

Часть 1

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

Шифр: **21205554**

ID профиля: **885574**

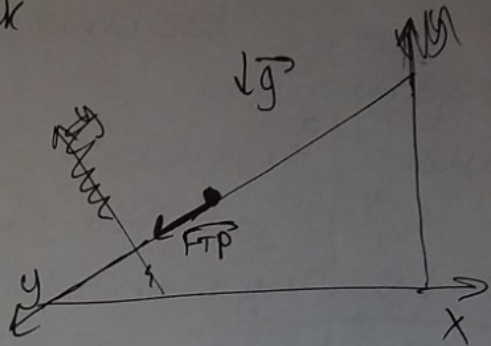
Вариант 4

~~Черный~~ Черный

$$4. v = \sqrt{v_x^2 + v_y^2} = \sqrt{v_x^2} = v_x$$

$$x: v_x = v_{x0} - at$$

$$y: F_{\text{тр}} =$$



Чистовик

Задание 1.

Дано:

- $M = 0,36 \text{ кг}$
- $\rho_0 = 1 \cdot 10^3 \frac{\text{кг}}{\text{м}^3}$
- $\rho = 0,9 \cdot 10^3 \frac{\text{кг}}{\text{м}^3}$
- $m = 0,4 \text{ кг}$
- $V_1 = 120 \text{ см}^3$
- $\lambda = 3,36 \cdot 10^5 \frac{\text{Дж}}{\text{кг} \cdot \text{°C}}$
- $\rho = 4,2 \cdot 10^3 \frac{\text{Дж}}{\text{м} \cdot \text{°C}}$

Решение:

по 2 и 3. Ньютона (т.к. система в равновесии)

$$\vec{F}_{\text{арх}} + \vec{Mg} = 0$$

$$y: F_{\text{арх}} - Mg = 0$$

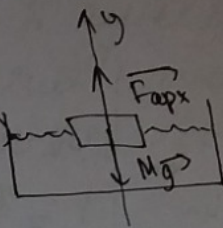
$$F_{\text{арх}} = Mg$$

$$\rho_0 \cdot g \cdot V = Mg$$

$$\rho_0 \cdot V = M \Rightarrow V = \frac{M}{\rho_0}$$

$$V = \frac{0,36 \text{ кг}}{1 \cdot 10^3 \frac{\text{кг}}{\text{м}^3}} = 0,00036 \text{ м}^3$$

$$2. V_1 = 120 \text{ см}^3 = 0,00012 \text{ м}^3$$



$V_2 = ?$
 $t = ?$

$$V_2 = V_1 - V_1 = \frac{M}{\rho_0} - V_1$$

по 2 и 3. Ньютона

$$\vec{F}_{\text{арх}2} + \vec{m_2 g} = 0$$

$$y: F_{\text{арх}2} - m_2 g = 0$$

$$\rho g V_{\text{арх}2} = m_2 g$$

$$\rho g V_{\text{арх}2} = m_2 g$$

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$$m_2 = \rho \cdot V_2 = \rho \cdot \left(\frac{M}{\rho_0} - V_1 \right)$$

$$\Delta m = M - m_2 = M - \rho \cdot \left(\frac{M}{\rho_0} - V_1 \right)$$

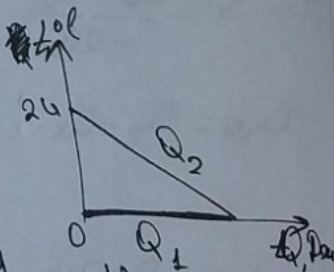
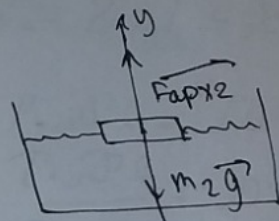
Т.к. система в тепловом равновесии, $t_0 = 0^\circ \text{C}$

$$Q_1 = Q_2$$

$$\lambda \cdot \Delta m = \rho \cdot m \cdot \Delta t \Rightarrow \Delta t = \frac{\lambda \cdot \Delta m}{\rho \cdot m}$$

$$t - t_0 = \frac{\lambda \cdot \left(M - \rho \cdot \left(\frac{M}{\rho_0} - V_1 \right) \right)}{\rho \cdot m} \Rightarrow t = \frac{\lambda \cdot \left(M - \rho \cdot \left(\frac{M}{\rho_0} - V_1 \right) \right)}{\rho \cdot m} + t_0 =$$

$$t = \frac{3,36 \cdot 10^5 \frac{\text{Дж}}{\text{кг} \cdot \text{°C}} \cdot 0,9 \cdot 10^3 \frac{\text{кг}}{\text{м}^3} \cdot 0,00012 \text{ м}^3}{4,2 \cdot 10^3 \frac{\text{Дж}}{\text{м} \cdot \text{°C}} \cdot 0,4 \text{ кг}} + 0^\circ \text{C} = 21,6^\circ \text{C}$$



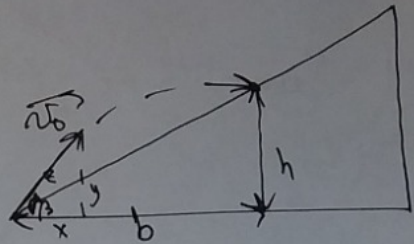
Ответ: $V = 0,00036 \text{ м}^3$; $t = 21,6^\circ \text{C}$

①

Угробуу

Зогануу 3

Дано:	Решение:
$v_0 = 10 \frac{M}{c}$	$v_y = 0 = v_{0y} - gT$
$tg \alpha = 1,5$	$v_{0y} = v_0 \cdot \sin \alpha \Rightarrow$
$T, tg \beta, S - ?$	$\Rightarrow gT = v_0 \cdot \sin \alpha$
	$T = \frac{v_0 \cdot \sin \alpha}{g}$



$$tg \alpha = \frac{y}{x} \Rightarrow y = 1,5x$$

$$\text{уз } \tau. \text{ Пураланга } z = \sqrt{x^2 + (1,5x)^2} = \sqrt{3,25x^2} = 1,802x$$

$$\sin \alpha = \frac{y}{z} = \frac{1,5x}{1,802x} = 0,83$$

$$T = \frac{10 \frac{M}{c} \cdot 0,83}{10 \frac{M}{c^2}} = 0,83c$$

$$2. b = v_{0x} \cdot T = v_0 \cdot \cos \alpha \cdot T$$

$$\cos \alpha = \frac{x}{z} = \frac{x}{1,802x} = 0,56$$

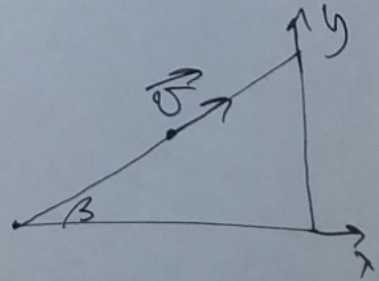
$$h = y_0^0 + v_{0y} \cdot T - \frac{gT^2}{2} = v_0 \cdot \sin \alpha \cdot T - \frac{gT^2}{2}$$

$$tg \beta = \frac{h}{b} = \frac{v_0 \cdot \sin \alpha \cdot T - \frac{gT^2}{2}}{v_0 \cdot \cos \alpha \cdot T} = \frac{v_0 \cdot \sin \alpha - \frac{gT}{2}}{v_0 \cdot \cos \alpha}$$

$$tg \beta = \frac{10 \frac{M}{c} \cdot 0,83 - \frac{10 \frac{M}{c^2} \cdot 0,83c}{2}}{10 \frac{M}{c} \cdot 0,56} = 0,75$$

~~2. $v_x = v_0 \cdot \cos \beta$
 $v_y = v_0 \cdot \sin \beta$~~

$$3. S = \frac{v_0^2 - v_x^2}{-2g} = \frac{v_x^2}{2g} = \frac{(\sqrt{v_x^2 + v_y^2})^2}{2g} = \frac{v_x^2}{2g} = \frac{v_{0x}^2}{2g} = \frac{(v_0 \cdot \cos \alpha)^2}{2g} = \frac{(10 \frac{M}{c} \cdot 0,56)^2}{2 \cdot 10 \frac{M}{c^2}} = 1,568 \mu$$

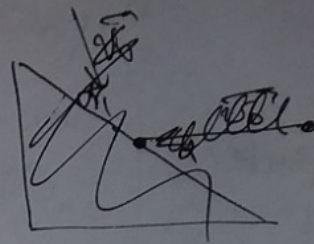
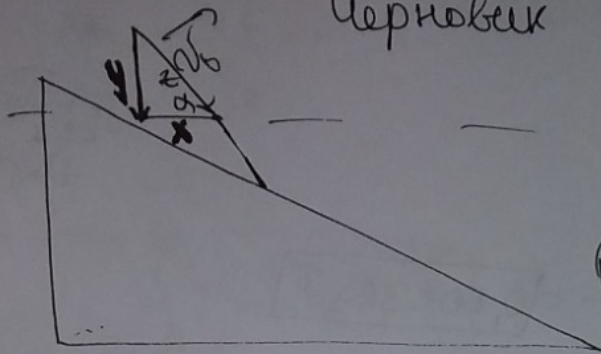


Омжон: $T = 0,83c$; $tg \beta = 0,75$; $S = 1,568 \mu$.

(3)

3

Черновик



1 2 3

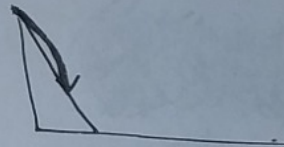
$$\frac{3,36 \cdot 10^5 \cdot 0,9 \cdot 10^8 \cdot 0,00012 \text{ м}^3}{4,2 \cdot 0,4 \cdot 10^8} = \frac{3,36 \cdot 0,9 \cdot 12}{4,2 \cdot 0,4} = 24,6^\circ$$

$$\frac{y}{x} = \text{tg} \alpha = 1,5 \Rightarrow y = 1,5x$$

$$v_{0y} = v_0 \cdot \sin \alpha$$

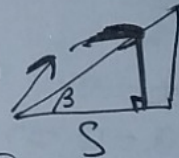
$$v_y = v_0 \cdot \sin \alpha - gT = 0 \quad y = 1,5x$$

$$T = \frac{v_0 \cdot \sin \alpha}{g} = \frac{10 \cdot 0,83}{10} = 0,83 \text{ с}$$



$$S = v_{0x} \cdot T = v_0 \cdot \cos \alpha \cdot T = 0,56 \cdot 10 \cdot 0,83 = 4,6 \text{ м}$$

$$h = v_{0y} \cdot T - \frac{gT^2}{2} = 10 \cdot 0,83 \cdot 0,83 - \frac{10 \cdot (0,83)^2}{2} = 3,4445 \text{ м}$$



$$\text{tg} \beta = \frac{h}{S} = \frac{3,4445 \text{ м}}{4,6 \text{ м}} = 0,75$$

Честовик

Задача 2

Дано: Решение:

$$v_0 = 5 \frac{\text{м}}{\text{с}}$$

$$T = 4 \text{ с}$$

$$S = 2,5 \text{ м}$$

$$1. v_k = 0 = v_0 - a_a T \Rightarrow a_a = \frac{v_0}{T}$$

$$L = \frac{v_k^2 - v_0^2}{-2a_a} = \frac{-v_0^2}{-2a_a} = \frac{v_0^2}{2a_a} = \frac{v_0^2}{2 \frac{v_0}{T}} = \frac{v_0^2 \cdot T}{2v_0} = \frac{v_0 \cdot T}{2}$$

$$L, a, t, v_{\text{max}}? \quad L = \frac{5 \frac{\text{м}}{\text{с}} \cdot 4 \text{ с}}{2} = 10 \text{ м}$$

~~$$L = \frac{v_0^2 - v_k^2}{-2a_a} = \frac{v_0^2}{-2a_a} \Rightarrow a_a = \frac{v_0^2}{-2L}$$~~

$$2. S_0 = v_0 \cdot T - \frac{aT^2}{2}$$

$$S_0 = L + S \Rightarrow \frac{aT^2}{2} = v_0 \cdot T - L - S$$

$$aT^2 = 2v_0 \cdot T - 2L - 2S$$

$$a = \frac{2v_0 \cdot T - 2L - 2S}{T^2}$$

$$a = \frac{2 \cdot 5 \frac{\text{м}}{\text{с}} \cdot 4 \text{ с} - 2 \cdot 10 \text{ м} - 2 \cdot 2,5 \text{ м}}{(4 \text{ с})^2} = 0,9375 \frac{\text{м}}{\text{с}^2}$$

$$3. S = \frac{v_k^2 - v_0^2}{-2a_k} = \frac{v_0^2}{2a_k} \Rightarrow a_k = \frac{v_0^2}{2S}$$

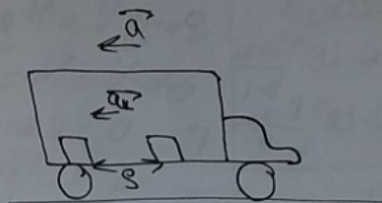
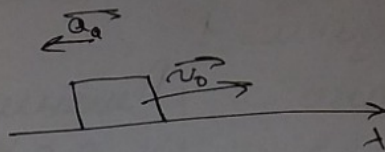
$$v_{k0} = v_0 - a_k \cdot t = 0 \Rightarrow a_k \cdot t = v_0$$

$$t = \frac{v_0}{a_k} = \frac{v_0}{\frac{v_0^2}{2S}} = \frac{2S \cdot v_0}{v_0^2} = \frac{2S}{v_0}$$

$$t = \frac{2 \cdot 2,5 \text{ м}}{5 \frac{\text{м}}{\text{с}}} = 1 \text{ с}$$

4. Т.к. коробка останавливается, $v_{\text{max}} = v_{\text{начальная коробка}} \Rightarrow v_{\text{max}} = 5 \frac{\text{м}}{\text{с}}$

Ответ: $L = 10 \text{ м}$; $a = 0,9375 \frac{\text{м}}{\text{с}^2}$; $t = 1 \text{ с}$; $v_{\text{max}} = 5 \frac{\text{м}}{\text{с}}$.



Uprabus

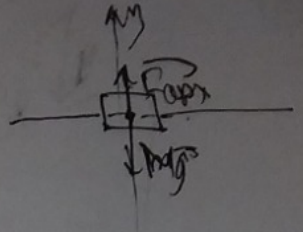
$$\rho = 0,86 \text{ t/m}^3$$

$$\rho = 900 \frac{\text{kg}}{\text{m}^3}$$

$$\rho = 1000 \frac{\text{kg}}{\text{m}^3}$$

$$y: F_{\text{apx}} - Mg = 0$$

$$\rho \cdot g \cdot V_n = Mg$$



$$V_n = ?$$

$$V_n = \frac{M}{\rho} = \frac{0,36}{1000} = \boxed{0,00036 \text{ m}^3}$$

$$m = 0,4 \text{ m}$$

$$F_{\text{apx}} = m_2 g$$

$$\rho \cdot g \cdot V_{n2} = m_2 g \Rightarrow m_2 = \rho \cdot (V_n - V_1) = 1000 \cdot (0,00036 - 0,00012) = 0,24 \text{ m}$$

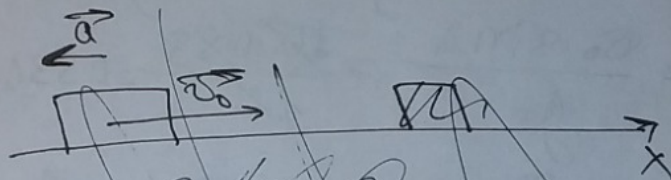
$$\Delta m = 0,36 - 0,24 = 0,12 \text{ m}$$

$$Q = \rho \cdot \Delta m = 3,36 \cdot 10^5 \cdot 0,12 = 40320 \text{ J}$$

$$Q = c \cdot m \cdot \Delta t \Rightarrow \Delta t = \frac{Q}{c \cdot m} = \frac{40320}{0,4 \cdot 4,2 \cdot 10^3} = 24^\circ \text{C} \Rightarrow \boxed{t = 24^\circ \text{C}}$$

~~$t_0 = 0^\circ \text{C}$~~

~~2~~



$$v_2 = v_0 - at = 0$$

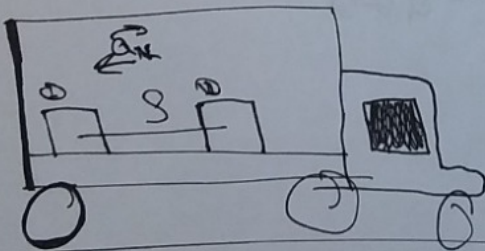
$$5 - 4a = 0 \Rightarrow a = \frac{5}{4} = 1,25$$

$$L = \frac{v_2^2 - v_0^2}{-2a} = \frac{0 - 25}{-2 \cdot 1,25} = \frac{25}{2,5} = \boxed{10 \text{ m}}$$

~~$$S_3 = S_k + S$$

$$S_3 = v_x \cdot T - \frac{aT^2}{2} + S$$

$$v_x T - \frac{aT^2}{2} = v_x T - \frac{aT^2}{2}$$~~



$$S = \frac{v_2^2 - v_0^2}{-2ax} = \frac{25}{2ax} = 2,5$$

$$25 = 5ax$$

$$ax = 5$$

$$S + L = v_0 \cdot T - \frac{aT^2}{2}$$

$$12,5 \text{ m} = 5 \cdot 4 - \frac{a \cdot 16}{2}$$

$$20 - 12,5 = 8a$$

$$7,5 = 8a \Rightarrow a = 0,9375 \frac{\text{m}}{\text{s}^2}$$

$$12,5 \text{ m} = 5 \cdot 4 - \frac{a \cdot 16}{2}$$

$$20 - 12,5 = 8a$$

$$7,5 = 8a \Rightarrow a = 0,9375 \frac{\text{m}}{\text{s}^2}$$

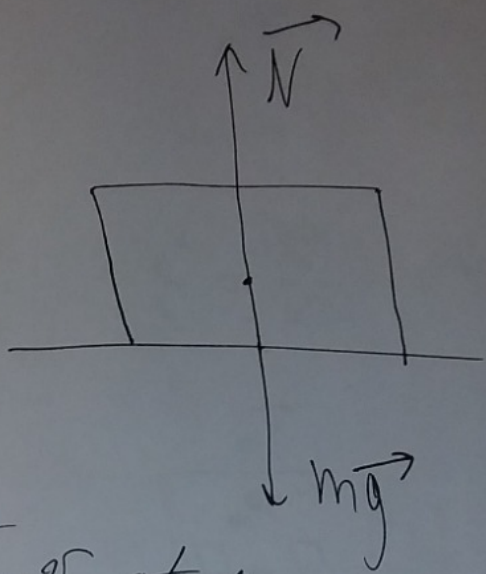
$$t = \frac{v_0}{ax} = \frac{5}{5} = 1 \text{ s}$$

$S + L = v_0 T - \frac{a_x T^2}{2}$ Цирковик

$12,5 = 20 - \frac{a_x \cdot 2,6}{2}$

$8a_x = 20 - 12,5$

$8a_x = 7,5 \Rightarrow a_x = 0,9375 \frac{m}{c^2}$?



~~$v_x = v_0 - at = 0$~~

$S = \frac{v_x^2 - v_0^2}{-2ay} = \frac{v_0^2}{2ay} = 2,5$

$\Rightarrow ay = \frac{v_0^2}{2S} = \frac{5^2}{2 \cdot 2,5} = 5 \frac{m}{c^2}$
 $\Rightarrow \frac{1}{x} = 1e$?

$v_x = v_0 - at = 0$
 $t = \frac{v_0}{a} = \frac{5}{1,25} = 4e$

$z = \sqrt{y^2 + (1,5x)^2} = \sqrt{(1,5x)^2 + x^2} = x \sqrt{2,25 + 1} = x \sqrt{3,25} =$
 $= 1,803 = \frac{3}{2} \sqrt{13} = \frac{x \sqrt{13}}{2}$

$\sin d = \frac{y}{z} = \frac{\frac{3}{2}x}{\frac{x \sqrt{13}}{2}} = \frac{3}{\sqrt{13}} = \frac{3}{3,61} = 0,83$

$\cos d = \sqrt{1 - 0,83^2} = 0,56$

Часть 2

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

Шифр: **21205554**

ID профиля: **885574**

Вариант 4

$$\frac{\sqrt{\frac{Rg\sqrt{2}}{2}}}{\pi \cdot R\sqrt{2}} = \frac{\sqrt{R} \cdot \sqrt{\frac{g}{\sqrt{2}}}}{\pi \cdot (\sqrt{R})^2 \cdot \sqrt{2}} = \frac{\sqrt{g}}{\sqrt{R} \cdot \pi \cdot \sqrt{2} \cdot \sqrt{2}} =$$

$$= \frac{\sqrt{g}}{\pi \cdot \sqrt{2R\sqrt{2}}} = \frac{1}{\pi} \cdot \sqrt{\frac{g}{2R\sqrt{2}}}$$

$$\sqrt{80^2 \cdot 100^2 \cdot \sqrt{2}} = 80 \cdot 100 \cdot \sqrt{2}$$

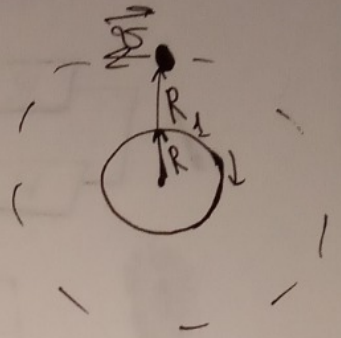
$$\frac{\cancel{80} \cdot 100 \cdot \sqrt{\sqrt{2}}}{2.3,14 \cdot \frac{6400 \cdot 100 \cdot \cancel{10}}{800}} = \frac{\sqrt{\sqrt{2}}}{2 \cdot 3,14 \cdot 800} = 0,00023658$$

$$0,000259428$$

$$0,00023148$$

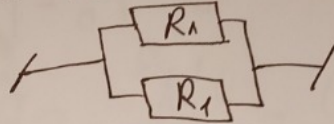
Черновик

$$T = \frac{L}{N}$$



~~scribbles~~

$$U = 4B$$



$$P_0 = 2B_T$$

$$P = I^2 \cdot R$$

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

$$P = U \cdot I$$

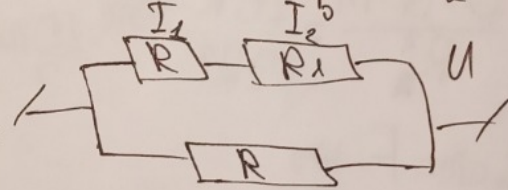
$$P = \frac{U^2}{R} = \frac{16B^2}{16\Omega} = 1B_T$$

$$P_0 = \frac{U^2}{\frac{R_1}{2}} = \frac{2U^2}{R_1} \Rightarrow P_0 \cdot R_1 = 2U^2$$

$$R_1 = \frac{2U^2}{P} = \frac{2 \cdot 4^2}{2} = 16\Omega$$

$$I = \frac{U}{R + R_1} = I_1 = I_2$$

$$P_1 = I^2 \cdot R = \frac{16U^2}{(R + R_1)^2} = \frac{16 \cdot 4^2}{(16 + R_1)^2} = \frac{256}{(R_1 + 16)^2}$$



$$P_2 = I^2 \cdot R_1 = \frac{16R_1}{(R_1 + 16)^2}$$

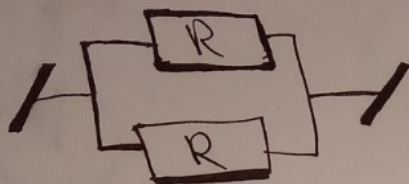
$$\frac{16R_1}{(R_1 + 16)^2} = \frac{16R_1}{R_1^2 + 32R_1 + 256} = \frac{16}{R_1 + \frac{256}{R_1} + 32}$$

$$R_1 + 32 + \frac{256}{R_1} \geq 0$$

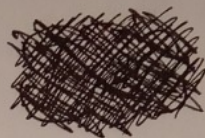
~~scribble~~

$$\frac{U^2}{R}$$

Черобук



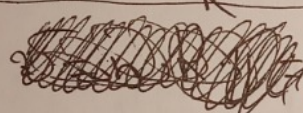
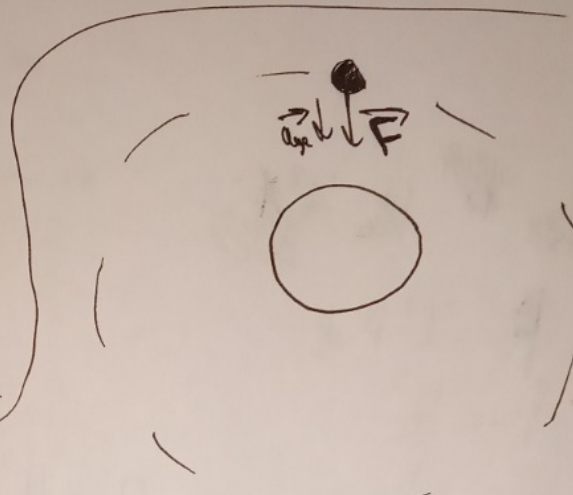
$$P_p = \frac{U^2}{R_0} = \frac{U^2}{\frac{R}{2}} = \frac{2U^2}{R}$$



$$P_u = P_0 - P_p$$

$$P_u = \frac{2U^2}{R} - 2R$$

$$P_u = \frac{32}{R} - 2 = \frac{32 - 2R}{R}$$



$$F = \frac{G \cdot M \cdot m}{R^2} = \frac{10R^2 \cdot m}{81R^2} = \frac{10m}{81} = 5$$

$$G \cdot \frac{M \cdot m}{R^2} = 10$$

$$G \cdot M = 10R^2$$

$$a_{ycm} = F \cdot m$$

$$a_{ycm} = 5m$$

$$a_{yc} = \frac{v^2}{R_1} \Rightarrow v^2 = 5R_1 \Rightarrow v = \sqrt{5R_1}$$

$$S = 2\pi R_2 \Rightarrow t = \frac{2\pi \cdot \sqrt{2} R_1}{\sqrt{5R_1}} = \frac{2\pi \sqrt{2} R_1}{\sqrt{5}}$$

$$= 2\pi \sqrt{\frac{2R_1}{5}}$$

$$N=1; T = \frac{t}{N} = t = 2\pi \cdot \sqrt{\frac{2R_1}{5}} = 2 \cdot 3,14 \cdot \sqrt{\frac{2 \cdot 64000 \cdot 40^3 \cdot 2}{5}} = 10048 \text{ c}$$

~~Учебное задание~~

Задача 5.

Дано:

~~$R_1 = R_2 = R$~~

~~$U = 4R$~~

~~$86400 e$~~

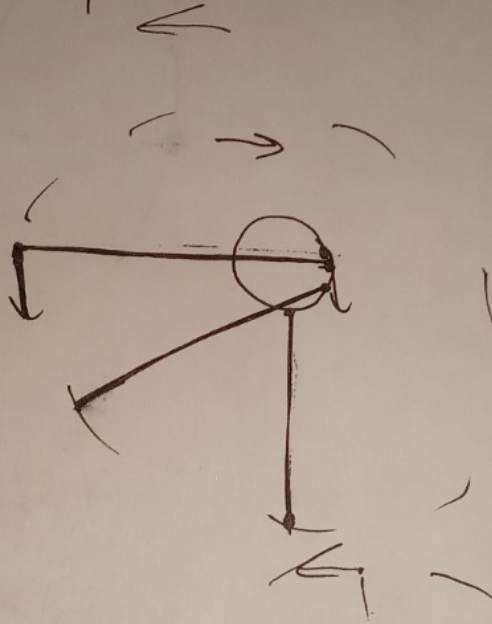
~~$45200 e$~~

~~10 ОУБ~~

~~$5024 e$~~

~~$24 \cdot 60 \cdot 60$~~

Черновик



$$\frac{2\pi \cdot \frac{R_1}{\sqrt{2}} \cdot \sqrt{2} \cdot \sqrt{2}}{\sqrt{R_2 g}} =$$

$$= \frac{2\sqrt{2} \cdot \pi \cdot R_1^2}{\sqrt{R_1} \cdot \sqrt{g}}$$

$$= \frac{2\sqrt{2} \cdot \pi \cdot \sqrt{R_1}}{\sqrt{g}} = 2\pi \sqrt{\frac{2R_1}{g}} = 2\sqrt{2}$$

$$= 2\pi \sqrt{\frac{2\sqrt{2} R}{g}} = \sqrt{\frac{2 \cdot \sqrt{2} \cdot 64000 \cdot 10^3}{10}} \cdot 2 \cdot 3,14$$

Упробун

$$S_x + S_y = \frac{S}{2}$$

$$\omega_1 = \frac{\varphi}{t}$$

$$\omega_2 = \frac{180^\circ - \varphi}{t}$$

$$v = \omega \cdot R$$

$$\omega_1 = \frac{v}{\pi \cdot R_1}$$

$$\frac{\varphi}{t} = \frac{v}{\pi \cdot R_1} = \frac{v}{\pi \cdot R \sqrt{2}}$$

$$\varphi = \frac{v \cdot t}{\pi R \sqrt{2}}$$

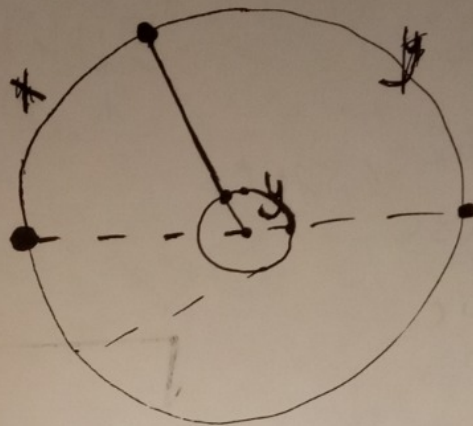
$$v_2 = \frac{S_2}{t_2} = \frac{2\pi R}{\frac{T_3}{v_1}} \Rightarrow \omega_2 = \frac{2\pi \cdot R}{T_3 \cdot \pi \cdot R \sqrt{2}} = \frac{2}{T_3}$$

$$\frac{2}{T_3} = \frac{180^\circ - \frac{v}{\pi \cdot R \sqrt{2}}}{t}$$

$$2t = T_3 \left(180^\circ - \frac{v}{\pi \cdot R \sqrt{2}} \right)$$

$$t = \frac{T_3 \left(180^\circ - \frac{v}{\pi \cdot R \sqrt{2}} \right)}{2} = \frac{T_3 \left(180^\circ - \frac{\sqrt{Rg\sqrt{2}}}{\pi \cdot R \sqrt{2}} \right)}{2}$$

$$t = \frac{86400 \text{ s} \left(180^\circ - \frac{\sqrt{6000 \cdot 10^3 \cdot 10 \cdot \sqrt{2}}}{3.14 \cdot 6000 \cdot 10^3 \cdot \sqrt{2}} \right)}{2}$$



$$T_3 = 86400 \text{ s}$$

$$T = 11.949 \text{ s}$$

$$\sqrt{2} \approx 1.4142$$

Четырёхугольник

Задача 4. проголосование

$$2. \omega_1 = \frac{\varphi}{t} \Rightarrow \varphi = \omega_1 \cdot t = \frac{v_1}{\pi \cdot R_1} \cdot t = \frac{\sqrt{\frac{R_1 g'}{2}} \cdot t}{\pi \cdot R_1}$$

$$\omega_2 = \frac{180^\circ - \varphi}{t}$$

$$\frac{v_2}{\pi \cdot R} = \frac{180^\circ - \frac{\sqrt{\frac{R_1 g'}{2}} \cdot t}{\pi \cdot R_1}}{t}$$

$$v_2 = \frac{s_2}{t_3} = \frac{2\pi R}{t_3} \Rightarrow \frac{2\pi R}{t_3 \cdot \pi \cdot R} = \frac{180^\circ - \frac{\sqrt{\frac{R_1 g'}{2}} \cdot t}{\pi \cdot R_1}}{t}$$

$$\Rightarrow t = \frac{t_3 \left(180^\circ - \frac{\sqrt{\frac{R_1 g'}{2}} \cdot t}{\pi \cdot R_1} \right)}{2}$$

$$= \frac{t_3}{2} \left(180^\circ - \frac{\sqrt{\frac{R_1 g'}{2}} \cdot t}{\pi \cdot R_1} \right) = \frac{t_3}{2} \left(180^\circ - \sqrt{\frac{R g \sqrt{2}}{2}} \right)$$

$$t = \frac{24 \cdot 60^2 \text{ e}}{2} (18)$$

$$\frac{\sqrt{\frac{R g \sqrt{2}}{2}}}{2 \pi \cdot R}$$

Условие

Задача 5

Дано:

$$R_I = R_{II} = R$$

$$U = 4B$$

$$P = 2B \text{ Вт}$$

R-?

Решение:

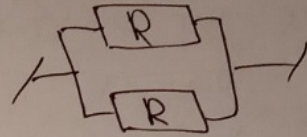
$$R_0 = \frac{R}{n} = \frac{R}{2}$$

$$P = \frac{U^2}{R_0} = \frac{U^2}{\frac{R}{2}} = \frac{2U^2}{R} \Rightarrow$$

$$\Rightarrow R = \frac{2U^2}{P}$$

$$R = \frac{2 \cdot (4B)^2}{2B \text{ Вт}} = 16 \text{ Ом}$$

Ответ: $R = 16 \text{ Ом}$.



3

Умови

Задача 4.

Дано:

$$R_1 = \sqrt{2} R$$

$$R = 6400 \text{ км} = 6400 \cdot 10^3 \text{ м}$$

$$g = 10 \frac{\text{м}}{\text{с}^2}$$

$$T, t = ?$$

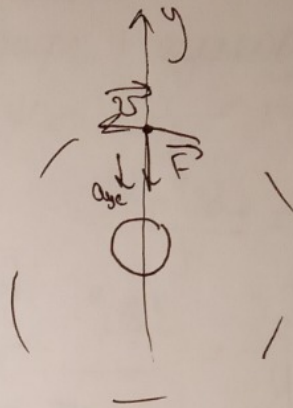
Решение:

$$1. \quad G \cdot M = \frac{G \cdot M}{R^2} \Rightarrow$$

$$\Rightarrow G \cdot M = g \cdot R^2$$

по 2-го Ньютона

$$\vec{F} = \vec{a}_{\text{ц.е.}} \cdot m$$



$$y: \vec{F} = a_{\text{ц.е.}} \cdot m$$

$$G \cdot \frac{M \cdot m}{R_1^2} = a_{\text{ц.е.}} \cdot m$$

$$G \cdot M = a_{\text{ц.е.}} \cdot R_1^2 \Rightarrow g \cdot R^2 = a_{\text{ц.е.}} \cdot R_1^2$$

$$g \cdot R^2 = a_{\text{ц.е.}} \cdot 2R^2 \Rightarrow a_{\text{ц.е.}} = \frac{g}{2}$$

$$a_{\text{ц.е.}} = \frac{v^2}{R_1} \Rightarrow v = \sqrt{a_{\text{ц.е.}} \cdot R_1} = \sqrt{\frac{R_1 g}{2}}$$

$$S = 2\pi R_1 = 2\pi \cdot \sqrt{2} \cdot R$$

$$t = \frac{S}{v} = \frac{2\pi R \sqrt{2}}{\sqrt{\frac{R_1 g}{2}}} = \frac{2\pi R \cdot (\sqrt{2})^2}{\sqrt{R_1 g}} = \frac{4\pi R}{\sqrt{g \sqrt{2}} \cdot \sqrt{R}} = \frac{4\pi \sqrt{R}}{\sqrt{g \sqrt{2}}} = 4\pi \sqrt{\frac{R}{g \sqrt{2}}}$$

~~$$T = \frac{t}{N} ; N = 4 \Rightarrow T = \frac{t}{4} = \frac{4\pi \sqrt{R}}{4 \sqrt{g \sqrt{2}}} = \pi \sqrt{\frac{R}{g \sqrt{2}}}$$~~

$$= \frac{4\pi R}{\sqrt{g} \cdot \sqrt{2} \cdot R} = \frac{4\pi R}{\sqrt{g \sqrt{2}} \cdot \sqrt{R}} = \frac{4\pi \sqrt{R}}{\sqrt{g \sqrt{2}}} = 4\pi \sqrt{\frac{R \sqrt{2}}{g}}$$

$$T = 4 \cdot 3,14 \sqrt{\frac{6400 \cdot 10^3 \text{ м} \cdot \sqrt{2}}{10 \frac{\text{м}}{\text{с}^2}}} = 11949 \text{ с}$$

1

Учетовик

Задача 4. продолжение

$$\omega_1 = \frac{\psi}{t} \Rightarrow \psi = \omega_1 \cdot t = \frac{v_1 \cdot t}{\pi \cdot R_1} = t \cdot \frac{\sqrt{R_1 g}}{\pi \cdot R_1} =$$

$$= \frac{t \cdot \sqrt{R_1 g \sqrt{2}}}{\pi R_1 \sqrt{2}}$$

$$\omega_2 = \frac{180^\circ - \psi}{t} \Rightarrow \psi = 180^\circ - \omega_2 \cdot t = 180^\circ - \frac{v_2}{\pi R} \cdot t$$

$$t \cdot \frac{\sqrt{R_1 g \sqrt{2}}}{\pi R \sqrt{2}} = 180^\circ - \frac{v_2}{\pi R} \cdot t$$

$$t \left(\frac{\sqrt{R_1 g \sqrt{2}}}{\pi R \sqrt{2}} + \frac{v_2}{\pi R} \right) = 180^\circ$$

$$v_2 = \frac{s_2}{t_3} = \frac{2\pi R}{t_3}$$

$$t \left(\frac{\sqrt{R_1 g \sqrt{2}}}{\pi R \sqrt{2}} + \frac{2\pi R}{t_3 \cdot \pi R} \right) = 180^\circ$$

$$t = \frac{\left(\frac{\sqrt{R_1 g \sqrt{2}}}{2\pi R} + \frac{2}{t_3} \right)}{180^\circ}$$

$$t = \frac{\left(\frac{\sqrt{6400 \cdot 10^3 \text{ м} \cdot 10^{\frac{11}{25}} \cdot \sqrt{2}}}{2 \cdot 3,14 \cdot 6400 \cdot 10^3 \text{ м}} + \frac{2}{24 \cdot 60 \cdot 60} \right)}{180^\circ} = 69 \text{ } 30 \text{ } 32 \text{ с}$$

Ответ: $T = 11 \text{ } 949 \text{ с}$; $t = 69 \text{ } 30 \text{ } 32 \text{ с}$.

(2)