

Часть 1

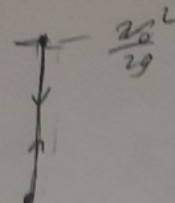
Олимпиада: **Физика, 10 класс (1 часть)**

Шифр: **21205085**

ID профиля: **369347**

Вариант 2

160028 = Черновик



$$v_0^2 = 2gh \sqrt{(-1+5)+48}$$

$$-1+5+48 = 52$$

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

$$1.5 \cdot 48 = 72$$

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$$1.5 \cdot 48 = 72$$

$$(1.5+1.5)(2+8) \cdot 900$$

$$(1.5+1.5)(2+8) \cdot 900 = 1.5 \cdot 10 \cdot 10 = 150$$

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

$$\frac{pH}{3.6} = \frac{p}{\mu} RT$$

$$1.5 \cdot 10 \cdot p_H = \frac{p}{1.5 \cdot 10^{-2}} \cdot (1.5+5.0) \cdot (2+8)$$

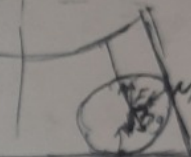
$$\frac{v_0^2}{2g} - \frac{v_0^2}{8g} = \frac{3}{t}$$

$$= \frac{3v_0^2}{8g}$$

$$150378 - 1.5 \cdot 10^5$$

$$-1+5+3^2$$

$$(1.5+0.43)(2+8)$$



$$1.5 \cdot 10^5 \cdot 3.2 = 480000$$

$$1.5 \cdot (5-3) = 3$$

$$120 - 12 = 108$$

$$1.5 \cdot 48 = 72$$

$$1.5 \cdot (2+8) = 15$$

$$p_1 V_1 = \nu_1 RT$$

$$p_2 V_2 = \nu_2 RT$$

$$p_1 V_1 = \nu_1 RT$$

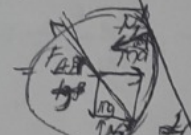
$$3.6 p_1 \cdot \frac{V}{7} = \frac{1}{2} RT$$

$$(1.5+7)(2+8) p_1 V_1 \neq \text{const}$$

$$(-1+5+7)(2+8) p_2 = p_H = 0.5 \cdot 10^5 = mg - F_A =$$

$$150928$$

$$(1.5+0.19)(2+8) = 100 = 5pVg =$$



$$v_1 = 0 \quad 1528$$

$$1.5 \cdot 5.8 = 8.7$$

$$1.5 \cdot 5.5 = 8.25$$

$$= 6pVg - pVg =$$

$$1.5 \cdot 10^5$$

$$= 5pVg =$$

$$1556$$

$$1.5+3.6 = \frac{V_2}{V_1}$$

$$1.533$$

$$(1+1.8)(2+8) \cdot 9 \cdot m \sqrt{1.5/5.8}$$

$$1.5/5.8 = 0.2586$$

$$1.5+5.8 = 7.3$$

$$1600$$

$$1.5+8 = 9.5$$

$$= \frac{20}{3} p \pi R^3 g$$

$$P_1 = \frac{P_2}{3.6} = \rho V \sqrt{g^2 a^2} \cos \beta + N_1 \sin \alpha = mg$$

$$1.7+3.3 = \frac{0.5 \cdot 10^5}{3.6}$$

$$\rho V \sqrt{g^2 a^2} \sin$$

$$(1.5+2.0)(2+8) = 1.5+5.7$$

$$(1.5+2+0)(2+8) = 1.5+5.7$$

$$N_2 = \frac{5pV(20+3g)}{3} = 1558$$

$$-1+5.3 \cdot \frac{5 \cdot 10^5}{36}$$

$$+1.5 \cdot 3.5 \cdot \frac{5 \cdot 10^5}{36}$$

$$5pV \cdot (3\omega^2 R + 3g)$$

$$\rho V a + N_2' \sin \alpha = mg$$

$$1.5+5.8$$

$$1.5+5.7$$

$$1.5+5.8$$

$$1.5+5.7$$

$$1.5+3.6 \cdot \frac{20}{3} \pi R^3$$

$$1.5+3.6$$

$$\rho V g + N_2 = N_2' \cos \alpha + mg$$

$$1.5+5.4+5.4$$

$$1.5+5.4+5.4$$

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$$1.5+5.4+5.4$$

$$\frac{20}{3} p \pi R^3 (\omega^2 R + g) = \frac{10pVg + 15pVg}{3}$$

$$N_2' \cos \alpha = N_2 - 5pVg$$

$$1.5-3.8$$

$$1.5-3.9$$

$$+g \cdot 2 = \frac{5pVg}{N_2 - 5pVg}$$

$$(1+1) \cdot 1 \cdot 1 \cdot 1$$

$$1.5+3.7$$

$$3N_2 - 15pVg = 10pVg$$

$$1.5+2.1$$

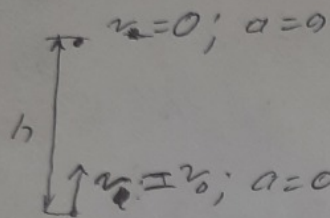
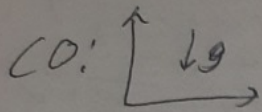
$$1.5+4.4$$

$$1.5+2.2$$

21205085 (U269347) 11281503

Чистовик

ЗЦЗ: $\frac{mv_0^2}{2} = mgh \Rightarrow h = \frac{v_0^2}{2g}$;



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

$$t_1 = t_{\uparrow} + t_2 = \sqrt{\frac{2h}{g}} + \frac{v_0}{2g} = \frac{v_0}{g} + \frac{v_0}{2g} = \frac{3v_0}{2g}$$

$$\frac{t_1}{t_2} = \frac{\frac{3v_0}{2g}}{\frac{v_0}{2g}} = 3;$$

$$h_0 = h - \frac{gt_2^2}{2} = \frac{v_0^2}{2g} - \frac{v_0^2}{8g} = \frac{3v_0^2}{8g}$$

Ответ: $t_1 = \frac{3v_0}{2g}$; $\frac{t_1}{t_2} = 3$; $h_0 = \frac{3v_0^2}{8g}$

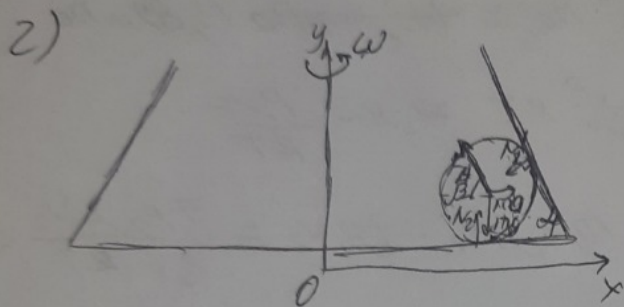
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Чистовик

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$Ox: N_1' \sin \alpha = 0 \Rightarrow N_1' = 0$
 $Oy: N_1 + F_A = mg + N_1' \cos \alpha = mg$
 $\Rightarrow N_1 = mg - F_A = 6\rho Vg - \rho Vg = 5\rho Vg =$
 $= \frac{20}{3} \pi R^3 \rho g$



$CO \text{ } \omega:$
 $Ox: F_A \cos \beta + N_2' \sin \alpha = m a$
 $Oy: F_A \sin \beta + N_2 = mg + N_2' \cos \alpha$
 $\tan \beta = \frac{g}{a}; F_A = \rho V g^* = \rho V \sqrt{g^2 + a^2};$
 $a = 1,5 \omega^2 R.$

$\Rightarrow N_2' \sin \alpha = 1,5 m \omega^2 R - \rho V \sqrt{g^2 + a^2};$ 1)

$N_2' \cos \alpha = N_2 + mg + \rho V g$ 2)

$\Rightarrow \frac{1}{2) \Leftrightarrow} \tan \alpha = \frac{5 \cdot 1,5 \rho V a^2 R}{N_2 - 5 \rho V g} = \frac{3}{2}$

$\Rightarrow 3N_2 - 15\rho V g = 15\rho V a^2 R$

$\Rightarrow N_2 = 5\rho V (g + \omega^2 R) = \frac{20}{3} \rho \pi R^3 (g + \omega^2 R)$

Ответ: $N_1 = \frac{20}{3} \rho \pi R^3 g; N_2 = \frac{20}{3} \rho \pi R^3 (g + \omega^2 R)$

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Чистовик

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$$\frac{p_1 V_1}{T_1} \neq \frac{p_2 V_2}{T_2} \quad \frac{p_2 V_2}{T_2} = \frac{3,6 p_1 \cdot \frac{V_1}{7}}{T_1} \neq \frac{3,6}{7} \cdot \frac{p_1 V_1}{T_1} \neq \frac{p_1 V_1}{T_1}$$

$\Rightarrow V_1 \neq V_2 \Rightarrow$ пар сконденсировался \Rightarrow

$$\Rightarrow p_2 = p_H = 0,5 \cdot 10^5 \text{ Па}$$

$$\Rightarrow p_1 = \frac{p_2}{3,6} = \frac{5 \cdot 10^5}{3,6} \approx 0,14 \cdot 10^5 \text{ Па} \approx \cancel{139,9 \text{ Па}} \approx 13,89 \text{ кПа}$$

$$pV = \nu RT = \frac{m}{\mu} RT \Rightarrow p = \frac{\rho}{\mu} RT \Rightarrow \rho = \frac{p \mu}{RT}$$

$$\Rightarrow \rho_1 = \frac{p_1 \mu}{RT} = \frac{p_H \mu}{3,6 RT} \Rightarrow m_1 = \rho_1 V_1 = \rho_1 V_2 = \frac{7 p_H \mu V_2}{3,6 RT} =$$

$$= \frac{7 \cdot 0,5 \cdot 10^5 \cdot 18 \cdot 10^{-3} \cdot 1,7 \cdot 10^{-3}}{3,6 \cdot 8,31 \cdot (273 + 81)} = \frac{3,5 \cdot 18 \cdot 1,7 \cdot 10^{-1}}{3,6 \cdot 8,31 \cdot 354} = \frac{3,5 \cdot 18 \cdot 1,7}{3,6 \cdot 8,31 \cdot 354} =$$

$$= \frac{3,5 \cdot 1,7}{2 \cdot 8,31 \cdot 354} \approx 10^{-3} \text{ кг} \approx 1,012$$

Ответ: $p_1 \approx 13,89 \text{ кПа}$; $p_2 \approx 1,012$

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Часть 2

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

Шифр: **21205085**

ID профиля: **369347**

Вариант 2

Черновик

$$\frac{PV}{T_1} = \frac{0,998 \cdot 1,02V}{T_2}$$

$$T_1 = \frac{T_2}{0,998 \cdot 1,02} = \frac{T_2}{1,0098}$$

$$1,0098 T_1 = T_2$$

$$\Delta T = 0,0098$$

≈ 0,1% увеличения g

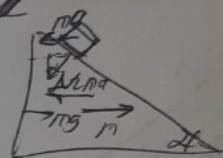
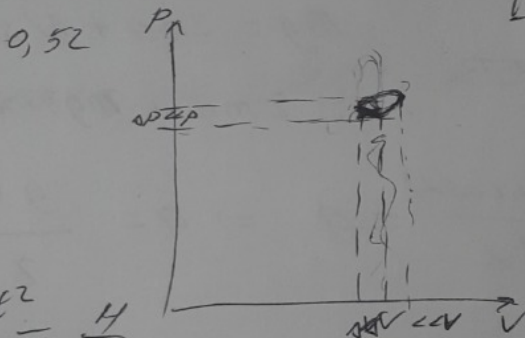
$$g \left(1 - \frac{3 \cdot 4}{5 \cdot 5}\right) = \frac{2 + \frac{4^2}{5^2}}{2}$$

$$= \frac{g \left(1 - \frac{12}{25}\right)}{2 + \frac{16}{25}} = \frac{3}{2} (1,02 \cdot 0,98 - 1) PV$$

$$\frac{13}{25} g$$

$$\frac{66}{25}$$

$$\frac{13g}{66} \approx 0,2g$$



$$20g = mg - N \sin \alpha =$$

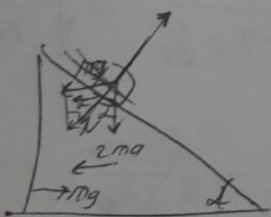
$$mg \sin \alpha - N \cos \alpha = 2$$

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

$$\frac{(g \sin \alpha - a \cos \alpha) t^2}{2} = \frac{H}{\sin \alpha}$$

$$\frac{g \sin^2 \alpha t^2}{2} = H \frac{1}{\sin \alpha} \sqrt{\frac{2H}{g \sin^2 \alpha}}$$

$$\sqrt{\frac{25H}{8g}}$$



$$dQ = \frac{3}{2} 10^{-3} PV + p dV$$

$$a \approx 0,2g$$

$$\frac{(4g - \frac{3g}{25}) \cdot \frac{4}{5}}{25 \cdot \frac{1}{5}}$$

$$mg = 2ma + (m \sin \alpha + m g \cos \alpha) \sin \alpha$$

$$dQ = \frac{3}{2} (p dV + d p V) + p dV =$$

$$g = 2a + \frac{1}{5} \sin^2 \alpha + g \sin \alpha \cos \alpha$$

$$\frac{g}{PV} = \frac{1}{2} \left(\frac{dp}{P} + \frac{dV}{V} \right)$$

$$= \frac{1}{2} p dV + \frac{3}{2} d p V$$

$$\sqrt{\frac{125H}{34g}}$$

$$\frac{g(1 + \sin \alpha \cos \alpha)}{2 + \sin^2 \alpha} = a$$

$$\frac{dQ}{PV} = \frac{3}{2} \frac{dV}{V} + \frac{3}{2} \frac{dp}{P}$$

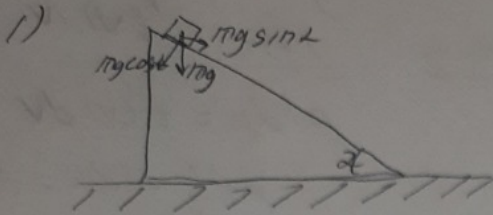
$$5 \sqrt{\frac{5H}{34g}}$$

$$g \left(1 - \frac{\sin^2 \alpha}{2}\right)$$

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

Числовик

~1

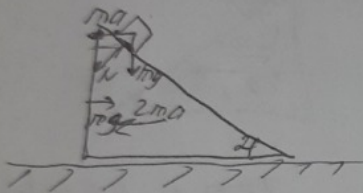


$$\frac{g \sin^2 \alpha t_1^2}{2} = \frac{H}{\sin \alpha}$$

$$\Rightarrow t_1 = \sqrt{\frac{2H}{g \sin^2 \alpha}} = \sqrt{\frac{25 \cdot 4}{9 \cdot 16}} =$$

$$= \sqrt{\frac{25H}{8g}}$$

2) со кучмо:



$$N = mg \cos \alpha + ma \sin \alpha$$

$$mg = 2ma + N \sin \alpha =$$

$$= 2ma + mg \sin \alpha \cos \alpha + ma \sin^2 \alpha$$

$$\Rightarrow \frac{g(1 - \sin \alpha \cos \alpha)}{2 + \sin^2 \alpha} = a \Rightarrow a = \frac{g(1 - \frac{3}{5} \cdot \frac{4}{5})}{2 + \frac{16}{25}} \approx 0,29$$

3) $ma_f = mg \sin \alpha - ma \cos \alpha \Rightarrow a_f = g \sin \alpha - a \cos \alpha$

$$t_2 = \sqrt{\frac{2H}{a_f \sin \alpha}} = \sqrt{\frac{2H}{g \sin^2 \alpha - a \sin \alpha \cos \alpha}} \approx \sqrt{\frac{2H}{g \frac{16}{25} - 0,29 \cdot \frac{3 \cdot 4}{25}}} = \sqrt{\frac{125H}{349}}$$

Омберн: $t_1 = \sqrt{\frac{25H}{8g}}$; $a \approx 0,29$; $t_2 = \sqrt{\frac{125H}{349}}$

①

Чистовик

~ 2

$$1) = \frac{PV}{T_1} = \frac{0,99p \cdot 1,02V}{T_2} \Rightarrow T_2 = T_1 \cdot 0,99 \cdot 1,02 = 1,0098T_1$$

$$\Rightarrow T_2 > T_1 \text{ на } \cancel{1\%} \text{ } 0,98\%$$

$$2) k = \frac{\Delta R}{\Delta U} = \frac{\Delta U + A}{\Delta U} = 1 + \frac{A}{\Delta U} \approx 1 + \frac{(p + 0,99p) \cdot 0,02V}{\frac{3}{2}(0,99 \cdot 1,02PV - PV)} =$$

$$= 1 + \frac{1,99 \cdot 0,02}{3 \cdot 0,0098} \approx 2,35 \quad (\text{можно считать, что } p = 2V^2)$$

$$\text{п.к. } \frac{\Delta p}{p} \ll 1; \frac{\Delta V}{V} \ll 1; \frac{\Delta T}{T} \ll 1)$$

Ответ: увеличится на 0,98%; $k \approx 2,35$

(2)