

# Часть 1

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

Шифр: **21205494**

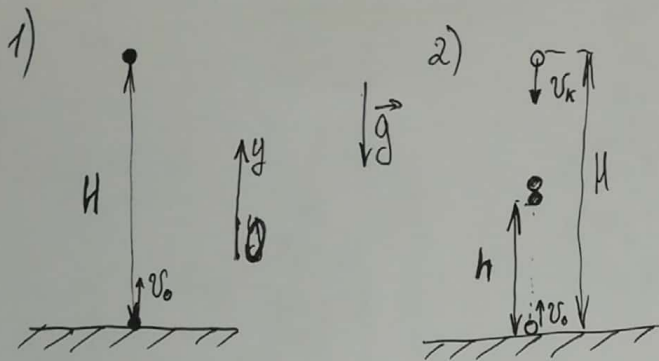
ID профиля: **223273**

Вариант 1

√1

Чистовик

①



$$1. \text{ ~~1) } O_y: H = v_0 t - \frac{gt^2}{2}~~$$

$$2) O_y: H = \frac{v_k^2 - v_0^2}{-2g} = \frac{v_0^2}{2g} \text{ т.к. } v_k = 0 \Rightarrow v_0 = \sqrt{2gH} \text{ для 1 мяча}$$

$$3) O_y: H - h = v_k t + \frac{gt^2}{2} \text{ для 1 мяча}$$

$$H - h = \frac{gt^2}{2}$$

$$4) O_y: h = v_0 t - \frac{gt^2}{2} \Rightarrow \text{из (2) и (3) } h = \sqrt{2gH}t - H + h \Rightarrow H = \sqrt{2gH}t$$

$$H^2 = 2gHt^2$$

$$\boxed{H = 2gt^2}$$

$$2. 5) \text{  ~~} H = 2gt^2 \text{ из (3) } H - h = \frac{gt^2}{2} \Rightarrow h = H - \frac{gt^2}{2}~~$$

$$h = 2gt^2 - \frac{gt^2}{2} = \frac{3}{2}gt^2 = 1,5gt^2$$

$$\boxed{h = 1,5gt^2}$$

6)  $S_1$  - путь 1 мяча до ~~столкновения~~ столкновения

$S_2$  - путь 2 мяча до столкновения

$$S_1 = H + H - h = 2H - h$$

$$S_2 = h$$

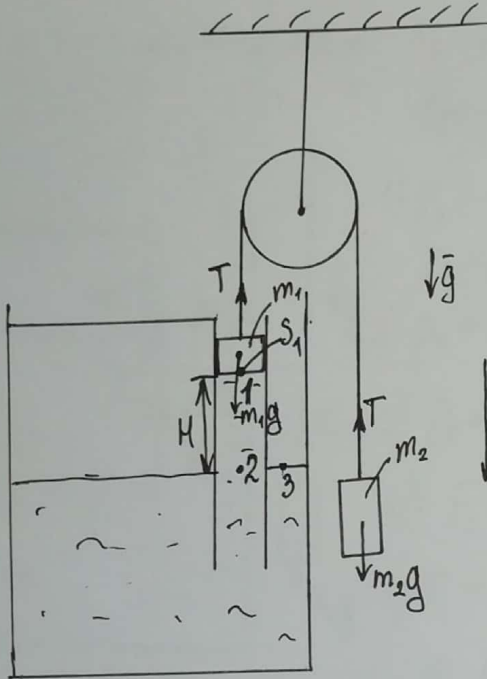
$$\Rightarrow \begin{cases} S_1 = 2 \cdot 2gt^2 - 1,5gt^2 = gt^2(4 - 1,5) = 2,5gt^2 \\ S_2 = 1,5gt^2 \end{cases}$$

$$\boxed{\frac{S_1}{S_2} = \frac{2,5gt^2}{1,5gt^2} = \frac{25}{15} = \frac{5}{3}}$$

$$\text{Ответ: } 1) H = 2gt^2 \quad 3) \frac{S_1}{S_2} = \frac{5}{3}$$

√2

Чистовик



~~8 см = 0,08 м~~  
 $S_1 = 8 \text{ см}^2$   
 $m_1 = 50 \text{ г}$   
 $H = 10 \text{ см}$   
 $m_2 = 120 \text{ г}$

- 1)  $p_1$  - ?
- 2)  $m_2$  - ?
- 3)  ~~$m_1$~~   $h$  - ?

1)  ~~$p_1 = \frac{F_1}{S_1} + p_0$~~   
 ~~$F_1 = m_1 g - T$~~   
 $p_1 = \frac{F_1}{S_1} + p_0$   
 $F_1$  - сила давления поршня

2)  $p_2 = p_3$   
 $p_2 = p_3$  т.к. на одном уровне  
 $p_2 = p_0 + \frac{F_1}{S_1} + \rho g H$

$p_2 = p_1 + \rho g H$   
 $p_1 = -\rho g H + p_2$

$p_1 = p_0 - \rho g H$

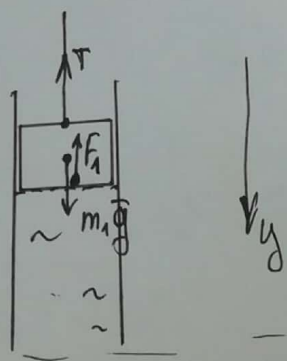
$p_1 = 100 \cdot 10^3 - 1000 \cdot 10 \cdot 0,1 = 10^5 - 10^3 =$   
 $= 10^3 (100 - 1) = 99 \cdot 10^3 = 99000 \text{ Па}$

$p_1 = 99 \text{ кПа}$

2. 3)  $m_2 g = T$  (23Н для тела в равновесии)

4) 23Н для ~~поршня~~ ~~пружины~~:  $m_1 g - T - F_1 = 0$

увеличенное изображение:



5)  ~~$F_1 = p_1 S_1$~~   $\frac{F_1}{S_1} = p_1 - p_0$

$F_1 = (p_1 - p_0) S_1$

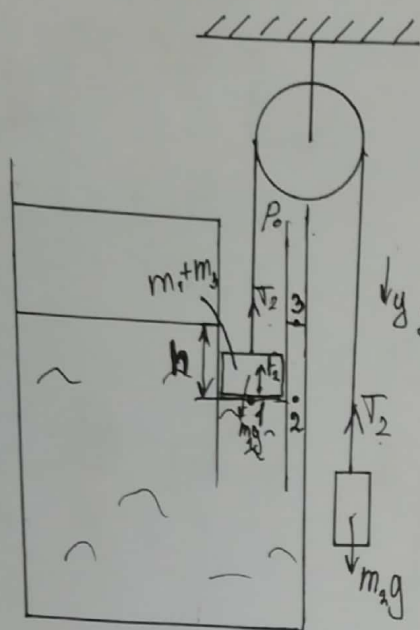
6)  $m_1 g = m_2 g + (p_1 - p_0) S_1$

$m_2 = \frac{m_1 g - (p_1 - p_0) S_1}{g}$

$m_2 = \frac{0,05 \cdot 10 - (99 \cdot 10^3 - 100 \cdot 10^3) \cdot 8 \cdot 10^{-4}}{10}$

$m_2 = \frac{0,5 + 10^3 \cdot 8 \cdot 10^{-4}}{10} = \frac{0,5 + 8 \cdot 10^{-1}}{10} = \frac{0,5 + 0,8}{10} = \frac{1,3}{10} = 0,13 \text{ кг}$

$m_2 = 130 \text{ г}$



3.  $M = m_1 + m_3$

Предположу, что ~~поршень~~ <sup>поршень</sup> опустился ниже уровня воды система ~~стала~~ <sup>стала</sup> в равновесии

1)  $p_3 = p_0$

$p_2 = p_1$  т.к. на одном уровне находятся точки

2)  $p_1 = \frac{F_2}{S_1} + p_0$

3)  $p_2 = p_3 + \rho g h = p_0 + \rho g h$

4)  $F_2 = Mg - T_2$  (2ЗН для "нового" блока с шреп)

5)  $T_2 = m_2 g \Rightarrow T_2 = T$

$\Rightarrow F_2 = Mg - m_2 g$

6) (3) = (2) :  $p_0 + \rho g h = \frac{F_2}{S_1} + p_0 \Rightarrow \rho g h = \frac{F_2}{S_1}$

7)  $\rho g h = \frac{(M - m_2)g}{S_1} \Rightarrow \rho h = \frac{M - m_2}{S_1}$

8)  $h = \frac{M - m_2}{S_1 \cdot \rho} \Leftrightarrow h = \frac{m_1 + m_3 - m_2}{S_1 \cdot \rho}$

$h = \frac{0,05 + 0,12 - 0,13}{8 \cdot 10^{-4} \cdot 10^3} = \frac{0,05 - 0,01}{8 \cdot 10^{-1}} = \frac{0,04}{8} \cdot 10 = \frac{0,4}{8} = \frac{0,1}{2} = 0,05 \text{ м}$

$h = 5 \text{ см}$

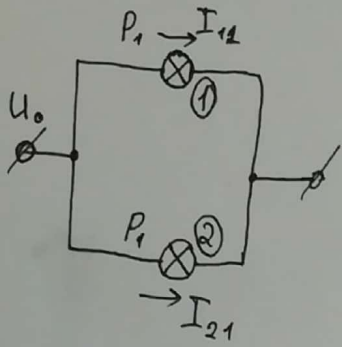
- Ответ: 1)  $p_1 = 99 \text{ кПа}$   
 2)  $m_2 = 130 \text{ г}$   
 3)  $h = 5 \text{ см}$



N3

Чистовик

(4)

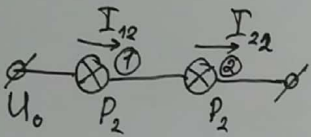


$$1. 1) P_1 = U_0 \cdot I_{11} \Rightarrow I_{11} = \frac{P_1}{U_0} \Rightarrow I_{11} = \frac{20 \text{ Вт}}{12 \text{ В}} = 1,67 \text{ А}$$

$$I_{11} = 1\frac{2}{3} \text{ А}$$

$$2) P_1 = U_0 \cdot I_{21} \Rightarrow I_{21} = \frac{P_1}{U_0} \Rightarrow I_{21} = \frac{20 \text{ Вт}}{12 \text{ В}} = 1\frac{2}{3} \text{ А} \approx 1,67 \text{ А}$$

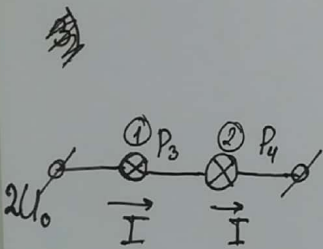
2. 1)  $I_{12} = I_{22}$  т.к. последовательное соединение.



$$2) \begin{cases} P_2 = U_1 I_{12} \\ P_2 = U_2 I_{22} = U_2 I_{12} \\ U_0 = U_1 + U_2 \end{cases}$$

$$2P_2 = I_{12} (U_1 + U_2)$$

$$I_{12} = \frac{2P_2}{U_0} \Rightarrow I_{12} = I_{22} = \frac{2 \cdot 6,6 \text{ Вт}}{12 \text{ В}} = 1,1 \text{ А}$$



3. 1) т.к. лампы одинаковые  $\Rightarrow$  и мощности тоже одинаковы.  $P_3 = P_4 = P$ .  $I_1 = I_2 = I$  т.к. последовательно

$$2) P = U_{13} I$$

$$3) P = U_{23} I$$

$$4) U_{13} + U_{23} = 2U_0$$

$$5) \frac{P}{P} = \frac{U_{13} I}{U_{23} I} \Rightarrow \frac{U_{13}}{U_{23}} = 1 \Rightarrow U_{13} = U_{23}$$

$$6) (4): U_{13} + U_{23} = 2U_0 \Rightarrow U_{13} = U_0$$

$$7) P = U_0 I$$

см лист 5

~~8)  $2U_0 = R I$~~  ~~9)  $U_0 = R I$~~  ~~10)  $U_0 = 2R I$~~  ~~11)  $U_0 = R I$~~  ~~12)  $U_0 = R I$~~  ~~13)  $U_0 = R I$~~  ~~14)  $U_0 = R I$~~  ~~15)  $U_0 = R I$~~  ~~16)  $U_0 = R I$~~  ~~17)  $U_0 = R I$~~  ~~18)  $U_0 = R I$~~  ~~19)  $U_0 = R I$~~  ~~20)  $U_0 = R I$~~  ~~21)  $U_0 = R I$~~  ~~22)  $U_0 = R I$~~  ~~23)  $U_0 = R I$~~  ~~24)  $U_0 = R I$~~  ~~25)  $U_0 = R I$~~  ~~26)  $U_0 = R I$~~  ~~27)  $U_0 = R I$~~  ~~28)  $U_0 = R I$~~  ~~29)  $U_0 = R I$~~  ~~30)  $U_0 = R I$~~  ~~31)  $U_0 = R I$~~  ~~32)  $U_0 = R I$~~  ~~33)  $U_0 = R I$~~  ~~34)  $U_0 = R I$~~  ~~35)  $U_0 = R I$~~  ~~36)  $U_0 = R I$~~  ~~37)  $U_0 = R I$~~  ~~38)  $U_0 = R I$~~  ~~39)  $U_0 = R I$~~  ~~40)  $U_0 = R I$~~  ~~41)  $U_0 = R I$~~  ~~42)  $U_0 = R I$~~  ~~43)  $U_0 = R I$~~  ~~44)  $U_0 = R I$~~  ~~45)  $U_0 = R I$~~  ~~46)  $U_0 = R I$~~  ~~47)  $U_0 = R I$~~  ~~48)  $U_0 = R I$~~  ~~49)  $U_0 = R I$~~  ~~50)  $U_0 = R I$~~  ~~51)  $U_0 = R I$~~  ~~52)  $U_0 = R I$~~  ~~53)  $U_0 = R I$~~  ~~54)  $U_0 = R I$~~  ~~55)  $U_0 = R I$~~  ~~56)  $U_0 = R I$~~  ~~57)  $U_0 = R I$~~  ~~58)  $U_0 = R I$~~  ~~59)  $U_0 = R I$~~  ~~60)  $U_0 = R I$~~  ~~61)  $U_0 = R I$~~  ~~62)  $U_0 = R I$~~  ~~63)  $U_0 = R I$~~  ~~64)  $U_0 = R I$~~  ~~65)  $U_0 = R I$~~  ~~66)  $U_0 = R I$~~  ~~67)  $U_0 = R I$~~  ~~68)  $U_0 = R I$~~  ~~69)  $U_0 = R I$~~  ~~70)  $U_0 = R I$~~  ~~71)  $U_0 = R I$~~  ~~72)  $U_0 = R I$~~  ~~73)  $U_0 = R I$~~  ~~74)  $U_0 = R I$~~  ~~75)  $U_0 = R I$~~  ~~76)  $U_0 = R I$~~  ~~77)  $U_0 = R I$~~  ~~78)  $U_0 = R I$~~  ~~79)  $U_0 = R I$~~  ~~80)  $U_0 = R I$~~  ~~81)  $U_0 = R I$~~  ~~82)  $U_0 = R I$~~  ~~83)  $U_0 = R I$~~  ~~84)  $U_0 = R I$~~  ~~85)  $U_0 = R I$~~  ~~86)  $U_0 = R I$~~  ~~87)  $U_0 = R I$~~  ~~88)  $U_0 = R I$~~  ~~89)  $U_0 = R I$~~  ~~90)  $U_0 = R I$~~  ~~91)  $U_0 = R I$~~  ~~92)  $U_0 = R I$~~  ~~93)  $U_0 = R I$~~  ~~94)  $U_0 = R I$~~  ~~95)  $U_0 = R I$~~  ~~96)  $U_0 = R I$~~  ~~97)  $U_0 = R I$~~  ~~98)  $U_0 = R I$~~  ~~99)  $U_0 = R I$~~  ~~100)  $U_0 = R I$~~

ответ: 1)  $I_{11} = I_{21} = 1,67 \text{ А}$   
 2)  $I_{12} = I_{22} = 1,1 \text{ А}$   
 3)  $P = 20,4 \text{ Вт}$

N3

Чистовик

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$$8) 2U_0 = 2R \cdot I \Rightarrow U_0 = \alpha R \cdot I$$

$$9) U_0 = \alpha 2R \cdot I_{12} \Rightarrow \alpha \cdot 2R = \frac{U_0}{I_{12}} \Rightarrow \alpha R = \frac{U_0}{2I_{12}} \quad (2 \text{ цепи паралл. соединены к напряжению } U_0)$$

$$10) ~~P = U_0~~ I = \frac{U_0}{2R} = \frac{U_0}{U_0} \cdot 2I_{12} \Rightarrow I = 2I_{12}$$

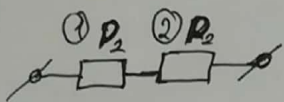
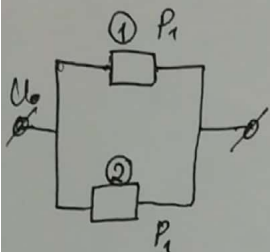
$$11) \boxed{P = U_0 \cdot 2I_{12}} = 2 \cdot 12 \cdot 1,1 = 26,4 \text{ Вт}$$

Ответ: 1)  $I_{12} = I_{21} = 1,67 \text{ А}$

2)  $I_{12} = I_{22} = 1,1 \text{ А}$

3)  $P = 26,4 \text{ Вт}$

√3



1)  $P_1 = U_0 I_1$   
 $P_1 = U_0 I_2$  } для параллельного соединения

$P_1 = U_0 I_1$

$P_2 = U_0 I_2$

$P_2 = U_1 I_2$

1.  $\frac{P_1}{U_0} = I_1 \Rightarrow I_{11} = \frac{20 \text{ Вт}}{10 \text{ В}} = 2 \text{ А}$   
 $\frac{P_1}{U_0} = I_2 \Rightarrow I_{21} = 2 \text{ А}$

2)  $P_2 = I_{12}^2 R$ , где  $R = \frac{U_0}{I_{11}} = 5 \text{ Ом}$

$\sqrt{\frac{P_2}{R}} = I_{12} \Rightarrow I_{12} = \sqrt{\frac{6,6}{5}} = 1,15 \text{ А}$

$P_2 = U_1 I_{12} \Rightarrow I_{12} = \frac{P_2}{U_0} = \frac{6,6}{12} = 0,55 \text{ А}$

$P_2 = U_2 I_{22}$   $I_{11} = I_{22} = 0,55 \text{ А}$

$U = 2IR$

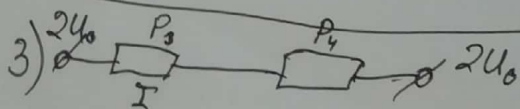
$P_2 = U_1 I_{12}$   $I_{12} = I_{22}$  послед

$P_2 = U_2 I_{22}$

$U_1 + U_2 = U_0$   $\frac{20}{12} = \frac{10}{6} = \frac{5}{3} = 1,66$

$2P_2 = I_{12} (U_1 + U_2)$

2)  $I_{12} = \frac{2P_2}{U_1 + U_2} = \frac{2 \cdot 6,6}{12,6} = 1,1 \text{ А}$



$P_3 = U_1 I$

$P_4 = U_2 I$

$P_3 + P_4 = 2U_0 I$

$P_3 = P_4$  не имеет накопления

$P_3 = U_0 I$

$I_{12} = U_0 / 2R \Rightarrow R = \frac{I_{12}}{2U_0}$

$R_{12} = \frac{2U_0}{I_{12}} \Rightarrow I = \frac{2U_0}{R}$

$P_3 = U_0^2 / R = \frac{U_0^2}{2U_0} \cdot I_{12}$

$P_3 = \frac{U_0}{2} \cdot I_{12} = \frac{6,6}{2} \cdot 1,1 =$

$= 2,2 \cdot 1,1 = 2,42 \text{ Вт}$

$P_3 = \frac{U_0 \cdot 2U_0}{R} = \frac{2U_0^2}{2U_0} \cdot I_{12} = 6,6 \cdot 1,1 =$

$= 7,26 \text{ Вт}$

$2P_3 = 2U_0 I$

$P_3 = U_0 I$

$$8 \text{ см}^2 = 8 \cdot 10^{-4} \text{ м}^2$$

Черновик

$$1 \text{ см}^2 = 0,01 \text{ м} \cdot 0,01 \text{ м} = 0,0001 \text{ м}^2$$

$$10^{-2} \cdot 10^{-2} = 10^{-4}$$

$$\boxed{50 \text{ м} = 0,05 \text{ км}}$$

$$0,1 \text{ км} = 100 \text{ м}$$

$$0,05 \text{ км}$$

$$H = 10 \text{ см} = 0,1 \text{ м}$$

$$R_1 = \frac{U_0}{I_{12}} = \frac{12,3}{5} = \frac{36}{5} = 7,2$$

$$R_2 = \frac{U_0}{2I_{12}} = \frac{12}{2 \cdot 1,1} = \frac{6}{1,1} = 5,45$$



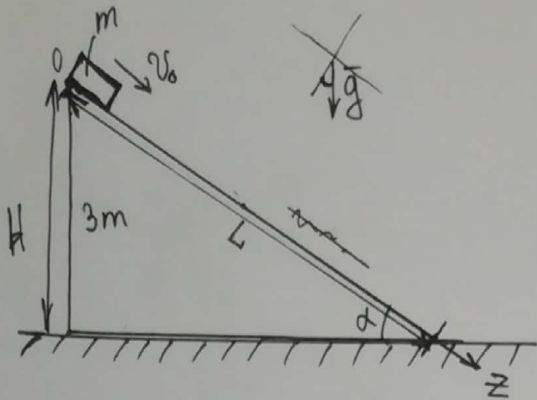
# Часть 2

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

Шифр: **21205494**

ID профиля: **223273**

Вариант 1



$$0 = v_0 t + \frac{g \cdot \sin \alpha \cdot t^2}{2} \Rightarrow \text{при } v_0 = 0$$

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

$$\sin \alpha = \frac{H}{L} \Rightarrow L = \frac{H}{\sin \alpha}$$

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

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

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

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

$$t = \sqrt{\frac{2H}{g(1 - \cos^2 \alpha)}} = \sqrt{\frac{2H}{g(1 - (\frac{4}{5})^2)}}$$

$$t = \sqrt{\frac{2H \cdot 25}{9g}} = \frac{5}{3} \sqrt{\frac{2H}{g}}$$

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

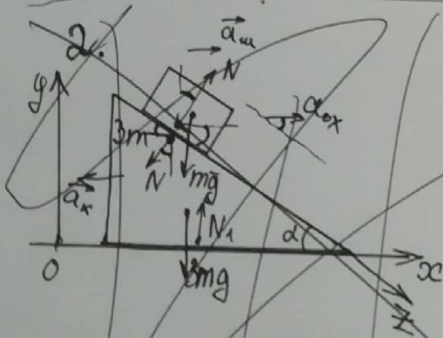
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- 1) H - ?
- 2) a<sub>x</sub> - ?
- 3) t<sub>1</sub> - ?

$$1 - \frac{16}{25} = \frac{9}{25}$$

$$\sin \alpha = \sqrt{1 - \cos^2 \alpha} = \sqrt{1 - \frac{16}{25}} = \sqrt{\frac{9}{25}}$$

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



1) O x гиз кунда:  $N \sin \alpha = 3ma_x$

O y гиз кунда:  $N + N \cos \alpha = 3mg$

$$\Rightarrow \frac{N \sin \alpha}{N \cos \alpha} = \frac{3ma_x}{3mg} \Rightarrow \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{a_x}{g} \Rightarrow \frac{a_x}{g} = \frac{3}{4}$$

$$a_x = \frac{3}{4}g$$

2) O x гиз кунда:  $N \cdot \sin \alpha = ma_{\text{ин}}$

O y гиз кунда:  $N \cdot \cos \alpha = mg \Rightarrow a_{\text{ин}} = \frac{3}{4}g$

3)  $a_{rx} = -|\vec{a}_x|$

$a_{\text{ин}x} = |\vec{a}_{\text{ин}}|$

3. 1)  $a_{\text{абс}} = a_{\text{ин}}$   
 $a_{\text{отн}} = a_0$   
 $a_{\text{нр}} = a_x$

$$\vec{a}_{\text{ин}} = \vec{a}_0 + \vec{a}_x$$

$$\vec{a}_{\text{ин}} - \vec{a}_x = \vec{a}_0$$

O x:  $a_{\text{ин}} + a_x = a_{0x}$

$$a_{0x} = \frac{3}{4}g + \frac{3}{4}g = \frac{6}{4}g = \frac{3}{2}g$$

2) O z:  $a_{0z} = a_{0x} \cdot \cos \alpha$

3) O z:  $L = v_0 t_1 + \frac{a_{0z} t_1^2}{2}$

из условия  $\frac{H}{\sin \alpha} = \frac{a_{0x} \cos \alpha t_1^2}{2}$

$$t_1 = \sqrt{\frac{2H}{a_{0x} \cos \alpha \sin \alpha}}$$

ан нет 2

√4  
2.

Чистовик

(2)

1) 23H ось горизонтальная:

$$N \cdot \sin \alpha = 3ma_x$$

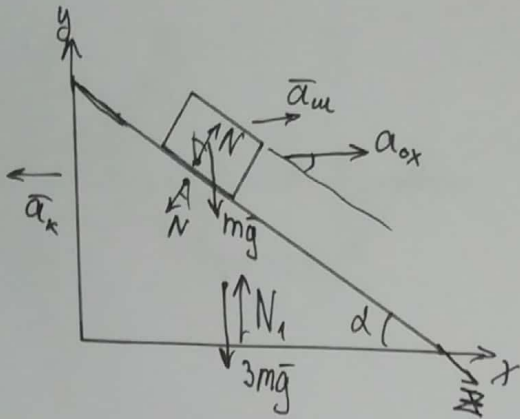
Oy ось вертикальная

$$N_1 - 3mg - N \cdot \cos \alpha = 0$$

1.1)  $N_1 = 4mg$  (для системы шайба-масса на Oy (23H))

$$\Rightarrow mg = N \cdot \cos \alpha$$

$$\frac{N \sin \alpha}{N \cos \alpha} = \frac{3ma_x}{mg} \Rightarrow \frac{3}{5} = \frac{3a_x}{g} \Rightarrow \boxed{a_x = \frac{g}{4}}$$



2) 23H ось вертикальная: Oy:  $mg = N \cdot \cos \alpha$

Ox:  $N \cdot \sin \alpha = ma_{\text{along}}$

$$\frac{ma_{\text{along}}}{mg} = \frac{N \sin \alpha}{N \cos \alpha} \Rightarrow a_{\text{along}} = \frac{3}{4}g$$

$$3) \vec{a}_0 = \vec{a}_{\text{along}} - \vec{a}_x$$

$$a_{0x} = a_{\text{along}} + a_x = g$$

$$4) L = v_0 t_1 + \frac{a_{0z} \cdot t_1^2}{2} \Rightarrow L = \frac{a_{0z} \cdot t_1^2}{2}$$

$$5) a_{0z} = a_{0x} \cdot \cos \alpha$$

$$6) \frac{H}{\sin \alpha} = L \Rightarrow \frac{H}{\sin \alpha} = \frac{a_{0x} \cdot \cos \alpha \cdot t_1^2}{2} \Rightarrow t_1 = \sqrt{\frac{2H}{a_{0x} \cdot \cos \alpha \cdot \sin \alpha}}$$

$$t_1 = \sqrt{\frac{2H}{g \cdot \cos \alpha \cdot \sin \alpha}} = \sqrt{\frac{2H}{g \cdot \frac{4}{5} \cdot \frac{3}{5}}} = \sqrt{\frac{2H \cdot 5^2}{g \cdot 2 \cdot 3}} = 5\sqrt{\frac{H}{6g}}$$

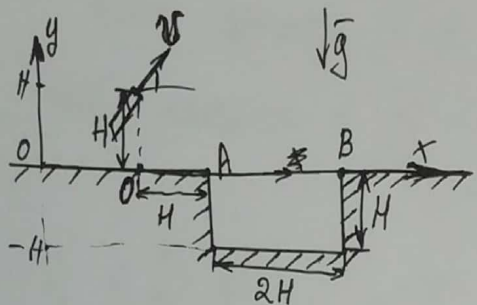
Ответ: 1)  $t = \frac{5}{3} \sqrt{\frac{2H}{g}}$

2)  $a_x = \frac{g}{4}$

3)  $t_1 = 5\sqrt{\frac{H}{6g}}$

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Условие



Дано:  
 $S$   
 $v = \sqrt{0,5gH}$   
 $H$   
 1)  $t_1$   
 2)  $\text{tg } \alpha$  или?  
 3)  $\alpha < \text{tg } \alpha < \text{se}$

1. 1)  $V$ -объем бака ③  
 ~~$t = \frac{V}{S \cdot v}$~~   ~~$v = \sqrt{0,5gH}$~~

2) За время  $\Delta t$  из шланга выливается  $V_0 = S \cdot v \cdot \Delta t$   
 $\frac{V_0}{m}$   
 3) Чтобы бак наполнился  $\Delta t = t_1$   
 ~~$V_0 = V$~~   
 $V_0 = V$

4)  ~~$V = S v t_1$~~   $V = S v t_1$

5)  $V = S_2 \cdot H = \pi \cdot H^2 \cdot H = \pi H^3$

6)  $\pi H^3 = S v t_1 \Rightarrow t_1 = \frac{\pi H^3}{S v}$

$t_1 = \frac{\pi H^3}{S \cdot \sqrt{0,5gH}} \Leftrightarrow t_1^2 = \frac{\pi^2 H^6}{S^2 \cdot 0,5gH} \Rightarrow t_1 = \frac{\pi H^2 \sqrt{H}}{S \sqrt{0,5g}}$

2.  $O_y: 0 = v \cdot \sin \alpha t - \frac{g t^2}{2} + H$

$O_x: H = v \cdot \cos \alpha t \Rightarrow t = \frac{H}{v \cdot \cos \alpha} = \frac{H}{\sqrt{0,5gH} \cdot \cos \alpha} = \frac{\sqrt{H}}{\sqrt{0,5g} \cos \alpha} = \sqrt{\frac{2H}{g}} \frac{1}{\cos \alpha}$

~~$0 = \sqrt{0,5gH} \cdot \sin \alpha \cdot \sqrt{\frac{2H}{g}} \frac{1}{\cos \alpha} - \frac{g \cdot 2H}{2g \cdot \cos^2 \alpha} + H \Rightarrow 2H = \sqrt{0,5}$~~

$0 = \sqrt{0,5gH} \cdot \sin \alpha \cdot \sqrt{\frac{2H}{g}} \frac{1}{\cos \alpha} - \frac{g \cdot 2H}{2g \cdot \cos^2 \alpha} + H = \frac{1}{\sqrt{2}} \cdot \sqrt{g} \cdot \sqrt{H} \cdot \frac{\sqrt{2H}}{\sqrt{g}} \text{tg } \alpha - \frac{H}{\cos^2 \alpha} + H$

$0 = H \cdot \text{tg } \alpha - \frac{H}{\cos^2 \alpha} + H = H \left( \text{tg } \alpha - \frac{1}{\cos^2 \alpha} \right) + H$

~~$0 \Rightarrow \text{tg } \alpha - \frac{1}{\cos^2 \alpha} \Rightarrow \text{tg } \alpha = \frac{1}{\cos^2 \alpha} \Rightarrow \text{tg } \alpha = 1 + \text{tg}^2 \alpha$~~

~~$2 \cdot \text{tg } \alpha + \text{tg}^3 \alpha = 0 \quad \text{tg } \alpha \geq 0 \quad \text{tg } \alpha = \frac{1}{\cos^2 \alpha} \Rightarrow \text{tg } \alpha =$~~

~~$0 \Rightarrow \text{tg } \alpha \text{tg } \alpha = 0$~~

~~$b^2 - b + 2 = 0$~~

~~$\Delta = 1 - 8 = -7 \Rightarrow \text{корней нет}$~~

$-1 = \text{tg } \alpha - \frac{1}{\cos^2 \alpha}$

$\text{tg } \alpha + 1 = \frac{1}{\cos^2 \alpha} \Rightarrow \text{tg } \alpha + 1 = 1 + \text{tg}^2 \alpha$

$\text{tg } \alpha = \text{tg}^2 \alpha$

$\boxed{\text{tg } \alpha = 0}$  или

$\boxed{\text{tg } \alpha = 1}$

или  $\text{tg } \alpha = 4$



3. Чтобы попасть в бак нужно попасть между A и B

Чтобы попасть в A  $\text{tg} \alpha = 1$  или  $\text{tg} \alpha = 0$

Чтобы попасть в B  $O_y: 0 = v \cdot \sin \alpha t_2 - \frac{g t_2^2}{2} + H$

$O_x: H + 2H \approx v \cdot \cos \alpha t_2$

1)  $t_2 \leq \frac{3H}{v \cos \alpha} = \frac{3\sqrt{H}}{\sqrt{0,5Hg} \cdot \cos \alpha} \leq \frac{3\sqrt{H}}{\sqrt{0,5g} \cdot \cos \alpha} \leq \frac{3}{\cos \alpha} \sqrt{\frac{2H}{g}}$

3)  $0 = \frac{1}{\sqrt{2}} \sqrt{gH} \cdot \sin \alpha \cdot \frac{3}{\cos \alpha} \sqrt{\frac{2H}{g}} - \frac{g \cdot 9 \cdot 2H}{2g \cdot \cos^2 \alpha} + H$

$0 = 3 \text{tg} \alpha H - \frac{9H}{\cos^2 \alpha} + H$

$3 \text{tg} \alpha - \frac{9}{\cos^2 \alpha} + 1 = 0$

~~Ошибка~~

$3 \text{tg} \alpha - 9(1 + \text{tg}^2 \alpha) + 1 = 0$

$3 \text{tg} \alpha - 9 - 9 \text{tg}^2 \alpha + 1 = 0$

$3 \text{tg} \alpha (1 - 3 \text{tg} \alpha) = 8$

$-9 \text{tg}^2 \alpha + 3 \text{tg} \alpha - 8 = 0$

$\text{tg} \alpha = b$

$-9b^2 + 3b - 8 = 0$   $\text{так } b > 0$  т.к. угол острый с горизонталем

или лист 5

~~$D = 9 + 4 \cdot 8 \cdot 9 = 324$~~

~~$b_1 = \frac{-3 + \sqrt{324}}{-18} = \frac{\sqrt{81}}{-18} + \frac{1}{6} \approx \frac{6,4 - 3}{-18} \approx -0,189$~~

~~$b_2 = \frac{-3 - \sqrt{324}}{-18} = 0,52 \Rightarrow \text{tg} \alpha = 0,52$~~

~~$0,52 \leq \text{tg} \alpha \leq 1$  или  $0 \leq \text{tg} \alpha \leq 0,52 \Rightarrow 0 \leq \text{tg} \alpha \leq 1$~~

Ответ: 1)  $t_1 = \frac{\pi H \sqrt{H}}{5 \cdot \sqrt{0,5g}} = \frac{\pi H \sqrt{2H}}{5 \sqrt{g}}$

2)  $\text{tg} \alpha = 1$  или  $\text{tg} \alpha = 0$

3)  ~~$0,52 \leq \text{tg} \alpha \leq 1$~~   $0 \leq \text{tg} \alpha \leq 1$



√5

Чистовик

⑤

$$-9b^2 + 3b - 8 = 0$$

$$D = 3^2 - 4 \cdot 8 \cdot 9 = 9(1 - 32) < 0 \Rightarrow \emptyset$$

в точку В попасть нельзя

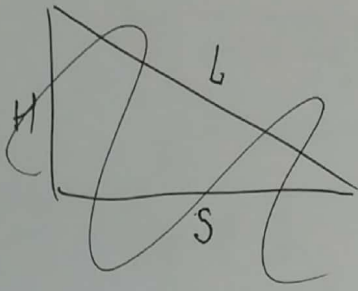
⇒ и дальше В тоже

⇒  $\operatorname{tg} \alpha = 1$  или  $\operatorname{tg} \alpha = 0$

Ответ: 1)  $t_1 = \frac{\pi H^2}{S} \sqrt{\frac{2H}{g}}$

2)  $\operatorname{tg} \alpha = 0$ ;  $\operatorname{tg} \alpha = 1$

цирковик



$$\frac{H}{S} = \operatorname{tg} \alpha = \frac{\sin \alpha}{\cos \alpha}$$

$$S = \frac{H \cdot \cos \alpha}{\sin \alpha}$$

$$S = v_0 t$$
$$S = 0$$

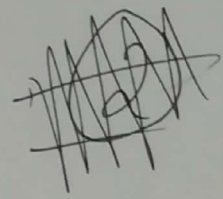
$$H = \frac{gt^2}{2}$$

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

$$5 \sqrt{\frac{2H}{9g}} = 5 \sqrt{\frac{H}{4,5g}}$$

~~Черновик~~

Черновик



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$$t_1 = \sqrt{\frac{2H}{a_{\text{ax}} \cdot \cos\alpha \cdot \sin\alpha}}$$

$$t_1 = \sqrt{\frac{2H}{\frac{3}{2}g \cdot \frac{4}{5} \cdot \frac{3}{5}}} = \sqrt{\frac{2H \cdot 5^2 \cdot 2}{3^2 \cdot 4 \cdot g}} = \frac{5}{3} \sqrt{\frac{H}{g}}$$

Ответ: 1)  $t = \frac{5}{3} \sqrt{\frac{2H}{g}}$

2)  $a_{\text{ax}} = \frac{3}{4}g$

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