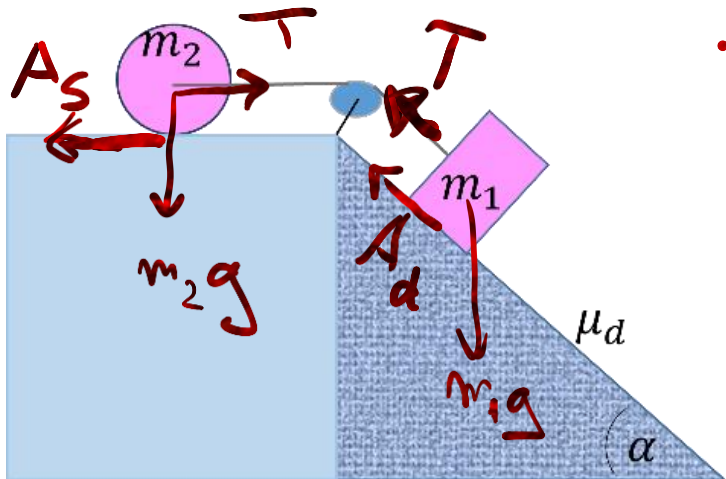


1.



$$\textcircled{1} m_1 a = m_1 g \sin \alpha - T - A_d$$

$$\textcircled{2} m_2 a = T - A_s$$

$$\textcircled{3} I \alpha = A_s R$$

$$m_2 R^2 \frac{\alpha}{2} \quad \alpha = \frac{a}{R} \text{ (pure rot.)}$$

$$m_1 g \cos \alpha \mu_d$$

$$\textcircled{1} m_1 a = m_1 g \sin \alpha - T - \mu_d m_1 g \cos \alpha$$

$$\textcircled{2} m_2 a = T - A_s$$

$$\textcircled{3} m_2 R^2 \frac{\alpha}{2} = A_s R \Rightarrow A_s = m_2 \frac{a}{2} \quad T = m_2 a + m_2 \frac{a}{2} = \frac{3m_2 a}{2}$$

$$m_1 a + 3m_2 \frac{a}{2} = m_1 g (\sin \alpha - \mu_d \cos \alpha) \Rightarrow a (m_1 + \frac{3m_2}{2}) = m_1 g (\sin \alpha - \mu_d \cos \alpha)$$

$$\text{Con: dati: } a = \frac{g \sqrt{2}}{10}$$

2.

A diagram of a spring-mass system on an inclined plane. A pink square mass m is attached to a spring with constant k and displacement Δl_1 . The spring is attached to a vertical wall. The mass is on an inclined plane with angle α . A yellow line of length L is attached to the mass and extends up the incline. A green dot is at the end of the yellow line. A green arrow points up the incline, and a green arrow points down the incline, both labeled H . The coefficient of friction is μ_d . A yellow line of length d is also shown, extending from the mass up the incline.

11 a)

$$mgh - \frac{k \Delta l_1^2}{2} = -\mu_d m g \cos \alpha \cdot d$$

$$\sin \alpha = H/d \Rightarrow d = H / \sin \alpha$$

$$\Rightarrow \underline{mgh - k\Delta l_1^2 = -\mu_d mgh \tan \alpha} \quad \left\{ H(mg + \mu_d \underline{mg \tan \alpha}) = k\Delta l_1^2 \right.$$

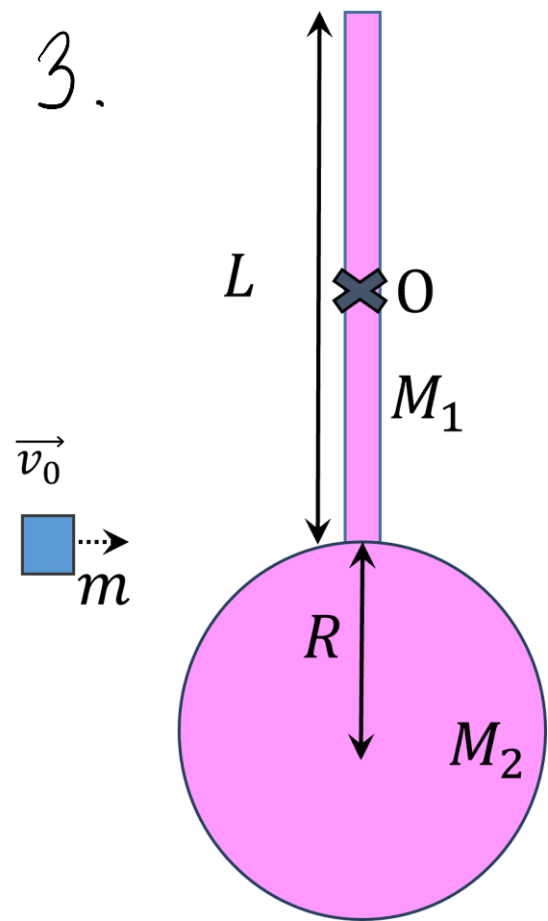
$$\Rightarrow H = \frac{k_{\Delta} \rho_{\Delta}^2}{2m_{\Delta} g} \frac{1}{1 + \rho_{\Delta} / \rho_{\text{gel}}}$$

$$\Delta \ell_2^2 - \Delta \ell_1^2 = \frac{4 \mu d m g \cos \alpha}{k} \cdot \frac{H}{\sin \alpha}$$

$$b) \quad k \frac{\Delta l_2^2}{2} - k \frac{\Delta l_1^2}{2} = - \mu_d m g \cos \alpha \cdot 2d$$

$$\Delta l_2 = \sqrt{\Delta l_1^2 - \frac{4\mu m g H}{k \tan \alpha}}$$

3.



$$a) I_{tot_0} = I_{M1} + I_{M2} + I_m =$$

$$= \frac{M_1 L^2}{12} + \frac{M_2}{2} \left(\frac{L}{2} \right)^2 + M_2 \cdot L^2 + m \cdot \left(\frac{L}{2} \right)^2 =$$

$$= \frac{M_1 L^2}{12} + \frac{M_2 L^2}{8} + M_2 L^2 + m \frac{L^2}{4}$$

$$m = M/3$$

$$M_2 = M$$

$$M_1 = M/2$$

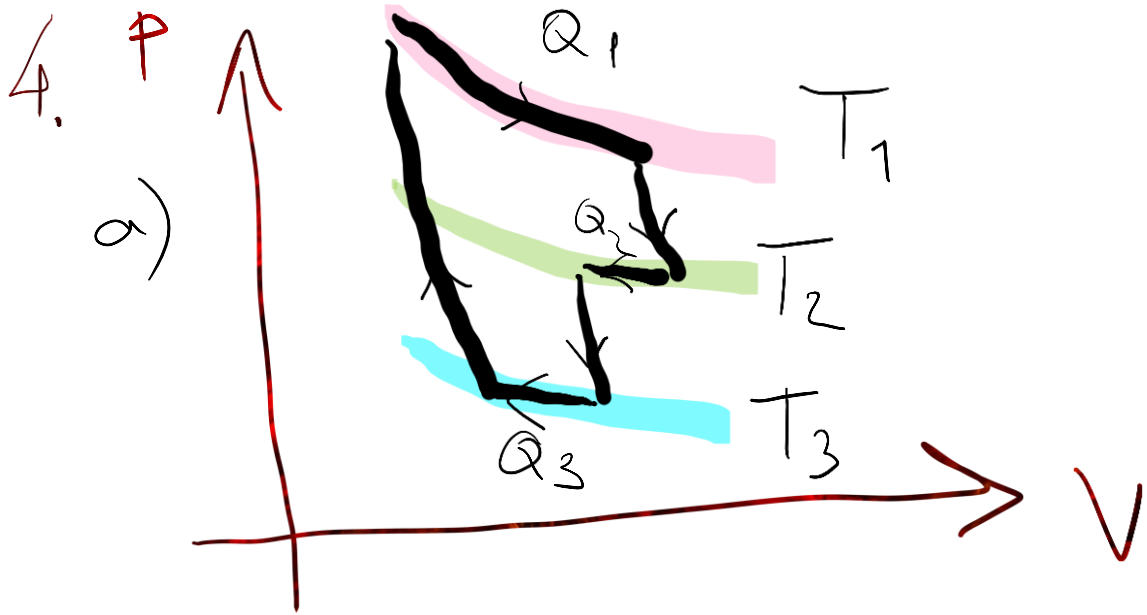
$$\frac{30 M L^2}{24} = \frac{5 M L^2}{4}$$

$$= 1.25 \text{ kgm}^2$$

$$b) m v_0 \frac{L}{2} = I_{tot} \omega$$



$$\omega = \frac{\frac{M}{3} \cdot v_0 \cdot \frac{L}{2}}{\frac{5 M L^2}{4}} = \frac{4 v_0}{30 L} = 4 \frac{\text{rad}}{\text{s}}$$



$$\oint \frac{dQ}{T} = 0$$

$\Downarrow$

$$\frac{Q_1}{T_1} + \frac{Q_2}{T_2} + \frac{Q_3}{T_3} = 0$$

b)

$$Q_1 = T_1 \cdot \left(-\frac{Q_2}{T_2} - \frac{Q_3}{T_3} \right) = 400 \text{ K} \left(\frac{400 \text{ J}}{350 \text{ K}} + \frac{900 \text{ J}}{300 \text{ K}} \right) = 2000 \text{ J}$$

$$W = Q_1 + Q_2 + Q_3 = 400 \text{ J}$$

c)

$$\eta = \frac{W}{Q_{\text{ass}}} = 20\% \quad \text{O.K.}$$