Часть 1

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

Шифр: **21205400**

ID профиля: **338715**

Вариант 4

ЧИСТОВИК

№1 задача 1 В4

$\alpha = 45°$

$h_{max} = 10\ м$

$F_р = mg/2$

$V_0 - ?$

$V - ?$

1) $t_{полёт} = \frac{2V_0 \sin\alpha}{g}$ $\quad h_{max} = y\left(t_{max}/2\right) = V_0 \sin\alpha \cdot \frac{V_0 \sin\alpha}{g} - \frac{g}{2}\cdot\left(\frac{V_0 \sin\alpha}{g}\right)^2$

$h_{max} = \frac{V_0^2 \sin^2\alpha}{2g} \Rightarrow V_0^2 = \frac{2gh_{max}}{\sin^2\alpha}$

$V_0 = \frac{1}{\sin\alpha}\sqrt{2gh_{max}} = \sqrt{\frac{2\cdot 10\cdot 10}{\left(\frac{1}{\sqrt{2}}\right)^2}}\ м/с = 20\ м/с$

2) для камня в верхней точке: $V \perp g \Rightarrow a = a_{ц.с.} = g = \frac{V_x^2}{R_{крив}}$

$\Rightarrow R_{крив} = \frac{V_x^2}{g} = \frac{(V_0\cos\alpha)^2}{g}$

Т.к. самолёт летит по дуге окружности, в верхней точке у него такой же радиус кривизны.

$V_{сам} = const \Rightarrow a_\tau = 0 \Rightarrow a_{сам} = a_{ц.с.} = \frac{V^2}{R_{крив}}$

$a_{сам} = \frac{F_р}{m} = \frac{\frac{1}{2}mg}{m} = \frac{g}{2}$

$\frac{g}{2} = \frac{V^2}{R_{крив}} = \frac{V^2}{V_0^2\cos^2\alpha}\,g$ $\quad V^2 = \frac{V_0^2\cos^2\alpha}{2}$ $\quad V = V_0\cdot\sqrt{\frac{\cos^2\alpha}{2}}$

$V = 20\ м/с \cdot \sqrt{\frac{\left(\frac{1}{\sqrt{2}}\right)^2}{2}} = 10\ м/с$ $\quad \left(\frac{1}{\sqrt{2}} = \frac{1}{2}\right)$

(1)

Ответ: $V_0 = 20\ м/с$

$V = 10\ м/с$

Часовик

№2 задача $\frac{1}{84}$ 1) $a_1 = g\sin\alpha - \mu_1 g\cos\alpha$

$\cos\alpha = \frac{24}{25}$ $\left(\sin\alpha = \frac{7}{25}\right.$

$h = 1.4$ м $\left.\operatorname{ctg}\alpha = \frac{24}{7}\right)$

$\mu_1 = 0.5$

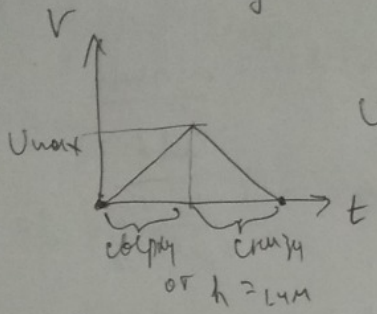
$\mu_2 = 0.06$

$v_{max} - ?$

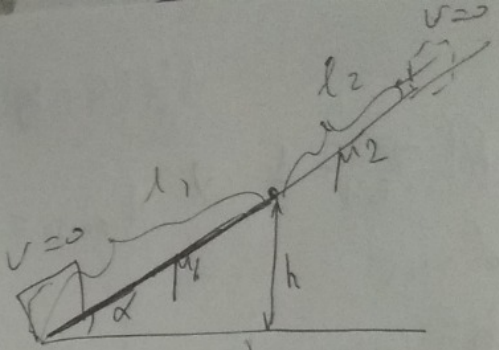
$S - ?$

$a_2 \approx 0.22g > 0$ – разгон

$a_1 = -0.2g < 0$ – торможение



v_{max} будет в момент перехода со II участка на I.



$l_1 = \frac{h}{\sin\alpha}$

$v_{max}^2 = 2l_2(g\sin\alpha - \mu_2 g\cos\alpha) = -2(g\sin\alpha - \mu_1 g\cos\alpha)l_1$

$v_{max}^2 = \frac{2gh}{\sin\alpha}\left(\mu_1\cos\alpha - \sin\alpha\right) = 2gh\left(\mu_1\operatorname{ctg}\alpha - 1\right)$

$v_{max}^2 = 2\cdot 10\cdot 1.4\left(\frac{1}{2}\cdot\frac{24}{7} - 1\right) = 2\cdot 10\cdot\frac{14}{10}\cdot\frac{10}{14} = 20\ м^2/с^2$

$v_{max} = \sqrt{2gh\left(\mu_1\operatorname{ctg}\alpha - 1\right)} = \sqrt{20}\ м/с = 2\sqrt{5}\ м/с \approx 4.47\ м/с$

2) $S = l_1 + l_2$

$gl_2\left(\sin\alpha - \mu_2\cos\alpha\right) = gl_1\left(\mu_1\cos\alpha - \sin\alpha\right)$

$l_2\left(1 - \mu_2\operatorname{ctg}\alpha\right) = l_1\left(\mu_1\operatorname{ctg}\alpha - 1\right)$

$l_2 = l_1\cdot\frac{\mu_1\operatorname{ctg}\alpha - 1}{1 - \mu_2\operatorname{ctg}\alpha}$

$S = l_1\left(1 + \frac{\mu_1\operatorname{ctg}\alpha - 1}{1 - \mu_2\operatorname{ctg}\alpha}\right) = l_1\cdot\frac{1 - \mu_2\operatorname{ctg}\alpha + \mu_1\operatorname{ctg}\alpha - 1}{1 - \mu_2\operatorname{ctg}\alpha} = l_1\frac{(\mu_1 - \mu_2)\operatorname{ctg}\alpha}{1 - \mu_2\operatorname{ctg}\alpha}$

$S = \frac{h}{\sin\alpha}(\mu_1 - \mu_2)\cdot\frac{\operatorname{ctg}\alpha}{1 - \mu_2\operatorname{ctg}\alpha} = \frac{1.4}{7/25}\left(0.44\right)\cdot\frac{24/7}{1 - 0.06\cdot\frac{24}{7}} = 5\cdot 0.44\cdot\frac{24}{5.56} = 9.5\ м$

(2)

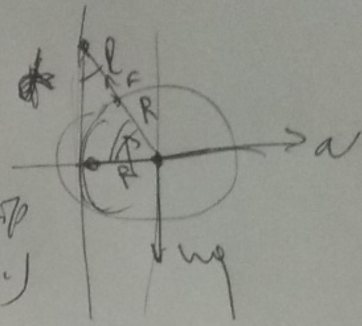
Ответ: $v_{max} = 2\sqrt{5}\ м/с \approx 4.47\ м/с$

$S \approx 9.5$ м

ЧИСТОВИК

№3 часть 1 ВЧ

$R = 0.08$ м
$l = 0.08$ м
$m = 5.2$ кг
$\alpha = 60°$
$F - ?$
$T - ?$



1) $\mu = 0 \Rightarrow R = N$

$mg \cap N = $ центр $\Rightarrow F$ проходит через центр (3 силы, в равновесии)

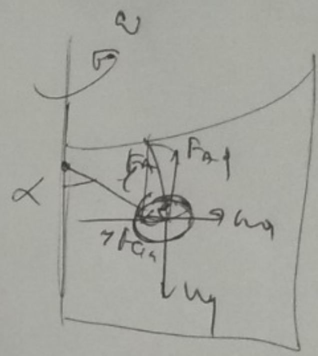
$F\cos\beta = N$ $\qquad \cos\beta = \frac{R}{R+l}$

$F\sin\beta = mg$

$$F = \frac{mg}{\sin\beta} = \frac{mg}{\sqrt{1-\left(\frac{R}{R+l}\right)^2}}$$

$\cos\beta = \frac{1}{2} \Rightarrow \sin\beta = \frac{\sqrt{3}}{2}$

$F \approx 60$ Н



2)

$ma = m\omega^2 r = m\omega^2(R+l)\cdot\sin\alpha$

$\overline{F_A} = \overline{F_{Aa}} + \overline{F_{Ag}}$ $\qquad F_{Aa} = m\frac{\rho}{\rho_ш} a$

$F_{Ag} = m\frac{\rho}{\rho_ш} g$ $\qquad \rho_ш = \frac{m}{\frac{4}{3}\pi R^3} \simeq 2.4$ г/см³

...

$$\operatorname{tg}\alpha = \frac{ma - F_{Aa}}{mg - F_{Ag}} = \frac{a}{g}$$

$\omega^2 r = g\operatorname{tg}\alpha$

...

$$\omega^2 = \frac{g}{(l+R)\cos\alpha}$$

$$T = \frac{2\pi}{\omega} \simeq 0.56 \text{ с}$$

(3)

Ответ: $F = 60$ Н
$T \simeq 0.56$ с

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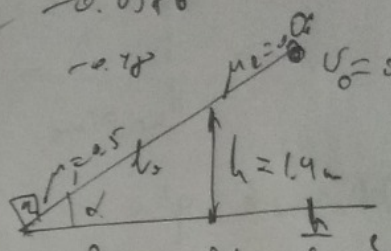
2) $a = g\sin\alpha - \mu g\cos\alpha = g\left(\frac{7}{25} - \mu\cdot\frac{24}{25}\right)$

$a_2 = 0.2221\,g$ — ускорение

$a_1 = -0.576\,g$ — торможение

→ На I корабль прыгать и домой не возвращаться

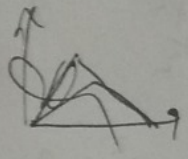


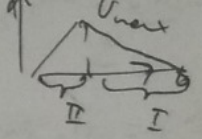
$\cos\alpha = \frac{24}{25}$ $\quad l_2 = \frac{h}{\sin\alpha}$ $\quad h = l_2\sin\alpha$

$\rightarrow h = \frac{7}{25}$ м

$v_{max} - ?$

$S - ?$





0.8216
0.784
0.4

$v_{max}^2 = 2(g\sin\alpha - \mu_2 g\cos\alpha)\,l_2$

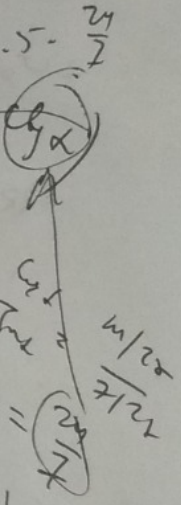
$= 2(g\sin\alpha - \mu_2 g\cos\alpha)\left(l_1 - \frac{h}{\sin\alpha}\right)$

$v_{max}^2 = \frac{2hg}{\sin\alpha}\left(\sin\alpha - \mu_1\cos\alpha\right) = \frac{2h}{\sin\alpha}\left(\sin\alpha - \mu_1\cos\alpha\right)$

$= 2gh\left(\mu_1 \operatorname{ctg}\alpha - 1\right)$

$v_{max}^2 = 20$ $\quad v_{max} = \sqrt{20} = 2\sqrt{5}$ м/с

$v_{max}^2 = 2h\cdot\left(0.5\cdot\frac{24}{7} - 1\right)$



$S = l_1 + l_2 = h/\sin\alpha + \ldots$

$l_2\left(g\sin\alpha - \mu_2 g\cos\alpha\right) = l_1\left(g\sin\alpha - \mu_1 g\cos\alpha\right)$ $\quad / : g\sin\alpha$

$l_2\left(1 - \mu_2\operatorname{ctg}\alpha\right) = l_1\left(\mu_1\operatorname{ctg}\alpha - 1\right)$

$l_2 = l_1\left(\frac{\mu_1\operatorname{ctg}\alpha - 1}{1 - \mu_2\operatorname{ctg}\alpha}\right)$ 0.889

$l_1 = 5$ м

$l_2 = 4.496$

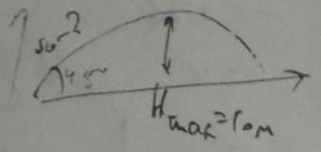
$S = \frac{h}{\sin\alpha}\left(1 + \frac{\mu_1\operatorname{ctg}\alpha - 1}{1 - \mu_2\operatorname{ctg}\alpha}\right)$

$= \frac{1 - \mu_2\operatorname{ctg}\alpha + \mu_1\operatorname{ctg}\alpha - 1}{1 - \mu_2\operatorname{ctg}\alpha}$

$\frac{24}{7} - \frac{14}{7} = \frac{h}{\sin\alpha}\cdot\frac{\mu_1 - \mu_2}{1 - \mu_2\operatorname{ctg}\alpha}$ $\quad \operatorname{ctg}\alpha = 0.4$

$S = 9.496$ м

1.)



$$H_{max}=\frac{v_0^2\sin^2\alpha}{2g}$$

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

$$v_0=\sqrt{\frac{2gH_{max}}{\sin^2\alpha}}=\frac{1}{\sin\alpha}$$

$$=\sqrt{2\cdot 10\cdot 10\cdot 2}$$

$$=2\cdot 10=20\,м/с$$

$$2v_0\sin\alpha\cdot t=gt_n$$

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

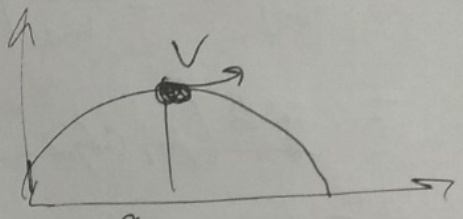
$$H_{max}=v_0\sin\alpha\cdot t-\frac{gt^2}{2}$$

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

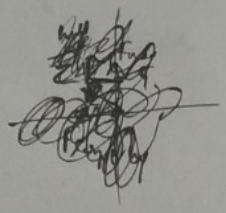
$$H=y\left(\frac{t_n}{2}\right)=v_0\sin\alpha\cdot\frac{v_0\sin\alpha}{g}+\frac{g\cdot v_0^2\sin^2\alpha}{2gR}$$

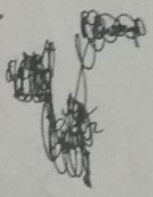
$$=\frac{v_0^2\sin^2\alpha}{g}-\frac{v_0^2\sin^2\alpha}{2g}$$

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



$$a_ц=\frac{g}{2}$$





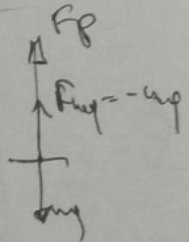
$$a_{ц}=g=\frac{v_0^2}{R_{кривиз}}$$

$$\Rightarrow R_{кривиз}=\frac{v_0^2}{g}$$

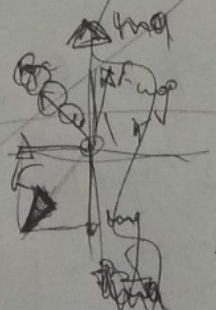
для обруча подходит

$$F_{тяж}=mg$$

$$\Rightarrow F_{равн}=ma_{ц}$$



$$V_{прод}=\text{Const}\quad a_{\tau}\,mg=0$$



$$F_{тяж}\cos\gamma=F_ц$$

$$F_{тяж}\sin\gamma=ma_{\tau}=mg$$

$$V_{прод}=\text{Const}\Rightarrow a_{\tau}\,mg=0\Rightarrow a_{тяж}^{центр}=a_{прод}=\frac{v_0^2}{R_{кривиз}}$$

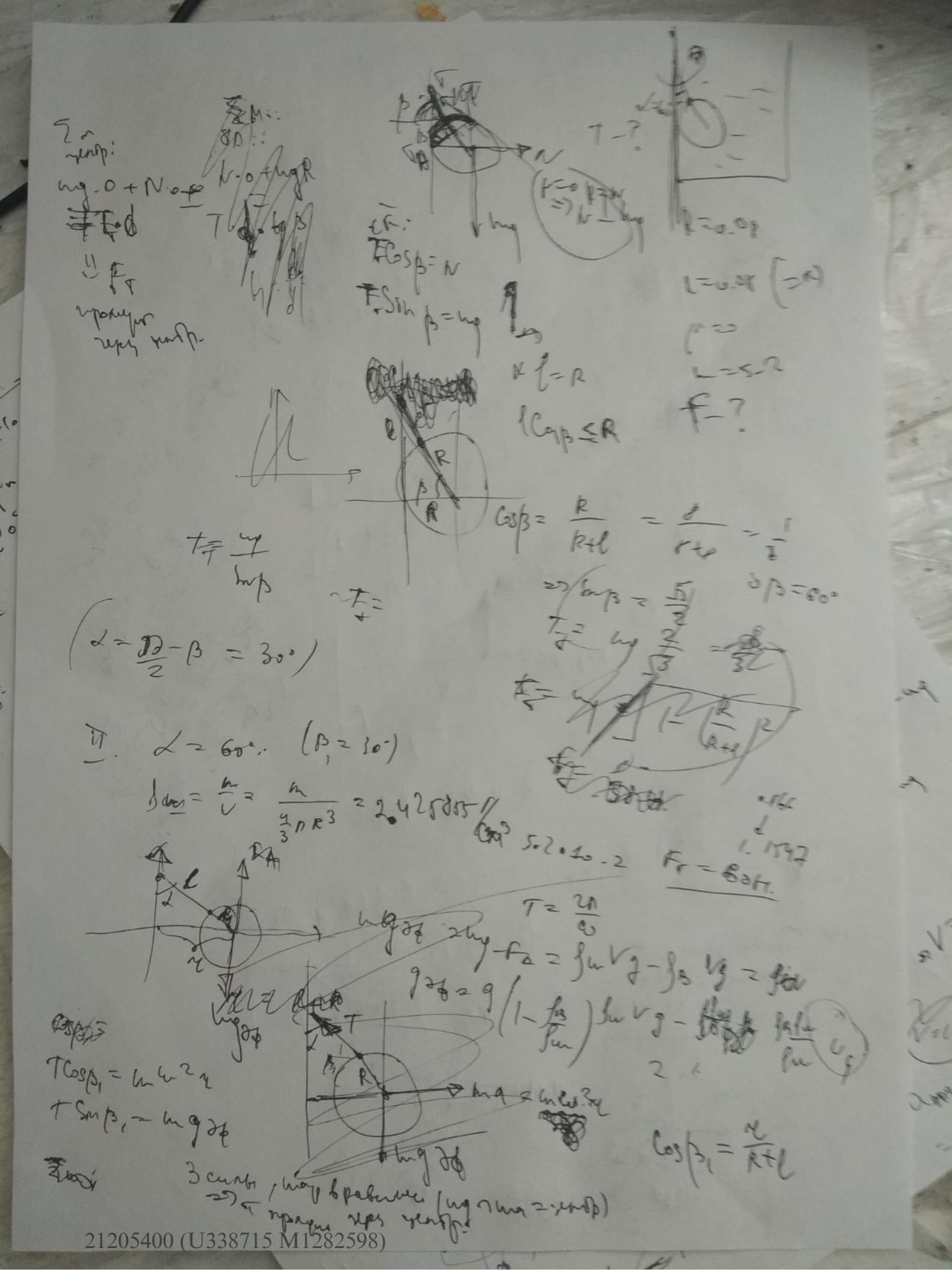
$$\frac{r}{2}=\frac{v^2}{v_0^2\cos\alpha}$$

$$\frac{g}{2}=m\cdot\frac{v_y^2}{R}$$

$$\frac{g}{2}=\frac{v^2\cdot\frac{1}{2}}{R}\Rightarrow V=\frac{v_0^2}{2}$$

$$\frac{v_0^2\cos\alpha}{2}\le\frac{v_0^2}{4}$$

$V=\text{const}$



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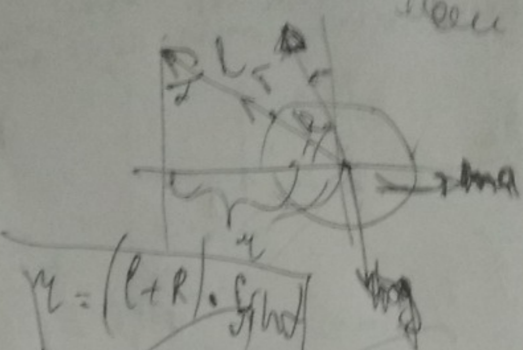
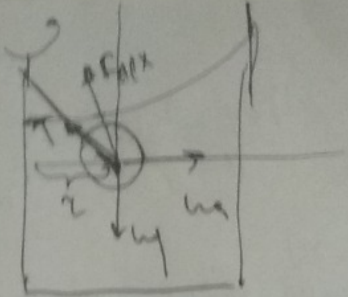




$r = (l+R)\cdot \sin\alpha$

F_A, mg, ma [illegible]

→ T [illegible]

$ma = T\sin\alpha + F_A\cos\beta$

$m\omega^2 (l+R)\sin\alpha = T\sin\alpha + F_A\cos\beta$

$\Sigma M = 0$

$mg = T\cos\alpha + F_A\sin\beta$

$T\cos\beta_1 = m\omega^2 r$

$T\sin\beta_1 = mg\,\partial\beta$

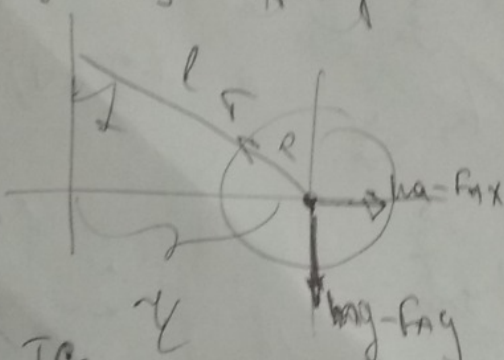
$\cos\beta_1 = \frac{r}{R+l}$

$\cos\beta_1 = \sin\alpha = \sin 60$

$\beta_1 = 30$

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

$t = \frac{2\pi}{\sqrt{5}} = 0.56c$



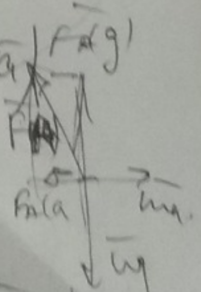
$F_A = mg\,\partial\beta$

$\vec{F_A} = \vec{F_{Ay}} + \vec{F_{Ax}}$

$\vec{F_A} = \vec{F_{Ag}} + \vec{F_{Aa}}$

$\vec{F_A} = \rho V \vec{g} + \rho V \vec{a}$

$F_A = \rho V(\vec{g} + \vec{a})$



$F_A = \frac{m}{\rho_m}\rho g$

$F_A = m\frac{\rho}{\rho_m}(g + a)$

$T\sin\alpha = ma - F_{Ax}$

$T\cos\alpha = mg - F_{Ay}$

$\frac{\sin\alpha}{\cos\alpha} = \frac{ma - F_{Ax}}{mg - F_{Ay}}$

$tg\alpha = \frac{ma(1 - \frac{\rho}{\rho_m})}{mg(1 - \frac{\rho}{\rho_m})}$

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

$ma - F_{Aa} =$

$= ma - m\frac{\rho}{\rho_m}a$

$= ma(1 - \rho_m$

$\cos 60 = \frac{1}{2}$

→ $a = g\,tg\alpha = g\sqrt{3}$

$a = 11$

125

$\omega^2 r = g\,tg\alpha$

$\omega^2 (l+R)\sin\alpha = g\frac{\sin\alpha}{\cos\alpha}$

$\omega^2 = \frac{g}{(l+R)\cos\alpha}$

$T = \frac{2\pi}{\omega}$

$\omega = \sqrt{5}$

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Часть 2

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

Шифр: **21205400**

ID профиля: **338715**

Вариант 4

~5 вч

Частотник

$U = 24$ В

$R_\Sigma = 72$ Ом

$\alpha = 90°$

$I_0 = 0.5$ А

P_α – ?

β – ?

P_2 – ?

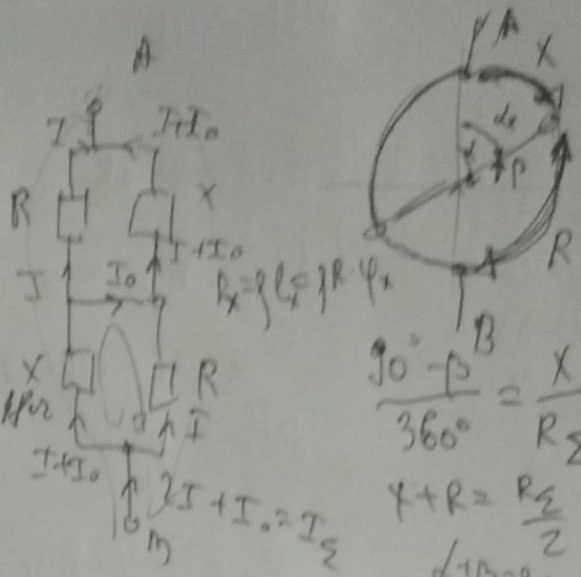
1) при $\alpha = 90°$ $R = X \Rightarrow I_0 = 0$

(мост сбалансирован)

$R_{AB} = \frac{RR}{R+R} + \frac{RR}{R+R} = R$

$R = \frac{90°}{360°} \cdot R_\Sigma = \frac{90°}{360°} \cdot R_\Sigma = \frac{72\,\Omega}{4} = 18\,\Omega$

$P = \frac{U^2}{R} = \frac{24^2}{18} = 32$ Вт



$\frac{90° - \beta}{360°} = \frac{X}{R_\Sigma}$

$X + R = \frac{R_\Sigma}{2}$

$\alpha + \beta = 90°$

2) по 2 закону Кирхгофа для контура

$(I + I_0)X + I_0 \cdot 0 = IR$

$(I + I_0)X + IR = U$

$I X + I_0 X + IR = U$

$I(X + R) + I_0 X = U$

$I = \frac{U - I_0 X}{X + R} = \frac{U - I_0 X}{R_\Sigma / 2} = 2\frac{U - I_0 X}{R_\Sigma}$

$2(I + I_0)X = U$

$2X\left(I_0 + \frac{2U - 2I_0 X}{R_\Sigma}\right) = U$

$2X\left(\frac{R_\Sigma I_0 + 2U - 2I_0 X}{R_\Sigma}\right) - \frac{4UR_\Sigma}{R_\Sigma} = 0$

$2R_\Sigma I_0 \cdot X + 4U \cdot X - 4I_0 \cdot X^2 - 4UR_\Sigma = 0$

$4U \cdot X - X(2R_\Sigma I_0 + 4U) + 4UR_\Sigma = 0$

$D = (2R_\Sigma I_0 + 4U)^2 - 4 \cdot 4UR_\Sigma \cdot 4U X$

$X = \frac{(2R_\Sigma I_0 + 4U) \pm \sqrt{(2R_\Sigma I_0 + 4U)^2 - 4 \cdot 4UR_\Sigma \cdot 4UX}}{2 \cdot 4U \cdot 4R_\Sigma}$

$X = \frac{168 \pm 120}{4}\,\Omega$ $\Big|$ $X = 72\,\Omega$, $X = 12\,\Omega$

$X = 12\,\Omega$

$X + R = \frac{R_\Sigma}{2} = 36\,\Omega$

$X = 36\,\Omega$

$\frac{90° - \beta}{360°} = \frac{X}{R_\Sigma} = \frac{12}{72} = \frac{1}{6} \Rightarrow 90° - \beta = 60° \Rightarrow \beta = 30°$

$P_2 = I_\Sigma U = (2I + I_0)U = \left(U\frac{U - I_0 X}{R_\Sigma} + I_0\right)U = 36$ Вт

Ответ: $P_\alpha = 32$ Вт

$\beta = 30°$

$P_2 = 36$ Вт

(2)

ЧИСТОВИК

№ 04

$m = 10\,г$ (0,01 кг)

$t_0 = 20°C$

$P_0 = 10^5$ Па

$Q = 3344$ Дж

$Q_1 - ?$

$V - ?$

1) $Q_1 = cm\Delta t = 4180 \cdot 0.01 \cdot (100-20) = 3344$ Дж

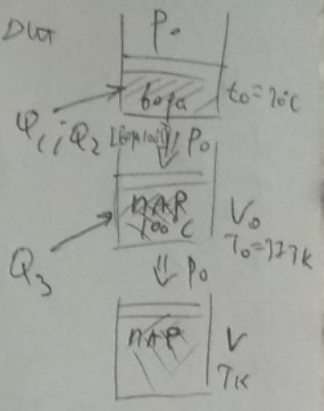
(Активное испарение больше при кипении)

2) $Q_2 = r m = 22.6$ кДж/кг ($c_p \ll r$)

$Q_3 = Q - Q_1 - Q_2 = 7056$ Дж

$p_0 V_0 = \frac{m}{\mu} RT \Rightarrow V_0 = \frac{mRT}{\mu p_0}$

$V_0 = \frac{0{,}01 \cdot 8{,}31 \cdot 373}{1{,}8 \cdot (10^5)} = 17.22\,см^3$



Р.К. нагревают медленно, клапан сосуда буреб равновесии $\Rightarrow P_n = p_0 = const \Rightarrow \frac{V}{T} = const$

$\frac{V}{V_0} = \frac{T_к}{T_0}$ $\quad Q_3 = c_p m (T_к - T_0) \Rightarrow T_к = T_0 + \frac{Q_3}{c_p m}$

$\Delta T = 372 К$

$V = V_0 \frac{T_к}{T_0} = V_0 \cdot \frac{T_0 + \frac{Q_3}{c_p m}}{T_0} = V_0 \left(1 + \frac{Q_3}{c_p m T_0}\right)$

$V = \left(1 + \frac{7056}{2200 \cdot 0{,}01 \cdot 373}\right) \cdot 17.22\,см^3 \approx 17.22 \cdot 1{,}8$

~~$V = 32\,см^3$~~

Отбр.: $Q_1 = 3344$ Дж

$V \approx$ [illegible] $см^3$

(1)

Испарение: $T_к - T_0$

$Q_{испар} = cm\Delta t$ $\quad \Delta m = \frac{cm\Delta t}{r}$

$V = \frac{m RT_{100}}{\mu p_0} = \frac{(m_0 - \Delta m) RT_{100}}{\mu p_0}$

$V = \frac{m_0 \left(1 - \frac{c\Delta t}{r}\right) RT_{100}}{\mu p_0} = \left(1 - \frac{c\Delta t}{r}\right) V_0 \approx 0.8 V_0$

$(I+I_0)x+IR=U$ $Ix+I_0x+IR=U$

$(I+I_0)x=IR$ $I(x+R)=U-I_0x$

$I=\frac{U-I_0x}{x+R}$

$2(I+I_0)x=U$

$x+R=\frac{R_\Sigma}{2}$

$2x\left(I_0+\frac{U-I_0x}{x+R}\right)=U$ $I\frac{R_\Sigma}{2}=U-I_0x$

$I=2_0\frac{U-I_0x}{R_\Sigma}$

$2x\left(I_0+\frac{2U-2I_0x}{R_\Sigma}\right)=U$

$2x\left(\frac{I_0R_\Sigma+2U-2I_0x}{R_\Sigma}\right)=U$

$\frac{2xI_0R_\Sigma+4Ux-4I_0x^2}{R_\Sigma}-\frac{UR_\Sigma}{R_\Sigma}=0$

$2xI_0R_\Sigma+4Ux-4I_0x^2-UR_\Sigma=0$

$-4I_0\cdot x^2+x(2I_0R_\Sigma+4U)-UR_\Sigma=0$

$\frac{4\cdot0.5}{2}$ $2\cdot0.5\cdot72+4\cdot24$ $\frac{72\cdot24}{1728}$

$0=168$

$x=\frac{\pm168\pm120}{4}$ $4\cdot172\cdot8\cdot2=14400$

$\frac{288}{4}=72$ 212Ω

$\frac{48}{4}=12$ $R+x=36$

$x=12$ $R\leq36$

$(R=24)$

$P_2=I_2U=(2I-I_0)U$

$I=\frac{24-0.5\cdot12}{36}=\frac{18}{36}=\frac{1}{2}$

$\frac{90-\beta}{360}=\frac{12}{72}=\frac{1}{6}$

$90-\beta=60$

$\beta=30$

$P_2=(2\cdot\frac{1}{2}-\frac{1}{2})U=1,5\cdot24=36W$

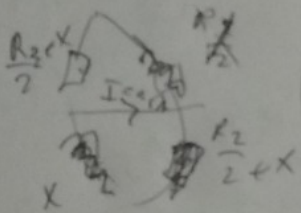
1)

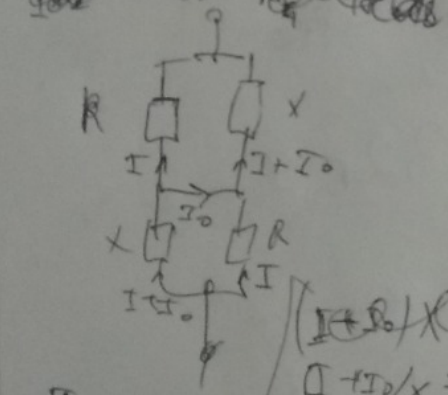
A) $R_{AB} = \frac{R}{2} + \frac{R}{2} = R$

$\alpha = \frac{30°}{360°} \cdot R_0 = \frac{1}{4} \cdot 24\Omega$: 1 Ω

$P = \frac{U^2}{R} = \frac{4^2}{0.5} = 32\,W$

2)





$I_\Sigma = 2I + I_0$

$R + x = \frac{R_\Sigma}{2}$

$(I + I_0)x = I\left(\frac{R_\Sigma}{2} - x\right)$

$Ix + I_0 x = I\frac{R_\Sigma}{2} - Ix$

$x\left(2I + I_0\right) = I\frac{R_\Sigma}{2}$

$x = \frac{R_\Sigma}{2} \cdot \frac{I}{(2I + I_0)}$

$Ix + I_0 x + IR = U$

$I(x + R) = U - I_0 x$

$I = \frac{U - I_0 x}{x + R}$

$Ix + I_0 x = IR$

$\left(\frac{U - I_0 x}{x + R} + I_0\right)x = \frac{U - I_0 x}{x + R} \cdot R$

$2x\left(2 \cdot \frac{U - I_0 x}{x + R} + I_0\right) = R_\Sigma \cdot \frac{U - I_0 x}{x + R}$

$4x(U - I_0 x) + 2xI_0(x + R) = R_\Sigma(U - I_0 x)$

$4x(U - I_0 x) + 2xI_0 R_\Sigma - R_\Sigma(U - I_0 x) = 0$

1) $Q_1 = Cm\Delta t = 4180 \cdot 0.01 \cdot 80 = 3{,}344$ кДж

(все 29656 Дж)

$Q_2 = rm = 22600$ Дж $[c_p << r]$

$2.26 \cdot 10^6 \cdot 10^{-3} = 22{,}6 \cdot 10^3$

$pV_0 = \nu RT = \frac{m}{\mu}RT$

$V_0 = \frac{mRT}{\mu P} = \frac{0.01 \cdot 8.31 \cdot 373}{18 \cdot (1 \cdot 10^5)}$

$V_0 = 17.22$ см3

$Q_3 = Q - Q_1 - Q_2 = 7.056$ кДж

$Q_3 = c_p m \Delta t \rightarrow \Delta t = Q_3 / c_p m = 320.73$ K

$\frac{\Delta U}{Q_p} = \frac{\frac{i}{2}RT}{\frac{i}{2}RT + RT}$; $i_{\text{водн}} = 6$

$\frac{\Delta U}{Q_p} = \frac{3}{3+1} = \frac{3}{4}$

$U_k = U_0 + \Delta U$

$\frac{6}{2}pV_k = \frac{6}{2}pV_0 + \frac{3}{4}Q_3$

$3pV_k = 3pV_0 + \frac{3}{4}Q_3$

$V_k = \frac{pV_0 + \frac{1}{4}Q_3}{p} = V_0 + \frac{Q_3}{4p} = 1764$ см3 $= 0.01764$ м3

$\frac{V_k}{V_0} = \frac{T_k}{T_0}$

$\frac{x}{17.22} = \frac{320.73 + 373}{373}$

32 см3

$V = V_k + V_0 = 1764 + 17.22 = 1781$ см3

P = 1·10⁵ Па

m = 0

Q = 33 кДж

t₀ = 20°

C = 4180

r = 226·10⁴

C_p = 2200 (1·10⁵ Па)

21205400 (U338715 M1282599)