Часть 1

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

Шифр: **21205888**

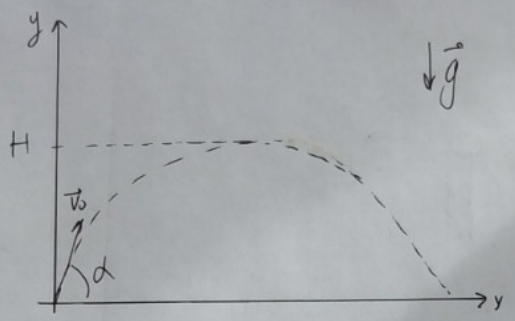
ID профиля: **315785**

Вариант 4

Чистовик Вариант 10-04

№1

①



$\vec{V} = \vec{V_0} + \vec{a}t$

$\vec{r} = \vec{r_0} + \vec{V_0}t + \frac{\vec{a}t^2}{2}$

1) Oy: $V_{0y} = V_0 \sin\alpha$

$V_y = V_{0y} - gt = V_0 \sin\alpha - gt$

Пусть t_n – время полета до наивысшей точки траектории

$V_y(t_n) = 0 \Rightarrow V_0 \sin\alpha - g t_n = 0 \Rightarrow t_n = \frac{V_0 \sin\alpha}{g}$

$y = 0 + V_{0y} t - \frac{g t^2}{2} \Rightarrow$

$H = V_0 \sin\alpha \cdot t_n - \frac{g t_n^2}{2}$

Подставим t_n в выражение для H:

$H = \frac{V_0 \sin\alpha \cdot V_0 \sin\alpha}{g} - \frac{g V_0^2 \sin^2\alpha}{2g^2} = \frac{V_0^2 \sin^2\alpha}{2g} \Rightarrow$

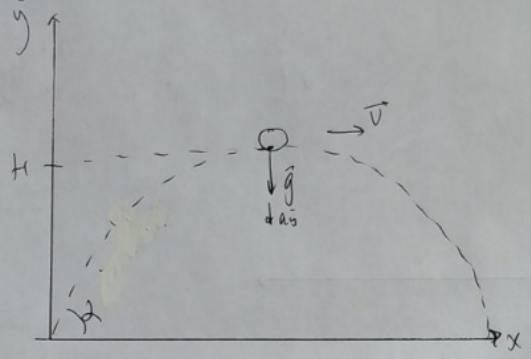
$V_0 = \sqrt{\frac{2gH}{\sin^2\alpha}} = \frac{\sqrt{2gH}}{\sin\alpha} = \frac{\sqrt{2 \cdot 10 \frac{м}{с^2} \cdot 10 м}}{\sin 45°} =$

$= \frac{10 \cdot \sqrt{2}}{\frac{\sqrt{2}}{2}} \left(\frac{м}{с}\right) = 10 \cdot 2 = 20 \left(\frac{м}{с}\right)$

(чистовик) №1

2) В каждый момент времени самолет движется по дуге окр-ти

②



$\vec{F}_p = \frac{\vec{F}_m}{2} = \frac{m\vec{g}}{2} \Rightarrow F_p$ - направлена вниз по Oy и $|\vec{F}_p| = |\frac{m\vec{g}}{2}|$

$m\vec{a}_y = \vec{F}_p \Rightarrow Oy: ma_y = \frac{mg}{2} \Rightarrow a_y = 0{,}5g$

$a_y = \frac{V^2}{R} \Rightarrow V = \sqrt{a_y \cdot R} = \sqrt{0{,}5gR}$

Т.к. тело находится в наивысшей точке траектории, то $R = H \Rightarrow V = \sqrt{0{,}5gH} = \sqrt{0{,}5 \cdot 10 \cdot 10} \cdot \frac{10\sqrt{2}}{2} = 5\sqrt{2} =$

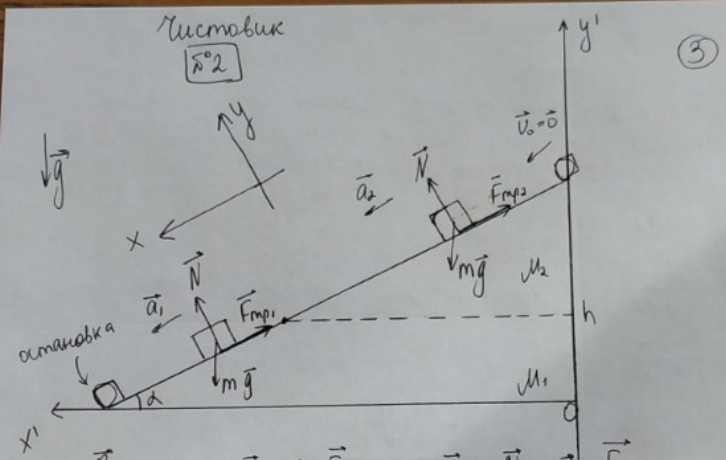
$= 7$ (м/с)

Ответ: 1) $V_0 = \frac{\sqrt{2gH}}{\sin\alpha} = 20$ м/с

2) $V = \sqrt{0{,}5gH} = 7$ м/с

Чистовик

№2



③

1) $\vec{a}=\frac{\vec{R}}{m}$; $m\vec{a_1}=\vec{N}+m\vec{g}+\vec{F_{тр1}}$; $m\vec{a_2}=\vec{N}+m\vec{g}+\vec{F_{тр2}}$

0x: $ma_1 = mg\sin\alpha - F_{тр1}$

$ma_2 = mg\sin\alpha - F_{тр2}$

Т.к. брусок скользит, то $\vec{F_{тр1}}=\mu_1\vec{N}$, $\vec{F_{тр2}}=\mu_2\vec{N}$

0y: $0 = N - mg\cos\alpha \Rightarrow N = mg\cos\alpha$

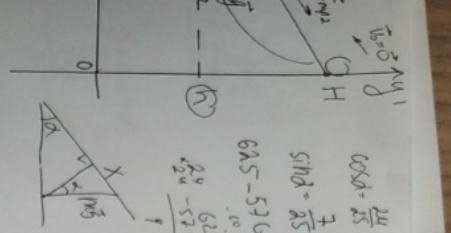
$$\left.\begin{aligned} ma_1 &= mg\sin\alpha - \mu_1 mg\cos\alpha \\ ma_2 &= mg\sin\alpha - \mu_2 mg\cos\alpha \end{aligned}\right| \Rightarrow \begin{cases} a_1 = g\sin\alpha - \mu_1 g\cos\alpha \\ a_2 = g\sin\alpha - \mu_2 g\cos\alpha \end{cases}$$

2) $\cos\alpha = \frac{24}{25}$; $\sin\alpha = \sqrt{1-\cos^2\alpha} = \sqrt{1-\frac{24^2}{25^2}} = \frac{7}{25}$

$a_1 = 10\cdot\frac{7}{25} - \frac{0{,}5\cdot 10\cdot 24}{25} = \frac{70-120}{25} = -\frac{50}{25} = -2\ \left(\frac{м}{с^2}\right)$

$a_2 = 10\cdot\frac{7}{25} - \frac{0{,}06\cdot 10\cdot 24}{25} = \frac{70-14{,}4}{25} = \frac{55{,}6}{25} = 2{,}224\ \left(\frac{м}{с^2}\right)$

Т.к. $a_2>0$, то тело разгоняется, т.к. $a_1<0$, то тело замедляется. Значит, ~~брусок~~ коробка будет иметь максимальную скорость на стыке μ_1 и μ_2.



Чистовик (4)

№2

3) Пусть S_2 – путь, прошёл. коробкой от т. старта до точки, где меняется коэф-т трения, а S_1 – путь от этой точки до основания наш. плоскости.

$\frac{h}{S_1} = \sin\alpha \Rightarrow S_1 = \frac{h}{\sin\alpha}$

$S_2 = \frac{V_{cm}^2 - V_0^2}{2a_2}$, где $V_{cm} = V_{max}$ – скорость в точке смены μ

$S_1 = \frac{0^2 - V_{cm}^2}{2a_1}$

$\frac{h}{\sin\alpha} = \frac{-V_{cm}^2}{2a_1} \Rightarrow V_{cm}^2 = -\frac{2ha_1}{\sin\alpha}$

$V_{max} = V_{cm} = \sqrt{-\frac{2h(g\sin\alpha - \mu_1 g\cos\alpha)}{\sin\alpha}} =$

$= \sqrt{-\frac{2 \cdot 1{,}4 \cdot (-2) \cdot 25}{7}} = \sqrt{4 \cdot 25 \cdot 0{,}2} = 4{,}47 \left(\frac{м}{с}\right)$

4) $\left.\begin{aligned} S_2 &= \frac{V_{cm}^2}{2a_2} \\ S_1 &= \frac{-V_{cm}^2}{2a_1} \end{aligned}\right\} \Rightarrow \frac{S_2}{S_1} = \frac{V_{cm}^2 \cdot 2a_1}{2a_2 \cdot (-V_{cm}^2)} = -\frac{a_1}{a_2} \Rightarrow$

$\Rightarrow S_2 = -\frac{a_1}{a_2} \cdot S_1$

$S = S_1 + S_2 = S_1 - \frac{a_1}{a_2} S_1 = S_1 \left(1 - \frac{a_1}{a_2}\right) =$

$= S_1 \left(1 - \frac{g\sin\alpha - \mu_1 g\cos\alpha}{g\sin\alpha - \mu_2 g\cos\alpha}\right) = S_1 \frac{g\sin\alpha - \mu_2 g\cos\alpha - g\sin\alpha + \mu_1 g\cos\alpha}{g\sin\alpha - \mu_2 g\cos\alpha} =$

Чистовик

№2

(5)

$$= S_1 \cdot \frac{\mu_1 g\cos\alpha - \mu_2 g\cos\alpha}{g(\sin\alpha - \mu_2\cos\alpha)} = \frac{\cos\alpha(\mu_1 - \mu_2)}{\sin\alpha - \mu_2\cos\alpha} \cdot \frac{h}{\sin\alpha} =$$

$$= \frac{24(0{,}5 - 0{,}06) \cdot 0{,}2 \cdot 25}{25 \cdot \left(\frac{7}{25} - \frac{0{,}06 \cdot 24}{25}\right) \cdot 7} = \frac{24 \cdot 0{,}2 \cdot 0{,}44 \cdot 25}{7 - 1{,}44} =$$

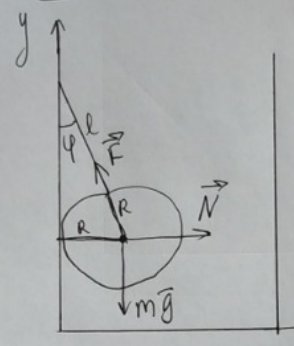
$$= \frac{24 \cdot 0{,}2 \cdot 0{,}44 \cdot 25}{5{,}56} = 9{,}5 \text{ (м)}$$

Ответ: 1) $V_{max} = \sqrt{\frac{2h(\mu_1 g\cos\alpha - g\sin\alpha)}{\sin\alpha}} = 4{,}47 \frac{м}{с}$

2) $S = \frac{h\cos\alpha(\mu_1 - \mu_2)}{\sin\alpha(\sin\alpha - \mu_2\cos\alpha)} = 9{,}5$ м

Листовик ⑥

№3



1) $\sin\varphi = \frac{R}{R+l} \Rightarrow \cos\varphi = \frac{\sqrt{(R+l)^2 - R^2}}{R+l}$

2) $\vec{a} = \frac{\vec{R}}{m}$

$\vec{0} = \vec{F} + \vec{N} + m\vec{g}$

Oy: $0 = F\cos\varphi - mg \Rightarrow$

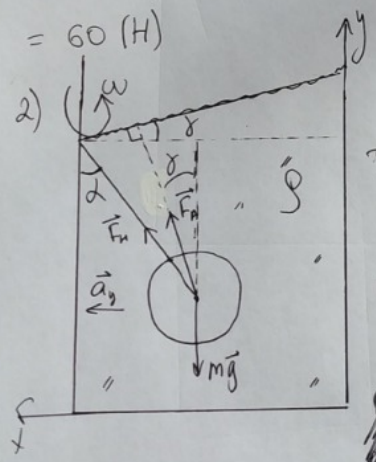
$F = \frac{mg}{\cos\varphi} =$

$= \frac{mg(R+l)}{\sqrt{(R+l)^2 - R^2}} =$

$= \frac{5{,}2 \cdot 10 \cdot (8+8)}{\sqrt{16^2 - 8^2}} = \frac{52 \cdot 16}{\sqrt{192}} = \frac{52 \cdot 16}{\sqrt{64 \cdot 3}} = \frac{52 \cdot 8 \cdot 2}{8\sqrt{3}} = \frac{104\sqrt{3}}{3} =$

$= 60$ (Н)

2)



$\vec{a} = \frac{\vec{R}}{m}$

$m\vec{a}_y = \vec{F}_H + m\vec{g} + \vec{F}_A$

Т.к. сосуд вращается, то вода наклонена к горизонт. пл-ти под углом γ.

F_A направлена ⊥ поверхности воды

$a_y = \omega^2 R_{вр} = \frac{v^2}{R_{вр}}$

$\sin\alpha = \frac{R_{вр}}{R+l} \Rightarrow R_{вр} = (R+l)\sin\alpha$

[illegible]

$F_{Ax} = a_y \rho V$

$F_{Ay} = g \rho V$

Чистовик | №3 | ⑦

$Ox: ma_y = a_g \rho V + F_н \sin\alpha$

$Oy: 0 = F_н \cos\alpha + g\rho V - mg \Rightarrow F_н = \frac{mg - g\rho V}{\cos\alpha}$

$ma_y = a_y \rho V + (mg - g\rho V)\operatorname{tg}\alpha$

$a_y(m - \rho V) = g(m - \rho V)\cdot \operatorname{tg}\alpha \Rightarrow a_y = g\operatorname{tg}\alpha$

3) $a_y = \frac{v^2}{R_{бр}} \Rightarrow v^2 = a_y \cdot R_{бр} = g\operatorname{tg}\alpha \cdot (R+l)\sin\alpha = \frac{g(R+l)}{\cos\alpha}\cdot \sin^2\alpha$

$v = \frac{2\pi R_{бр}}{T} \Rightarrow T = \frac{2\pi R_{бр}}{v} = \frac{2\pi(R+l)\sin\alpha}{\sqrt{\frac{g(R+l)\sin^2\alpha}{\cos\alpha}}} =$

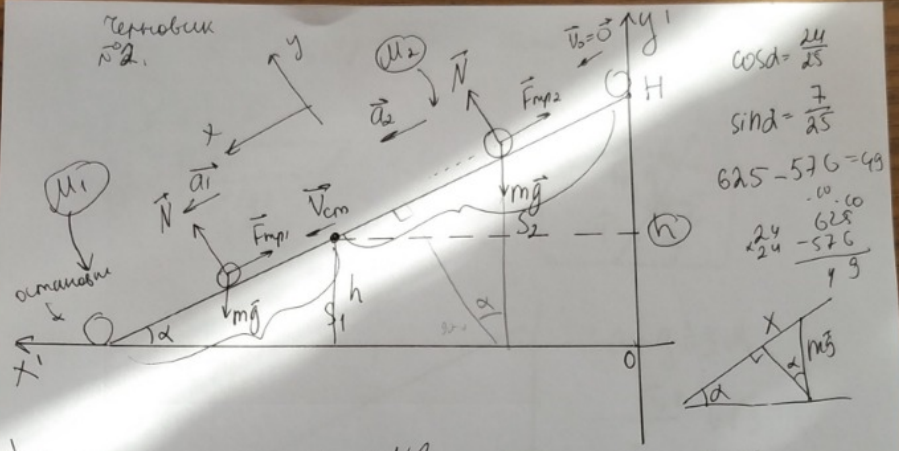
$= \frac{2\pi \cdot \sqrt{\cos\alpha}\cdot (R+l)\sin\alpha}{\sqrt{g(R+l)}\cdot \sin\alpha} = \frac{2\pi \cdot \sqrt{g(R+l)\cos\alpha}}{g} =$

$= \frac{2\cdot 3{,}14 \cdot \sqrt{10(0{,}08+0{,}08)\cdot 0{,}5}}{10} = 0{,}56\ (с)$

Ответ: 1) $F = \frac{mg(R+l)}{\sqrt{(R+l)^2 - R^2}} = 60\ (Н)$

2) $T = \frac{2\pi \cdot \sqrt{g(R+l)\cos\alpha}}{g} = 0{,}56с$

Черновик
№2.



$\cos\alpha = \frac{24}{25}$

$\sin\alpha = \frac{7}{25}$

$625 - 576 = 49$

$\begin{array}{r} 24 \\ \cdot 24 \\ \hline 96 \\ 48 \\ \hline 576 \end{array}$ $\begin{array}{r} 625 \\ -576 \\ \hline 49 \end{array}$

1) $\begin{cases} Ox: ma_2 = mg\sin\alpha - \mu_2 N \\ ma_1 = mg\sin\alpha - \mu_1 N \\ Oy: N = mg\cos\alpha \end{cases} \Rightarrow \begin{cases} a_2 = g\sin\alpha - \mu_2 g\cos\alpha \\ a_1 = g\sin\alpha - \mu_1 g\cos\alpha \end{cases}$

$a_2 = \frac{10 \cdot 7}{25} - \frac{0{,}06 \cdot 10 \cdot 24}{25} = \frac{70 - 14{,}4}{25} = \frac{55{,}6}{25} \left(\frac{м}{с^2}\right) > 0$

$a_1 \Big| \frac{70 - 0{,}5 \cdot 10 \cdot 24}{25} = \frac{70 - 120}{25} = \frac{-50}{25} = -2 \left(\frac{м}{с^2}\right) < 0$

$a_2 > 0$ – тело ускоряется
$a_1 < 0$ – тело замедляется
$\Rightarrow v_{max}$ на стыке μ_1 и μ_2

(по модулю)

$\frac{S_2}{S_1} = \frac{a_1}{a_2}$

2) $S_2 = \frac{v_{cm}^2}{2a_2}$

$S_1 = \frac{v_{cm}^2}{2a_1}$; $\frac{h}{S_1} = \sin\alpha \Rightarrow S_1 = \frac{h}{\sin\alpha}$

$S_2 = \frac{a_1}{a_2} \cdot S_1 = \frac{560 \cdot 25}{25 \cdot 556 \cdot 7} \cdot 1{,}4 \cdot 25 = 4{,}49$

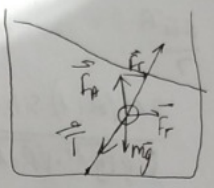
$v_{cm} = \sqrt{2a_1 S_1} = \sqrt{2 \cdot 2 \cdot \frac{h}{\sin\alpha}} = 2\sqrt{\frac{1{,}4 \cdot 25}{7}} = 2 \cdot \sqrt{0{,}2 \cdot 25}$

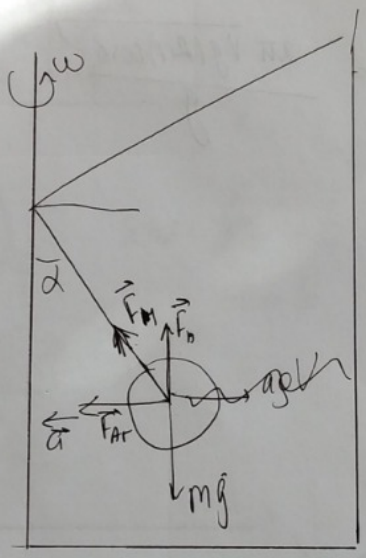
$\frac{92}{49} \cdot \frac{25}{7} = 5$ м

$g^2 \sin^2\gamma = a^2 - a^2\sin^2\gamma$

$\sin^2\gamma\,(g^2 + a^2) = a^2$

$\sin\gamma = \sqrt{\frac{a^2}{a^2+g^2}}$





$a = g\,\mathrm{tg}\,\alpha$

$\frac{\sqrt{3}^2}{2} = \sqrt{3}$

$10\sqrt{3}$

$R_{бр} = \frac{0{,}16\cdot\sqrt{3}}{2}$

$v^2 = \frac{0{,}16\cdot\sqrt{3}\cdot 10\cdot\sqrt{3}}{2} =$

$= 0{,}08\cdot 3\cdot 10 = 2{,}4\sqrt{3}$

$v = \frac{2\pi R}{T}$

$T = \frac{2\cdot 3{,}14\cdot 0{,}16\cdot\sqrt{3}}{2\cdot 2\cdot\sqrt{0{,}24}\cdot 3}$

В Небо

$\frac{\sqrt{\frac{m}{c^2}\cdot m}}{\frac{m}{c^2}} = \frac{m\cdot c^2}{c^2\cdot m} = c$

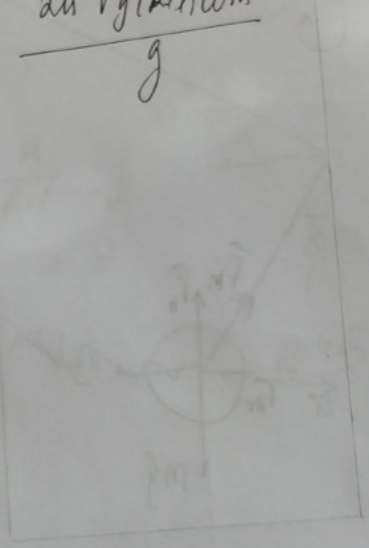
Черновик

$a = g \operatorname{tg} \alpha$

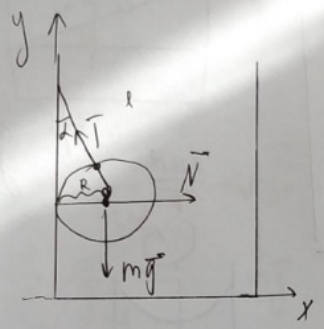
$v = \frac{2\pi R}{T}$

$T = \frac{2\pi (R+l) \sin\alpha}{\sqrt{g \operatorname{tg}\alpha} \cdot \sqrt{R + l\sin\alpha}} = \frac{2\pi \sqrt{(R+l)\sin\alpha}}{\sqrt{g \sin\alpha} \cdot \sqrt{\frac{1}{\cos\alpha}}} =$

$= \frac{2\pi \sqrt{g(R+l)\cos\alpha}}{g}$



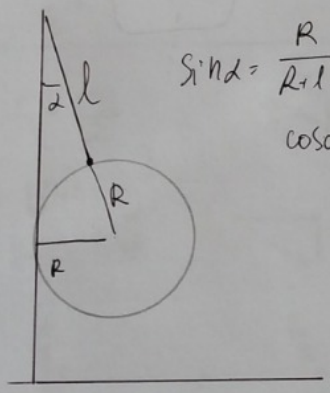
Тепловик
№3



$\sin\alpha = \frac{R}{l} = 1$

Oy: $0 = T\cos\alpha - mg$

$\Rightarrow T = \frac{mg}{\cos\alpha} =$

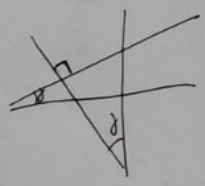


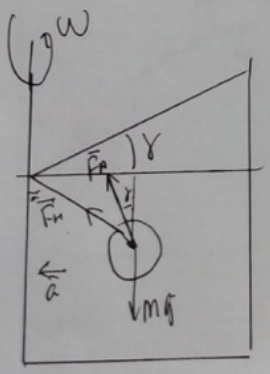
$\sin\alpha = \frac{R}{R+l} = \frac{1}{2}$

$\cos\alpha = \frac{\sqrt{3}}{2}$

$= \frac{5{,}2 \cdot 10 \cdot 2}{\sqrt{3}} = \frac{52 \cdot 2}{\sqrt{3}} =$

$= \frac{104\sqrt{3}}{3} = 60(H)$

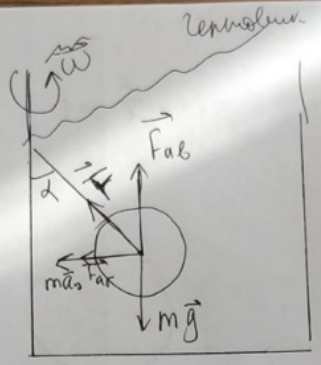


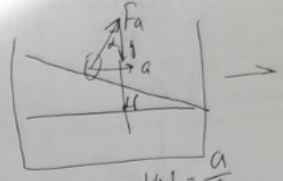


$\frac{\sin\gamma}{\sqrt{1-\sin^2\gamma}} = \frac{a_y}{g}$

$\frac{\sin^2\gamma}{1-\sin^2\gamma} = \frac{a^2}{g^2}$

$tg\gamma = \frac{a_y}{g}$





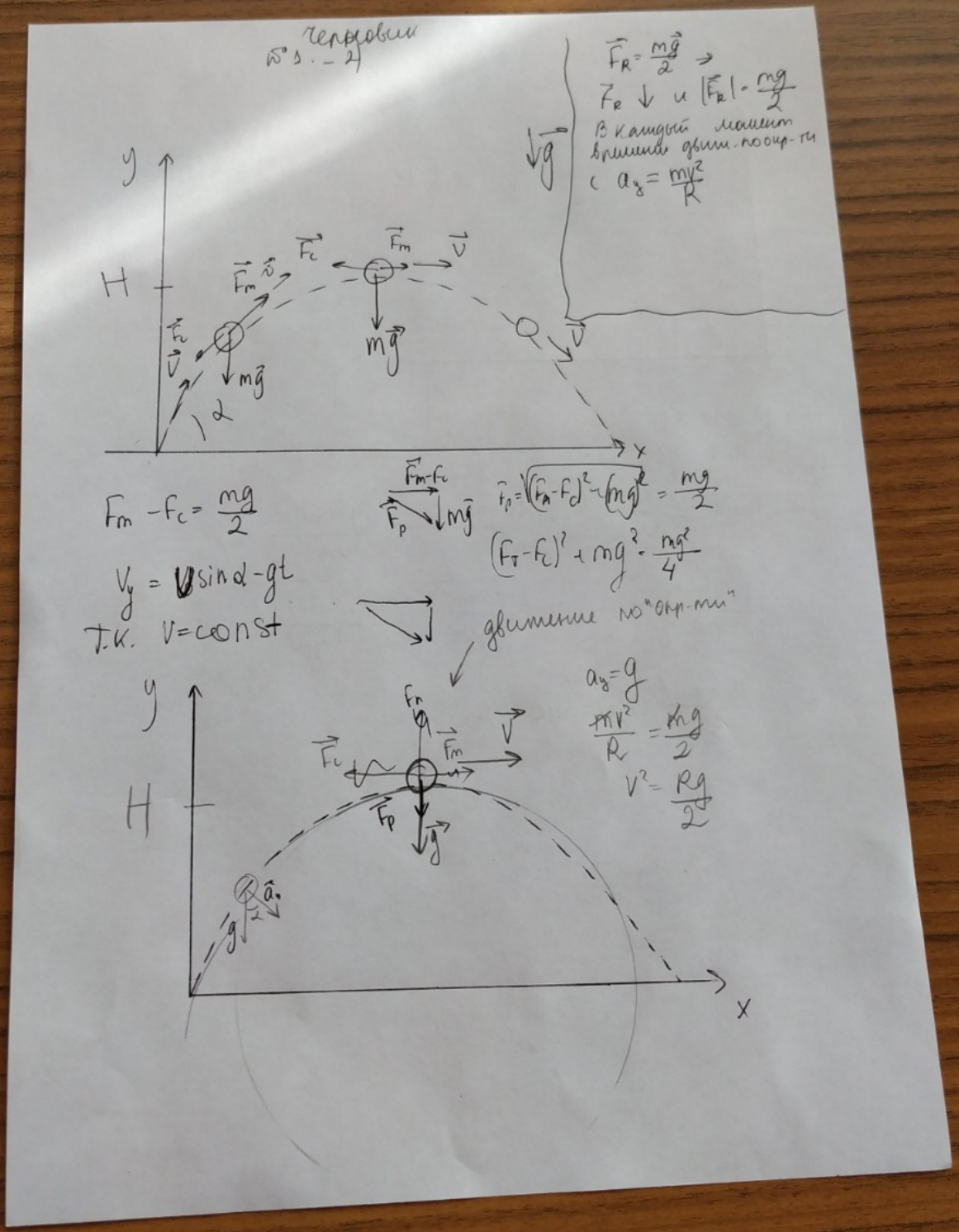
$v = \frac{2\pi R}{T}$

$F_{Aб} = g\rho V$

$F_{Ar} = a\rho V$

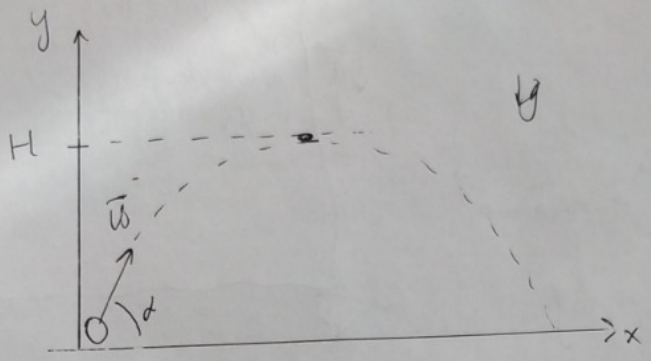
$ma = F\sin\alpha$

$g\rho V + F\cos\alpha = mg$



Вариант (В 10-04)

№1.



$v_x = v_0 \cos\alpha = \text{const}$

$v_y = v_0 \sin\alpha - gt = 0 \Rightarrow t = \frac{v_0 \sin\alpha}{g}$

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

$= \frac{v_0^2 \sin^2\alpha}{2g} \Rightarrow v_0 = \frac{\sqrt{2gH}}{\sin\alpha} = \frac{\sqrt{2 \cdot 10 \cdot 10}}{\frac{\sqrt{2}}{2}} =$

$= \frac{10\sqrt{2} \cdot 2}{\sqrt{2}} = 20$ м/с

Часть 2

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

Шифр: **21205888**

ID профиля: **315785**

Вариант 4

Листовик
№4

①

Вода начинает испаряться, когда вода достигает $t_к = 100°C$

$Q_1 = cm(t_к - t_0) = 4180 \cdot 10^{-3} \cdot (100 - 20) =$

$= 4180 \cdot 10^{-3} \cdot 80 \cdot 10 = 418 \cdot 8 = 3344$ (Дж)

$Q_{исп} = Q - Q_1 = 29656$ (Дж) – пойдет на испарение)

~~$Q_{исп} = Q - Q_1 = 29656$~~

Ответ: $Q_1 = 3344$ Дж $= cm(t_к - t_0)$

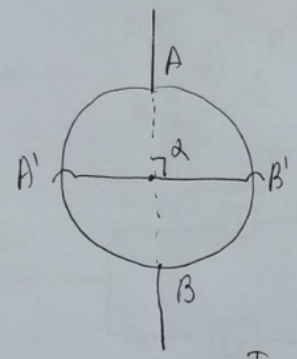
Чистовик

(2)

№5

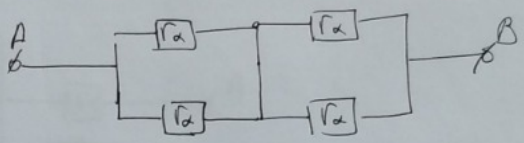
$U = 24$ В, $R = 72$ Ом

1)

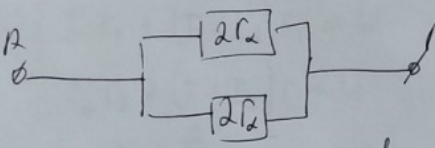


$$R = \frac{\rho l}{S}$$

Значит, данную ситуацию можно представить в след. виде.



Т.к. все сопротивления одинаковые, то ток не течет через перемычку.



$$\frac{1}{R_\alpha} = \frac{1}{2r_\alpha} + \frac{1}{2r_\alpha} = \frac{1}{r_\alpha} \Rightarrow R_\alpha = r_\alpha$$

Т.к. $R = \frac{\rho l}{S}$, то сопротивление части кольца прямо пропорц. его длине

AB' – $\frac{1}{4}$ длины всего кольца $\Rightarrow r_\alpha = \frac{R}{4} \Rightarrow$

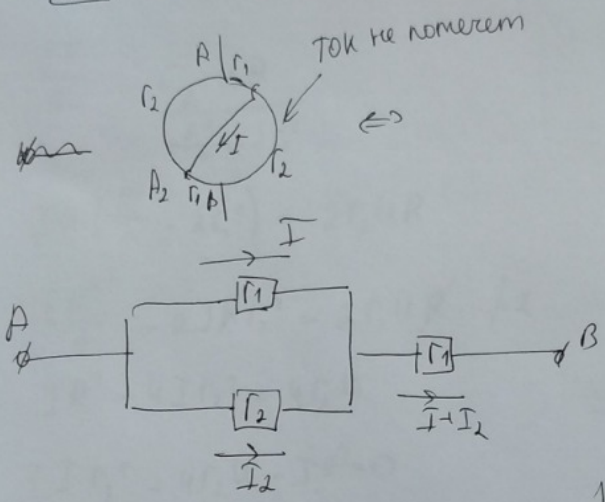
$$R_\alpha = \frac{R}{4}$$

$$I_\alpha = \frac{U}{R} = \frac{4U}{R}$$

$$P = P_\alpha = UI_\alpha = \frac{4U^2}{R} = \frac{4 \cdot 24 \cdot 24}{72} = 32 \text{ (Вт)}$$

Листовка
№5

(3)



2) $\begin{cases} I r_1 + (I+I_2) r_1 = U \\ I_2 r_2 + (I+I_2) r_1 = U \\ r_1 + r_2 = \frac{R}{2} \end{cases}$

$\begin{cases} I r_1 = I_2 r_2 \\ r_1 + r_2 = \frac{R}{2} \Rightarrow r_1 = \frac{R}{2} - r_2 \end{cases}$

$\frac{IR}{2} - I r_2 = I_2 r_2$

$\frac{IR}{2} = r_2 (I + I_2)$

3) $\frac{1}{r_1} + \frac{1}{r_2} = \frac{r_1 + r_2}{r_1 r_2}$

$R_0 = r_1 + \frac{r_1 r_2}{r_1 + r_2} = \frac{r_1 \frac{R}{2} + r_1 r_2}{\frac{R}{2}} =$

$= \frac{r_1 \left(\frac{R}{2} + r_2\right) \cdot 2}{R} =$

$= \frac{\left(\frac{R}{2} - r_2\right)\left(\frac{R}{2} + r_2\right) \cdot 2}{R} =$

$= \left(\frac{R^2}{4} - r_2^2\right) \cdot \frac{2}{R}$

чистовик
№5

4) $I+I_2 = \frac{U}{R_0} = \frac{U \cdot R}{2\left(\frac{R^2}{4} - r_2^2\right)}$

(4)

$\frac{IR}{2} = \frac{r_2 UR}{\frac{R^2}{2} - 2r_2^2}$

$IR\left(\frac{R^2}{2} - 2r_2^2\right) = 2r_2 UR$

$\frac{IR^{3\,2}}{2} - 2IRr_2^2 = 2r_2 UR \quad /\cdot 2$

$IR^2 - 4Ir_2^2 = 4r_2 U$

$4Ir_2^2 + 4r_2 U - IR^2 = 0$

$D_1 = 4U^2 + 4I^2R^2 = 4(U^2 + I^2R^2)$

$r_2 = \frac{-2U - \sqrt{D_1}}{4} < 0$

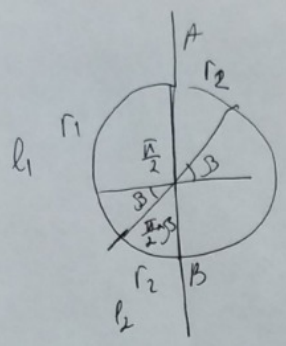
$r_2 = \frac{-2U + 2\sqrt{U^2 + I^2R^2}}{4} = \frac{-U + \sqrt{U^2 + I^2R^2}}{2} =$

$= \frac{-24 + \sqrt{24^2 + 0{,}5^2 \cdot 72^2}}{2} = 9{,}6\ (\text{Ом})$

$r_1 = \frac{R}{2} - r_2 = 36 - 9{,}6 = 26{,}4\ (\text{Ом})$

Чистовик №5

(5)



5) $\frac{l_1}{l_2} = \frac{r_1}{r_2}$

$l_1 = R_к\left(\frac{\pi}{2}+\beta\right)$

$l_2 = R_к\left(\frac{\pi}{2}-\beta\right)$

$\frac{\frac{\pi}{2}+\beta}{\frac{\pi}{2}-\beta} = \frac{r_1}{r_2} = \frac{26,4}{9,6} = 2,75$

$\frac{2,75\cdot\pi}{2} - 2,75\beta = \frac{\pi}{2} + \beta$

$3,75\beta = 0,875\pi$

$\beta = 0,23\pi = 0,7\ (рад)$

6) $R_0 = \left(\frac{72^2}{4} - 9,6^2\right)\cdot\frac{1}{36} = 33,44\ (Ом)$

$P_2 = \frac{U^2}{R_0} = \frac{24^2}{33,44} = 17,2\ (Вт)$

Ответ:

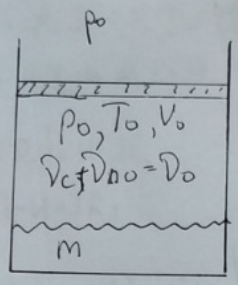
1) $P = \frac{4U^2}{R} = 32\ Вт$

2) $\beta = 0,7\ рад$

3) $P_2 = 17,2\ Вт$

Черновик

№4.



Воды начинает кип. при $t_к = 100°C$

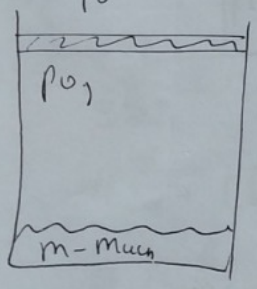
$Q_1 = cm(t_к - t_0) + m_п$

$= 4180 \cdot 10 \cdot 80 =$

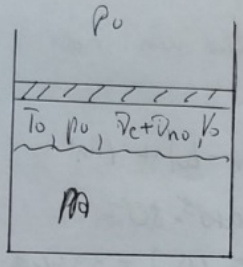
$= 418 \cdot 80\ (кДж) = 3344\ (кДж)$

$Q_{исп} = Q - Q_1 = 33000 - 3344 = 29656\ (кДж)$ — пошла на испарение

$m_{исп} = \frac{Q_{исп}}{r}$



Черновик:



$p_0 V_0 = (\nu_c + \nu_{n0}) R T_0$

$p_0 V_0 = \nu_0 R T_0$

$C_p = \frac{dQ}{dT} = \frac{dA + dU}{dT} = \frac{p(V_2 - V_1) + \frac{i}{2}(pV_2 - pV_1)}{\nu R dT}$

$pV_1 = \nu R T_1$

$pV_2 = \nu R T_2$

$p(V_2 - V_1) = \nu R dT$

$\nu R dT + \frac{i}{2} \nu R dT$

$\frac{i+2}{2} R = R(\frac{i}{2} + 1) = \frac{i+2}{2} R$

$\frac{\nu R}{p}$

$I_1 = \frac{\mathcal{E}(\mathcal{U} - I R_1)}{R}$

$I_3 (\frac{R}{2} + r) = \mathcal{U} - I r_1$

$I_3 r_2 + I_3 R_1 + I r_1 = \mathcal{U}$

$I_3 r_1 + I r_1 + I_3 r_2 - I r_1 = \mathcal{U}$

$I_3 r_2 + I_3 R_1 + I r_1 = \mathcal{U}$

$\begin{cases} (I_3 + I) r_1 + (I_3 + I) R_2 - I r_1 = \mathcal{U} \\ I_3 r_2 + I_3 R_1 + I r_1 = \mathcal{U} \end{cases}$

Черновик

$I_1 R_1 + I_1 R_2 + I R_2 = I_2 R_2 + I_2 R_1 - I R_1$

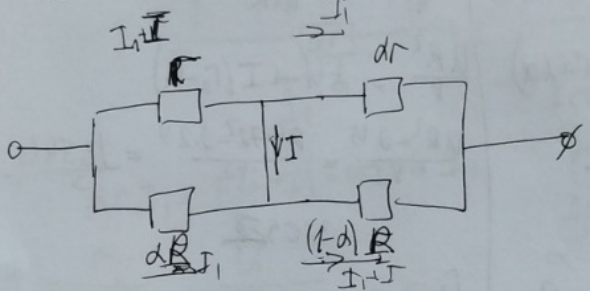
$R_1 I_1 + R_2 I_1 + R_2 I = U$

$R_2 I_2 + R_1 I_2 + R_1 I = U$

$I_1 (R_1 + R_2) = U - I R_2$

$I_2 (R_1 + R_2) = U + I R_1$

$I_1 (R_1 + R_2) + I R_2 = U$



$\frac{r(\alpha+1)}{2} = \frac{U}{2I_1 + I}$

$\alpha r I_1 + r(I + I_1) = U$

$\alpha r + r = \frac{R}{2} \Rightarrow r(\alpha+1) = \frac{R}{2} \Rightarrow r = \frac{R}{2(\alpha+1)}$

$\frac{2}{r + \alpha r}$

$r \| i$

$\frac{\alpha R}{2} I_1 + \frac{(1-\alpha) R}{2} (I_1 + I) = U$

$r + \alpha r$

черновик

$I_1 r(\alpha+1) = U - Ir$

$I_1 = \frac{U - Ir}{r(\alpha+1)}$

$\frac{\cancel{r}}{2(\alpha+2)} = \frac{Ur(\alpha+1)}{2(U-Ir)+Ir(\alpha+1)}$

$2U - \underline{2Ir} + \underline{Ir\alpha} + \underline{Ir} = (2\alpha+2)(U\alpha+U) = U2(\alpha+1)^2$

$Ir(\alpha+1) + 2U = 2U(\alpha+1)^2$

$Ir(\alpha-1) = 2U(\alpha^2+2\alpha)$

$r = \frac{2U(\alpha^2+2\alpha)}{I(\alpha-1)}$

$\frac{2U\alpha(\alpha+1)}{I(\alpha-1)} = 2R$

$\frac{UR}{4} = \frac{U+Ir_2+U-Ir_1}{0{,}5R}$

$\frac{UR^2}{8} = 2U + I(r_2-r_1)$

$\frac{UR^2-2U}{8I} = \frac{24 \cdot 72^2 - 2 \cdot 24}{8 \cdot 5} = \frac{15546}{5} =$

$= 3109{,}2$

$\frac{r_2}{r_1} - 1 = 3109{,}2$

$\frac{r_2}{r_1} = 3109{,}2 \Rightarrow \frac{l_2}{l_1} = 3109{,}2$

~~$I_1 r_1 + (I_1 - I) r_2 = U \Leftrightarrow$~~

$\begin{cases} I_1 r_1 + I_1 r_2 - I r_2 = U \Rightarrow I_1(r_1+r_2) = U + Ir_2 \\ I_2 r_2 + I_2 r_1 + I r_1 = U \Rightarrow I_2(r_1+r_2) = U - Ir_1 \\ r_1 + r_2 = \frac{R}{2} \end{cases}$

$I_1 = \frac{U+Ir_2}{0{,}5R}$

$I_2 = \frac{U-Ir_1}{0{,}5R}$

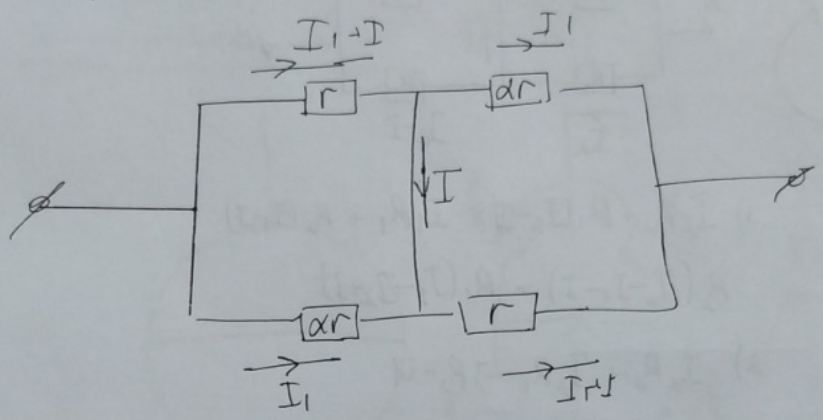
$I_1, I_2, \frac{r_1}{r_2} - ?$

$\frac{3109{,}2}{1} = \frac{\pi - \beta}{\beta}$

$l_1 = r\beta$

$3109{,}2 l_1 = r(\pi - \beta)$

черновик



$$\begin{cases} \alpha r I_1 + r(I_1+I) = U \rightarrow I_1 \\ \dfrac{r}{2(\alpha+1)} = \dfrac{U}{2I_1+I} \rightarrow r \\ r(\alpha+1) = 2R \end{cases}$$

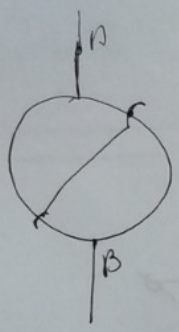
r, I_1, α

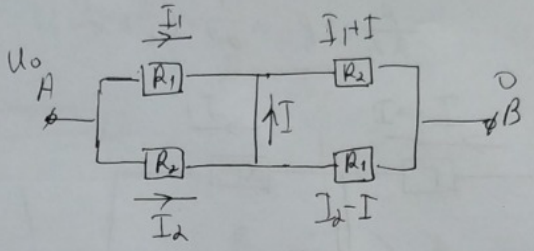
$$r = \frac{2R-\alpha}{\alpha}$$

$$I_1 r(\alpha+1) = U - Ir$$

$$I_1' = \frac{U}{r(\alpha+1)} - I = \frac{U}{}$$

Черновик №5





1) $I_2R_2 + R_1(I_2-I) = I_1R_1 + R_2(I_1+I)$

$R_2(I_2-I_1-I) = R_1(I_1-I_2+I)$

2) $I_2R_2 + I_2R_1 - IR_1 = U$

$I_2(R_2+R_1) = U + IR_1$

$I_2 = \frac{U+IR_1}{R_1+R_2}$

3) $I_1R_1 + I_1R_2 + IR_2 = U$

$I_1 = \frac{U - IR_2}{R_1+R_2}$

$\frac{R_2}{R_1} = \frac{I_1 - I_2 + I}{I_2 - I_1 - I} = \frac{\frac{U-IR_2-U-IR_1}{R_1+R_2} + I}{\frac{U+IR_1-U+IR_2}{R_1+R_2} - I} =$

$= \frac{-IR_2 - IR_1 + IR_1 + IR_2}{}$

Челнокин

№5

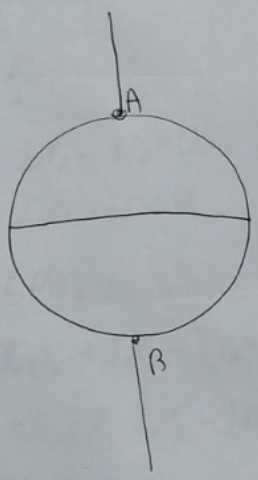
$P = UI$

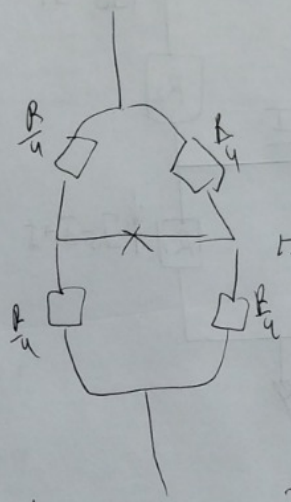
$R = 72\ Ом$ $U = 24\ В$

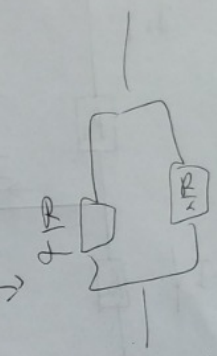
l

S

$R = \frac{\rho l}{S}$







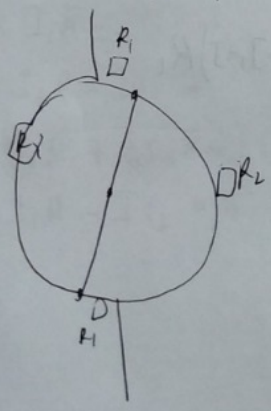
$\frac{1}{R_0} = \frac{2}{R} + \frac{2}{R} = \frac{4}{R}$

$R_0 = \frac{R}{4} = 18$

$I = \frac{24}{18} = \frac{8}{6} = \frac{4}{3}$

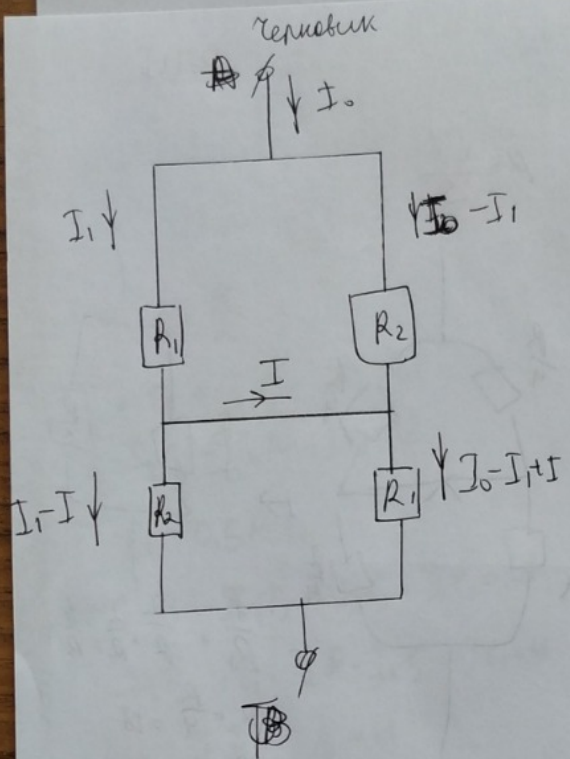
$P = UI = \frac{24 \cdot 4}{3} = 32 (R_x)$

$\frac{16 \cdot 9.2}{9} = 32$



$\frac{2}{R} + \frac{2}{R} = \frac{R}{4}$

черновик

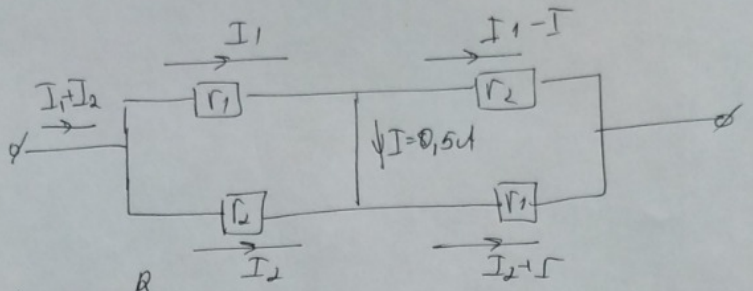


$$I_1 R_1 + (I_1 - I) R_2 = (I_0 - I_1) R_2 + (I_0 - I_1 + I) R_1$$

$$R_1 (I_1 - I_0 - I_1 - I) = R_2 (I_0 - I_1 - I_1 + I)$$

$$R_1 (2I_1 - I_0 - I) = R_2 (I_0 + I - 2I_1)$$

Черновик



$$\begin{cases} r_1 + r_2 = \frac{R}{2} \\ I_1 r_1 + I_1 r_2 - I r_2 = U \\ I_2 r_2 + I_2 r_1 + I r_1 = U \end{cases}$$

$$r_1 = 0{,}5R - r_2$$

$$\begin{cases} 0{,}5 I_1 R - I_1 r_2 + I_1 r_2 - I r_2 = U \\ I_2 r_2 + 0{,}5 I_2 R - I_2 r_2 + I r_1 = U \end{cases}$$

$$\begin{cases} 0{,}5 I_1 R - I r_2 = U \\ 0{,}5 I_2 R + I r_1 = U \end{cases}$$

$$0{,}5 I_1 R + 0{,}5 I R - I r_2 = U$$

$$0{,}5 I_1 R - I r_2 = U$$