Часть 1

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

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Вариант 1

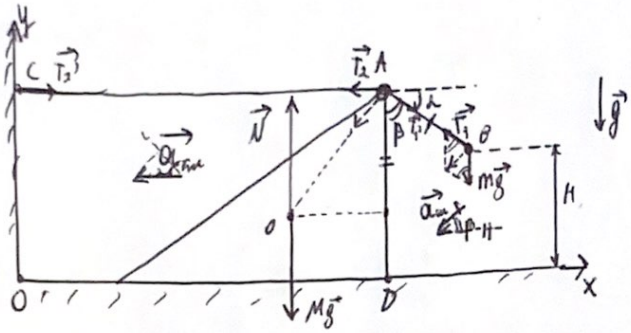
Химавия

$T = T_1 = T_1' = T_2 = T_2'$, т.к. нить невесома, нерастяж.

1. $\cos\alpha = \frac{3}{5}$, $F_{тр} = 0$, H

$\sin\beta - ?$, $a_{ш} - ?$, $\frac{m}{M} - ?$, $t - ?$

$\sin^2\alpha + \cos^2\alpha = 1 \to \sin^2\alpha + \frac{9}{25} = 1 \to \sin^2\alpha = \frac{16}{25} \to \sin\alpha = \frac{4}{5}$



1) Для шара:

$m\vec{g} + \vec{T_1} = m\vec{a_ш}$

На нить: $-mg_H + T_1 = 0$

т.к. $a_{уст.} = 0$

т.к. $a_{дс} = \frac{v_0^2}{R}$, $v_0 = 0$

$a_{дс} = 0 \to \vec{a}_{ш} \perp AB$ (нить)

$AB \perp a_{ш}$, горизонт. $\perp AD$ $\} \angle DAB = \beta \to \beta = 90° - \alpha \to \sin\beta = \sin(90° - \alpha) = \cos\alpha \to \boxed{\sin\beta = \frac{3}{5}}$

2) ~~Для клина~~: $M\vec{g} + \vec{N} + \vec{T_2} + \vec{T_1'} = M\vec{a_{кл}}$

Oy: $-Mg + N - T_1'\sin\alpha = 0$

Ox: $-T_2 + T_1'\cos\alpha = -Ma_{кл} \to T(1-\cos\alpha) = Ma_{кл} \to a_{кл} = \frac{T(1-\cos\alpha)}{M}$

Для шара: $m\vec{g} + \vec{T_1} = m\vec{a_ш}$ → На нить: $-mg\cos\beta + T_1 = 0 \to T = mg\sin\alpha \to \boxed{a_{кл} = \frac{mg(1-\cos\alpha)\sin\alpha}{M}}$

Центростр. нить: $mg\sin\beta = ma_ш \to \boxed{a_ш = \frac{3g}{5}}$

$a_{кл} = \frac{mg(1-\frac{3}{5})\frac{4}{5}}{M} = \boxed{\frac{8mg}{25M}}$

~~Клин не переворачивается~~ → T_1 отн. т. O $M_N, M_{mg} = 0$

$M_{T_1, T_2} = 0$

~~Для шара в произвольной точке: $m\vec{g} + \vec{T'} = m\vec{a'}$~~

~~На нить: $-mg\cos\beta + T' = \frac{mv^2}{l}$~~

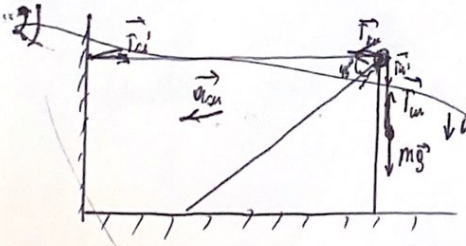
~~Для шара в произвольной точке: $a_{ш}' = T$~~

ЗСЭ для шара в т. произвольной точке: $\frac{mv^2}{2} + mgH' = E_0$

$\frac{mR^2(\beta')^2}{2} + mg(h_0 - AD \cdot$

1

2)



Нить одна → $v_ш = v_{кл}$, скорости шара и клина после неупругого удара равны → $a_ш = a_{кл}$

$\frac{mg - T}{m} = \frac{\frac{\sqrt{2}}{2}T}{M} \to mMg - TM = \frac{\sqrt{2}}{2}mT \to T(M + \frac{\sqrt{2}}{2}m) = mMg$

$T = \frac{mMg}{M + \frac{\sqrt{2}}{2}m} \to g - \frac{T}{m} = \frac{\sqrt{2}T}{2M} \to g - \frac{Mg}{M + \frac{\sqrt{2}}{2}m} = \frac{\sqrt{2}mg}{2M + \sqrt{2}m} \to$ Ω.т.g

2) Для шарика: $m\vec{g} + \vec{T_1} = m\vec{a_{ш}} \to m\vec{g} + \vec{T_1} = m\vec{a}_{шот.ш} + m\vec{a_{ш}} \to m\vec{g} + \vec{T_1} = m\vec{a_{ш}}$ (Чистовик; $a_{шот.ш} = 0$, т.к. $a = const$)

$Ox: T_1 \sin\beta = m a_{ш} \to a_{ш} = \frac{T \sin\beta}{m}$

$Oy: T\cos\beta - mg = 0 \to T = \frac{mg}{\cos\beta} \to a_{ш} = \frac{mg\sin\beta}{m\cos\beta} \to a_{ш} = g\operatorname{tg}\beta = g\frac{\sin\beta}{\cos\beta} = g\frac{\frac{3}{5}}{\sin\alpha} = g\frac{\frac{3}{5}}{\frac{4}{5}}$

$a_{ш} = \frac{3}{4}g$

3) Для клина: $M\vec{g} + \vec{N} + \vec{T_2} + \vec{T_{11}} = M\vec{a_{кл}}$

$\frac{m}{\sin\alpha}(1-\cos\alpha) = \frac{3}{4}M \to$ Ox: $-T_2 + T_1'\cos\alpha = -Ma_{кл} \to T(1-\cos\alpha) = \frac{3}{4}Mg \to \frac{mg}{\cos\beta}(1-\cos\alpha) = \frac{3}{4}Mg$

$\frac{5}{4}m\left(1-\frac{3}{5}\right) = \frac{3}{4}M \to \frac{5}{4}m \cdot \frac{2}{5} = \frac{3}{4}M \to \frac{1}{2}m = \frac{3}{4}M \to \frac{m}{M} = \frac{3}{2}$

2) Для шарика: $m\vec{g} + \vec{T_1} = m\vec{a_{ш}} \to m\vec{g} + \vec{T_1} = m\vec{a}_{мош} + m\vec{a_{ш}}$

~~На ось: $-mg\cos\beta + T = 0 + ma_{ш} + \frac{ma_{ш}}{\cos\alpha} \; ma_{ш}\cos\alpha$~~

$-mg$ Перпенд. линии: $mg\sin\beta = 0 + ma_{ш}\sin\alpha \to a_{ш} = \frac{g\sin\beta}{\sin\alpha} = \frac{g\frac{3}{5}}{\frac{4}{5}} =$

На ось: $-mg\cos\beta + T = -ma_{мош} + ma_{ш}\cos\alpha$

$a_{ш} = \frac{3}{4}g$

3) Для клина: $M\vec{g} + \vec{N} + \vec{T_2} + \vec{T_1'} = Ma_{кл} +$

Ox: $-T_2 + T_1'\cos\alpha = -Ma_{кл} \to T(1-\cos\alpha) = \frac{3}{4}Mg \to T\left(1-\frac{3}{5}\right) = \frac{3}{4}Mg$

$-mg\cos\beta + T = -ma_{мош} + ma_{ш}\cos\alpha$

$T \cdot \frac{2}{5} = \frac{3}{4}Mg \to T = \frac{15}{8}Mg$

Т.к. нить идеал. $\to$ $a_{мош} = a_x \to -mg\cdot\sin\alpha + \frac{15}{8}Mg = m\cdot\frac{3}{4}g(\cos\alpha - 1) \to -\frac{4mg}{5} + \frac{15}{8}Mg = \frac{3}{4}mg\cdot\frac{2}{5}$

($a_{мош}$ – ускорение подвеса отн. клина)

$-\frac{4mg}{5} + \frac{15}{8}Mg = \frac{3}{10}mg \to \frac{15}{8}M = \frac{11}{10}m$

$\frac{m}{M} = \frac{150}{88} \to \frac{m}{M} = \frac{75}{44}$

4) $H_y = \overset{=0}{v_y}t + \frac{a_y}{2}t^2 \to Oy: -H = -\frac{a_{мош}\sin\alpha}{2}t^2 \to t^2 = \frac{2H}{a_{ш}\sin\alpha} = \frac{2H}{\frac{3}{4}g\cdot\frac{1}{5}} = \frac{2H}{\frac{3}{5}g} = \frac{10}{3}\frac{H}{g} \to t = \sqrt{\frac{10H}{3g}}$

Ответ: $\sin\beta = \frac{3}{5}$; $a_{ш} = \frac{3}{4}g$; $\frac{m}{M} = \frac{75}{44}$; $t = \sqrt{\frac{10H}{3g}}$

Чистовик

2. 1)

T_0

$C(T) = 2R\frac{T}{T_0}$

$T_1' = \frac{5}{6}T_0$

$Q_1 - ?$

$T_2 - ?$

$A'_{min} - ?$

1) $C(T) = 2R\frac{T}{T_0} \to \frac{|\Delta Q|}{\Delta T} = 2R\frac{T}{T_0} \to |\Delta Q| = 2R\nu\frac{T}{T_0}\Delta T \to \int_0^{Q_1} dQ = \int_{T_0}^{\frac{5}{6}T_0} \frac{2R\nu}{T_0} T\,dT$

$Q_1 = \left|\frac{2R\nu}{T_0}\left(\frac{\left(\frac{5}{6}T_0\right)^2}{2} - \frac{T_0^2}{2}\right)\right| = \left|\frac{R\nu}{T_0}\left(\frac{25}{36}T_0^2 - T_0^2\right)\right| = \frac{9R\nu}{36T_0}T_0^2 \to \boxed{Q_1 = \frac{R\nu T_0}{4}}$

2) $\int_0^Q dQ = \int_{T_0}^{T} \frac{2R\nu}{T_0} T\,dT \to Q(T) = \frac{R\nu}{T_0}(T^2 - T_0^2)$

$A' = Q - \Delta U = \frac{R\nu}{T_0}(T^2 - T_0^2) - \frac{3}{2}\nu R(T - T_0) = \frac{\nu R T^2}{T_0} - \nu R T_0 - \frac{3}{2}\nu R T + \frac{3}{2}\nu R T_0$

$A'(T) = \frac{\nu R}{T_0}T^2 + \frac{\nu R T_0}{2} - \frac{3}{2}\nu R T \to (A'(T))' = \frac{2\nu R}{T_0}T - \frac{3}{2}\nu R = 0$ при A'_{min}

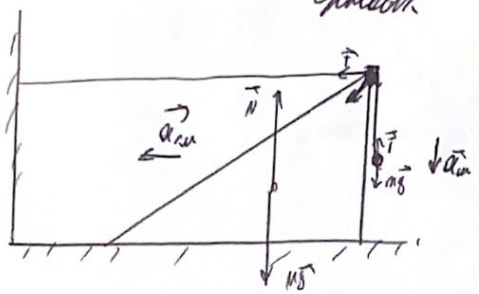
$\frac{2T_2}{T_0} = \frac{3}{2} \to \boxed{T_2 = \frac{3T_0}{4}}$

$A'_{min} = \frac{\nu R}{T_0}\cdot\left(\frac{3}{4}T_0\right)^2 + \frac{\nu R T_0}{2} - \frac{9}{8}\nu R T_0 = \frac{9}{16}\nu R T_0 + \frac{1}{2}\nu R T_0 - \frac{9}{8}\nu R T_0$

$A'_{min} = \left(\frac{9}{16} + \frac{8}{16} - \frac{18}{16}\right)\nu R T_0 = -\frac{1}{16}\nu R T_0 \to \boxed{A'_{min} = -\frac{\nu R T_0}{16}}$

Ответ: $\boxed{Q_1 = \frac{\nu R T_0}{4}}$; $\boxed{T_2 = \frac{3}{4}T_0}$; $\boxed{A'_{min} = -\frac{\nu R T_0}{16}}$

Чернавин



$v_{cm} = v_m$

$a_{cm} = a_m$

$\frac{mg - T}{m} = \frac{\frac{\sqrt{2}}{2} T}{M}$

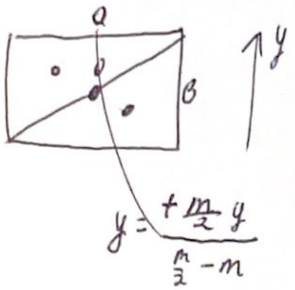
$g - \frac{T}{m} = \frac{\sqrt{2}\, T}{2M}$

$T = \frac{g}{\left(\frac{1}{m} + \frac{\sqrt{2}}{2M}\right)}$

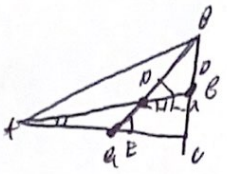
$T = \frac{g}{\frac{2M + \sqrt{2}m}{2Mm}} = \frac{2mMg}{2M + \sqrt{2}m}$

$\frac{T - mg}{m} = \frac{T}{m} - g = \frac{2Mg}{2M + \sqrt{2}m} - g = \frac{\sqrt{2}mg}{2M + \sqrt{2}m}$

Черновик



$$y = \frac{+\frac{m}{2}y}{\frac{m}{2} - m}$$



Δ $tg\alpha = \frac{2b}{a}$

$tg\beta = \frac{b}{2a}$

$x \longrightarrow x+$ $tg\beta = \frac{x}{y}$

$ctg\alpha = \frac{y}{\frac{b}{2}}$ $\quad x = \frac{b}{2} + tg\beta ctg\alpha$

$tg\beta = \frac{x}{\frac{b}{2} ctg\alpha}$ $\quad \frac{b}{2} \cdot \frac{b}{2a} \cdot \frac{a}{2b}$

$\frac{b}{8}$

$\frac{10^\circ}{360^\circ} \cdot 2\pi = \frac{1}{18\pi}$ $\quad \frac{1}{6}$

10 0 0 6

~~1,666~~

0,1666

Часть 2

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

Шифр: **21202152**

ID профиля: **815338**

Вариант 1

Чистяков

№3

$C_2 = C$

$C_1 = 2C$

$\mathcal{E}$

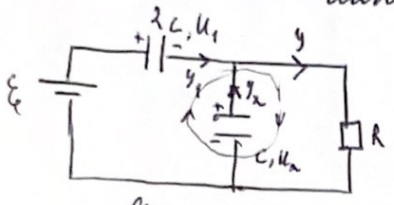
R

ν_0

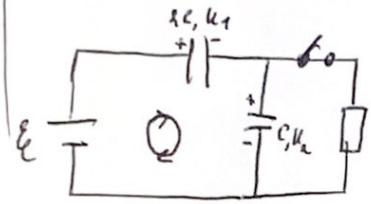
$\nu - ?$

$Q - ?$

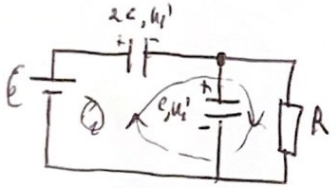
$\nu_R - ?$



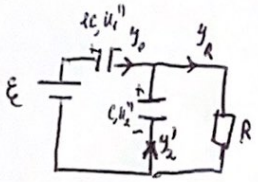
сразу после замыкания



ключ разомкнут



через долгое время



при ν_0

1) Ключ разомкнут. II З.К.:

$$\mathcal{E} - U_1 - U_2 = 0$$

$$\mathcal{E} - \frac{q}{2C} - \frac{q}{C} = 0 \to \mathcal{E} = \frac{3q}{2C} = \frac{3 \cdot 2C U_1}{2C}$$

$$U_1 = \frac{\mathcal{E}}{3} \qquad U_2 = \mathcal{E} - U_1 = \mathcal{E} - \frac{\mathcal{E}}{3} \to U_2 = \frac{2\mathcal{E}}{3}$$

Сразу после замыкания II З.К. для внешней цепи: $\mathcal{E} - U_1 = \nu R \to \mathcal{E} - \frac{\mathcal{E}}{3} = \nu R \to \boxed{\nu = \frac{2\mathcal{E}}{3R}}$

2) Через долгое время II З.К. для внешней цепи: $\mathcal{E} - U_1' = 0$

$$U_1' = \mathcal{E}$$

внутр. цепь: $\mathcal{E} - U_1' - U_2' = 0$

$$\mathcal{E} - \mathcal{E} - U_2' = 0 \to U_2' = 0$$

ЗСЭ: $\frac{2C \cdot U_1^2}{2} + \frac{C \cdot U_2^2}{2} - Q + \mathcal{E}(2C U_1' - 2C U_1) = \frac{2CU_1'^2}{2} + \frac{CU_2'^2}{2}$

$$\frac{C\mathcal{E}^2}{9} + \frac{C \cdot \frac{4}{9}\mathcal{E}^2}{2} - Q + \mathcal{E}\left(2C\mathcal{E} - \frac{2C\mathcal{E}}{3}\right) = C\mathcal{E}^2 \to \frac{C\mathcal{E}^2}{9} + \frac{2C\mathcal{E}^2}{9} - Q + \frac{4C\mathcal{E}^2}{3} = C\mathcal{E}^2 \to \boxed{Q = \frac{2}{3} C\mathcal{E}^2}$$

~~3) $\mathcal{E} - U_1' = \nu_R R \to \mathcal{E} - \frac{2C\mathcal{E} + q}{2C} = \frac{\Delta q}{\Delta t} R$~~

3) $\underbrace{\mathcal{E} - U_1' - U_2'}_{\text{II З.К. в дифференциальной форме}} = 0 \to \mathcal{E} - \frac{\frac{2}{3}C\mathcal{E} + q_1}{2C} - \frac{\frac{2}{3}C\mathcal{E} + q_2}{C} = 0 \to \mathcal{E} = \frac{\mathcal{E}}{3} + \frac{q_1}{2C} + \frac{2}{3}\mathcal{E} + \frac{q_2}{C} \to \frac{q_1}{2C} = \frac{q_2}{C} \to \frac{q_1}{2} = q_2$

q_1 - заряд пластины C_1

q_2 - заряд пластины C_2

$$\to \frac{q_1'}{2} = q_2' \to \nu_0 = 2\nu_2'$$

$\nu_R = \nu_0 + \nu_2' = \nu_0 + \frac{\nu_0}{2} \to \boxed{\nu_R = \frac{3\nu_0}{2}}$

Ответ: $\boxed{\nu = \frac{2\mathcal{E}}{3R}}$ $\boxed{Q = \frac{2}{3} C\mathcal{E}^2}$ $\boxed{\nu_R = \frac{3\nu_0}{2}}$

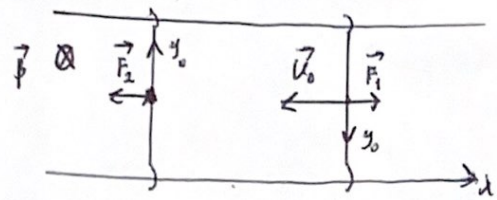
(1)

№4

Числовик

β
L
$m_1 = m$
$m_2 = 2m$
$R_1 = R$
$R_2 = 2R$
v_0
S_0

$Q_{20} - ?$
$v_1 - ?$
$v_2 - ?$
$S - ?$



1) $\beta v_0 L = \mathcal{E}_i \to \beta v_0 L = y_0 \cdot 3R \to y_0 = \frac{\beta v_0}{3R}$

$F_2 = \beta y_0 L = \frac{\beta^2 L^2 v_0}{3R}$

$F_2 = m_2 a_{2_x} \to a_{2_x} = \frac{F_2}{2m} \to \boxed{a_{2_x} = \frac{\beta^2 L^2 v_0}{6mR}}$

2) ~~$F_1^{\cdot} = m_1 a_1^{\cdot} \to \beta y^{\cdot} L = m a_1^{\cdot} \to$~~

~~$\to \frac{\beta^2 L^2 v_x^{\cdot}}{3R} =$~~

2) Для 1 перелым отн. 2 в проекциях. зам. время:

$F_1^{\cdot} = m_1 a_2^{\cdot} + m_1 a^{\cdot} \to F_1^{\cdot} = \frac{m_1}{m_2} F_2^{\cdot} + m_1 a^{\cdot} \to F^{\cdot} - \frac{1}{2} F^{\cdot} = m_1 a^{\cdot}$

$\frac{1}{2} \beta y^{\cdot} L = m a^{\cdot} \to -\frac{1}{2} \frac{\beta^2 L^2 v_x^{\cdot}}{3R} = m a^{\cdot} \to -\frac{\beta^2 L^2}{6mR} v_x^{\cdot} = \frac{\Delta v_x^{\cdot}}{\Delta t} \to \frac{\Delta v_x^{\cdot}}{v_x^{\cdot}} = -\frac{\beta^2 L^2}{6mR} \Delta t$

$\int_{v_0}^{v^{\cdot}} \frac{dv_x^{\cdot}}{v_x^{\cdot}} = \int_0^t -\frac{\beta^2 L^2}{6mR} dt \to \ln\left(\frac{v_x^{\cdot}}{v_0}\right) = -\frac{\beta^2 L^2}{6mR} t \to v_x^{\cdot} = v_0 e^{-\frac{\beta^2 L^2}{6mR} t}$ — зависимость от скорости 1 отн. 2 от времени

$\to t \to \infty \to v_x^{\cdot} = 0 \to v_1 = v_2$

~~$v_1^{\cdot} - v_2^{\cdot} = v_0 e^{-\frac{\beta^2 L^2}{6mR} t}$~~

$F_1^{\cdot} = m_1 a_1^{\cdot} \to \beta y^{\cdot} L = m a_1^{\cdot} \to -\frac{\beta^2 L^2 v_x^{\cdot}}{3R} = m a_1^{\cdot} \to \frac{\Delta v_1^{\cdot}}{\Delta t} = -\frac{\beta^2 L^2 v_0 e^{-\frac{\beta^2 L^2}{6mR} t}}{3mR}$

$\int_{v_0}^{v_1} dv_1^{\cdot} = \int_0^t -\frac{\beta^2 L^2 v_0}{3mR} e^{-\frac{\beta^2 L^2}{6mR} t} \to v_{1x} - v_0 = 2v_0 e^{-\frac{\beta^2 L^2}{6mR} t} \to v_{1x} = -v_0 + 2v_0 e^{-\frac{\beta^2 L^2}{6mR} t} + 2v_0 \to v_{1x} = v_0 \left(1 - 2e^{-\frac{\beta^2 L^2}{6mR} t}\right)$

$v_{1x} - v_0 = 2v_0 e^{-\frac{\beta^2 L^2}{6mR} t} \Big|_0^t \to v_{1x} - v_0 = 2v_0 e^{-\frac{\beta^2 L^2}{6mR} t} - 2v_0$

$v_{1x} = 3v_0 \left(1 - \frac{2}{3} e^{-\frac{\beta^2 L^2}{6mR} t}\right)$

$F_1 \cdot t = -m_1 v_1 + m_1 v_0$
$F_2 t = m_2 v_2$
$\to -m_1 v_1 + m_1 v_0 = m_2 v_2 \to -m v_1 + m v_0 = 2m v_2 \to -m v_1 + m v_0 = 2m v_1$

$3m v_1 = m v_0 \to v_1 = \frac{v_0}{3}$

$\boxed{v_1 = v_2 = \frac{v_0}{3}}$

3) $-\frac{\beta^2 L^2}{6mR} v^{\cdot} = a^{\cdot} \to -\frac{\beta^2 L^2}{6mR} v_x^{\cdot} = \frac{\Delta v_x^{\cdot} v_x^{\cdot}}{\Delta x} \to \Delta x = -\frac{6mR}{\beta^2 L^2} \Delta v_x \to \int_0^x dx = \int_{v_0}^0 -\frac{6mR}{\beta^2 L^2} dv_x$

$a^{\cdot} = \frac{\Delta v_x^{\cdot}}{\Delta t}$
$v_x^{\cdot} = \frac{\Delta x}{\Delta t}$
$\to a^{\cdot} = \frac{\Delta v_x^{\cdot} v_x^{\cdot}}{\Delta x}$

$X = \frac{6mR v_0}{\beta^2 L^2} \to S = S_0 - X \to \boxed{S = S_0 - \frac{6mR v_0}{\beta^2 L^2}}$

Ответ: $\boxed{a_{2_x} = \frac{\beta^2 L^2 v_0}{6mR}}$; $\boxed{v_1 = v_2 = \frac{v_0}{3}}$; $\boxed{S = S_0 - \frac{6mR v_0}{\beta^2 L^2}}$

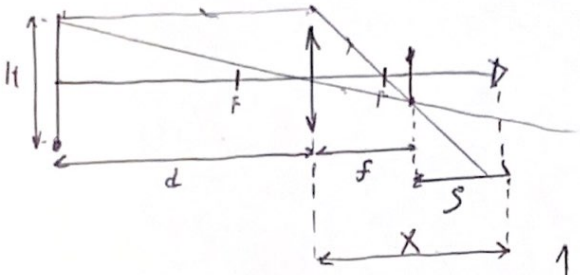
(2)

№5

Чистовик

$F = 9$ см
$H = 9$ см
$d = 36$ см
$S = 24$ см

$X - ?$
$D_л - ?$
$l - ?$

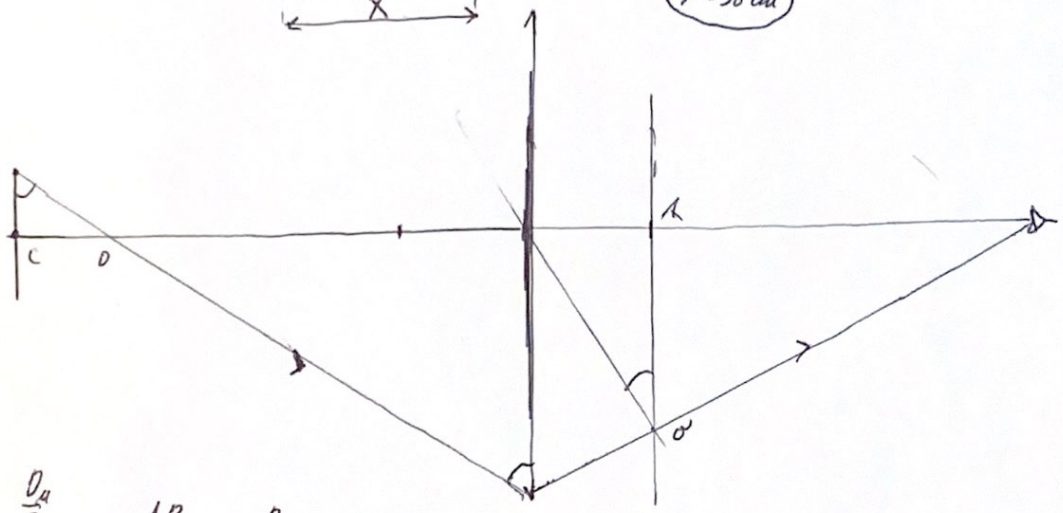


$\frac{1}{F} = \frac{1}{d} + \frac{1}{f} \rightarrow \frac{1}{f} = \frac{1}{F} - \frac{1}{d} = \frac{d-F}{Fd}$

$f = \frac{Fd}{d-F} \Rightarrow X = f + S = \frac{Fd}{d-F} + S$

$X = \frac{9\text{см} \cdot 36\text{см}}{36\text{см} - 9\text{см}} + 24\text{см} = 36\text{см}$

$X = 36$ см

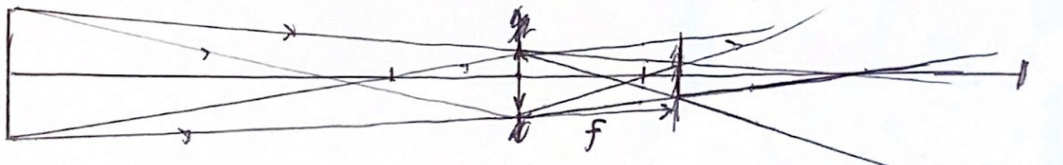


$\frac{\frac{D_л}{2}}{X} = \frac{AB}{X-F} \rightarrow \frac{D_л}{2X} = \frac{F}{(x+H)tg\alpha} \rightarrow \frac{D_л}{2X} = \frac{F}{(x-F)\frac{2CD}{H}} \rightarrow \frac{D_л}{2X} = \frac{F \cdot H}{2CD(x-F)} \Rightarrow \frac{D_л}{X} = \frac{F \cdot H}{CD(x-F)}$

$\frac{2CD}{H} = \frac{2(d-CD)}{D_л} \rightarrow CD \cdot D_л = Hd - H \cdot CD \Rightarrow CD = \frac{Hd}{H+D_л} \rightarrow \frac{D_л}{X} = \frac{F(H+D_л)}{d(X-F)} \rightarrow D_л dX - D_л dF = XFH + XFD_л$

$D_л(dX - dF - XF) = XFH \rightarrow D_л = \frac{XFH}{dX - dF - XF} = \frac{36\text{см} \cdot 9\text{см} \cdot 9\text{см}}{36\text{см} \cdot 36\text{см} - 36\text{см} \cdot 9\text{см} - 36\text{см} \cdot 9\text{см}} = 4{,}5\text{ см}$

$D_л = 4{,}5$ см



$l = f = \frac{Fd}{d-F} = \frac{9\text{см} \cdot 36\text{см}}{36\text{см} - 9\text{см}} = 12\text{ см} \rightarrow l = 12$ см

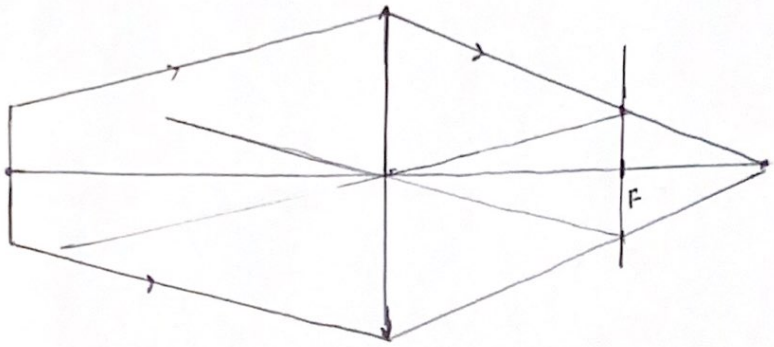
Ответ: $X = 36$ см; $D_л = 4{,}5$ см; $l = 12$ см

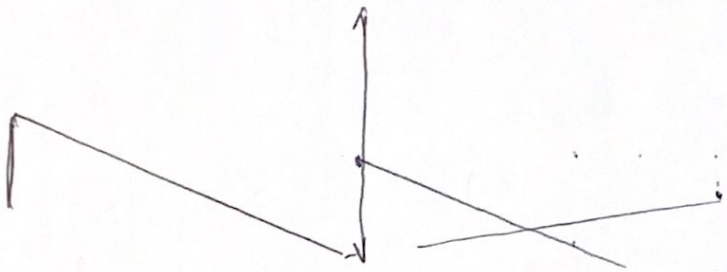
N 5

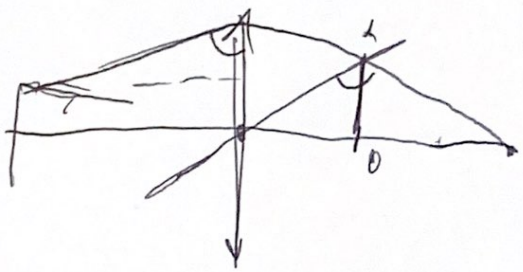
Черновик

$F = 9$ см
$H = 9$ см
$d = 36$ см
$S = 74$ см

x - ?
$D_л$ - ?
l - ?







$\frac{\frac{D_л}{2}}{x} = \frac{AO}{x-F}$

$\frac{D_л}{2x} = \frac{F}{(x-F)\operatorname{tg}\alpha}$

$\operatorname{tg}\alpha = \frac{d}{\frac{D_л}{2} - \frac{H}{2}}$

$\operatorname{tg}\alpha = \frac{2d}{D_л - H}$

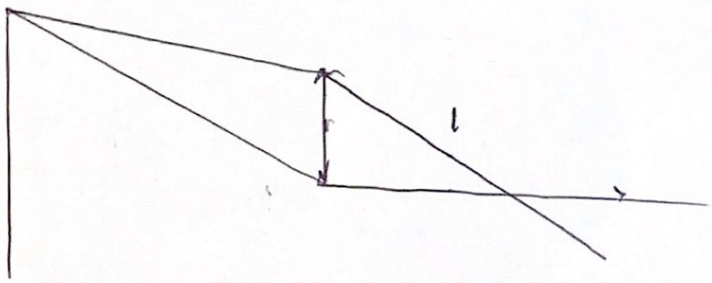
$\frac{D_л}{2x} = \frac{F(D_л - H)}{2d(x-F)}$

$D_л dx - D_л dF = xFD_л - xFH$

$D_л(dx - dF - xF) =$

$= -xFH$

$D_л =$



№5

Чернова

$F = 9\,см = 0{,}09\,м$

$H = 9\,см = 0{,}09\,м$

$d = 36\,см = 0{,}36\,м$

$S = 24\,см = 0{,}24\,м$

$x - ?$

$D_л - ?$

$\varphi - ?$