Часть 1

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

Шифр: **21201318**

ID профиля: **205215**

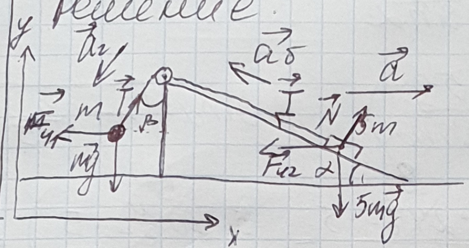
Вариант 8

Чистовик
Вариант 11-02.
№1.

1

Дано:
$\cos\alpha = \frac{3}{5}$
$m; 5m$
$\cos\beta = \frac{5}{13}$

Решение:



1) Решим задачу в НСО: $\vec{F_и} = -m\vec{a} \Rightarrow$

II з-н Ньютона:

$m\vec{g} + \vec{T} + \vec{F}_{и1} = 0$; $5m\vec{g} + \vec{N} + \vec{F}_{и2} + \vec{T} = 0.$

x: $T\sin\beta - ma = 0$; x: $N\sin\alpha - 5ma - T\cos\alpha = 0$

y: $T\cos\beta - mg = 0$; y: $N\cos\alpha - 5mg + T\sin\alpha = 0.$

Нить невесома $\Rightarrow T_1 = T_2 = T$.

$T\sin\beta = ma$

$T\cos\beta = mg \Rightarrow T = \frac{mg}{\cos\beta} \Rightarrow \frac{mg\cdot\sin\beta}{\cos\beta} = ma \Rightarrow$

$\underline{a = g\cdot tg\,\beta}$.

$\sin\beta = \sqrt{1-\cos^2\beta}$; $\sin\beta = \sqrt{1-\frac{25}{169}} = \frac{12}{13} \Rightarrow$

$tg\,\beta = \frac{12}{13}\cdot\frac{13}{5} = \frac{12}{5} = 2,4 \Rightarrow$

$a = 2,4\cdot 10\,\frac{м}{с^2} = 24\,\frac{м}{с^2}$ Ответ: $a = 24\,\frac{м}{с^2}$.

2) Пусть ускорение бруска относительно клина равно: $a_б$. Т.к. нить нерастяжима: $a_б = a_г$.

$m\vec{g} + \vec{T} + \vec{F}_{и1} = m\vec{a_г}$; $5m\vec{g} + \vec{F}_{и2} + \vec{N} + \vec{T} = m\vec{a_б}$

x: $T\sin\beta - ma = -ma_б\cdot\sin\beta \,|: -\sin\beta$ | x: $N\sin\alpha - 5ma - T\cos\alpha = -5ma_б\cos\alpha \,|: -\cos\alpha$

y: $T\cos\beta - mg = -ma_б\cdot\cos\beta \,|: -\cos\beta$ | y: $N\cos\alpha - 5mg + T\sin\alpha = -5ma_б\sin\alpha \,|: \sin\alpha$

$\frac{ma}{\sin\beta} - T = ma_б$; $\frac{mg}{\cos\beta} - T = ma_б$; $\frac{5ma}{\cos\alpha} + T - N tg\,\alpha = 5ma_б$

$\underline{T = \frac{ma}{\sin\beta} - ma_б}$ $-\frac{5mg}{\sin\alpha} + T + N tg\,\alpha = 5ma_б$

$10ma_б = 2T + \frac{5ma}{\cos\alpha} - \frac{5mg}{\sin\alpha}$.

чистовик

2

$$10 \cancel{m} a_б = \frac{2\cancel{m}a}{\sin\beta} - 2\cancel{m}a_б + \frac{5\cancel{m}a}{\cos\alpha} - \frac{5\cancel{m}g}{\sin\alpha} \quad \Big| : m$$

$$12a_б = \frac{2a}{\sin\beta} + \frac{5a}{\cos\alpha} - \frac{5g}{\sin\alpha}$$

$$a_б = \frac{1}{12}\left(\frac{2a}{\sin\beta} + \frac{5a}{\cos\alpha} - \frac{5g}{\sin\alpha}\right); \quad \sin\alpha = \sqrt{1 - \frac{9}{25}} = \frac{4}{5}$$

$$a_б = \frac{1}{12}\cdot\left(\frac{2\cdot \overset{2}{\cancel{24}}\frac{м}{с^2}\cdot 13}{\cancel{12}} + \frac{5\cdot \overset{8}{\cancel{24}}\frac{м}{с^2}\cdot 5}{\cancel{3}} - \frac{5\cdot \overset{5}{\cancel{10}}\frac{м}{с^2}\cdot 5}{\cancel{4}\,2}\right) =$$

$$= \frac{1}{12}\left(52\frac{м}{с^2} + 200\frac{м}{с^2} - \frac{125}{2}\frac{м}{с^2}\right) = \frac{1}{12}\left(252\frac{м}{с^2} - 62{,}5\frac{м}{с^2}\right) =$$

$$\approx 15{,}8\frac{м}{с^2}.$$

Ответ: $a_б = 15{,}8\frac{м}{с^2}$.

3. Путь пройденный шариком: $\ell = \frac{H}{\cos\beta} = \frac{13H}{5} = 2{,}6H$

Движение шарика равноускоренное:

$$x = x_0 + v_{0x}t + \frac{a_x t^2}{2}, \quad v_0 = 0; \quad x_0 = 0; \quad x = \ell = 2{,}6H.$$
$$a_x = a_б.$$

$$2{,}6H = \frac{a_б t^2}{2} \Rightarrow t = \sqrt{\frac{5{,}2H}{a_б}};$$

$$t = \sqrt{\frac{5{,}2\,H\,м}{15{,}8\frac{м}{с^2}}} \approx \sqrt{0{,}33\,Hс} \approx 0{,}57\sqrt{H}\ с.$$

Ответ: $t \approx 0{,}57\sqrt{H}$.

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Чистовик.

№2

③

Дано:

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

$\angle\alpha = 22{,}5^\circ$

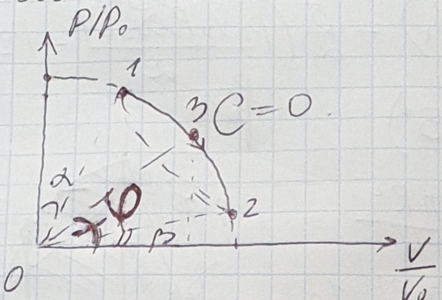
$\angle\beta = 15^\circ$

1) $\frac{T_1 - T_2}{T_2}$

2) φ - ? $(C=0)$

3) η - ?

Решение:



Ур-ие Менделеева-Клапейрона:

$pV = \nu RT \Rightarrow$

$p_1V_1 = \nu RT_1$; $p_2V_2 = \nu RT_2$

$T_1 = \frac{p_1V_1}{\nu R}$; $T_2 = \frac{p_2V_2}{\nu R} \Rightarrow$

$$\frac{T_1 - T_2}{T_2} = \left(\frac{p_1V_1}{\nu R} - \frac{p_2V_2}{\nu R}\right)\cdot\frac{\nu R}{p_2V_2} =$$

$$= \frac{p_1V_1 - p_2V_2}{p_2V_2} = \frac{p_1V_1}{p_2V_2} - 1$$

1. Если радиус окружности с центром в 0 равен R, то:

$\frac{p_1}{p_0} = \cos 22{,}5^\circ \cdot R$; $\frac{p_2}{p_0} = R \sin 15^\circ$

$p_1 = \cos 22{,}5^\circ \cdot Rp_0$ $\quad$ $p_2 = \sin 15^\circ Rp_0$

$\frac{V_1}{V_0} = \sin 22{,}5^\circ R$, $\quad$ $\frac{V_2}{V_0} = \cos 15^\circ \cdot R$

$V_1 = \sin 22{,}5^\circ RV_0$ $\quad$ $V_2 = \cos 15^\circ \cdot RV_0$.

$$\frac{T_1 - T_2}{T_2} = \frac{p_1V_1}{p_2V_2} - 1 = \frac{\cos 22{,}5^\circ \cdot Rp_0 \cdot \sin 22{,}5^\circ \cdot RV_0}{\sin 15^\circ Rp_0 \cos 15^\circ RV_0} - 1 =$$

$$= \frac{\sin 22{,}5^\circ \cos 22{,}5^\circ}{\sin 15^\circ \cdot \cos 15^\circ} - 1 = \frac{\cancel{0{,}5}\sin 45^\circ}{\cancel{0{,}5}\sin 30^\circ} - 1 =$$

$$= \frac{\sqrt{2}}{\cancel{2}}\cdot\cancel{2} - 1 = \sqrt{2} - 1.$$

1) Ответ: $\frac{T_1 - T_2}{T_2} = \sqrt{2} - 1 \approx 0{,}41$.

2) $C = \frac{\Delta Q}{\Delta T}$; $C = 0 \Rightarrow \Delta Q = 0$;

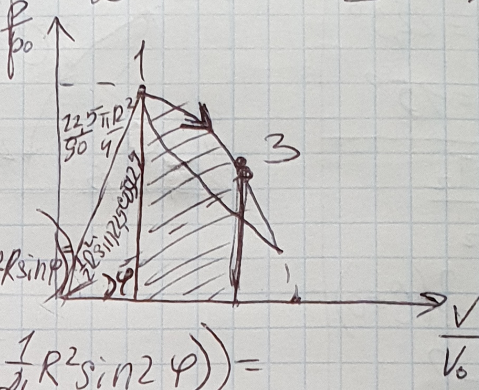
$\Delta U = \frac{i}{2}\nu R\Delta T$; $i = 5$; $\Delta U = \frac{5}{2}\nu R\Delta T$.

$Q = A_2 + \Delta U$; $Q = 0 \Rightarrow A_2 = -\Delta U$. 4.

$\Delta U = \frac{5}{2} \nu R \Delta T$; $\nu R \Delta T = \Delta p \Delta V \Rightarrow$ чистовик.

$$\Delta U = \frac{5}{2}(p_3V_3 - p_1V_1) = \frac{5}{2}\left(\frac{p_0V_0R^2\cancel{\cos}\sin 2\varphi}{2} - \frac{p_0V_0R^2\sin 45^\circ}{2}\right) =$$

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



$$A_{1-3} = p_0V_0 S = p_0V_0\left(\frac{\pi R^2}{4} - \frac{22{,}5}{90}\frac{\pi R^2}{4} -\right.$$

$$- \frac{1}{2}R\sin 22{,}5^\circ \cdot R\cos 22{,}5^\circ - \left(\frac{\varphi}{90^\circ}\cdot\frac{\pi R^2}{4} - \frac{1}{2}R\cos\varphi R\sin\varphi\right)$$

$$= p_0V_0\left(\frac{\pi R^2}{4} - \frac{\pi R^2}{16} - \frac{1}{4}R^2\sin 45^\circ - \left(\frac{\varphi}{90^\circ}\frac{\pi R^2}{2} - \frac{1}{4}R^2\sin 2\varphi\right)\right) =$$

$$= p_0V_0\left(\frac{3}{16}\pi R^2 - \frac{1}{4}R^2\frac{\sqrt{2}}{2} - \left(\frac{\varphi}{90^\circ}\frac{\pi R^2}{2} - \frac{1}{4}R^2\sin 2\varphi\right)\right) =$$

$$= p_0V_0R^2\left(\frac{3}{16}\pi - \frac{\sqrt{2}}{8} - \frac{\varphi}{90^\circ}\frac{\pi}{2} + \frac{1}{4}\sin 2\varphi\right)$$

$$A_{1-3} = -\Delta U \Rightarrow p_0\cancel{V_0R^2}\left(\frac{3}{16}\pi - \frac{\sqrt{2}}{8} - \frac{\varphi\pi}{180^\circ} + \frac{1}{4}\sin 2\varphi\right) = \frac{5}{4}p_0\cancel{V_0}R^2(\sin 45^\circ - \sin 2\varphi) \Big| : \frac{1}{4}$$

$$\frac{3}{4}\pi - \frac{\sqrt{2}}{2} - \frac{\varphi\pi}{45^\circ} + \sin 2\varphi = 5\sin 45^\circ - \sin 2\varphi$$

$$2\sin 2\varphi = 6\sin 45^\circ - \frac{3}{4}\pi - \frac{\varphi\pi}{45^\circ} \Big| : 2$$

$$\sin 2\varphi = 3\sin\frac{\pi}{4} - \frac{3}{8}\pi - \frac{\varphi\,\pi\cdot 2}{\pi}$$

sin

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$Q=0 \Rightarrow A_2 = -\Delta U$ чистовик

$\Delta T = \Delta p \Delta V \Rightarrow$

$\frac{p_0 V_0 R^2 \sin 45^\circ}{}) =$

$$mg + ma + T = ma_б \quad (0)$$

$$T\sin\beta - ma = ma_б \sin\beta$$

$$T\cos\beta - mg = -ma_б \cos\beta$$

$$mg - T\cos\beta = T\sin\beta - ma$$

$$tg\beta = \frac{T\sin\beta - ma}{mg - T\cos\beta}$$

$$\frac{ma}{\sin\beta} - \cancel{T} - \frac{mg}{\cos\beta} + \cancel{T} = 0$$

$$\frac{a}{\sin\beta} = \frac{g}{\cos\beta} \Rightarrow a = g\, tg\,\beta$$

$$pV = \nu RT$$

$$\frac{5}{2}\nu R \Delta T = 0$$

$$\frac{5}{2} p_1 V_1 - p_x V_x = 0$$

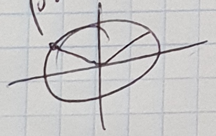
$$p_1 V_1 = p_x V_x$$

$$\sin 2\varphi = \sin 45^\circ$$

$$Q_{2-1} = 0 \Rightarrow \qquad Q = \Delta U = \frac{5}{2} R \nu T$$

$$A_{2-1} = -\Delta U_{2-1} \qquad \frac{p_0 R V_0 \sin 45^\circ}{2} \quad p_1 V_1$$

$$\frac{p^2}{p_0^2} + \frac{V^2}{V_0^2} = R^2$$



$$-p_2 V_2 + p_1 V_1 = A_{2-1}$$

$$p_1 V_1 - p_2 V_2 = A_{2-1}$$

$$p_0 R \cdot \cos 22{,}5 \sin 22{,}5\, V_0 R = \frac{p_0 V_0 R \sin 2\varphi}{2} =$$

$$2\varphi = 135^\circ \Rightarrow \varphi =$$

$$= \frac{\sin 45^\circ p_0 V_0 R^2}{2} - \frac{p_0 V_0 R \sin 45^\circ}{2}$$

$$\frac{135}{2} =$$

$$A_{2-1} = \frac{\sin 45^\circ}{2} p_0 V_0 R^2 - \frac{\sin 30^\circ}{2} p_0 V_0 R^2 =$$

$$= p_0 V_0 R^2 \left(\frac{\sqrt{2}}{4} - \frac{1}{4} \right) = \frac{5}{2} \frac{p_0 V_0 R^2}{4} (\sqrt{2} - 1) R$$

$$\frac{5}{2} \frac{p_0 V_0 R^2}{4} (1 - \sqrt{2}) R = \frac{5}{2} (p_x V_x - p_1 V_1)$$

Часть 2

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

Шифр: **21201318**

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Вариант 8

Чистовик

①

№1.

Дано:

$C_1 = C; C_2 = 5C$

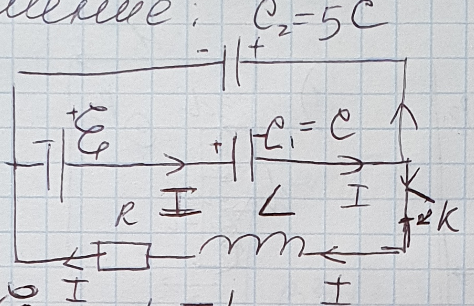
$\mathcal{E}_i; R; L$

1) $I' - ?$

2) $Q - ?$

3) $U_R - ? \left(I = \frac{I_0}{2}\right)$

Решение:



$\mathcal{E}_{is} = L I'$

Ответ: $I' = \frac{\mathcal{E}_i}{L}$

Чистовик

№4

②

Дано:

m, d, v_0, R, B

$l = \frac{2}{3}d$;

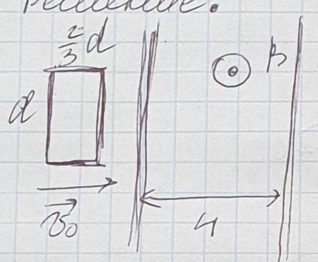
$H = 3d$

1) a – ?

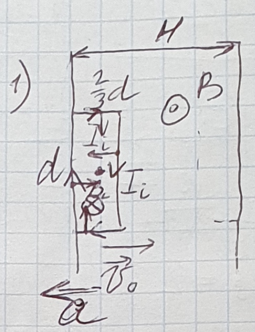
2) v_1 – ?

3) v_2 – ?

Решение:



1)



$$\mathcal{E}_i = \frac{\Delta \Phi}{\Delta t}; \quad \Delta\Phi = B\cdot S - 0 = B\cdot d\cdot\frac{2}{3}d - 0 = \frac{2}{3}B\cdot d^2$$

$$\Delta t = \frac{l}{v_0} = \frac{2}{3}\frac{d}{v_0} \Rightarrow \mathcal{E}_i = \frac{\cancel{2}}{\cancel{3}}B\cdot d^{\cancel{2}}\,\frac{\cancel{3}v_0}{\cancel{2}\cancel{d}} = B\cdot d\cdot v_0.$$

$$I_i = \frac{\mathcal{E}_i}{R} = \frac{B\cdot d\cdot v_0}{R}.$$

$$F_A = B\cdot I\cdot l\sin 90^\circ = B\cdot I\cdot l.$$

$F_{1A} = B\cdot I_i\cdot d$, $F_{2A} = B\cdot I_i\frac{2}{3}d$; $F_{3A} = B\cdot I_i\cdot d$; $F_{4A} = B\cdot I\cdot\frac{2}{3}d$. $(\vec{F}_{2A} = -\vec{F}_{4A}, \vec{F}_{1A} = -\vec{F}_{3A})$.

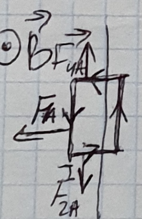
Пока рамка не войдёт полностью в магнитное поле сила ампера на правую сторону будет сообщ. ускорение рамке (F_2 и F_4 будут компенсировать друг друга).

$$ma = F_{1A}; \quad ma = B\cdot\frac{B\cdot d\cdot v_0}{R}\cdot d = \frac{B^2\cdot d^2\cdot v_0}{R} \Rightarrow$$

$$\Rightarrow \underbrace{a = \frac{B^2\cdot d^2\cdot v_0}{Rm}}$$

Ответ: $a = \frac{B^2\cdot d^2\cdot v_0}{Rm}$.

2)



Когда рамка полностью окажется в магнитном поле, сила ампера будет равна 0, $(\frac{\Delta\Phi}{\Delta t} = 0) \Rightarrow$ движение ~~равноускорен~~ равномерное.

$$F_A = \frac{B^2\cdot d^2\cdot v}{R}, \quad a = -v' = -\frac{\Delta v}{\Delta t}$$ (ускорение против движения).

$$\frac{B^2\cdot d^2\cdot v}{R} = -m\frac{\Delta v}{\Delta t}\ \Big|\cdot\Delta t, \quad \frac{B^2\cdot d^2\cdot v\Delta t}{R} = -m\Delta v$$

$v\Delta t = \Delta S \Rightarrow \dfrac{B^2 \cdot d^2 \Delta S}{R} = -m\Delta v$ Чистовик.

(3)

$$\frac{B^2 \cdot d^2}{R}\int_0^S dS = -m\int_{v_0}^{v_1} dv$$

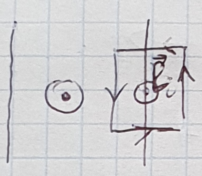
$$\frac{B^2 d^2 S}{R} - 0 = -mv_1 + mv_0 \text{ или } \frac{B^2 d^2 S}{R} = m(v_0 - v_1)$$

$$v_1 = v_0 - \frac{B^2 d^2 S}{Rm}, \quad S = v\Delta t = H = 3d;$$

$$v_1 = v_0 - \frac{B_1^2 \cdot d^2 \cdot H}{Rm} = v_0 - \frac{3B_1^2 \cdot d^3}{Rm}.$$

Ответ: $v_1 = v_0 - \dfrac{3B_1^2 d^3}{Rm}$

2)



По правилу Ленца: $\Delta\Phi < 0 \Rightarrow \vec{B}_i \uparrow\uparrow \vec{B} \Rightarrow$ ток против часовой стрелки.

$$\frac{B^2 \cdot d^2 \cdot v}{R} = -m\frac{\Delta v}{\Delta t}$$

$$\frac{B^2 \cdot d^2 \cdot \Delta S}{R} = -m\Delta v$$

$$\frac{B^2 d^2}{R}\int_0^S dS = -m\int_{v_1}^{v_2} dv.$$

$$\frac{B^2 \cdot d^2}{R} \cdot S = m(v_1 - v_2)$$

$$v_2 = v_1 - \frac{B^2 d^2 S}{Rm} = v_0 - \frac{3B_1^2 \cdot d^3}{Rm} - \frac{B^2 d^2 S}{Rm}.$$

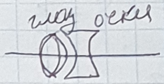
$$S = v\Delta t = \frac{2}{3}d \Rightarrow v_2 = v_0 - 3 \cdot \frac{B_2^2 d^3}{Rm} - \frac{2}{3} \cdot \frac{B^2 d^3}{Rm} =$$

$$= v_0 - \frac{11}{3}\frac{B^2 d^3}{Rm}.$$

Ответ: $v_2 = v_0 - \dfrac{11}{3}\dfrac{B^2 d^3}{Rm}.$

№5. чистовик

4



Дано:
$d_0 = 25$ см
$d_x : d_y = 1 : 5$

Решение:

рассеивающая линза

1) $\begin{cases} \frac{1}{d_0} + \frac{1}{f} = D_{гл} - D_1 & (1) \\ \frac{1}{d_\infty} + \frac{1}{f} = D_{гл} - D_2 & \left(\frac{1}{d_\infty} \to 0\right) \Rightarrow \frac{1}{f} = D_{гл} - D_2 \ (2) \end{cases}$

$$\frac{1}{d_0} = D_2 - D_1 = 5D - D = 4D \Rightarrow D = \frac{1}{4d_0}$$

$$D_1 = D = -\frac{1}{4 \cdot 25\text{см}} = -\frac{1}{100\text{см}} = -1\text{дптр}; \quad D_2 = 5D; \ \underline{D_2 = 5\text{дптр}}$$

$$\frac{1}{d_x} + \frac{1}{f} = D_{гл}; \quad \frac{1}{d_0} + \frac{1}{f} = D_{гл} - D_1 \Rightarrow$$

$$\frac{1}{d_x} - \frac{1}{d_0} = D_1 \Rightarrow d_x = \left(D_1 + \frac{1}{d_0}\right)^{-1}$$

$$d_x = \left(\frac{1}{100\text{см}} + \frac{1}{25\text{см}}\right)^{-1} = \left(\frac{25 + 100}{2500}\right)^{-1}_{\text{см}} = 20\text{см}.$$

Ответ: $D_2 = -5$ дптр; $d_x = 20$ см.

2) $\frac{1}{d_y} + \frac{1}{f} = D_{гл} - D_3.$

$\begin{cases} \frac{1}{d_0} + \frac{1}{f} = D_{гл} - D_1 \\ \frac{1}{\infty} + \frac{1}{f} = D_2 - D_2 \\ \frac{1}{d_x} + \frac{1}{f} = D_{гл} \end{cases}$ $+$ $\quad \frac{1}{d_0} + \frac{2}{f} = 2D_{гл} - D_1 - D_2$

$$D_3 = D_{гл} - \left(\frac{1}{d_y} + \frac{1}{f}\right) = D_{гл} - \left(\frac{1}{d_y} + D_{гл} - \frac{1}{d_x}\right) =$$

$$= \frac{1}{d_x} - \frac{1}{d_y} = \frac{d_y - d_x}{d_x d_y}, \quad D_3 = \frac{50\text{см} - 25\text{см}}{25 \cdot 50\text{см}^2} = \frac{1}{50\text{см}} = \frac{1}{0{,}5\text{м}} =$$

$= 2$ дптр. (линза рассеивающая $\Rightarrow D_3 < 0$; $D_3 = -2$ дптр)

Ответ: $\underline{D_3 = -2\text{ дптр}}$.

$\frac{1}{f} + \frac{1}{d}$

II

$\frac{1}{F_0} = \frac{1}{f} + \underbrace{\frac{1}{d_0} + \frac{1}{F_1}}_{1}$

I $\quad \frac{1}{F_0} - \frac{1}{F_1} = \frac{1}{f} + \frac{1}{d_0}$

$\frac{60-25}{60 \cdot 25}$

$\frac{1}{F_0} = \frac{1}{f} + \underbrace{\frac{1}{d_0} + \frac{1}{F_1}}_{\frac{1}{d_x}}$; $\frac{1}{d_x} = \frac{1}{d_0} + \frac{1}{F_1}$.

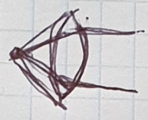
$\frac{1}{F_0} - \frac{1}{f} =$

$d_x = \frac{d_0 F_1}{F_1 + d_0}$.

$\frac{1}{d_x} = D_1 + \frac{1}{d}$

$\frac{1}{F_0} - \frac{1}{F_2} = \frac{1}{f} + \frac{1}{d}$; $d \to \infty \Rightarrow$

$B^2 \cdot d^2 \cdot 1$



$\frac{D_1 d + 1}{d}$

$\frac{1}{F} - \frac{1}{F_2} = \frac{1}{f}$.

$\frac{B^2 \cdot d^2}{R \cdot M} \cdot \frac{M}{c} = \frac{M}{c^2}$

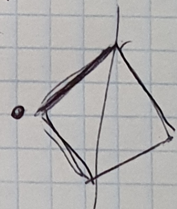
$0{,}02$ $\quad F_1 = \frac{F_2}{5}$; $D_1 = 5 D_2$

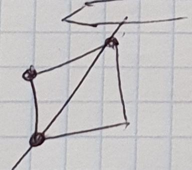
$\cdot 1 + 1$ $\quad 5F_1 = F_2$ $\quad 5$ $\quad \frac{20+25}{20 \cdot 25}$ $\quad \frac{1}{F_0} - \frac{1}{5F_1} = \frac{1}{f}$ $\quad \frac{1}{c}$

$\frac{1}{20\,cm} + \frac{1}{25}$

$\frac{d}{D \cdot d + 1}$

$\frac{1}{F_0}$ $\quad \frac{1}{d_x} = \frac{1}{F_0} - \frac{1}{f}$.





$\cancel{\frac{1}{f}} + \frac{1}{5F_1} - \cancel{\frac{1}{f}}$.

$\frac{1}{F_0} - \frac{1}{F_1} = \frac{1}{f} + \frac{1}{d_0}$ $\quad \frac{1}{d_x} = \frac{1}{5F_1} \Rightarrow d_x = 5F_1$.

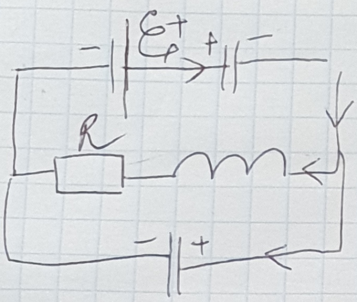
$-\frac{1}{f} + \frac{4}{5} f$

$\frac{1}{F_\infty} - \frac{1}{F_2} = \frac{1}{f} + \frac{1}{\infty}$; $\frac{1}{F_\infty} - \frac{1}{F_2} = \frac{1}{f}$.

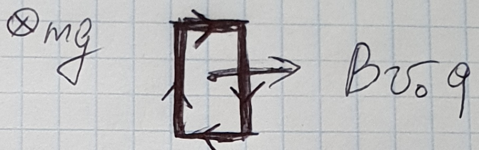
$\frac{1}{F_0} - \frac{1}{5F_1} = \frac{1}{f} + \frac{1}{d_0}$, $\frac{1}{F_\infty} - \frac{1}{f} = \frac{1}{F_2}$

$\frac{1}{F_0} - \frac{1}{d_0} - \frac{1}{f} = \frac{1}{F_1}$ $\quad :5 \quad$ $\frac{1}{F_\infty} - \frac{1}{f} = \frac{1}{5F_1}$.

$\frac{1}{5F_0} - \frac{1}{5d_0} - \frac{1}{5f} = \frac{1}{5F_1}$; $\frac{1}{F_\infty} = \frac{1}{5F_0} - \frac{1}{5d_0} + \frac{4}{5f}$



$\mathcal{E}$



$\mathcal{E}_{\ell} = B v_0 \ell$ $\quad$ $Тл \cdot \frac{м}{с} \cdot м$

$Тл \cdot \frac{м}{с} \cdot q = F \qquad B \cdot I \cdot \ell$

$\frac{Н}{Кл} \cdot м = \frac{Дж}{Кл} = В \qquad \frac{B v_0 \ell}{R}$

$$\Delta\Phi = B \cdot S - 0 = B \cdot d^2 \cdot \frac{2}{3} = \frac{2}{3} B \cdot d^2$$

$$\mathcal{E}_i = \frac{\Delta\Phi}{\Delta t} = \cancel{\tfrac{2}{3}B}\ \Delta t = \frac{\ell}{v_0} = \frac{\frac{2}{3}d}{v_0} = \frac{2}{3}\frac{d}{v_0} \Rightarrow$$

$$\mathcal{E}_i = \frac{\cancel{2}}{\cancel{3}} B \cdot d^{\cancel{2}} \cdot \frac{\cancel{3} v_0}{\cancel{2} \cancel{d}} = \underline{B \cdot d \cdot v_0}$$

$$I_i = \frac{\mathcal{E}_i}{R} = \frac{B \cdot d \cdot v_0}{R};$$