Часть 1

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

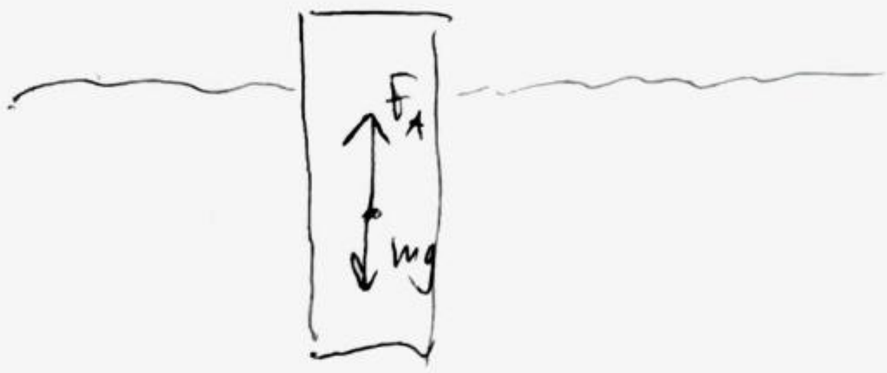
Шифр: **21205056**

ID профиля: **307526**

Вариант 3

ЧИСТОВИК

№1



$F_A = mg$

$\rho_0 g V_n = \rho g V$

$\frac{V_n}{V} = \frac{\rho}{\rho_0}$

$\frac{V_n}{V} = 0,9$

$\frac{V - V_H}{V} = 0,9$

$\frac{V_H}{V} = 0,1$

1) $V_{H_1} = V \cdot 0,1 = \frac{M}{\rho} \cdot 0,1 = \frac{0,45}{900} \cdot 0,1 = 0,00005\ м^3 = 50\ см^3$

$\frac{V_{H_2}}{V_2} = 0,1$

$V_{H_2} = 50\ см^3 - 25\ см^3 = 25\ см^3$

$V_2 = 250\ см^3$

$\Delta V = V - V_2 = \frac{0,45}{900} \cdot 10^6 - 250 = 500\ (см^3)$

Такое кол-во льда растопила налитая вода.

$m C_в \cdot |t_1 - 0°C| = \lambda \Delta V \cdot \rho$

$m = \frac{\lambda \Delta V \cdot \rho}{C_в t_1} = 0,6\ кг$

Ответ: 0,6 кг

ЧИСТОВИК

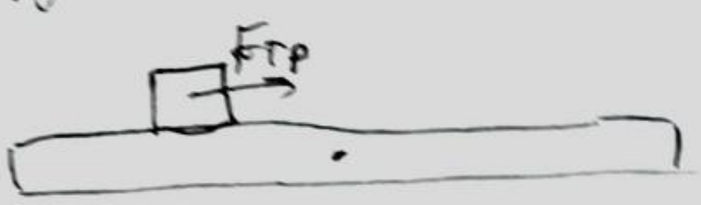
№2

Пока платформа движется с ускорением, на коробку действует сила трения в противоположном направлении.

2

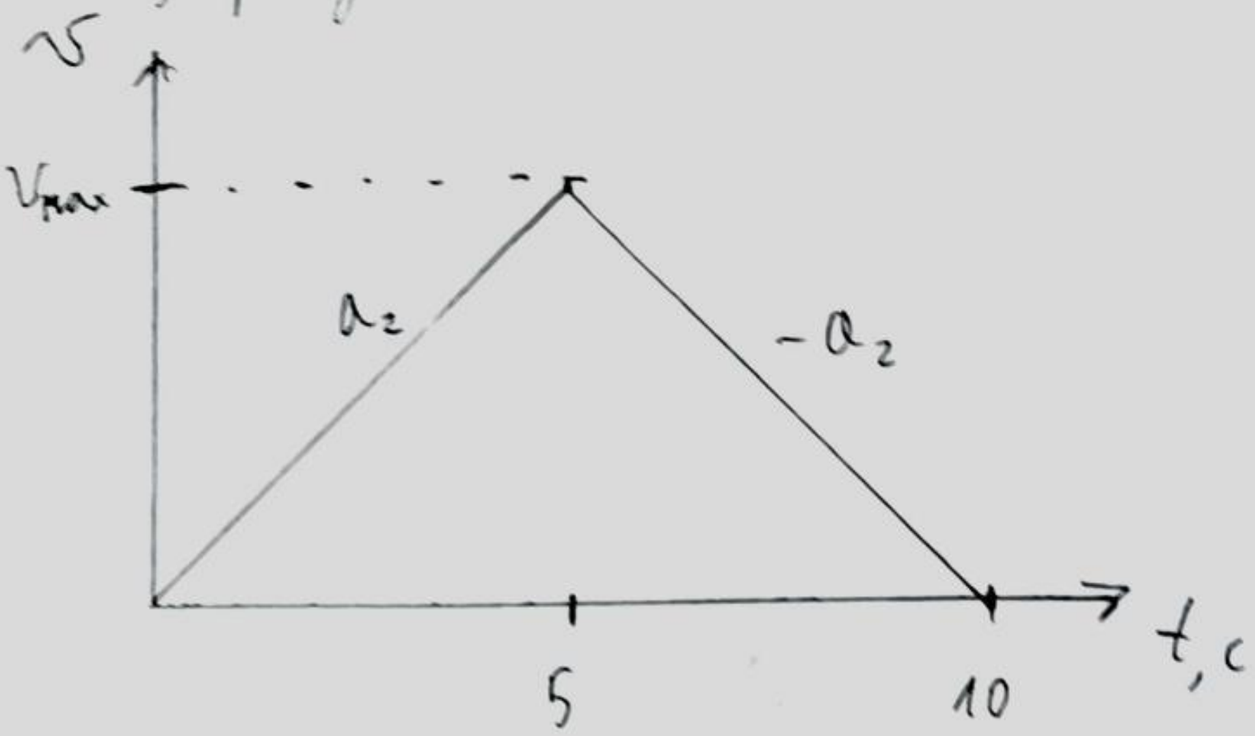
Начиная с момента платформа коробка начинает ускоряться с ускорением a_2.

Когда платформа остановится (через $\frac{V_0}{a} = 5c$), коробка будет иметь скорость, но на нее начнет действовать ускорение по модулю, но противоположная по напр. сила $F_{тр}$.



Коробка движется с тем же по модулю ускорением.

Нарисуем график скорости коробки отн. платформы во времени



Найдем перемещение

$$\left(a_2 \cdot \frac{(5c)^2}{2}\right) + \left(V_{max} \cdot 5c - a_2 \cdot \frac{(5c)^2}{2}\right) = 12м$$

$$V_{max} \cdot 5c = 12м$$

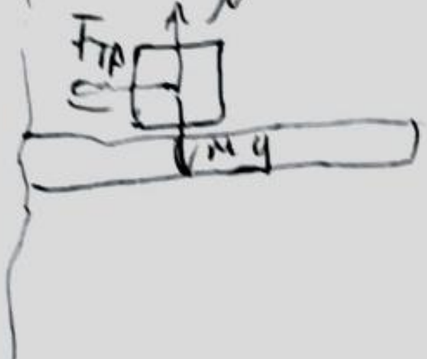
$V_{max} = 5c \cdot a_2$

$a_2 \cdot 25c^2 = 12м$

$a_2 = 0{,}48 \frac{м}{c^2}$

$V_{max} = 2{,}4 \frac{м}{c}$

$L = 10\frac{м}{c} \cdot 5c - 2\frac{м}{c^2} \cdot \frac{(5c)^2}{2} = 50м - 25м = 25м$



$F_{тр} = \mu N = \mu mg$

$ma_2 = \mu mg$

$\mu = \frac{a_2}{g} = 0{,}048$

Из графика видно, что

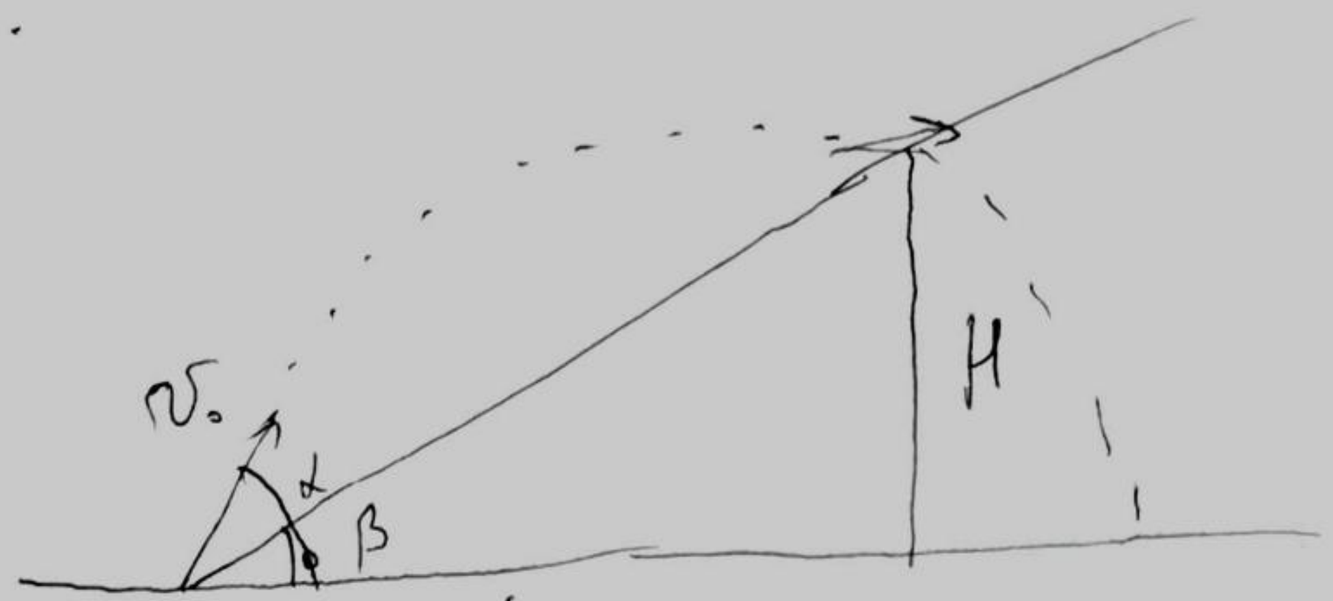
$T = 5c$

Ответ: $L = 25м$; $\mu = 0{,}048$; $T = 5c$; $V_{max} = 2{,}4 \frac{м}{c}$

смотри →

№3

ЧИСТОВИК



Если скорость горизонтальная, то камень пролетит равно половину.

$$\begin{cases} L = V_0 \cdot \cos\alpha \cdot t \\ H = V_0 \cdot \sin\alpha \cdot \frac{t}{2} - g\frac{t^2}{8} \\ 0 = V_0 \cdot \sin\alpha \cdot \frac{t}{2} - g\frac{t^2}{2} \mid :4 \end{cases}$$

$$\begin{cases} H = V_0 \cdot \sin\alpha \cdot t - g\frac{t^2}{2} \\ 0 = 2V_0 \cdot \sin\alpha \cdot t - g\frac{t^2}{2} \end{cases} (-)$$

$$H = \begin{cases} H = V_0 \cdot \sin\alpha \frac{t}{2} - g\frac{t^2}{8} \\ 0 = V_0 \cdot \sin\alpha \frac{t}{4} - g\frac{t^2}{8} \end{cases} (-)$$

$$\begin{cases} H = V_0 \sin\alpha \cdot \frac{t}{4} \\ L = V_0 \cdot \cos\alpha \cdot t \end{cases} (:)$$

$$\frac{H}{L} = \frac{\sin\alpha}{\cos\alpha} \cdot \frac{1}{4} = tg\alpha \cdot \frac{1}{4} \quad tg\alpha \cdot \frac{1}{4}$$

$$tg\beta = 2\frac{H}{L} = \frac{8}{3} \cdot \frac{1}{2} = \frac{4}{3}$$

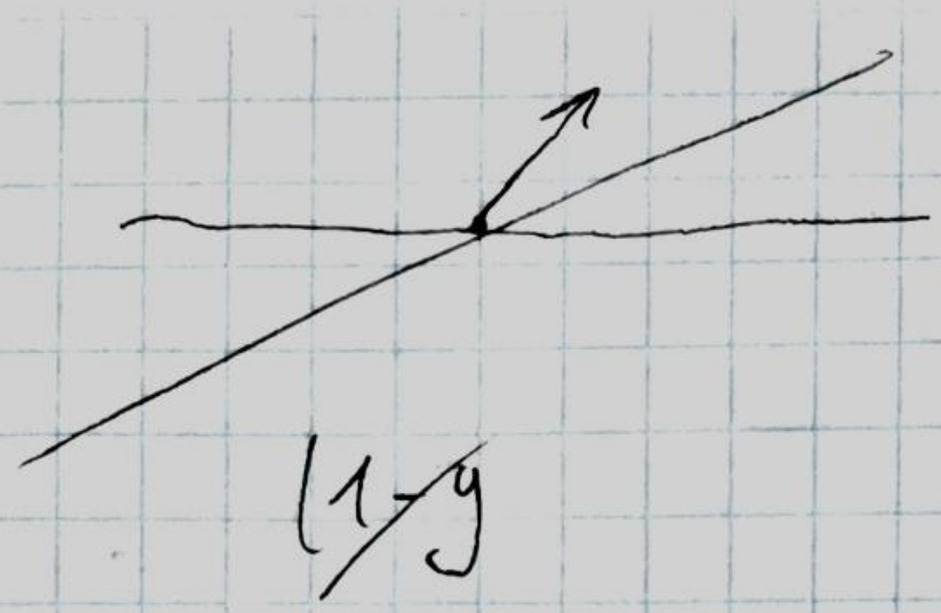
$$0 = V_0 \cdot \sin\alpha - g\frac{t}{2}$$

$$t = \frac{2V_0 \cdot \sin\alpha}{g} \approx 2{,}24\ с.$$

$$\begin{cases} H = V_0 \cdot \sin\alpha \cdot \frac{t}{2} - g\frac{t^2}{8} \\ 0 = V_0 \cdot \sin\alpha \cdot t - g\frac{t^2}{2} \mid :2 \end{cases} (-)$$

$$H = g\frac{t^2}{8} = 6{,}311\ м$$

Ответ: $H = 6{,}311\ м$; $tg\beta = \frac{4}{3}$

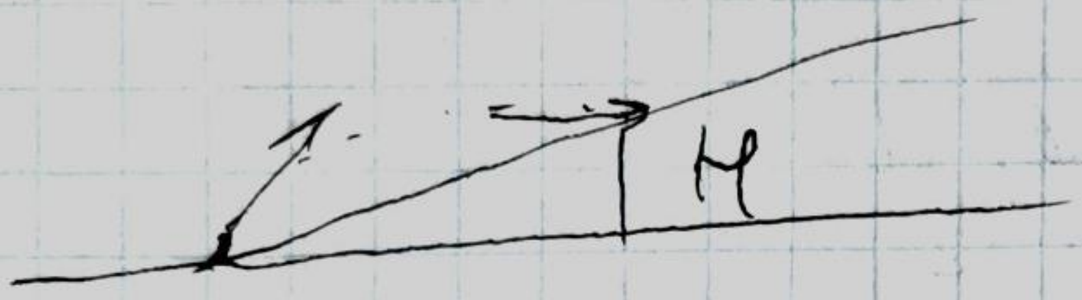


(1-y

$$L = 69.4\,м$$

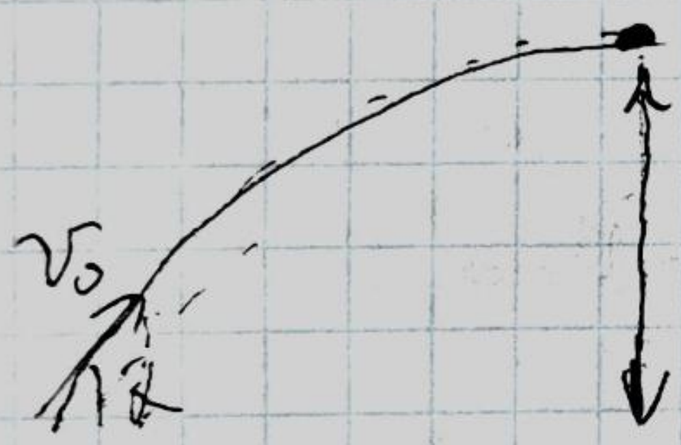
$$\frac{2 v_0^2 \cdot \sin\alpha^2}{g} - g\frac{v_0^2 \cdot \sin\alpha^2}{2} =$$

$$= \mu =$$



$$tg\,\beta = \frac{H}{\frac{L}{2}} = 2\frac{H}{L}$$

$$\frac{1}{2} \quad \frac{\sqrt{2}}{2}$$



$$v_0 \cdot \sin\alpha - g\frac{t}{2} = 0$$

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

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

$$v_0 \cdot \sin\alpha \cdot t - g\frac{t^2}{2} = 0 \;|:2$$

$$v_0 \cdot \sin\alpha \cdot \frac{t}{2} - g\frac{t^2}{8} = \alpha H$$

$$-g\frac{t^2}{8} + g\frac{t^2}{4} = H$$

$$v_0 \cdot \sin\alpha \cdot \frac{t}{4} - g\frac{t^2}{8} = 0$$

$$v_0 \cdot \sin\alpha \cdot \frac{t}{2} - g\frac{t^2}{8} = H$$

$$g\frac{t^2}{8} = H$$

$$v_0 \cdot \sin\alpha \cdot \frac{t}{4} = H$$

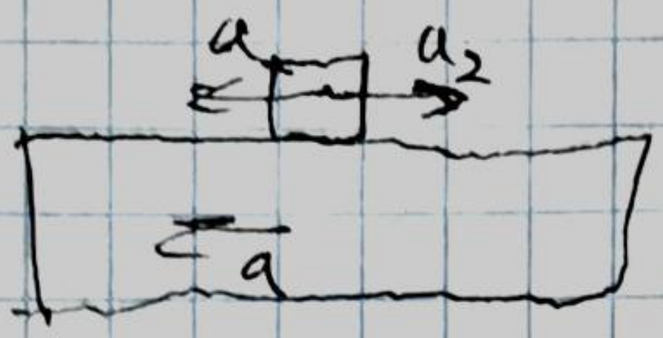
$$t^2 =$$

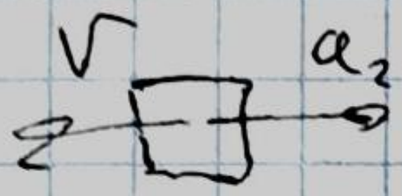
$$\frac{v_0 \cdot \sin\alpha \cdot \frac{t}{4}}{v_0 \cdot \cos\alpha\, t} = \frac{H}{L}$$

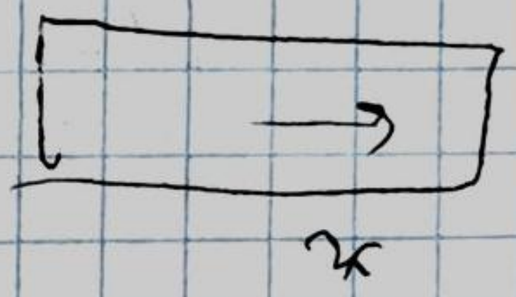
$$2\frac{H}{L} = \frac{1}{2}$$

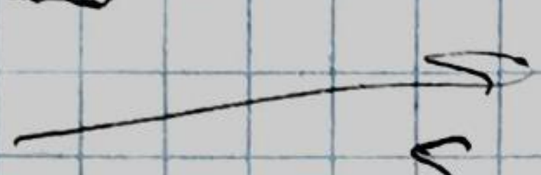
$$\frac{H}{L} = \frac{1}{4} \cdot \frac{\sin\alpha}{\cos\alpha} \qquad \frac{H}{L} = \frac{1}{4} \cdot tg\alpha$$

$$\frac{H}{L} = \frac{2}{3} \quad \frac{1}{2}\frac{H}{L} = \frac{4}{3}$$









$$12 м = -V \cdot t + \frac{a_2 \cdot t^2}{2}$$

$$a_2 V t = a$$

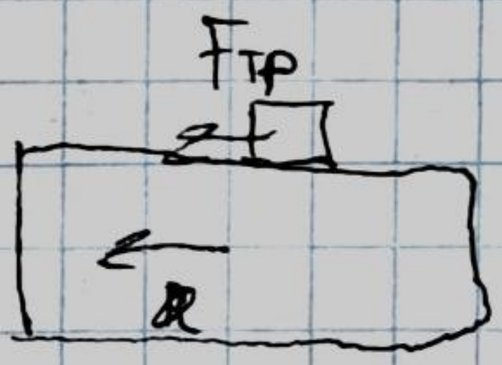
$$t = \frac{S}{a} = \frac{\frac{м}{с}}{\frac{м}{с^2}}$$

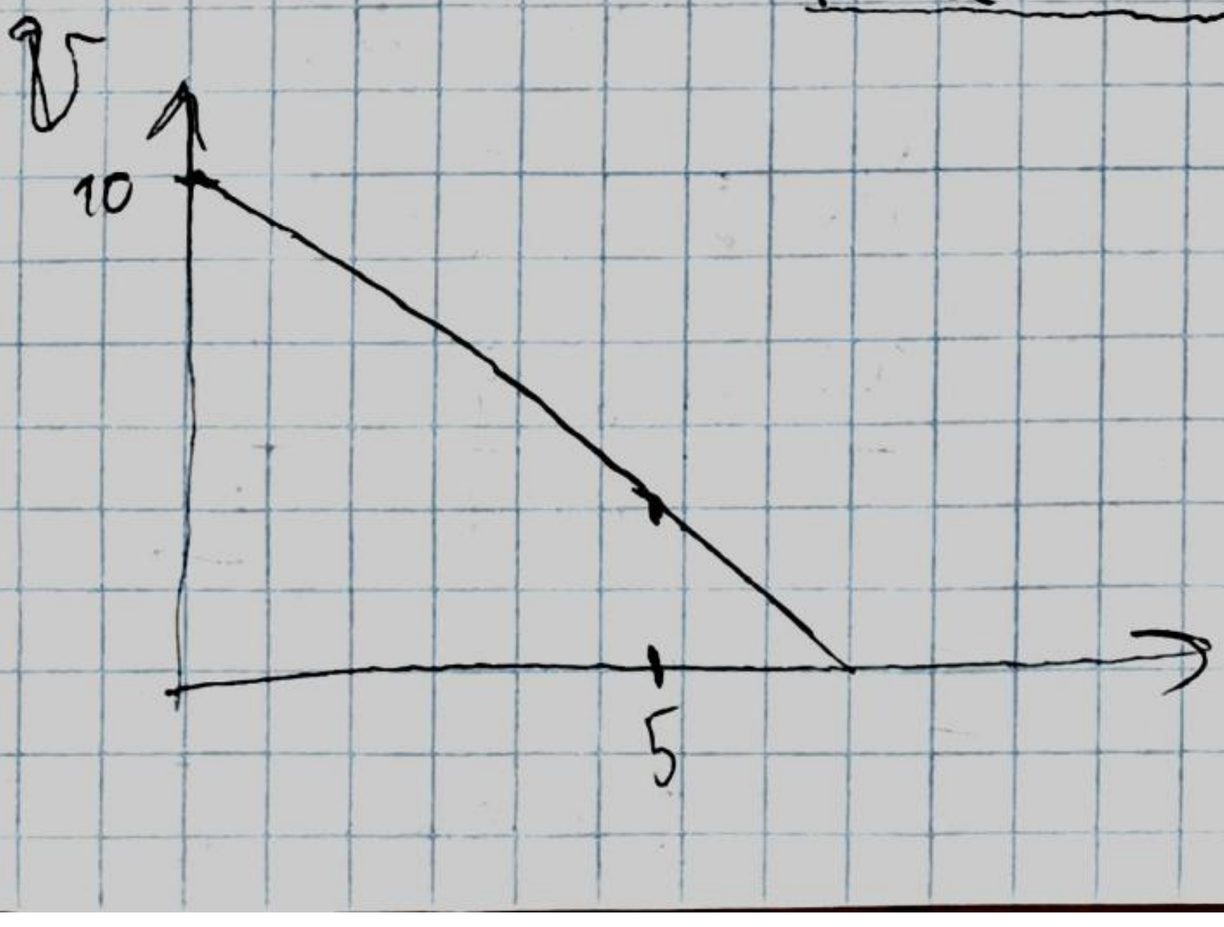
$$-Vt + a_2 = 0$$

$$at - V = 0$$

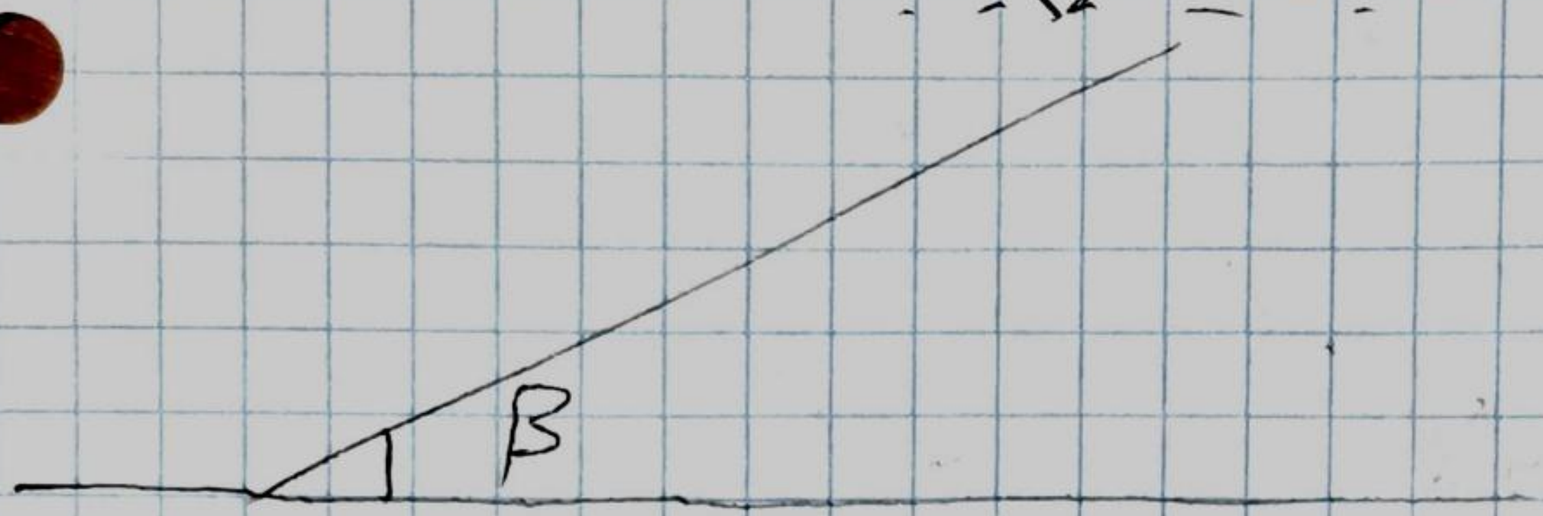
$$12 = -\frac{v^2}{a_2} + \frac{a_2 \cdot v^2}{a_2^2 \cdot 2}$$

$$12 = -\frac{V^2}{a_2} + \frac{V^2}{a_2 \cdot 2} = V^2$$

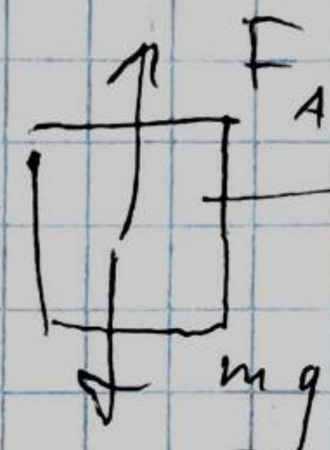




ЧЕРНОВИК



1) ~~$\frac{V_A}{N}$~~



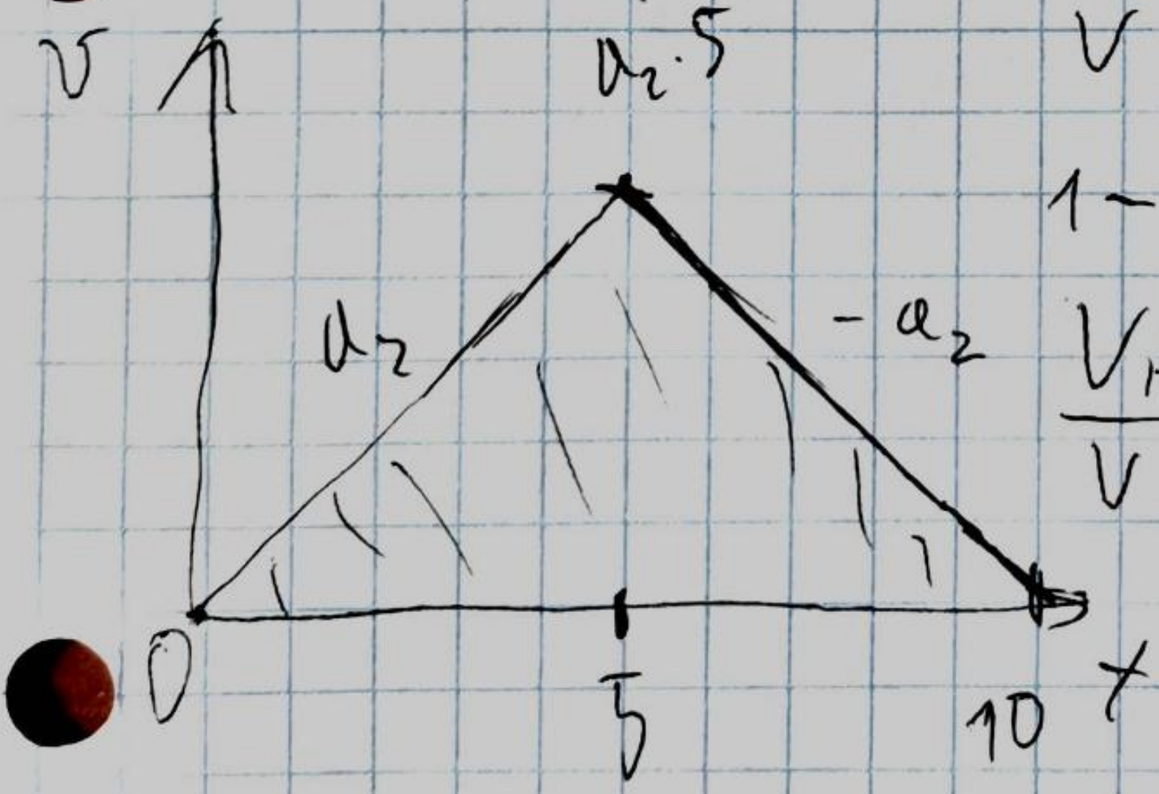
$mg = F_A \quad \rho g V = \rho_0 g V_n \quad F_{тр} = \mu m g$

$\frac{V_n}{V} = \frac{\rho}{\rho_0}$ $\quad ma = a_2 = \mu m g$

$\mu = \frac{a_2}{g}$

$\frac{V_n}{V} = 0,9$

$\frac{V - V_n}{V} = 0,9$ $\quad V = at$



$1 - \frac{V_n}{V} = 0,9$

$\frac{V_n}{V} = 0,1$

v_{max}

$\frac{a_2 \cdot 5^2}{2} - \frac{a_2 \cdot 5^2}{2}$

$10 \cdot a_2 \cdot 5 \cdot \frac{1}{2} = 25 a_2 = 12 м$

$a_2 = 0,48 \frac{м}{с^2}$

$v - at = 0$

$t = \frac{v}{a} = \frac{\frac{s}{2}}{\frac{a}{2}} = \frac{s}{a}$

$12\mu =$

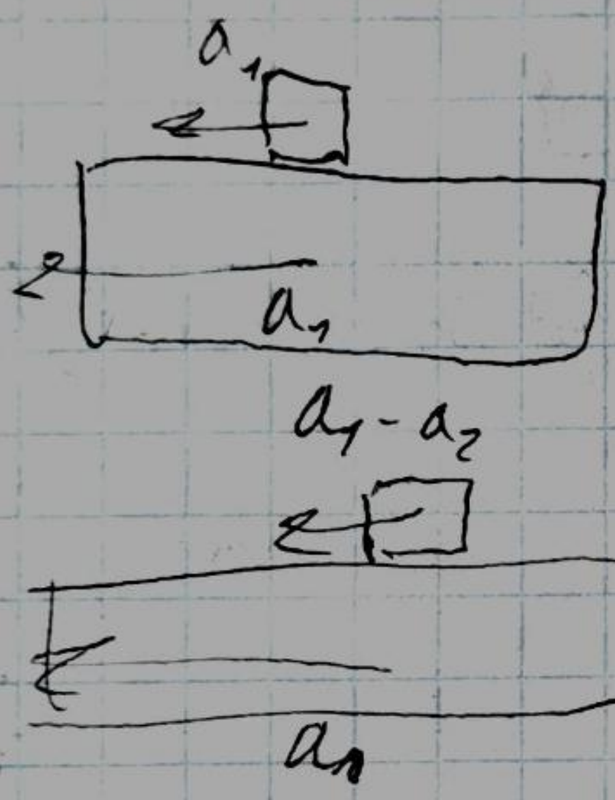
$12\mu = \frac{5t^2}{2}$

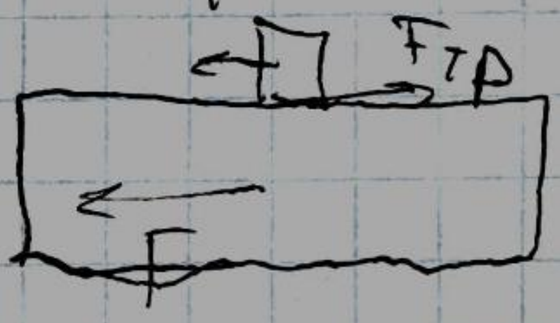
$12\mu = a_2 \frac{s}{2}$

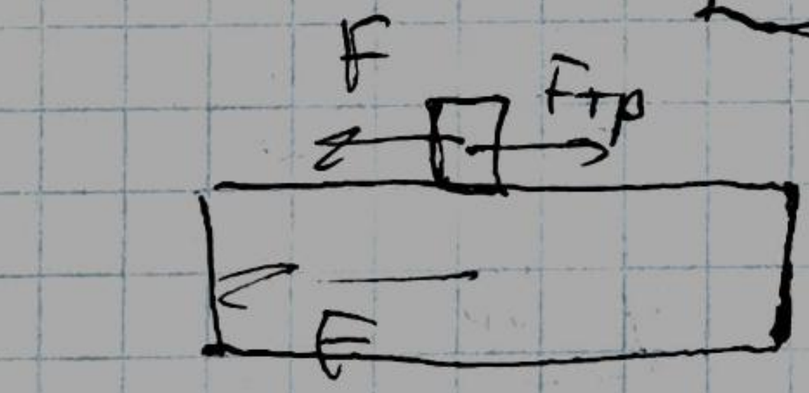
$24\mu = 25 a_2$

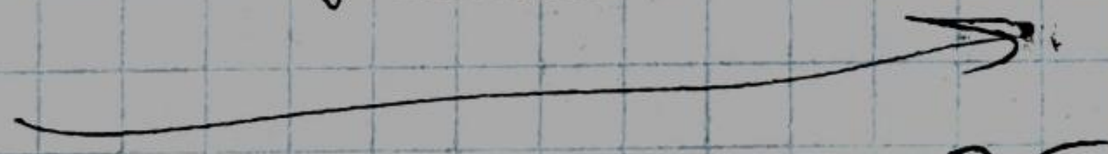
$a_2 = \frac{24\mu}{25}$

$a_2 = 0{,}96\mu$









v_0

$\bar{F} = m\bar{a}$

Часть 2

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

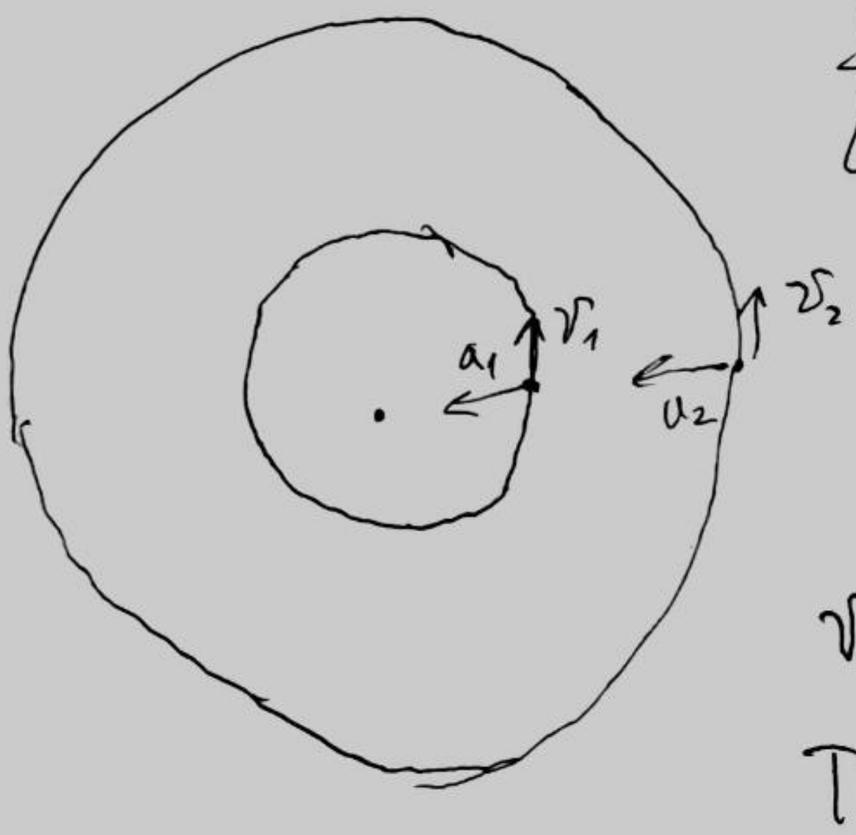
Шифр: **21205056**

ID профиля: **307526**

Вариант 3

ЧИСТОВИК

№1



$$\begin{cases} m_1 a_1 = \dfrac{m_1 M}{R^2} \\ m_2 a_2 = \dfrac{m_2 M}{4R^2} \end{cases}$$

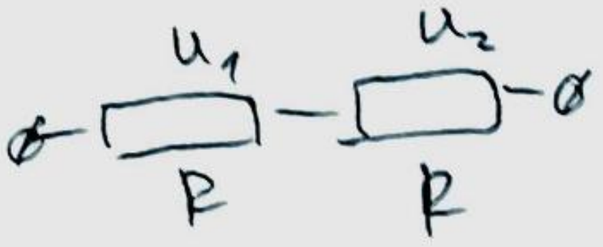
$$\begin{cases} g = \dfrac{M}{R^2} \\ a_2 = \dfrac{M}{4R^2} \end{cases} \Rightarrow a_2 = \frac{1}{4} g$$

$$v_2 = \sqrt{\frac{1}{4} g \cdot 2R} = 5656 \frac{м}{с}$$

$$T = \frac{4 \cdot 8 \pi R}{v_2} = 4 ч$$

ЧИСТОВИК

№2



$$P = u_1 I + u_2 I = \frac{u}{} u I = \frac{u^2}{2R}$$

$$R = \frac{u^2}{2P} = 18\,\text{Ом}$$

$P = UI$ $\quad U = IR$ $\quad I = \frac{U}{R}$

$P = I^2 R$ $\quad P = UI$ $\quad \frac{U^2}{R}$

$I = \frac{U}{2R}$ $\quad P = U \cdot$

$P = \frac{U^2}{4R^2}$ $\quad R = \frac{U^2}{4R}$

$R = \frac{U^2}{4P} = \frac{36}{4} = 6\ \text{Ом}$ $\quad \frac{R_1 R}{R_1 + R} + R$

$\frac{\alpha^2 + \alpha}{2\alpha + 1} = \frac{\alpha + 1}{2 + \frac{1}{\alpha}}$ $\quad \frac{U}{\frac{R_1 R}{R_1 + R} + R} \cdot R_1$

$y(\alpha) = \frac{\alpha + 1}{2 + \frac{1}{\alpha}}$ $\quad \frac{U}{\frac{R_1 R + R(R_1 + R)}{R_1 + R}} \cdot R_1 =$

$\frac{U(R_1 + R)}{2R_1 R + R^2} \cdot R_1$

~~P~~ ~~R~~ $\quad \frac{R_1}{R} = \alpha$ $\quad \frac{U(\alpha R + R)}{2\alpha R^2 + R^2} \cdot \alpha R =$

$P(\alpha) = U \cdot \frac{\alpha(\alpha + 1)}{2\alpha + 1} =$ $\quad \frac{U R(\alpha + 1)}{R^2(2\alpha + 1)} \cdot \alpha R =$

$= \quad = U \cdot \frac{\alpha(\alpha + 1)}{2\alpha + 1}$

$(R^2 + R^2 - 2\cos(\omega_1 \cdot t) \cdot 2R^2)$

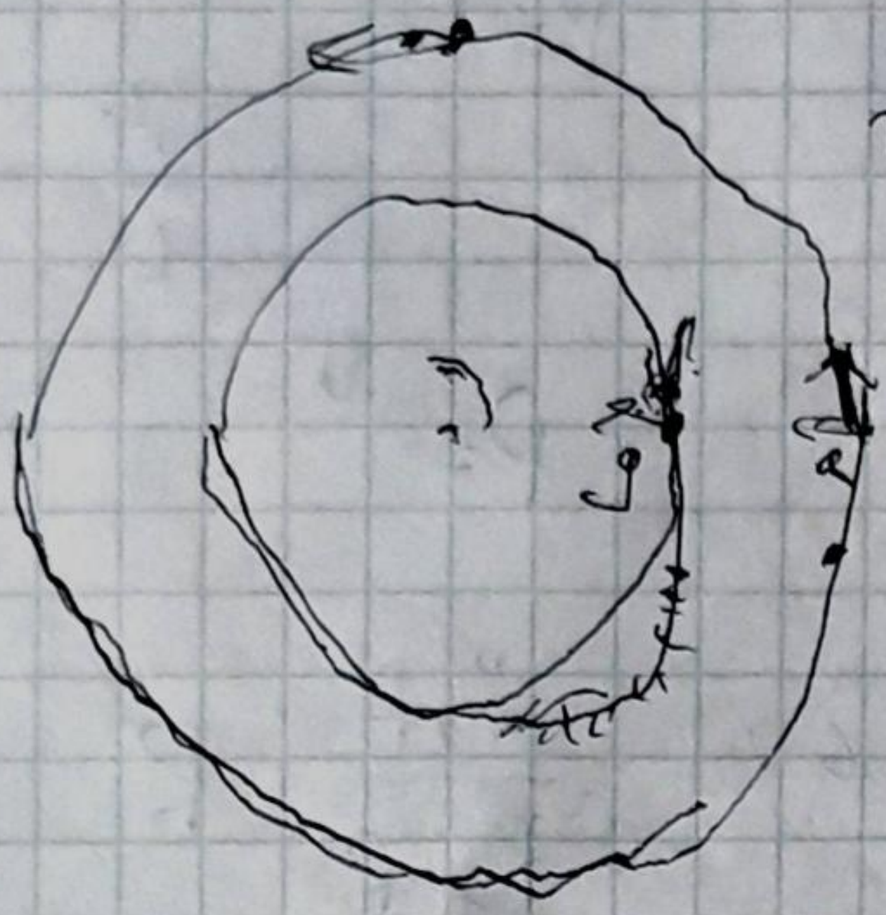
$v\omega = a$

$\frac{2\pi R}{v}$ $5656 \frac{\text{м}}{\text{с}}$

$v\omega = a$

$v \frac{\text{м}}{\text{с}} \cdot \frac{1}{\text{с}} = a$

8000 $2\overline{23} \frac{\text{км}}{\text{ч}}$



$448 \frac{\text{м}}{\text{с}}$

$v_1 = \sqrt{gR}$

$a = \frac{v^2}{R}$ $\frac{v^2}{a} = R$ $R = \frac{v^2}{a}$ $v_1 = \sqrt{gR}$

F_1 $g m_1 = G \frac{m_1 M}{R^2}$ $\frac{\text{м}}{\text{с}^2} \cdot \text{м}$

$g = G \frac{M}{R^2}$

$a = G \frac{M}{4R^2}$ $a = \frac{g}{4}$ $\frac{v^2}{a} = R$

$\frac{v^2}{a} = \frac{\frac{\text{м}^2}{\text{с}^2}}{\frac{\text{м}}{\text{с}^2}} = \text{м}$ $\frac{v^2}{a} =$ $a = \frac{v^2}{R}$

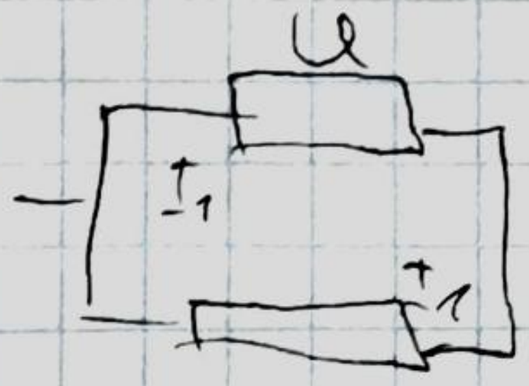
$v_1 = \sqrt{aR}$

F_2 $R = v^2 \cdot a$ $v_1 = \sqrt{gR} = \sqrt{gR}$

$v_2 = \sqrt{a \cdot 2R} = \sqrt{\frac{1}{2} gR}$

$$T = \frac{2\pi R}{2 \cdot 3}$$

$I^2 R$

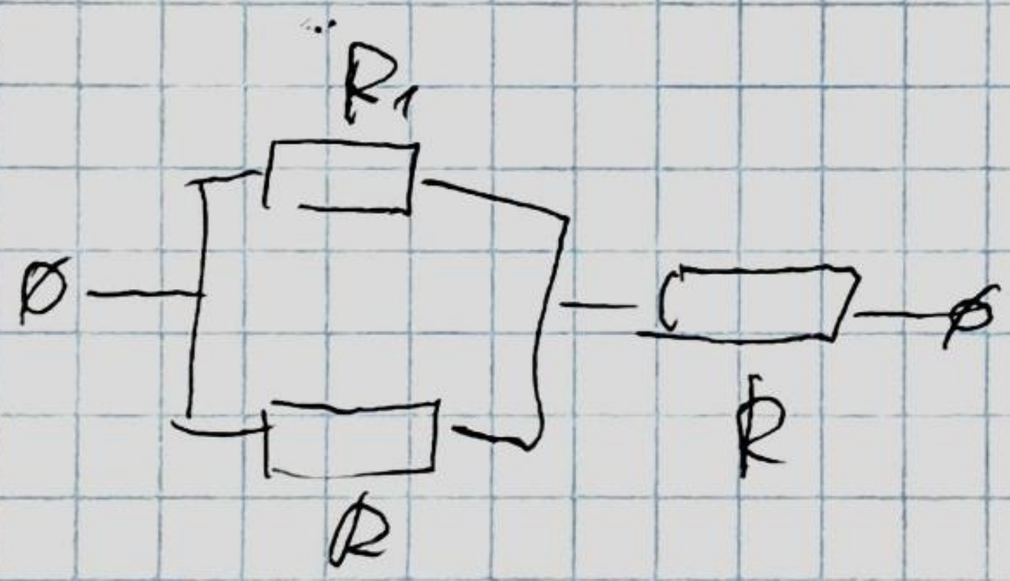


$$P = UI = \frac{U^2}{R} = R_1$$

$$I = \frac{U}{R}$$

$$\frac{(U - I_{общ} \cdot R)^2}{R_1}$$

$U I R^2$



$I -$

$$P = \frac{U^2 - 2 I_{общ} \cdot R + I_{общ}^2 \cdot R^2}{R_1}$$

$I_{общ} \cdot R$ $\quad U$ $\quad \frac{U_1}{R_1}$ $\quad U = I_{общ}$

$$\frac{U}{\frac{R_1 R}{R_1 + R} + R}$$

U $\quad \frac{U R_1}{U - I_{общ}} \cdot R_1$

$$\frac{U R_1^2}{U - \frac{R_1 R}{R_1 + R} - R}$$