Часть 1

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

Шифр: **21205082**

ID профиля: **808426**

Вариант 4

Чистовик

Вариант 10-04

№1. Дано:
$\alpha = 45°$
$H = 10\,м$
$g = 10\,м/с^2$
$v_0 - ?$
$v - ?$

$v_y = v_0 \cdot \sin\alpha$

$H = v_y \cdot t - \frac{gt^2}{2} = \frac{gt^2}{2}$

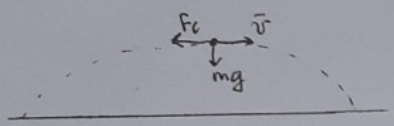
$v_y \cdot t = gt^2 \qquad H = \frac{gt^2}{2} \Rightarrow t = \sqrt{\frac{2H}{g}}$

$v_y = gt$

$v_0 \cdot \sin\alpha = gt \Rightarrow v_0 = \frac{gt}{\sin\alpha} = \frac{g}{\sin\alpha}\sqrt{\frac{2H}{g}} = \frac{10}{\sin 45}\sqrt{\frac{20}{10}} = \frac{10 \cdot \sqrt{2} \cdot 2}{\sqrt{2}} = 20\,м/с$

$F = \frac{1}{2}mg$

$F_c \sim v^2$



Ответ: $v_0 = 20\,м/с$

Чистовик.

№2. Дано:

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

$h = 1{,}4$ м

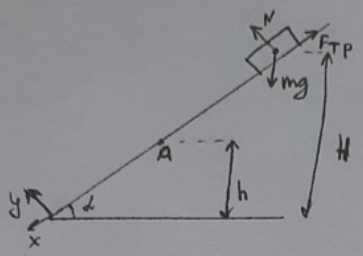
$\mu_1 = 0{,}5$

$\mu_2 = 0{,}06$

$g = 10$ м/с²

v_{max} – ?

S – ?



II З. Н.:

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

Ox: $mg\cdot\sin\alpha - \mu_2 N = ma_2$

$mg\cdot\sin\alpha - \mu_2 mg\cos\alpha = ma_2$

(3) $g(\sin\alpha - \mu_2\cdot\cos\alpha) = a_2$ – при $H > h$

Когда коробка достигает h, то сила трения увеличивается и изменяет модуль и направление ускорения, т.е. она начнет тормозить.

$\mu_1 mg\cdot\cos\alpha - mg\sin\alpha = ma_1$

$\sin\alpha = \sqrt{1-\cos^2\alpha}$ (по основному тригонометрическому)

$\sin\alpha = 0{,}28$

(1) $g(\mu_1\cdot\cos\alpha - \sin\alpha) = a_1$ – при $H \le h$.

$\frac{h}{\sin\alpha} = v_A\cdot t - \frac{a_1 t^2}{2} = \frac{a_1 t^2}{2} \Rightarrow \frac{h}{\sin\alpha} = \frac{a_1 t^2}{2} \Rightarrow t = \sqrt{\frac{2h}{a_1\sin\alpha}} \Rightarrow v_A = a_1 t = a_1\sqrt{\frac{2h}{a_1\sin\alpha}}$ (2)

$\frac{(H-h)}{\sin\alpha} = \frac{a_2 t'^2}{2} = v_A\cdot t - \frac{a_2 t'^2}{2}$

v_A будет v_{max}, т.к. это граница, на которой изменяется ускорение.

Из (1): $a_1 = 10(0{,}5\cdot\frac{24}{25} - 0{,}28) = 2$ м/с², из (3) $a_2 = 10(0{,}28 - 0{,}06\cdot\frac{24}{25}) = 2{,}224$ м/с²

Подставим в (2):

$$v_{max} = 2\cdot\sqrt{\frac{2\cdot 1{,}4}{2\cdot 0{,}28}} = 2\sqrt{5} \approx 4{,}47 \text{ м/с}$$

$S = \frac{h}{\sin\alpha} + \frac{H-h}{\sin\alpha}$

$\frac{H-h}{\sin\alpha} = \frac{a_2 t'^2}{2}$, $v_A = a_2 t' \Rightarrow t' = \frac{v_A}{a_2} = 2{,}01$ с

$\frac{H-h}{\sin\alpha} = \frac{a_2}{2}\cdot\frac{v_A^2}{a_2^2} = \frac{v_A^2}{2a_2} = \frac{4\cdot 5}{2\cdot 2{,}224} \approx 4{,}496$ м

$S = \frac{1{,}4}{0{,}28} + 4{,}496 = 9{,}496 \text{ м} \approx 9{,}5$ м

Ответ: $v_{max} \approx 2\sqrt{5}$ м/с $\approx 4{,}47$ м/с; $S \approx 9{,}5$ м

2

ЧИСТОВИК

№3. Дано:

$R = 8$ см

$l = 8$ см

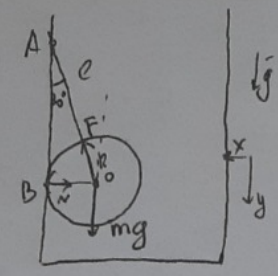
$m = 5{,}2$ кг

$\alpha = 60°$

$g = 10$ м/с²

F — ?

T — ?



$\triangle AOB$:

$AO = l + R = 16$ см $\Rightarrow \angle A = 30°$

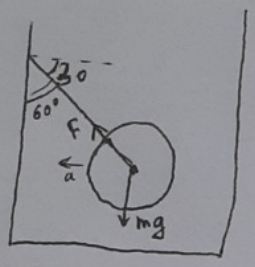
$OB = R = 8$ см

II з.н.:

Oy: $mg - F \cdot \cos 30° = 0$

$mg = F \cdot \cos 30°$

$F = \frac{mg}{\cos 30°} = \frac{52}{\sqrt{3}} = \frac{104}{\sqrt{3}} = 60{,}04$ Н



$a = \omega^2 \cdot (R + l) \cdot \sin 60°$

$\bar{F} + \bar{F_A} + m\bar{g} = m\bar{a}$

II з.н.:

Oy: $mg - F \cdot \cos 60° = F_{Ay} \Rightarrow F(\cos 30 - \cos 60) = F_{Ay} \approx 0{,}37F$

Ox: $F \cdot \cos 30° = ma + F_{Ax}$

$ma = F \cdot \cos 30 - F_{Ax} = mg - F_{Ax}$

$a = g - \frac{F_{Ax}}{m}$

$\omega^2 (R + l) \sin 60° = g - \frac{F_{Ax}}{m}$

$\omega^2 = \left(g - \frac{F_{Ax}}{m}\right) : (R + l) \sin 60°$

$\omega = \sqrt{\frac{g - \frac{F_{Ax}}{m}}{(R + l) \sin 60°}}$

$F_A = \rho V g$

$F_A = \sqrt{F_{Ax}^2 + F_{Ay}^2}$

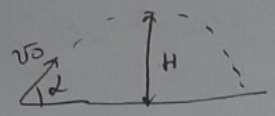
Ответ: $F \approx 60{,}04$ Н;

Черновик

$H = 10$ м

$\alpha = 45°$

v_0 - ?



$v_0 \cdot \sin\alpha \cdot t = v_y$

$F_c \sim v^2$

$v_y \cdot t - \frac{gt^2}{2} = H = \frac{gt^2}{2}$

$t = \sqrt{\frac{2H}{g}}$

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

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

$v_0 \cdot \sin\alpha = \frac{H}{1} + \frac{g}{2}\sqrt{\frac{2H}{g}}$

$v_0 = \frac{10 + \frac{10}{2}\cdot\sqrt{\frac{20}{10}}}{\sin 45}$

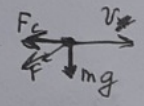
$10\sqrt{2} \to \sqrt{2} - 5\cdot\sqrt{2}$

$20 \cdot \frac{\sqrt{2}}{2} \cdot \sqrt{2} - 5 \cdot 2$

$mg = 2 \cdot F$

$\bar{F} = \bar{F}_c + m\bar{g}$

$F = \sqrt{F_c^2 + m^2g^2}$

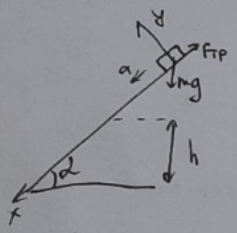


$F = \frac{1}{2}mg = \sqrt{F_c^2 + m^2g^2}$

$\frac{1}{4}m^2g^2 = F_c^2 + k^2g^2$

$-\frac{3}{4}m^2g^2 = F_c^2$

№2.



$\cos\alpha = \frac{24}{25} = 0{,}96$

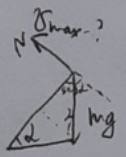
$\sin^2\alpha = \sqrt{1 - \cos^2\alpha} = 1 - \frac{24^2}{25^2} = 0{,}0784$

$h = 1{,}4$ м

$\mu_1 = 0{,}5$

$\mu_2 = 0{,}06$

$v_0 = 0$



$\sin\alpha = \frac{h}{min.}$

Ox: $mg \cdot \sin\alpha - \mu_1 N = ma$

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

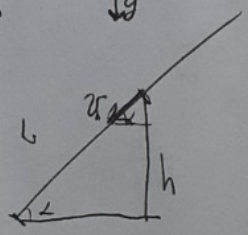
$mg \cdot \sin\alpha - \mu_1 mg \cdot \cos\alpha = ma$ (на H ≥ h)

при $H < h$

$\mu_2 mg \cdot \cos\alpha - mg \cdot \sin\alpha = ma'$

(1) $g(\sin\alpha - \mu_1\cos\alpha) = a$ $(H \geq h)$

(2) $g(\mu_2\cos\alpha - \sin\alpha) = a'$ $(H < h)$



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

$\frac{h}{\sin\alpha} = v_h \cdot t - \frac{at^2}{2} = \frac{at^2}{2}$

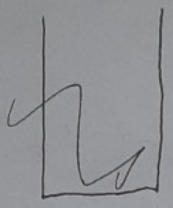
Черновик

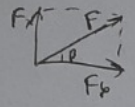
№3

R=8см
l=8см
h=5,2м
F-?

α=60°
q=90мкс
T-?

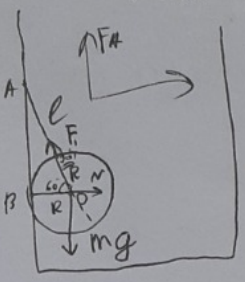
$T = \frac{t}{N}$

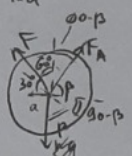




$\omega = \dots c^{-1}$

$F = \frac{F_y}{\sin\beta}$





90-90+β-60°

$\cos 30 \approx 0,15425144988750$

$\sqrt{3} = 1,73205080756888$

$a_1 = 10\left(0,5 \cdot \frac{24}{25} - 0,2\beta\right) = 2$ м/с²

$F(\cos 30 - \cos 60) = F_{Ay} \approx 0,37F$

$F \cdot \cos 30° - F_{Ax} = ma$

ΔABO:

$AO = 2R = R+R \Rightarrow \angle A = 30°$

$OB = R$

$Oy: mg = F \cdot \cos 30°$

$F = mg \cdot \cos 30° + N \cdot \cos 60° = mg \cdot \cos 30° + N\frac{1}{2} \Rightarrow \frac{1}{4}F + mg \cdot \cos 30° = F$

$\frac{3}{4}F = mg \cdot \cos 30° \Rightarrow F \approx 10,6947$ Н

$N = F \cdot \cos 60° = \frac{1}{2}F$

$mg = ma \Rightarrow a = g \Rightarrow 0,08 \cdot 0,86 \cdot \omega^2 = 10$

$mg = 5,2 \cdot 10 = 52$ Н $= F \cdot \cos 30°$

$\frac{52}{10^1}$

$\cos 30° = \frac{\sqrt{3}}{2}$

$\cos 45 = \frac{\sqrt{2}}{2}$

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

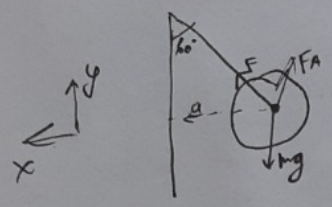
$(l+R)\cdot\sin 60°$

$V = \frac{4}{3}\pi R^3$

$F_A = \rho_e \cdot Vg = \frac{4}{3}\pi R^3 g \rho_б$

$\sqrt{F_x^2 + F_y^2} = F_A$

$T = \frac{mg}{\cos 30}$



$Ox: F \cdot \cos 30° - F_{Ax} = ma \Rightarrow mg - F_{Ax} = ma$

$Oy: mg - F_{Ay} = -F \cdot \cos 60° = 0$

$\frac{h}{\sin\alpha} = \frac{a_1 t^2}{2} \Rightarrow$

$ma = F\cos 30° - F_A$

$\frac{h}{\sin\alpha} = \frac{g(\mu_0 \cdot \cos\alpha - \sin\alpha)}{2} \cdot t^2$

$F \cdot \cos 30 - F \cdot \cos 60° = F_{Ay}$

$F(\cos 30° - \cos 60°)$

$\sqrt{\frac{2h}{\sin\alpha \cdot a_1}} = t$

$v_a = a_1 t = a_1 \cdot \sqrt{\frac{2h}{\sin\alpha \cdot a_1}} = 2 \cdot \sqrt{\frac{2 \cdot 1,4}{0,28 \cdot 2}} = 2\sqrt{5} \approx 4,47$

$\sin\alpha = 0,28$

$F \cdot \cos(\beta - 60) - mg \cdot \cos\beta = ma \cdot \cos(90 - \beta)$

$180 - 60 - \beta = \beta - \beta$

$90 + \beta - 2\beta = 90 - \beta$

$\frac{H-h}{\sin\alpha} = v_A t' - \frac{a_2 t'^2}{2} = \frac{a_1 t'^2}{2}$

$a_2 = 10(0,28 - 0,06 \cdot \frac{24}{25}) = 2,224$

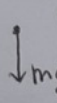
$v_A = a_2 t' \Rightarrow t' = \frac{v_A}{a_2} \approx 2,011$ с

$0,28 = 1 - \frac{2H^2}{25^2}$

$(30 - \beta + 60)$

$\cos 30 \approx \sin 60$

$\cos(90-60) = \sin 60$



0,96 : 2 = 0,48

$\frac{a_2}{2}$ $\frac{v_A^2}{a_2^2} = \frac{v_A^2}{2a_2}$

$\frac{2 \cdot 1,4}{2 \cdot 0,28}$

$\frac{2 \cdot 0,\dots \cdot 10}{2 \cdot 0,28}$

$v_A = 4,47213\dots$

2,0

Часть 2

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

Шифр: **21205082**

ID профиля: **808426**

Вариант 4

Чистовик

Вариант 10-04

№4. Дано:

$m = 10$ г

$t_0 = 20°C = 293$ К

$P_0 = 1{,}0 \cdot 10^5$ Па

$Q = 33$ кДж

$c = 4180 \frac{Дж}{кг \cdot К}$

$r = 2{,}26 \cdot 10^6 \frac{Дж}{кг}$

$c_p = 2200 \frac{Дж}{кг \cdot К}$

Q_1 - ?

V - ?

$Q_1 = m \cdot c \cdot \Delta t = m \cdot c (T_к - T_0)$, где $T_к = 100°C = 373$ К

$Q_1 = 10 \cdot 10^{-3} \cdot 4180 (373 - 293) = 3344$ (Дж)

$Q = Q_1 + Q_2 + Q_3$

$Q_2 = r \cdot m = 10 \cdot 10^{-3} \cdot 2{,}26 \cdot 10^6 = 22600$ (Дж)

$Q_3 = Q - Q_1 - Q_2 = 33000 - 3344 - 22600 = 7056$ (Дж)

$Q_3 = m \cdot c_p \cdot \Delta T \Rightarrow \Delta T = \frac{Q_3}{m \cdot c_p} = \frac{7056}{10 \cdot 10^{-3} \cdot 2{,}2 \cdot 10^3} = \frac{7056}{22} \approx 320{,}73$

$\Delta T = T_2 - T_к \Rightarrow T_2 = \Delta T + T_к = 693{,}73$ К

$P_0 \cdot V = \nu R T_2$ - ур-е Менделеева-Клапейрона для конечного состояния

$V = \frac{\nu R T_2}{P_0} = V = \frac{m R T_2}{M P_0}$

$P_0 \cdot V = \frac{m}{M} \cdot R T_2$

Т.к. пар водяной, то $M = 18$ г/моль:

$V = \frac{10 \cdot 8{,}31 \cdot 693{,}73}{18 \cdot 10^5} \approx 32 \cdot 10^{-3}$ м^3

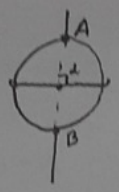
Ответ: $Q_1 = 3344$ Дж; $V = 32 \cdot 10^{-3}$ м^3.

Чистовик.

№5. Дано:
$R = 72\ \Omega$
$U = 24\ В$
$\alpha = 90°$
$I = 0{,}5\ А$

P-?
β-?
P_0-?

$I = \frac{U}{R}$ - Закон Ома для участка цепи



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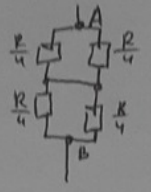
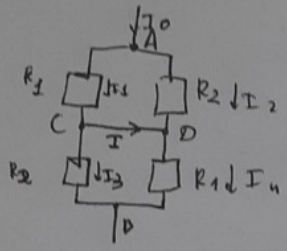


- взвешенный мостик ⇒ так по перемычке не идет

$$P = IU = \frac{U^2}{R_0} = I^2 R_0$$

$$R_0 = \frac{1}{\left(\frac{2}{R} + \frac{2}{R}\right)} = \frac{R}{4} \Rightarrow P = \frac{24 \cdot 24 \cdot 4}{72} = 32\ Вт$$



$I_0 = \frac{U}{R_{об}} = \frac{24}{72} = \frac{1}{3}\ А$

$I_0 = I_1 + I_2 = I_3 + I_4$

$I = I_1 - I_3 = I_4 - I_2$

$R_1 + R_2 = \frac{R}{2}$

$I_1 + I_2 - I_1 + I_3 = I_2 + I_3 = I_0 - I$

$I_1 - I_3 + I_3 + I_4 = I + I_0 = I_1 + I_4$

$U = I_0 \cdot R_0 = (I_2 + I_3) R_2 = (I_1 + I_4) R_1$

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

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

$R_{об} = \frac{R_1 \cdot R_2}{R_1 + R_2} \cdot 2$

$U = I_0 \frac{2 R_1 R_2}{R_1 + R_2} = R_1 (I + I_0)$

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

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

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

$I_0\left(\frac{I + I_0}{I_0 - I} - 1\right) = I\left(1 + \frac{I + I_0}{I_0 - I}\right)$

$I_0(I + I_0) - I_0(I_0 - I) = I(I_0 - I) + I(I + I_0)$

$I_0 I + I_0^2 - I_0^2 + I_0 I = I I_0 - I^2 + I^2 + I I_0$

$I_2 R_2 - I_3 R_1 = 0$ (по контуру ADC)

$I_4 R_1 - I_3 R_2 = 0$ (по контуру CEB)

$I_2 R_2 = I_1 R_1$

$I_4 R_1 = I_3 R_2$

$R_2(I_2 + I_3) = R_1(I_1 + I_4)$

$\frac{R_2}{R_1} = \frac{I_1 + I_4}{I_2 + I_3} = \frac{I + I_0}{I_0 - I}$

$R_2 = \frac{I + I_0}{I_0 - I} R_1$

$\frac{R_2}{R_1} = \frac{11}{6} \cdot \frac{6}{5} = \frac{11}{5}$

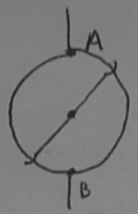
$R_1 = \frac{5}{16} \cdot \frac{R}{2} \Rightarrow \frac{5}{16} \cdot 180°$

$\beta = 33{,}75°$

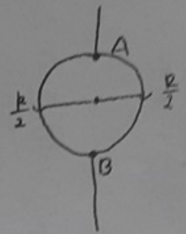
Ответ: $P = 32\ Вт$; $\beta = 33{,}75°$

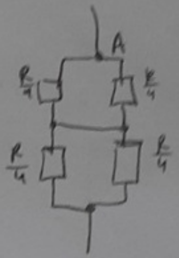
$I_0 R_0 = \frac{4}{3} \cdot 18 = 32$

$R = 72$ Ом
$U = 24$ В
$r \approx 0$



1.





Взвешенный мостик
и
понижающее напряжение

$R_{об} =$

$\frac{R}{8} + \frac{R}{8} = \frac{2R}{8} = \frac{R}{4}$

$\frac{4}{R} + \frac{4}{R} \Rightarrow$

$24 = 6 \cdot 4 = 3 \cdot 2 \cdot 4$

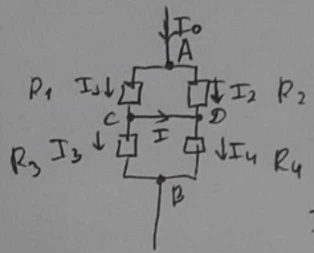
$\frac{1}{R_{об}} = \frac{2}{R} + \frac{2}{R} = \frac{4}{R} \Rightarrow R_{об} = \frac{R}{4} = \frac{72}{4} = 18\,\Omega$

$\frac{4}{R} + \frac{4}{R} = \frac{8}{R} = \frac{1}{R_0} = \frac{2}{R_0}$

$R_0 = \frac{2R}{8} = \frac{1}{4}R$

$I = \frac{U}{R} = \frac{24}{18} = \frac{12}{9} = \frac{4}{3} I$

$P = I \cdot U = \frac{U^2}{R} = \frac{24 \cdot 24}{18} = \frac{4 \cdot 24}{3} = 4 \cdot 8 = 32$ Вт



$I_1 = I + I_3$
$I_4 = I + I_2$
$I = 0{,}5A$
$I_0 = \frac{U}{R}$

$R_1 + R_3 = R_2 + R_4 = \frac{R}{2}$

~~AD: $I_2 R_2 = I_1 R_1$~~
~~CD: $I_4 R_4 = I_3 R_3$~~

$I = 0{,}5A$ $\frac{1}{2}A$

~~$R_{об} = \frac{R}{4} = 18\Omega$~~ $R_{об} = 18\Omega$

$I_0 = \frac{24}{18} = \frac{4}{3}A$

$R_1 = R_4$
$R_3 = R_2$

$I_1 + I_2 = I_3 + I_4 = I_0$

$I_1 + I_4 = 2I + I_2 + I_3$

$I_1 - I_3 + I_3 + I_4 = I + I_0$

$I_2 R_2 = I_1 R_1$

$I_4 R_4 = I_3 R_3$

$I_1 - I_3 = I = I_4 - I_2$

$I_1 + I_4 = I + I_0 = 2I + I_2 + I_3$

$I_0 = I + I_2 + I_3$

~~$I + I_3 + I \ldots$~~

$\frac{I_1}{I_4} = \frac{I_2}{I_3}$

$I_1 + I_4 - I = I_1 - I + I_4 = I_0$

$I_2 R_2 = I_1 R_1$

$I_3 R_2 = I_4 R_1$

$I_1 + I_4 - I = I + I_2 + I_3$

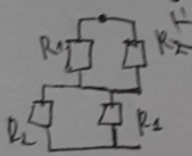
$I_1 + I_4 - I_2 - I_3 = 2I$

$I_0 = \frac{8}{6} A$

$I = \frac{3}{6} A$

$R_2 = \frac{I + I_0}{I_0 - I} R_1$

$I_0\left(\frac{I - I_0}{I_0 + I} - 1\right) = I\left(\frac{I + I_0}{I_0 - I} + 1\right)$



$I_0 - I = I_1 + I_2 - I_1 + I_3 - I_2 + I_3 = \frac{5}{6}A$

$I_1 + I_4 = I + I_0 = \frac{11}{6}A$

$R_2(I_2 + I_3) = R_1(I_1 + I_4)$

$R_2 \cdot \frac{5}{6}A = R_1 \cdot \frac{11}{6}A$

$\frac{R_2}{R_1} = \frac{11}{6} \cdot \frac{6}{5} = \frac{11}{5} \Rightarrow R_1 = \frac{5}{16} \cdot \frac{R}{2}$

$180 : 16 = \frac{180}{16} = 11{,}25 \Rightarrow 56{,}25$

$\beta = 33{,}75°$

Черновик

№4.

$m = 10\,г$

$t_0 = 20°C = 293\,K$

$p_0 = 1{,}013\,Па$ ($Па = \frac{Н}{м^2}$)

$Q = 33{,}6\,Дж$

$Q_1 - ?$

$V - ?$

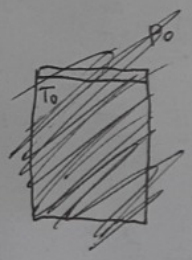
$\rho = 1000\ кг/м^3$

$V_в = 10\,см^3 = 10^{-5}\,м^3$

$c_в = 4180\ \frac{Дж}{кг \cdot К}$

$r = 2{,}26 \cdot 10^6\ \frac{Дж}{кг}$

$c_p = 2200\ \frac{Дж}{кг \cdot К}$



$c_p = c_v + R$

$c_v = \frac{i}{2} \nu R \Rightarrow c_p = \frac{i+2}{2} \nu R$

$\frac{c_p 2}{R} = (i+2) \cdot \nu$

$Q_1 = m_в c_в \Delta t = 10 \cdot 10^{-3} \cdot 4180 \cdot (100+273-20-273) = 10 \cdot 4{,}18 \cdot 80 = 418 \cdot 8 = 3344\,Дж$

$Q_1 = 3{,}344\,Дж$

$Q' = Q_1 + Q_2 = m_в \cdot c_в \cdot \Delta t + r m_{кв}$

$\nu_в = \frac{m}{M} = \frac{10}{18} = 0{,}6\,моль$ $Q_2 = r \cdot m_2 = 2{,}26 \cdot 10^6 \cdot 10 \cdot 10^{-3} = 2{,}26 \cdot 10 \cdot 10^3 = 2{,}26 \cdot 10^4 = 22{,}6 \cdot 10^3 = 226 \cdot 10^2 = 22{,}600\,Дж$

$Q_1 + Q_2 = 3{,}344 + 22.600 = 25.944\,Дж$

$1\,см^3 = 1 \cdot 10^{-6}\,м^3$

$Q_3 = Q - Q' = 7056\,Дж$

$pV = \frac{p}{V} RT$

$Q_3 = m_п \cdot c_p \cdot \Delta t = 7056\,Дж$

$p_2 = p_0$

$p_2 \cdot V = \nu R T_2$

$p_0 \cdot V = \nu R T_2$

$V = \frac{\nu R T_2}{p_0}$

$\frac{1}{R_1} + \frac{1}{R_2} = \nu \frac{R_1 \cdot R_2}{R_1 + R_2} + \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{\nu R_1 R_2}{R_1 + R_2} = R_0$

$C_{уд} = \frac{3R}{M} = \frac{3\nu R}{m}$

$\nu = \frac{c_p \cdot m}{3R}$

$\frac{0{,}032027}{32 \cdot 10^{-3}}\,м^3$

$m = \rho_в \cdot V_в = \rho_п \cdot V_к$

$\frac{Дж}{кг \cdot К} \cdot м^3 = К \cdot моль \cdot R$

$\frac{Н \cdot м}{К \cdot моль} = [R]$

$\nu = \frac{m}{M} = \frac{\rho}{V \cdot M}$

$p_0 \cdot V_к = \nu R T_к \Rightarrow \frac{V_к}{V} = \frac{T_к}{T_2}$

$p_0 V = \nu R T_2$

$V = \frac{\frac{m}{M} \cdot RT}{p_0} = \frac{\frac{10}{18} \cdot 8{,}31 \cdot (320{,}73 + 273)}{1 \cdot 10^5}\,К$

$p_0 = \frac{\frac{m}{M} \cdot RT}{V} = \frac{100 \cdot 831 \cdot 69373}{28}$

$\frac{10 \cdot 831 \cdot 69373 \cdot 10^6}{18 \cdot 105}$

$V = \frac{моль \cdot К \cdot Па \cdot м^2}{Па \cdot моль} = \frac{моль \cdot К \cdot м^2 \cdot Н}{Н \cdot м \cdot К \cdot моль} = м^3$

$V = 32027{,}20167\,см^3$