

Часть 1

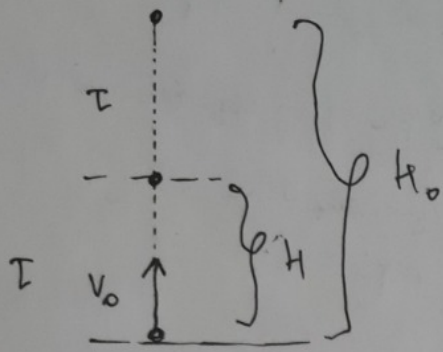
Олимпиада: **Физика, 10 класс (1 часть)**

Шифр: **21205881**

ID профиля: **375202**

Вариант 1

H | τ ? v_0 ? l ? } системки 1 \& 2



1) ЗСА 1 мез:

$$\frac{mv_0^2}{2} = mgH_0$$

$$\Rightarrow H_0 = \frac{v_0^2}{2g}$$

2) $H_0 - H = \frac{g\tau^2}{2}$

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

(+) $\rightarrow H_0 = v_0\tau = \frac{v_0^2}{2g} \Rightarrow \tau = \frac{v_0}{2g}$, погребам

$$H_0 - H = \frac{g}{2} \cdot \frac{v_0^2}{4g^2} = \frac{v_0^2}{8g}$$

3) (1) $H_0 = \frac{v_0^2}{8g} + H = \frac{v_0^2}{2g} \Rightarrow \frac{v_0^2}{g} \left(\frac{1}{2} - \frac{1}{8} \right) = H$

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

$$v_0 = \sqrt{\frac{8gH}{3}} = 2\sqrt{\frac{2gH}{3}}$$

3) $\tau = \frac{v_0}{2g} = \sqrt{\frac{2H}{3g}}$

4) $l = H_0 + (H_0 - H) = \frac{v_0^2}{g} - H = \frac{8H}{3} - H = \frac{5}{3}H$

Отвеч: 1) $\tau = \sqrt{\frac{2H}{3g}}$

2) $v_0 = 2\sqrt{\frac{2gH}{3}} = \sqrt{\frac{8gH}{3}}$

3) $l = \frac{5}{3}H$

задание 2.

№3:

$$m = 3 \cdot 10^{-3} \text{ кг}$$

$$T = 21^\circ \text{C} = 354 \text{ K}$$

$$\alpha = 3,5$$

$$\beta = 1,8$$

$$P_{\text{насыщ}}(T) = 0,5 \cdot 10^5 \text{ Па}$$

$$\mu = 18 \cdot 10^{-3} \frac{\text{кг}}{\text{моль}}$$

$$R = 8,31 \frac{\text{Дж}}{\text{моль} \cdot \text{К}}$$

$$1) \quad p_0, V_0 \xrightarrow{\text{изотерм.}} \frac{V_0}{\alpha}, \beta p_0$$

т.к. $p_0 V_0 \neq \frac{V_0}{\alpha} \beta p_0$ (- изотерма и т.)

часть пара конденсировалась

$$\text{и } \beta p_0 = P_{\text{насыщ}}(T)$$

$$p_0 = \frac{P_{\text{насыщ}}(T)}{\beta} = \frac{0,5 \cdot 10^5}{1,8} \text{ Па}$$

$$\approx 27778 \text{ Па.}$$

2) при p_0, V_0
все - пар.

$$p_0 V_0 = \frac{m}{\mu} R T$$

$$V_0 = \frac{m R T}{p_0 \mu} = \frac{m R T}{\mu} \cdot \frac{\beta}{P_{\text{насыщ}}(T)}$$

$$3) V_{\text{конд}} = \frac{V_0}{\alpha} = \frac{\beta}{\alpha} \cdot \frac{m R T}{\mu P_{\text{насыщ}}(T)} \approx 5 \cdot 10^{-3} \text{ м}^3$$

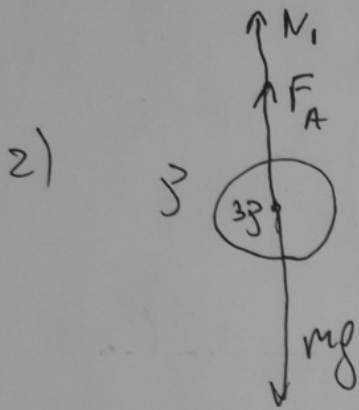
Ответ: $p_0 = \frac{P_{\text{нас}}(T)}{\beta} \approx 28 \text{ кПа}$

$$V_{\text{конд}} = \frac{\beta m R T}{\alpha \mu P_{\text{нас}}(T)} \approx 5 \cdot 10^{-3} \text{ м}^3$$

$$\int \rho \omega R z R \rho g z = 2$$

система 3. $\sqrt{2}$
 1) вращ. тем.

N от верхней ст. тем
 т.к. это един. сила с хор. проекцией

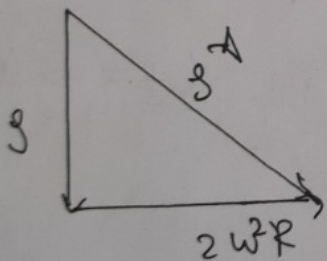


$$2) N_1 = mg - F_A =$$

$$= 3\rho V g - \rho g V = 2\rho g V$$

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

3) Перейдем к КИСО вращ. с ω с уг.
 $\vec{a}_{\text{ср}} = \vec{g} - \vec{a}_{\text{ср}}, |\vec{a}_{\text{ср}}| = 2\omega^2 R$
 (каждому элементу шарика в центре шара).



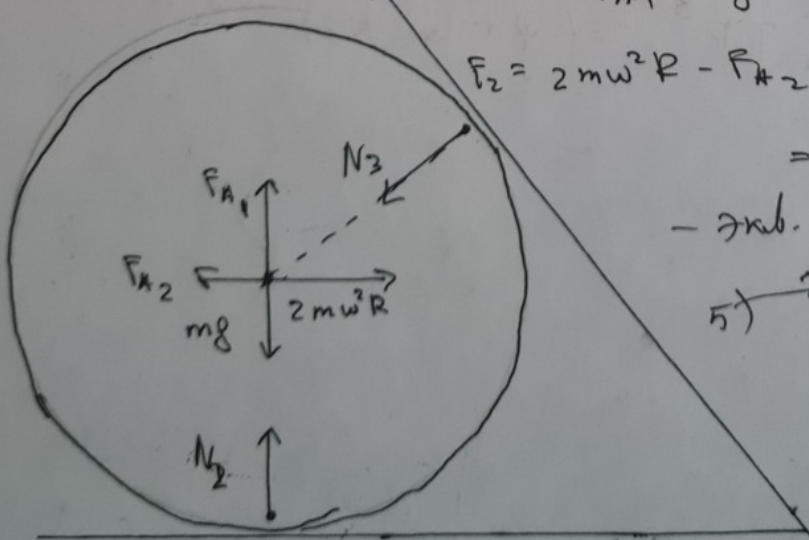
~~$\vec{F}_{\text{ср}} = m\vec{g}$~~

$$\vec{F}_{\text{ср}} = m\vec{g}$$

$$\vec{F}_A = -m_b \vec{g}$$

4) б + тем КИСО шар покоится

4)



$$F_1 = -F_{A1} + mg = 3\rho V g - \rho V g = 2\rho V g$$

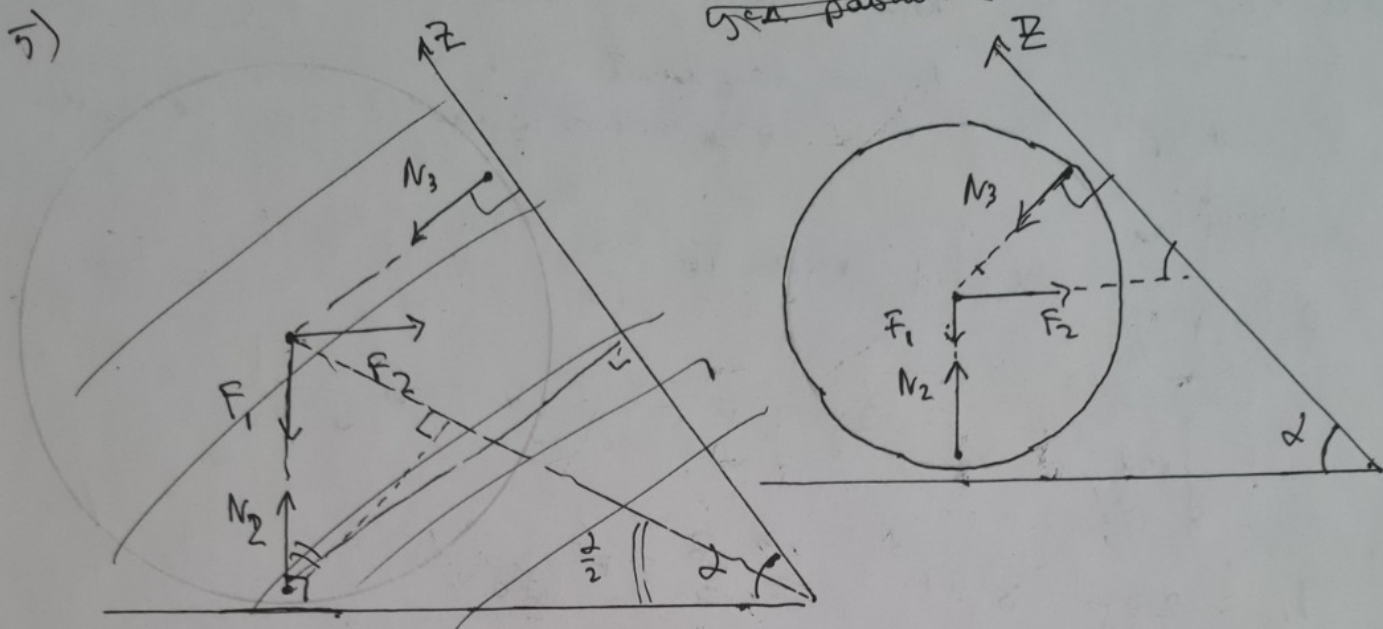
$$F_2 = 2m\omega^2 R - F_{A2} = 2\rho V \cdot 2\omega^2 R =$$

$$= 4\rho V \omega^2 R$$

- экв. шми. с стороны

5) ~~23R~~ 3R!
 Земля + вода.

5) ~~ген параболес~~ $\Rightarrow Z$:



5) ~~ген параболес~~ $\Rightarrow Z$:

$$+F_2 \cos \alpha + F_1 \sin \alpha = N_2 \sin \alpha$$

$$N_2 = F_1 + F_2 \operatorname{ctg} \alpha = F_1 + \frac{F_2}{2} \quad (\operatorname{tg} \alpha = 2)$$

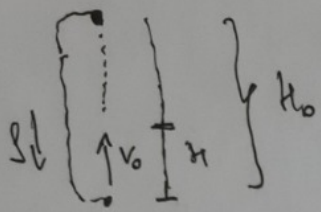
$$N_2 = 2\rho V g + 2\rho V \omega^2 R =$$

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

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

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

Упробук 1



$$1) \frac{mv_0^2}{2} = mgH_0$$

$$H_0 = \frac{v_0^2}{2g}$$

$$2) H_0 - H = \frac{gT^2}{2}$$

$$H = v_0 T - \frac{gT^2}{2}$$

$$H_0 = v_0 T = \frac{v_0^2}{2g}$$

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

$$\frac{v_0^2}{2g} - H = \frac{g}{2} \cdot \frac{v_0^2}{4g^2} = \frac{v_0^2}{8g}$$

$$H = \frac{v_0^2}{g} \left(\frac{1}{2} - \frac{1}{8} \right) = \frac{v_0^2}{g} \cdot \frac{4-1}{8} = \frac{3v_0^2}{8g}$$

$$v_0 = \sqrt{\frac{8gH}{3}} = 2 \sqrt{\frac{2gH}{3}}$$

$$3) T = \frac{v_0}{2g} = \sqrt{\frac{2H}{3g}}$$

$$4) g = H_0 - H = \frac{v_0^2}{2g}$$

$$L = 2H_0 - H$$

$$0,5 \cdot 10^5 = 5 \cdot 10^4$$

$$u) S = \frac{3T}{2} + \frac{3T}{2} + \frac{3T}{2} = \frac{9T}{2}$$

$\sqrt{3}$:

$$v_0 p_0 \rightarrow \frac{v_0}{2} \beta p_0$$

$$15 \cdot 335396$$

$$3150$$

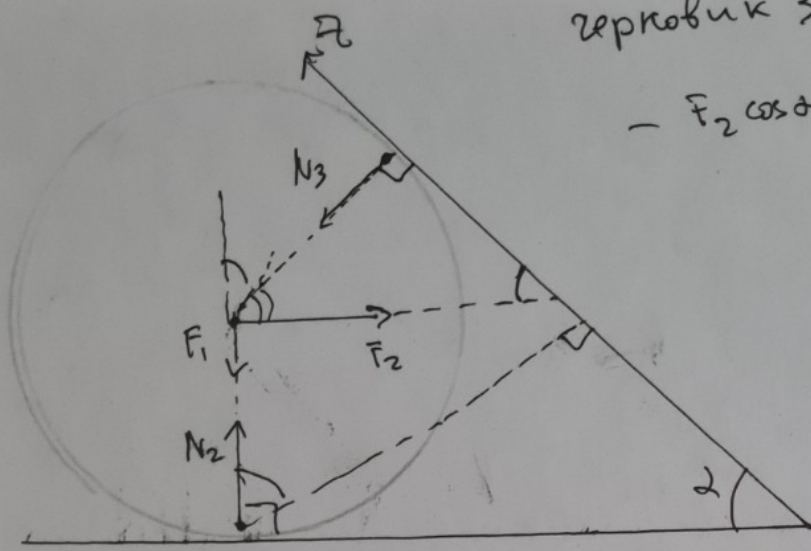
$m = 35$
 $T = 31^\circ C = 354K$
 $\alpha = 3,5$
 $\beta = 1,8$

Рхавшы (T) = $0,5 \cdot 10^5 Pa$
 $\mu = 18 \frac{r}{month} = 18 \cdot 10^{-3} \frac{kr}{month}$
 $P = 8,31 \frac{D^*}{km \cdot month}$

1) p_0 ?

2) dV_0 ?

зробинок 3.



$- F_2 \cos \alpha \rightarrow F_1 \sin \alpha + N_2 \sin \alpha$
 $\frac{F_1}{c} \cdot \frac{h}{c} = \frac{3}{c} zc$

Часть 2

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

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Вариант 1

методик 1
№5.

$$\left\{ \begin{array}{l} \frac{\Delta p}{p} = 2\% \\ \frac{\Delta V}{V} = -1\% \end{array} \right.$$

$$1) pV = \nu RT$$

$$p\Delta V + V\Delta p + \cancel{\Delta p\Delta V} = \nu R \Delta T$$

$$\Rightarrow \frac{\Delta T}{T} = \frac{\Delta p}{p} + \frac{\Delta V}{V} = (2-1)\% = 1\%$$

$T \uparrow \uparrow$ на 1%.

$$2) \Delta U = \frac{3}{2} \nu pV = \frac{3}{2} (p\Delta V + V\Delta p)$$

$$A = p\Delta V.$$

$$\Delta Q = A + \Delta U$$

$$\begin{aligned} \frac{\Delta Q}{A} &= \frac{A + \Delta U}{A} = 1 + \frac{\frac{3}{2} p\Delta V + \frac{3}{2} V\Delta p}{p\Delta V} = \\ &= \frac{5}{2} + \frac{3}{2} \cdot \frac{V\Delta p}{p\Delta V} = \frac{5}{2} + \frac{3}{2} \cdot \frac{\frac{\Delta p}{p}}{\frac{\Delta V}{V}} = \\ &= \frac{5}{2} + \frac{3}{2} \cdot \frac{2}{-1} = \frac{5}{2} - 3 = -0,5 = -\frac{1}{2}. \end{aligned}$$

Ответ: 1) $\frac{\Delta T}{T} = 1\%$

$$\Delta T > 0$$

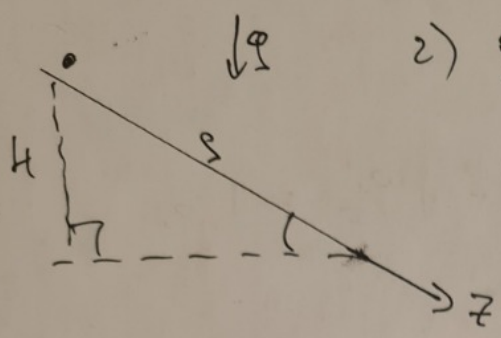
2) $\frac{\Delta Q}{A} = -\frac{1}{2}$

$\left(\begin{array}{l} A < 0 \text{ (на } \infty) \\ \Delta Q > 0 \text{ ← нагрев} \\ A - \text{ работа газа} \end{array} \right)$

$\cos \alpha = \frac{4}{5} H, m,$

числовик 2. Ну.

1) Книга покатится, шайба камыбается

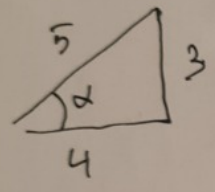


2) $g_z = +g \sin \alpha$

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

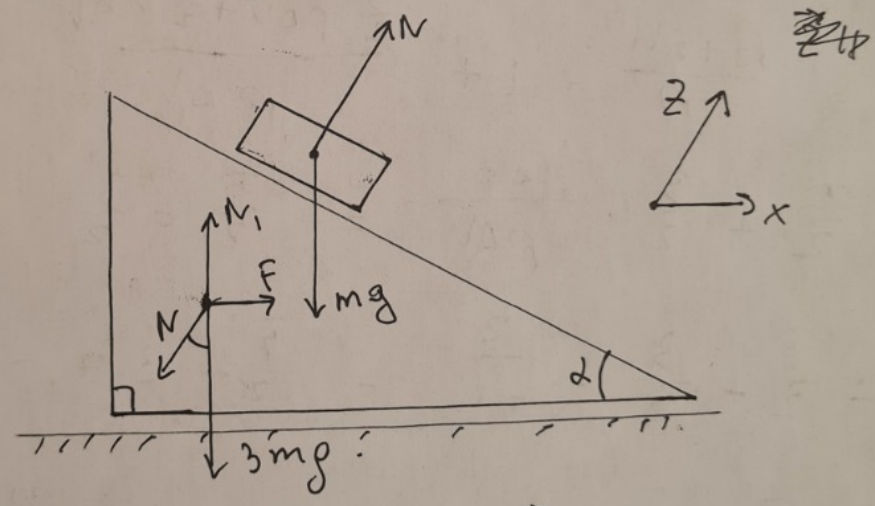
1) $\frac{g_z z^2}{2} = S$

$$z = \sqrt{\frac{2S}{g_z}} = \sqrt{\frac{2 \frac{H}{\sin \alpha}}{g \sin \alpha}} = \sqrt{\frac{2H}{g \sin^2 \alpha}}$$

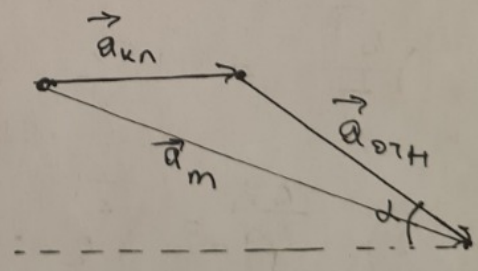
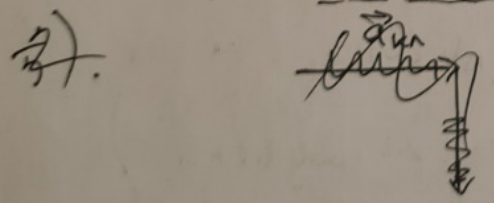


$z = \sqrt{\frac{2H}{g}} \cdot \frac{5}{3} = \frac{5}{3} \sqrt{\frac{2H}{g}}$

4) $F = 2mg$

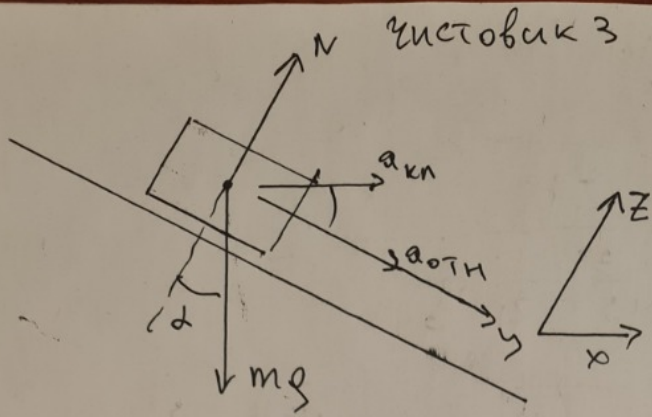


5) Пусть \vec{a}_{kn} вверх.



6) Т.к. шайба без отрыва a_{0TH} по книге.

$\vec{a}_m = \vec{a}_{kn} + \vec{a}_{0TH}$



7) $25\text{H} \times 3\text{m}!$
 $F - N \sin \alpha = 3m a_{kn}$

8) $25\text{H m}!$
 z: $N - mg \cos \alpha =$
 $= 3m a_{kn} \sin \alpha$

o y: $mg \sin \alpha = m a_{отн} + m a_{kn} \cos \alpha$

$g \sin \alpha = a_{отн} + a_{kn} \cos \alpha.$

$N = m(a_{kn} \sin \alpha + g \cos \alpha) = \frac{F - 3m a_{kn}}{\sin \alpha}$

$\cos \alpha = \frac{4}{5} \rightarrow \sin \alpha = \frac{3}{5}, \quad F = 2mg. \quad \text{Рогератон.}$

$m a_{kn} \frac{3}{5} + mg \frac{4}{5} = \frac{2}{5} \cdot 2mg - \frac{2}{5} \cdot 3m a_{kn}$

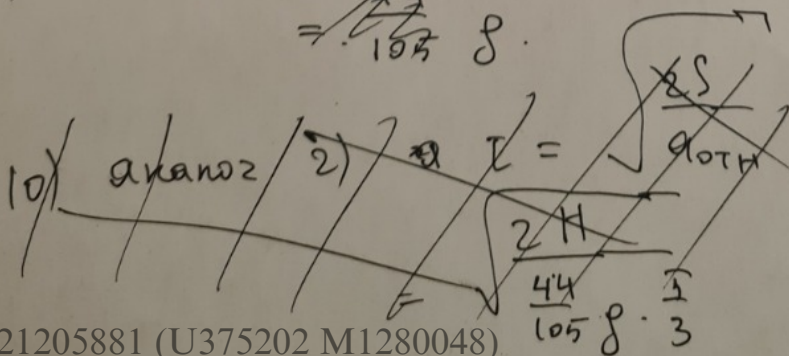
$m a_{kn} \left(\frac{3}{5} + 5 \right) = mg \left(\frac{10}{3} - \frac{4}{5} \right) \quad 105 = 5 \cdot 21$

$a_{kn} = g \frac{\frac{38}{15}}{\frac{28}{5}} = g \frac{38}{3 \cdot 28} = g \frac{19}{42}$

$a_{kn} = \frac{19}{42} g$

$\frac{38}{2 \cdot 5} = \frac{19}{5}$
 $\frac{19}{5} \cdot \frac{4}{5} = \frac{76}{25}$
 $\frac{76}{25} - \frac{38}{25} = \frac{38}{25}$
 $\frac{38}{25} \cdot \frac{5}{5} = \frac{38}{5}$
 $\frac{38}{5} \cdot \frac{1}{3} = \frac{38}{15}$

9) $a_{отн} = g \sin \alpha - a_{kn} \cos \alpha = g \left(\frac{3}{5} - \frac{19}{42} \cdot \frac{4}{5} \right) =$
 $= \frac{44}{105} g$
 $\ominus \frac{5}{21} g$



задание 4.

анализ

2)

$$\tau_2 = \sqrt{\frac{2H}{g \sin^2 \alpha}} = \sqrt{\frac{2H}{\frac{3}{5} \cdot \frac{5}{21} g}} = \sqrt{\frac{2 \cdot 21 H}{3g}} = \sqrt{\frac{14H}{g}}$$

Ответ: 1) $\tau = \sqrt{\frac{2H}{g \sin^2 \alpha}} = \frac{5}{3} \sqrt{\frac{2H}{g}}$

2) $a_{kn} = \frac{19}{42} g$ вправо

3) $\tau_2 = \sqrt{\frac{14H}{g}}$

2/27

Чертовик 1.

$$\frac{\Delta P}{P} + \frac{\Delta V}{V} = \frac{\Delta T}{T}$$

$\sqrt{5}$

$$pV = \nu RT$$

$$\frac{dT}{T} = \frac{dp}{p} + \frac{dV}{V} \quad p dV + V dp = \nu R dT$$

1 ат $\frac{\Delta P}{P} = 2\%$ $\frac{\Delta V}{V} = -1\%$

$$\Delta Q = \Delta U + A = \frac{3}{2} \nu R \Delta T + p \Delta V$$

$$\Delta U = \nu(pV) = (p + \Delta p)(V + \Delta V) - pV = p \Delta V + V \Delta p$$

$$\frac{\Delta Q}{A} = \frac{\frac{3}{2} V \Delta p + \frac{5}{2} p \Delta V}{p \Delta V} = \frac{5}{2} + \frac{3}{2} \cdot \frac{V \Delta p}{p \Delta V}$$

$$\frac{10}{3} - \frac{4}{3} = \frac{50-2}{15} = \frac{48}{15} = \frac{16}{5}$$

$$\frac{5}{2} - 3 = \frac{5-6}{2} = -\frac{1}{2}$$

$$13-8=5$$

$$\frac{10}{3} - \frac{4}{3} = \frac{10-5-4 \cdot 3}{15} = \frac{50-12}{15} = \frac{38}{15}$$

$$\frac{1}{5} + 5 = \frac{3+25}{5} = \frac{28}{5} \quad \frac{1}{5} + 5 = \frac{3+25}{5} = \frac{28}{5}$$

$$63 - \frac{38}{25}$$

$$\frac{38 \cdot 5}{28 \cdot 15} = \frac{2 \cdot 19}{2 \cdot 14 \cdot 3} = \frac{19}{42}$$

$$\frac{19}{14 \cdot 3} = \frac{19}{42}$$

$$= \frac{19}{42}$$

$$\frac{3}{5} - \frac{19}{42} \cdot \frac{4}{5}$$

$$42 = 2 \cdot 21$$

$$\frac{3}{5} - \frac{4}{5} \cdot \frac{19}{42} = \frac{3}{5} - \frac{76}{420}$$

$$\frac{19}{21} \cdot \frac{2}{5}$$

$$\frac{1}{105} (25)$$

$$-\frac{1}{5} \left(3 - \frac{38}{21} \right) \frac{4}{5} = \frac{1}{5} \left(\frac{63-38}{21} \right) \frac{4}{5} = \frac{1}{5} \left(3 - \frac{19}{21} \right) = \frac{9}{5} \left(\frac{63-19}{21} \right) = \frac{44}{105}$$

$$\begin{array}{r} 63 \\ -19 \\ \hline 44 \end{array}$$

чирковикт.

$$\frac{8}{5} \left(3 - \frac{18 \cdot 4}{42} \right) = \frac{8}{5} \left(3 - \frac{18 \cdot 2}{21} \right) = \frac{8}{5} \left(63 - \frac{38}{21} \right) =$$

$$= \frac{8}{5} (25) = 8 \frac{5 \cdot 5}{5 \cdot 21} = \frac{5}{21} 8$$

7.3

$$\frac{2}{5} \cdot \frac{5}{21} = \frac{21 \cdot 2}{3} = \frac{142}{3} = \frac{14}{3}$$

$$= \frac{7 \cdot 3 \cdot 2}{3} = 14. \quad 14 = 7 \cdot 2.$$

$$42 = 14 \cdot 3 = 42 \text{ (⊕)}$$