№1

$F = \alpha v$, m, h,

$F = \beta v$

1) $mv_0 = mv_1 + mv_2$

$$\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + \frac{mv_2^2}{2}$$

$$\cancel{v_1^2} + \cancel{v_2^2} + 2v_1v_2 = \cancel{v_1^2} + \cancel{v_2^2}$$

$$2v_1v_2 = 0$$

$$\Rightarrow v_1 = 0 \Rightarrow v_2 = v_0$$

$$mv_0^2 = mv_1^2 + mv_2^2$$

$$v_0^2 = v_1^2 + v_2^2$$

$$m\dot{v} = \alpha v \Rightarrow \frac{dv_0}{v} = \frac{\alpha}{m}dt \Rightarrow \int_{v_0}^{v}\frac{dv}{v} = \frac{\alpha}{m}\int_0^{\tau}dt$$

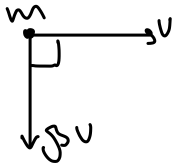
$$\ln\frac{v}{v_0} = \frac{\alpha}{m}\tau \Rightarrow v = v_0 e^{\frac{\alpha}{m}\tau}$$

$$ds = v\,dt \Rightarrow \int_0^h ds = \int_0^{\tau} v\,dt$$

$$h = \int v_0 e^{\frac{\alpha}{m}t}dt = \frac{m}{\alpha}v_0\left(e^{\frac{\alpha}{m}\tau} - 1\right) \Rightarrow$$

$$\Rightarrow \tau = \frac{m}{\alpha}\ln\left(1 + \frac{\alpha h}{mv_0}\right) \Rightarrow v = v_0 e^{\frac{\alpha}{m}\tau} = v_0\left(1 + \frac{\alpha h}{mv_0}\right)$$

$$t = \frac{m}{\alpha}\ln\left(1 + \frac{\alpha h}{mv_0}\right)$$



$\Rightarrow \quad ma = \beta v \Rightarrow a = \frac{\beta v}{m}$, также $\quad a = \frac{v^2}{R} \Rightarrow$

$$\Rightarrow \frac{v^2}{R} = \frac{\beta v}{m} \Rightarrow R = \frac{mv}{\beta} = \frac{m v_0 \left(1 + \frac{\alpha h}{m v_0}\right)}{\beta} = \frac{m v_0 + \alpha h}{\beta}$$

$$\omega = \frac{v}{R} = \frac{\beta}{m}$$

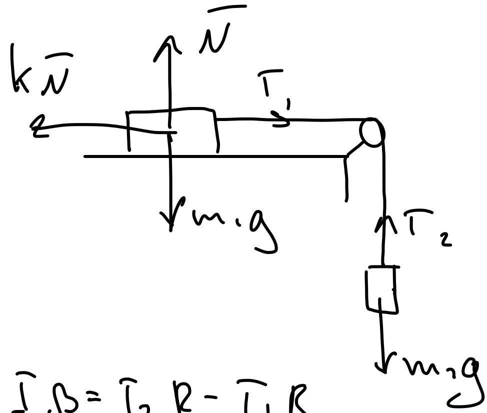
$$T = \frac{2\pi}{\omega} = \frac{2\pi m}{\beta}$$

N 2

Дано: Решение:

m_1, m_1, m 1) $m_1 a = T_1 - kN$

$k, v_0 = 0$ $m_1 g = N$



2) $m_2 a = m_2 g - T_2$ 3) $I\beta = T_2 R - T_1 R$

$$\frac{mR^2 a}{2R} = R(m_2 g - m_2 a - m_1 a - k m_1 g)$$

$$a = \frac{m_2 - k m_1}{\frac{1}{2}m + m_1 + m_2} \cdot g$$

$A_{тр} = F \cdot s \cos\pi = -kN s(t)$

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

$$A = -\frac{k m g t^2 (m_2 - k m_1)}{2(m_1 + m_2 + \frac{m}{2})} = -\frac{(m_2 - k m_1) k m_1 g t^2}{m + 2(m_1 + m_2)}$$

N 3

$$T = \frac{mv^2}{2} = \alpha s^2 \Rightarrow v^2 = \frac{2\alpha}{m} s^2 \Rightarrow v = s \cdot \sqrt{\frac{2\alpha}{m}}$$

$$a_\tau = \frac{dv}{dt} = \frac{dv\,ds}{dt\,ds} = s\sqrt{\frac{2\alpha}{m}} \cdot \sqrt{\frac{2\alpha}{m}} = \frac{2\alpha}{m} s$$

$$\bar{a} = \bar{a}_\tau + \bar{a}_n$$

$$|a| = \sqrt{a_\tau^2 + a_n^2}$$

$$a_n = \frac{v^2}{R} = \frac{2\alpha}{mR} s^2$$

$$F = ma = m\sqrt{a_\tau^2 + a_n^2} = \sqrt{\left(\frac{2\alpha s}{m}\right)^2 + \left(\frac{2\alpha s^2}{mR}\right)^2} \cdot m =$$

$$= 2\alpha s\sqrt{1 + \left(\frac{s}{R}\right)^2}$$

№ 4

Дано:

$\alpha = 30^\circ$, $\frac{\pi}{2}$, $\frac{M}{m} = 5$

ЗСИ:

1. $m v_1 = M u \sin\theta$
2. $m V = M u \cos\theta$

$\Rightarrow$ $T_0 = \frac{mv^2}{2}$, $T_k = \frac{m v_1^2}{2} + \frac{M u^2}{2}$

$V = \frac{M}{m} u \cos\theta$

$v_1 = \frac{M}{m} u \sin\theta$

$\Rightarrow$ $T_0 = \frac{m M^2}{2m^2} u^2 \sin^2\theta = \frac{M^2}{2m} u \cos\theta$

$T_k = \frac{M^2 u^2 \sin^2\theta + m M u^2}{2m}$

$$\frac{T_0}{T_k} = \frac{M \cos^2\theta}{M \sin^2\theta + m} = \frac{\frac{M}{m}\cos^2\theta}{\frac{M}{m}\sin^2\theta + 1} = \frac{5}{3} \Rightarrow$$

$T_0 = \frac{5}{3} T_k \Rightarrow T_k = 0{,}6\, T_0$

Ответ: Кин. энергия уменьшилась на 40%

NS

$A: (0,0,0)$

$B: (l_0 \cos\theta_0, l_0 \sin\theta_0, 0)$

$\rightarrow$

$\rightarrow$ $A': (vt', 0, 0)$

$B': \left(l_0 \cos\theta_0 \sqrt{1-\underbrace{\frac{v^2}{c^2}}_{\beta^2}} + vt', l_0 \sin\theta_0, 0 \right)$

$l \cos\theta_0 = l_0 \cos\theta_0 \sqrt{1-\beta^2}$

$l \sin\theta = l_0 \sin\theta_0$

$l_0^2 = l^2 \cdot \left(\frac{(1-\beta^2)\sin^2\theta}{1-\beta^2} \right) = 1{,}046\ m$