10.7.2025 Fisica 1 (1)

Soluzione

1. Dati: $a_t = 6\,m/s^2$, $a_r = 2\,m/s^2$, $d = 50\,m$

Leggi orarie:
- treno: $x_t(t) = \frac{a_t t^2}{2}$
- ragazzo: $x_r(t) = a_r \frac{t^2}{2}$

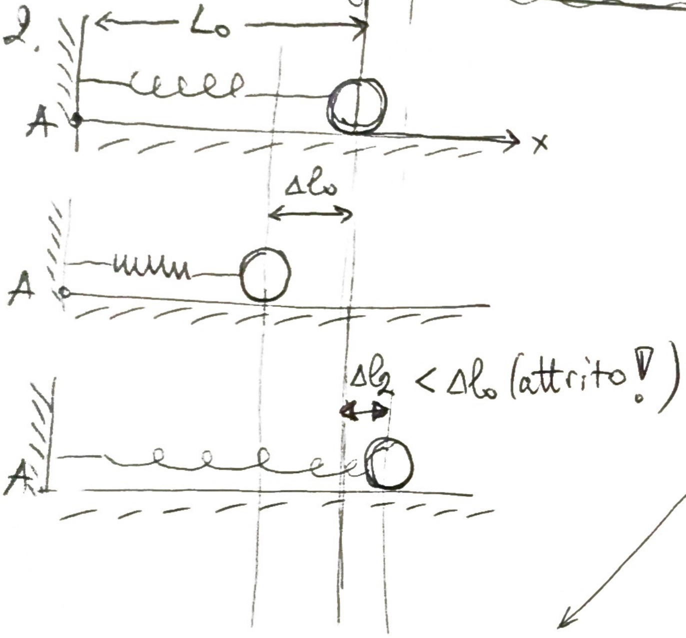
$$a_t \frac{t^{*2}}{2} - a_r \frac{t^{*2}}{2} \geq d$$

$$\Rightarrow t^{*2} \geq \frac{2d}{a_t - a_r}$$

$$\boxed{t^*_{min} = \sqrt{\frac{2d}{a_t - a_r}}}$$

$$t_{min} = \sqrt{\frac{2 \cdot 50\,m}{4\,m/s^2}} = 5\,s$$

2.



Dati: $m, k, l_0, \mu_d, \Delta l_0, g$

$$\Delta E_{mecc} = W_{\text{forze non cons.}}$$

$$\downarrow$$

$$\frac{k\Delta l_2^2}{2} - \frac{k\Delta l_0^2}{2} = -\mu_d m g (\Delta l_0 + \Delta l_2)$$

$$\downarrow$$

$$\boxed{d_{max} = L_0 + \Delta l_2}$$

$$\Delta l_2^2 - \Delta l_0^2 = -\frac{2\mu_d m g}{k}(\Delta l_0 + \Delta l_2) \Rightarrow \Delta l_2^2 \underbrace{- \Delta l_0^2 + \frac{2\mu_d m g}{k}\Delta l_0}_{c} + \underbrace{\frac{2\mu_d m g}{k}}_{b}\Delta l_2 = 0$$

$$\boxed{\Delta l_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$$

$a = 1$

$$b = \frac{2\mu_d m g}{k} = \frac{2 \cdot 0.1 \cdot 0.1\,kg \cdot 10\,m/s^2}{2\,N/m} = 0.1\,m$$

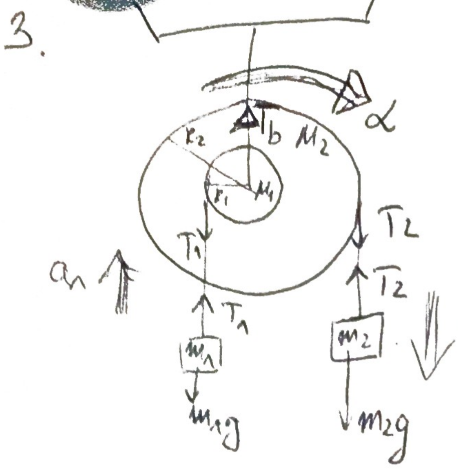
$$c = \frac{2 \cdot 0.1 \cdot 0.1\,kg \cdot 10\,m/s^2}{2\,N/m} \cdot 0.2\,m - 0.04\,m^2 = -0.02\,m^2$$

$$\Delta l_2 = \frac{-0.1\,m \pm \sqrt{(0.01 + 4 \cdot 0.02)\,m^2}}{2} = \frac{-0.1 \pm 0.3}{2}\,m = \begin{cases} \boxed{0.1\,m} \\ -0.2\,m \end{cases}$$

$$\Downarrow$$

$$\boxed{d_{max} = (0.8 + 0.1)\,m = 0.9\,m}$$

3.



Dati: m, R, g

Rotazione: $I_{tot} \cdot \alpha = T_2 R_2 - T_1 R_1$

Tras. m_1: $m_1 a_1 = T_1 - m_1 g$

Tras. m_2: $m_2 a_2 = m_2 g - T_2$

$I_{tot} = \frac{M_1 R_1^2}{2} + \frac{M_2 R_2^2}{2}$

$$\begin{cases} a_1 = \alpha \cdot R_1 \\ a_2 = \alpha \cdot R_2 \\ T_b = (M_1 + M_2) g + T_1 + T_2 \end{cases}$$

$\Rightarrow T_1 = m_1 \cdot \alpha \cdot R_1 + m_1 g$

$\Rightarrow T_2 = m_2 g - m_2 \alpha \cdot R_2$

$I_{tot} \cdot \alpha = m_2 g R_2 - m_2 \alpha R_2^2 - m_1 \alpha R_1^2 - m_1 g R_1$

$\Rightarrow \alpha (I_{tot} + m_1 R_1^2 + m_2 R_2^2) = g (m_2 R_2 - m_1 R_1)$

$$\Rightarrow \boxed{\alpha = g \cdot \frac{m_2 R_2 - m_1 R_1}{\frac{M_1 R_1^2}{2} + \frac{M_2 R_2^2}{2} + m_1 R_1^2 + m_2 R_2^2}}$$

b $\Rightarrow$ $T_1 = m_1 \alpha R_1 + m_1 g$, $T_2 = m_2 g - m_2 \alpha R_2$

c $\Rightarrow$ $T_b = (M_1 + M_2) g + T_1 + T_2$

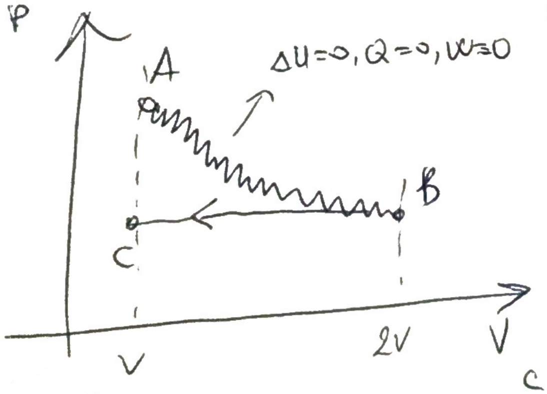
$$\Rightarrow \boxed{\alpha = g \cdot \frac{2m \cdot 2R - m \cdot R}{\frac{2m}{2} R^2 + \frac{m}{2} \cdot (2R)^2 + mR^2 + 2m \cdot (2R)^2} = \frac{g}{4R}}$$

$\Rightarrow$ $a_1 = g/4$, $a_2 = g/2$

$\Rightarrow \boxed{T_1 = \frac{mg}{4R} \cdot R + mg = \frac{5mg}{4}}$, $\boxed{T_2 = 2mg - 2m \cdot g/2 = mg}$, $\boxed{T_b = 3mg + mg + \frac{5mg}{4} = \frac{21 mg}{4}}$

4.

$T_i = 27°C = 300K$



	P	V	T
A	P	V	T
B	P/2	2V	T
C	P/2	V	T/2

a) $\boxed{T_f = \frac{T_i}{2}} = 150K$

b) $\Delta S_{AC} = \cancel{\Delta S_{AB} + \Delta S_{BC}} = \int_{A,\,REV}^{C} \frac{\delta Q}{T} = \int_{A,\,REV,\,V=cost}^{C} \frac{n c_v dT}{T} = \boxed{n c_v \ln \frac{T_C}{T_A}} = \boxed{n^{2} \cdot \frac{5}{2} R \cdot \ln \frac{1}{2}} =$

$\Delta S_{AC} = \boxed{= -5R \ln 2}$