Часть 1

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

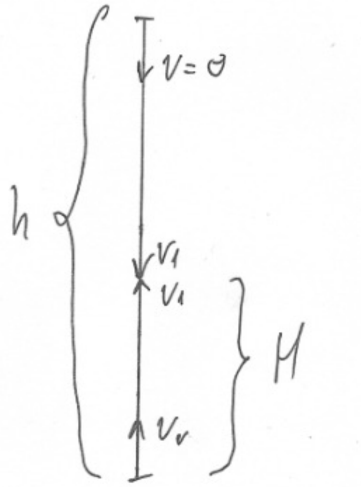
Шифр: **21205681**

ID профиля: **827844**

Вариант 1

№1

Чистовик



В момент столкновения ~~мячи~~ по ЗСЭ мячи имеют одинаковую скорость v_1

$H = \frac{v_0 + v_1}{2} t_1$ — путь 2го мяча

$v_1 = g t_1$ — для ~~первого~~ ~~второго~~ первого мяча

$v_1 = v_0 - g t_1$ — для ~~второго~~ ~~первого~~ второго мяча

$v_0 = v_1 + g t_1 = 2 g t_1.$

$H = \frac{v_0 + v_1}{2} t_1 = \frac{2 g t_1 + g t_1}{2} t_1 = \frac{3g}{2} t_1^2$

t_1 — время полета второго мяча, оно же время падения первого

$t_1^2 = \frac{2}{3} \frac{H}{g}$

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

$v_0 = 2 g t_1 = \underline{2\sqrt{\frac{2}{3} g H}}$

h — максимальная в-та подъема первого мяча

$h = \frac{0 - v_0^2}{-2g} = \frac{v_0^2}{2g}$

$S = h + (h - H) = 2h - H$

$S = \frac{v_0^2}{g} - H = \frac{8gH}{3g} - H = \frac{8}{3} H - H = \underline{\frac{5}{3} H}$

Ответ: 1) $t_1 = \sqrt{\frac{2H}{3g}}$, 2) $v_0 = 2\sqrt{\frac{2}{3} g H}$, 3) $S = \frac{5}{3} H$

№2 Чистовик

При изотерме:

$p_0 V_0 = p_к V_к$

$\frac{p_0}{p_к} = \frac{V_к}{V_0}$, т. к. это равенство не выполняется часть пара сконденсировалась, т. е. $p_к = p_н$

$p_н$ — давление нас. пара

$\frac{p_0}{p_к} = \frac{1}{1,8} \neq \frac{V_к}{V_0} = \frac{1}{3,5}$

$p_к = 1,8 p_0 = p_н$

$p_0 = \frac{p_н}{1,8} = \frac{9,5 \cdot 10^5 Па}{1,8} = \underline{27,8 кПа}$

$\nu_0 = \frac{m}{\mu}$

$p_0 V_0 = \nu_0 RT$ — нач. сост.

$p_н V_к = \nu_к RT$ — кон. сост. $\nu_к$ — оставшийся пар

$\frac{p_0}{p_н} \frac{V_0}{V_к} = \frac{\nu_0}{\nu_к} = \frac{1}{1,8} \cdot 3,5$

$\nu_к = \frac{18}{35} \nu_0$

$V_к = \frac{\nu_к RT}{p_н} = \frac{18 \nu_0 RT}{35 p_н} = \frac{18 m RT}{35 \mu p_н} = \frac{18 \cdot 3г \cdot 8,31 \frac{Дж}{моль К} \cdot 354 К}{35 \cdot 18 \frac{г}{моль} \cdot 9,5 \cdot 10^5 Па} = 5 \cdot 10^{-3} м^3 = 5л$

Ответ: 1) $p_0 = \frac{p_н}{1,8} = 27,8 кПа$

2) $V_к = \frac{18 m RT}{35 \mu p_н} = 5л$

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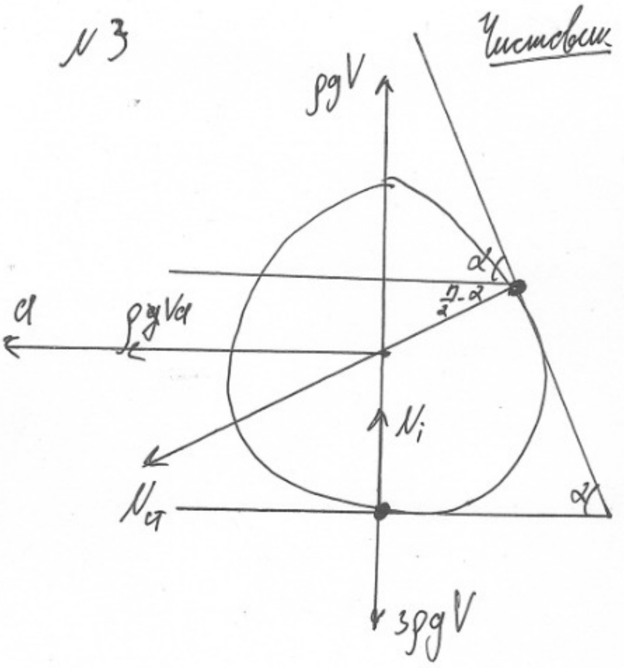
№3 Чистовик



1) ВЗН на верт ось $\quad m = 3\rho V$

$$\rho gV + N_1 - 3\rho gV = 0$$

$$N_1 = 2\rho gV = \underline{\frac{8}{3}\pi\rho g R^3}$$

$$V = \frac{4}{3}\pi R^3$$

~~2) $a = 2\omega^2 R$ — т.к. ускорение зависит линейно от расст до оси вращения, средним ускорением для тела можно рассматривать ускорение ц.м.~~

~~ВЗН~~

2) $a = 2R\omega^2$ — ц центростремительное ускорение ц. масс.

(при условии однородности шара именно к его ц. масс приложена с. Архимеда)

ВЗН на гор. ось

$$N_{ст}\cos\left(\frac{\pi}{2}-\alpha\right) + \rho Va = ma = 3\rho Va$$

$$N_{ст} = \frac{2\rho Va}{\cancel{\cos\alpha}\sin\alpha}$$

ВЗН на верт ось

$$N_2 + \rho gV - N_{ст}\sin\left(\frac{\pi}{2}-\alpha\right) - 3\rho gV = 0 \qquad \frac{\cos\alpha}{\sin\alpha} = ctg\,\alpha = \frac{1}{2}$$

$$N_2 = 2\rho gV + N_{ст}\cos\alpha = 2\rho gV + \frac{\cos\alpha}{\sin\alpha}\cdot 2\rho Va = \rho V(2g+a) = \rho V(2g+2R\omega^2) =$$

$$= 2\rho\frac{4}{3}\pi R^3(g+R\omega^2) = \underline{\frac{8}{3}\rho\pi R^3(g+R\omega^2)}$$

Ответ: 1) $N_1 = \frac{8}{3}\pi\rho R^3 g$

2) $N_2 = \frac{8}{3}\rho\pi R^3(g+R\omega^2)$

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№1

Черновик

$t_2 = t_1 + \tau$

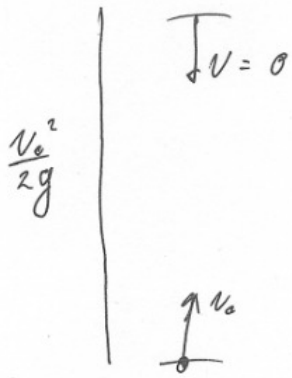
$$H = v_0 t_1 - \frac{g t_1^2}{2} = v_0 t_2 - \frac{g t_2^2}{2}$$

$$\cancel{v_0} t_1 - \frac{g t_1^2}{2} = \cancel{v_0}(t_1+\tau) - \frac{g(t_1+\tau)^2}{2}$$

$$\cancel{h = v_0 t_0 - g t_1}$$

$$h = \frac{0 - v_0^2}{-2g} = \frac{v_0^2}{2g}$$

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



$$H = v_0 t_2 - \frac{g t_2^2}{2}$$

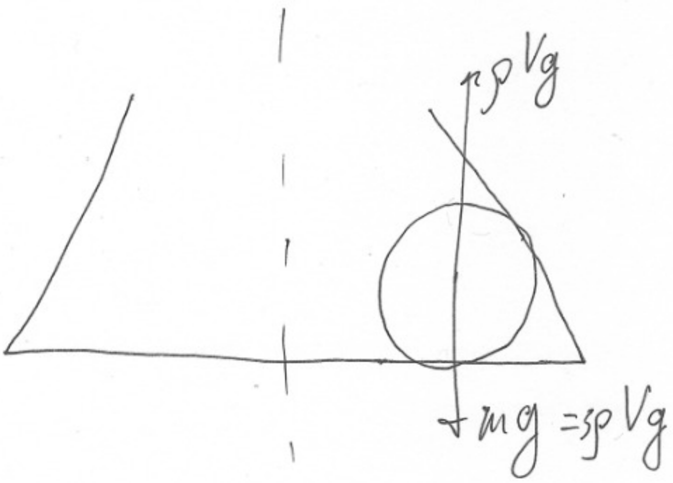
$$h - H = \frac{g t_2^2}{2}$$

$$h = v_0 t_2$$

$$\frac{v_0^2}{2g} = v_0 t_2$$

$$\cancel{t_2 = \frac{1}{vg}}$$

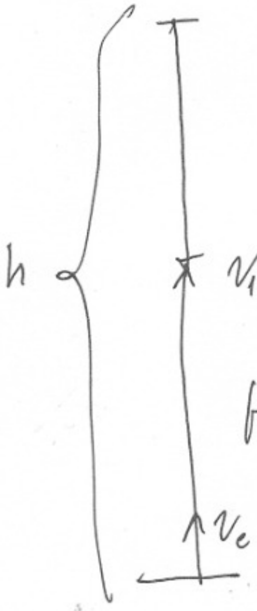
$$t_2 = \frac{v_0}{2g}$$



v_2

$$H = \frac{v_0 + v_2}{2} t \qquad \frac{v_2}{2} t = h - H$$

Черновик



$v_1 = t_1 g$ $\quad$ $v_1 = v_0 - t_1 g$

$t_1 g = v_0 - t_1 g$

$t_1 = \frac{v_0}{2g}$

$v_0 = v_1 + t_1 g$

$v_0 = 2 t_1 g$

$\cancel{H = v_0 t_1}$

$v_1 = t_1 g$

$H = \frac{v_0 + v_1}{2} t_1 = \frac{2 t_1 g + t_1 g}{2} t_1$

$= \frac{3}{2} t_1^2 g$

$t_1^2 = \cancel{\frac{2}{3} H} \; \frac{2H}{3g}$

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

$v_1 = t_1 g = v_0 - t_1 g$

$\underline{v_0 = 2 t_1 g = 2\sqrt{\frac{2}{3} H g}}$

$h = \cancel{v_0^2 - 0} \; \frac{0 - v_0^2}{-2g} = \frac{v_0^2}{2g}$

$s = h + (h - H) = 2h - H = \frac{v_0^2}{g} - H$

$= \frac{8}{3}\frac{Hg}{g} - H = \frac{8}{3} H - H = \underline{\frac{5}{3} H}$

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$1{,}8 p_c = p_н$ $\frac{p_c}{p_н} = \frac{1}{1{,}8}$ $\frac{V_c}{V_к} = 3{,}5$ Черновик

$p_c = \frac{p_н}{1{,}8} = \frac{0{,}5 \cdot 10^5}{1{,}8} = \cancel{28\ кПа}\ 27{,}8\ кПа$

$\nu_0 \cancel{M} = \frac{m}{M}$

$p_0 V_0 = \nu_0 R T$

$V_0 = \frac{\nu_0 R T}{p_0}$

$p_н V_к = \nu_к R T$

$V_к = \frac{V_c}{3{,}5}$

$p_н V_c = 3{,}5 \nu_к R T$

$\nu_к = \frac{p_н V_c}{3{,}5 R T}$

$p_0 V_c = \nu_0 R T$

$p_н V_к = \nu_к R T$

$\cancel{\nu_к = p_н V_к}$

$V_к = \frac{\nu_к R T}{p_н} =$

$\frac{p_c}{p_н} \frac{V_c}{V_к} = \frac{\nu_c}{\nu_к}$

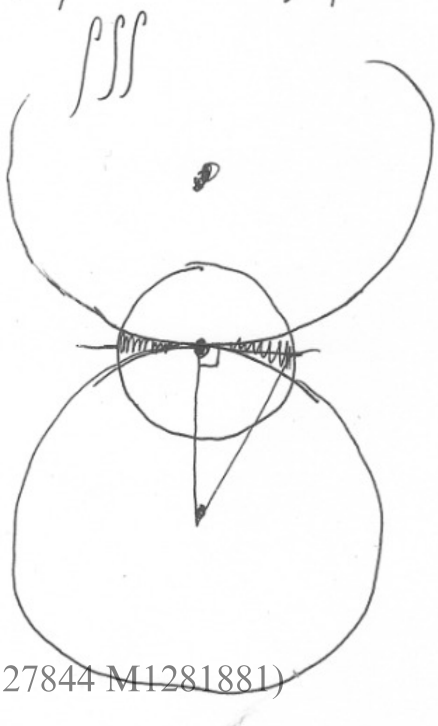
$V_к = \frac{\nu_к R T}{p_н}$

$\frac{35}{18} = \frac{1}{1{,}8} 3{,}5 = \frac{\nu_c}{\nu_к}$

$\nu_к = \frac{18}{35} \nu_0$

$\begin{array}{r} 273 \\ 81 \\ \hline 354 \end{array}$

$V_к = \frac{18 \nu_c R T}{35 p_н} = \frac{18 m R T}{35 M p_н} = \frac{159 \cdot 10^3}{315 \cdot 10^5} = 0{,}5 \cdot 10^{-2} = 5 \cdot 10^{-3}\ м^3 = 5\ л$



273

$\sqrt{2}$

$\sqrt{4R^2 + R^2} = \sqrt{3} R$

$\frac{\cancel{18} \cdot 3 \cdot 8{,}31 \cdot 354}{35 \cdot \cancel{18} \cdot 0{,}5 \cdot 10^5} =$

$= \frac{3 \cdot 8{,}31 \cdot 10}{0{,}5 \cdot 10^5} = 6 \cdot 8{,}31 \cdot 10^{-4}$

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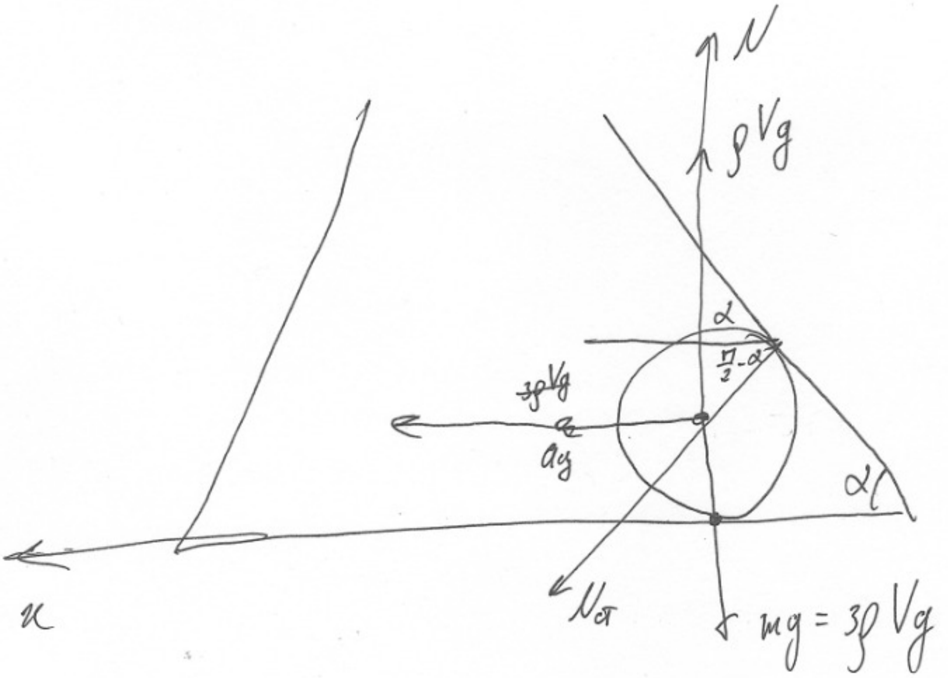
Черновик



$a_y = 2R\omega^2$

$\cos\alpha = \frac{1}{\sqrt{1+tg^2\alpha}} = \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5}$

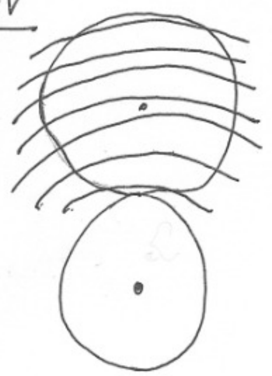
$\sin\alpha = \sqrt{1-\frac{5}{25}} = \frac{\sqrt{20}}{5} = \frac{2\sqrt{5}}{5}$

$\cancel{mg}$

$3\rho Vg - \rho Vg - N = 0 \qquad V = \frac{4}{3}\pi r^3$

$N_1 = 2\rho gV = 2\rho g\frac{4}{3}\pi R^3 = \underline{\frac{8}{3}\rho g\pi R^3}$

$V\rho g a + N_{ст}\cos(90^\circ-\alpha) = 3\rho gVa \qquad N_{ст} = \frac{3\rho gVa - \rho g a V}{\sin\alpha}$

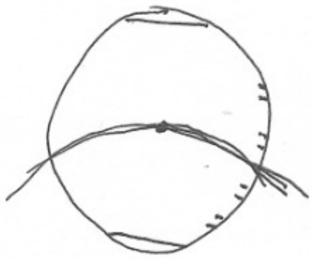


$N_2 + \rho gV - 3\rho gV - N_{ст}\sin(90^\circ-\alpha) = 0$

$N_{ст} = \frac{N_2 - 2\rho gV}{\cos\alpha} \qquad \frac{N_2 - 2\rho gV}{\cos\alpha} = \frac{3\rho gVa - \rho g a V}{\sin\alpha}$

$N_2 = 2\rho gV + \frac{\cos\alpha}{\sin\alpha}\cdot 2\rho gVa = 2\rho gV + 2\rho Va = 2\rho V(2g+a)$

$= 2\rho V(2g + 2R\omega^2)$



$= 2\rho\frac{4}{3}\pi R^3(g + 2R\omega^2) = \frac{8}{3}\rho\pi R^3(g + 2R\omega^2)$

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Часть 2

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

Шифр: **21205681**

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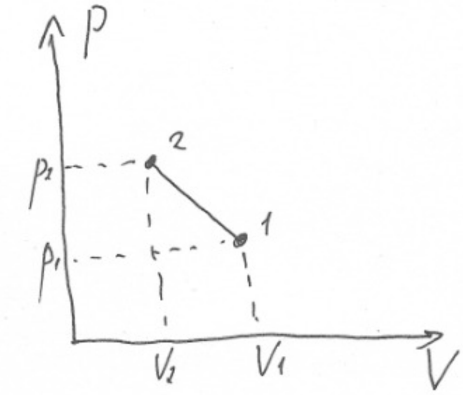
Вариант 1

Чистовик

№5



$\frac{V_2}{V_1} = 1+\beta \qquad \beta = -0{,}01 \qquad \Delta V = \beta V_1$

$\frac{p_2}{p_1} = 1+\alpha \qquad \alpha = 0{,}02 \qquad \Delta p = \alpha p_1$

$\frac{T_2}{T_1} = 1+\gamma \qquad \cancel{\Delta T = \gamma \Delta T T_1} \quad \Delta T = \gamma T_1$

1) $\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2} \quad => \quad \frac{T_2}{T_1} = \frac{p_2}{p_1}\frac{V_2}{V_1} = (1+\alpha)(1+\beta)$

$(1+\gamma) = 1+\alpha+\beta+\alpha\beta \qquad \alpha\beta << 1$

$\gamma = \alpha+\beta = 0{,}02 - 0{,}01 = 0{,}01 > 0 \qquad$ T – выросла на 1%

2) ~~A =~~ давление можно считать постоянным ($\alpha << 1$)

$A = p_1 \Delta V = \beta p_1 V_1$

$\Delta U = \frac{3}{2}\nu R \Delta T = \frac{3}{2}\gamma \nu R T_1 = \frac{3}{2}\gamma p_1 V_1$

$Q = A + \Delta U = \beta p_1 V_1 + \frac{3}{2}\gamma p_1 V_1 = p_1 V_1 (\beta + \frac{3}{2}\gamma) = p_1 V_1 (\frac{5}{2}\beta + \frac{3}{2}\alpha)$

$\frac{Q}{A} = \frac{p_1 V_1 (\frac{5}{2}\beta + \frac{3}{2}\alpha)}{\beta p_1 V_1} = \frac{5}{2} + \frac{3\alpha}{2\beta} = \frac{5}{2} + \frac{3 \cdot 0{,}02}{-2 \cdot 0{,}01} = \frac{5}{2} - 3 = -\frac{1}{2}$

Ответ: 1) T выросла на $\gamma = 1\%$

2) $\frac{Q}{A} = -\frac{1}{2}$

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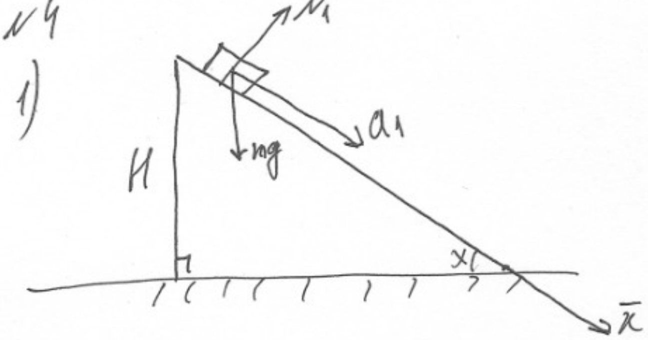
Чистовик

$\cos\alpha = \frac{4}{5}$ $\sin\alpha = \frac{3}{5}$

№4

1)



ВЗН на Ox:

$mg\sin\alpha = ma_1$

$a_1 = g\sin\alpha$

$L = \frac{a_1 t_1^2}{2}$

$H = L\sin\alpha$

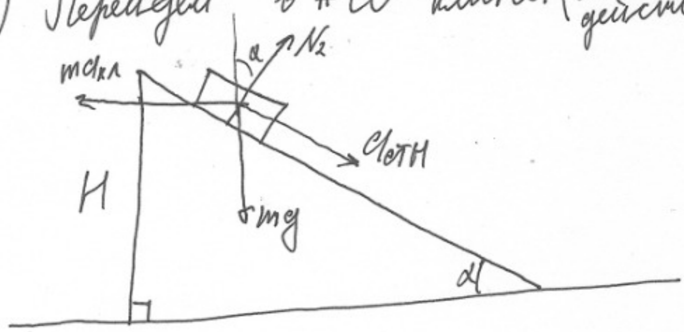
$L = \frac{H}{\sin\alpha}$

L – длина ската клина

$t_1 = \sqrt{\frac{2L}{a_1}} = \sqrt{\frac{2H}{g\sin^2\alpha}} = \frac{1}{\sin\alpha}\sqrt{\frac{2H}{g}}$

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

2) Перейдем в ~~ИСО~~ неИСО клина (в ней на брусок действует сила инерции)



ВЗН в проекции на верт. ось

$mg - N_2\cos\alpha = ma_{отн}\sin\alpha$

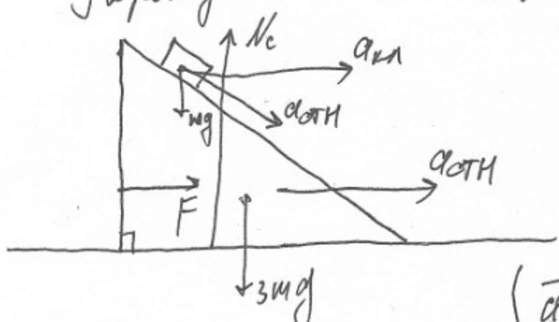
ВЗН в проекции на гор. ось

$N_2\sin\alpha - ma_{кл} = ma_{отн}\cos\alpha$

$$N_2 = \frac{m(g - a_{отн}\sin\alpha)}{\cos\alpha} = \frac{m(a_{кл} + a_{отн}\cos\alpha)}{\sin\alpha}$$

$$a_{отн} = g\sin\alpha - a_{кл}\cos\alpha$$

Перейдем в ИСО (изобразим силы действующие на систему «брусок + клин»)



ВЗН для ~~си~~ системы в проекции на горизонтальную ось

$$F = Ma_{ц} = ma_{кл} + ma_{отн}\cos\alpha + 3M\,a_{\cancel{отн}\,кл}$$

$$\left(\vec{a}_{ц} = \frac{d^2}{dt^2}\left(\frac{\sum m_i \vec{r}_i}{M}\right) = \frac{\sum m_i \vec{a}_i}{M}\right)$$

$$F = \cancel{3}4ma_{кл} + m(g\sin\alpha - a_{кл}\cos\alpha)\cos\alpha$$

$$a_{кл} = \frac{F - mg\sin\alpha\cos\alpha}{4m - m\cos^2\alpha} = \frac{2mg - mg\sin\alpha\cos\alpha}{4m - m\cos^2\alpha} = \frac{2 - \sin\alpha\cos\alpha}{4 - \cos^2\alpha}g = \frac{2 - \frac{3}{5}\frac{4}{5}}{4 - \frac{16}{25}}g = \frac{19}{42}g$$

3) $a_{отн} = g\sin\alpha - a_{кл}\cos\alpha = \frac{3}{5}g - \frac{4}{5}\frac{19}{42}g = \frac{5}{21}g$

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

$L = \frac{a_{отн}t_2^2}{2} \Leftrightarrow t_2 = \sqrt{\frac{2L}{a_{отн}}} = \sqrt{\frac{10/3\,H}{5/21\,g}} = \sqrt{\frac{14H}{g}}$

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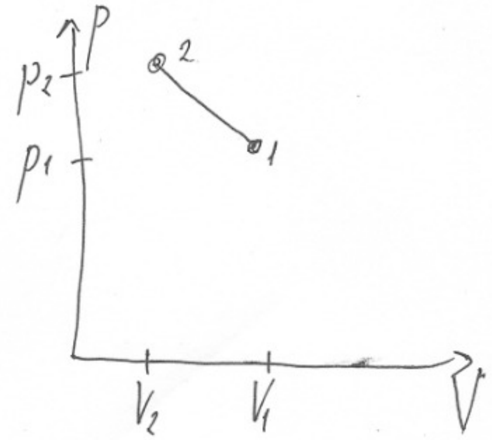
Ответ: 1) $t_1 = \frac{5}{3}\sqrt{\frac{2H}{g}}$, 2) $a_{кл} = \frac{19}{42}g$, 3) ~~$a_{отн} = \frac{5}{21}g$~~ $t_2 = \sqrt{\frac{14H}{g}}$.

№5

Черновик

$V_2 - V_1 = \beta V_1$

$V_2 - V_1 - \beta V_1 = 0$



$V_2 = (1+\beta) V_1$

$\beta = -0{,}01$

$p_2 = (1+\alpha) p_1$

$\alpha = 0{,}02$

$T_2 = (1+\gamma) T_1$

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\frac{T_2}{T_1} = \frac{p_2}{p_1} \frac{V_2}{V_1} = (1+\alpha)(1+\beta) = (1+\gamma)$$

$$\gamma = 1+\alpha+\beta+\alpha\beta - 1 = \alpha+\beta$$

$\gamma = 0{,}01$ — выросла на 1%

$$A = p_1 \xi \Delta V = p_1 \beta V_1 = \beta p_1 V_1$$

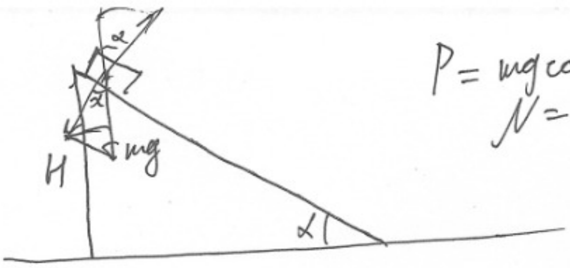
$$Q = A + \frac{3}{2} \Delta U$$

$$\Delta U = \frac{3}{2} \nu R \Delta T = \frac{3}{2} \gamma \nu R T_1 = \frac{3}{2} \gamma p_1 V_1$$

$$Q = A + \Delta U = \beta p_1 V_1 + \frac{3}{2} \gamma p_1 V_1 = p_1 V_1 \left(\beta + \frac{3}{2}\gamma\right) = p_1 V_1 \left(\frac{5}{2}\beta + \frac{3}{2}\alpha\right)$$

$$\frac{Q}{A} = \frac{p_1 V_1 \left(\frac{5}{2}\beta + \frac{3}{2}\alpha\right)}{\beta p_1 V_1} = \frac{5}{2} + \frac{3\alpha}{2\beta} = \frac{5}{2} + \frac{3}{2} \cdot \frac{0{,}02}{-0{,}01} = \frac{5}{2} - \frac{6}{2} = -\frac{1}{2}$$

$$\frac{Q}{A} = -\frac{1}{2}$$



$P = mg\cos\alpha$
$N = mg\cos\alpha$

Черновик

$H = l\sin\alpha$

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

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

$\cancel{m}g\sin\alpha = \cancel{m}a$

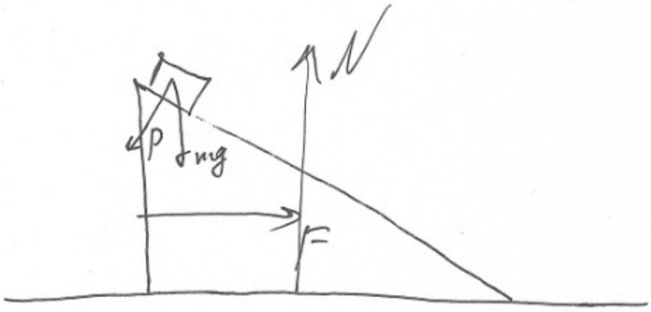
$a = g\sin\alpha$

$l = \frac{a t_1^2}{2} = \frac{H}{\sin\alpha}$

$t_1^2 = \frac{2H}{a\sin\alpha} = \frac{2H}{g\sin^2\alpha}$

$t = \sqrt{\frac{2H}{g\frac{9}{25}}} = \cancel{5} = \frac{1}{\sin\alpha}\sqrt{\frac{2H}{g}} = \frac{5}{3}\sqrt{\frac{2H}{g}}$

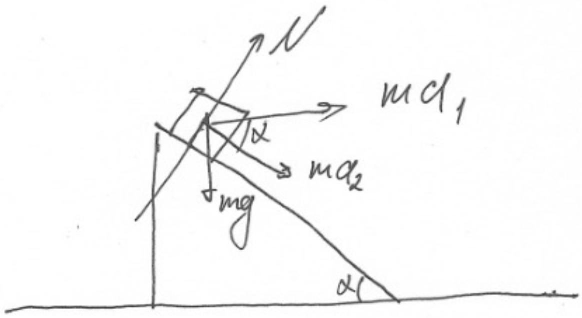
$\frac{\Delta\vec{P}}{\Delta t} = m\vec{g} + 3m\vec{g} + \vec{N} + \vec{F}$



$\frac{\Delta P_x}{\Delta t} = F$

$\sum \Delta P_x = \sum F\Delta t$

$P_x = F\Delta\tau$



$g - a_{отн}\sin\alpha = \frac{\cos\alpha}{\sin\alpha}\left(a_{кл} + a_{отн}\cos\alpha\right)$

$g - ctg\,\alpha\, a_{кл} = a_{отн}\left(\sin\alpha + \frac{\cos^2\alpha}{\sin\alpha}\right)$

$\vec{r} = \frac{\sum m_i\vec{r}_i}{\sum m_i}$ $\quad v = \frac{\sum m_i\vec{v}_i}{\sum m_i}$

$g\sin\alpha - a_{кл}\cos\alpha = a_{отн}$

$a = \frac{\sum m_i\vec{a}_i}{\sum m_i}$ $\quad \cancel{m(a_{кл}+}\ 4m\,a_{кл} = F - m a_{отн}\cos\alpha$

$a_{кл} = \frac{F - m a_{отн}\cos\alpha}{4m} = \frac{2mg - m(g\sin\alpha - a_{кл}\cos\alpha)\cos\alpha}{4m} = \frac{1}{2}g - g\sin\alpha\cos\alpha$

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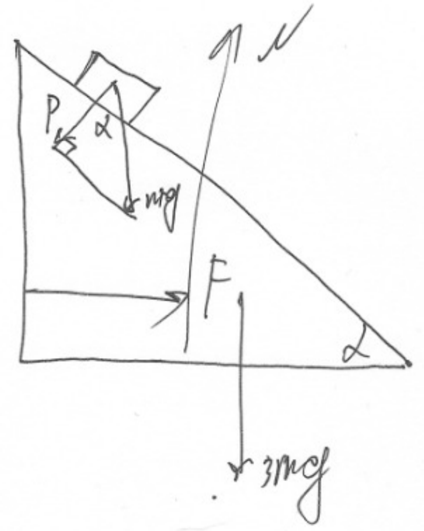
$F = \cancel{m(3a}\ m a_{кл}(3 - \cos^2\alpha) + mg\sin\alpha\cos\alpha$ $\quad a_{кл} = \frac{2mg - mg\sin\alpha}{m(3 - \cos^2\alpha)} = \frac{2 - \sin\alpha}{3 - \cos^2\alpha}g = \frac{2 - \frac{3}{5}}{3 - \frac{16}{25}}g =$

$= \cancel{\frac{7/5}{59/25} = \frac{5\cdot 7}{59}} = \frac{7/5}{84/25} = \frac{35}{84}$

Черновик



$P = mg\cos\alpha$

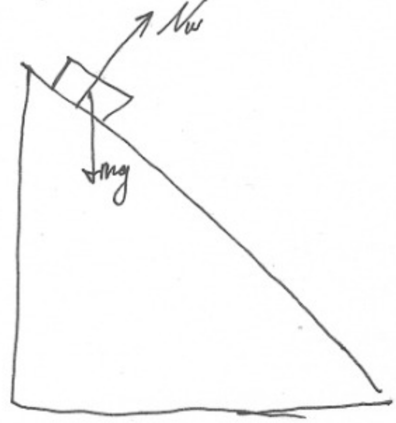
$F - P\sin\alpha = 3m a_к$

$a_к = \dfrac{F - P\sin\alpha}{3m} = \dfrac{2mg - mg\cos\alpha\sin\alpha}{3m} =$

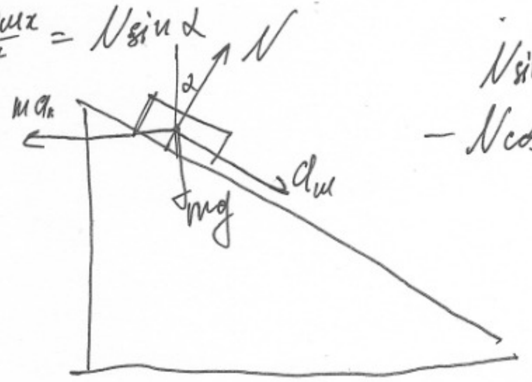
$= g(2 - \cos\alpha\sin\alpha) = g\left(2 - \frac{4}{5}\cdot\frac{3}{5}\right) =$

$= g\left(2 - \frac{12}{25}\right) = \frac{13}{25} g$

$\dfrac{\Delta P_x}{\Delta t} = F = \dfrac{\Delta p_{шx}}{\Delta t} + \dfrac{\Delta p_{кx}}{\Delta t}$



$\dfrac{\Delta p_{шx}}{\Delta t} = N\sin\alpha$



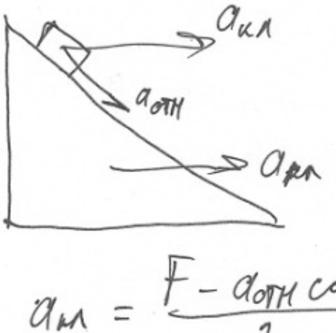
$N\sin\alpha = m a_к = m a_ш\cos\alpha$

$-N\cos\alpha + mg = m a_ш\sin\alpha$

$a_ш = a_{отн} = \dfrac{mg - N\cos\alpha}{m\sin\alpha}$

$N = \dfrac{m(a_к + a_ш\cos\alpha)}{\sin\alpha}$

$N = \dfrac{m(g - a_ш\sin\alpha)}{\cos\alpha}$



$F/ = 2a_{кл} + a_{отн}\cos\alpha = \dfrac{F}{4m}$

$a_{кл} = \dfrac{F - a_{отн}\cos\alpha}{2} = \dfrac{2mg - \frac{mg - N\cos\alpha}{m\sin\alpha}\cos\alpha}{2} = ma$

$\dfrac{a_к + a_ш\cos\alpha}{\sin\alpha} = \dfrac{g - a_ш\sin\alpha}{\cos\alpha}$

$\mathrm{ctg}\,\alpha + \mathrm{tg}\,\alpha = \dfrac{\cos^2\alpha + \sin^2\alpha}{\sin\alpha\cos\alpha} = \dfrac{2}{\sin 2\alpha}$

$a_ш\,\mathrm{ctg}\,\alpha + a_ш\,\mathrm{tg}\,\alpha = \dfrac{g}{\cos\alpha} - \dfrac{a_к}{\sin\alpha}$

$a_ш = \dfrac{\frac{g}{\cos\alpha} - \frac{a_к}{\sin\alpha}}{\mathrm{tg}\,\alpha + \mathrm{ctg}\,\alpha} = \frac{1}{2}\sin\alpha\cos\alpha\left(\frac{g}{\cos\alpha} - \frac{a_к}{\sin\alpha}\right) = g\sin\alpha - a_к\cos\alpha$

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$a_{кл} m + a_{кл} 3m + a_{отн} m \cos\alpha = F$ Черновик

$4a_{кл} m + a_{отн} m \cos\alpha = F$

$a_{отн} = \dfrac{F - 4a_{кл} m}{m \cos\alpha}$

$4a_{кл} m = F - a_{отн} m \cos\alpha$

$= \dfrac{2mg - 4\frac{38}{25} g m}{m \frac{4}{5}}$

$a_{кл} = \dfrac{F}{4m} - \frac{1}{4} a_{отн} m \cos\alpha$

$= \frac{10}{2} g - \frac{19}{10} g = \frac{50-19}{10} g = \frac{31}{10} g = 3{,}1 g$

$- \frac{1}{4} \frac{mg - N\cos\alpha}{m \sin\alpha} m \cos\alpha$

$a_{кл} = \dfrac{F}{4m} - \frac{1}{4}(g\sin\alpha - a_к \cos\alpha)\cos\alpha$

$= \dfrac{2mg - 4 \cdot \frac{19}{42} g m}{m \frac{4}{5}}$

$= \dfrac{\left(2 - \frac{38}{21}\right)}{\frac{4}{5}} g = \frac{4}{21} \frac{5}{4} g = \frac{5}{21} g$

$a_{кл} - \frac{1}{4} a_к \cos^2\alpha = \dfrac{F}{4m} - \frac{1}{4} g \sin\alpha \cos\alpha$

$a_{кл} = \dfrac{\frac{F}{4m} - \frac{1}{4} g \sin\alpha\cos\alpha}{1 - \frac{1}{4}\cos^2\alpha} = \dfrac{\frac{1}{4}\frac{2mg}{4m} - \frac{1}{4} g \sin\alpha \cos\alpha}{1 - \frac{1}{4}\cos^2\alpha} =$

$= \dfrac{\frac{1}{2} g - \frac{1}{4} g \sin\alpha\cos\alpha}{1 - \frac{1}{4}\cos^2\alpha} = \dfrac{2g - g\sin\alpha\cos\alpha}{4 - \cos^2\alpha} = \dfrac{2g - \frac{12}{25} g}{4 - \frac{16}{25}} = \dfrac{50g - 12g}{100 - 16} =$

$= \dfrac{38g}{84} = \dfrac{19g}{42} = \dfrac{19}{42} g$

$\frac{3}{5} - \frac{4}{5}\frac{19}{42} = \frac{1}{5}\left(3 - \frac{38}{21}\right) = \frac{1}{5}\left(\frac{63-38}{21}\right)$

$= \frac{1}{5}\frac{25}{21} = \frac{5}{21}$

$L = \dfrac{a_{отн} t^2}{2}$

$t^2 = \dfrac{2L}{a_{отн}} = \dfrac{\frac{10}{3} H}{5/21 g} = \frac{2}{63}\frac{H}{g} \quad \dfrac{10 \cdot 21}{5 \cdot 3} \dfrac{H}{g} = \dfrac{2 \cdot 7 H}{g} = 14 \dfrac{H}{g}$

$\frac{10 \cdot 21}{5 \cdot 3} = 2 \cdot 7$

$t = \sqrt{\dfrac{14H}{g}}$

$a_{кл} = 2g - g$

$\dfrac{V_2 - V_1}{V_1} = \beta$

$F = 4ma_{кл} + mg \sin\alpha\cos\alpha - ma_{кл}\cos^2\alpha$

$\dfrac{V_2}{V_1} = 1 + \beta$

$a_{кл} = \dfrac{F - mg\sin\alpha\cos\alpha}{4m - m\cos^2\alpha} = \dfrac{2mg - mg\sin\alpha\cos\alpha}{4m - m\cos^2\alpha} = \dfrac{2 - \sin\alpha\cos\alpha}{4 - \cos^2\alpha} g$

$= \dfrac{2 - \frac{3}{5}\frac{4}{5}}{4 - \frac{16}{25}} g = \dfrac{\frac{50-12}{25}}{\frac{100-16}{25}} g = \dfrac{38}{84} = \dfrac{19}{42} g$

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