

Часть 1

Олимпиада: **Физика, 9 класс (1 часть)**

Шифр: **21204399**

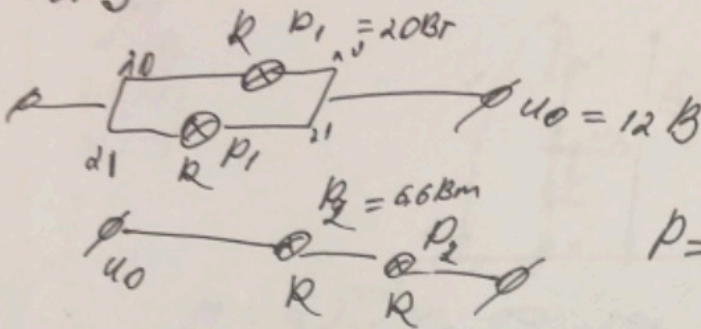
ID профиля: **835879**

Вариант 1

Черновик

Черновик 2

N3



$$I = \frac{U}{R}$$

$$U = IR$$

$$P = UI = I^2 R$$

$$P_1 = I^2 R$$

$$P_1 = \frac{U^2}{R^2 \cdot R}$$

$$P_1 = \frac{U^2}{R}$$

$$R = \frac{U^2}{P_1}$$

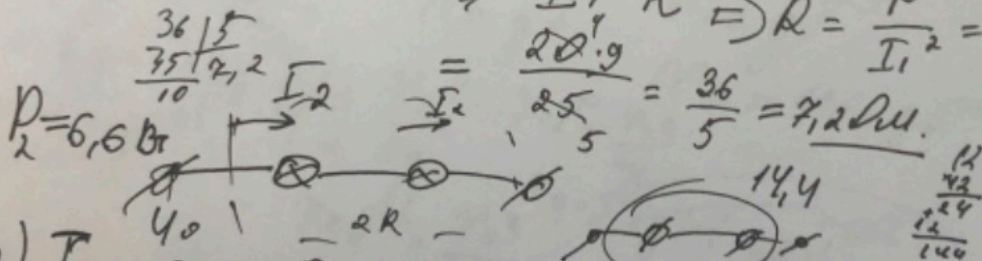
$$I_{\text{avg}_1} = \frac{12V}{2R} = \frac{6V}{R}$$

$$I_1 = \frac{6}{2R} = \frac{3}{R}$$

$$P_1 = 4I^2$$

$$I_1 = \frac{P_1}{4} = \frac{20}{12} = \frac{10}{6} = \frac{5}{3} A = 1\frac{2}{3} A$$

$$R = \frac{U^2}{I_1^2} = \frac{20 \cdot 9}{25} = \frac{36}{5} = 7,2 \text{ Ohm}$$



2) $I_2 = ?$

$$P = I^2 R$$

$$6,6 = I^2 \cdot 7,2$$

$$P_1 = 12 \cdot I$$

$$20 = 12 I \Rightarrow I = \frac{5}{3} \cdot 4 = \frac{10}{3}$$

$$U = IR$$

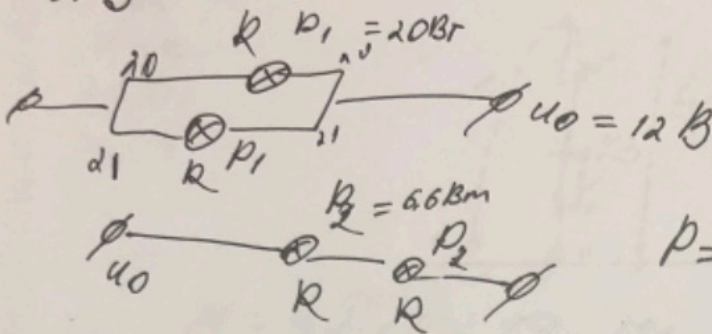
$$R = \frac{U}{I} = \frac{12 \cdot 3}{5} = \frac{36}{5} = 7,2 \text{ Ohm}$$

$$R = \left(\frac{5}{6}\right)^2 \cdot 7,2 = \frac{25 \cdot 7,2}{6}$$

Черновик

Черновик 2

N3



$$I = \frac{U}{R}$$

$$U = IR$$

$$P = UI = I^2 R$$

$$P_1 = I_1^2 R$$

$$P_1 = \frac{9}{R^2} \cdot R$$

$$P_1 = \frac{9}{R}$$

$$R = \frac{9}{P_1}$$

$$I_{\text{доп}} = \frac{12V}{2R} = \frac{6V}{R}$$

$$I_1 = \frac{6}{2R} = \frac{3}{R}$$

$$P_1 = 4I_1^2 R$$

$$I_1 = \frac{P_1}{4} = \frac{20}{12} = \frac{10}{6} = \frac{5}{3} A = 1\frac{2}{3} A$$

$$P_1 = I_1^2 R \Rightarrow R = \frac{P}{I_1^2} = \frac{20 \cdot 9}{25} = \frac{36}{5} = 7,2 \text{ Ом.}$$

36 | 5
72 | 2,2
10

$$P_2 = 6,6 \text{ Вт}$$

2) $I_2 = ?$

$$P = I_2^2 R$$

$$6,6 = I_2^2 \cdot 7,2$$

$$P_1 = 12 \cdot I$$

$$20 = 12 I \Rightarrow I = \frac{5}{6} \cdot 4 = \frac{10}{3}$$

$$U = IR$$

$$R = \frac{U}{I} = \frac{12 \cdot 3}{5} = \frac{36}{5} = 7,2 \text{ Ом.}$$

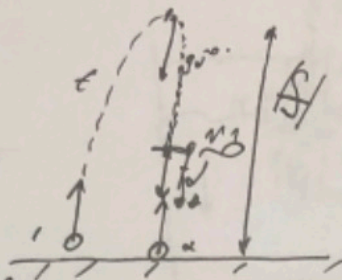
$$P_2 = \left(\frac{5}{6}\right)^2 \cdot 7,2 = \frac{25 \cdot 7,2}{6}$$

Черновик

Черновик 1

v_1

\vec{v}, g
 $H - ?$
 $h - ?$



$$H = g \frac{\tau^2}{2} + v_0 \tau - g \frac{\tau^2}{2}$$

$$H = v_0 \tau$$

$$H = S_1 + S_2 = g \frac{\tau^2}{2} + (v_0 \tau - g \frac{\tau^2}{2}) =$$

$$H = v_0 \tau$$

$$= v_0 \tau$$

$$v_0 = g t =$$

$$t = \frac{H}{g}$$

$$h = 2g \frac{\tau^2}{2} - g \frac{\tau^2}{2} =$$

$$= 2g \frac{\tau^2}{2} - g \frac{\tau^2}{2} =$$

$$= 1,5g \frac{\tau^2}{2}$$

$$v_0 = g t$$

$$v_1 = g \tau$$

$$v_2 = v_0 - g \tau$$

$$v_0 \tau = \frac{v_0^2}{2g}$$

$$\tau = \frac{v_0}{2g}$$

$$v_0 = 2g \tau$$

$$H = 2g \frac{\tau^2}{2}$$

$$S_1 = H + h =$$

$$S_2 = h$$

$$= 1,5g \frac{\tau^2}{2}$$

$$2g \frac{\tau^2}{2} + H - h =$$

$$2g \frac{\tau^2}{2} + H - h =$$

$$\frac{S_1}{S_2} = \frac{2,5g \frac{\tau^2}{2}}{1,5g \frac{\tau^2}{2}} = \frac{0,5}{0,3} = \frac{5}{3} = 1\frac{2}{3} =$$

$$= 4g \frac{\tau^2}{2} - 1,5g \frac{\tau^2}{2} =$$

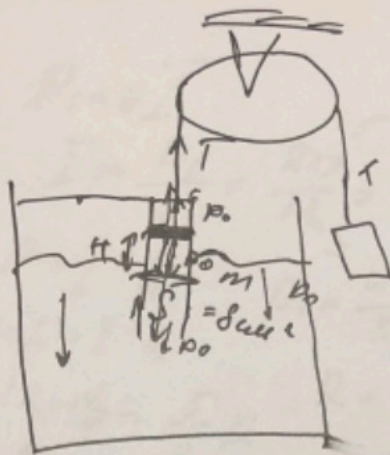
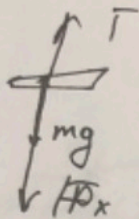
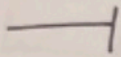
$$2,5g \frac{\tau^2}{2}$$

Умнож.

Упробек 3

N 3

Nd



$$p_x = H \cdot \rho g + p_0 = 0,1 \cdot 1000 \cdot 10 + 100 \cdot 1000 = 1000 + 100 \cdot 1000 = 101000$$

$$F_x = p_x \cdot S = 101000 \cdot 8 = 808000$$

$$T - mg - F_x = 0$$

$$T = mg + F_x = 0,05 \cdot 10 + 808000 = 808005$$

$$m_2 = 8,005 \text{ т}$$

$$p_x = H \cdot \rho g + p_0 = 0,1 + 1000 \cdot 10 + 100 \cdot 1000 = 101 \cdot 1000 \text{ Па}$$

$$F_x = p_x \cdot S = 101 \cdot 1000 \cdot 8 = 808000$$

$$T = F_x + mg = 808000 + 0,05 \cdot 10 = 808005$$

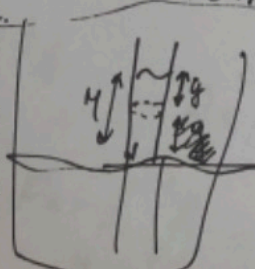
$$m_2 = 8,005 \text{ т}$$

$$F_y = (H \rho g + p_0) S - y \rho g + p_0 S$$

$$T - (m + M)g - F_y = 0$$

$$T - (m + M)g = (H \rho g + p_0 - y \rho g + p_0) S$$

$$T - (m + M)g = SH \rho g + S p_0 - S y \rho g$$



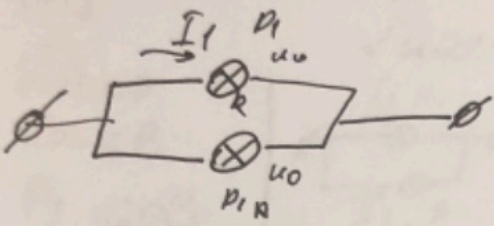
$$S y \rho g = SH \rho g + S p_0 - T + (m + M)g$$

$$y = \frac{SH \rho g + S p_0 - T + (m + M)g}{S \rho g}$$

$$y = 0,0875$$

Чистов.

Черновик 4



$$P_1 = uI$$

$$I = \frac{P_1}{u} = \frac{20}{12} = \frac{5}{3} \text{ A}$$

$$P = I^2 R$$

$$P_1 = \frac{u^2}{R}$$

$$uI = I^2 R$$

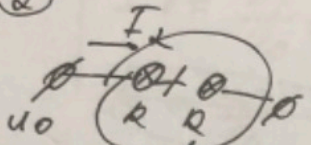
$$R = \frac{u^2}{P_1}$$

$$12 \cdot \frac{5}{3} = \frac{5}{3} R$$

$$\frac{36}{5} = R = 7,2 \text{ Ohm}$$

$$R = 7,2 \text{ Ohm}$$

2



$$P_2 = I_2^2 R$$

$$I = \frac{u}{R} \quad u = IR$$

$$P_3 = uI = \frac{u^2}{R}$$

$$4 = \frac{I^2 R}{2}$$

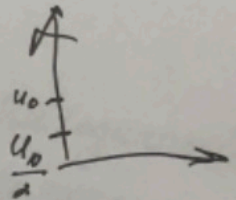
$$R = \frac{4}{I^2}$$

$$I_2 = \frac{u}{R} = \frac{12}{2 \cdot \frac{4}{I^2}} = \frac{120}{44} = \frac{10}{5} = \frac{5}{6}$$

$$P = 6$$

$$\frac{4 \cdot 4}{R} = \frac{16}{7,2}$$

$$I = \frac{u}{R} = \frac{20}{\frac{12^2}{3,6 \cdot 0,6}} = \frac{20}{6} : 2 = \frac{10}{3}$$



$$P_2 = uI = \frac{u_0}{2} \cdot I$$

$$I_2 = \frac{u_0}{2R} = \frac{120}{144} = \frac{10}{12} =$$

$$= \frac{5}{6} \text{ A} \quad P_2 = uI =$$

$$\frac{2P_2}{u_0} = I_2 = 1,1 \text{ A}$$

$$= I^2 R$$

$$R = \frac{u}{2I}$$

$$P_2 = \frac{u_0 \cdot u_0}{2 \cdot R} = \frac{u_0^2}{4R} = I = \sqrt{\frac{P_2}{R}} =$$

$$R = \frac{6,6}{1,1 \cdot 1,1} = \frac{u_0}{4R} = \frac{12^2}{4 \cdot 7,2^2} = \sqrt{\frac{6,6}{7,2}}$$

$$P_3 = I_3^2 R = 40 I_3$$

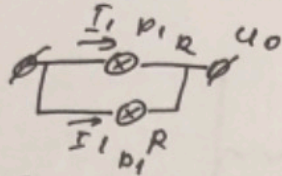
$$u_0 = I_3 R \quad R = \frac{u_0}{I_3} \quad P = I_3^2 R$$

Чистовик...

Чистовик 3
№3

Дано:
 $U_0 = 12 \text{ В}$
 $P_1 = 20 \text{ Вт}$
 $P_2 = 6,6 \text{ Вт}$

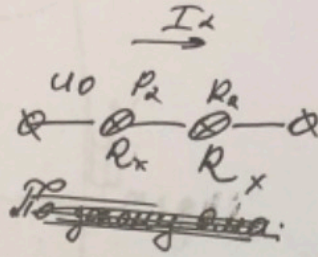
Решение



$$① P_1 = U_0 I_1$$

$$I_1 = \frac{P_1}{U_0} = \frac{20}{12} \text{ А} = 1\frac{2}{3} \text{ А}$$

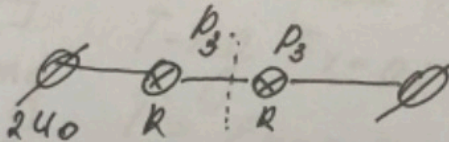
$$R = \frac{U_0^2}{P_1} = 7,2 \text{ Ом}$$



$$② P_2 = U_0 \cdot I_2$$

$$I_2 = \frac{P_2}{U_0} = \frac{6,6}{12} = 0,55 \text{ А}$$

③



$$P_3 = \frac{2U_0 \cdot I_3}{2} = U_0 I_3 \quad ; \quad R = \frac{U_0^2}{P_1} = 7,2 \text{ Ом (одинаковое напряжение на лампочках)}$$

$$2P_3 = 2U_0 \cdot I_3 = \frac{4U_0^2}{R} = \frac{4 \cdot 144}{7,2} = 80 \text{ Вт}$$

$$P_3 = 40 \text{ Вт}$$

Ответ: $I_1 = 1\frac{2}{3} \text{ А}$

$I_2 = 0,55 \text{ А}$

$P_3 = 40 \text{ Вт}$

Чистовик 2

N1

Чистовик 1

N2

Дано:

$$m = 0,05 \text{ кг}$$

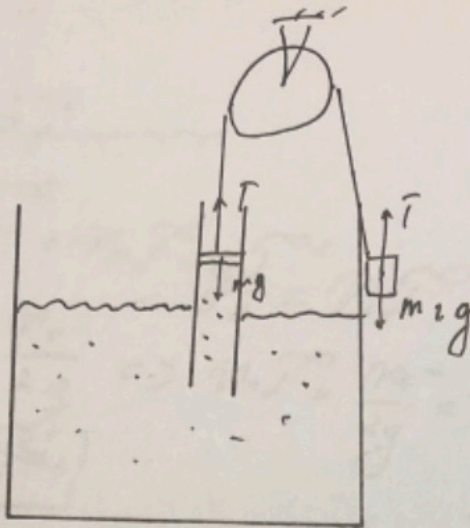
$$S = 8 \text{ см}^2$$

$$H = 0,1 \text{ м}$$

$$p_x = ?$$

$$m_2 = ?$$

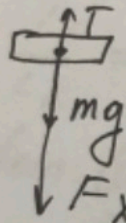
$$\Delta l = ?$$



Решение:

$$① p_x = H\rho g + p_0 = 101 \text{ кПа}$$

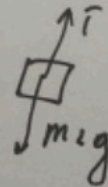
② Условие равновесия поршня:



$$T - mg - F_x = 0; \text{ где } F_x = p_x \cdot S$$

$$T = F_x + mg$$

Условие равновесия груза:

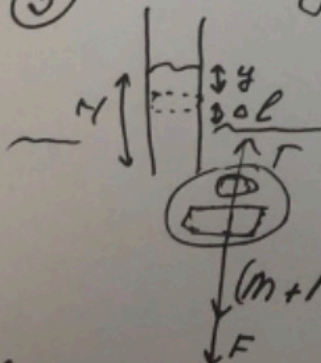


$$T = m_2 g$$

$$m_2 g = F_x + mg$$

$$m_2 = \frac{F_x + mg}{g} = \frac{p_x \cdot S + mg}{g} = \frac{80,8 + 0,5}{g} = 8,13 \text{ кг}$$

③



$$\Delta l = H - y$$

$$F_y = + S \rho g \cdot y$$

$$F = F_x - F_y$$

$$y = \frac{(m+M)g + F_x - T}{S \rho g}$$

Усл. равновес груза поршня с шпирей:

$$(m+M)g + F_x - F_y = T$$

Ответ:

$$① 101 \text{ кПа}$$

$$② 8,13 \text{ кг}$$

$$③ 0,0125 \text{ м}$$

$$\Delta l = 0,0125 \text{ м} = 0,0875 \text{ м}$$

Чистовик 2

N1

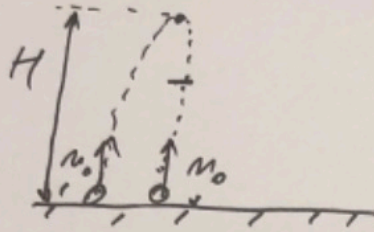
Дано:

T, g

$H - ?$

$h - ?$

$\frac{L_1}{L_2} - ?$



$$\textcircled{1} H = \frac{gT^2}{2} + v_0 T - \frac{gT^2}{2} = v_0 T$$

$$\& H = \frac{v_0^2}{2g} \Leftrightarrow v_0 T = \frac{v_0^2}{2g} \Leftrightarrow$$

$$H = 2gT^2$$

$$v_0 = 2gT$$

$$\textcircled{2} h = 2gT^2 - \frac{gT^2}{2} = 1,5gT^2$$

$$h = 1,5gT^2$$

$$\textcircled{3} \frac{L_1}{L_2} = \frac{2gT^2 + 2gT^2 - 1,5gT^2}{1,5gT^2} = \frac{2,5gT^2}{1,5gT^2} = \frac{5}{3} = 1\frac{2}{3}$$

Ответ: ① $H = 2gT^2$

② $h = 1,5gT^2$

③ $\frac{L_1}{L_2} = 1\frac{2}{3}$

Часть 2

Олимпиада: **Физика, 9 класс (2 часть)**

Шифр: **21204399**

ID профиля: **835879**

Вариант 1

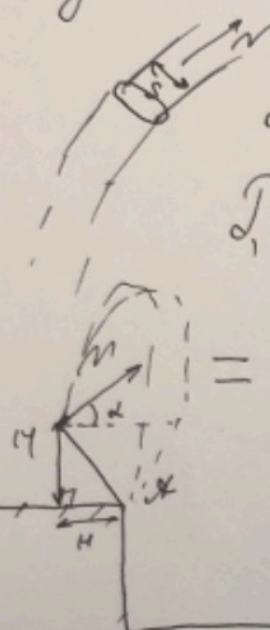
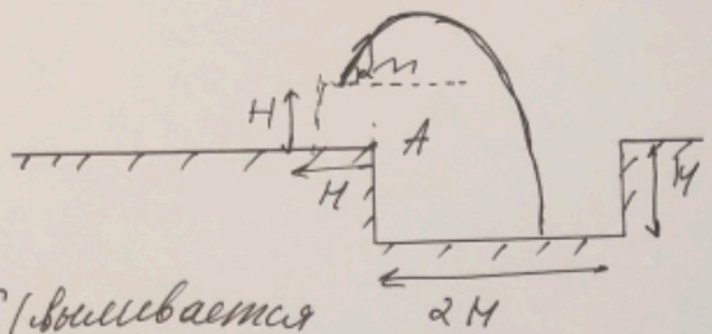
Чистовик 2

№5

Дано
 v, S, H $\textcircled{1}$ раам. воду
 из шланга

\mathcal{L}_1 - ?
 \mathcal{L}_2 - ?
 α_x - ?

Решение:

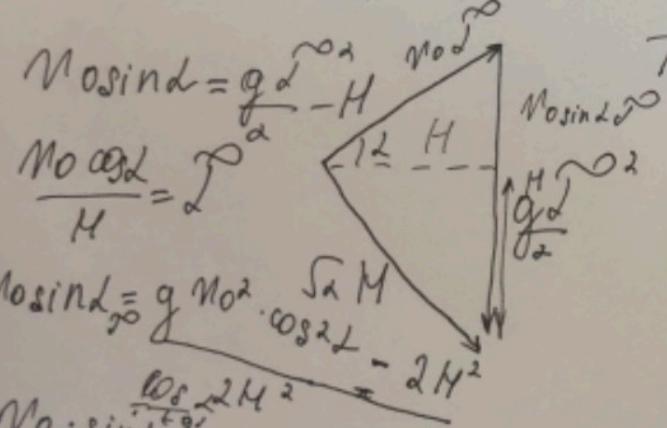


$\mu = vS$ (высвобождается в секунду)

$$\mathcal{L}_1 = \frac{v}{\mu} = \frac{M^2 g \mathcal{L}_1}{vS} = \frac{M^3 \mathcal{L}_1}{\sqrt{0,5gH} \cdot S} = \frac{M^3 \mathcal{L}_1 \cdot \sqrt{0,5gH}}{0,5gH \cdot S} = \frac{2M^2 \mathcal{L}_1}{S} \cdot \sqrt{0,5gH}$$

$\textcircled{2}$

Векторный треугольн: $S = N \cos \alpha + \frac{g \mathcal{L}_1}{2}$ ($N_0 = N$)



$$N \cos \alpha = \frac{g \mathcal{L}_1}{2} - H$$

$$\frac{N \cos \alpha}{H} = \frac{\mathcal{L}_1}{2}$$

$$N \cos \alpha = \frac{g \mathcal{L}_1}{2} \cdot \frac{S \mu}{2M^2} = 2M^2$$

$$\frac{N \cdot \sin \alpha \cdot \frac{g \mathcal{L}_1}{2} \cdot \frac{S \mu}{2M^2}}{N^2 \cdot \frac{g \mathcal{L}_1}{2} \cdot \frac{S \mu}{2M^2}} = \frac{g \mathcal{L}_1 \cdot \cos^2 \alpha - 2M^2}{g \mathcal{L}_1 \cdot \frac{S \mu}{2M^2}}$$

$$N^2 \cdot \frac{g \mathcal{L}_1}{2} \cdot \cos^2 \alpha = g \mathcal{L}_1 \cdot \frac{S \mu}{2M^2}$$

$$H + N \cos \alpha \sin \alpha - \frac{g \mathcal{L}_1}{2} = 0$$

$$H + N \cos \alpha \sin \alpha$$

$$N \cos \alpha \sin \alpha = H$$

$$N \sin \alpha \sin \alpha = \frac{g \mathcal{L}_1}{2} - H$$

$$H + N \cos \alpha \sin \alpha - \frac{g \mathcal{L}_1}{2} = 0$$

$$N \cos \alpha \sin \alpha + N \cos \alpha \sin \alpha - \frac{g \mathcal{L}_1}{2} = 0$$

$$2N \cos \alpha \sin \alpha = \frac{g \mathcal{L}_1}{2}$$

$$\frac{\sin \alpha}{\cos \alpha} = \frac{1}{2} \Rightarrow \sin \alpha = \frac{1}{2} \cos \alpha$$

Ответ: $\mathcal{L}_1 = \frac{2M^2 \mathcal{L}_1}{S} \cdot \sqrt{0,5gH}$

Чистовик:

Дано:

$3m, m, H$

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

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

Решение:

① $\frac{H}{L} = \sin \alpha \Rightarrow L = \frac{5H}{3}$

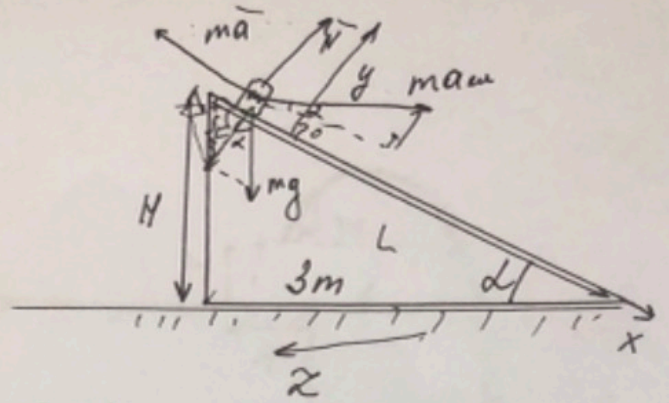
2 3M груз "м".

$\vec{N} + m\vec{g} = m\vec{a}$

на x: $mg \sin \alpha = a'm \Rightarrow a' = g \sin \alpha$

$L = \frac{5H}{3} = \frac{a'^2 t^2}{2} = \frac{g \sin^2 \alpha t^2}{2}$

$\frac{5H}{3} = \frac{g \cdot \frac{3}{5}}{2} t^2 \Rightarrow t = \frac{5}{3} \sqrt{\frac{2H}{g}}$



② Переход в НСВ кукла и шайбы, вводим $F_{ум} = m\vec{a}_m + m\vec{a}$

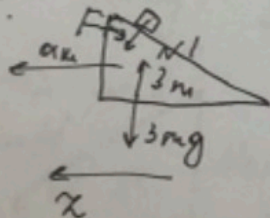
2 3M груз шайбы на x: $m a_m \cos \alpha - m a + mg \sin \alpha = 0$

$a_m \cos \alpha - a + g \sin \alpha = 0$

на y: $N - mg \cos \alpha + m a_m \sin \alpha = 0$

$N = mg \cos \alpha - m a_m \sin \alpha$ (1)

Рассм куклу:



$F = N$

на x: 2 3M

$N \cdot \sin \alpha = 3m a_m$

$N = \frac{3m a_m}{\sin \alpha} = 5m a_m$ (2)

③ в ②:

$5m a_m = mg \cdot \frac{4}{5} - m a_m \cdot \frac{3}{5}$

$25m a_m = 4mg - 3m a_m$

$8m a_m = 4mg$

$a_{ку} = \frac{mg}{2m} = \frac{g}{2}$ (4)

③ (4) в (1)

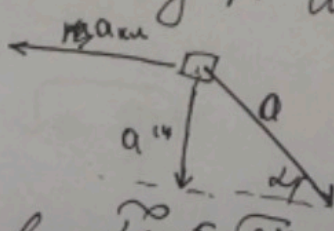
$\frac{g}{2} \cdot \frac{4}{5} + g \cdot \frac{3}{5} = a$

$g \left(\frac{4}{5} + \frac{3}{5} \right) = a$

$g \cdot \frac{7}{5} = a$

$a = \frac{7g}{5}$

Рассм укор. шайбы



$a \cdot \sin \alpha = a''$, где a'' - ускорение

$H = a'' \frac{t^2}{2} \Rightarrow t = \sqrt{\frac{14H}{3g}}$

Ответ:

$t_1 = \frac{5}{3} \sqrt{\frac{2H}{g}}$

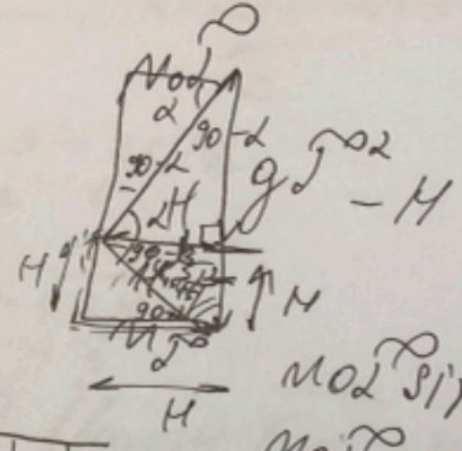
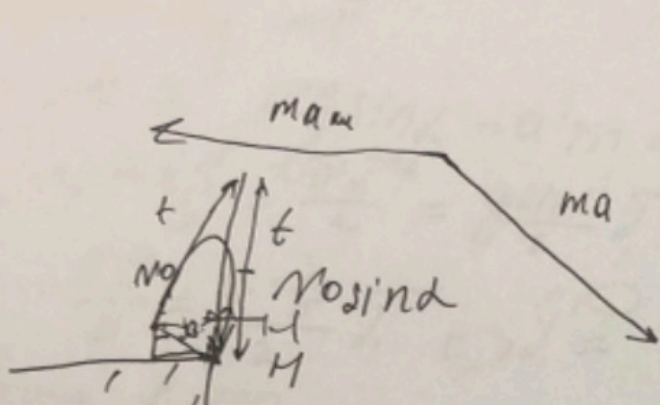
$a_{ш} = \frac{g}{2}$

$t_2 = \sqrt{\frac{14H}{3g}}$

листок 2 (Продолжение задачи №1)

31 ак = 3g
 ак = $\frac{3g}{31}$

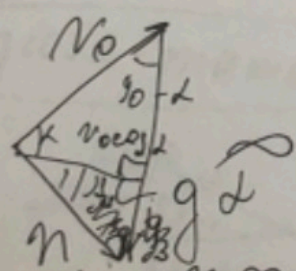
Мерников 3



$H + N \cos \alpha = \frac{g d^2}{2} = \rho$

$H + N \cos \alpha + (N \sin \alpha + A \cdot H) = 0$

H +



$N \cos \alpha$

$N \cos \alpha \cdot \sin \beta = H = N \cos \alpha \cdot \sin 45^\circ \Rightarrow \frac{H}{\cos \alpha} = \frac{N \cos \alpha}{\cos \alpha} = \frac{N}{\cos \alpha} = \frac{g d^2}{H} - 1$

$N \cos \beta = N \cos \alpha \cdot \frac{2 N \cos \alpha}{\sqrt{2}} = \frac{N}{\cos \alpha}$

$\frac{N}{\cos \beta} = \frac{N}{\cos \alpha} \cdot \frac{g d^2}{2} = N$

$g d^2 - N \cos \alpha = N \cdot \sin \beta$

$g d^2 = N \sin \beta + N \cos \alpha$

$N \cos \alpha = L = H \Rightarrow \frac{2 N \cos \alpha}{M} = \frac{H}{M}$

$N \cos \alpha = \frac{g d^2}{2} - H$
 $N \cos \alpha = \frac{g d^2}{2} - H$

Черновик 2

$$M + N \cos \alpha - g \frac{d}{2} = 0$$

$$N \cos \alpha \cdot \cos \alpha = M$$

$$N \cos \alpha \sin \alpha + N \sin \alpha - g \frac{d}{2} = 0$$

$$N \cos \alpha (\cos \alpha + \sin \alpha) = \frac{g d}{2} M$$

$$N = \frac{M}{\cos \alpha (\cos \alpha + \sin \alpha)} = 0,5 g M$$

S, M

$$\mu = \frac{v}{\mu} \frac{v}{\mu} = \frac{v^2}{\mu}$$

$$M + \mu g M = \frac{g d}{2}$$

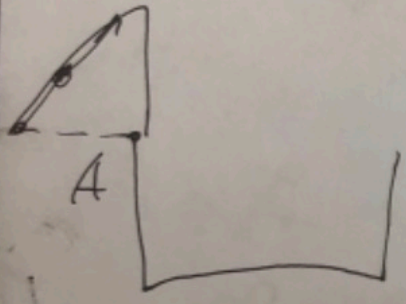
$$M(1 + \mu g) = \frac{g d}{2}$$

$$S = \frac{1}{2} \mu^2 = \frac{1}{2} \mu H^2$$

$$N \cos \alpha (\cos \alpha + \sin \alpha) = \mu = S \cdot N$$

$$\frac{1}{2} v = H \cdot 2H \cdot H \cdot \frac{1}{2} \mu^2 = H^3 \mu^2$$

$$\mu = \frac{M^3 \mu^2}{S \cdot N} = \frac{M^3 \mu^2}{S \cdot 0,5 g M} = \frac{2 M^2 \mu^2}{S g}$$



$$x = \sqrt{\frac{0,5}{Mg}} \cdot x = \sqrt{0,5 g M} \cdot M^3 \mu^2$$

$$M \cos \alpha \cdot \mu = L = H$$

$$N \sin \alpha = g \frac{d}{2}$$

$$\mu = \frac{N \sin \alpha \cdot M}{N \cos \alpha}$$

$$M = 2 \cdot \frac{g}{N \sin \alpha}$$

$$\mu = \frac{2 N \sin \alpha \cdot M}{2 g}$$

$$M + N \sin \alpha \mu - g \frac{d}{2} = 0$$

$$M = g \frac{d}{2} - 2 N \sin \alpha \mu - M = 0$$

$$\mu = \frac{4 M^2 \sin^2 \alpha \mu^2 + 4 M g d}{2 g} = \frac{4 \mu^2 \sin^2 \alpha - M g}{2 g}$$

Чертовик 1

$3m, m, H,$
 $\cos \alpha = \frac{4}{5}$

Решение

- ① $T_1 - ?$
- ② $a_{ку} - ?$
- ③ $T_2 - ?$

① Ma

$23M \text{ грав. } m''$

$\vec{N} + m\vec{g} = m\vec{a}$

на Ox :

$mg \sin \alpha = ma$
 $a = g \sin \alpha$

$\frac{H}{L} = \sin \alpha = \frac{3}{5} \cdot L$

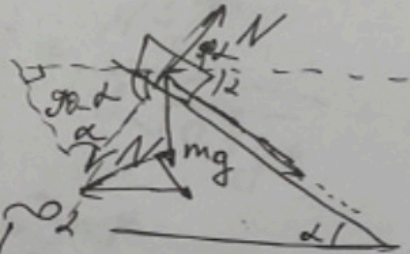
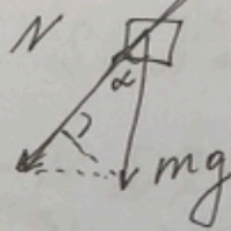
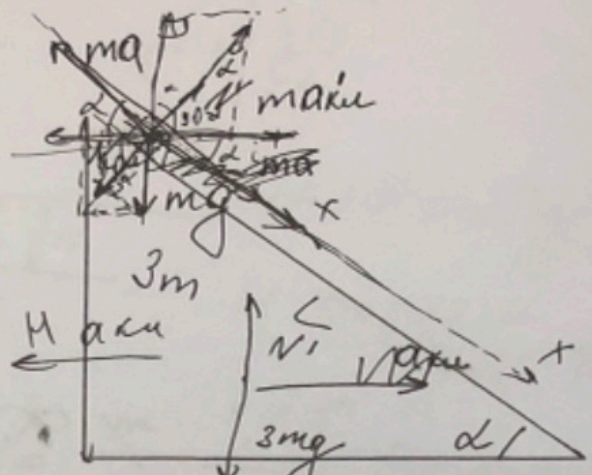
$L =$

$H = \frac{3}{5} L$

$\frac{H}{L} = \frac{5}{3} H$

$\frac{5}{3} H = \frac{aL}{2}$

$\sqrt{\frac{10M}{3g \sin \alpha}} = L$



$mg \sin \alpha - ma \cdot \cos \alpha = \frac{10M}{3g \cdot \frac{3}{5}} = \sqrt{\frac{50M}{9g}} = \frac{5\sqrt{2}}{3} \sqrt{\frac{H}{g}}$

$ma_{ку} = 0$

~~$N \sin \alpha = 3ma_{ку}$~~

~~$g \sin \alpha - a \cos \alpha =$~~

~~$g \sin \alpha + a_{ку} = a \cos \alpha$~~

~~$N = mg$~~

$mg \sin \alpha + ma_{ку} \cos \alpha - ma = 0$

$g \sin \alpha + a_{ку} \cos \alpha = a$

$N \sin \alpha + ma_{ку} - ma \cos \alpha = 0$

$\frac{3}{25} g + \frac{4}{25}$

$N \sin \alpha + ma_{ку} = ma \cos \alpha$

$N \sin \alpha = 3ma_{ку}$

$4a_{ку} = a \cos \alpha$

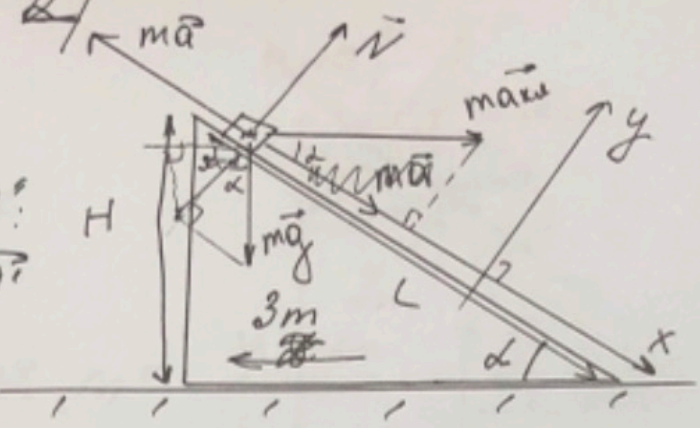
$4ma_{ку} = ma \cos \alpha$

$a_{ку} = \frac{a}{5} = \frac{g \sin \alpha + a_{ку} \cos \alpha}{5}$

Настоящий чертовик 2

Дано:
 $3m, m, M$
 $\cos \alpha = \frac{4}{5}$
 $\sin \alpha = \frac{3}{5}$

①
 $23M$ для "м"
 $\vec{N} + m\vec{g} = m\vec{a}$
 на Ox:



на Oy:
 $mg \sin \alpha = ma'$
 $a' = g \sin \alpha$
 $\frac{H}{L} = \sin \alpha = \frac{3}{5}$
 $L = \frac{5H}{3}$

$\frac{5H}{3} = \frac{a' L}{2}$
 $\frac{10H}{3} = g \sin \alpha \cdot L$

$L_1 = \sqrt{\frac{10M}{3g \sin \alpha}}$
 $= \sqrt{\frac{10M \cdot 5}{3g \cdot 3}} = \sqrt{\frac{50M}{9g}} = \frac{5\sqrt{2M}}{3\sqrt{g}}$

$\frac{10Mg \sin \alpha}{3g \sin \alpha} = L_1 = \frac{10 \cdot Hg}{3g}$

② Перех. в ИСО шмма: эквивалентная сила
 шериум $F_{\text{шм}} = m\vec{a}_{\text{шм}} + m\vec{a}_{\text{шм}}$

23M для шайбы:

$m\vec{a} + \vec{N} + m\vec{a}_{\text{шм}} + m\vec{g} = 0$

$M = \frac{a \sin \alpha \cdot L_2}{2}$
 $= \frac{5g \cdot 3}{14 \cdot 5}$

на x: $-ma + ma_{\text{шм}} \cdot \cos \alpha + mg \sin \alpha = 0$
 $a_{\text{шм}} \cos \alpha + g \sin \alpha = a$

на y: $N + ma_{\text{шм}} \cdot \sin \alpha - ma \cos \alpha = 0$
 $N + ma_{\text{шм}} \sin \alpha = ma \cos \alpha$

$M = \frac{3g}{14}$
 $L_2 = \sqrt{\frac{14M}{5g}}$

на z для шмма: $N \cdot \sin \alpha = 3ma_{\text{шм}}$

$5ma_{\text{шм}} + ma_{\text{шм}} \cdot \frac{3}{5} = ma \cdot \frac{4}{5}$

$\frac{9}{5} N = 3ma_{\text{шм}}$
 $N = 5ma_{\text{шм}}$

$25a_{\text{шм}} + 3a_{\text{шм}} = 4a$
 $28a_{\text{шм}} = 4a$
 $7a_{\text{шм}} = a$

$\frac{a_{\text{шм}}}{5} + g \cdot \frac{3}{5} = 7a_{\text{шм}} / 5 \Rightarrow 4a_{\text{шм}} + 3g = 35a_{\text{шм}}$