightarrow a = \frac{IBL}{m} = \frac{\frac{v_0 (Bd)^2}{R}}{m} = \frac{v_0 (13d)^2}{mR}$$

2)

Рамка уменьшает поток $\vec{B}$ ~~/3~~ собой, позн. $\vec{a} \uparrow\downarrow \vec{v}_0$



$\mathcal{E}_i$ не менялось, т.к. оно зависит от попереч. размера рамки d, 2-ой конец еще не вошел

$\Rightarrow a = const$ // т.к. $F_A \sim I \sim \mathcal{E}_i = const$

в обр. сторону, поэтому знак ⊖

$v_1 = v_0 - at$

$$\frac{d}{3} = \frac{v_0^2 - v_1^2}{2a} = \frac{v_0^2 - v_1^2}{v_0 (Bd)^2} \cdot mR$$

$$\frac{d\, v_0 (Bd)^2}{3mR} = v_0^2 - v_1^2 \Rightarrow$$

$$\Rightarrow v_1 = \left[v_0^2 - \frac{d v_0 (Bd)^2}{3mR} \right]^{1/2}$$

4

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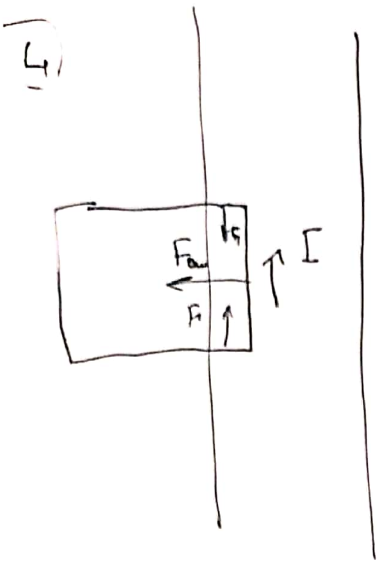
чистовик

4)



$$m\frac{dv}{dt} = -IBL = -\frac{\mathcal{E}_{in}}{R}BL =$$

$$= -\frac{vBd}{R}BL$$

$$m\frac{dv}{dt} = -\frac{vB^2d^2}{R}$$

$$m\int_{v_0}^{v_1} dv = -\int_0^{d/3} (\underbrace{v\,dt}_{=ds}) \frac{B^2d^2}{R} \Rightarrow$$

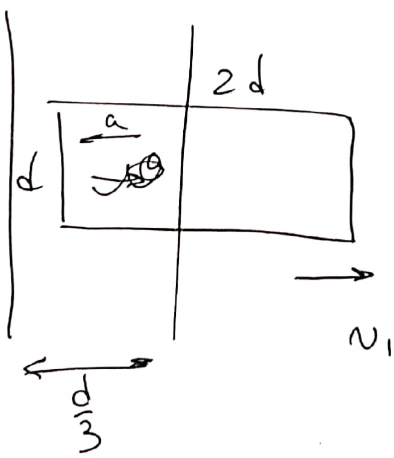
$$\Rightarrow (v_0 - v_1) = \frac{d}{3m}\frac{B^2d^2}{R}$$

$$\boxed{v_1 = v_0 - \frac{B^2d^3}{3mR}}$$

3) Когда передний край выходит из поля

$\Phi = const \Rightarrow \dot{\Phi} = 0 \Rightarrow \mathcal{E}_i = 0 \Rightarrow I = 0 \Rightarrow F_A = 0 \Rightarrow \frac{dv}{dt} = 0 \Rightarrow \boxed{v = const} = v_1$

4) После этого рамка подъедет своим 2-м концом к полю



Рамка начинает сокр-ть поле и (з леве) $\Rightarrow \vec{a} \uparrow\downarrow \vec{v}$

$$m\frac{dv}{dt} = +\frac{\mathcal{E}_i}{R}Bd \Rightarrow$$

$$v_1 \Big| \Rightarrow m\frac{dv}{dt} = -\frac{vBd}{R}Bd$$

5

Черновик.

$$\int_{v_1}^{v_2} m\, dv = \int_0^{d/3} ds \frac{(Bd^2}{R}$$

$$(v_2 - v_1) = \frac{B^2 d^3}{3Rm}$$

$$v_2 = v_0 + \cancel{\frac{B^2 d^3}{3Rm}} = \cancel{\frac{B^2 d^3}{3Rm}} \to \boxed{v_2 = v_0}$$

см-о п.2

$$\boxed{v_2 = v_0 - \frac{2}{3}\frac{B^2 d^3}{mR}}$$

Ответ

1) $a = \frac{v_0 (Bd)^2}{mR}$

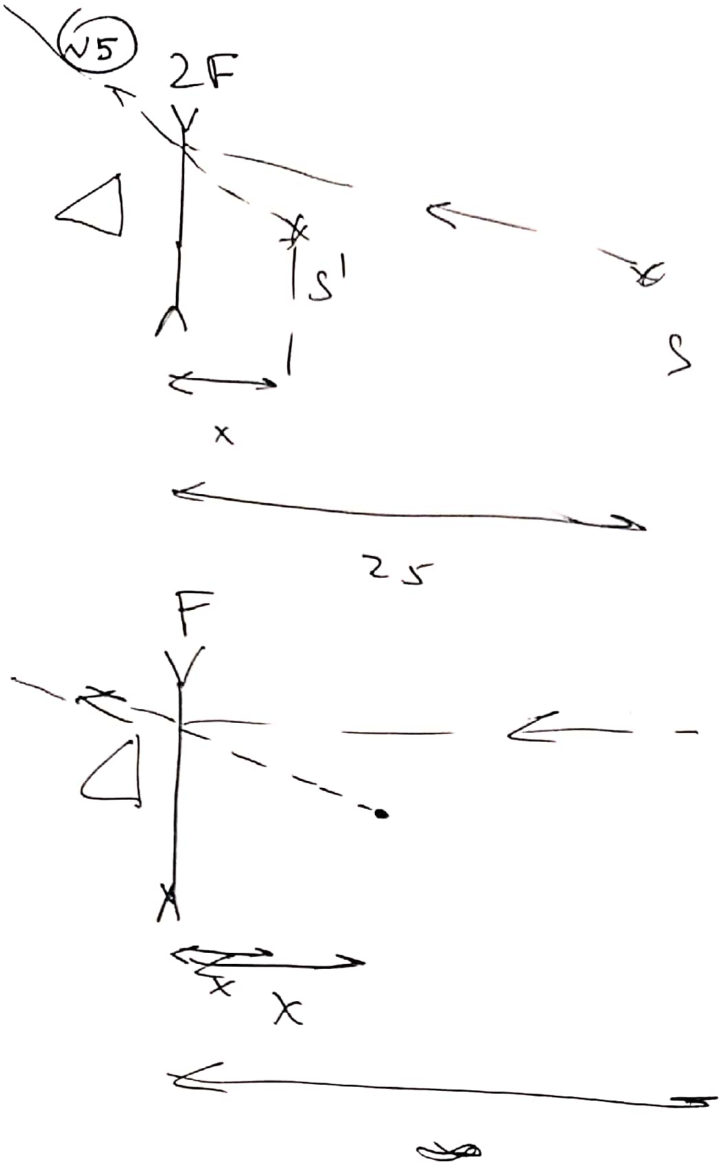
2) $v_1 = v_0 - \frac{1}{3}\frac{B^2 d^3}{mR}$

3) $v_2 = v_0 - \frac{2}{3}\frac{B^2 d^3}{mR}$

(6

№5

Чистовик.



$D \sim \frac{1}{F} \Rightarrow$

$\frac{D_1}{D_2} = \Rightarrow \boxed{\frac{F_1}{F_2} = \frac{1}{2}}$

0) Пусть этому человеку лучше всего видит предмет с расстояния x. Значит очки должны создать изображение предмета на расстоянии x от себя, чтобы человек их увидел

1) По ф-е тонкой линзы.

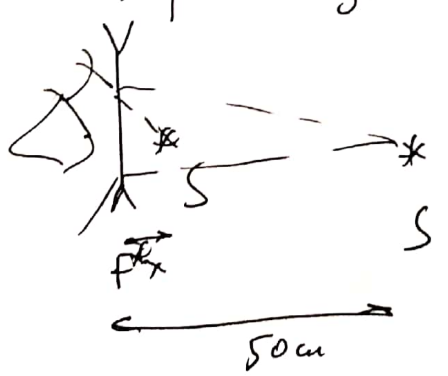
$$\begin{cases} \frac{1}{2F} = \frac{1}{25} - \frac{1}{x} \\ \frac{1}{F} = 0 - \frac{1}{x} \end{cases} \Rightarrow \frac{1}{2F} = \frac{1}{25} + \frac{1}{F} \Rightarrow -\frac{1}{2F} = \frac{1}{25} \Rightarrow$$

$$\Rightarrow \boxed{x = 12.5 \text{ см}}$$

$$\Rightarrow \boxed{F = -12.5 \text{ см}}$$

$$D = \frac{-1}{12.5} = -0.08 \text{ см}^{-1}$$

2) При работе за ПК.



$$\frac{1}{F^*} = \frac{1}{50} - \frac{1}{x} \Rightarrow$$

$$\Rightarrow D^* = -0.06 \text{ см}^{-1}$$

Ответ: $x = 12.5$, $D_2 = -0.08 \text{ см}^{-1}$, $D^* = -0.06 \text{ см}^{-1}$

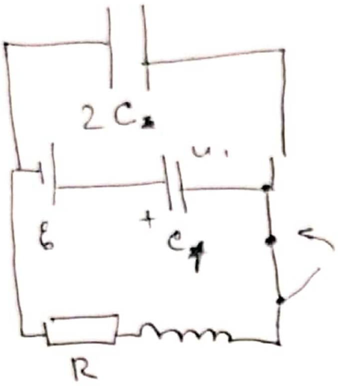
7

$$\frac{d}{3}$$

$$m\,dv = ds\,\frac{B^2 d^3}{R}$$

$$m\left(v_2 - v_0 + \frac{B^2 d^3}{3mR}\right) = -\frac{B^2 d^3}{3mR}$$

$$v_2 = v_0 - \frac{2}{3}$$



$$\cancel{C}u_1 = 2\cancel{C}u_2$$

$$u_1 + u_2 = \mathcal{E}$$

$$3u_2 = \mathcal{E} \Rightarrow u_2 = \frac{\mathcal{E}}{3}$$

$$L\dot{I} = \frac{2}{3}\mathcal{E}$$

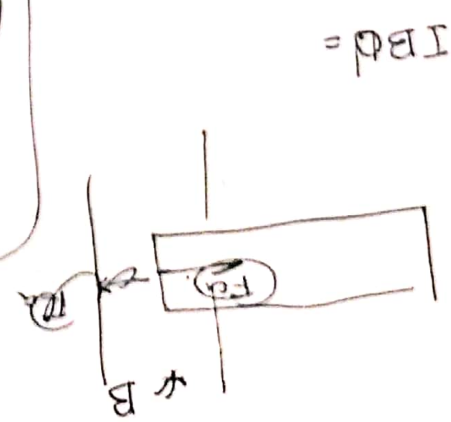
$$\dot{I} =$$

$$\frac{C\left(\frac{2}{3}\mathcal{E}\right)^2}{2} + C\left(\frac{\mathcal{E}}{3}\right)^2 + \frac{3\mathcal{E}^2 C}{9} = \frac{C\mathcal{E}^2}{2} + Q$$

$$\frac{2}{9}C\mathcal{E}^2 + \frac{1}{9}C\mathcal{E}^2 + \frac{3}{9}C\mathcal{E}^2 - \frac{C\mathcal{E}^2}{2} = Q$$

$$\frac{6}{9} - \frac{4.5}{9} = \frac{1.5}{9}C\mathcal{E}^2.$$

Чернови №10



$$\frac{F_1+F_2}{F_1F_2}=\frac{1}{25}+\frac{1}{x}$$

$$\frac{2F_1+F_2}{F_1F_2}=\frac{1}{x}$$

$$\frac{1}{F_2}=\frac{1}{x}\Rightarrow\boxed{x=F_2}$$

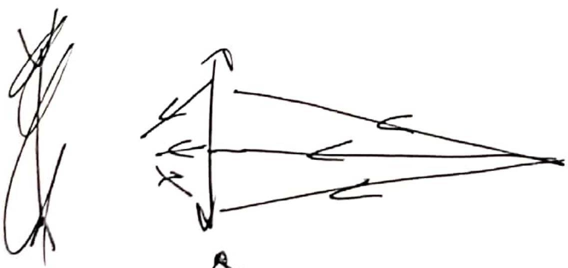
$$\cancel{\frac{2F_1+F_2}{F_1}}\neq$$

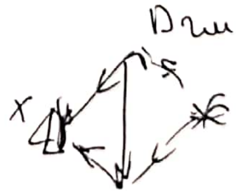
$$\frac{F_1+x}{F_1x}=\frac{1}{25}+\frac{1}{x}$$

$$\frac{2F_1+x}{F_1}=1\Rightarrow\boxed{F_1=x}$$

$$\Downarrow$$

$$0=\frac{1}{25}+\frac{1}{x}\Rightarrow x=-25\text{ cm}$$





$$\boxed{\frac{1}{x}+\frac{1}{p}=\frac{1}{F_2}}$$

D_2-D_1

№5

$$\frac{F_1}{F_2} = \frac{1}{2} \Rightarrow \boxed{F_2 = 2F_1}$$

$F_ш$ - дальше

Пусть его шаг имеет $D_ш \Rightarrow F_ш = \frac{1}{D_ш}$

Для линзы:

$$\frac{F_1 + F_ш}{F_1 F_ш} = \frac{1}{25} - \frac{1}{x}$$

$$\frac{F_2 + F_ш}{F_2 F_ш} = \frac{1}{\infty} - \frac{1}{x}$$

$$\begin{cases} x = \dfrac{F_2 F_ш}{F_2 + F_ш} \Rightarrow \\ \dfrac{25x}{-25+x} = \dfrac{F_1 F_ш}{F_1 + F_ш} \end{cases}$$

Черновик №9

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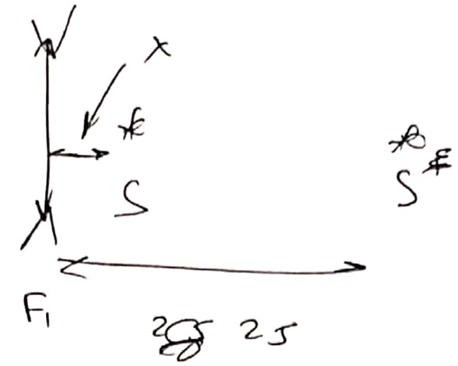
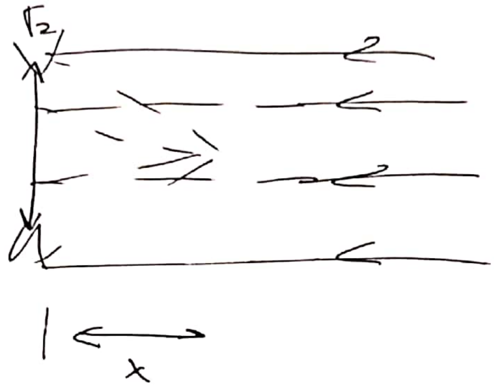




$$\cancel{\frac{1}{F_1} = \frac{1}{25} - \frac{1}{x}}$$

$$\frac{1}{F_2} = \cancel{\frac{1}{\infty}} - \frac{1}{x}$$

$$\Rightarrow \boxed{\frac{1}{F_1} - \frac{1}{F_2} = \frac{1}{25}}$$

F

$$X = \frac{2F_1 F_2}{2F_1 + F_2}$$

$$-X = \frac{F_1 F_2}{F_1 + F_2}$$

$$\Rightarrow -1 = \frac{F_1 + F_2}{2F_1 + F_2}$$

$$-2F_1 - 2F_2 = +F_1 + F_2$$

$$-3F_1 = 3F_2$$

$$\boxed{F_1 = -F_2}$$

$$B I L = H$$

$$B^2 d^2 = \left(\frac{H}{A}\right)^2$$

$$\frac{H}{A} \quad \frac{H^2 u}{A^2 \cdot kr \cdot Qu} = \frac{kr\, u^2}{c \cdot B \cdot kd\, Au}$$

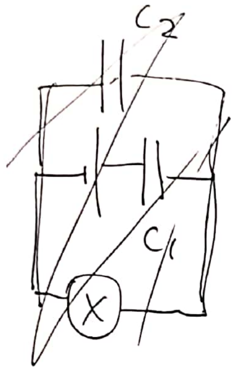
$$A = \frac{ku}{c} \quad \boxed{B \cdot ku}$$

T_V

$$m\frac{dv}{dt} = -IBL = -\frac{\mathcal{E}_{in}}{R}Bd = -\frac{v(dB)^2}{R}$$

$$\Delta v = \Delta S\,\frac{(d^3B)^2}{3Rm}$$

$$v_1 = v_0 -$$



$$dP = \frac{dvB}{R}\,Bd\,\Delta t$$

$$m\,dv = \frac{d^3B^2\,\Delta S}{3R}$$

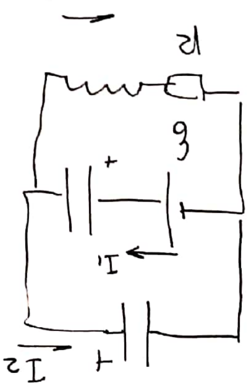
$3I_0$

I_0

$2I_0$

$$I_L = 3$$

$$I = I_2$$



$$\mathcal{E} = U_1 + U_2$$

$$0 = \frac{\dot{q}_1}{C} + \frac{\dot{q}_2}{2C}$$

$$I_1 = -\frac{I_2}{2} \Rightarrow I_2 = 2I_1$$

$$I_1 - I_2 = -\frac{I_2}{2} - I_2 = \frac{3}{2}I_2 = \boxed{3I_1}$$