

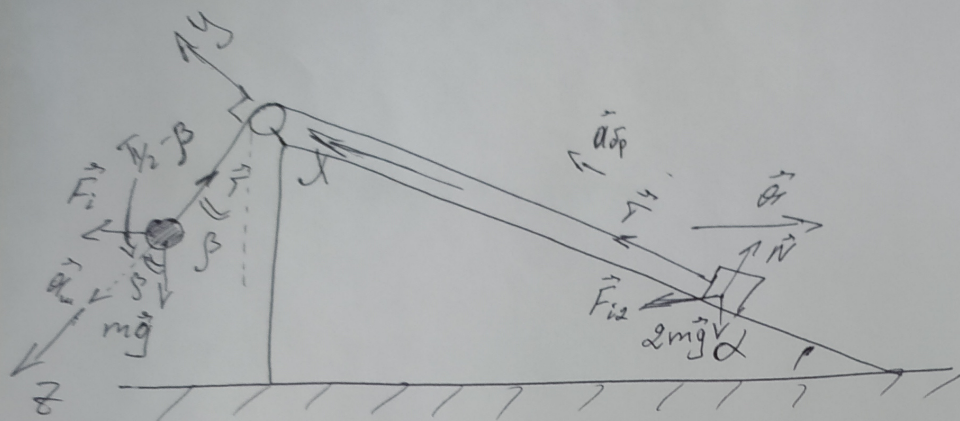
Часть 1

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

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Вариант 6



Введём систему координат действующую на брусок и на шарик, на шарик: $F_1 = ma$; на брусок: $F_2 = 2ma$, где a — ускорение клина. Так как нить нерастяжима, то ускорения бруска и шарика должны быть равны ($a_m = a_{бр}$). Так как шарик изначально был у блока и покоился, а после движения (начала движения) клина сместился вниз под углом β , то сумма сил действующая на шарик постоянна, то ускорение шарика направлено под углом β к горизонту. Ось x параллельна пов-ти клина. Ось z параллельна нити.

$$z: ma_m = mg \cos \beta + ma \sin \beta - T \quad (1)$$

Ось $y \perp$ Оси z

$$y: mg \sin \beta = ma \cos \beta \quad (2)$$

$$a = g \tan \beta$$

$$x: 2ma_{бр} = T + 2ma \cos \alpha - 2mg \sin \alpha \quad (3)$$

$$a_m = a_{бр} \quad (4)$$

Задание 8

Числовик

$$\sin \beta = \frac{\sqrt{1 - \cos^2 \beta}}{\cos \beta} = \frac{\sqrt{25/169}}{12/13} = \frac{5 \cdot 13}{13 \cdot 12} = \frac{5}{12}$$

$\theta = \frac{5g}{12}$ — ускорение кривизны

$$(1) + (3) + (4)$$

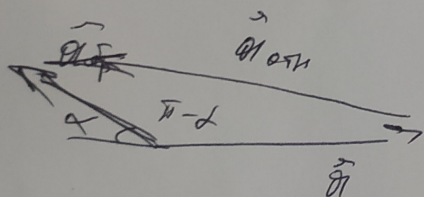
$$\sum m a_{\vec{p}} = mg \cos \beta + m a \sin \beta + 2m a \cos \alpha - 2mg \sin \alpha$$

$$\sum m a_{\vec{p}} = mg \frac{12}{13} + m \frac{5^2}{12} g \frac{5}{13} + 2 \frac{5}{12} g m \frac{4}{5} - 2mg \frac{3}{5}$$

$$\sum m a_{\vec{p}} = \left(\frac{273}{156} - \frac{6}{5} \right) mg$$

$$a_{\vec{p}} = \left(\frac{91}{156} - \frac{2}{5} \right) g = \frac{455 - 312}{780} g = \frac{143}{780} g$$

$$\vec{a}_{\vec{p}} = \vec{a} + a_{\text{крив}}^2$$



$$a_{\text{крив}}^2 = a^2 + a_{\vec{p}}^2 + 2a_{\vec{p}} a \cos \alpha = \frac{25}{144} g^2 + \frac{20449}{608400} g^2 + 2 \frac{4}{5} \frac{1715}{9360} g^2$$

$$a_{\text{крив}} = \sqrt{\frac{25}{144} + \frac{20449}{608400} + \frac{8 \cdot 715}{5 \cdot 9360}} g$$

Задание 1

Чистовик

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

$$H = \frac{5}{12} \cdot \frac{12}{13} \cdot \frac{t^2 g}{2}$$

$$H = \frac{5}{26} g t^2$$

$$t = \sqrt{\frac{26H}{5g}}$$

Ответ: 1) $a = \frac{5}{12} g$

2) $a_{\text{общ}} = \sqrt{\frac{25}{144} + \frac{20449}{608400} + \frac{8.715}{5.9360}} g = g \sqrt{\left(\frac{5}{12}\right)^2 + \left(\frac{143}{780}\right)^2 + 2 \cdot \frac{5}{12} \cdot \frac{143}{780}}$

3) $t = \sqrt{\frac{26H}{5g}}$

Sorgorot 2 (11-06)

Microbun

$$\alpha = 22,5^\circ$$

$$\beta = 15^\circ$$

$$\left(\frac{p_1}{p_0}\right)^2 + \left(\frac{v_1}{v_0}\right)^2 = r^2$$

$$r \cos \alpha = \frac{p_1}{p_0}$$

$$r \sin \alpha = \frac{v_1}{v_0}$$

$$r \sin \beta = \frac{p_2}{p_0}$$

$$r \cos \beta = \frac{v_2}{v_0}$$

$$\frac{p_1 v_1}{T_1} = \frac{p_2 v_2}{T_2}$$

$$\frac{v_2}{v_1} = \frac{p_2 v_2}{p_1 v_1} = \frac{p_2 v_2}{p_0 v_0} \frac{p_0 v_0}{p_1 v_1} = r \sin \beta r \cos \beta \frac{1}{r \cos \alpha \cdot r \sin \alpha}$$

$$\frac{v_2}{v_1} = \frac{\sin \beta \cos \beta}{\cos \alpha \sin \alpha}$$

$$\frac{v_2}{v_1} = \frac{\sin 15^\circ \cos 15^\circ}{\sin 22,5^\circ \cos 22,5^\circ} = \frac{\frac{1}{2} \sin 30^\circ}{\frac{1}{2} \sin 45^\circ} = \frac{1/2}{\sqrt{2}/2} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\boxed{\frac{v_2}{v_1} = \frac{\sqrt{2}}{2}}$$

(4)

Задача 2 (11-06)

Температура равна нулю, в точке пересечения графика с абсциссой

исходным

$$pV^\gamma = \text{const} \quad (1)$$

$$\gamma = \frac{i+2}{i} = \frac{7}{5}$$

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

$$(1)' \quad dp V^\gamma + \gamma p V^{\gamma-1} dV = 0$$

$$dp = -\gamma p \frac{dV}{V}$$

(2)'

$$2 \frac{p}{p_0^2} dp + 2 \frac{V}{V_0^2} dV = 0$$

$$\frac{p}{p_0^2} dp = -\frac{V}{V_0^2} dV$$

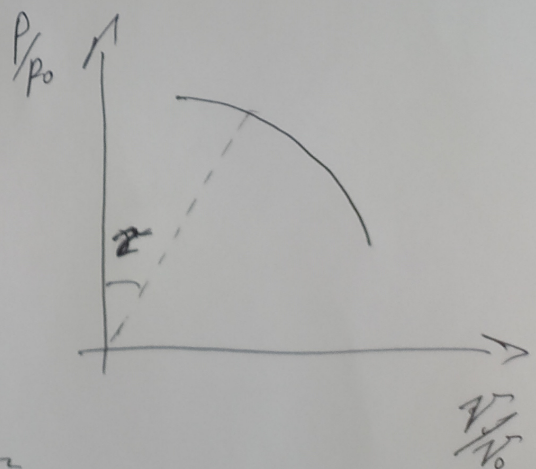
$$\frac{p}{p_0^2} (\gamma p) \frac{dV}{V} = -\frac{V}{V_0^2} dV$$

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

$$\left(\frac{p}{p_0}\right)^2 / (1+\gamma) = r^2$$

$$\cos \angle = \left(\frac{p}{p_0}\right)^2 / r^2 = \frac{1}{1+\gamma}$$

$$\cos \angle = \frac{1}{1+\frac{7}{5}} = \frac{1}{12/5} = \frac{5}{12}$$



(5)

$$Q_{21} = 0 \quad \text{Затрачено } (1-\alpha_2) \quad \text{микрофон}$$

$$|A_{21}| = |-U_{21}| = \frac{5}{2} R(T_2 - T_1) = \frac{5}{2} (P_2 T_2 - P_1 T_1) = \frac{5}{2} \left(\frac{P_1 T_2}{P_1 T_1} - \frac{P_1 T_1}{P_1 T_1} \right) P_1 T_1$$

$$\frac{A_{12}}{P_0 T_0} = \pi r^2 \cdot \frac{90^\circ - 15^\circ - 22,5^\circ}{360^\circ} = \pi r^2 \frac{52,5^\circ}{360^\circ}$$

$$r^2 = \frac{V_1}{T_0 \sin \alpha} \frac{P_1}{P_0 \cos \alpha}$$

$$\frac{A_{12}}{P_0 T_0} = \frac{\pi 52,5}{360} \frac{P_1 T_1}{P_1 T_0 \frac{1}{2} \sin 45^\circ} = \frac{105\pi}{360 \sin 45^\circ} \frac{P_1 T_1}{P_0 T_0}$$

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$$A_{12} = P_1 T_1 \cdot 1$$

$$A_y = A_{12} - |A_{21}|$$

$$\mu = \frac{A_y}{A_{12}} = 1 - \frac{A_{21}}{A_{12}} = 1 - \frac{5}{2} \left(\frac{P_2 T_2 - P_1 T_1}{P_1 T_1 \cdot 1} \right)$$

$$\mu = 1 - \frac{5}{2} \left(\frac{P_2 T_2}{P_1 T_1 \cdot 1} - \frac{1}{1} \right) = 1 - \frac{5}{2} \left(\frac{\sqrt{2} \cdot 360 \sqrt{2}}{2 \cdot 105\pi \cdot 2} - \frac{360 \sqrt{2}}{2 \cdot 105\pi} \right)$$

$$\mu = 1 - \frac{5}{2} \left(\frac{360}{210\pi} - \frac{360 \sqrt{2}}{210\pi} \right)$$

$$\boxed{\mu = 1 - \frac{5}{2} \frac{12}{7\pi} (1 - \sqrt{2})}$$

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Митровић Задатак 2 (11-06)

Одговор: 1) $\frac{T_2}{T_1} = \frac{\sqrt{2}}{2}$

2) $\cos \gamma = \frac{5}{12}$

3) $\mu = \frac{A_3}{A_{12}} = 1 - \frac{60}{148} (1 - \sqrt{2})$

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Курсовая Задание 2 (11-06)

Решение: 1) $\frac{F_2}{F_1} = \frac{\sqrt{2}}{2}$

2) $\cos \alpha = \frac{5}{12}$

3) $\mu = \frac{A_3}{A_{12}} = 1 - \frac{60}{148} (1 - \sqrt{2})$

$$\frac{p_1 v_1}{T_1} = \frac{p_2 v_2}{T_2}$$

Уравнение

$$\left(\frac{p}{p_0}\right)^2 + \left(\frac{v}{v_0}\right)^2 = r^2$$

$\alpha = 22.5^\circ$
 $\beta = 15^\circ$

$$r \cos \alpha = \frac{p_1}{p_0}$$

$$r \sin \alpha = \frac{v_1}{v_0}$$

$$r \sin \beta = \frac{p_2}{p_0}$$

$$Q_{12} = 0$$

$$r$$

$$\gamma = \frac{i+2}{1} = \frac{7}{5}$$

$$p_1 v_1^\gamma$$

$$p v^\gamma = \text{const}$$

$$\left(\frac{p}{p_0}\right)^2 + \left(\frac{v}{v_0}\right)^2 = r^2$$

$$\left(\frac{p}{p_0}\right)^2 (1 + \gamma) = r^2$$

$$dp v^\gamma + \gamma p v^{\gamma-1} dv = 0$$

$$dp v^\gamma = -\gamma p v^{\gamma-1} dv = -\gamma p \frac{v^\gamma}{v} dv$$

$$2 \frac{p}{p_0} dp + 2 \frac{v}{v_0} dv = 0$$

$$dp = -\gamma p \frac{dv}{v}$$

$$\frac{p}{p_0} (1 + \gamma \frac{v}{v_0}) = 1 + \frac{v}{v_0}$$

$$\frac{p}{p_0} \gamma = \left(\frac{v}{v_0}\right)^2$$

$$F_1 = ma$$

$$m\vec{a}_m = m\vec{g} + \vec{F}_i + \vec{T}$$

$$2mgs_p = T + 2mg \cos \alpha - 2mg \sin \alpha$$

$$|\vec{\partial}_p| = |\vec{\partial}_m| \rightarrow \text{из-за неэрмитности}$$

$$m_{\text{car}} \cos \theta = m g - T \cos \beta$$

$$m \sin \gamma = F_1 - F \sin \beta$$

$$(m_{\text{am}})^2 = (m_{\text{p}} - T \cos \beta)^2 + (m_{\text{ar}} - T \sin \beta)^2$$

$$= (mg)^2 - 2Tmg\cos\beta + \underbrace{T^2\cos^2\beta} + (ma)^2 - 2T\sin\beta\,ma + \underbrace{T^2\sin^2\beta}$$

$$(m\dot{x}_m)^2 = (mg)^2 - 2Tm(g\cos\beta + a\sin\beta) + T^2$$

$$2ma\sin\theta = T + 2ma\cos\theta - 2mg\sin\theta$$

$\Delta m = 25p$

$$\phi_p = \frac{I}{2m} + n \cos \varphi - g \sin \varphi$$

$$(\Delta \phi_p)^2 = \left(\frac{I}{2m} + a \cos \alpha \right)^2 - 2gh \sin \alpha \left(\frac{I}{2m} + a \cos \alpha \right) + g^2 h^2 \sin^2 \alpha$$



$$f = \pi/2 - \beta$$

$$m a_n = T - m g \cos \beta = m a \sin \beta$$

$$m a_z = -m g \cos \beta + m g \sin \beta$$

$$a_n^2 + a_{n+1}^2 = a_{n+p}^2$$

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Кривобук

$$\begin{array}{r} \times 12 \\ 12 \\ \hline 24 \\ 12 \\ \hline 144 \end{array}$$

$$\begin{array}{r} \times 13 \\ 13 \\ \hline 39 \\ 13 \\ \hline 169 \end{array}$$

$$169 \left(\frac{12}{13} + \frac{25}{156} + \frac{8}{12} - \frac{6}{5} \right) =$$

$$= \frac{144 + 25 + 104}{156} - \frac{6}{5}$$

$$\begin{array}{r} 169 \\ 144 \\ \hline 25 \end{array}$$

$$\sqrt{\frac{25}{13^2}} = \frac{5}{13} \quad \frac{5}{13 \cdot 12} = \frac{5}{12}$$

$$\begin{array}{r} \times 13 \\ 12 \\ \hline 26 \\ 13 \\ \hline 156 \end{array}$$

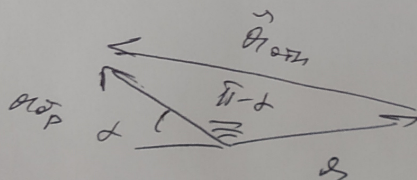
$$\vec{a}_p = \frac{\vec{r}}{2m} + \vec{a} \cos \alpha - \vec{g} \sin \alpha$$

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

$$\begin{array}{r} \times 13 \\ 8 \\ \hline 104 \end{array}$$

$$3m\vec{a}_p = m\vec{g} \cos \beta + m\vec{a} \sin \beta + 2m\vec{a} \cos \alpha - 2m\vec{g} \sin \alpha$$

$$\vec{a}_p = \vec{a} + \vec{a}_{\text{отн}}$$



$$\begin{array}{r} + 248 \\ 25 \\ \hline 3 \end{array}$$

$$268 + 5 = 273$$

$\vec{a}_{\text{отн}}$

$$\begin{array}{r} \times 156 \\ 5 \\ \hline 780 \end{array}$$

$$\begin{array}{r} 273 \\ - 27 \\ \hline 191 \end{array}$$

$$455 - 312$$

$$134$$

$$S = \pi R^2$$

Число

$$S = \pi r^2$$

$$S_0 = \frac{\pi r^2}{4}$$

$$L = \frac{\pi}{2}$$

$$S = 2\pi$$

$$S_0 = \frac{\pi}{2}$$

$$\frac{S}{S_x} = \frac{360^\circ}{L} = \frac{360^\circ}{90^\circ - 15^\circ - 23.5^\circ}$$

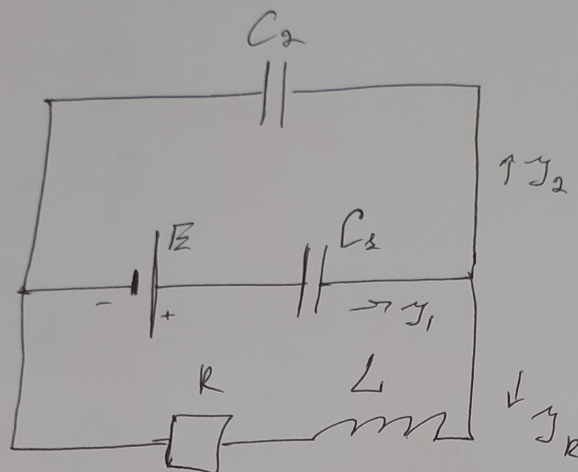
Часть 2

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

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Вариант 6



1) В начальный момент ток i_L катушки, а i_R резистор равен нулю $i_R /_{t=0}$

$$E - L \frac{di_R}{dt} = i_R R$$

$$\downarrow i_R /_{t=0}$$

$$\boxed{\frac{di_R}{dt} /_{t=0} = \frac{E}{L}}$$

2)

$$A_{\text{ист}} = W_1 + Q + W_L$$

$$A_{\text{ист}} = W_1 + W_2$$

$$\left. \begin{array}{l} A_{\text{ист}} = W_1 + Q + W_L \\ A_{\text{ист}} = W_1 + W_2 \end{array} \right\} W_2 = Q + W_L$$

В конце ток i_L катушки равен нулю

$$\downarrow W_L = 0$$

$$W_2 = Q$$

Задача 3 (11-06) числовик
В цепи два конденсатора $|q_1| = |q_2|$

$$U_2 = \varepsilon + U_1$$

$$\frac{q_2}{3C} = \varepsilon + \frac{q_1}{C}$$

$$-\frac{2}{3} \frac{q_2}{C} = \varepsilon$$

$$|q_2| = \frac{3C\varepsilon}{2}$$

$$W_2 = \frac{q_2^2}{2 \cdot 3C} = \frac{9C^2\varepsilon^2}{4 \cdot 2 \cdot 3C} = \frac{3}{8} C\varepsilon^2$$

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

$$3) \quad E = U_2 - U_1 = \frac{q_2}{3C} - \frac{q_1}{C}$$

$$\frac{dE}{dt} = \frac{j_2}{3C} - \frac{j_1}{C} = 0$$

$$j_1 = \frac{j_2}{3}$$

$$j_1 = j_2 + j_k$$

$$-\frac{2}{3} j_2 = j_k$$

$$j_2 = j_0 \text{ — по условию}$$

$$|U_k| = \frac{2}{3} j_0 R$$

Задание 3 Микробуль

Рис. 1) $\frac{dI_k}{dt/t_0} = \frac{E}{L}$

2) $R = \frac{3}{8} C \varepsilon^2$

3) $|U_k| = \frac{2}{3} I_0 R$

3

Чистовик

Задача 4 (11-06)



1)

$$\mathcal{E} = B d \dot{\phi}$$

$t=0$

рамка входит в магн. поле

$$\mathcal{E} = IR$$

$$ma = IRBd$$

$$ma = \frac{\mathcal{E}}{R} B d = \frac{(B d)^2 \dot{\phi}}{R}$$

$$a = \frac{(B d)^2 \dot{\phi}}{R m}$$

2) Скорость рамки будет изменяться только при входе и выходе, когда рамка полностью войдет, сила Ампера правой и левой сторон уравновесит друг друга $\Rightarrow a = 0$

При входе:

$$a = \frac{(B d)^2 \dot{\phi}}{R m}$$

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(4)

Задача 4

интегрируем

$$-\frac{d\bar{v}}{dt} = \frac{(Bd)^2}{Rm} \frac{dx}{dt}$$

$$-\int_{\bar{v}_0}^{\bar{v}_1} d\bar{v} = \frac{(Bd)^2}{Rm} \int_0^{d/4} dx$$

$$-(\bar{v}_1 - \bar{v}_0) = \frac{(Bd)^2}{Rm} \frac{d}{4}$$

$$\boxed{\bar{v}_1 = \bar{v}_0 - \frac{(Bd)^2 d}{4Rm}}$$

3) Тип катушки:

$$-\frac{d\bar{v}}{dt} = \frac{(Bd)^2}{Rm} \frac{dx}{dt}$$

$$-\int_{\bar{v}_1}^{\bar{v}_2} d\bar{v} = \frac{(Bd)^2}{Rm} \int_0^{d/4} dx$$

$$\bar{v}_1 - \bar{v}_2 = \frac{(Bd)^2}{Rm} \frac{d}{4}$$

$$\boxed{\bar{v}_2 = \bar{v}_0 - \frac{(Bd)^2 d}{2Rm}}$$

Ответ: 1) $a = \frac{(Bd)^2 \bar{v}_0}{Rm}$

2) $\bar{v}_1 = \bar{v}_0 - \frac{(Bd)^2 d}{4Rm}$

3) $\bar{v}_2 = \bar{v}_0 - \frac{(Bd)^2 d}{2Rm}$

(B)

- 1) Так как по условию линзы расположены вплотную, то оптическая сила линз и глаз складываются.

$$D_{\sigma} = D_1 + D_{\Gamma}$$

$$D_{25} = D_2 + D_{\Gamma}$$

$$D_{25} - D_{\sigma} = D_2 - D_1$$

$$D_{25} = \frac{1}{f} + \frac{1}{d_{25}}, \text{ где } d_{25} = 25 \text{ см}$$

$$D_{\sigma} = \frac{1}{f} + \frac{1}{f} = \frac{1}{f}$$

$$\frac{1}{d_{25}} = \frac{1}{F_2} - \frac{1}{F_1}$$

$$D_{\sigma} < D_{25}$$

$$\Downarrow$$

$$D_1 < D_2$$

$$\Downarrow$$

$$\frac{F_1}{F_2} = \frac{7}{3}$$

$$\frac{F_1}{d_{25}} = \frac{F_2}{F_2} - 1$$

$$\frac{F_1}{d_{25}} = \frac{7}{3} - 1 = \frac{4}{3}$$

$$F_1 = \frac{4}{3} d_{25}$$

$$F_1 \approx 33,3 \text{ см}$$

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Задача 5 Листовик

$$\frac{1}{F_r} = \frac{1}{x} + \frac{1}{f}$$

$$D_{\phi} - D_1 = \frac{1}{x} + \frac{1}{f}$$

$$\frac{1}{f} + (-\frac{1}{F_1}) = \frac{1}{x} + \frac{1}{f}$$

$$x = -F_1$$

$$x = -33,3 \text{ см}$$

То есть человек находится и при этом, чтобы видеть, ему нужен объект $\Rightarrow x_{\text{гн}} = 0 \text{ см}$

$$2) \quad D_r + D_3 = D_{50}$$

$$D_{50} = \frac{1}{f} + \frac{1}{d_{50}}, \text{ где } d_{50} = 50 \text{ см}$$

$$D_1 + D_r = D_{\phi}$$

$$D_3 - D_1 = D_{50} - D_{\phi}$$

$$\frac{1}{F_3} - \frac{1}{F_1} = \frac{1}{f} + \frac{1}{d_{50}} - \frac{1}{f}$$

$$\frac{1}{F_3} - \frac{1}{F_1} = \frac{1}{d_{50}}$$

$$\frac{1}{F_3} = \frac{1}{F_1} + \frac{1}{d_{50}} = \frac{d_{50} + F_1}{F_1 \cdot d_{50}}$$

$$F_3 = \frac{F_1 \cdot d_{50}}{d_{50} + F_1}$$

$$F_3 = \frac{100 \cdot 50}{3(30 + \frac{100}{3})} = \frac{5000}{150 + 100} = 20 \text{ (см)}$$

$$F_3 = 20 \text{ см}$$

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Задание 5

Числовик

Ответ: 1) человек без отклоняться не может;

$$F_1 = 33,3 \text{ см}$$

2) 20 см

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

Кепробуе

$$\frac{F_1}{F_2} = -\frac{7}{3}$$

$$\frac{F_2}{F_1} = -\frac{3}{7}$$

$$-\frac{10}{3}$$

$$F_2 < 0$$

$$\frac{F_2}{25} = -\frac{10}{3} \text{ м.}$$

$$F_2 = -\frac{250}{3}$$

$$\frac{F_1}{25} = -\frac{3}{7} - 1 = -\frac{10}{7}$$

$$F_1 = -\frac{250}{7}$$

$$\frac{1}{f} + \frac{1}{25} - \frac{1}{F_2} = \frac{1}{f} + \frac{1}{x}$$

$$\epsilon_{\text{phobun}} \frac{1}{25} - \frac{1}{\frac{4}{3} \cdot 25} = \frac{1}{25} \left(1 - \frac{7}{n}\right) = \frac{-1}{25} \frac{3}{4}$$

$$D_f = D_1 + D_r$$

$$D_{25} = D_2 + D_r$$

$$f = \text{const} \quad \text{Diagram: A lens with focal length } f \text{ and object distance } d.$$

$$x = -\frac{4}{3} 25 \text{ cm}$$

$$\frac{1}{f} + \frac{1}{f} - \frac{1}{f} - \frac{1}{d_{25}} = \frac{1}{F_1} - \frac{1}{F_2}$$

$$\frac{1}{25}$$

$$-\frac{1}{d_{25}} = \frac{1}{F_1} - \frac{1}{F_2}$$

$$F_1 \approx 33,3 \text{ cm}$$

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

$$D_r + D_3 = D_{50}$$

$$D_1 + D_r = D_f$$

$$D_1 - D_3 = D_f - D_{50}$$

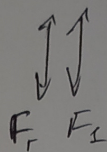
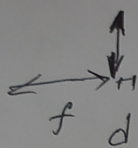
$$D_3 - D_1 = \left(\frac{1}{f} - \frac{1}{f} - \frac{1}{50} \right)$$

$$\frac{1}{F_3} - \frac{1}{F_1} = + \frac{1}{50 \text{ cm}}$$

$$F_3 = \frac{60 F_1}{50 + F_1} = \frac{60 \cdot \frac{4}{3} 25}{60 + \frac{100}{3}} = \frac{100 \cdot 50}{150 + 100} = \frac{5000}{250}$$

$$F_3 = 20 \text{ cm}$$

Упробун



$$\left(\begin{array}{l} \frac{1}{d} + \frac{1}{f} = \frac{1}{F} \\ d \rightarrow 0 \\ \frac{d+f}{df} = \frac{1}{F} \end{array} \right)$$

$$-\frac{1}{F_r} = \frac{1}{x} + \frac{1}{f}$$

$$D_d - D_1 = \frac{1}{x} + \frac{1}{f}$$

$$x = F_1 ?$$

$$\frac{100}{3} \text{ cm} \approx 33,3 \text{ cm}$$

$$\left(\frac{1}{f} + \frac{1}{80 \text{ cm}} = \frac{1}{F_r} = \frac{1}{f} - \frac{1}{F_1} \right)$$

$$D_{25} - D_2 = D_r$$

$$\frac{1}{F_{25}} = \frac{1}{f} + \frac{1}{25 \text{ cm}}$$

$$\frac{1}{f} + \frac{1}{25 \text{ cm}} - \frac{1}{F_2} = \frac{1}{F_r}$$

$$D_d = D_1 + D_r$$

$$D_{25} = D_2 + D_r$$

$$D_d - D_{25} = D_1 - D_2$$

$$\frac{1}{F_d} = \frac{1}{f} + \frac{1}{f}$$

$$F_d = f$$

$$\frac{1}{F_{25}} = \frac{1}{f} + \frac{1}{25 \text{ cm}}$$

$$\frac{1}{f} + \frac{1}{f} - \frac{1}{25 \text{ cm}} = D_1 - D_2$$

$$D_d < D_{25}$$

$$D_1 < D_2$$

$$\frac{F_1}{F_2} = \frac{7}{3}$$

$$\frac{1}{F_2} - \frac{1}{F_1} = \frac{1}{25 \text{ cm}}$$

$$F_2 = \frac{3}{7} F_1$$

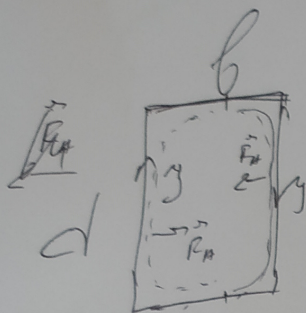
$$\frac{F_1}{F_2} - 1 = \frac{F_1}{25 \text{ cm}}$$

$$\frac{7}{3} - 1 = \frac{F_1}{25 \text{ cm}}$$

$$\frac{4}{3} \cdot 25 \text{ cm} = F_1$$

реpублuк

$$E = \gamma r + \gamma(r-r)$$



$\odot \vec{B}$

$H, 2d$

$H = Am \cdot \gamma_1$

$\gamma_1 = \frac{H}{Am}$

$D \times = A^2 Om \cdot c$

$$\frac{(\gamma_1 \cdot m)^2 \frac{H}{c}}{Om} = \frac{\left(\frac{H}{Am}\right)^2 \frac{H}{c}}{Om}$$

$$= \frac{D \times m}{Om Om c c}$$

$$E = \frac{d\Phi_B}{dt} = B d \dot{\alpha}_0$$

$$E = \gamma R \quad m\alpha = F_A = \gamma d B$$

$$m\alpha = \frac{E}{R} dB = \frac{(Bd)^2 \dot{\alpha}_0}{R}$$

$$\alpha = \frac{(Bd)^2 \dot{\alpha}_0}{R m}$$

$$\dot{\alpha}_1 = \dot{\alpha}_0 - \alpha \dot{\alpha}_1$$

$$b = \dot{\alpha}_0 t_1 - \frac{\alpha t_1^2}{2}$$

$$\frac{d\dot{\alpha}}{dt} = \lambda \frac{dx}{dt} \quad \alpha = \lambda \dot{\alpha}$$

$$\frac{H^2 m}{A^2 Om c} = \frac{D \times H}{D \times} \quad (4)$$

$$\frac{H^2 m}{A^2 Om \omega^2} = \frac{D \times H c}{D \times \omega^2} = \frac{H \cdot c}{\omega^2}$$

$$\alpha = \frac{(Bd)^2}{R m} (\dot{\alpha}_0 - \alpha t)$$

$$\Rightarrow \lambda \left(\frac{\omega^2 \cdot m c}{c^2 \omega^2} \right) \frac{m}{c}$$

$$\alpha = \lambda \dot{\alpha}_0 - \alpha t \lambda$$

$$\alpha (1 + t \lambda) = \lambda \dot{\alpha}_0$$

$$\alpha = \frac{\lambda \dot{\alpha}_0}{1 + t \lambda}$$

$$\mathcal{E} - L \frac{dI_2}{dt} = \mathcal{I}R$$

$t=0 \rightarrow I_2=0$

$$\frac{dI_2}{dt} = \frac{\mathcal{E}}{L}$$

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

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

reproblem

$$q_1 = q_2$$

$$-\frac{2}{3} \frac{q_2}{C} = \mathcal{E}$$

$$q_2 = -\frac{3\mathcal{E}C}{2}$$

$$-L \frac{dI}{dt} = \mathcal{I}R - U_2 = \mathcal{I}R + \frac{q_2}{3C}$$

$$\left(-L \frac{dI}{dt} = \mathcal{I}R + \frac{q_2}{3C} \right)$$

$$I_1 = I_2 + I_R$$

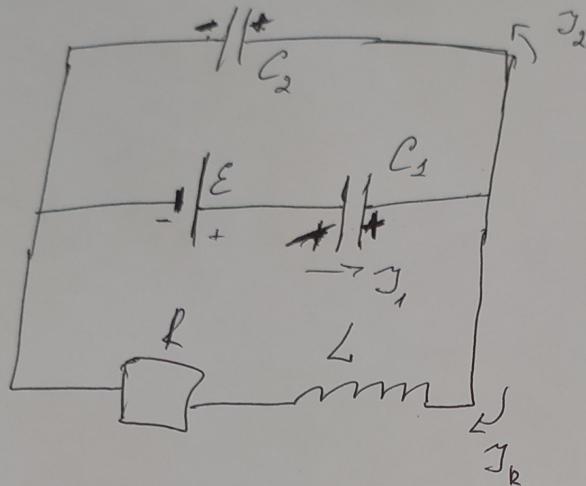
$$\mathcal{E} = U_1 + U_2$$

$$\mathcal{E} = U_2 - U_1 = \frac{q_2}{3C} - \frac{q_1}{C}$$

$$\frac{I_2}{3C} = \frac{I_1}{C}$$

$$\frac{h^2 m}{h^2 m \omega} = \frac{\hbar \omega}{\hbar \omega} = \frac{\hbar \omega}{\hbar \omega} \quad \text{---}$$

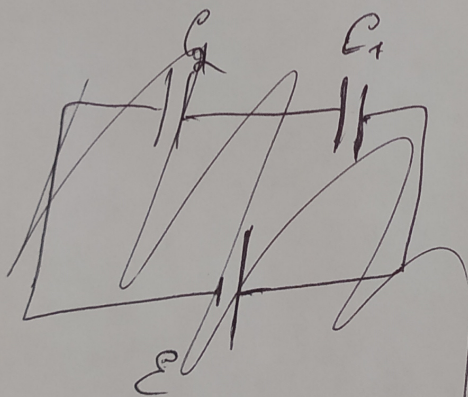
репробум



$$\mathcal{E} - L \frac{dI_R}{dt} = I_R R$$

$\downarrow$
 $I_{R0} = 0$

$$\frac{dI_R}{dt} = \frac{\mathcal{E}}{L}$$



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

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

$$q_1 = q_2$$

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

$$A_{\text{ист}} = W_1 + W_2 + W_R + Q$$

$$A_{\text{ист}} = W_1 + Q + W_R$$

$$A_{\text{ист}} = W_1 + W_2$$

$$W_1 = \frac{C_1 \mathcal{E}^2}{2} \rightarrow 10$$

$$W_2 = Q$$