

Часть 1

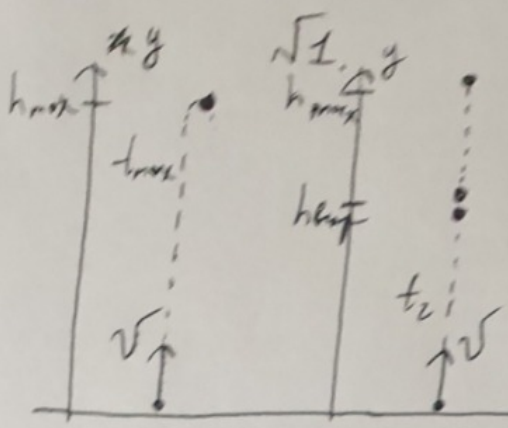
Олимпиада: **Физика, 9 класс (1 часть)**

Шифр: **21204139**

ID профиля: **329728**

Вариант 2

Дано:
 τ



- 1) t_2 - ?
- 2) h_{max} - ?
- 3) v - ?

Путь hump - высота максоборень
~~Путь~~ Путь t_{max} - время разема до h_{max}

Путь:

$$1) h_{hump} = v\tau - \frac{g\tau^2}{2}$$

$$2) h_{hump} = vt_2 - \frac{gt_2^2}{2}$$

$$v\tau - \frac{g\tau^2}{2} = vt_2 - \frac{gt_2^2}{2}$$

$$(\tau - t_2)g\tau - \frac{g\tau^2}{2} = (\tau - t_2)gt_2 - \frac{gt_2^2}{2}$$

$$g\tau^2 - g\tau t_2 - \frac{g\tau^2}{2} - g\tau t_2 + gt_2^2 + \frac{gt_2^2}{2} = 0$$

$$\frac{g\tau^2}{2} - 2g\tau t_2 + \frac{3}{2}gt_2^2 = 0 \quad | :g$$

$$\frac{3}{2}t_2^2 - 2\tau \cdot t_2 + \frac{g\tau^2}{2} = 0 \quad | \cdot 2$$

$$3t_2^2 - 4\tau \cdot t_2 + \tau^2 = 0$$

$$D = 16\tau^2 - 4 \cdot 3 \cdot \tau^2 = 4\tau^2$$

$$\sqrt{D} = 2\tau$$

$t_1 = \frac{4\tau + 2\tau}{6} = \frac{6\tau}{6} = \tau$ - не рассогнуем м.к. это время t разема до h_{max} , а разема до hump.

$$t_2 = \frac{4\tau - 2\tau}{6} = \frac{1}{3}\tau$$

$$2) h_{max} = \frac{v^2}{2g} = \frac{(\tau - t_2)^2 g}{2} = \frac{(\tau - \frac{1}{3}\tau)^2 g}{2} = \frac{4\tau^2 g}{2} = \frac{2\tau^2 \cdot 10}{9} = \frac{20}{9}\tau^2$$

$\tau = t_{max} + t_2$ (это время разема до h_{max} и время t_2 до h_{hump})
 u.m.k. на h_{max}
 $v' = 0$, mo:
 $v - gt_{max} = 0$
 $v = gt_{max}$
 $v = (\tau - t_2)g$

3) $v = g t_{max}$ $\sqrt{1}$ (прогнана) $\text{Тораниспенко Бригид}$
 $v = (\tilde{t} - t_2)g$ Бапуанн 09-02
 $v = \frac{2}{3} \tilde{t} \cdot g = \frac{2}{3} \tilde{t} \cdot 10 = \frac{20}{3} \cdot \tilde{t}$ Тумобух

Омбем: 1) $\frac{1}{3} \tilde{t}$; 2) $\frac{20}{9} \tilde{t}^2$; 3) $\frac{20}{3} \tilde{t}$.

Дано:

$$S = 9 \text{ м}^2$$

$$P_0 = 100 \text{ кПа}$$

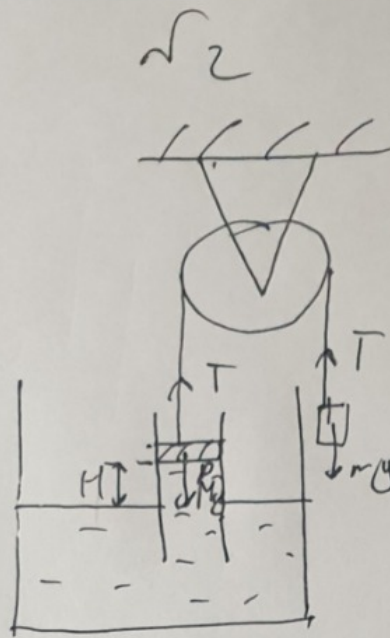
$$m = 250 \text{ кг} = 0,25 \text{ т}$$

$$H = 20 \text{ м}$$

1) p - ?

2) M - ?

3)



$$1) p = P_0 - \rho g H = 100 \cdot 10^3 - 2 \cdot 10^3 = 98 \text{ кПа}$$

~~Ответ: 1) 98 кПа~~

$$2) p = \frac{F}{S} = \frac{Mg - T}{S} = \frac{Mg - mg}{S}$$

$$T = mg$$

$$Mg - mg = p \cdot S$$

$$Mg = pS + mg$$

$$M = \frac{pS + mg}{g} = \frac{98 \cdot 10^3 + 9 \cdot 10^3 + 10 \cdot 0,25}{10} =$$

$$= \frac{98 \cdot 9 + 2,5}{10} = 9,07 \text{ т}$$

Ответ: 1) 98 кПа; 2) 9,07 т

Дано:

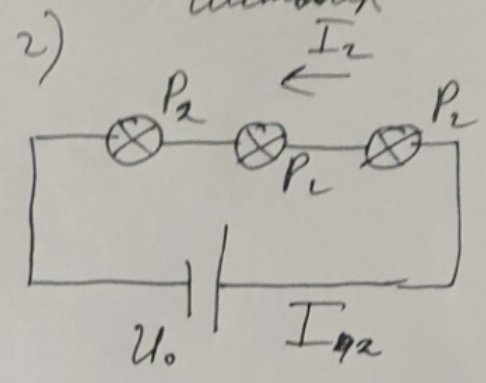
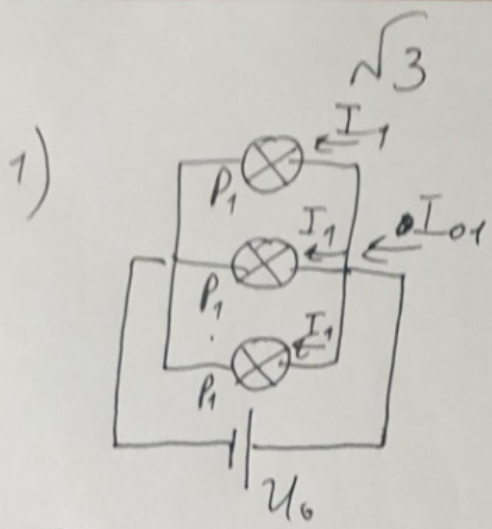
$P_1 = 2,4 \text{ Вт}$

$P_2 = 0,5 \text{ Вт}$

1) $I_1 = ?$

2) $I_2 = ?$

3) $P_3 = ?$



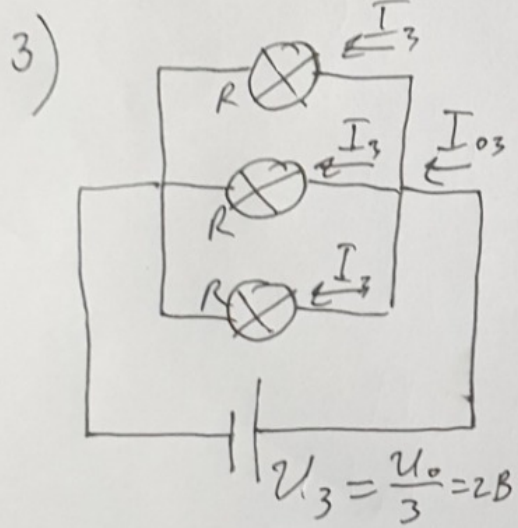
$P = UI$

1) $P_1 = U_0 \cdot I_1$

$I_1 = \frac{P_1}{U_0} = \frac{2,4}{6} = 0,4 \text{ A}$

2) $P_2 = \frac{U_0}{3} \cdot I_2$

$I_2 = \frac{P_2}{\frac{U_0}{3}} = \frac{0,5}{2} = 0,25 \text{ A}$



из 1) найдем, что:

1) $R = \frac{U_0}{I_1} = \frac{6}{0,4} = 15 \text{ Ом}$

2) $I_3 = \frac{I_{03}}{3}$

3) $R_{\text{общ}} = \frac{R \cdot R \cdot R}{R^2 + R^2 + R^2} = \frac{15 \cdot 15 \cdot 15}{15^2 + 15^2 + 15^2} = 5 \text{ Ом}$

$I_{03} = \frac{U_3}{R} = \frac{2}{5} = 0,4 \text{ A}$

$I_3 = \frac{0,4}{3} = \frac{4}{30}$

$P_3 = U_3 I_3 = \frac{2 \cdot 4}{30} = \frac{4}{15} \text{ Вт}$

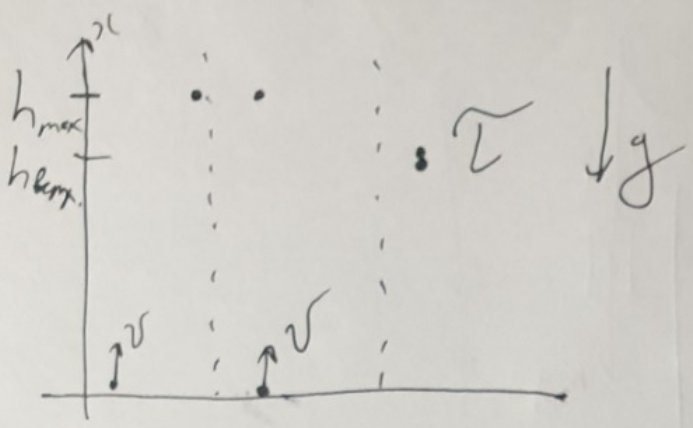
~~Дано~~

Ответ: 1) 0,4 A; 2) 0,25 A; 3) $\frac{4}{15}$ Вт.

српаниса 04 из 04

mm

Задача Дано: T



- 3) $v = ?$
- 2) $h_{max} = ?$
- 1) $t_2 = ?$

~~$y = h_0 + vt_1 - \frac{gt_1^2}{2}$~~

~~$h_{max} = \frac{v}{2} t_1$~~

~~$v - gt_1 = 0$~~

~~$v = gt_1$~~

~~$h_{max} = \frac{v^2}{2g}$~~

~~$v = v_0 - gt$~~ ~~$v_0 = gt_{max}$~~

~~$T = (t_{max} + t_1)$~~

~~$t_{max} = \frac{v}{g}$~~

~~$t_2 = T - t_{max}$~~

~~$t_2 = T - \frac{v}{g}$~~

$h_{komp} = vT - \frac{gT^2}{2}$

$h_{komp} = vt_2 - \frac{gt_2^2}{2}$

$vT - \frac{gT^2}{2} = vt_2 - \frac{gt_2^2}{2}$

$(T - t_2)gT - \frac{gT^2}{2} = vt_2 - \frac{gt_2^2}{2}$

~~$gT(T - t_2) - \frac{gT^2}{2} =$~~

~~$(T - t_2)(gT - gt_2) = \dots$~~

$v = (T - t_2)g$

$gT^2 - gTt_2 - \frac{gT^2}{2} = gTt_2 - gt_2^2 - \frac{gt_2^2}{2}$

$\frac{gT^2}{2} - 2gTt_2 = -\frac{3}{2}gt_2^2$

$\frac{3}{2}t_2^2 - 2Tt_2 + \frac{T^2}{2} = 0$

$\frac{3}{2}t_2^2 - 2T \cdot t_2 + \frac{1}{2}T^2 = 0 \quad | \times 2$

$3t_2^2 - 4T \cdot t_2 + T^2 = 0$

$D = 16T^2 - 4 \cdot 3 \cdot T^2 = 16T^2 - 12T^2 = 4T^2$

$\sqrt{D} = 2T$

$$t_1 = \frac{4\tilde{t} + 2\tilde{t}}{6} = \frac{6\tilde{t}}{6} = \tilde{t} \quad \text{—ve magnitude reproduced}$$

$$t_2 = \frac{4\tilde{t} - 2\tilde{t}}{6} = \frac{2\tilde{t}}{6} = \frac{1}{3}\tilde{t} \quad \frac{4}{9} \cdot \frac{1}{2}$$

$$2) \quad h_{\max} = \frac{v^2}{2g} = \frac{(\tilde{t} - t_2)^2 g}{2g} = \frac{(\tilde{t} - t_2)^2 \cdot g}{2} =$$

$$= \frac{(\tilde{t} - \frac{1}{3}\tilde{t})^2 \cdot g}{2} = \frac{4}{9} \frac{\tilde{t}^2 \cdot g}{2} = \frac{2}{9} \frac{\tilde{t}^2 \cdot 10}{2} =$$

$$= \frac{20}{9} \tilde{t}^2$$

~~$$\frac{(20 \cdot \tilde{t})^2}{9 \cdot 20} = \frac{400 \cdot \tilde{t}^2}{180}$$~~

$$3) \quad v' = v - gt_{\max}$$

$$\Rightarrow v' = 0$$

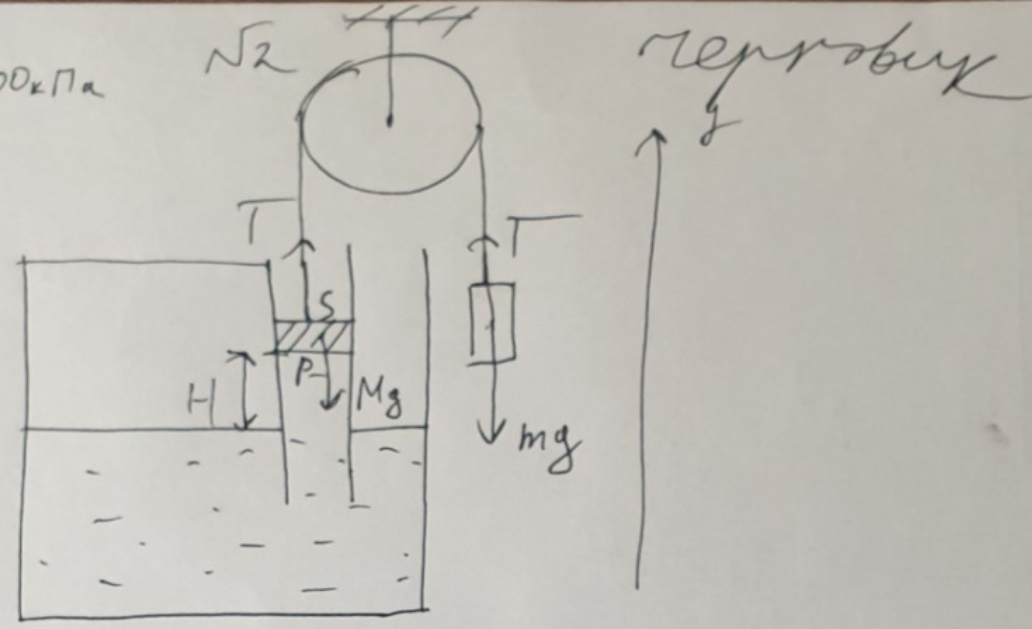
$$v = gt_{\max}$$

$$v = (\tilde{t} - t_2)g$$

$$v = \frac{2}{3}\tilde{t} \cdot g = \frac{20}{3}\tilde{t}$$

reproduced

$S = 9 \text{ m}^2$
 $P_0 = 100 \text{ kPa}$
 $m = 250 \text{ kg}$
 $H = 20 \text{ cm}$
 1) $p = ?$
 2) $M = ?$
 3) ...



$$1) p = \frac{F}{S} = \frac{Mg - T}{S} = \frac{Mg - mg}{S}$$

~~eg: $T - mg = 0$~~
 ~~$T = mg$~~
 ~~$Mg = mg$~~

~~$$P = -\rho g H =$$~~

$$p = P_0 - \rho g H$$

$$P_0 = 100 \cdot 10^3$$

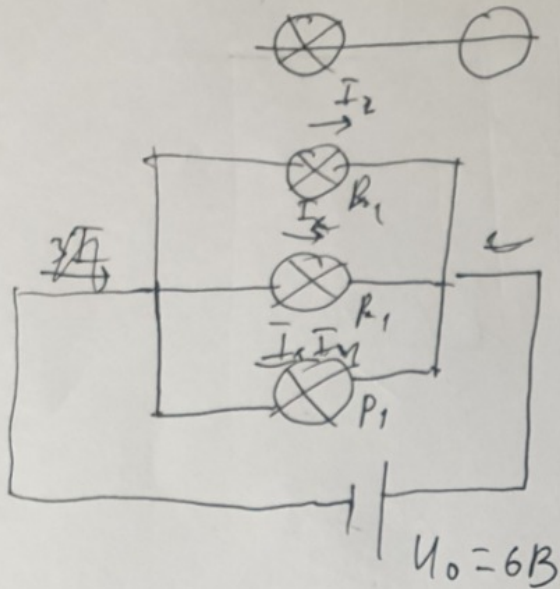
$$\rho g H = 1000 \cdot 10 \cdot 0,2$$

$$1000 \cdot 2$$

$$10^3$$

03 uz 05
 02 uz

reproben

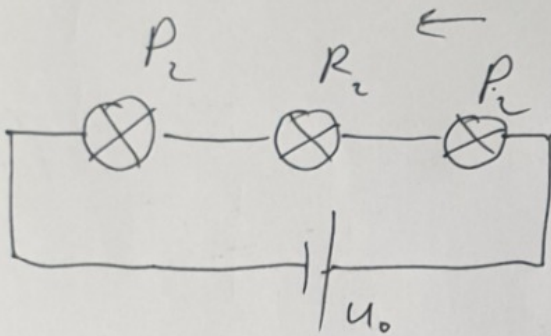


$$P_1 = 2,4 \text{ Вт}$$

$$P_2 = 0,5 \text{ Вт}$$

$$1) I_{1,2,3} - ?$$

$$2) I_{1,5,6} - ?$$



$$P = I^2 R$$

$$P = UI$$

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

$$P = UI$$

$$P_1 = U_0 \cdot I$$

$$\frac{2,4}{0,4} = 6$$

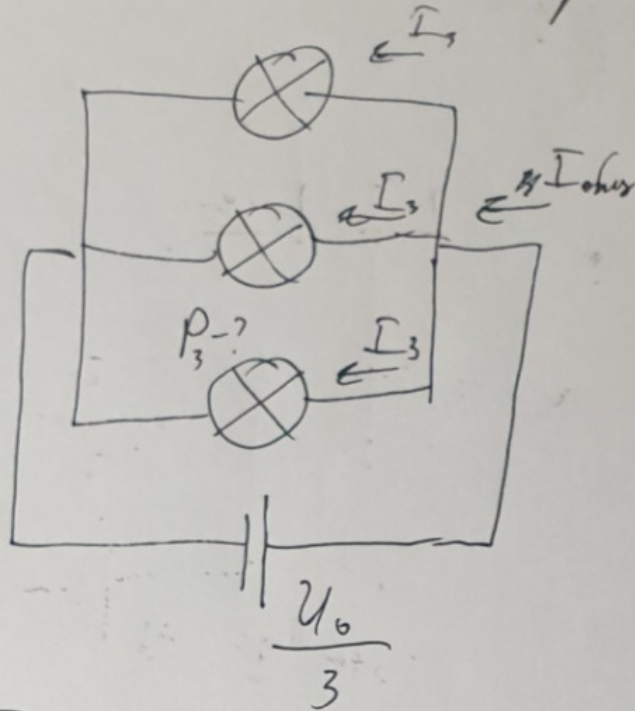
$$1) I_1 = \frac{P_1}{U_0} = \frac{2,4}{6} = 0,4 \text{ A}$$

$$2) P_2 = U_0 I_2 \Rightarrow I_2 = \frac{P_2}{U_0} = \frac{0,5}{6} = \frac{1}{12} = \frac{1}{12} \text{ A}$$

$$P_2 = \frac{U_0}{3} I_2 \quad I_2 = \frac{P_2}{\frac{U_0}{3}} = \frac{0,5}{2} = 0,25 \text{ A}$$

3)

rechner



$$P_3 = \frac{U_0}{3} \cdot I$$

$$\begin{array}{r} 2 \\ 15 \\ \times 0,4 \\ \hline 6,0 \end{array}$$

uz 1 naitgen

$$U = IR$$

$$R = \frac{U}{I} = \frac{6}{0,4} = 15 \text{ Ohm}$$

$$I_3 = \frac{I_{ohm}}{3} = \frac{1,2}{3}$$

$$\begin{array}{r} 2 \\ 15 \\ \times 15 \\ \hline + 75 \\ 15 \\ \hline 225 \end{array}$$

$$R_{ohm} = \frac{R \cdot R \cdot R}{R^2 + R^2 + R^2} = \frac{15 \cdot 15 \cdot 15}{675} = 5 \text{ Ohm}$$

$$U_3 = \frac{U_0}{3} = 2 \text{ V}$$

$$I_{ohm} = \frac{U_0}{R} = \frac{6}{15} = 0,4$$

$$I_3 = \frac{0,4}{3} = \frac{4}{30} = \frac{2}{15}$$

$$P = UI = \frac{2 \cdot 2}{15} = \frac{4}{15} \text{ W}$$

Часть 2

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

Шифр: **21204139**

ID профиля: **329728**

Вариант 2

Dano:

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

H, m, M = 2m

1) t - ?

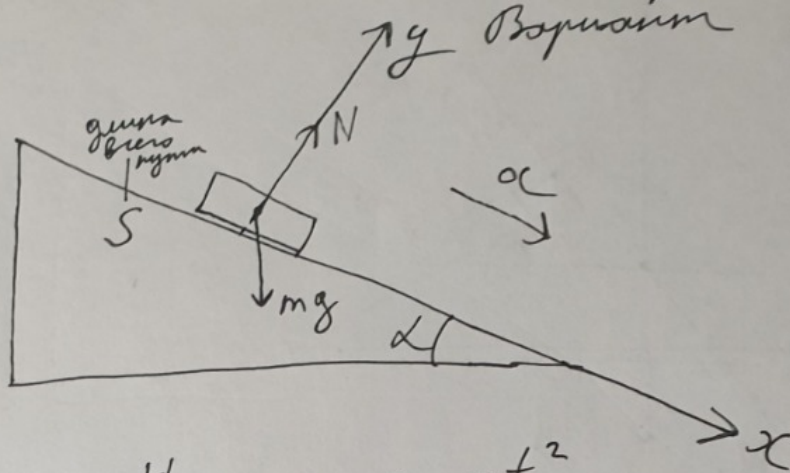
2) v - ?

3) t₂ - ?

√4

Ученский
Инженерный Вестник
Богданов 09-02

1)



$$1) S = \frac{H}{\sin \alpha}$$

$$2) S = \frac{at^2}{2}$$

По 2 закону Ньютона:

$$3) m\vec{g} + \vec{N} = m\vec{a}$$

$$\text{ок: } mg \cdot \sin \alpha = ma$$

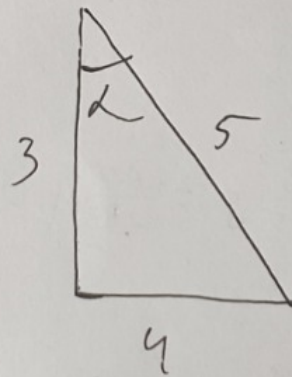
$$g \cdot \sin \alpha = a$$

$$\frac{H}{\sin \alpha} = \frac{at^2}{2}$$

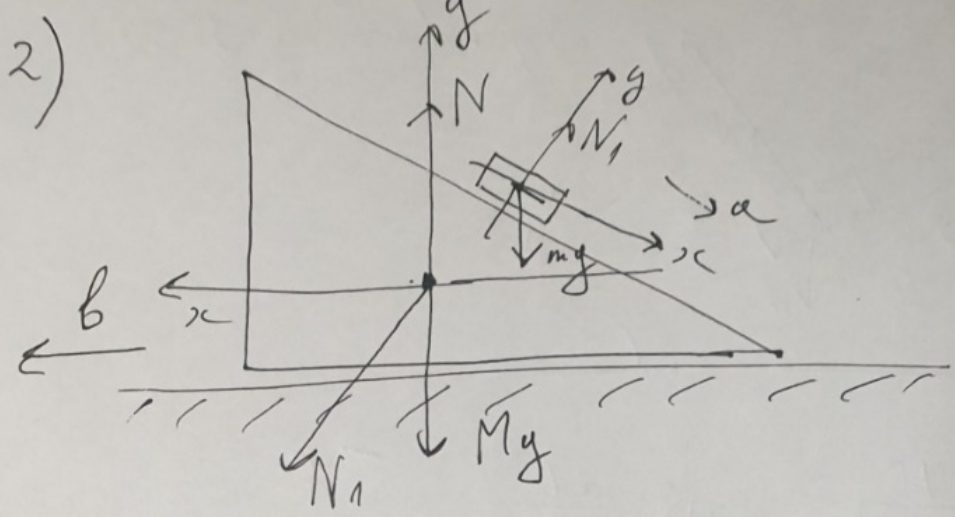
$$\frac{H}{\sin \alpha} = \frac{g \sin \alpha \cdot t^2}{2}$$

$$t = \sqrt{\frac{2H}{g \sin^2 \alpha}}$$

$$t = \sqrt{\frac{2H \cdot 25}{g \cdot 16}} = \frac{5}{4} \sqrt{\frac{2H}{g}} = \frac{5}{4} \sqrt{0,2H}$$



м.к.
 $\cos \alpha = \frac{3}{5}$
мо:
 $\sin \alpha = \frac{4}{5}$



$\vec{N} + M\vec{g} + \vec{N}_1 = M\vec{b}$ 2 закон Ньютона

oy: $N_1 = mg \cos \alpha$

ox: $N_1 \sin \alpha = Mb$

$mg \cos \alpha \cdot \sin \alpha = 2mb$

$g \cos \alpha \cdot \sin \alpha = 2b$

$b = \frac{1}{2} g \cdot \sin \alpha \cdot \cos \alpha$

$b = \frac{1}{2} \cdot \frac{4}{5} \cdot \frac{3}{5} \cdot g = \frac{6}{25} g = \frac{60}{25} = 2,4 \frac{m}{c^2}$

3) Omn zaman:

maunda $a = g \cdot \sin \alpha = \frac{4}{5} g = 0,8g = 8 \frac{m}{c^2}$

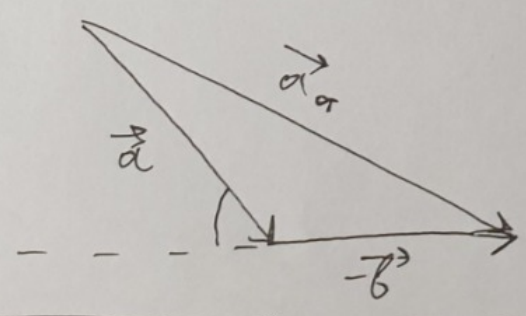
kun $b = \frac{6}{25} g = 2,4 \frac{m}{c^2}$

$\vec{a}_a = \vec{a}_{ng} + \vec{a}_{or}$

$\vec{a}_{or} = \vec{a}_a - \vec{a}_{ng}$

$\vec{a}_{or} = \vec{a} - \vec{b}$

$\vec{a}_{or} = \vec{a} + (-\vec{b})$



$a_{or} = \sqrt{a^2 + b^2 - 2ab \cdot \cos(180 - \alpha)} = \sqrt{a^2 + b^2 + 2ab \cdot \cos \alpha} =$

$= \sqrt{64 + 5,76 - 2 \cdot 2,4 \cdot 8 \cdot \frac{3}{5}} = \sqrt{69,76 - 23,04} = 6,8 \frac{m}{c^2} \quad \text{O'z uy OS}$

мага:

$\sqrt{4}$

Земсков
Форамперово Брагунцов
Богданов 09-02

$$t_1 \frac{H}{\sin \alpha} = \frac{a_{\text{от}} t_2^2}{a}$$

$$t_2 = \sqrt{\frac{2H}{\sin \alpha \cdot a_{\text{от}}}} = \sqrt{\frac{2H \cdot 5}{4 \cdot 6,8}} = \sqrt{\frac{10H}{27,2}} = \sqrt{0,37H}$$

Ответ: 1) $\frac{5}{4} \sqrt{0,2H}$; 2) $6,8 \frac{H}{a}$; 3) $\sqrt{0,37H}$.

Dato:

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

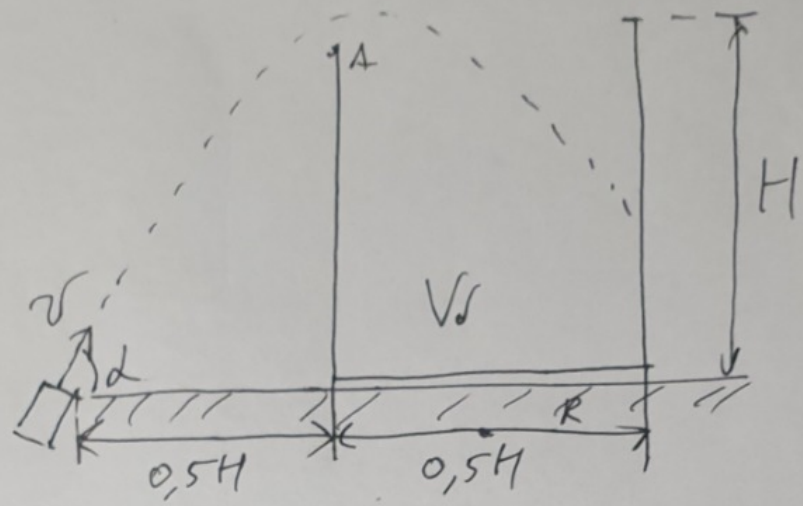
H, S

1) t - ?

2) α - ?

$\sqrt{5}$

Ummobun
Foramnyento Proqram
Bapnam 09-02



$$1) V_d = H \cdot \pi R^2 = H \cdot \pi \cdot \left(\frac{1}{4}H\right)^2 = \frac{1}{16} \pi H^3$$

$$V_{St} = \frac{1}{16} \pi H^3$$

$$t = \frac{\pi H^3}{16 \cdot S \cdot V} = \frac{\pi H^3}{16 \cdot S \cdot \sqrt{2,5gH}} = \frac{3,14 H^3}{16 \cdot S \cdot \sqrt{25H}} =$$

$$= 0,2 \sqrt{\frac{H^6}{S^2 \cdot H \cdot 25}} = 0,2 \frac{\sqrt{H^5}}{5S} = 0,04 \frac{\sqrt{H^5}}{S}$$

~~2) $h_{max} = H$~~

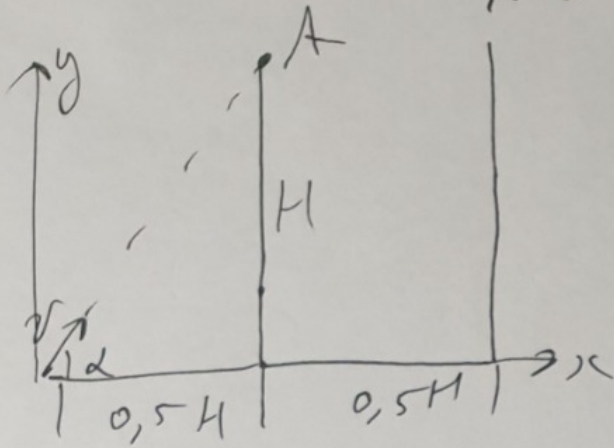
~~$$h_{max} = \frac{V^2 \cdot \sin^2 \alpha}{2g} = H$$~~

~~$$\sin \alpha = \sqrt{\frac{2gH}{V^2}} = \sqrt{\frac{2gH}{2,5gH}} = \sqrt{\frac{20}{25}} = \sqrt{\frac{4}{5}} = \sqrt{0,8} = 0,89$$~~

~~$$\sin \alpha = 0,89$$~~

~~$$\alpha = 62,9^\circ$$~~

2)



Умови
Борановського Блогера

$$y = v_0 \sin \alpha \cdot t - \frac{g t^2}{2}$$

$$x = v_0 \cos \alpha \cdot t$$

$$t = \frac{x}{v_0 \cos \alpha}$$

~~$$x = 0,5H$$

$$y = H$$~~

$$y = \frac{v_0 \sin \alpha \cdot x}{v_0 \cos \alpha} - \frac{g x^2}{2 v_0^2 \cos^2 \alpha}$$

$$x = 0,5H$$

$$y = x \operatorname{tg} \alpha - \frac{g x^2}{2 v_0^2} (1 + \operatorname{tg}^2 \alpha)$$

$$y = H$$

$$H = \frac{H}{2} \operatorname{tg} \alpha - \frac{g \cdot 1}{2 \cdot 2,5gH} \cdot \frac{H^2}{4} - \frac{g}{2} \cdot \frac{1}{2,5gH} \cdot \frac{H^2}{4} \cdot \operatorname{tg}^2 \alpha$$

$$\frac{H}{2} \operatorname{tg} \alpha - \frac{H}{20} - \frac{H}{10} \operatorname{tg}^2 \alpha - H = 0 \quad | : H$$

$$\operatorname{tg}^2 \alpha - 10 \operatorname{tg} \alpha + 20 + 1 = 0$$

$$\operatorname{tg}^2 \alpha - 10 \operatorname{tg} \alpha + 21 = 0$$

$$\operatorname{tg} \alpha = \frac{10 \pm \sqrt{100 - 84}}{2} = \frac{10 \pm 4}{2}$$

$$\operatorname{tg} \alpha_1 = 7$$

$$\operatorname{tg} \alpha_2 = 3$$

Осьби: 1) $0,04 \frac{H^5}{5}$; 2) 7 ум 3.

Багисина 09-02

$$h_{max} = H$$

reproduz

~~$$h_{max} = \frac{v_0^2 \cdot \sin^2 \alpha}{2g}$$~~

~~$$v_0 = 5$$~~

~~$$H = \frac{v^2 \cdot \sin^2 \alpha}{2g}$$~~

~~$$v = \sqrt{25}$$~~

~~$$\sqrt{\frac{50}{v^2}} = \frac{\sqrt{50}}{v} = \frac{5\sqrt{2}}{5} = \sqrt{2}$$~~

~~$$\sin^2 \alpha = \frac{2gH}{v^2}$$~~

~~$$\sin \alpha = \sqrt{\frac{2gH}{v^2}} = \sqrt{\frac{2gH}{2,5gH}} = \sqrt{\frac{20}{25}} = \frac{1}{5} \sqrt{20} =$$~~

~~$$= \frac{1}{5} \cdot 2\sqrt{5} = \frac{2}{5} \sqrt{5} = 0,4\sqrt{5}$$~~



~~$$\frac{\sqrt{2gH}}{2,5gH} = \frac{\sqrt{20gH}}{2,5gH}$$~~

~~$$\sqrt{\frac{2gH}{v^2}} = \sqrt{\frac{2gH}{5,5gH^2}} = \sqrt{\frac{2gH}{2,5gH}} =$$~~

~~$$= \sqrt{\frac{20}{25}} = \sqrt{\frac{4}{5}} = \frac{2}{\sqrt{5}}$$~~

~~$$\sin \alpha = 0,89$$~~

~~$$\alpha = 62,9^\circ$$~~

3)

амп. змуні:

$$a = g \cdot \sin 2 = \frac{4}{5} g = \cancel{0,8g} \quad 0,8g = 8 \frac{u}{c^2}$$

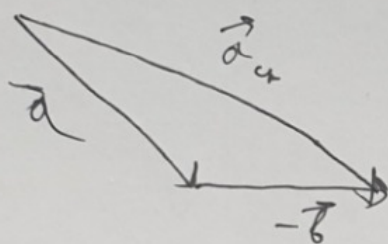
$$b = \frac{6}{25} g$$

$$\vec{a}_a = \vec{a}_{\text{ref}} + \vec{a}_{\text{ca}}$$

$$\vec{a}_{\text{cr}} = \vec{a}_a - \vec{a}_{\text{ref}}$$

$$a_{\text{cm}} = \vec{a}_{\text{ref}} - \vec{b}$$

Меридіан



$$a_{\text{cr}} = \sqrt{a^2 + b^2 - 2ab \cdot \cos(180^\circ - \alpha)} =$$

$$= \sqrt{a^2 + b^2 + 2ab \cdot \sin \alpha}$$

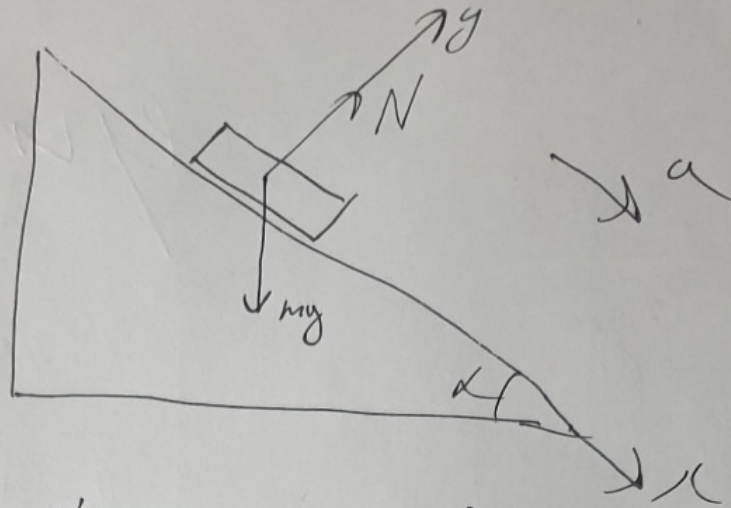
$$\frac{H}{\sin \alpha} = \frac{a + b^2}{a}$$

Given:

H

$\sqrt{1}$

reproduction :



$$s = \frac{H}{\sin \alpha} \quad s = \frac{at^2}{2}$$

no 2 gan. Kuvon.

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

$$\text{or: } mg \sin \alpha = ma$$

$$a = g \cdot \sin \alpha$$

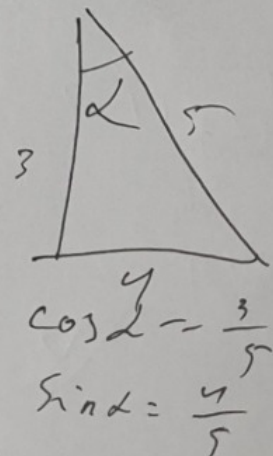
$$\frac{H}{\sin \alpha} = \frac{at^2}{2}$$

$$\frac{H}{\sin \alpha} = \frac{g \cdot \sin \alpha \cdot t^2}{2}$$

$$t = \sqrt{\frac{2H}{g \sin \alpha}}$$

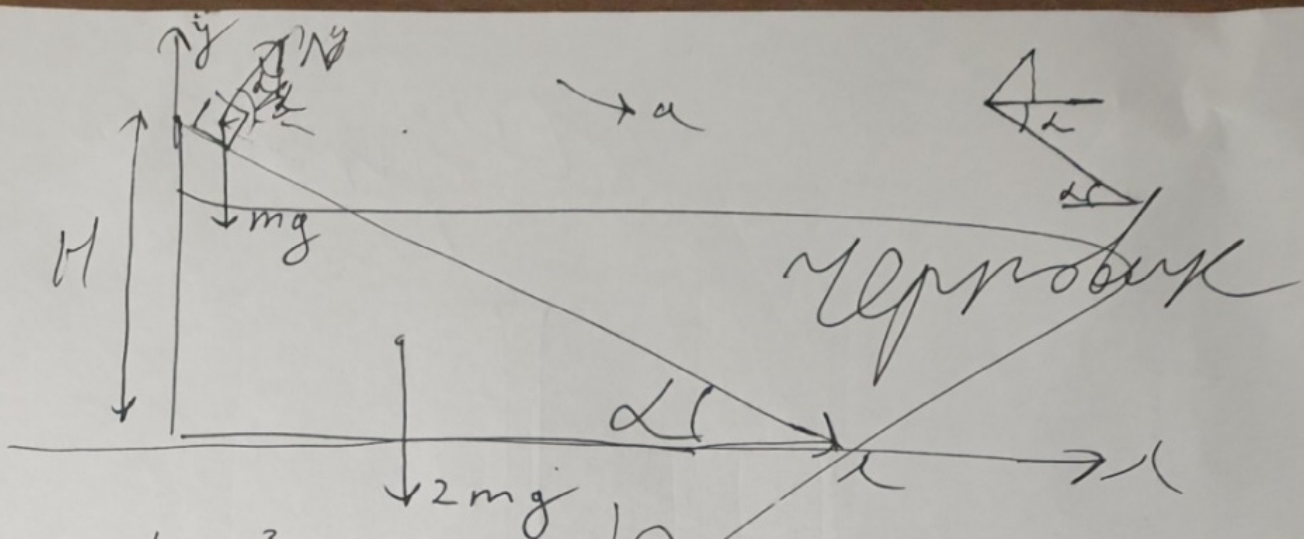
$$t = \sqrt{\frac{2H}{g \cdot \frac{16}{25}}} =$$

$$= \sqrt{\frac{2H \cdot 25}{16g}} = \frac{5}{4} \sqrt{\frac{2H}{g}} =$$



$$21204139 (U329728 M1239106) = \frac{5}{4} \sqrt{0,2H} \neq$$

02 uz 06



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

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

1) t

~~$N + mg = 0$~~
 $\text{or } x:$

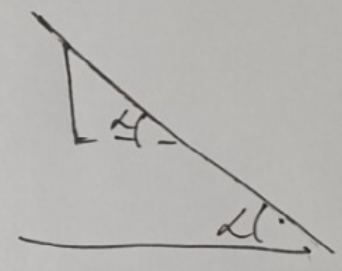
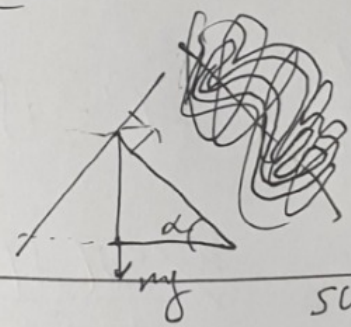
$$\sin = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$$



$$N + mg = ma$$

$\text{or } x:$



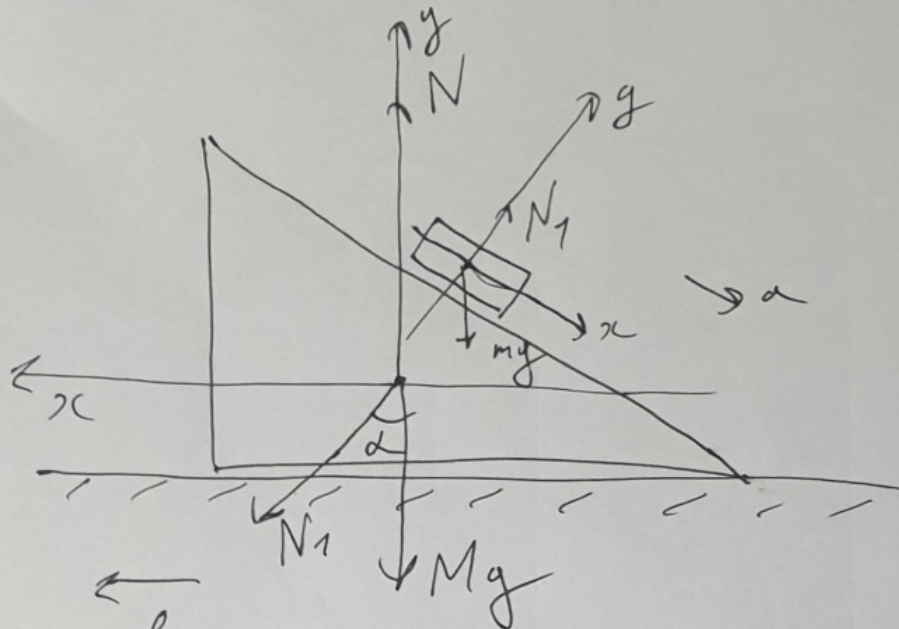
$$\frac{\sin \alpha}{mg} = ma$$

$$\sin \alpha = \frac{mg}{(mg)_{\parallel}}$$

$$(mg)_{\parallel} = \frac{\sin \alpha}{mg}$$

$$N =$$

2)



b - гек. кинна

репробур

$$\text{о } y: N_1 = mg \cos \alpha$$

$$\text{о } x: N_1 \sin \alpha = Mb$$

$$mg \cos \alpha \cdot \sin \alpha = 2mb$$

$$g \cdot \cos \alpha \cdot \sin \alpha = 2b$$

$$b = \frac{1}{2} g \cdot \sin \alpha \cdot \cos \alpha$$

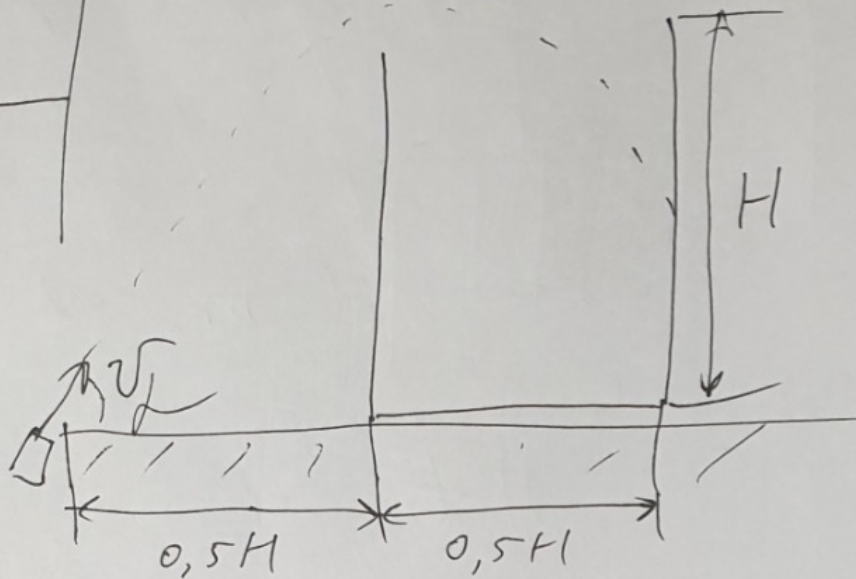
$$b = \frac{1}{2} \cdot \frac{4}{5} \cdot \frac{3}{5} \cdot g = \frac{6}{25} g = \frac{60}{25} = \frac{10}{5} = 2,4 \frac{m}{c^2}$$

55 Мелководье

$$v = \sqrt{2,5gH}$$

$$H, S$$

$$1) t = ?$$



$$1) \quad \cancel{V} = H \cdot \pi R^2 = H \cdot \pi \cdot \frac{1}{16} H^2 = \frac{1}{16} \pi H^3$$

$$\frac{1}{16} \pi H^3 = v \cdot S \cdot t$$

$$t = \frac{\pi H^3}{16 \cdot S \cdot v}$$

$$= \frac{3,14 H^3}{16 \cdot S \cdot \sqrt{2,5gH}} = \emptyset$$

$$= 0,2 \frac{H^3}{S \cdot \sqrt{2,5gH}} = 0,2 \sqrt{\frac{H^5}{S^2 \cdot 2,5 \cdot g \cdot H}} =$$

$$= 0,2 \frac{\sqrt{H^5}}{S \cdot 5} = 0,04 \sqrt{H^5}$$

$$= 0,04 \frac{\sqrt{H^5}}{S}$$