

Часть 1

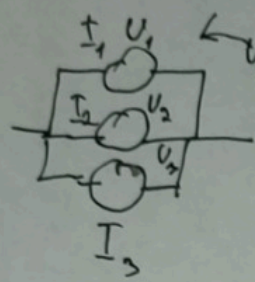
Олимпиада: **Физика, 9 класс (1 часть)**

Шифр: **21204542**

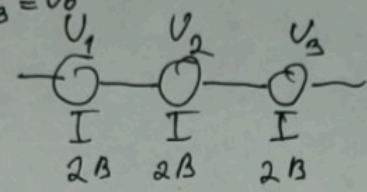
ID профиля: **361946**

Вариант 2

цепочка



$$U_1 = U_2 = U_3 = U_0$$



$$U_1 + U_2 + U_3 = U_6$$

$$I_1 + I_2 + I_3 = 3I = I_0$$

~~Учит~~

$$P = I \cdot U$$

$$U_1 \cdot I + U_2 \cdot I + U_3 \cdot I = 3r$$

$$2,4 = I \cdot 6$$

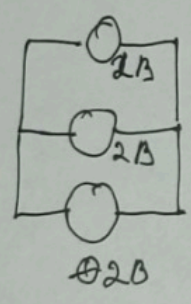
$$I = 0,4 \text{ A}$$

$$0,5 = I \cdot 2$$

$$r = \frac{6}{0,4} = 15 \Omega$$

$$I_1 = 0,25 \text{ A}$$

$$r = \frac{2}{0,25} = 8 \Omega$$



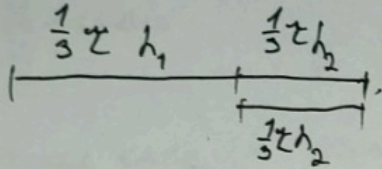
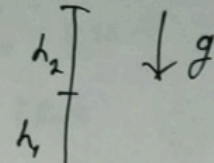
$$\frac{2}{0,8} = 0,25 \quad \underline{\underline{0,5 \text{ BT}}}$$

Умножение

N1

объем пути двух тел после старта 2 тела = h , а время $\tau + \frac{1}{3}\tau$, так как тела движутся с одной скоростью и по разному месту.

время полета 2 = $\frac{1}{3}\tau$



$h_1 + h_2 + h_2$ путь за τ , но как

h_1, h_2 и h_2 - путь за одно и то же время τ , так же $v_{cm1} = v_{cm2} = 0,5 v_0$

$$h_1 = v \cdot \frac{1}{3}\tau - \frac{10 \cdot (\frac{1}{3}\tau)^2}{2}$$

$$v = v_0 + a \cdot \frac{1}{3}\tau$$

$$h_1 = \tau \left(\frac{1}{3}v - 5 \cdot \frac{1}{9}\tau \right)$$

$$v_{cm1} = a \cdot \frac{1}{3}\tau$$

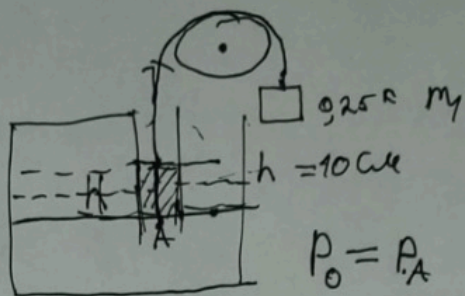
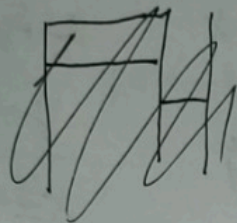
$$h_1 = \tau \left(\frac{1}{3} \cdot \frac{20}{3}\tau - \frac{5}{9}\tau \right)$$

$$2 \times v = \frac{2}{3}g\tau = \frac{20}{3}\tau$$

$$h_1 = \tau^2 \left(\frac{20}{9} - \frac{5}{9} \right) = \tau^2 \left(\frac{15}{9} \right) = \tau^2 \frac{5}{3}$$

Оконч.: 1) $h_2 = \frac{1}{3}\tau$; 2) $h_1 = \tau^2 \frac{5}{3}$; 3) $v = \frac{20}{3}\tau$

Черновик



$$P_0 = P_A$$

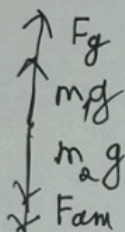
$$P_A = P_0 - \rho g h =$$

$$= 100000 - 1000 \cdot 10 \cdot 0,10 =$$

$$= 98000 \text{ Па}$$

$$98 \text{ кПа}$$

$$T = m_1 g = m_2 g - \frac{P}{S_h}$$



$$0,25 \cdot 10 = x \cdot g - \frac{98000}{0,000009}$$

$$2,5 = 10x - 0,882$$

$$10x = +1,618$$

$$10x = 3,382$$

$$x = 0,3382 \text{ т}$$

~~$$m_1 g + F_g = m_2 g$$~~

~~$$0,25 \cdot 10 + 98000 \cdot 0,000009 = x \cdot g$$~~

~~$$x = 0,07 \text{ т}$$~~

~~$$0,25$$~~

$$m_1 g = m_2 g - S \cdot P$$

$$0,25 = 0,338 -$$

$$3,132 = S \cdot P$$

$$m_1 g + F_g = m_2 g + F_{ам}$$

$$2,5 + 88,2 = x \cdot g + 90$$

$$0,7 = x \cdot g$$

$$x = 0,07 \text{ т или } 70 \text{ г}$$

$$0,25 + 0,7 = x \cdot g + 90$$

$$x = 0,7 + 0,25$$

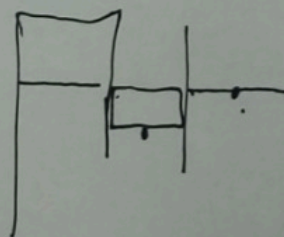
$$x = 0,95$$

$$P \cdot S = 9095$$

$$P = 101055,6 \text{ Па}$$

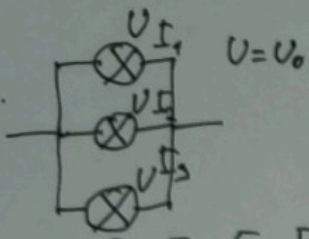
$$1055,6 = \rho g h_2$$

$$h_2 = 10,6 \text{ см}$$



$$0,25 + x = 0,7 + 0,5$$

$$x = 0,95$$



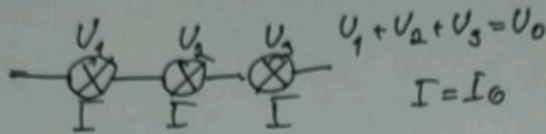
$$\eta) I_1 + I_2 + I_3 = I_0$$

$$\theta P = U \cdot I_1 = 40 \text{ Вт}$$

$$I_1 = \frac{P}{U} = \frac{24}{6} = 0,4 \text{ А} = I_2 = I_3$$

$$r = \frac{U}{I_1} = 15 \text{ Ом}$$

шестовик №3



т.к. лампы одинаковые то

$$U_1 = U_2 = U_3 \text{ и } I_1 = I_2 = I_3$$

$$2) P = U_i \cdot I \quad U_1 = U_2 = U_3 = \frac{U}{3} = 2 \text{ В}$$

$$I = \frac{P}{U_i} = \frac{0,5}{2} = 0,25 \text{ А}$$

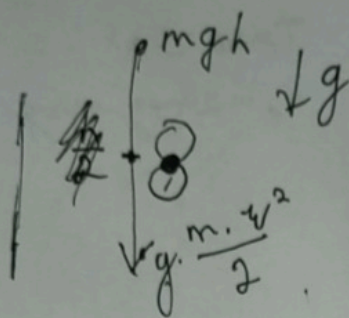
$$r = \frac{U_i}{I} = 8 \text{ Ом}$$

- 3) при параллельном соединении каждой лампы 2 В \Rightarrow сопротивление их = 8 Ом
у лампы в зависимости от U меняется R

$$P = I \cdot U = \frac{U}{r} \cdot U = \frac{2 \cdot 2}{8} = 0,5 \text{ Вт}$$

Ответ: 1) $I_1 = I_2 = I_3 = 0,4 \text{ А}$; 2) $I = 0,25 \text{ А}$; 3) $P = 0,5 \text{ Вт}$

через



$v = 0$

$t_1 = t_2 = t_{cm}$

$v_0 = v$

$S = \tau^2 \cdot 15$

$2g\tau$

$mg h_1 = \frac{m v_{kx2}^2}{2}$

$v = v_0 + a_x t$

$g \cdot h_1 = \frac{v_{kx2}^2}{2}$

$t = \frac{v - v_0}{a_x}$

$2g h_1 = v_{kx2}^2$

$t_1 = \frac{v_{kx}}{a_x} = \frac{v_{kx}}{g}$

$v_{kx2} = \sqrt{2g h_1}$

$t_2 = \frac{v_{kx2} - v}{-g}$

$= 2\sqrt{5h_1}$

$\frac{v_{kx2} - v_{kx}}{-g} = \frac{v_{kx}}{g}$

$v = a \cdot t$

$t = \frac{-v}{g} = \frac{v}{g}$

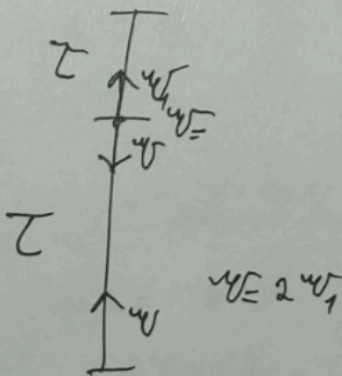
$v - v_{kx2} = v_{kx}$

$t_{od} = \frac{v}{g} + \tau$

$v = v_{kx2} + v_{kx}$

$t_{cm} = t + t_n$

$t_{od} = 3\tau$



$20 \quad 10 \quad 0$

$S = \frac{20^2 - 10^2}{2 \cdot 10} = \frac{300}{20} = 15 \text{ m}$

$\frac{100}{2 \cdot 10} = 5 \text{ m}$

$S = v \cdot t - \frac{10 \cdot \tau^2}{2}$

$S = v \cdot t - 5\tau^2$

$S = t(v - 5\tau)$

$S = \frac{v^2 - 1v^2}{2 \cdot 10}$

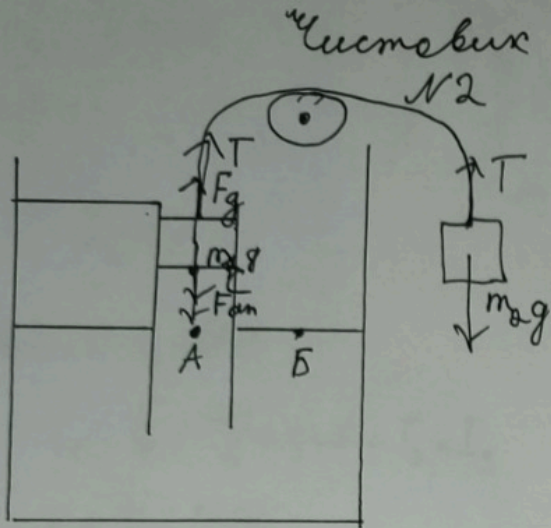
$= \frac{3v^2}{20} = \frac{3v^2}{20}$

$v = g \cdot \tau$

$S = \tau(2g\tau - 5\tau) = 3v^2$

(1)

$3v^2 = 20(v - 5\tau) \quad v = \frac{20}{3}(v - 5\tau) = \frac{20}{3}v - \frac{100}{3}\tau \quad \frac{10}{3}v = \frac{200}{3}\tau \quad v = \frac{20}{3}\tau$



1) $P_A = P_B$ - система в равновесии
 $P_A = P_0 = P_B$

$P_C = P_0 - \rho_f H$, и $P_A = \rho_f h + P_C = P_0$

$P_C = 100000 - 1000 \cdot 10 \cdot 0,2 = 98000 \text{ Па}$

2) На piston действуют: $T, F_g; m_1 g$ и $F_{ам}$

$T = m_2 g$

$T + F_g = m_1 g + F_{ам}$

$m_2 g + P_C \cdot S = m_1 g + P_0 \cdot S$

$m_1 g = m_2 g + P_0 S - P_C S$

$m_1 = \frac{m_2 g + P_0 S - P_C S}{g} = m_2 + \frac{S(P_0 - P_C)}{g} = 0,25 + \frac{0,00009 \cdot (-2000)}{10} =$
 $= 0,25 - 0,18 = 0,07 \text{ кг}$

3)

$m_2 = 10 m_{2u} \Rightarrow m_2 = 0,025 \text{ кг}$

$m_2 g + P_C S = m_1 g + P_0 S$

$P_C S = m_1 g + P_0 S - m_2 g$

$P_2 = \frac{m_1 g + P_0 S - m_2 g}{S} = P_0 + \frac{g(m_1 - m_2)}{S} = 100000 + \frac{0,45}{0,00009} =$
 $100500 = P_2 \Rightarrow$ в m_2 - газе будет $P_{2c} = P_0 + \rho_f h_2 m_2$

$K P_2 > P_0 \Rightarrow \rho_f h_2 = 500$

$h_2 = \frac{500}{10000} = 0,05 \text{ м или } 5 \text{ см}$

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Решение: 1) $P_C = 98 \text{ кПа}$; 2) $m_1 = 0,07 \text{ кг}$; 3) $h_2 = 0,05 \text{ м}$

Часть 2

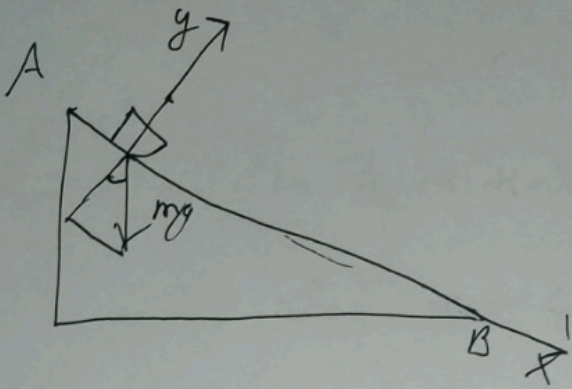
Олимпиада: **Физика, 9 класс (2 часть)**

Шифр: **21204542**

ID профиля: **361946**

Вариант 2

числових и



$$mg_y = \cos \alpha \cdot mg = \frac{3}{5} mg$$

$$mg_x = \sin \alpha \cdot mg = \frac{4}{5} mg$$

$$\cos^2 + \sin^2 = 1$$

$$\left(\frac{3}{5}\right)^2 + x^2 = 1$$

$$x^2 = \frac{16}{25} \Rightarrow \sin \alpha = \frac{4}{5}$$

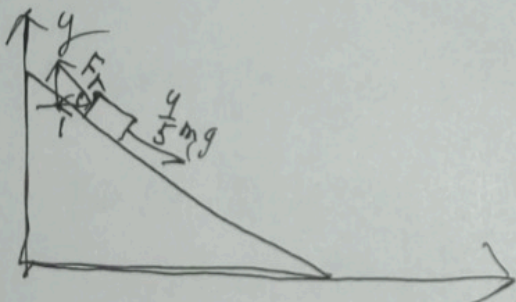
По т. синуса

$$\frac{H}{\frac{4}{5}} = \frac{AB}{1} \Rightarrow AB = \frac{5}{4} H$$

$$\frac{4}{5} mg = ma \text{ (по II з)} \text{)}$$

$$\frac{4}{5} g = a \Rightarrow a = \frac{4}{5} g \text{ - гелогрени маниски}$$

$$\frac{5}{4} H = \frac{g \cdot t^2}{2} \Rightarrow t = \sqrt{\frac{10H}{3g}} = \frac{\sqrt{10H}}{6}$$



$$F_{\text{тр}} = \cos \alpha \cdot mg \cdot \frac{4}{5} = \frac{12}{25} mg$$

$$\frac{12}{25} mg = \mu N$$

$$\frac{120}{25} = 2a \Rightarrow a = 2,4 \frac{m}{c^2}$$

3) Ответ такой же как в, так как нет силы трения

Ответ: 1) $t = \frac{\sqrt{10H}}{6}$; 2) $a = 2,4 \frac{m}{c^2}$; 3) $t = \frac{\sqrt{10H}}{6}$

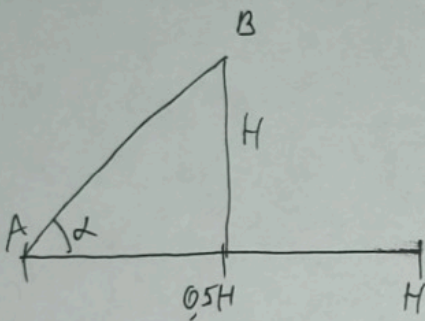
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числовик
№2

$$V_{\text{д}} = S \cdot h = \pi \cdot r^2 \cdot h = \pi \cdot (0,25H)^2 \cdot H = \pi \cdot 0,0625 \cdot H^3$$

$$v_{\text{д}} = \frac{V}{t} \Rightarrow t = \frac{V}{v} = \frac{\pi \cdot 0,0625 \cdot H^3}{\sqrt{2,5gH}} = \frac{\pi \cdot 0,0625 \cdot H^3}{5\sqrt{H}} = \frac{\pi \cdot 0,0625 \cdot H^2 \cdot \sqrt{H}}{5 \cdot H} =$$

$$= \pi \cdot 0,0125 \cdot H^2 \cdot \sqrt{H} = 0,0015 \cdot H^2 \cdot \sqrt{H}$$



траекторию АВ - можно условно считать прямой что позволяет считать ААВН - трапецией
Т - высота трапеции

$$\text{tg} \alpha = \frac{H}{0,5H} = 2$$

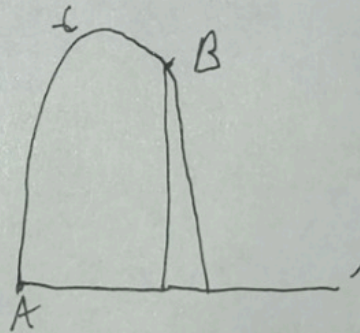
3) от $\text{tg} \alpha = 2$ до $\text{tg} \alpha = \sqrt{\frac{t^2 - 0,1H}{0,1H}}$, где t - время от т. А до т. В.

$$\cos \alpha \cdot v \cdot t = 0,5H$$

$$t \cdot \cos \alpha \cdot \sqrt{H} = 0,5H$$

$$t^2 \cdot \cos^2 \alpha = 0,1H$$

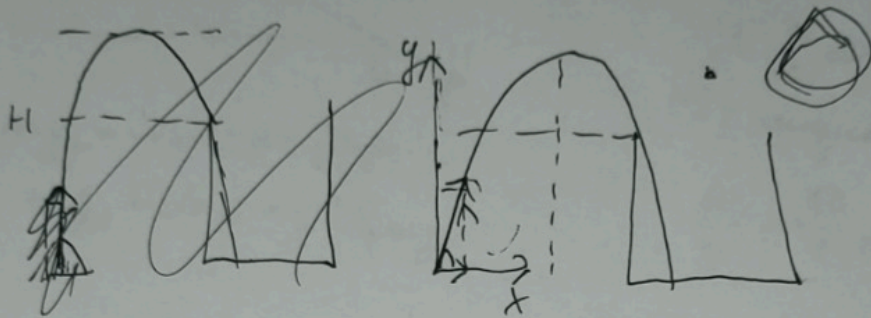
$$\cos^2 \alpha = \frac{0,1H}{t^2}$$



$$1 + \text{tg}^2 \alpha = \frac{1}{\cos^2 \alpha} \Rightarrow \frac{t^2}{0,1H} = 1 + \text{tg}^2 \alpha \Rightarrow \text{tg} \alpha = \sqrt{\frac{t^2}{0,1H} - 1} =$$

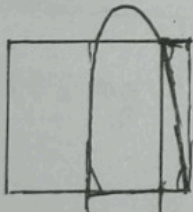
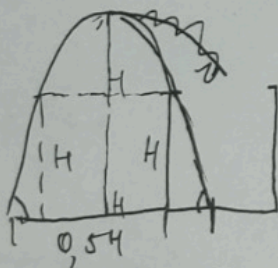
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меридиан



$$v_x = \cos \alpha \cdot v$$

$$v_y = \sin \alpha \cdot v$$



$$H = \sin \alpha \cdot v \cdot t - 5 \cdot t^2$$

$$0 = \sin \alpha \cdot v \cdot t_n - 5 \cdot t_n^2$$

$$5 \cdot t_n^2 = \sin \alpha \cdot v \cdot t_n$$

$$\sin \alpha \cdot v = 5 \cdot t_n$$

$$\cos \alpha \cdot v \cdot t = 0,5H$$

$$t \cdot \cos \alpha \cdot \sqrt{2,5 \cdot g \cdot H} = 0,5H$$

$$t \cdot \cos \alpha \cdot \sqrt{5H} = 0,5H$$

$$t \cos \alpha \cdot \sqrt{5H} = H$$

$$t^2 \cdot \cos^2 \alpha \cdot H = H^2 \cdot 0,1$$

$$t^2 \cdot \cos^2 \alpha = H \cdot 0,1$$

$$\cos^2 \alpha = \frac{H \cdot 0,1}{t^2}$$

$$\cos^2 \alpha = \frac{H \cdot 0,1}{t^2}$$

$$1 + \tan^2 \alpha = \frac{t^2}{H \cdot 0,1}$$

через

$$\pi R^2 \Rightarrow S = \pi \cdot (0,25H)^2 = \pi \cdot 0,0625 H^2$$

$$V = \pi \cdot 0,0625 \cdot H^3$$

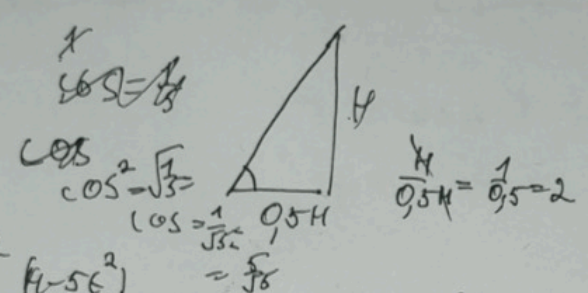
$$\sqrt{2,5 \cdot gH} = 5\sqrt{H} = \frac{V}{t}$$

$$\frac{\pi \cdot 0,5^4 \cdot H^3}{t} = \sqrt{2,5gH}$$

$$1 + 4 = \frac{1}{\cos^2 \alpha}$$

$$t \sqrt{2,5gH} = \frac{V}{t}$$

$$\frac{\pi \cdot 0,5^4 \cdot H^3}{\sqrt{2,5gH}} = t =$$



$$\frac{H}{0,5H} = \frac{1}{0,5} = 2$$

$$= \frac{\pi \cdot 0,5^4 \cdot H^3}{5\sqrt{H}} = \frac{\pi \cdot 0,0125 \cdot H^3}{\sqrt{H}} =$$

$$\left(\frac{0,1\sqrt{H}}{t}\right)^2 + \left(\frac{H-5t^2}{t_1 \cdot \sqrt{H}}\right)^2 = 1$$

$$H^2 = 0,25H^2$$

$$2 \pi \cdot 0,0125 \cdot H^2 \cdot \sqrt{H} = 0,04H^2 \sqrt{H}$$

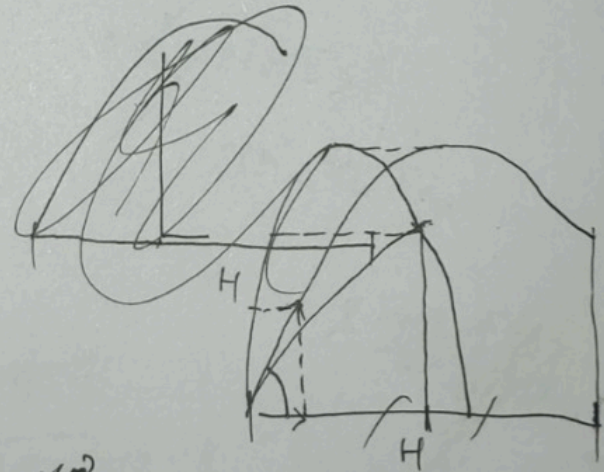
$$\frac{0,01 \cdot H}{t^2} + \frac{H^2 - 10t_1 H + 25t_1^2}{t_1^2 \cdot H^2} = 1$$

$$325H^2 =$$

$$\sqrt{\frac{125}{100}} = \frac{H \cdot \sqrt{125}}{10} = \frac{5H\sqrt{5}}{10} = 0,5H\sqrt{5}$$

$$\frac{1}{0,5\sqrt{5}} = \frac{\sqrt{5}}{0,5 \cdot 5} = \frac{\sqrt{5}}{2,5}$$

$$\sin \alpha = \frac{H-5t_1^2}{t_1 \cdot \sqrt{H}}$$



$$\frac{0,5H}{0,5H\sqrt{5}}$$

mgH,

$$gH + \frac{v^2}{2} = gH + \frac{v^2}{2}$$

$$\cos \alpha \cdot v = v_x$$

$$\sin \alpha \cdot v = v_y$$



$$H = \sin \alpha \cdot v \cdot t_1 - \frac{10 \cdot t_1^2}{2}$$

$$0,5H = \cos \alpha \cdot v \cdot t$$

$$H = \sin \alpha \cdot v \cdot t_1 - 5t_1^2$$

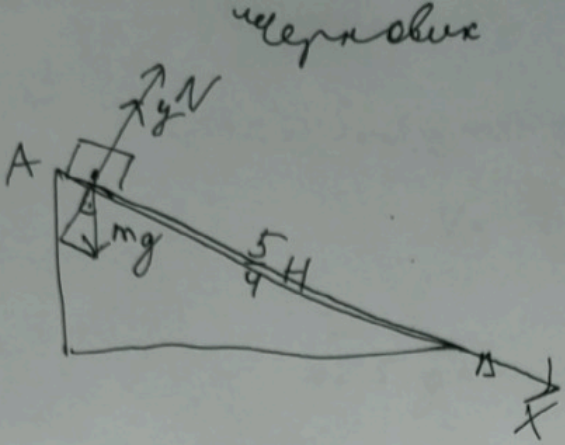
$$0,5H = \cos \alpha \cdot \sqrt{2,5gH} \cdot t$$

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$$H = t_1 (\sin \alpha \cdot v - 5t_1)$$

$$\cos \alpha = \frac{0,1\sqrt{H}}{t} \quad \cos \alpha = \frac{0,5H \cdot \sqrt{H}}{50Ht} = \frac{0,5\sqrt{H}}{5t} = \frac{0,1}{t}$$

$$\sin \alpha \cdot v = \frac{H}{t_1} - 5t_1 \quad \sin \alpha \cdot v - 5t_1 = \frac{H}{t_1}$$



$$\cos^2 \alpha + \sin^2 \alpha = 1$$

$$\frac{0}{25} + \sin^2 \alpha = 1$$

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

$$\frac{H}{\frac{5}{4}H} = \frac{AB}{1}$$

$$\frac{4}{5} AB = H$$

$$AB = \frac{H}{\frac{4}{5}} = H \cdot \frac{5}{4} = H \cdot 1.25$$

$$mg_y = \cos mg = \frac{3}{5} mg$$

$$mg_x = \sin mg = \frac{4}{5} mg$$

$$\frac{4}{5} mg = ma$$

$$\frac{4}{5} g = a$$

$$a = 9 \frac{m}{c^2}$$

$$\frac{5}{4} H = \frac{0.5 \cdot t^2}{2}$$

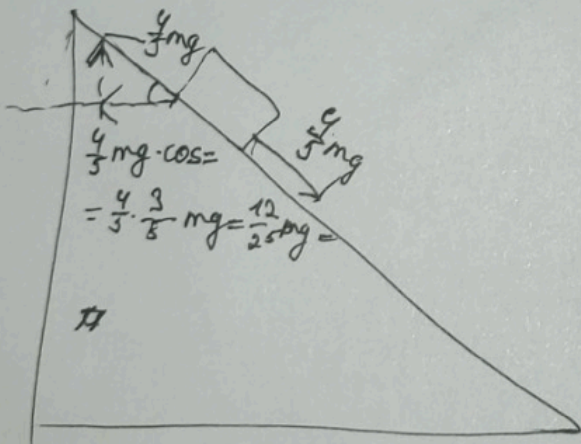
$$\frac{5H}{4} = \frac{9t^2}{2}$$

$$36t^2 = 10H$$

$$t^2 = \frac{10H}{36}$$

$$t = \sqrt{\frac{10H}{36}} = \frac{\sqrt{10H}}{6}$$

$$t = \sqrt{\frac{10H}{36}} = \sqrt{\frac{54}{18}} = \frac{\sqrt{54}}{3\sqrt{2}} = \frac{\sqrt{108}}{6}$$



$$\frac{12}{25} mg = ma$$

$$\frac{120}{25}$$

$$a = \frac{48 \frac{m}{c^2}}{2} = 24$$

