

Рубежная контрольная работа
по дополнительной общеразвивающей программе
«Олимпиадная физика.2026» 9 класс
(очно-заочная форма обучения с применением дистанционных
образовательных технологий)

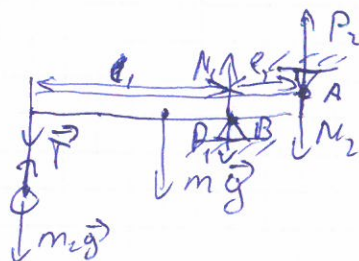
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$$M = 60 \text{ кг}$$

$$m_2 = 50 \text{ кг}$$

$$l_1 = 2 \text{ м}$$

$$l_2 = 0,5 \text{ м}$$



$$P_1 - ?$$

$$P_2 - ?$$

$$m_1 g + m g + N_2 = N_1$$

$$A: m_1 g (l_1 + l_2) + m g \frac{l_1 + l_2}{2} = N_1 l_2$$

$$l_2 m_2 g + l_2 m g + P_2 N_2 = (m_1 g (l_1 + l_2) + m g \frac{l_1 + l_2}{2})$$

$$N_2 = \frac{m_1 g l_1 + \frac{l_1 + 3l_2}{2} m g}{l_2} = \frac{2m_2 g l_1 + m g (l_1 + 3l_2)}{2l_2}$$

$$N_2 = \frac{2 \cdot 50 \cdot 10 \cdot 2 + 60 \cdot 10 \cdot 3,5}{1} = 4100 \text{ Н}$$

$$N_1 = 500 + 600 + 4100 = 5200 \text{ Н}$$

$$v_{01} = 5 \frac{\text{м}}{\text{с}}$$

$$v_{02} = 8 \frac{\text{м}}{\text{с}}$$

$$\alpha_1 = 80^\circ$$

$$\alpha_2 = 20^\circ$$

$$t = \frac{1}{3} \text{ с}$$

$$\Delta l - ?$$



$$x_1 = v_{x1} t = \cos \alpha_1 v_{01} t$$

$$x_2 = v_{x2} t = \cos \alpha_2 v_{02} t$$

$$y_1 = v_{y1} t = \left(v_{y1} - \frac{gt}{2} \right) t = \left(v_{01} \sin \alpha_1 - \frac{gt}{2} \right) t$$

$$y_2 = \left(v_{02} \sin \alpha_2 - \frac{gt}{2} \right) t$$

$$\Delta l = y_2 - y_1$$

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СТУПЕНИ УСПЕХА



$$\Delta C = \sqrt{\Delta x^2 + \Delta y^2} = \sqrt{(\cos \alpha_1 v_{01} t - \cos \alpha_2 v_{02} t)^2 + ((v_{01} \sin \alpha_1 - \frac{g}{2} t - v_{02} \sin \alpha_2 + \frac{g}{2} t)^2)}$$

$$= t \sqrt{(\cos \alpha_1 v_{01} - \cos \alpha_2 v_{02})^2 + (v_{01} \sin \alpha_1 - v_{02} \sin \alpha_2)^2}$$

$$= t \sqrt{\cos^2 \alpha_1 v_{01}^2 - 2 \cos \alpha_1 \cos \alpha_2 v_{01} v_{02} + \cos^2 \alpha_2 v_{02}^2 + \sin^2 \alpha_1 v_{01}^2 - 2 \sin \alpha_1 \sin \alpha_2 v_{01} v_{02} + \sin^2 \alpha_2 v_{02}^2}$$

$$= \sqrt{v_{01}^2 + v_{02}^2 - 2 \cos(\alpha_1 - \alpha_2) v_{01} v_{02}}$$

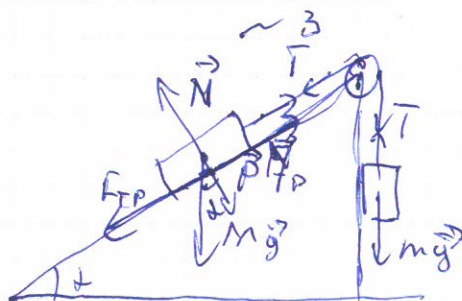
$$\Delta C = \sqrt{5^2 + 8^2 - 2 \cos 60^\circ 5 \cdot 8} = 7$$

$$M = 0,8 \text{ кН}$$

$$\alpha = 30^\circ$$

$$\mu = 0,2$$

$$m = ?$$



$$\begin{cases} mg = T \\ \sin \alpha Mg + F_{\text{тр}} = T \\ \cos \alpha Mg = N \\ F_{\text{тр}} = \mu N \end{cases}$$

mg — макс. при $F_{\text{тр}n} - \text{макс} = F_{\text{тр}ск}$
 $g \text{ макс} - F_{\text{тр}}$

$$Mg \sin \alpha + F_{\text{тр}} = mg$$

$$F_{\text{тр}} = \mu \cos \alpha Mg$$

$$Mg \sin \alpha + \mu Mg \cos \alpha = mg$$

$$m = M \sin \alpha + \mu M \cos \alpha$$

$$m = 0,8 \cdot \frac{1}{2} + 0,2 \cdot 0,8 \cdot \frac{\sqrt{3}}{2} \approx 0,54 \text{ кН}$$



$$v = 1 \text{ м/с}$$

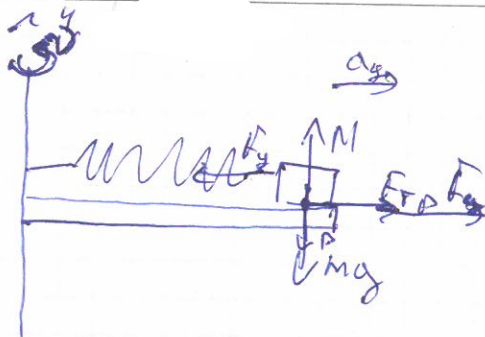
$$m = 0,3 \text{ кг}$$

$$l = 12 \text{ см} = 0,12 \text{ м}$$

$$k = 60 \frac{\text{Н}}{\text{м}}$$

$$\mu = 0,25$$

Решение



$$F_y = F_{\text{тр}} + F_y$$

н.н. метод
поискателя.

и.н.

$$l = \frac{F_y + l}{k} \text{ или } F_y, \text{ или } l$$

$$F_y = F_{\text{тр}} - F_y \text{ или } F_{\text{тр}}, \text{ или } F_y$$

$$(L - e)k = \mu mg + m a_y$$

$$(L - e)k = \mu mg + m \frac{v_x^2}{L}$$

$$(L - e)k = \mu mg + m \frac{4\pi^2 L v^2}{\Delta}$$

$$kL - ke = \mu mg + 4\pi^2 m v^2 L$$

$$kL - 4\pi^2 m v^2 L = \mu mg + ke$$

$$L = \frac{\mu mg + ke}{k - 4\pi^2 m v^2}$$

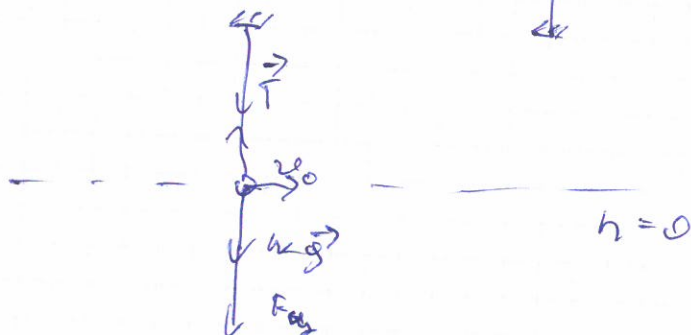
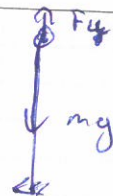
$$L = \frac{0,25 \cdot 0,3 \cdot 10 + 60 \cdot 0,12}{60 - 4 \cdot 3,14^2 \cdot 0,3 \cdot 1} \approx 0,165 \text{ м}$$





$m = 100 \text{ г} = 0,1 \text{ кг}$
 $l = 50 \text{ см} = 0,5 \text{ м}$
 $v_0 = ?$

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$$\begin{cases} \frac{mv_0^2}{2} = mgl + \frac{mv_0^2}{2} \\ mg = F_4 \\ F_4 = ma_4 = m \frac{v_0^2}{l} \end{cases}$$

$$\frac{mv_0^2}{2} = 2mgl + \frac{mgl}{2}$$

$$v_0^2 = 4gl + gl$$

$$v_0 = \sqrt{5gl}$$

$$v_0 = \sqrt{5 \cdot 10 \cdot 0,5} = 5 \frac{\text{м}}{\text{с}}$$

~7

$$R_n = 240 \Omega$$

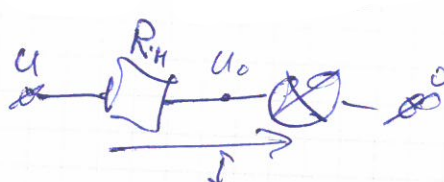
$$U_0 = 120 \text{ В}$$

$$U = 220 \text{ В}$$

$$S = 0,55 \text{ мВ}^2 = 0,55 \cdot 10^{-6} \text{ мВ}^2$$

$$P = 11 \cdot 10^{-6} \text{ Вт} \cdot \text{м}$$

$l = ?$



$$I = \frac{U}{R_n + R_l} = \frac{U - U_0}{R_n}$$

$$I = \frac{U_0}{R_n}$$

$$R_l = P \frac{l}{S}$$

$$\frac{U - U_0}{P \frac{l}{S}} = \frac{U_0}{R_n}$$

$$\frac{S(U - U_0)}{P l} = \frac{U_0}{R_n}$$

$$e = \frac{S(u-u_0)R_n}{u_0 \cdot p}$$

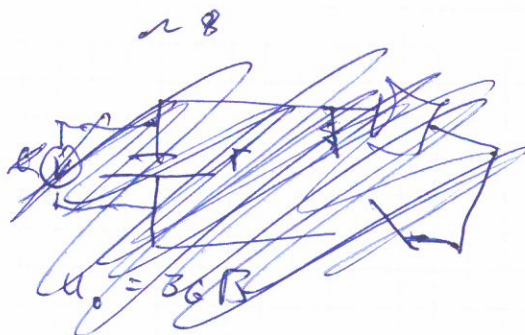
$$e = \frac{0.55 \cdot 10^{-6} \cdot (220 - 220) \cdot 240}{220 \cdot 1.1 \cdot 10^{-6}} \approx 54.5 \mu$$

$$u_0 = 36 \text{ В}$$

$$I = 2 \text{ А}$$

$$u = 32 \text{ В}$$

$$r = ?$$





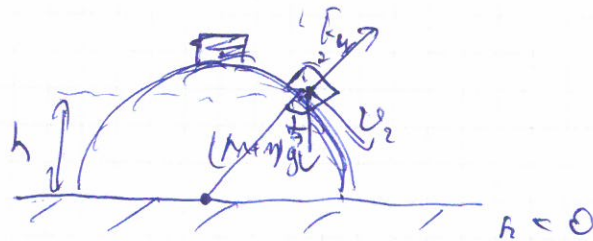
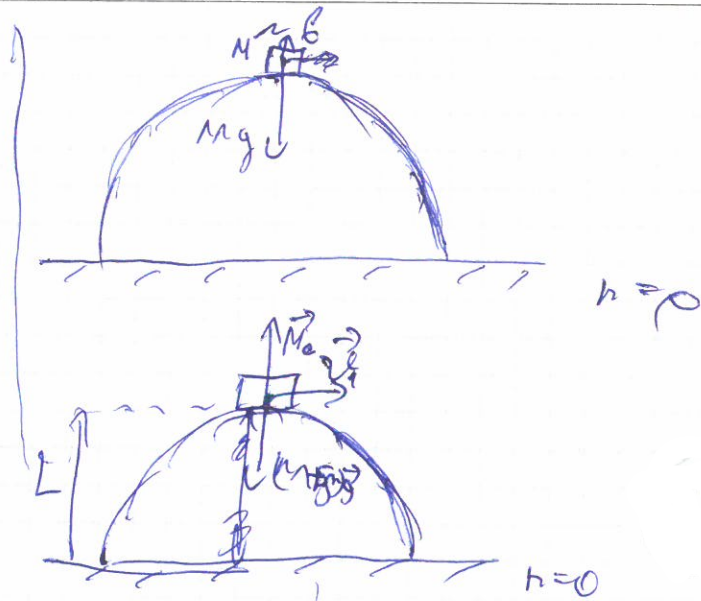
$$L = 0.6 \text{ m}$$

$$M = 0.89 \text{ kg}$$

$$m = 0.01 \text{ kg}$$

$$v = 1.8 \frac{\text{m}}{\text{s}}$$

$$h \rightarrow$$



$$\begin{cases} m v = (M+m) v_1 \\ \frac{(M+m) v_1^2}{2} + (M+m) g L = \frac{(M+m) v_2^2}{2} + (M+m) g h \\ (M+m) g = \cos \alpha F_y \\ F_y = (M+m) a_y = (M+m) \frac{v_2^2}{L} \\ \cos \alpha = \frac{h}{L} \end{cases}$$

$$\frac{m^2 v^2}{(M+m)^2} + g L = \frac{v_2^2}{2} + g h$$

$$(M+m) g = \frac{h}{L} (M+m) \frac{v_2^2}{L}$$

$$v_2^2 = \frac{g L^2}{h}$$

$$\frac{m^2 v^2}{2(M+m)^2} + g L = \frac{g L^2}{2h} + g h$$

$$g h^2 - \left(\frac{m^2 v^2}{2(M+m)^2} + g L \right) h + \frac{g L^2}{2} = 0$$

ср 5 н 3 с

СТУПЕНИ УСПЕХА



$$a = 10 \frac{u}{c^2}$$

$$b = 2,62 \frac{u^2}{c^2}$$

$$c = 7,8 \frac{u^3}{c^2}$$

$$h = \text{---}$$