

Часть 1

Олимпиада: **Физика, 10 класс (1 часть)**

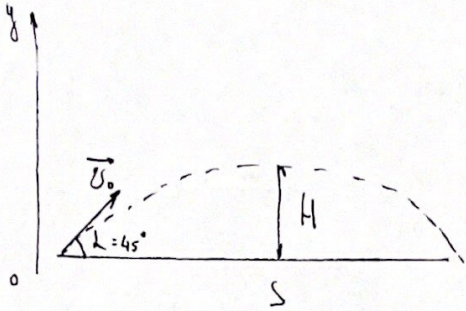
Шифр: **21206001**

ID профиля: **804892**

Вариант 4

1) Kugel

$\sqrt{1}$



Dано:

$\alpha = 45^\circ$

$H = 10 \text{ m}$

$g = 10 \frac{\text{m}}{\text{s}^2}$

Найти: v_0

$F_T = 2R$

Найти: v

1) 3C3

$E_k = E_n$

$\frac{mv_y^2}{2} = mgh$

2) $0y: v_y = v_0 \cdot \sin \alpha$

3) $v_0^2 \cdot \left(\frac{\sqrt{2}}{2}\right)^2 = 2gh$

$v_0 = \sqrt{4gh}$

$v_0 = 20 \frac{\text{m}}{\text{s}}$

2



1) $2R = mg$
 $\Sigma F = ma \quad (\Sigma \square \downarrow -H)$

$R = ma \Rightarrow$

$2ma = mg$

$a = \frac{g}{2}$

$\frac{v^2}{2a} = h$

$v^2 = 2ah$

$v = \sqrt{2ah}$

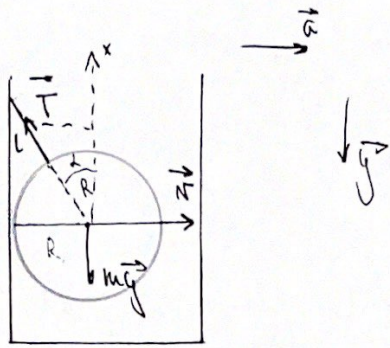
$v = \sqrt{2 \cdot 5 \cdot 10} = 10 \frac{\text{m}}{\text{s}}$

Ответ: $v_0 = 20 \frac{\text{m}}{\text{s}}$

$v = 10 \frac{\text{m}}{\text{s}}$

Умови

2



Дано: $R = 8 \text{ м} = 0,08 \text{ м}$

$L = 8 \text{ м} = 0,08 \text{ м}$

$m = 5,2 \text{ кг}$ $g = 10 \frac{\text{м}}{\text{с}^2}$

$\alpha = 60^\circ$
 угол с верш

$\rho = 1000 \frac{\text{кг}}{\text{м}^3}$

Найти:

1 $T_{\text{ниту}}$ = $T_{\text{натр. н}}$
 2 T

1) or: $mg - T_{\text{натр. н}} \cos \alpha = 0$

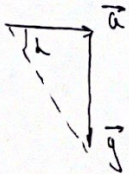
$mg = T_{\text{натр. н}} \cos \alpha$

$T_{\text{натр. н}} = \frac{mg}{\cos \alpha}$
 $\cos \alpha = \frac{\sqrt{(L+R)^2 - R^2}}{L+R}$

$T_{\text{натр. н}} = \frac{mg(L+R)}{\sqrt{(L+R)^2 - R^2}}$

$T_{\text{натр. н}} = \frac{5,2 \cdot 10 (0,08 + 0,08)}{\sqrt{(0,08 + 0,08)^2 - 0,08^2}} = \frac{8,32}{0,14} = 59,43 \text{ Н}$

2



$a_{\text{н}} = g \cdot \sin \alpha$

$a_{\text{с}} = \omega^2 R$

$\omega^2 R = g \sin \alpha$

$\omega^2 = \frac{g \sin \alpha}{R}$

3

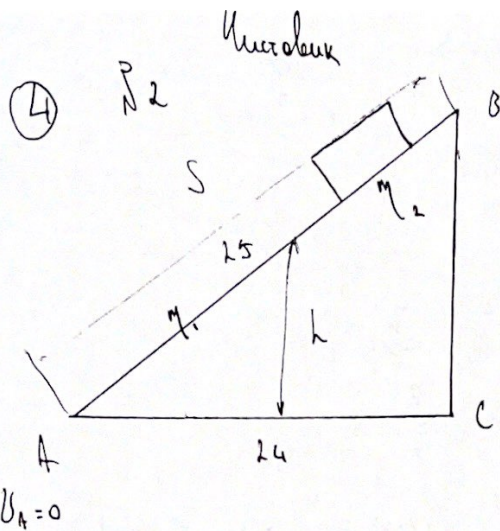
$$T = \frac{2\pi R}{\omega} = 2\pi \cdot \sqrt{\frac{R}{g \cdot \sin \alpha}}$$

$$T = \sqrt{\frac{0,08 \text{ m}}{10 \cdot 2,7}} \cdot 6,28$$

$$T = 0,431 \text{ s}$$

Answer: $\underline{\underline{T = 59,43 \text{ H}}}$

$\underline{\underline{T = 0,431 \text{ s}}}$



Dano: $U_A = 0$

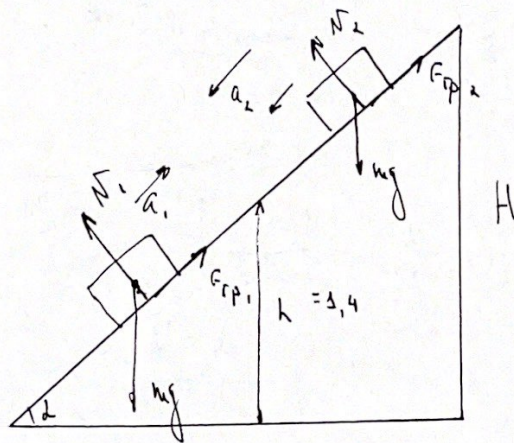
$$\cos \alpha = \frac{24}{25}$$

$$h = 1,4 \text{ m}$$

$$m_1 = 0,5$$

$$m_2 = 0,06$$

$$U_0 = 0$$



$$1) \quad mg \sin \alpha - m_2 (N_2 - mg \cos \alpha) = m_2 a$$

$$2) \quad mg \sin \alpha - m_1 (N_1 - mg \cos \alpha) = -m_1 a$$

$$3) \quad S_2 = \frac{v_{max}^2}{2a_2}$$

$$4) \quad S_1 = \frac{v_{max}^2}{2a_1}$$

$$5) \quad S = S_1 + S_2$$

$$A \quad \frac{h}{S_1} = \sin \alpha \Rightarrow \frac{h}{S_1} = \frac{H}{S_2}$$

$$\frac{H}{S_2} = \sin \alpha$$

$$\sin \alpha = \sqrt{1 - \cos^2 \alpha} = \sqrt{1 - \left(\frac{24}{25}\right)^2} = \frac{7}{25}$$

$$S_1 = \frac{25h}{7}$$

$$U_{\max}^2 = 2a_1 \cdot S_1 = 2 \cdot 2 \cdot 5 = 20 \left(\frac{m}{c}\right)^2$$

$$S_2 = \frac{25H}{7} ; S_1 = \frac{25 \cdot 1,4}{7} = 5 \text{ м}$$

$$U_{\max} = \sqrt{20 \frac{m^2}{c^2}} = 2\sqrt{5} \frac{m}{c}$$

3) $-a_1 = g \sin \alpha - \mu_1 g \cos \alpha \Rightarrow$

$$-a_1 = g (\sin \alpha - \mu_1 \cos \alpha) = 10 \left(\frac{7}{25} - \frac{1 \cdot 24}{2 \cdot 25} \right) = -2 \frac{m}{c^2}$$

$$a_1 = 2 \frac{m}{c^2}$$

4) ЗЦЗ

$$E_n = A_{\text{Frp}}, \text{ м.к } U_A = 0 \quad (U_{\text{конера}} = 0)$$

$$mg(h+H) = \mu_1 N_1 S_1 + \mu_2 N_2 S_2 ; N_1 = N_1 ; F_T = \text{const}$$

5) $oy: N = mg \cos \alpha$
 $ox: ma = F_{\text{Frp}}$

6) $mg(h+H) = \mu_1 mg \cos \alpha S_1 + \mu_2 mg \cos \alpha S_2$

$$h+H = 0,5 \cdot \frac{24}{25} \cdot S_1 + 0,06 \cdot \frac{24}{25} \cdot S_2$$

$$h+H = 0,48 S_1 + 0,0576 S_2$$

7) $S = S_1 + S_2$

$$S = AB$$

$$\sin \alpha = \frac{7}{25}$$

$$\frac{7}{25} = \frac{BC}{AB}$$

$$\frac{h+H}{S} = \frac{7}{25} ; \frac{h+H}{S_1 + S_2} = \frac{7}{25} \Rightarrow$$

$$\frac{h+H}{S} = \frac{7(S_1 + S_2)}{25}$$

⑥ Amplitude

$$\frac{7(S_1 + S_2)}{25} = 0,48 S_1 + 0,0576 S_2 \quad | \cdot 25$$

$$7(S_1 + S_2) = 12 S_1 + 1,44 S_2$$

$$5,56 S_2 = 5 S_1$$

$$S_1 = 1,112 S_2$$

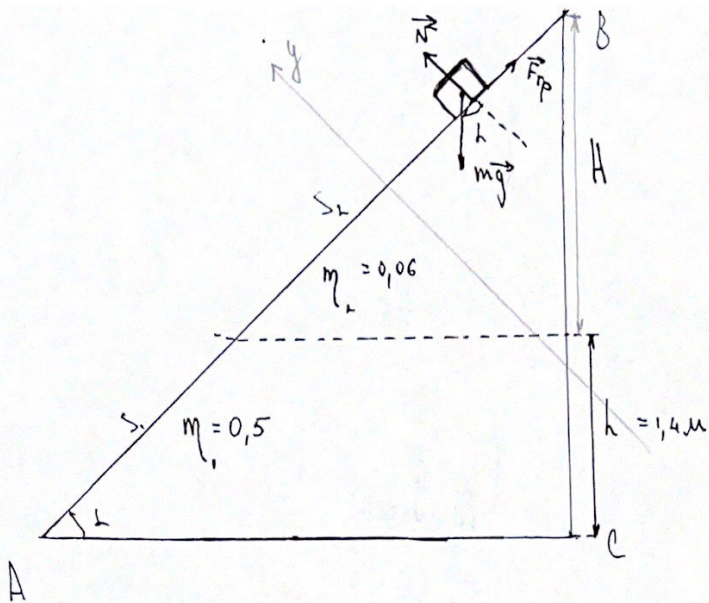
$$S_1 = 5 \mu \text{ (no u. 2), Aug}$$

$$S_2 = \frac{5}{1,112} = 4,496 \mu$$

$$S = S_1 + S_2 = 5 + 4,496 = \underline{9,496 \mu}$$

Antwort: 1) $v_{\max} = 2\sqrt{5} \frac{m}{s}$

2) $S = 9,496 \mu$



$$\frac{AB}{AC} = \frac{24}{25}$$

Решение

$$E_{\text{к}} = A_{\text{спр}}$$

1) П.к. нач. скорость = 0, то $E_{\text{к.0}} = 0$, ссыл 3(3)

$E_{\text{п}} = A_{\text{F}_{\text{тр}}}$, т.к. $F_{\text{тр}}$ является эквивалентной силой, направленной по гипотенузе и ортосебе \Rightarrow

$$F_{\text{тр}} = mN; \quad mg(h+H) = m_1 N_1 S_1 + m_2 N_2 S_2; \quad N_1 = N_2, \text{ т.к. } F_{\text{тр}} = \text{const},$$

$$A) \quad mg(h+H) = m_1 N_1 S_1 + m_2 N_1 S_2$$

$$\text{о } y: \quad N = mg \cos \alpha$$

$$\text{о } x: \quad \Sigma F = ma; \quad ma = F_{\text{тр}}$$

~~мы~~ ~~на~~ ~~есть~~ ~~о~~ ~~т~~ ~~н~~

3) Найти ускорение на 1-м участке

$$ma = m_1 mg \cos \alpha$$

$$a_1 = m_1 \cdot g \cdot \cos \alpha$$

$$a_1 = 4,8 \frac{\text{м}}{\text{с}^2}$$

$$4) \quad m_1 g (h+H) = m_1 m g \cos \alpha S_1 + m_2 m g \cos \alpha S_2$$

$$h+H = 0,5 \cdot \frac{24}{25} \cdot S_1 + 0,06 \cdot \frac{24}{25} \cdot S_2$$

$$h+H = 0,48 S_1 + 0,0576 S_2$$

5)

$$S = S_1 + S_2$$

$$S = AB$$

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

$$\sin^2 \alpha = \sqrt{\frac{625}{625} - \frac{576}{625}}$$

$$\sin \alpha = \frac{7}{25}$$

$$\frac{7}{25} = \frac{BC}{AB} \quad ; \quad BC = H+h$$

$$\frac{H+h}{S} = \frac{7}{25}$$

$$\frac{H+h}{S_1+S_2} = \frac{7}{25} \Rightarrow H+h = \frac{7(S_1+S_2)}{25}$$

↑
Lepidum

6)

$$\frac{7(S_1+S_2)}{25} = 0,48 S_1 + 0,0576 S_2 \quad | \cdot 25$$

$$7(S_1+S_2) = 12 S_1 + 1,44 S_2$$

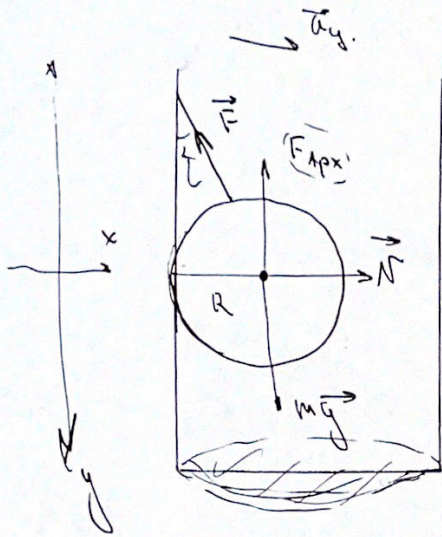
$$7S_1 + 7S_2 = 12S_1 + 1,44S_2$$

$$5,56 S_2 = 5 S_1$$

$$S_1 = 1,12 S_2$$

~~Handwritten scribble~~

23



$$1) \vec{F}_A + \vec{F} + m\vec{a}_y + m\vec{g} = 0 \quad (\text{not correct})$$

$$\left. \begin{array}{l} 0x: -F \cdot \sin \alpha + m a_y = 0 \\ 0y: -F \cos \alpha + mg + F_A = 0 \end{array} \right\}$$

$$\left. \begin{array}{l} F \cos \alpha = mg + F_A \\ F \sin \alpha = m a_y \end{array} \right| \vec{F}; a_y; F_A$$

$$\text{ctg} \alpha = \frac{mg + \rho g \cdot \frac{4}{3} \pi R^3}{m a_y}$$

$$a_{y,c} = \frac{mg + \rho g \cdot \frac{4}{3} \pi R^3}{\text{ctg} \alpha \cdot m}$$

$$a_{y,c} = \frac{52 + 24,435}{0,57 \cdot 5,2} = 24,8 \frac{\text{m}}{\text{s}^2}$$

$$2) \vec{F} = \frac{m \cdot a_{y,c}}{\sin 60} = 148,2 \text{ N}$$

$$S = S_1 + S_2$$

↳ Lepukokan

$$S = AB$$

$$\sin L = \frac{\sqrt{625 - 576}}{625 - 625}$$

$$\sin L = \frac{7}{25}, \text{ maka}$$

$$\frac{BC}{AB} = \frac{7}{25}$$

$$\frac{H+h}{S} = \frac{7}{25}$$

$$\frac{H+h}{S_1 + S_2} = \frac{7}{25}$$

S_1



~~AD~~

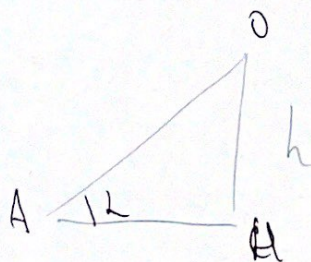
$$\sin L = \frac{h}{S_1}$$

$$\frac{7}{25} = \frac{1,4}{S_1}$$

$$S_1 = 50$$

0,0182

$$\begin{array}{r} 0,0256 \\ - 0,0064 \\ \hline \end{array}$$

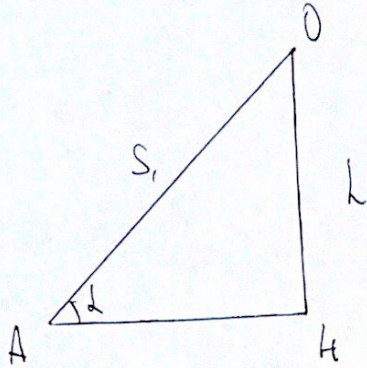


$$7) \quad H + h = 0,53376 S_2 + 0,0576 S_2$$

$$H = 0,59136 S_2 - 1,4$$

4
Lpudauk

8)



$$\sin \alpha = \frac{h}{S_1}$$

$$\frac{7}{25} = \frac{1,4}{S_1}$$

$$S_1 = 5 \text{ m, maka}$$

$$S_2 = \frac{5}{1,12} = 4,496 \text{ m}$$

$$\underline{\underline{S = S_1 + S_2 = 5 + 4,496 = 9,496 \text{ m}}}$$

14,12

128,96
0,87

$$a = \frac{g}{2}$$

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

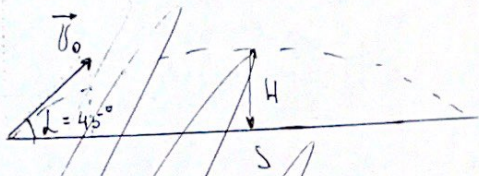
Угловое

$$1 \quad \frac{v^2}{2} = \frac{g}{2} \quad 2$$

$$mgH = m \frac{v^2}{2} + m_2 N_1 S_2$$

$$2mgH = m v^2 + m_2 mg \cos \alpha \cdot S_2 \quad | \quad H v^2 S_2$$

4. Үрвэлүүк



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

$$\frac{v_0 \sin \alpha \cdot t}{2} = g h$$

$$v_0 \cdot t \cdot \frac{1}{2} = 2 g h$$

$$v_0 \cdot t = 4 \cdot 10 \cdot 10$$

$$v_0 = 20 \frac{\text{м}}{\text{с}}$$

Часть 2

Олимпиада: **Физика, 10 класс (2 часть)**

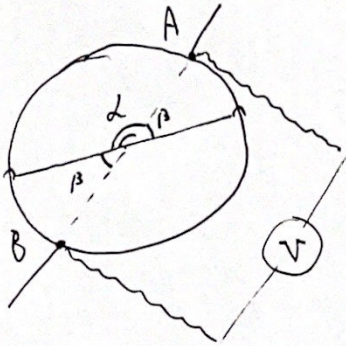
Шифр: **21206001**

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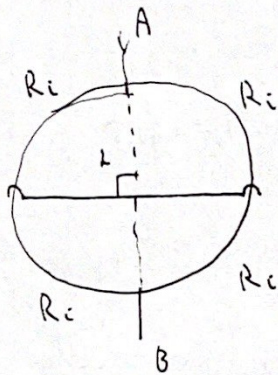
Вариант 4

1) Умножен

$\sqrt{5}$



2)



Дано:

$$R = 72 \text{ Ом} ; R_{\text{внеш}} = 0$$

$$U = 24 \text{ В}$$

$$L = 90$$

$$I = 0,5 \text{ А}$$

Найти:

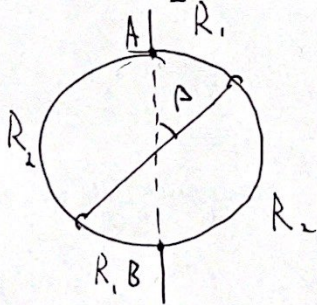
- 1) R_{AB}
- 2) P
- 3) R_x

$$\Delta \phi_{\text{всп}} = 0$$

$$R_{AB} = \frac{R_c}{2} + \frac{R_i}{2} = R_c = \frac{1}{4} R = \frac{72}{4} = 18 \text{ (Ом)}$$

$$P = \frac{U^2}{R} = \frac{24 \cdot 24}{18} = \underline{\underline{32 \text{ Вт}}}$$

$$R_x = \frac{U}{I} = \frac{24}{0,5} = 48 \text{ (Ом)} - \text{группа точек соединенных}$$



$$R_{12} = \frac{R_1 R_2}{R_1 + R_2} ; R_x = \frac{2 R_1 R_2}{R_1 + R_2} = 48$$

$$2 R_1 + 2 R_2 = R = 72$$

$$\begin{cases} \frac{2 R_1 R_2}{R_1 + R_2} = 48 \Rightarrow \frac{R_1 R_2}{R_1 + R_2} = 24 \\ R_1 + R_2 = 36 \Rightarrow R_1 = 36 - R_2 \end{cases}$$

$$\frac{(36 - R_2) R_2}{36 - R_2 + R_2} = 24 \Rightarrow (36 - R_2) \cdot R_2 = 864$$

② Численка

$$36R_2 - R_2^2 = 864$$

$$R_2^2 - 36R_2 + 864 = 0$$

$$R_2 = \frac{18 \pm \sqrt{432}}{2}$$

$$R_2 = 28,5$$

$$R_1 = 36 - 28,5 = 7,5$$

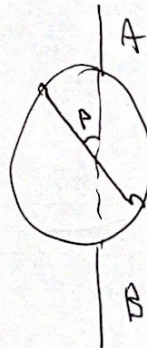
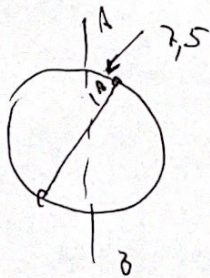
$$R_2 = 7,5$$

$$R_1 = 36 - 7,5 = 28,5$$



⇓
можно повернуть сопротивление как влево,

так и вправо



7,5 Ом 28,5 Ом

0,263 (26,3%), тогда

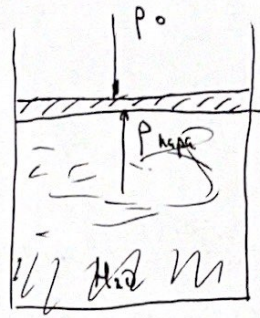
$0,263 \cdot 180 \approx 47,34^\circ$, следовательно граница тока поворачивается на 90° , и е
надо повернуть α на $42,66^\circ$ влево или вправо

$$\underline{\underline{P}} = \frac{U^2}{R} = \frac{24^2}{48} = 12 \text{ Вт.}$$

Ответ: $\underline{\underline{1}}$ 32 Вт; $\underline{\underline{2}}$ $42,66^\circ$; $\underline{\underline{3}}$ 12 Вт.

3) Умножен

Найти: $\underline{1} Q_1$ (гоисчир-а)
 $\underline{2} \Delta t_{\text{кон}}$



Дано:
 $c_k = 4180 \frac{Дж}{кг \cdot ^\circ C}$
 $\tau = 2,26 \cdot 10^6 \frac{Дж}{кг}$

$p_0 = 10^5 \text{ Па}$
 $c_p = 2200 \frac{Дж}{кг \cdot ^\circ C}$
 $\mu_b = 10,1 = 10^{-2} \text{ кг}$
 $t_0 = 20^\circ C$

$\underline{1}$

1) $Q_1 = Q_{\text{в.чир}} = c_k m \Delta t_c =$
 $= 4180 \cdot 20 \cdot 10^{-2} = 3344 \text{ Дж}$

Начинаем подниматься паром

$\underline{2}$

2) $Q_{\text{кип. пар}} = \tau m_{\text{пар}} = (Q - Q_1) = 33000 \text{ Дж} - 3344 \text{ Дж}$

$2,26 \cdot 10^6 \cdot m_{\text{пар}} = 2,966$

$m_{\text{пар}} = 0,0131239 \text{ кг} = 13,12 \text{ г} \Rightarrow$

ка вода кипит в пар, а часть
тепла пошла на исп-е пар

3) $Q_{\text{кип. вода}} = 2,26 \cdot 10^6 \cdot 10^{-2} =$
 $= 22,6 \text{ кДж} - \text{всё тепло вошло}$

4) $Q_x = Q_{\text{кип}} + Q_{\text{кип. пар}} =$
 $= 22,6 \text{ кДж} + 3,344 \text{ кДж} = 25,94 \text{ кДж}$

5) Откажем на кипев пар

$Q_y = Q - Q_x = 7,06 \cdot 10^3 \text{ Дж}$

$Q_y = c_{\text{пар}} \cdot m_{\text{пар}} \cdot \Delta t$

$\Delta t = \frac{7,06 \cdot 10^3 \cdot 10^{-2}}{2,1 \cdot 10^3 \cdot 10^{-2}} = 341^\circ C$

6) $p \Delta V = \frac{m}{M} R \Delta T \quad (p = \text{const})$

④ Umsatz

$$10^5 \cdot \Delta V = \frac{10^2}{18 \cdot 10} \cdot \frac{1}{2} \cdot 8,31 \cdot 321$$

$$\Delta V = 148 \cdot 10^{-4} \approx 0,0148195 \text{ m}^3$$

Antwort: 1 3344 D*

2 0,0148195 m³

$$Q_1 = m \cdot v \cdot t$$

$$= \frac{10}{1000} \cdot 4180 \cdot 80 = 3344 \text{ Дж}$$

$$33000 - 3344 = m \cdot v$$

$$\frac{29656}{2,26 \cdot 10^6} = m$$

$m = 0,01312$, г. к. масса воды, прошедшей в пар > масса воды, но часть тепла пошла на нагревание воды



Упрощение

Q на испарение:

$$Q = m \cdot v \cdot \rho = 970$$

$$Q = 22600 \text{ Дж}$$

$$Q_{\text{ост}} = 33000 - 22600 - 3344 = 7056 \text{ Дж}$$

1236 -

$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2}$



$$\frac{1}{R_{12}} =$$

$$24, 36$$

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$2R_1 = R_2$$

$$\frac{R_1}{2} = 48$$

$$R_1 = 24$$

$$R_{12} = \frac{R_1}{2}$$

$$\frac{R_1}{2} = R_2$$

$$R_1 + R_2 = 36$$

R

$$\frac{1}{R_{12}} = \frac{R_2 + R_1}{R_1 \cdot R_2}$$

$$R_{12} = R_1 + R_2$$

$$\frac{1}{R_x} = \frac{1}{R_1}$$

$$R_x = \frac{R_1}{2}$$

$$48 = \frac{R_1}{2}$$

$$R_1 = 96$$

$$R_2 = \frac{86 \pm 21}{2}$$

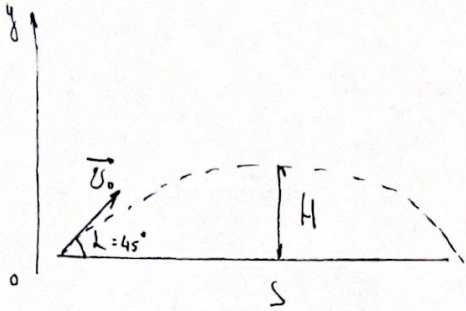
$$R = 28,5$$

$$R = 7,5$$

Usporednik.

1) Kugel

$\sqrt{1}$



Dано:

$$\alpha = 45^\circ$$

$$H = 10 \text{ m}$$

$$g = 10 \frac{\text{m}}{\text{s}^2}$$

Найти: v_0

$$F_T = 2R$$

Найти: v

1) 3C3

$$E_k = E_n$$

$$\frac{mv_y^2}{2} = mgh$$

$$2) \text{ ой: } v_y = v_0 \cdot \sin \alpha$$

$$3) v_0^2 \cdot \left(\frac{\sqrt{2}}{2}\right)^2 = 2gh$$

$$v_0 = \sqrt{4gh}$$

$$v_0 = 20 \frac{\text{m}}{\text{s}}$$

2



$$1) 2R = mg$$

$$\Sigma F = ma \quad (\square \text{ } z - n \text{ } H)$$

$$R = ma \Rightarrow$$

$$2ma = mg$$

$$a = \frac{g}{2}$$

$$\frac{v^2}{2a} = h$$

$$v^2 = 2ah$$

$$v = \sqrt{2ah}$$

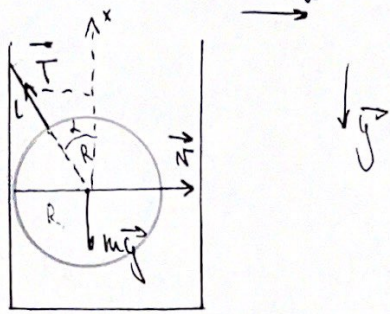
$$v = \sqrt{2 \cdot 5 \cdot 10} = 10 \frac{\text{m}}{\text{s}}$$

Ответ: $v_0 = 20 \frac{\text{m}}{\text{s}}$

$v = 10 \frac{\text{m}}{\text{s}}$

Умови

2



Дано: $R = 8 \text{ м} = 0,08 \text{ м}$

$L = 8 \text{ м} = 0,08 \text{ м}$

$m = 5,2 \text{ кг}$ $g = 10 \frac{\text{м}}{\text{с}^2}$

$\alpha = 60^\circ$
усп. б. б. б.

$\rho = 1000 \frac{\text{кг}}{\text{м}^3}$

Найти:

$T_{\text{норм}} = F_{\text{норм.л}}$

T

1) or: $mg - T \cos \alpha = 0$

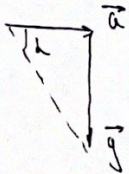
$mg = T \cos \alpha$

$T = \frac{mg}{\cos \alpha}$
2) $\cos \alpha = \frac{L+R}{\sqrt{(L+R)^2 - R^2}}$

$T = \frac{mg(L+R)}{\sqrt{(L+R)^2 - R^2}}$

$T = \frac{5,2 \cdot 10 (0,08 + 0,08)}{\sqrt{(0,08 + 0,08)^2 - 0,08^2}} = \frac{8,32}{0,14} = 59,43 \text{ Н}$

2



$a_{\text{н}} = g \cdot \frac{R}{L}$

$a_{\text{с}} = \omega^2 R$

$\omega^2 R = g \cdot \frac{R}{L}$

$\omega^2 = g \cdot \frac{L}{R}$

③

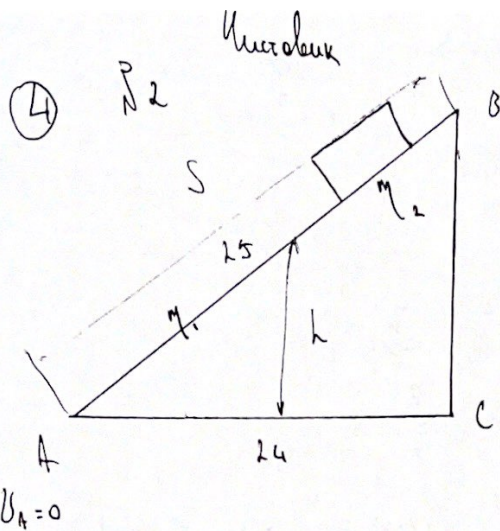
$$T = \frac{2\pi R}{\omega} = 2\pi \cdot \sqrt{\frac{R}{g \cdot \sin \theta}}$$

$$T = \sqrt{\frac{0,08 \text{ m}}{10 \cdot 2,7}} \cdot 6,28$$

$$T = 0,431 \text{ s}$$

Output: $\underline{\underline{T = 59,43 \text{ H}}}$

$\underline{\underline{T = 0,431 \text{ s}}}$



Dano: $U_A = 0$

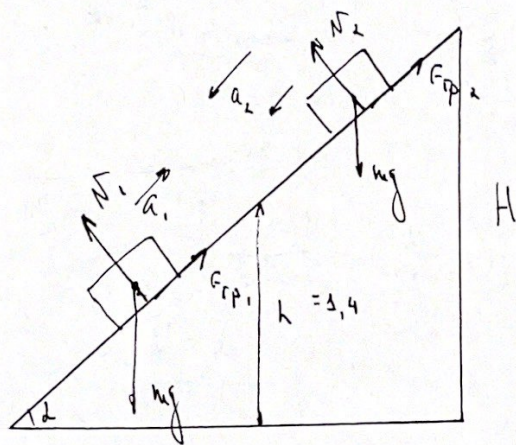
$$\cos \alpha = \frac{24}{25}$$

$$h = 1,4 \text{ m}$$

$$m_1 = 0,5$$

$$m_2 = 0,06$$

$$U_0 = 0$$



$$1) \quad mg \sin \alpha - m_2 (N_2 - mg \cos \alpha) = m_2 a$$

$$2) \quad mg \sin \alpha - m_1 (N_1 - mg \cos \alpha) = -m_1 a$$

$$3) \quad S_2 = \frac{v_{max}^2}{2a_2}$$

$$4) \quad S_1 = \frac{v_{max}^2}{2a_1}$$

$$5) \quad S = S_1 + S_2$$

$$A \quad \frac{h}{S_1} = \sin \alpha \Rightarrow \frac{h}{S_2} = \frac{H}{S_1}$$

$$\frac{H}{S_2} = \sin \alpha$$

$$\sin \alpha = \sqrt{1 - \cos^2 \alpha} = \sqrt{1 - \left(\frac{24}{25}\right)^2} = \frac{7}{25}$$

$$S_1 = \frac{25h}{7}$$

$$U_{\max}^2 = 2a_1 \cdot S_1 = 2 \cdot 2 \cdot 5 = 20 \left(\frac{m}{c}\right)^2$$

$$S_2 = \frac{25H}{7} ; S_1 = \frac{25 \cdot 1,4}{7} = 5 \text{ м}$$

$$U_{\max} = \sqrt{20 \frac{m^2}{c^2}} = 2\sqrt{5} \frac{m}{c}$$

3) $-a_1 = g \sin \alpha - \mu_1 g \cos \alpha \Rightarrow$

$$-a_1 = g (\sin \alpha - \mu_1 \cos \alpha) = 10 \left(\frac{7}{25} - \frac{1 \cdot 24}{2 \cdot 25} \right) = -2 \frac{m}{c^2}$$

$$a_1 = 2 \frac{m}{c^2}$$

4) ЗЦЗ

$$E_n = A_{\text{Frp}}, \text{ м.к } U_A = 0 \quad (U_{\text{конера}} = 0)$$

$$mg(h+H) = \mu_1 N_1 S_1 + \mu_2 N_2 S_2 ; N_1 = N_2 ; F_T = \text{const}$$

5) $oy: N = mg \cos \alpha$
 $ox: ma = F_{\text{Frp}}$

6) $mg(h+H) = \mu_1 mg \cos \alpha S_1 + \mu_2 mg \cos \alpha S_2$

$$h+H = 0,5 \cdot \frac{24}{25} \cdot S_1 + 0,06 \cdot \frac{24}{25} \cdot S_2$$

$$h+H = 0,48 S_1 + 0,0576 S_2$$

7) $S = S_1 + S_2$

$$S = AB$$

$$\sin \alpha = \frac{7}{25}$$

$$\frac{7}{25} = \frac{BC}{AB}$$

$$\frac{h+H}{S} = \frac{7}{25} ; \frac{h+H}{S_1 + S_2} = \frac{7}{25} \Rightarrow$$

$$\frac{h+H}{S} = \frac{7(S_1 + S_2)}{25}$$

⑥ Amplitude

$$\frac{7(S_1 + S_2)}{25} = 0,48 S_1 + 0,0576 S_2 \quad | \cdot 25$$

$$7(S_1 + S_2) = 12 S_1 + 1,44 S_2$$

$$5,56 S_2 = 5 S_1$$

$$S_1 = 1,112 S_2$$

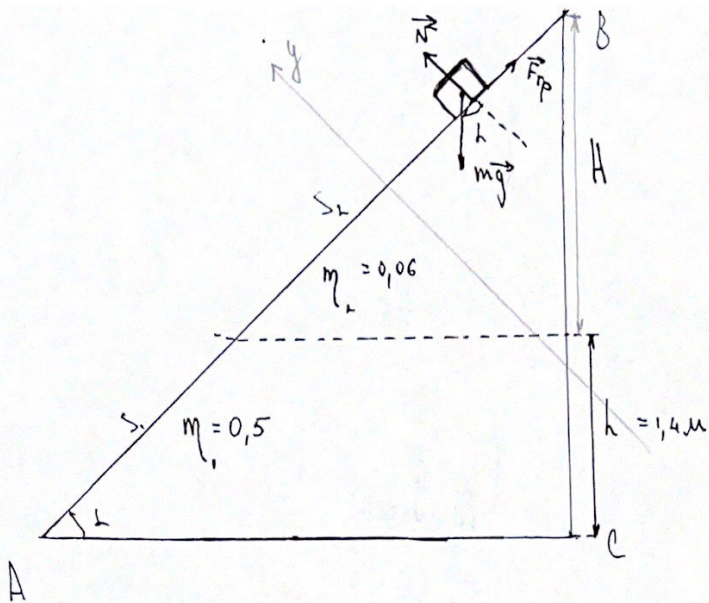
$$S_1 = 5 \mu \text{ (no u. 2), Aug}$$

$$S_2 = \frac{5}{1,112} = 4,496 \mu$$

$$S = S_1 + S_2 = 5 + 4,496 = \underline{9,496 \mu}$$

Antwort: 1) $v_{\max} = 2\sqrt{5} \frac{m}{s}$

2) $S = 9,496 \mu$



$$\frac{AB}{AC} = \frac{24}{25}$$

Решение

$$E_{\text{к}} = A_{\text{спр}}$$

1) П.к. нач. скорость = 0, то $E_{\text{к.0}} = 0$, ссыл 3(3)

$E_{\text{п}} = A_{\text{Fтр}}$, т.к. $F_{\text{тр}}$ является эквивалентной силой, направленной по гипотенузе и отталкивает \Rightarrow

$$F_{\text{тр}} = mN; \quad mg(h+H) = m_1 N_1 S_1 + m_2 N_2 S_2; \quad N_1 = N_2, \text{ т.к. } F_{\text{тр}} = \text{const},$$

$$A) \quad mg(h+H) = m_1 N_1 S_1 + m_2 N_1 S_2$$

$$Oy: \quad N = mg \cos \alpha$$

$$Ox: \quad \Sigma F = ma; \quad ma = F_{\text{тр}}$$

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3) Найти ускорение на 1-м участке

$$ma = m g \cos \alpha$$

$$a_1 = m_1 \cdot g \cdot \cos \alpha$$

$$a_1 = 4,8 \frac{\text{м}}{\text{с}^2}$$

$$4) \quad m_1 g (h+H) = m_1 m g \cos \alpha S_1 + m_2 m g \cos \alpha S_2$$

$$h+H = 0,5 \cdot \frac{24}{25} \cdot S_1 + 0,06 \cdot \frac{24}{25} \cdot S_2$$

$$h+H = 0,48 S_1 + 0,0576 S_2$$

5)

$$S = S_1 + S_2$$

$$S = AB$$

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

$$\sin^2 \alpha = \sqrt{\frac{625}{625} - \frac{576}{625}}$$

$$\sin \alpha = \frac{7}{25}$$

$$\frac{7}{25} = \frac{BC}{AB} \quad ; \quad BC = H+h$$

$$\frac{H+h}{S} = \frac{7}{25}$$

$$\frac{H+h}{S_1+S_2} = \frac{7}{25} \Rightarrow H+h = \frac{7(S_1+S_2)}{25}$$

↑
Lepidum

6)

$$\frac{7(S_1+S_2)}{25} = 0,48 S_1 + 0,0576 S_2 \quad | \cdot 25$$

$$7(S_1+S_2) = 12 S_1 + 1,44 S_2$$

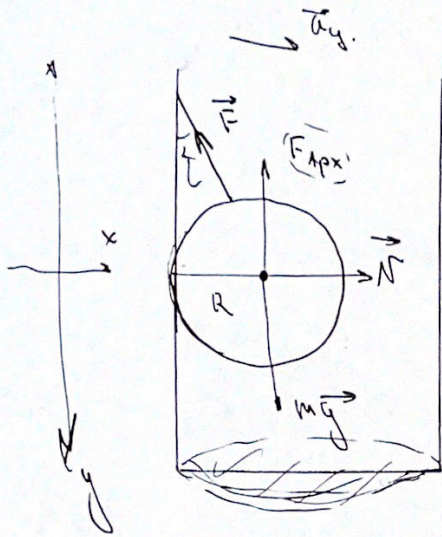
$$7S_1 + 7S_2 = 12S_1 + 1,44S_2$$

$$5,56 S_2 = 5 S_1$$

$$S_1 = 1,12 S_2$$

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23



$$1) \vec{F}_A + \vec{F} + m\vec{a}_y + m\vec{g} = 0 \quad (\text{not correct})$$

$$\left. \begin{array}{l} 0x: -F \cdot \sin \alpha + m a_y = 0 \\ 0y: -F \cos \alpha + mg + F_A = 0 \end{array} \right\}$$

$$\left. \begin{array}{l} F \cos \alpha = mg + F_A \\ F \sin \alpha = m a_y \end{array} \right| \vec{F}; a_y; F_A$$

$$\text{ctg} \alpha = \frac{mg + \rho g \cdot \frac{4}{3} \pi R^3}{m a_y}$$

$$a_{y,c} = \frac{mg + \rho g \cdot \frac{4}{3} \pi R^3}{\text{ctg} \alpha \cdot m}$$

$$a_{y,c} = \frac{52 + 24,435}{0,57 \cdot 5,2} = 24,8 \frac{\text{m}}{\text{s}^2}$$

$$2) \vec{F} = \frac{m \cdot a_{y,c}}{\sin 60} = 148,2 \text{ N}$$

$$S = S_1 + S_2$$

↳ Lepukokan

$$S = AB$$

$$\sin L = \frac{\sqrt{625 - 576}}{625 - 625}$$

$$\sin L = \frac{7}{25}, \text{ maka}$$

$$\frac{BC}{AB} = \frac{7}{25}$$

$$\frac{H+h}{S} = \frac{7}{25}$$

$$\frac{H+h}{S_1 + S_2} = \frac{7}{25}$$

S_1



~~AD~~

$$\sin L = \frac{h}{S_1}$$

$$\frac{7}{25} = \frac{1,4}{S_1}$$

$$S_1 = 5m$$

0,0182

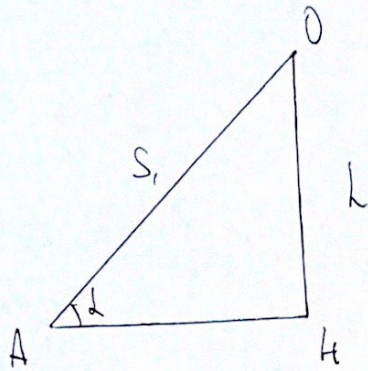
$$\begin{array}{r} 0,0256 \\ - 0,0064 \\ \hline \end{array}$$

$$7) \quad H+h = 0,53376 S_2 + 0,0576 S_2$$

$$H = 0,59136 S_2 - 1,4$$

4
Lpudauk

8)



$$\sin \alpha = \frac{h}{S_1}$$

$$\frac{7}{25} = \frac{1,4}{S_1}$$

$$S_1 = 5 \text{ m, maka}$$

$$S_2 = \frac{5}{1,12} = 4,496 \text{ m}$$

$$\underline{\underline{S = S_1 + S_2 = 5 + 4,496 = 9,496 \text{ m}}}$$

14,12

128,96
0,87

$$a = \frac{g}{2}$$

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

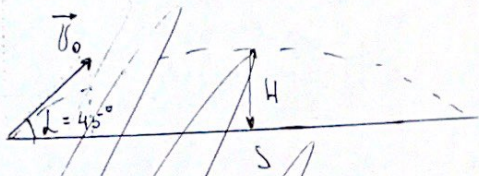
Угловое

$$1 \quad \frac{v^2}{2} = \frac{g}{2} \quad 2$$

$$mgH = m \frac{v^2}{2} + m_2 N_1 S_2$$

$$2mgH = m v^2 + m_2 mg \cos \alpha \cdot S_2 \quad | \quad H v^2 S_2$$

4. Үрвэлүүк



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

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

$$v_0 \cdot \frac{1}{2} = g t$$

$$v_0 \cdot \frac{1}{2} = 4 \cdot 10 \cdot 10$$

$$v_0 = 20 \frac{\text{м}}{\text{с}}$$