Часть 1

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

Шифр: **21206369**

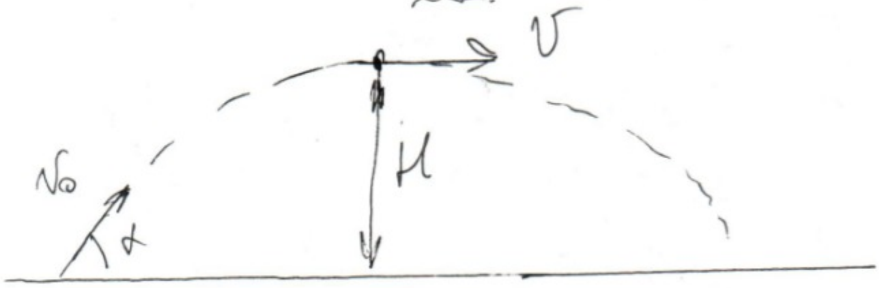
ID профиля: **285659**

Вариант 4

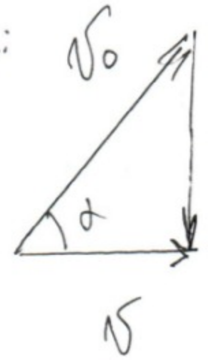
Черновик

~1.

1)



△ скоростей:



$$H = \frac{v_0^2 - v^2}{2g}$$

$$v = v_0\cos\alpha \Rightarrow H = \frac{v_0^2(1-\cos^2\alpha)}{2g}$$

$$\cancel{H =} v_0^2 = \frac{2gH}{1-\cos^2\alpha}$$

$$\boxed{v_0 = \frac{\sqrt{2gH}}{\sqrt{1-\cos^2\alpha}}}$$

$$v_0 = \sqrt{\frac{2\cdot 10\cdot 10}{\frac{1}{2}}}\ \frac{м}{с} = 20\ \frac{м}{с}.$$ ~~Ответ: 20 м/с~~

2) На камень действует ~~у~~ сила тяжести => ускорение камня равно g. Самолетик летит по той же траектории => радиус окружности, частью которой является верхняя часть траектории тот же самый для камня: $g = \frac{v^2}{R} = \frac{v_0^2\cos^2\alpha}{R} \Rightarrow R = \frac{v_0^2\cos^2\alpha}{g}$

$$R = \frac{2gH\cos^2\alpha}{(1-\cos^2\alpha)g} = \frac{2H\cos^2\alpha}{1-\cos^2\alpha}$$

Для модели самолета: существенное влияние на модель самолета оказывают 2 силы: сила тяжести и ~~сила~~ подъемная сила; в верхней части траектории обе эти силы действуют вдоль вертикали, очевидно, что сила

чистовик

тяжести больше, чем подъёмная (в ином случае самолет бы не приземлился) $\Rightarrow a = \frac{g}{2}$; $\vec{a} \uparrow\uparrow \vec{g} \Rightarrow$

$$\Rightarrow \frac{g}{2} = \frac{v_c^2}{R} = \frac{v_c^2(1-\cos^2\alpha)}{2H\cos^2\alpha}$$

$$v_c^2 = \frac{gH\cos^2\alpha}{1-\cos^2\alpha}; \quad \boxed{v_c = \sqrt{\frac{gH}{1-\cos^2\alpha}}\cos\alpha}$$

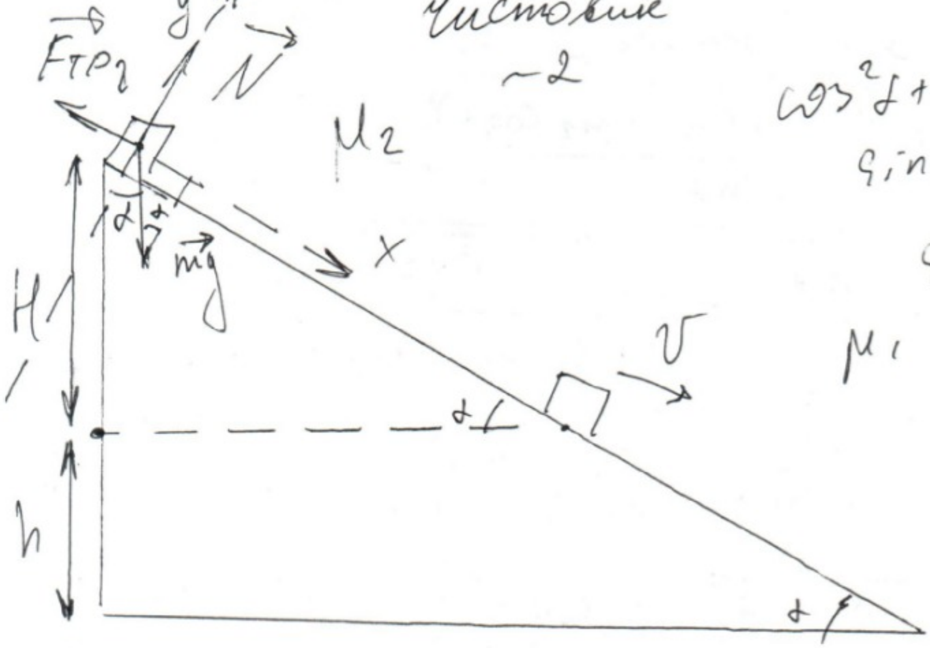
$$v_c = \sqrt{\frac{100}{\frac{1}{2}}} \cdot \frac{\sqrt{2}}{2}\,\frac{м}{с} = 10\sqrt{2} \cdot \frac{\sqrt{2}}{2}\,\frac{м}{с} = 10\,\frac{м}{с}.$$

Ответ: 1) $20\,\frac{м}{с}$.

2) $10\,\frac{м}{с}$.

21206369 (U285659 M1281619)

чистовик ~2



$$\cos^2\alpha + \sin^2\alpha = 1$$

$$\sin\alpha = \sqrt{1-\cos^2\alpha}$$

$$\sin\alpha = \sqrt{\frac{625-576}{625}}$$

μ_1 $$\sin\alpha = \frac{7}{25}$$

$$Oy:\ mg\cos\alpha = N$$

$$Ox:\ mg\sin\alpha - F_{тр_2} = ma \quad \Rightarrow a = g(\sin\alpha - \mu_2\cos\alpha)$$

$$F_{тр_2} = N\mu_2$$

$$Ox:\ \frac{H}{\sin\alpha} = \frac{v^2}{2g(\sin\alpha - \mu_2\cos\alpha)} \quad (1)$$

Заметим, что на участке выше h коробка разгоняется, а ниже h – замедляется, в ином случае коробка не сдвинулась бы с места или не остановилась бы в конце пути. => на высоте h коробка перестает разгоняться и начинает замедляться => $v = v_{max}$

По теореме об изменении полной механической энергии тела: $F_{тр1} + F_{тр2} = W_{p2} - W_{p1}$

$$\mu_2 \cancel{mg}\cos\alpha \cdot \frac{H}{\sin\alpha} + \mu_1 \cancel{mg}\cos\alpha\,\frac{h}{\sin\alpha} = \cancel{mg}(h+H)$$

$$h + H = ctg\,\alpha\,\mu_2 H + ctg\,\alpha\,\mu_1 h$$

$$H = \frac{h(ctg\,\alpha\,\mu_1 - 1)}{1 - ctg\,\alpha\,\mu_2}$$

Чистовик

Из ур-ия (1) находим:

$$v = \sqrt{\frac{2gH(\sin\alpha - \mu_2\cos\alpha)}{\sin\alpha}}$$

$$\boxed{v = \sqrt{\frac{2g(\sin\alpha - \mu_2\cos\alpha)h(\operatorname{ctg}\alpha\mu_1 - 1)}{\sin\alpha(1-\operatorname{ctg}\alpha\mu_2)}}}$$

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

$$v = \sqrt{\frac{20\left(\frac{7}{\cancel{25}} - 0{,}06\cdot\frac{24}{\cancel{25}}\right)\cdot 2\cancel{1{,}4}\cdot\left(\frac{24}{7}\cdot 0{,}5 - 1\right)}{\frac{\cancel{7}}{\cancel{25}}\left(1 - \frac{24}{7}\cdot 0{,}06\right)}}\ \frac{м}{с}$$

$$v = \sqrt{\frac{2(7-1{,}44)\cdot 2\cdot\left(\frac{12}{7} - 1\right)}{\frac{(7-1{,}44)}{7}}}\ \frac{м}{с} = \sqrt{\frac{4\cdot(12-7)}{1}}\ \frac{м}{с}$$

$$v = 2\sqrt{5}\ \frac{м}{с} \approx 4{,}47\ \frac{м}{с}$$

$$S = \frac{1{,}4\cdot 25}{7}\left(\frac{\frac{24}{7}\cdot 0{,}5 - 1}{1 - \frac{24}{7}\cdot 0{,}06} + 1\right)м$$

$$S = 5\left(\frac{12-7}{\cancel{7}\left(\frac{7-1{,}44}{\cancel{7}}\right)} + 1\right)м = 5\left(\frac{5}{5{,}56} + 1\right)м$$

$$S \approx 5(0{,}899 + 1)\ м = 5\cdot 1{,}899\ м = 9{,}495\ м \approx 9{,}5\ м.$$

Ответ: ~~9,5 м.~~

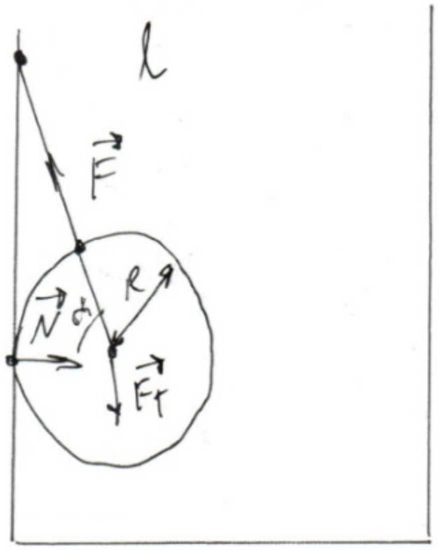
1) ~~$2\sqrt{5}\ \frac{м}{с}$~~ $4{,}47\ \frac{м}{с}$

2) 9,5 м

21206369 (U285659 M1281619)

Чистовик

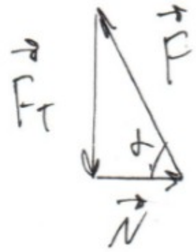
№3.



треугольники подобны по двум углам

$$\cos\alpha = \frac{R}{l+R}$$

$$\sin\alpha = \frac{\sqrt{l^2+2Rl}}{l+R}$$

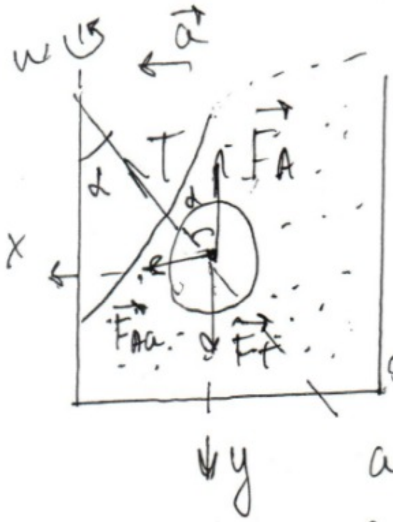


1) $\sin\alpha = \frac{F_T}{F} \Rightarrow F = \frac{mg}{\sin\alpha}$

$$\boxed{F = \frac{mg(l+R)}{\sqrt{l^2+2Rl}}}$$

$$F = \frac{52\cdot 16}{\sqrt{64+128}}\,Н = \frac{52\cdot 16}{64\sqrt{3}}\,Н = \frac{52\sqrt{3}}{12}\,Н = \frac{13\sqrt{3}}{3}\,Н \approx 7{,}5\,Н$$

2)



oy: $T\cos\alpha + \rho g\frac{4}{3}\pi R^3 = mg$

$$T = \frac{mg - \rho g\frac{4}{3}\pi R^3}{\cos\alpha}$$

ox: $T\sin\alpha + \rho a\frac{4}{3}\pi R^3 = ma$

$$a\left(m - \rho\frac{4}{3}\pi R^3\right) = g\left(m - \rho\frac{4}{3}\pi R^3\right)\operatorname{tg}\alpha$$

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

$$a = \frac{4\pi^2 r}{T^2};\ r = l\sin\alpha \Rightarrow T^2 = \frac{4\pi^2 l\sin\alpha}{a}$$

Чистовик

$$T^2 = \frac{4\pi^2 l \cancel{\sin\alpha} \cos\alpha}{g \cancel{\operatorname{tg}\alpha}} \Rightarrow \boxed{T = 2\pi\sqrt{\frac{l\cos\alpha}{g}}}$$

$$T = 2 \cdot 3{,}14 \cdot \sqrt{\frac{0{,}08 \cdot \frac{1}{2}}{10}}\ c$$

$$T = 6{,}28 \cdot 0{,}2 \cdot \sqrt{0{,}1}\ c$$

$$T \approx 0{,}316 \cdot 0{,}2 \cdot 6{,}28\ c \approx 0{,}4\ c.$$

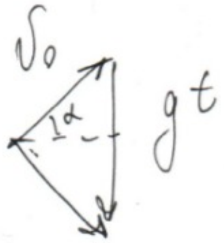
Ответ: 1) 7,5 Н

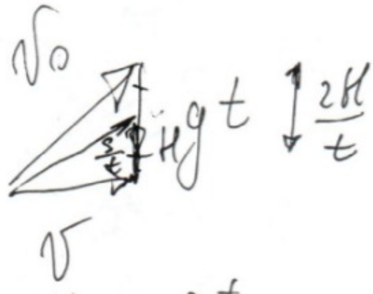
2) 0,4 с.

21206369 (U285659 M1281619)

№ 1

1)





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

$\cancel{2H=}$

$$\frac{L}{t} = \frac{2H}{t} = v_0\cos\alpha$$

$$2H = v_0 t \sin\alpha$$
$$2H = v_0 t \cos\alpha$$

$$H = \frac{-v^2 + v_0^2}{2g} = \frac{-v_0^2\cos^2\alpha + v_0^2}{2g}$$

$$H = \frac{v_0^2(\cos^2\alpha - 1)}{2g}$$

$$v_0^2 = \frac{2gH}{\cos^2\alpha - 1}$$

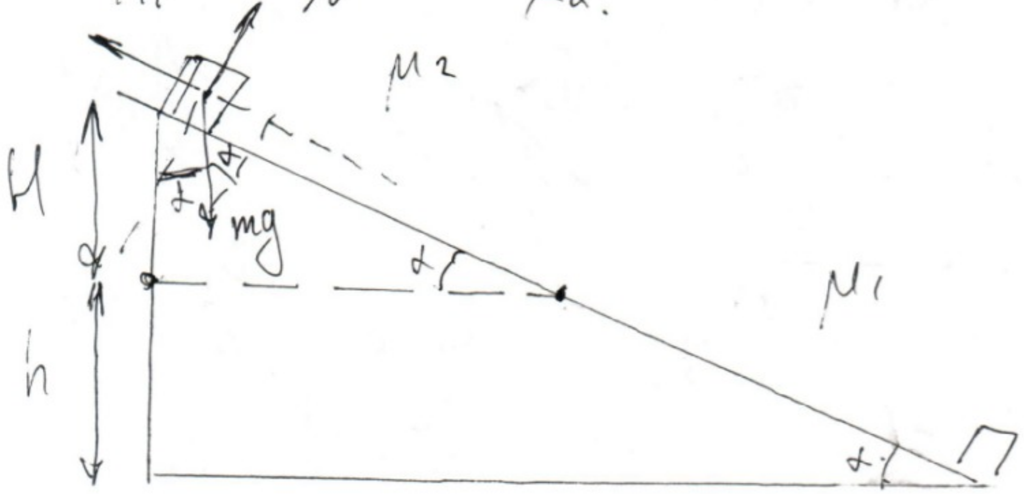
$$v_0 = \sqrt{\frac{200\cdot 2}{1}} = 20$$

2) $F_П = \frac{mg}{2}$ $\quad a = \frac{v^2}{H}$ $\quad \frac{g}{2} = \frac{v^2}{H}$

$a = \frac{g}{2}$ $\quad v^2 = \frac{gH}{2}$

$v^2 = 50 \Rightarrow v = \cancel{\sqrt{2}\,5}\ 5\sqrt{2}$

№2.



$$\frac{H}{\cos\alpha} = \frac{at^2}{2} \qquad a = \cancel{m}g\sin\alpha - \mu_2 \cancel{m}g\cos\alpha$$

$$\frac{H}{\sin\alpha} = \frac{v^2}{2\cancel{m}g(\sin\alpha - \mu_2\cos\alpha)}$$

$$\cancel{m}gH = \frac{\cancel{m}v^2}{2} + \cancel{m}g\cos\alpha\,\mu_2\frac{H}{\cancel{\cos\alpha}}$$

$$2gH = v^2 + 2g\mu_2 H$$

$$2gH(1-\mu_2) = v^2$$

$$mg(h+H) = mg\cancel{\cos\alpha}\,\mu_2 H + mg\mu_1 h$$

$$\cancel{mg}(h+H) = \cancel{mg}\cos\alpha\,\mu_2\frac{H}{\sin\alpha} + \cancel{mg}\cos\alpha\,\mu_1\frac{h}{\sin\alpha}$$

$$h+H = ctg\alpha\,\mu_2 H + ctg\alpha\,\mu_1 h$$

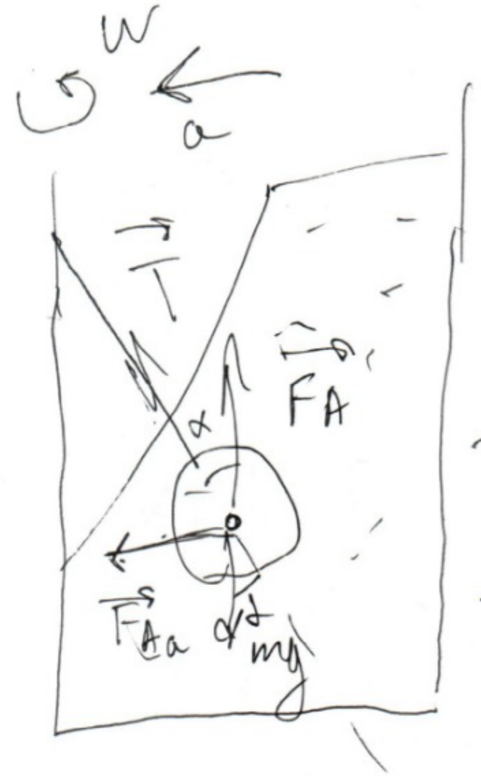
$$H(1 - ctg\alpha\,\mu_2) = h(ctg\alpha\,\mu_1 - 1)$$

$$H = \frac{h(ctg\alpha\,\mu_1 - 1)}{1 - ctg\alpha\,\mu_2}$$

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

$$v^k = \sqrt{\frac{2gH(\sin\alpha - \mu_2\cos\alpha)}{\sin\alpha}} = \sqrt{\frac{2g(\sin\alpha - \mu_2\cos\alpha)\,h(ctg\alpha\,\mu_1 - 1)}{\sin\alpha(1 - ctg\alpha\,\mu_2)}}$$

21206369 (U285659 M1281619)



$\cancel{II\ A\ \rho g \frac{4}{3}\pi R^3 \cos\alpha =}$

$$T\cos\alpha + \rho g \frac{4}{3}\pi R^3 = mg$$

$$T = \frac{mg - \rho g \frac{4}{3}\pi R^3}{\cos\alpha}$$

$$T\sin\alpha + \rho a \frac{4}{3}\pi R^3 = ma$$

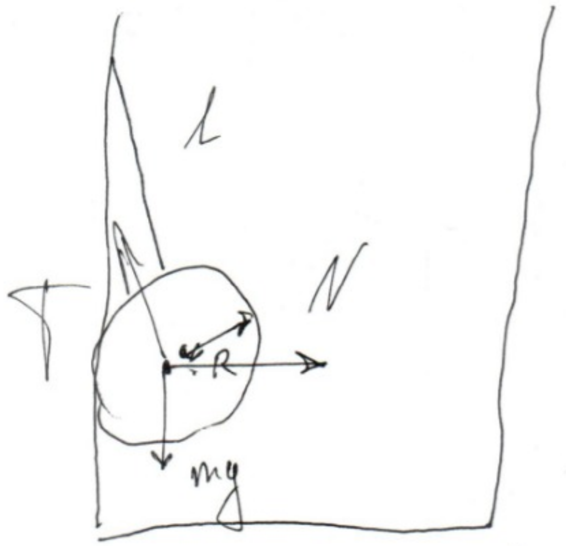
$$a\left(m - \rho \frac{4}{3}\pi R^3\right) = g\left(m - \rho \frac{4}{3}\pi R^3\right) tg\alpha$$

$$a = g\,tg\alpha \qquad v = \frac{2\pi R\sin\alpha}{T}$$

$$a = \frac{v^2}{l\sin\alpha}$$

$$a = \frac{4\pi^2 l\sin\alpha}{T^2} \qquad T^2 = \frac{4\pi^2 l\sin\alpha}{a}$$

$$T^2 = \frac{4\pi^2 l\cancel{\sin\alpha}\cos\alpha}{g\,\cancel{tg\alpha}} \qquad \boxed{T = 2\pi\sqrt{\frac{l}{g}\cos\alpha}}$$



$$\cos\alpha = \frac{R}{l}$$

$$\sin\alpha = \frac{mg}{T}$$

$$\frac{R^2}{l^2} + \frac{m^2g^2}{T^2} = 1$$

$$\frac{m^2g^2}{T^2} = \frac{l^2 - R^2}{l^2}$$

$$T^2 = \frac{m^2g^2l^2}{l^2 - R^2}$$

$$\boxed{T = \frac{mgl}{\sqrt{l^2 - R^2}}}$$

21206369 (U285659 M1281619)

Часть 2

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

Шифр: **21206369**

ID профиля: **285659**

Вариант 4

Чистовик Вариант 10-04

№1.

1) $\boxed{Q_1 = cm(t_{кип} - t_0)}$

$Q_1 = 4180 \cdot 0{,}001 \cdot 80$ Дж $= 3344$ Дж.

2) $Q_{исп} = \lambda m = 10^{-3} \cdot 2{,}26 \cdot 10^6$ Дж $= 2260$ Дж.

$Q' = A' + C_p \Delta t$

$Q'_p = \nu R \Delta t + \frac{5}{2} \nu R \Delta T$

$Q' = \frac{2}{5} C_p \Delta t + C_p \Delta t$

$Q' = \frac{7}{5} C_p \Delta t$

$Q = Q_1 + Q_{исп} + Q' = \frac{7}{5} C_p \Delta t + Q_1 + Q_{исп}$

$C_p \Delta t = \frac{Q - Q_1 - Q_{исп}}{7} \cdot 5$

$p_0 V = \nu R \Delta t$

$p_0 V = \frac{2}{5} C_p \Delta t = \frac{2(Q - Q_1 - Q_{исп})}{7}$

$$\boxed{V = \frac{2}{7} \frac{Q - Q_1 - Q_{исп}}{p_0}}$$

$V = \frac{2}{7} \cdot \frac{33000 - 3344 - 2260}{10^5}$ м^3 $= 7827 \cdot 10^{-5}$ м^3 $= 78{,}27$ л

Ответ: 1) 3344 Дж

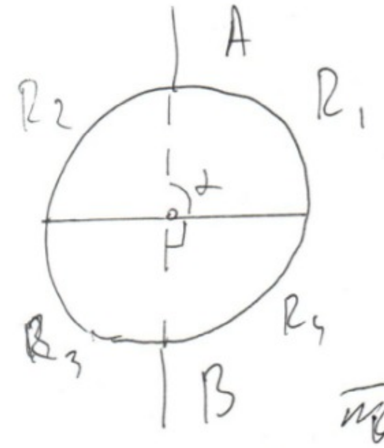
2) 78,27 л.

21206369 (U285659 M1281620)

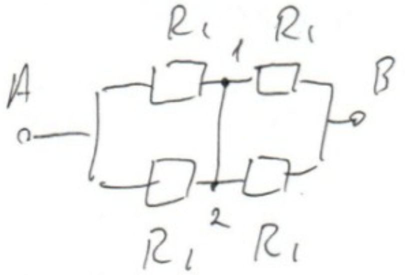
Чистовик Вариант 10-04

~2

1)



$\alpha = 90^\circ \Rightarrow R_1 = R_2 = R_3 = R_4 = \frac{R}{4}$

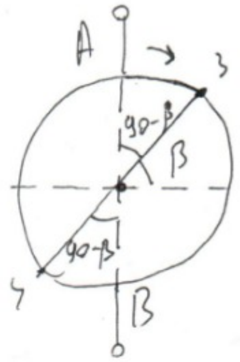


точки 1 и 2 - точки равного потенциала $\Rightarrow$ ток не пойдет через перемычку $\Rightarrow R' = 2R_1$

$R_0 = \frac{4R_1^2}{4R_1} = R_1$

$$\left[P = U \cdot I = \frac{U^2}{R_0} = \frac{U^2}{R_1} = \frac{4 \cdot U^2}{R}\right] \quad P = \frac{4 \cdot 576}{72} \text{ Вт} = 32 \text{ Вт}.$$

2)



ток полностью пойдет через перемычку, уйдя до т.3. $\Rightarrow$ через отрезок 3B ток не идет; схема симметрична $\Rightarrow$ через отрезок A4 ток также не идет.

$R_{A3} = \frac{90-\beta}{360} R$ ($R \sim l$)

$R_{4B} = \frac{90-\beta}{360} R$

$R_0 = R_{A3} + R_{4B} = \frac{90-\beta}{180} R$

$I = \frac{U}{R_0} = \frac{180U}{(90-\beta)R} \Rightarrow \frac{1}{2} = \frac{\overset{60}{\cancel{180}} \cdot 24}{(90-\beta)\cancel{72}_3} \Rightarrow 90 - \beta = 120 \Rightarrow$

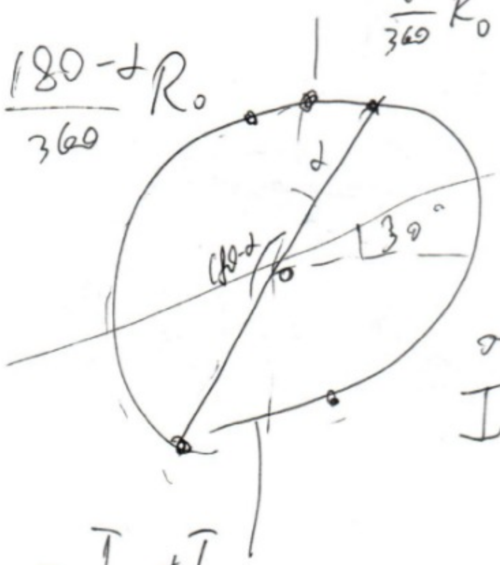
$\Rightarrow \beta = -30^\circ$; схема симметрична $\Rightarrow \beta = 30^\circ$.

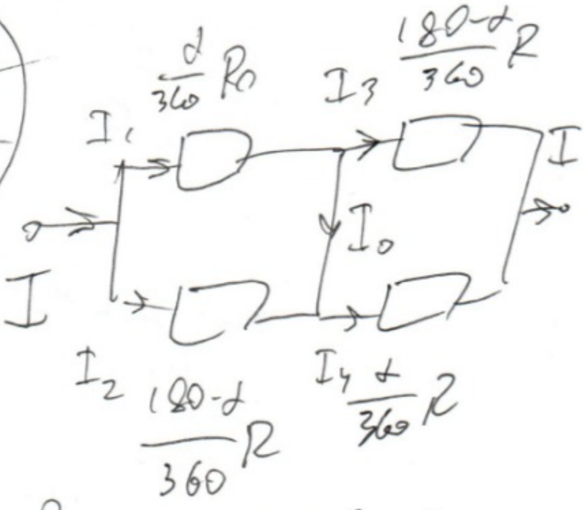
3) $P = \frac{U^2}{R_0} = \frac{576 \cdot 180}{(90-30) \cdot 72} \text{ Вт} = \frac{\overset{8}{\cancel{576}} \cdot \overset{3}{\cancel{180}}}{\cancel{60} \cdot \cancel{72}} \text{ Вт} = 24 \text{ Вт}$

Ответ: 1) 32 Вт

2) 30°

3) 24 Вт.

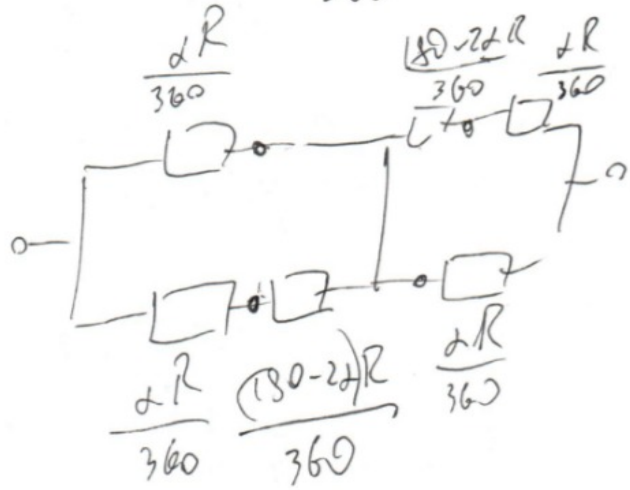


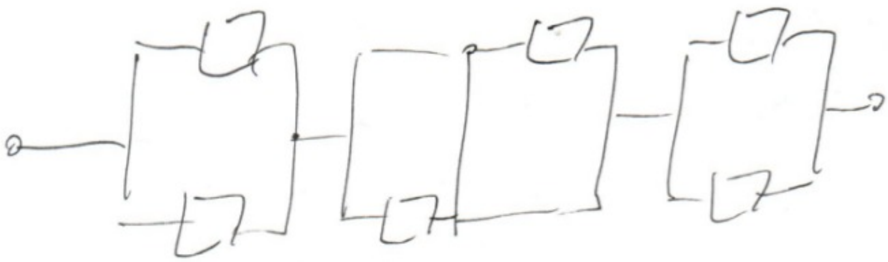


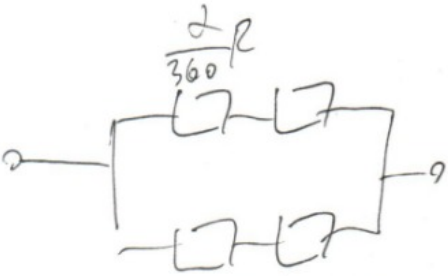
$$I_1 + I_2 = I_3 + I_4$$

$$I_1 = I_3 + I_0$$

$$I_2 + I_0 = I_4$$







$$\cancel{2\alpha}\ \frac{180}{\alpha R} + \frac{180}{\alpha R} = \frac{1}{R_0}$$

$$R_0 = \frac{\alpha R}{360}$$

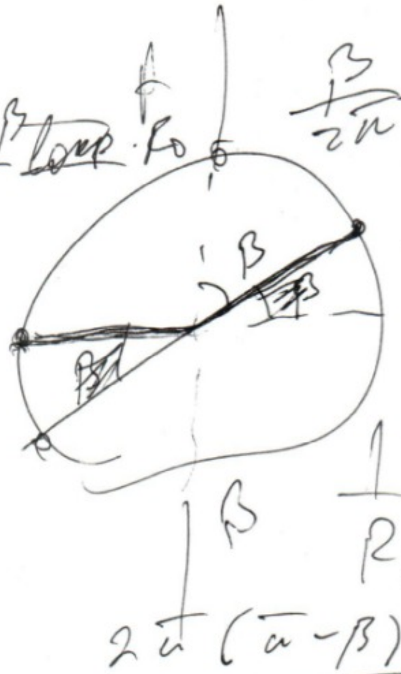
$$I = \frac{U \cdot 360}{\alpha R} \Rightarrow$$

$$\cancel{24 = 72} \qquad \frac{1}{2} = \frac{\overset{120}{\cancel{360}}}{3\alpha}$$

$$\alpha = 240°$$

21206369 (U285659 M1281620)

$\frac{\pi-\beta}{2\pi} \cancel{L_{omp}} \cdot R_0$ $\qquad$ $\frac{\beta}{2\pi} \cancel{L_{omp}} R_0$



$\frac{\beta}{360} \cancel{L_{omp}}$

$\beta \qquad \frac{1}{R_1} = \frac{2\pi}{\beta R_0} + \frac{2\pi}{(\pi-\beta)R_0}$

$$\frac{1}{R_1} = \frac{2\pi(\pi-\beta) + 2\pi\beta}{\beta(\pi-\beta)R_0}$$

$$R_1 = \frac{\beta(\pi-\beta)R_0}{2\pi^2}$$

$$R = \frac{\beta(\pi-\beta)R_0}{\pi^2} \qquad \frac{1}{8} = \frac{\cancel{24}\,2\,\pi^2}{\beta(\pi-\beta)\cancel{72}\cancel{36}\,3}$$

$$\frac{3}{2} = \frac{\pi^2}{\beta(\pi-\beta)}$$

$$3\pi\beta - 3\beta^2 = 2\pi^2$$

$$3\beta^2 - 3\pi\beta + 2\pi^2 = 0$$

$$D = 9\pi^2 - 24\pi^2$$

$$\frac{4}{3} = \frac{\cancel{24}\,\pi^2}{\beta(\pi-\beta)\cdot\cancel{72}\,3} \qquad 4\beta\pi - 4\beta^2 = \pi^2$$

$$4\beta^2 - 4\beta\pi + \pi^2 = 0$$

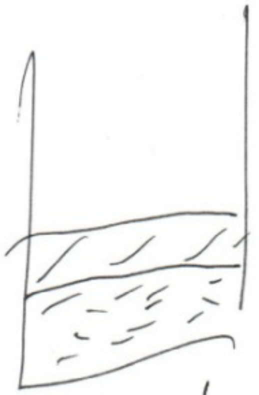
$$(2\beta - \pi)^2 = 0 \qquad \beta = \frac{\pi}{2}.$$

$$\beta^2 - \beta\pi + \pi^2 = 0$$

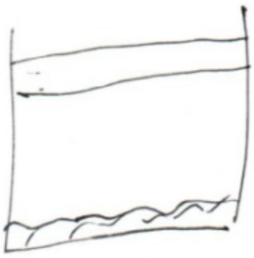
$$\frac{1}{3} = \frac{\pi^2}{\beta(\pi-\beta)3} \qquad \beta\pi - \beta^2 = \pi^2 \qquad D =$$

21206369 (U285659 M1281620)

~1



t_0



1) $Q = cm(t_{кип} - t_0)$

$Q = 4180 \cdot 10 \cdot 80 =$

$= 3344$ Дж.

$Q_{исп} = \lambda m = \cancel{0{,}001 \cdot 2{,}26 \cdot 10^6}$

$10^{-3} \cdot 2{,}26 \cdot 10^6$ Дж $=$

$= 2260$ Дж.

$Q' = A + C_p \Delta t$

$Q' = \nu R \Delta T + C_p \Delta t$

$Q' = \nu R \Delta T + \frac{7}{2} \nu R \Delta T$

$Q' = \frac{2}{7} C_p \Delta t + C_p \Delta t$

$Q' = \frac{9}{7} C_p \Delta t$

$Q' = Q_0 + Q + Q_{исп} = \frac{9}{7} C_p \Delta t + 3344 + 2260$

$23000 = \frac{9}{7} C_p \cancel{2200} \Delta t + 3344 + 2260$

$\Delta t = 9{,}685$ К

$pV = \nu R \Delta t$

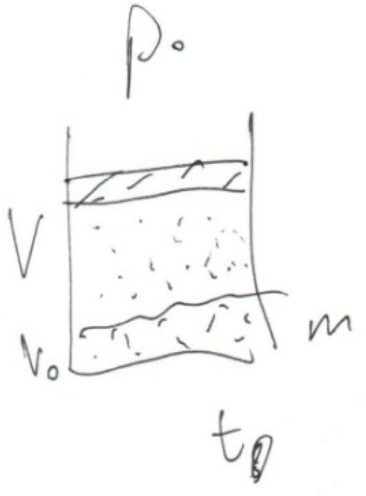
$pV = \frac{2}{7} C_p \Delta t$

$V = \frac{2 C_p \Delta t}{7 p}$

$V = \frac{2 \cdot 21308}{7 \cdot 10^5}$ м³

$V = 6088 \cdot 10^{-5}$ м³

$V = 60{,}88$ л



$$p_0 \overset{\sim 1}{V} = \nu R T_0$$

$$p_0 V = \frac{m_п}{\mu_п} RT$$

$$\varphi = \frac{p_0}{p_\bullet}$$

$$\begin{matrix} m_0 \\ t_0 \end{matrix} \xrightarrow{+Q_1} \begin{matrix} m_0 \\ t_{кип} \end{matrix} \xrightarrow{+Q_2} \begin{matrix} m \\ t_{кип} \end{matrix} \xrightarrow{-Q_3} \begin{matrix} m \\ t_0 \end{matrix}$$

$$\begin{matrix} m_п \\ t_{кип} \end{matrix} \xrightarrow{-Q_4} \begin{matrix} m_п \\ t_0 \end{matrix}$$

$$Q = Q_1 + Q_2 + Q_3 + Q_4$$

$$Q = c\, m_0 (t_{кип} - t_0) + \lambda m_п - c\, m (t_{кип} - t_0) - c_п m_п (t_{кип} - t_0)$$

$$Q = c (t_{кип} - t_0) m_п + \lambda m_п - c_п m_п (t_{кип} - t_0)$$

$$Q = m_п \left((t_{кип} - t_0)(c - c_п) + \lambda \right)$$

$$m_п = \frac{p_0 V \mu_п}{R T_0}$$

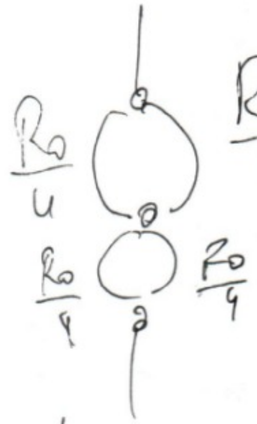
21206369 (U285659 M1281620)

$\alpha^2 - 180\alpha + 108\ldots = 0$

$D = 32400$

$R_1^{-1} = \frac{4}{R_0} + \frac{4}{R_0} = \frac{8}{R_0} \Rightarrow R_1 = \frac{R_0}{8}$

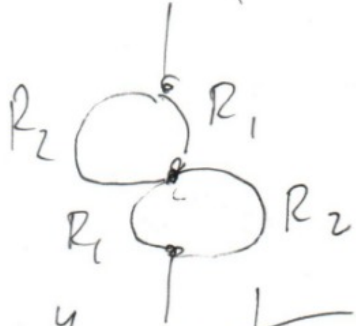
1)



$R_2^{-1} = \frac{8}{R_0} \Rightarrow R_2 = \frac{R_0}{8} \Rightarrow R = \frac{R_0}{4}$

$P = \frac{U^2}{R} = \frac{576 \cdot 4}{72} = 32$ Вт.

2)



$R_1 = \frac{\alpha}{180} R_0$

$\frac{1}{R_{12}} = \frac{360}{\alpha R_0} + \frac{360}{(180-\alpha)R_0}$

$R_2 = \frac{180-\alpha}{180} R_0$

$\frac{24}{18} = \frac{4}{3}$

$\frac{1}{360 R_{12}} = \frac{180 - \alpha + \alpha}{\alpha(180-\alpha) R_0} = \frac{180}{\alpha(180-\alpha) R_0}$

$R_{12} = \frac{\alpha(180-\alpha) R_0}{180 \cdot 360}$

$R = \frac{\alpha(180-\alpha) R_0}{360 \cdot 90}$

$I = \frac{U}{R} \Rightarrow \quad \frac{1}{2} = \frac{\cancel{24} \cdot \cancel{180}^{60} \cdot 90}{\alpha(180-\alpha) \cdot \cancel{72}}$

$180\alpha - \alpha^2 = 5400 \cdot 2 = 10800$

$\alpha^2 - 180\alpha + 10800$

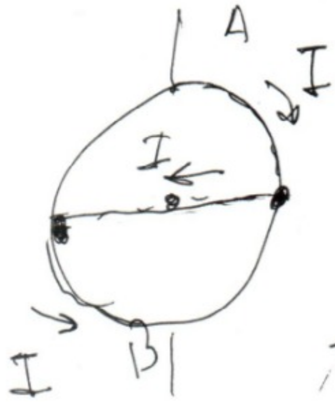
$D = 32400 -$

$180\alpha - \alpha^2 = 21600$

$\frac{1}{2} = \frac{\cancel{24} \cdot 360 \cdot 30}{\alpha(180-\alpha)}$

~8.

1)



$P = UI$

$U = const$

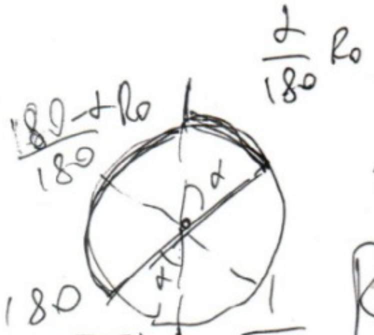
$I = \frac{U}{R}$

$R = 36\ \text{Ом} = \frac{R_0}{2}$

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

$P = \frac{576}{36} = 16\ \text{Вт}.$

2)



$l = \cancel{\frac{180}{\alpha}} \cancel{l_0}\ \frac{\alpha}{180} \cdot 2 l_0$

$R = \frac{2\alpha}{180} R_0 = \frac{\alpha R_0}{90}$

$\frac{180}{\alpha R_0} + \frac{180}{(180-\alpha)R_0} = \frac{1}{R}$

$= \frac{180(180-\alpha) + 360}{2R_0(180-\alpha)}$

$I = \frac{U}{R} = \frac{90U}{\alpha R_0} = \frac{30\cancel{90}\cdot\cancel{24}}{\alpha\cdot\cancel{72}\,3} = 0{,}5$

$\alpha = 30 \cdot 2 = 60°$

3) $\cancel{P = UI} = \frac{1}{180R} = \frac{180-\alpha+\alpha}{\alpha(180-\alpha)R_0}$

$180R = \frac{\alpha(180-\alpha)R_0}{180}$

$R' = \frac{\alpha(180-\alpha)R_0}{180\cdot 90}$

$0{,}5 = \frac{\overset{60}{\cancel{180}}\cdot 90\cdot\cancel{24}}{\alpha(180-\alpha)\cdot\cancel{72}}$

$(180-\alpha)\alpha = 10800$

21206369 (U285659 M1281620)