Часть 1

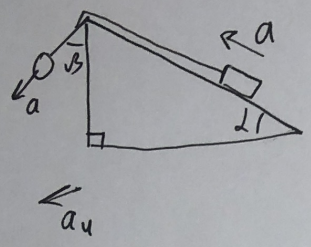
Олимпиада: **Физика, 11 класс (1 часть)**

Шифр: **21200207**

ID профиля: **256842**

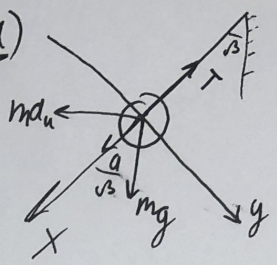
Вариант 8

N 1 Чистовик Лист 1



перейдём в систему связанную с клином

1)



$y: mg\sin\beta - ma_u\cos\beta = 0$

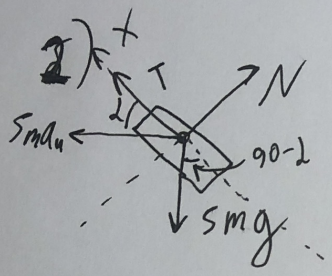
$mg\sin\beta = ma_u\cdot\cos\beta$

$a_u = g\cdot\frac{\sqrt{1-\cos^2\beta}}{\cos\beta} =$

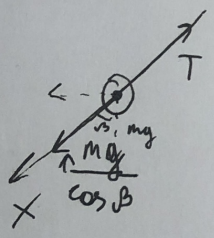
$= 24\ м/с^2$

1) Ответ: $24\ м/с^2$

2)



$X: 5ma = T + 5ma_u\cos 2 - 5mg\sin 2$



$X: ma = \frac{mg}{\cos\beta} - T$

$\frac{5mg}{\cos\beta} - 5T = T + 5ma_u\cos 2 - 5mg\sin 2$

$T = \frac{5}{6}m\left(\frac{g}{\cos\beta} - a_u\cos 2 + g\sin 2\right) \approx$

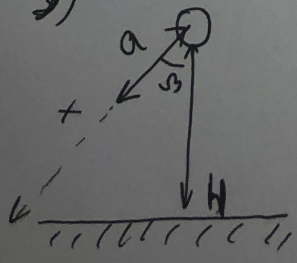
$\approx 16{,}4m$

$ma = \frac{m\cdot 10}{5}\cdot 13 - 16{,}4m$

$a = 26 - 16{,}4 = 9{,}6\ м/с^2$

2) ответ: $9{,}6\ м/с^2$

3)



$x = \frac{at^2}{2}$

$x = \frac{H}{\cos\beta}$

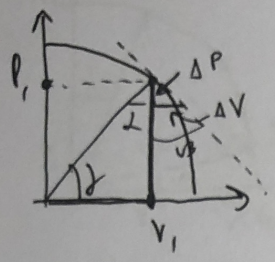
$t^2 = \frac{H}{\cos\beta}\cdot\frac{2}{a}$

$t = 0{,}74\sqrt{H}$

3) Ответ: $0{,}74\sqrt{H}$

Чистовик

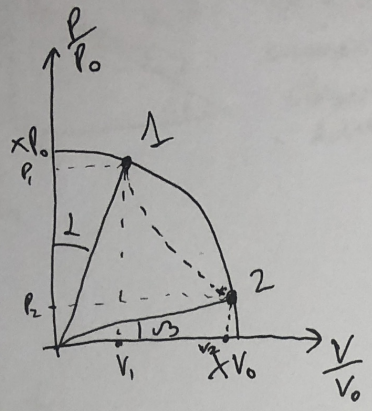
№2 продолжение 2)



$\Rightarrow \angle\alpha = \angle\beta \Rightarrow \gamma = 45°$

2) Ответ: $45°$

N2 Чистовик Лист 2



1) $PV = \nu R T \to T = \frac{PV}{\nu R}$

$$k = \frac{T_1 - T_2}{T_2} = \frac{\frac{P_1 V_1}{\nu R} - \frac{P_2 V_2}{\nu R}}{\frac{P_2 V_2}{\nu R}} =$$

$$= \frac{P_1 V_1 - P_2 V_2}{P_2 V_2} = \frac{P_1 V_1}{P_2 V_2} - 1$$

$P_1 = x \cdot P_0 \cdot \cos 2\alpha$

$V_1 = x \cdot V_0 \cdot \sin 2$

$P_1 V_1 = x^2 P_0 V_0 \cdot \frac{1}{2} \sin 2\alpha = x^2 P_0 V_0 \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{2}} = x^2 P_0 V_0 \cdot \frac{1}{2\sqrt{2}}$

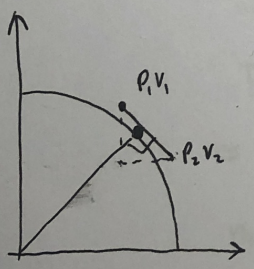
аналогично

$P_2 V_2 = x^2 P_0 V_0 \cdot \frac{1}{2} \cdot \sin 2\beta = x^2 P_0 V_0 \cdot \frac{1}{4}$

$$k = \frac{x^2 P_0 V_0 \frac{1}{2\sqrt{2}}}{x^2 P_0 V_0 \frac{1}{4}} - 1 = \frac{4}{2\sqrt{2}} - 1 = \frac{2}{\sqrt{2}} - 1$$

1) Ответ: $\frac{2}{\sqrt{2}} - 1$

2)



$$Q = A + U = \frac{(P_2 - P_1)(V_2 - V_1)}{2} + \frac{3}{2}\nu R \Delta T =$$

$$= \frac{(P_2 - P_1)(V_2 - V_1)}{2} + \frac{3}{2}(P_2 V_2 - P_1 V_1)$$

$$0 = dQ = \frac{-\Delta P \cdot \Delta V}{2} + \frac{3}{2}\left((P_1 - \Delta P)(V_1 + \Delta V) - P_1 V_1\right) =$$

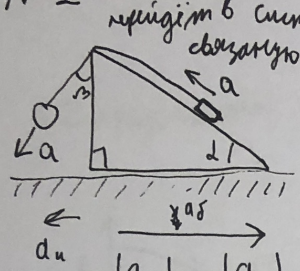
$$= \frac{-\Delta P \Delta V}{2} \to 0 + \frac{3}{2}\left(P_1 V_1 - P_1 V_1 - \Delta P V_1 + P_1 \Delta V - \Delta P \Delta V\right) \to 0 =$$

$$= \frac{3}{2}\left(P_1 \Delta V - \Delta P V_1\right)$$

$P_1 \Delta V = V_1 \Delta P$

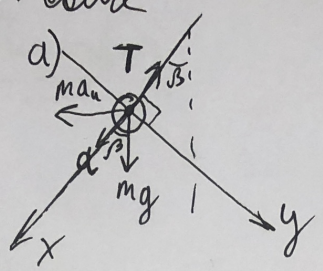
$\frac{P_1}{V_1} = \frac{\Delta P}{\Delta V}$

N 1



$|a_к| = |a_н|$

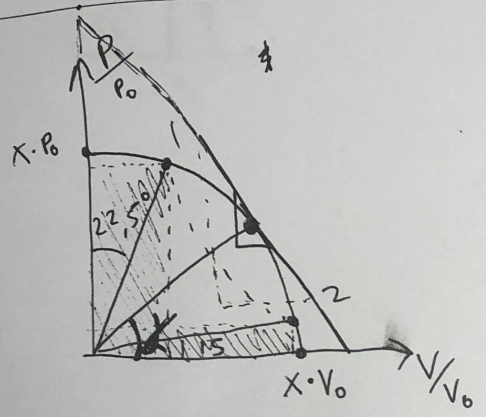
Чертёжик



$y: \; m a_н \cos\beta - m a_н \sin\beta = 0$

$m g \cos\beta = m a_н \cdot \sin\beta$

$a_н = \text{co}$



$PV = \nu R T$

$T = \frac{PV}{\nu R}$ ↑ const

$k = \frac{T_1 - T_2}{T_2} =$

$= \frac{-P_2 V_2 + P_1 V_1}{P_2 V_2} = \frac{P_1 V_1}{P_2 V_2} - 1$

$P_1 = X P_0 \cdot \cos 22{,}5°$

$V_1 = X \cdot V_0 \cdot \sin 22{,}5°$

$P_1 V_1 = X^2 P_0 V_0 \cdot \frac{1}{2} \sin 45° = X^2 P_0 V_0 \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{2}} = \frac{1}{2\sqrt{2}} \cdot X^2 P_0 V_0$

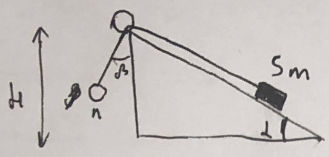
$P_2 V_2 = X^2 P_0 V_0 \cdot \frac{1}{2} \sin 30° = X^2 P_0 V_0 \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} X^2 P_0 V_0$

$Q = A + U = \frac{P\Delta V}{2} + \frac{3}{2} \nu R \Delta T =$

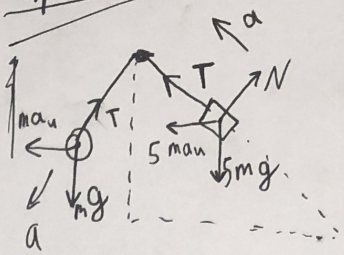
$= \frac{\Delta(PV)}{2} + \frac{3}{2} \frac{(P_1 - P_2)(V_1 - V_2)}{2} + \frac{3}{2} R \Delta T =$

$= + \frac{3}{2} (P_1 V_1 - P_2 V_2)$

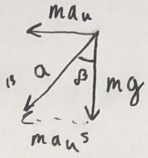
$|a| = |a_u|$



Тележка



$$\left(\frac{5}{13}\right)^2 = \frac{169}{25} = 0,852$$

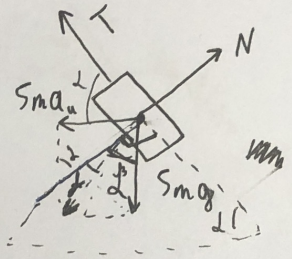


$$\frac{a_u}{g} = tg\,\beta$$

$$\sin\alpha = 4/5$$

$$\cos\alpha = 3/5$$

$$\cos\beta = 5/13$$



$$tg^2\beta + 1 = \frac{1}{\cos^2\beta}$$

$$tg\,\beta = \sqrt{\frac{1}{\cos^2\beta} - 1} = \sqrt{\frac{1 - \cos^2\beta}{\cos^2\beta}} = \frac{\sqrt{1 - \cos^2\beta}}{\cos\beta} = \frac{\sqrt{0,852}}{5/13} = \sqrt{0,852} \cdot \frac{13}{5} = 2,4$$

$$N = 5mg \cdot \cos\alpha + 5ma_u \cdot \sin\alpha =$$

$$= 5m(g\cos\alpha + a_u \sin\alpha)$$

$$a_u = 2,4 \cdot g = 24\ м/с^2$$

$$5ma = T + \cos\alpha \cdot 5ma_u - 5mg\sin\alpha$$

$$ma = \frac{mg}{\cos\beta} - T$$

$$\frac{2 \cdot 13}{5 \cdot 9,6}$$

$$\frac{5mg}{\cos\beta} - 5T = T + \cos\alpha\, 5m a_u - 5mg\sin\alpha$$

$$6T = \frac{5mg}{\cos\beta} - \cos\alpha \cdot 5ma_u + 5mg\sin\alpha$$

$$T = \frac{5m}{6}\left(\frac{g}{\cos\beta} - a_u\cos\alpha + g\sin\alpha\right)$$

Часть 2

Олимпиада: **Физика, 11 класс (2 часть)**

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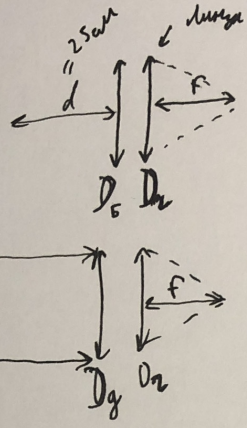
ID профиля: **256842**

Вариант 8

В-11-08 Чистовик Лист 1

N5



$D_б$ – оптическая сила очков для чтения

$D_л$ – оптическая сила глаза

$D_д$ – оптическая сила очков для дали

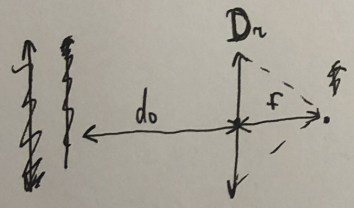
1) $d = 0{,}25м = \frac{1}{4} м$

$D_б + D_л = \frac{1}{d} + \frac{1}{F}$

$D_д + D_л = \frac{1}{f}$ (т.к. предмет удалённого изображение будет в фокусе)

$$\begin{cases} D_б = \frac{1}{d} + D_д \\ \frac{D_б}{D_д} = 5 \end{cases} \Rightarrow \frac{\frac{1}{d} + D_д}{D_д} = 5 \Rightarrow D_д = 1 м^{-1}$$

$\frac{1}{F} - D_л = D_д = 1$

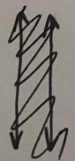


$D_л = \frac{1}{d_0} + \frac{1}{f}$

$\frac{1}{d_0} = D_л - \frac{1}{f} = -1$

противоречие => линза рассеивающая

2)



$$\begin{cases} \frac{D_д}{D_б} = 5 \\ D_б = \frac{1}{d} + D_д \end{cases} \quad \frac{D_д}{\frac{1}{d} + D_д} = 5 \Rightarrow D_д = -5 м^{-1}$$

$\frac{1}{F} - D_л = -5$

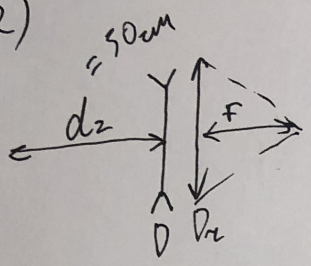
$D_л = \frac{1}{d_0} + \frac{1}{F}$

$\frac{1}{d_0} = D_л - \frac{1}{F} = 5$

$d_0 = 0{,}2 м$

1) Ответ: 0,2 м ; $-5 м^{-1}$

2)

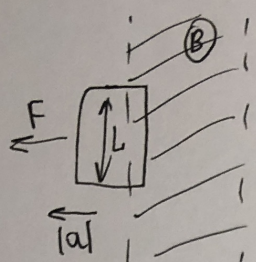


$D + D_2 = \frac{1}{d_2} + \frac{1}{f}$

$D = \frac{1}{d_2} + \frac{1}{f} - D_2 = \frac{1}{0,5} + 5 = 2 - 5 = -3$

2) Ответ: $-3 м^{-1}$

N4 Чистовик Лист 3



1) $\begin{cases} F = BIL \\ \mathcal{E} = \Delta S B = d v_0 B \\ F = ma \\ \mathcal{E} = IR \end{cases}$

$a = \frac{F}{m} = \frac{BIL}{m} = \frac{B d v_0 B L}{mR} = \frac{B^2 d^2 v_0}{mR}$

1) Ответ: $\frac{B^2 d^2 v_0}{mR}$

2) [illegible]

$v' = a = -\frac{B^2 d^2 \cdot v}{mR}$

$v = C_1 \cdot e^{tC_2}$

$v' = C_2 C_1 e^{tC_2}$

$C_2 C_1 e^{tC_2} = -\frac{B^2 d^2}{mR} C_1 \cdot e^{tC_2}$

$C_2 = -\frac{B^2 d^2}{mR}$

при $t = 0$ $v = v_0$

$v_0 = C_1 \cdot e^0 \to C_1 = v_0$

$v = v_0 \cdot e^{-t \cdot \frac{B^2 d^2}{mR}}$

$x' = v \to x = \frac{v}{\left(-\frac{B^2 d^2}{mR}\right)} + C_3 = \frac{v_0 \cdot e^{-t \cdot \frac{B^2 d^2}{mR}}}{-\frac{B^2 d^2}{mR}} + C_3$

при $t = 0$ $x = 0 \to C_3 = \frac{v_0 mR}{B^2 d^2}$

при $x = b = \frac{2}{3} d$ | $v = v_1$ т.к. далее $\Delta S = 0$ $a = 0$

пусть $e^{-t \cdot \frac{B^2 d^2}{mR}} = A$

$\frac{3}{2} = \frac{-v_0 mR}{B^2 d^2} A + \frac{v_0 mR}{B^2 d^2}$

$A = \frac{\frac{B^2 d^2}{v_0 mR} \cdot \frac{3}{2} - 1}{-1} = 1 - \frac{B^2 d^2}{v_0 mR} \cdot \frac{3}{2}$

Чистовик Лист 4

№4 (продолжение)

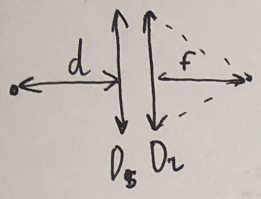
$$v_1 = v_0 \cdot A = v_0 - \frac{B^2 d^2}{mR} \cdot \frac{3}{2}$$

2) Ответ: $v_0 - \frac{B^2 d^2}{mR} \cdot \frac{3}{2}$

3) аналогично 2), только $v_0 \to v_1$, $v_1 \to v_2$

$$v_2 = v_1 \cdot A_2 = v_1 - \frac{B^2 d^2}{mR} \cdot \frac{3}{2} = v_0 - 3\frac{B^2 d^2}{mR}$$

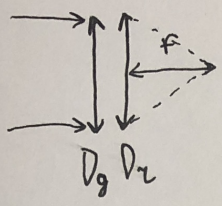
3) Ответ: $v_0 - 3\frac{B^2 d^2}{mR}$



$d = 0{,}25м = \frac{1}{4}$

$\frac{D_б}{D_г} = 5$

$D_б + D_л = \frac{1}{d} + \frac{1}{F}$



$D_г + D_л = \frac{1}{f}$

$D_б = \frac{1}{d} + D_г$

$\frac{D_г}{\frac{1}{d} + D_г} = 5$

$D_л \to 0$

$\frac{\frac{1}{d} + D_г}{D_г} = 5$

$D_г = 20 + 5D_г$

$-4D_г = -20$

$D_г = -5$

$\frac{4 + D_г}{D_г} = 5$

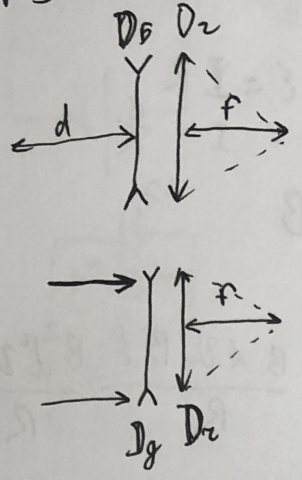
$4 + D_г = 5D_г$

$4 = 4D_г \to D_г = 1$

$D_л = \frac{1}{d_0} + \frac{1}{f}$

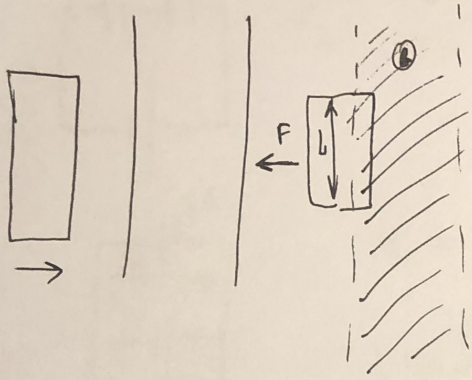
$\frac{1}{d_0} = -5$

NS



Чернобыль

Черновик



$F = BIL$

$\mathcal{E} = IR$

$I = \frac{\mathcal{E}}{R}$

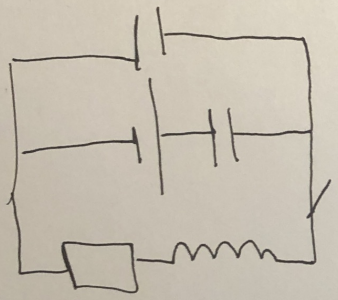
$\mathcal{E} = \frac{\Delta S}{\Delta t} B = d v_0 \cdot B$

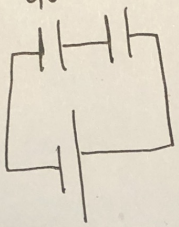
$ma = F$

$a = \frac{F}{m} = \frac{BIL}{m} = \frac{B d v_0 B d}{R} = \frac{B^2 d^2 v_0}{R}$

$x = C_1 e^{t C_2} = \frac{v}{C_2}$

$v = C_2 C_1 e^{t C_2}$





$C_0 = \frac{5CC}{5C+C} = \frac{5}{6} C$

$\mathcal{E} = IL$

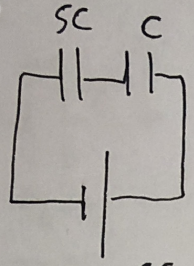
$\mathcal{E} = \frac{q}{C}$

$C = \frac{q}{\mathcal{E}}$

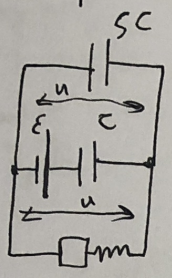
$q = C\mathcal{E}$

Черновик

N 3



$$C_0 = \frac{5CC}{5C+C} = \frac{5}{6}C \rightarrow q = \frac{5}{6}C\mathcal{E}$$



$$U = \frac{q}{5C} = \frac{5}{6}C\mathcal{E} \cdot \frac{1}{5C} = \frac{\mathcal{E}}{6}$$

$$\mathcal{E} = \Delta I' L$$