Часть 1

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

Шифр: **21206578**

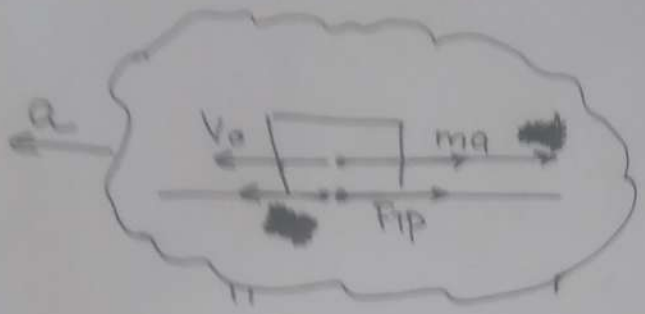
ID профиля: **801458**

Вариант 3

Черновик [redacted] стр 5

$$\Rightarrow \boxed{L = -\frac{(v_0^2 - 0^2)}{-2a} = \frac{v_0^2}{2a} = \frac{100}{4} = 25\text{м}}$$

Перейдём в НИСО платформы:



$ma_n = ma + F_{тр}$ [redacted]

[redacted] $\Rightarrow a_n = a + \mu g$

$$\Rightarrow \frac{v_0^2}{a + \mu g} = S$$

[redacted]

$$Sa + S\mu g = v_0^2$$

$$\frac{v_0^2 - Sa}{Sg} = \mu \qquad \mu = \frac{100 - 24}{120} = 0{,}6(3)$$

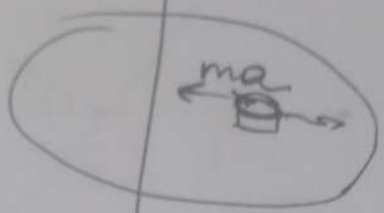
$$\mu = \frac{19}{30}$$

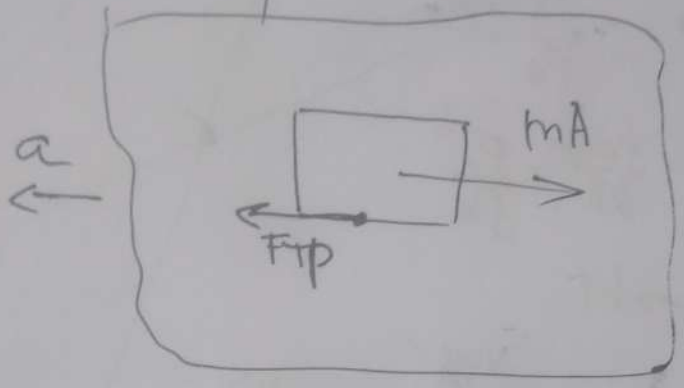
Ответ: 25м

Черновик стр 4

$mA = -ma$

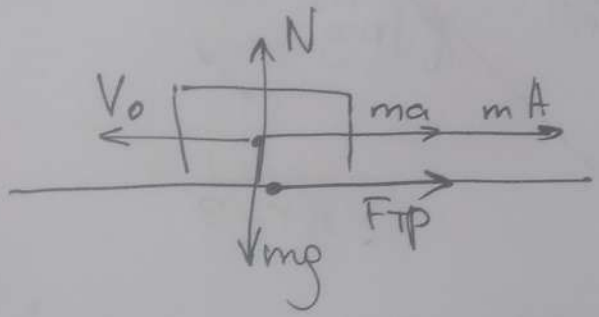
$A = -a$

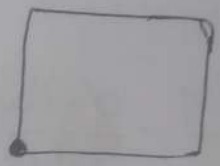


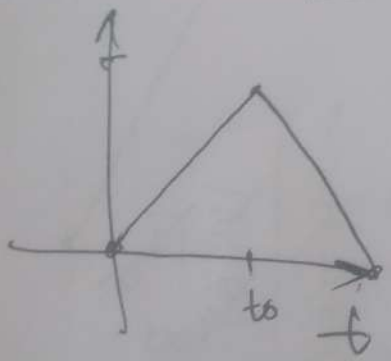


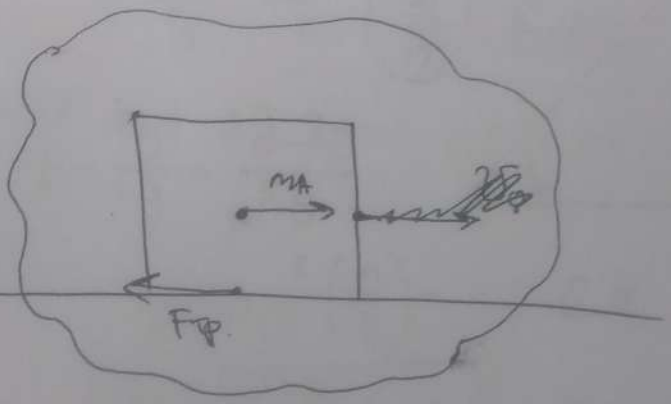
$mA = [redacted] - ma - F_{тр}$

μmg







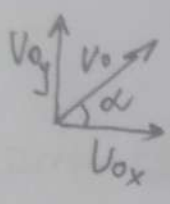


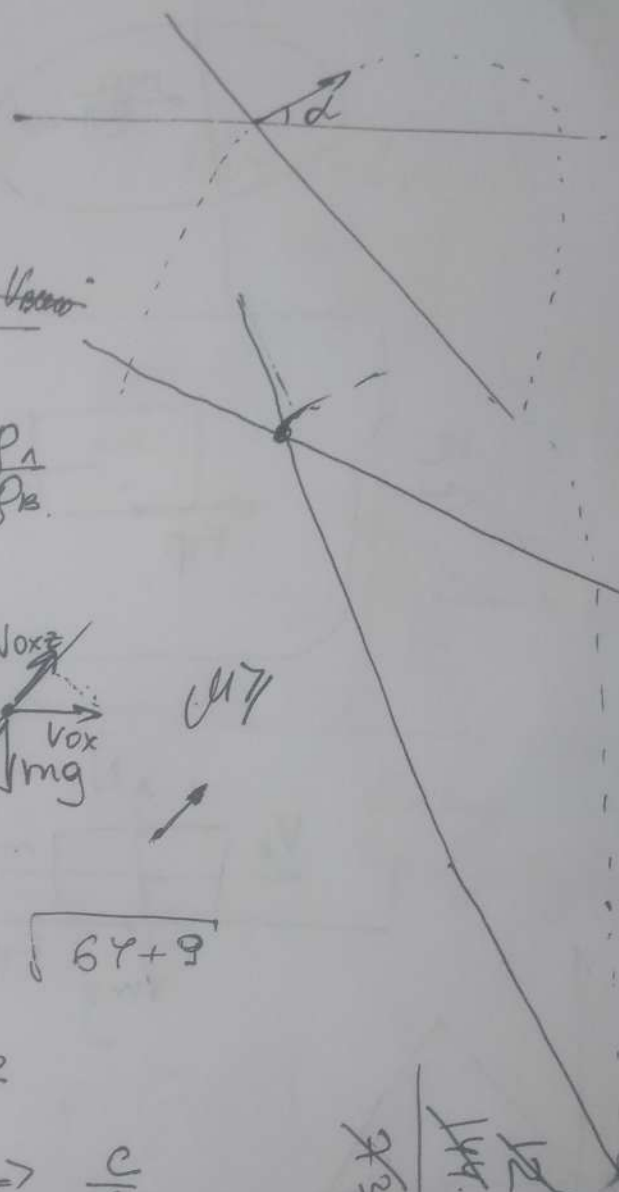
$a^2 + \mu^2 g^2 - 2a\mu g$

Черновик стр 3

$V_0 = 12$ м/с

$\operatorname{tg}\alpha = \frac{8}{3}$





$\frac{V_B - V_{нагр}}{V_B} = \frac{\rho_1 \cdot V_{всего}}{\rho_B}$

$1 - \frac{V_{нагр}}{V_B} = \frac{\rho_1}{\rho_B}$

$\frac{2V_{0y}}{g} = \pm$

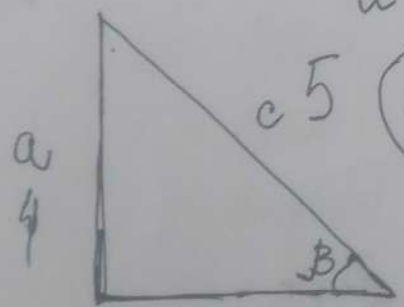
$+ \rightarrow H.$

$\frac{g}{\frac{36 \cdot 3}{4} \cdot \frac{1}{10}} \quad \frac{27}{10} \quad \sqrt{73}$

$\frac{V_0 \cdot V_{0y}}{g} - \frac{g \cdot V_{0y}^2}{g^2 \cdot 2}$

$\sqrt{67+9}$

$a^2 + b^2 = c^2$



$c\,5 \quad \left(\frac{a}{b}\right) \Rightarrow \frac{c}{b}.$

$\frac{c^2 - b^2}{b^2} = \frac{c^2}{b^2} - 1 =$

$\frac{16}{9} + 1 \quad \frac{25}{} \quad \text{в } 3 \quad = \left(\frac{c}{b}\right)^2 - 1$

$\frac{1}{\cos\beta} = \frac{c}{b} = \sqrt{\operatorname{tg}\beta^2 + 1}$

$\frac{144 \cdot 25 \cdot 25 \cdot 10^{-4}}{73 \cdot 2 \cdot 10 \cdot 36 \cdot 12 \cdot 2} \approx 3 \cdot 10^{-4}$

Черновик стр 2

$v_0 = 10 м/с$ $a = 2 м/с^2$

$S = 12 м$

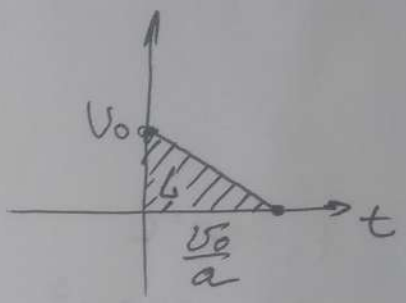
$L = v_0 t - \frac{at^2}{2}$

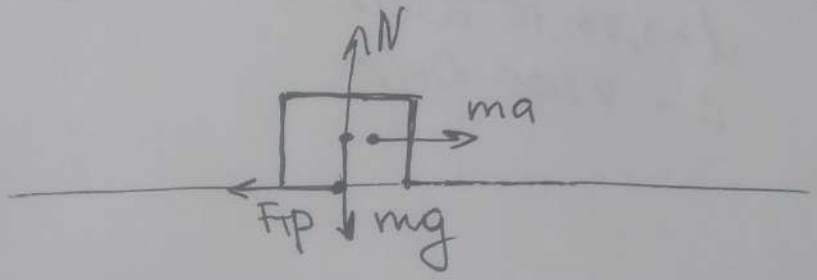
$0 = v_0 - at$

$v_0 = at$

$t = \frac{v_0}{a}$

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





$N = mg$

$F_{тр} = \mu N = \mu mg$

$1 м = 100 см$

$1 = 10000$

$1 = 1000000$

$\rho = \frac{m}{V}$

$m = 900 \cdot 0{,}00025$

$\Delta m = 0{,}45 - m$

$3{,}36 \cdot 10^5$

$4{,}2 \cdot 10^3$

10

Черновик стр1

$m = 0{,}45$ кг

$\rho_в = 1000$ кг/м³

$\rho_л = 900$ кг/м³

$\rho g V_п = mg$

$\rho g V_п = \rho_л V_л g$

$\frac{\rho_в}{\rho_л} = \frac{V_л}{V_п}$

$\frac{1000}{900} = \frac{V_л}{V_п}$

$V_п = \frac{m}{\rho_в} = \frac{0{,}45}{1000} = 0{,}00045$

$t_1 = 30°C$

$V_1 = 25$ см³

$m - ?$

$\lambda = 3{,}36 \cdot 10^5$ Дж/кг

$c = 4200$ Дж/кг

Условие стр 4. N2 продолж.

$A_n = 2 - \frac{5}{37} \cdot 10 = 0{,}65 \text{ м/с}^2$

$\Rightarrow v_k = 0{,}65 \cdot 5 = 3{,}25 \text{ (м/с)} = v_{max}$

$T = \frac{v_0}{a} = 5 \text{(с)}$

Ответ: 25 м ; $\frac{5}{37}$; 5 секунд ; 3,25 м/с

Чистовик (стр 3)

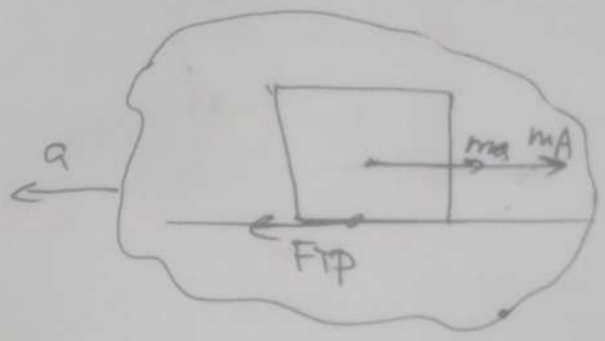
№2.

1) 

$$L = \frac{v_0^2}{2a} = \frac{100}{4} = 25 \text{ м}$$

$$t_0 = \frac{v_0}{a} = 5 \text{ с}$$

В ИСО платформы:



$\rightarrow A_n = a - \mu g$

$v_k = t_0 \cdot A_n$

$S_2 = \frac{v_k^2}{2\mu g}$

$S_1 = \frac{A_n t_0^2}{2}$

$$S = S_2 + S_1 = \frac{(t_0 \cdot A_n)^2}{2\mu g} + \frac{A_n \cdot t_0^2}{2} = \frac{t_0^2 a - t_0^2 \mu g}{2} +$$

$$+ \frac{t_0^2 a^2 + t_0^2 \mu^2 g^2 - t_0^2 2 a \mu g}{2\mu g} = \frac{t_0^2 a \mu g - t_0^2 \mu^2 g^2 + t_0^2 a^2 +}{2\mu g}$$

$$+ t_0^2 \mu^2 g^2 - t_0^2 2 \cdot a \mu g = \frac{-t_0^2 a \mu g + t_0^2 a^2}{2\mu g}$$

$$2\mu g S = t_0^2 a^2 - t_0^2 a \mu g$$

$$\mu = \frac{t_0^2 a^2}{2gS + t_0^2 ag} = \frac{25 \cdot 4}{240 + 25 \cdot 20} = \frac{100}{740} =$$

$$= \frac{10}{74} = \frac{5}{37}$$

Чистовик (стр 2)

№1

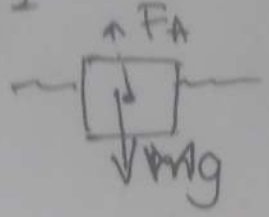
$M = 0{,}45$ кг

$\rho_в = 1000$ кг/м³

$\rho_л = 900$ кг/м³

$t_1 = 30°C$

$V_л = 25$ см³



$Mg = V_{погр} \cdot \rho_в \cdot g$

$V_{погр} = \frac{M}{\rho_в} = 0{,}00045$ м³

$\Rightarrow V_{надв_0} = 0{,}0005 - 0{,}00045 = 0{,}00005$ м³

$1 - \frac{\rho_л}{\rho_в} = \frac{V_{надв}}{V_{всего}} \Rightarrow V_{надв_1} = 0{,}000005 - 0{,}000025 = 0{,}000025$ м³

$\Rightarrow V_{всего_1} = \frac{0{,}000025 \cdot \rho_в}{\rho_в - \rho_л} = \frac{0{,}000025 \cdot 10000}{100} = 0{,}00025$ м³

$\Delta m_л = 0{,}225$ кг

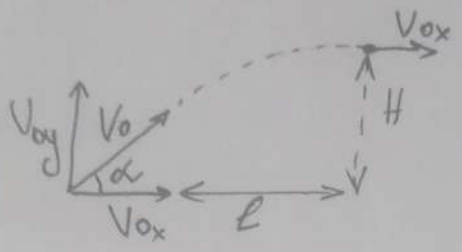
$\Rightarrow m_в \cdot c \cdot (t_1 - 0) = \Delta m_л \cdot \lambda$

$m_в = \frac{\Delta m_л \cdot \lambda}{c \cdot t_1} = \frac{0{,}225 \cdot 3{,}36 \cdot 10^5}{4{,}2 \cdot 10^3 \cdot 30} = \frac{0{,}225 \cdot 3{,}36 \cdot 10^2}{4{,}2 \cdot 3} = 0{,}6$ кг

Ответ: $0{,}00005$ м³; $0{,}6$ кг

Чистовик (стр 1)

N 3



$\Rightarrow \frac{v_{oy}}{v_{ox}} = \frac{8}{3}$ $\quad v_{oy}^2 + v_{ox}^2 = v_0$

$v_{oy} = \frac{8}{3} v_{ox}$

$v_{oy}^2 + \frac{9}{64} v_{oy}^2 = v_0^2$

$v_{oy}^2 = \frac{v_0^2}{1+\frac{9}{64}} = \frac{144 \cdot 64}{73} \Rightarrow v_{oy} = \frac{12 \cdot 8}{\sqrt{73}}$

$v_{ox} = \frac{36}{\sqrt{73}}$

$v_{oy} - gt = 0$

$t = \frac{v_{oy}}{g} = 1{,}12\,c$

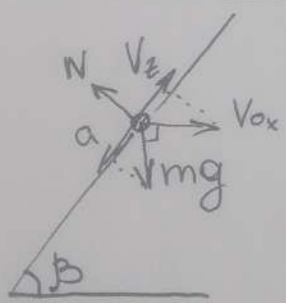
$H = \frac{-(v_{oy}^2 - 0^2)}{-2g} = \frac{v_{oy}^2}{2g} \approx 6{,}31\,м$

$\Rightarrow \ell = v_{ox} \cdot t = \frac{v_{ox} \cdot v_{oy}}{g} = \frac{36 \cdot 12 \cdot 8}{\sqrt{73} \cdot \sqrt{73} \cdot 10} =$

$= \frac{36 \cdot 12 \cdot 8}{730} \approx 4{,}73\,м$

$tg\beta = \frac{H}{\ell} =$

$= \frac{144 \cdot 64 \cdot 73 \cdot 10}{73 \cdot 2 \cdot 10 \cdot 36 \cdot 12 \cdot 8} =$



$1/\cos\beta = \sqrt{1 + \frac{v_z}{v_{ox}}} = \sqrt{tg^2\beta + 1} = \frac{4}{3}$

$= \frac{5}{3}$

$ma = mg \sin\beta$

$a = g \sin\beta = \frac{4}{5} g$

$T = \frac{v_z}{a} = \frac{\frac{3}{5} \cdot v_{ox}}{\frac{4}{5} g} = \frac{3}{4} \frac{v_{ox}}{g} = \frac{2{,}7}{\sqrt{73}} \approx 0{,}32\,c$

$F_{тр} = \mu mg \cos\beta$

$ma = mg \sin\beta$

$F_{тр} = ma \Rightarrow \mu \geq \frac{g \sin\beta}{g \cos\beta} = tg\beta$

$\mu \geq tg\beta = \frac{4}{3}$

Ответ: 6,31 м; $\frac{4}{3}$; 0,32 с; $\geq \frac{4}{3}$

Часть 2

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

Шифр: **21206578**

ID профиля: **801458**

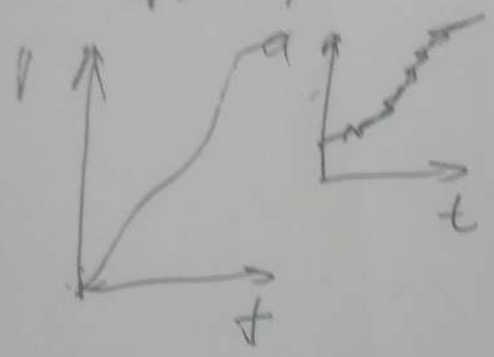
Вариант 3

$$\frac{\cancel{4}R_1^2 + 18^2 + \cancel{4}\cdot 18\cdot R_1}{\frac{36}{9}R_1} = \frac{\cancel{R}\,186}{3\sqrt[3]{4}}$$

Чернова

$$\sqrt[3]{4}\left(R_1^2 + 81 + 18R_1\right) = 54R_1$$

$$\sqrt[3]{4}R_1^2 + 81\sqrt[3]{4} + 18\sqrt[3]{4}R_1 = 54R_1$$

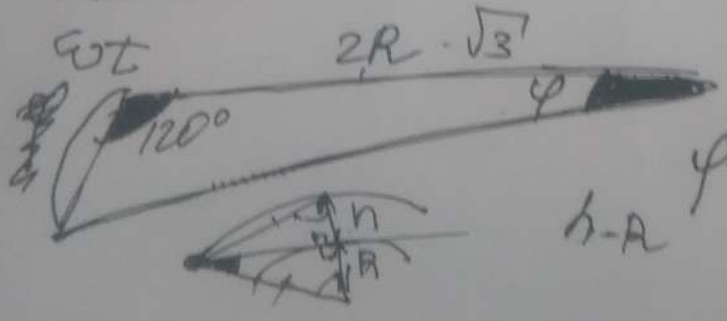


$-28,7732$

$816,728840$

$1,5874010$

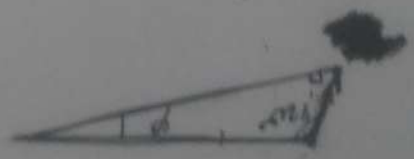
$0,001$



$\beta = ?$

$\varphi \to 0$

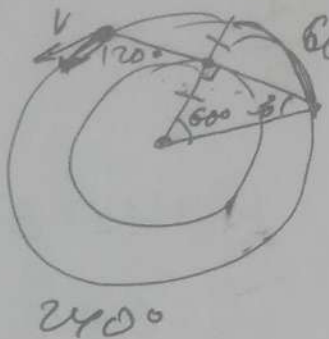
$h - A$



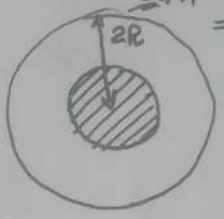
$0 \leftarrow d$

Черновик стр 3

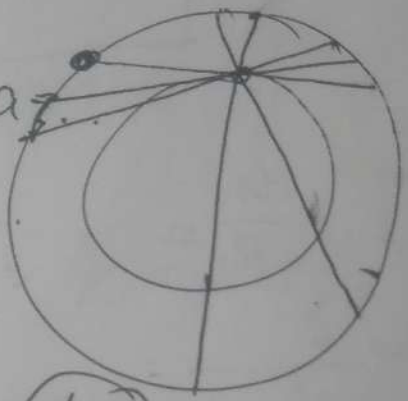
№4.



$\frac{\pi}{180} \cdot 60 = \frac{\pi}{3}$



$am = F = \frac{GMm}{4R^2}$



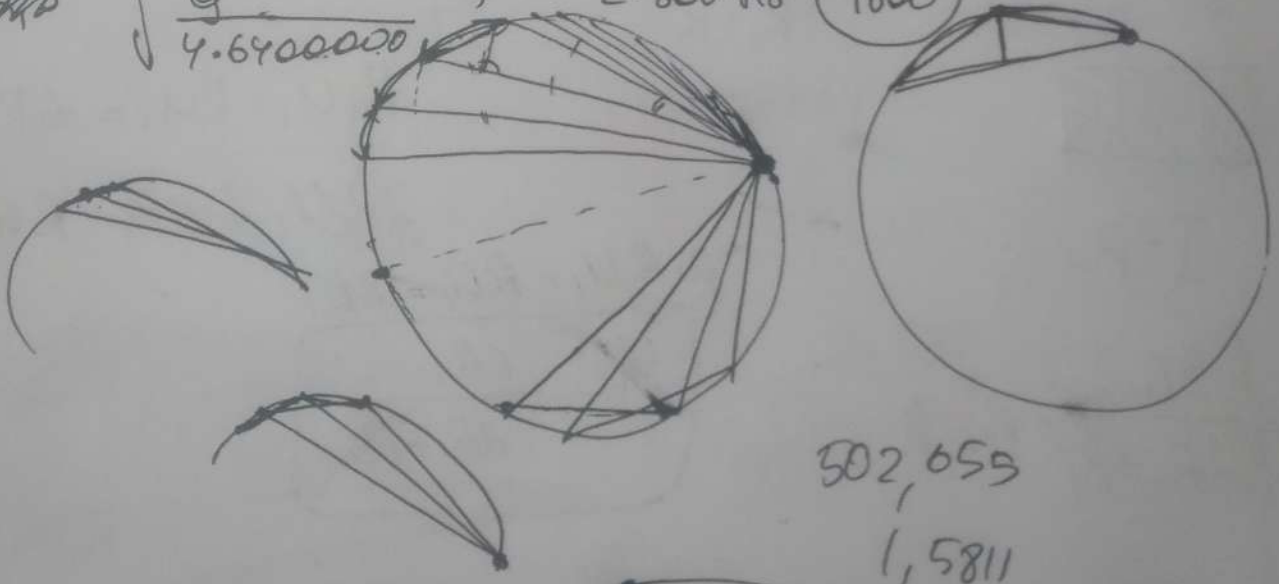
$mg = \frac{GMm}{4R^2}$ $\omega = \ldots$

$T = \ldots$

$G = 6{,}67 \cdot 10^{-11}$

$\frac{\sqrt{10}}{2 \cdot 800 \cdot \sqrt{10}} = \frac{1}{1600}$

$\sqrt{\frac{9}{4 \cdot 6400000}}$



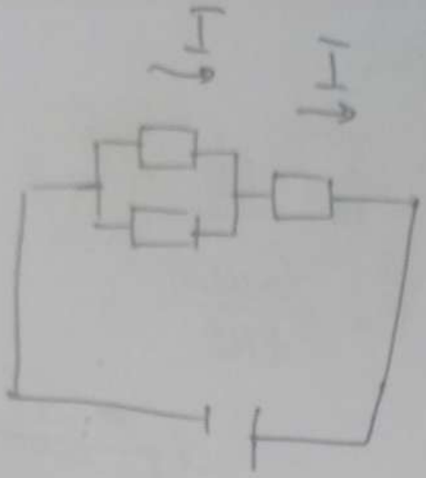
502,655

1,5811

$a = \frac{V^2}{R}$ $V = \omega R$

$\frac{\omega^2 R^2}{R} = \omega^2 R$

Черновик стр2



$\frac{U_1}{\frac{R_1 \cdot R}{R_1+R}} = \frac{U_2}{R}$

$U_1 + U_2 = 6$

$U_2 = 6 - U_1$

$I_1 = \frac{U_1}{R_1} = \frac{6}{2R_1 + R}$

$\frac{U_1}{\frac{R_1 \cdot R}{R_1+R}} = \frac{6-U_1}{R} \Rightarrow (R_1+R)U_1 \cdot R = (6 - U_1) R_1 \cdot R$

$R_1U_1 + RU_1 = 6R_1 - U_1R_1$

$2R_1U_1 + RU_1 = 6R_1$

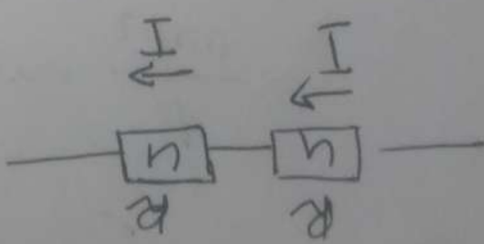
$U_1 = \frac{6R_1}{2R_1 + R}$

$I^2 R$

$\frac{36}{(2R_1+R)^2} \cdot R_1 \leq$

36

$U_0 = 2U = 6$



№5 Черновик стр1

$U = 6$ В $P = 1$ Вт

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

$N = \frac{A}{t}$ I^2Rt

$N = IU$

$A = UIt$

Черновик.

$$\frac{R_1}{9} + \frac{R}{9} + \frac{R^2}{36R_1} = \frac{R}{3\sqrt[3]{4}}$$

$$\frac{4R_1^2 + R^2}{36R_1} = \frac{3R - \sqrt[3]{4}R}{9\sqrt[3]{4}}$$

$$36\sqrt[3]{4}R_1^2 + 9\sqrt[3]{4}R^2 = 108R_1R - 36\sqrt[3]{4}R$$

$$36\sqrt[3]{4}R_1^2 - 108R_1R \quad \frac{2R}{9} + \frac{R^2}{36R}$$

$$\frac{8R^2 + R^2}{36R} = \frac{9R^2}{36R} = \frac{1}{4}R$$

$$36RR_1 = R^2 9$$

$$4RR_1 = R^2$$

$$4R_1 = R \Rightarrow R_1 = \frac{1}{4}R.$$

$$\frac{4R_1^2 + R^2 + 4R_1R}{36R_1} = \frac{R}{\sqrt[3]{4} \cdot 3}$$

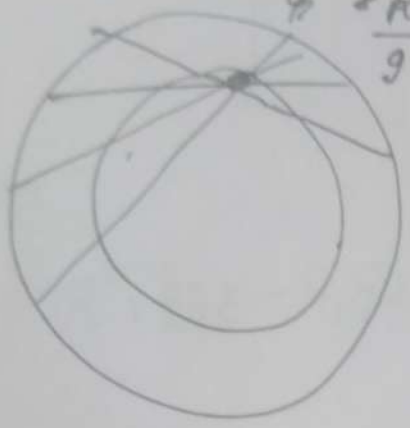
$$\frac{4R_1^2 + R^2 + 4R_1R}{12} = R \cdot 3\sqrt[3]{4^2}$$

$$\frac{4R_1^2 + R^2 + 4R_1R}{3\sqrt[3]{R^2}} = 3$$

$$R_1 = -4 \pm \sqrt{16 + 4 \cdot 4 \cdot (R^2 + R \cdot 3\sqrt[3]{4^2})}$$

Черновик стр 1

$$\frac{(2R_1+R)^2}{36R_1} \geq \frac{4R_1^2+R^2+4R_1R}{36R_1}$$



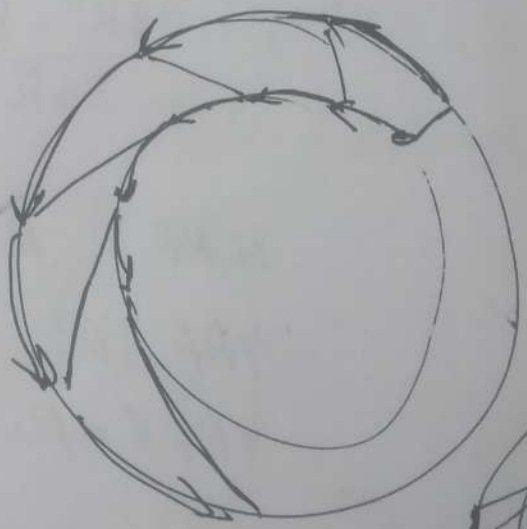
$$4 + \frac{R_1}{9} + \frac{R}{9} + \frac{R^2}{36R_1} \geq 5\sqrt[5]{\frac{R_1 \cdot R \cdot R^2}{81 \cdot 36 \cdot R_1}} \quad \sqrt{\frac{R^3}{3}}$$

$$\frac{R_1}{9} = \frac{R}{9} \Rightarrow R_1 = R$$

$$\frac{R}{9} = \frac{R^2}{R_1 \cdot 36} \qquad \frac{1}{9} = \frac{1}{36}$$

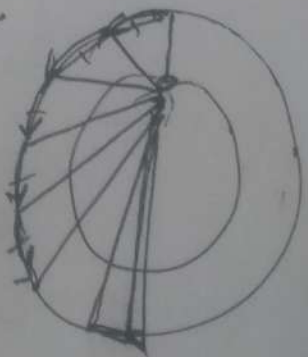
$$\frac{R_1+R}{9} \quad \frac{R^2}{36R}$$

$$\frac{2R - \sqrt[3]{4}\,R}{\sqrt[3]{4}\cdot 9}$$



$$\frac{4R_1^2 + R^2}{36R_1} = \ldots$$

$$4R_1^2 + \frac{(\sqrt[3]{4}\,R - R)36R_1}{\sqrt[3]{4}\cdot 9} = -R^2$$

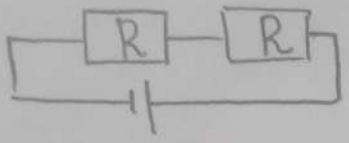


В. 09-03

Чистовик

стр 1

N5



$U = 6В = U_1 + U_2 = 2U_1 \Rightarrow U_1 = 3В$

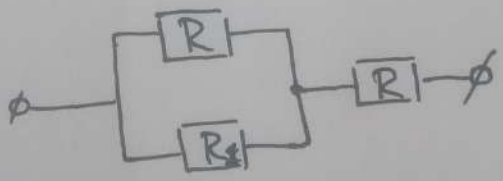
$U_1 = IR = U_2$

$A = IU_1 t$ - по з. Джоуля - Ленца

$\Rightarrow N = IU_1 = \frac{P}{2} = \frac{1}{2}$ Вт $I = \frac{U}{R}$ - з. Ома.

$\Rightarrow P = \frac{2U_1^2}{R} = 1$ Вт

$R = \frac{2U_1^2}{P} = \frac{2 \cdot 9}{1} = 18 (Ом)$



если напряжение на двух параллельно подключенных резисторах = U_1, а на третьем U_2, то:

$$\begin{cases} \frac{U_1 \cdot (R_1 + R)}{R_1 \cdot R} = \frac{U_2}{R} \\ U_1 + U_2 = 6 \end{cases}$$

Чистовик (стр 2) №5 продолжение

⇒ преобразуя эту систему получим, что:

$$(2R_1 + R) \cdot U_1 = 6R_1$$

$$\Rightarrow U_1 = \frac{6R_1}{2R_1 + R}$$

$$\Rightarrow P = \frac{36R_1}{(2R_1 + R)^2}$$ – если эта дробь максимальна, то обратная ей минимальна

$$\frac{(2R_1 + R)^2}{36R_1} = \frac{4R_1^2 + R^2 + 4R_1R}{36R_1} = \frac{R_1}{9} + \frac{R}{9} + \frac{R^2}{36R_1}$$

по неравенству Коши это выражение:

$$\frac{R_1}{9} + \frac{R}{9} + \frac{R^2}{36R_1} \geq \sqrt[3]{\frac{R_1 \cdot R \cdot R^2}{9 \cdot 9 \cdot 9 \cdot 4 \cdot R_1}} = \frac{3R}{\sqrt[3]{4 \cdot 9^3}}$$

минимум значения будет при равенстве.

$R_1 \approx 9$ Ом

$\Rightarrow P = 0{,}25$ Вт

Ответ 18 Ом; 9 Ом; 0,25 Вт.

Условие (стр 3)

$mg = \frac{GMm}{R^2}$

$\Rightarrow M = \frac{gR^2}{G} \Rightarrow a = \frac{GM}{4R^2} = \frac{G \cdot gR^2}{G \cdot 4R^2} = \frac{g}{4} =$

$= 2{,}5 м/с^2$

$\Rightarrow \omega = \sqrt{\frac{a}{R}}$

$T = \frac{2\pi}{\omega} = \frac{2\pi \cdot \sqrt{R}}{\sqrt{a}} =$ [illegible]

[illegible] $= \frac{2\pi \cdot \sqrt{6400000} \cdot 2}{\sqrt{10}} = \frac{2\pi \cdot \sqrt{10} \cdot 800 \cdot 2}{\sqrt{10}} =$

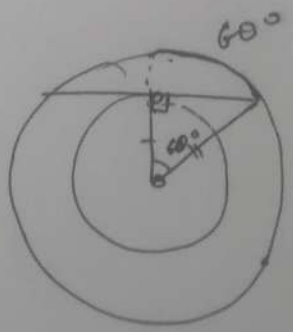
$= 2\pi \cdot 1600 = 10053 с \approx 2{,}8$ часа

Перейдем в СО Земли.

$\omega_3 = \frac{2\pi}{T} = 0{,}0000\,73$ рад/с

$\Rightarrow \omega_{спут} = \omega_{сп} - \omega_3 =$

$= \frac{1}{1600} - \frac{2\pi}{86400} = 0{,}000552$ р/с



$T = 1897$ сек $\approx \frac{1}{2}$ часа

Ответ: 2,8 часа; $\frac{1}{2}$ часа