

Министерство науки и образования Самарской области  
 Всероссийская олимпиада по физике 2015 года  
 Окружной тур. Ответы и решения для задания 10 класса

1.

$$y = -v_0 t - \frac{gt^2}{2} + h \quad (1)$$

to  $y = 0$

$$gt_0^2 + 2v_0 t_0 - 2h = 0$$

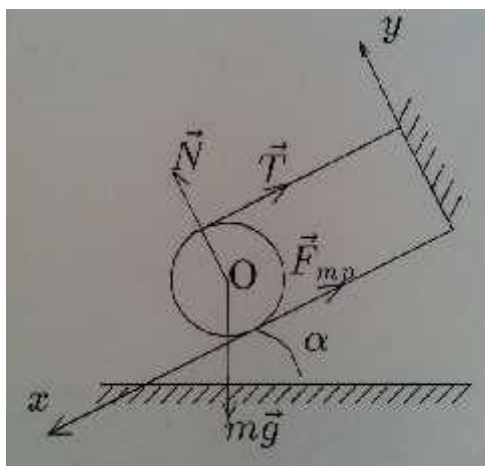
$$t_0 = -\frac{v_0}{g} + \sqrt{\frac{v_0^2}{g^2} + \frac{2h}{g}} \quad (2)$$

$$v = v_0 + gt$$

$$0 = (v_0 + gt_0) - gt_1, \quad t_1 = \frac{v_0}{g} + t_0 \quad (3)$$

$$\tau = 2t_1 = 2\left(\frac{v_0}{g} + t_0\right) = 2\sqrt{\frac{v_0^2}{g^2} + \frac{2h}{g}} \quad (4)$$

2.



$$\vec{T}, \quad \vec{N}, \quad \vec{F}_m, \quad m\vec{g}$$

$$F_x = mg \sin(\alpha) - T - F_{mp} = 0 \quad (1)$$

$$F_y = N - mg \cos(\alpha) = 0 \quad (2)$$

$$M_0 = F_{mp}R - TR = 0, \quad F_{mp} = \mu N = \mu mg \cos(\alpha) \quad (3)$$

$$mg \sin(\alpha) - 2\mu mg \cos(\alpha) = 0.$$

$$\alpha = \alpha(2\mu) \quad (4)$$

3.

$$(\alpha < 0).$$

$$n = \frac{t_c}{T}$$

$$nT_0 = \frac{t_c T_0}{T}$$

$$\Delta t = nT_0 - t_c = t_c \left( \frac{T_0}{T} - 1 \right) \quad (1)$$

h

$$T(h) = 2\pi \sqrt{\frac{l}{g(h)}} \quad (2)$$

1- ,

$$g(h) = g \left( \frac{R}{R+h} \right)^2 \quad (3)$$

- h. (2) (3) ,

$$T(h) = T \left( 1 + \frac{h}{R} \right) \quad (4)$$

h, ,

$$T(h) = T_0 \quad (5)$$

(4) (5)

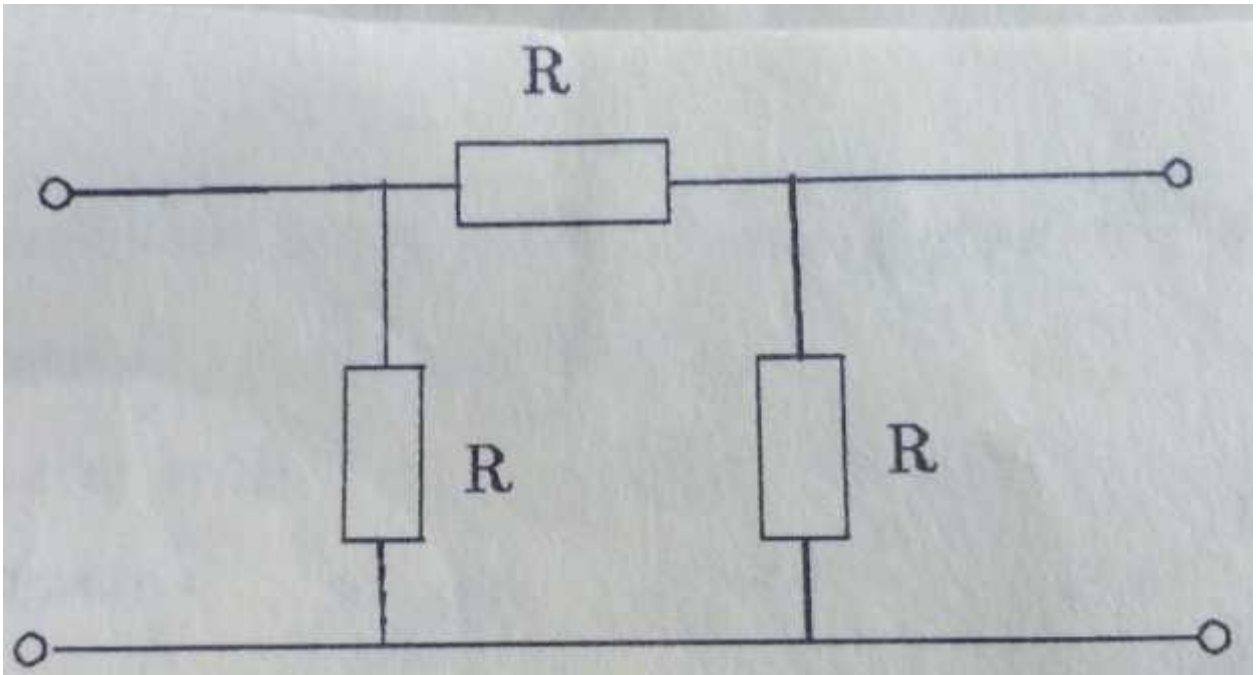
$$T_0 = T \left( 1 + \frac{h}{R} \right) \quad (6)$$

(6) T<sub>0</sub> (1),

$$\Delta t = t_c \frac{h}{R} \quad (7)$$

$$h = \frac{\Delta t}{t_c} = 6500 \text{ км} \quad (8)$$

4.



5.

$$F_{\text{Арх}} = g (\rho_x - \rho_T) \quad (1)$$

$V$  – ,  $\rho_x$  – ,  $\rho_T$  – .

$$M_{\text{под}} = \frac{F_{\text{Арх}}}{g} = V(\rho_x - \rho_T) = m_x - m_T \quad (2)$$

$m_x$  – ,  $m$  – .  
 $m_x$  m

$$\begin{cases} P_0 V = \frac{m_x}{M} RT_0 \\ P_0 V = \frac{m_T}{M} R \end{cases} \quad (3)$$

$P_0$  – ,  $0$  – ; -

$$M_{\text{под}} = m_x - m_T = M \frac{P_0 V}{R} \left( \frac{1}{T_0} - \frac{1}{T} \right) \quad (4)$$