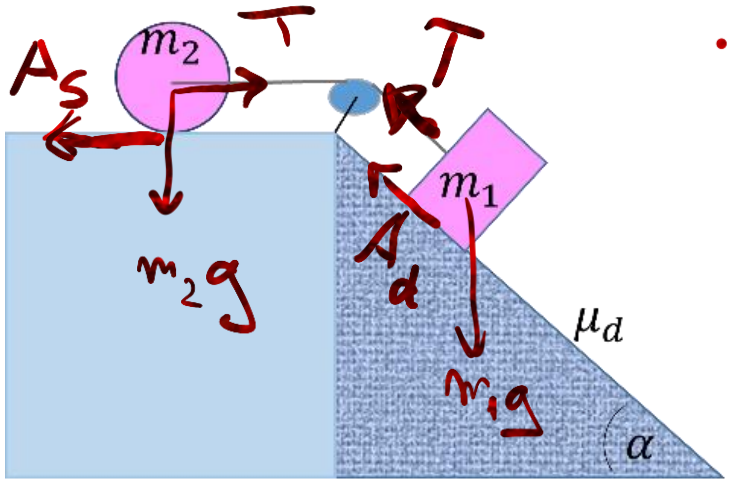
1.



(1) $m_1 a = m_1 g \sin\alpha - T - A_d$

(2) $m_2 a = T - A_s$

(3) $I\alpha = A_s \cdot R$

$A_d = m_1 g \cos\alpha \cdot \mu_d$

$I = \frac{m_2 R^2}{2}$ $\alpha = \frac{a}{R}$ (puro rot.)

(1) $m_1 a = m_1 g \sin\alpha - T - \mu_d m_1 g \cos\alpha$

(2) $m_2 a = T - A_s$

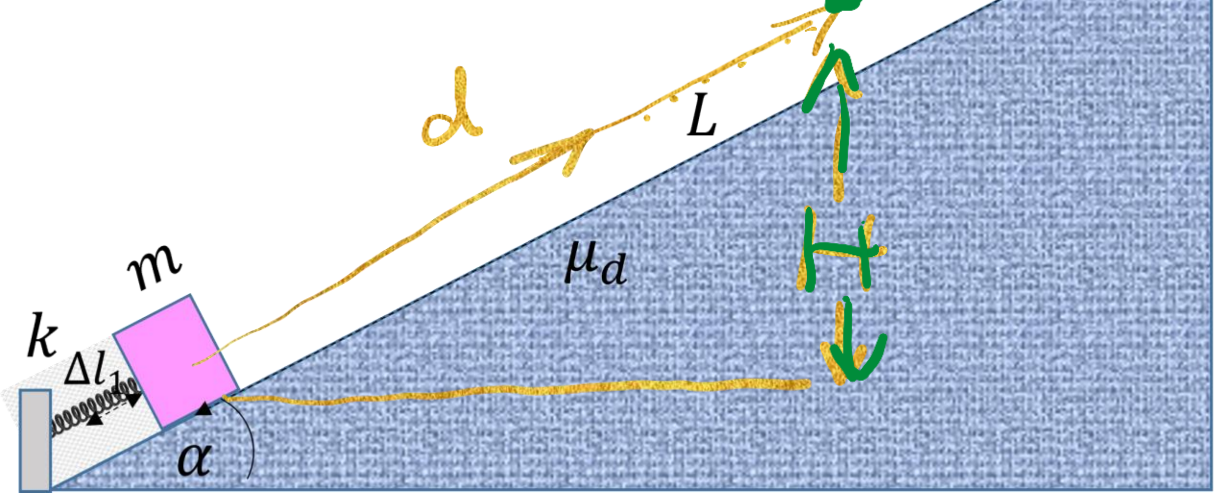
(3) $\frac{m_2 \cancel{R^2}}{2} \cdot \frac{a}{\cancel{R}} = A_s \cdot \cancel{R} \Rightarrow A_s = m_2 \cdot \frac{a}{2}$

$T = m_2 a + \frac{m_2}{2} a = \frac{3 m_2}{2} a$

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

Con i dati: $a = g\sqrt{2}/10$

2.



Quota massima: $v = 0$

$\Downarrow$ a)

$$mgH - \frac{k\Delta l_1^2}{2} = -\mu_d mg\cos\alpha \cdot d$$

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

$$\Rightarrow mgH - \frac{k\Delta l_1^2}{2} = -\mu_d mg\frac{H}{tg\alpha} \quad \Big\} \quad H\left(mg + \frac{\mu_d mg}{tg\alpha}\right) = \frac{k\Delta l_1^2}{2}$$

$$\Rightarrow \boxed{H = \frac{k\Delta l_1^2}{2mg}\,\frac{1}{1+\mu_d/tg\alpha}}$$

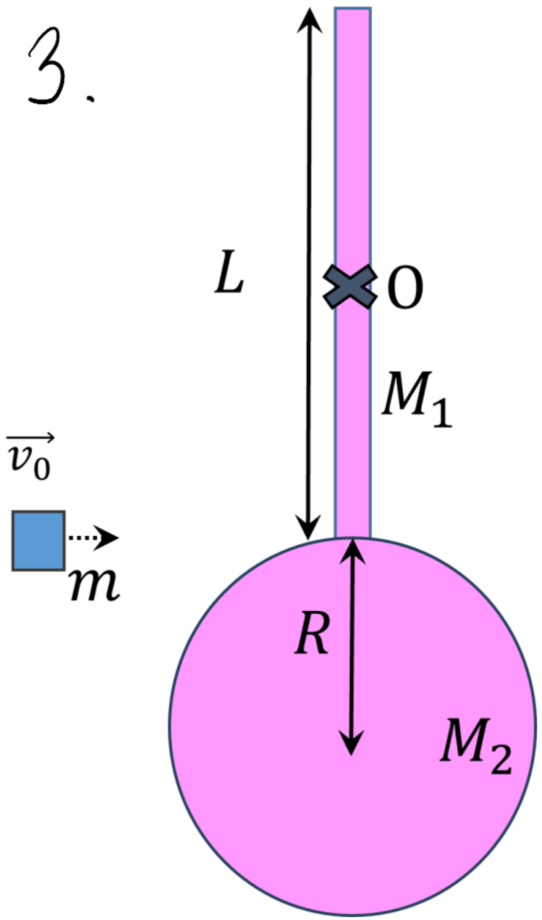
b) $$\frac{k\Delta l_2^2}{2} - \frac{k\Delta l_1^2}{2} = -\mu_d mg\cos\alpha\cdot 2d \quad \Big\}$$

$$\Delta l_2^2 - \Delta l_1^2 = -4\frac{\mu_d mg\cos\alpha}{k}\cdot\frac{H}{\sin\alpha}$$

$$\Downarrow$$

$$\Delta l_2 = \sqrt{\Delta l_1^2 - \frac{4\mu_d mg H}{k\,tg\alpha}}$$

3.



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

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

$m = M/3$
$M_2 = M$
$M_1 = M/2$

$$= \frac{M_1 L^2}{12} + \frac{M_2 L^2}{8} + M_2 L^2 + \frac{m L^2}{4} = \frac{30 M L^2}{24} = \boxed{\frac{5 M L^2}{4}}$$

$$= 1.25\,kgm^2$$

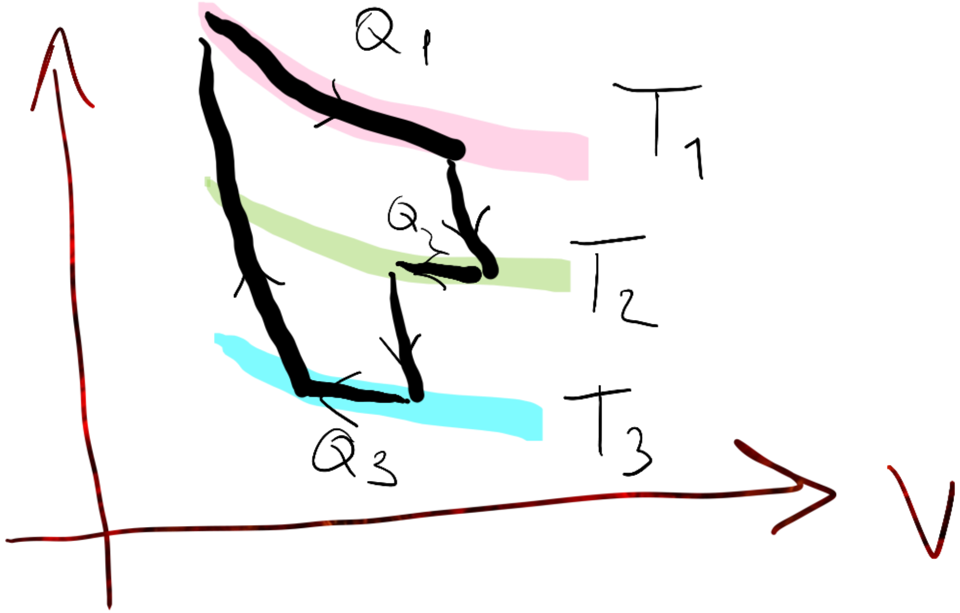
б) $$m v_0 \frac{L}{2} = I_{tot}\,\omega$$

$$\Downarrow$$

$$\omega = \frac{\frac{\cancel{M}}{3} \cdot v_0 \cdot \frac{\cancel{L}}{2}}{5\cancel{M}L^{\cancel{2}}/4} = \boxed{\frac{4 v_0}{30 L}} = 4\,\frac{rad}{s}$$

4\.

a)



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

$$\Downarrow$$

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

b) $Q_1 = T_1 \cdot \left(-\frac{Q_2}{T_2} - \frac{Q_3}{T_3} \right) = 400\,K \left(\frac{700\,J}{350\,K} + \frac{900\,J}{300\,K} \right) = 2000\,J$

$W = Q_1 + Q_2 + Q_3 = 400\,J$

c) $\eta = \frac{W}{Q_{ass}} = 20\,\%$ O.K.