Modul 7 - Zadaci

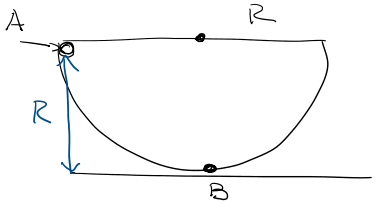
Sunday, November 26, 2023 9:13 PM

7.9) $m_k = 0{,}2\,kg$

$R = 0{,}5\,m$

$A_{AB}^{\vec{F}_{tr}} = -0{,}22\,J$

$\boxed{\Pi_x^{m\vec{g}} = mgy_x}$



a) $A_{AB}^{\vec{N}} = ?$ $A_{AB}^{m\vec{g}}$

$\boxed{A_{AB}^{\vec{N}} = 0}$

$y_A = R$, $y_B = 0$

$A_{AB}^{m\vec{g}} = \Pi_A^{m\vec{g}} - \Pi_B^{m\vec{g}} = mgy_A - \cancel{mgy_B}^{\,0} = mgy_A$

$\boxed{A_{AB}^{m\vec{g}} = 0{,}981\,J}$

b) $v_B = ?$

$a_k(B) = \frac{v_B^2}{R}$

$A_{AB} = A_{AB}^{m\vec{g}} + \cancel{A_{AB}^{\vec{N}}}^{\,0} + A_{AB}^{\vec{F}_{tr}}$

$A_{AB} = 0{,}981 - 0{,}22$

$\boxed{A_{AB} = 0{,}761\,J}$

$A_{AB} = Ek_B - Ek_A = \frac{1}{2}mv_B^2 - \cancel{\frac{1}{2}mv_A^2}^{\,0}$

$2A_{AB} = mv_B^2$

$v_B = \sqrt{\frac{2A_{AB}}{m}}$ $\boxed{v_B = 2{,}758\,m/s}$

c) $\vec{N}$ - nije const.

$m\vec{g}$ - const.

$\vec{F}_{tr}$ - nije const.

d) $N(B) = ?$ $\vec{F} = m\vec{a} = m\vec{g} + \vec{N} + \vec{F}_{tr} \;/\cdot\vec{j}$

$ma = -mg + N$

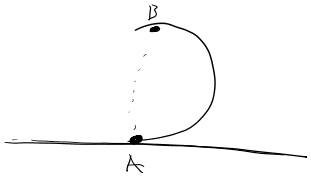
$N = ma + mg = m(a+g) = m\left(\frac{v_B^2}{R} + g\right)$ $\boxed{N = 5\,N}$

7.11) $m_k = 120\,kg$

$R = 12\,m$

$v_A = 25\,m/s$

$v_B = 8\,m/s$



$a_{kx} = \frac{v_x^2}{R}$

$A_{AB}^{\vec{F}_{tr}} = ?$ $y_A = 0$, $y_B = 2R = 24\,m$

$\Pi_A = 0$, $\Pi_B = mgy_B$ $\boxed{\Pi_B = 28252{,}8\,J}$

$Ek_A + \cancel{\Pi_A}^{\,0} + A_{AB}^{\vec{F}_{tr}} = Ek_B + \Pi_B$

$A_{AB}^{\vec{F}_{tr}} = Ek_B + \Pi_B - Ek_A$

$A_{AB}^{\vec{F}_{tr}} = \frac{1}{2}mv_B^2 + \Pi_B - \frac{1}{2}mv_A^2$

$\times \vec{F}_{tr}$

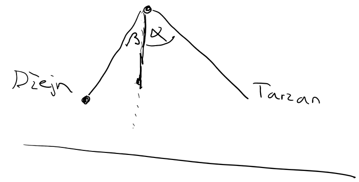
$\Pi_A = 0$, $\Pi_B = mg\,y_B$ $\boxed{\Pi_B = 28252{,}8\,J}$

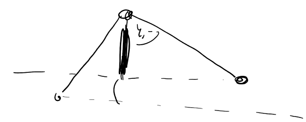
$A_{AB}^{F_{tr}} = \frac{1}{2}m v_B^2 + \Pi_B - \frac{1}{2}m v_A^2$

$A_{AB}^{\vec{F}_{tr}} = \frac{1}{2}m(v_B^2 - v_A^2) + \Pi_B$

$\boxed{A_{AB}^{\vec{F}_{tr}} = -5407{,}2\,J}$

7.12) $R = 20m$





$\alpha = 45°$, $\beta = 30°$

$v_B = ?$

$v_A = 0$

$E_{k_T} + \Pi_T = E_{k_{DŽ}} + \Pi_{DŽ}$

$\cos\alpha = \frac{y_T}{R}$ $\quad y_T = R\cos\alpha$

$\frac{1}{2}m v_A^2 + mg\,y_T = \frac{1}{2}m v_B^2 + mg\,y_{DŽ} \;/ :m \;\Big|\cdot 2$

$\cos\beta = \frac{y_{DŽ}}{R}$ $\quad y_{DŽ} = R\cos\beta$

$2g y_T = v_B^2 + 2g y_{DŽ}$ $\quad v_B^2 = 2gR(\cos\alpha - \cos\beta)$

$v_B = \sqrt{2gR\,|\cos\alpha - \cos\beta|}$ $\quad \boxed{v_B = 7{,}89\,m/s}$

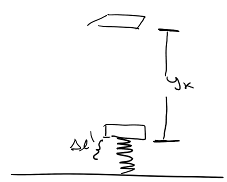
=> Tarzan nažalost obara Džejn sa drveta :(

7.14) $k = 1600\,N/m$ $\quad \boxed{\Pi_x^{opruge} = \frac{1}{2}k\,\Delta l^2}$

a) $\Delta l = ?$ $\quad \Pi_B = 3{,}2\,J$

$\Pi_B = \frac{1}{2}k\,\Delta l^2$

$\Delta l = \sqrt{\frac{2\Pi_B}{k}}$ $\quad \Delta l = 0{,}063\,m$ $\quad \boxed{\Delta l = 6{,}3\,cm}$



b) $m_k = 1{,}2\,kg$

$y_k = 0{,}8\,m$

$E_{k_{k0}} + \Pi_{k0} + A_{01} = E_{k_{k1}} + \Pi_{k1}$

$\Pi_{k0} = mg\,y_k + mg\,\Delta l' = mg(y_k + \Delta l')$

$\Pi_{k1} = \frac{1}{2}k\,\Delta l'^2$

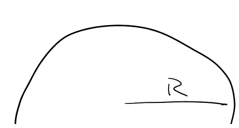
$mg(y_k + \Delta l') = \frac{1}{2}k\,\Delta l'^2$ $\quad k\,\Delta l'^2 - mg\,\Delta l' - 2mg\,y_k = 0$

$mg\,y_k + mg\,\Delta l' = \frac{1}{2}k\,\Delta l'^2 \;\Big|\cdot 2$ $\quad$ ~~$\Delta l' = -10\,cm$~~ $\vee$ $\boxed{\Delta l' = 11{,}22\,cm}$

$2mg\,y_k + mg\,\Delta l' = k\,\Delta l'^2$

7.27) $m_s = 10\,kg$

$\mu_k = 0{,}25$

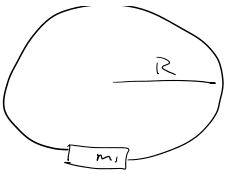


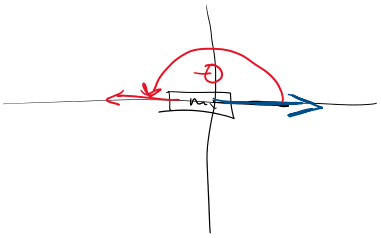
7.27) $m_3 = 10\,kg$

$\mu_D = 0{,}25$

a) $R = 2m$ b) $R = 4m$

$A_{01}^{\vec{F}_{tr}}$





$A_{01}^{\vec{F}_{tr}} = F_{tr} \cdot \cos\theta \cdot \Delta l$

$\Delta l = 2r\pi \qquad \theta = 180°$

$A_{01}^{\vec{F}_{tr}} = -\mu_D \cdot mg \cdot 2R\pi$

a) $A_{01}^{\vec{F}_{tr}} = -30\,J$

b) $A_{01}^{\vec{F}_{tr}} = -61\,J$

=> sila je nepotencijalna

7.34) $\Pi(x) = -\frac{C_6}{x^6} \qquad C_6 > 0,\ C_6 - const$

$$F_x = -\frac{d\Pi(x)}{dx} = -\frac{d}{dx}\left(-\frac{C_6}{x^6}\right) = C_6 \frac{d}{dx}\left(\frac{1}{x^6}\right) = -\frac{6C_6}{x^7}$$

$$\boxed{F_x = -\frac{6C_6}{x^7}}$$

7.46) $y_A = h$

a) $v_{min} \rightarrow N = 0$

$\vec{F} = m\vec{a} = \vec{N} + m\vec{g} \quad / \cdot \vec{j}$

$ma = mg$

$\frac{v_B^2}{R} = g \qquad v_B^2 = Rg$

$$\boxed{v_{1B} = \sqrt{Rg}}$$

$\Pi_A + \cancel{E_{k_A}}^{0} = \Pi_B + E_{k_B}$

$mgh = mg2R + \frac{1}{2}mv_B^2$

$mg(h-2R) = \frac{1}{2}mv_B^2 \quad / \cdot 2$

$2mg(h-2R) = mv_B^2$

$h - 2R = \frac{mRg}{2mg}$

$h - 2R = \frac{R}{2}$

$h = \frac{5R}{2} \Rightarrow$ $\boxed{h > \frac{5R}{2}}$

b) $h = 3{,}5R,\ R = 20m$

$\frac{2mg}{m}(h-R) = v_c^2$

$v_c = ?$, $a_{tan(c)} = ?$, $a_{norm(c)} = ?$

$y_c = h_c = R$

$\Pi_A + \cancel{Ek_A}^{\,0} = \Pi_c + Ek_c$

$mgh = mgR + \frac{1}{2}mv_c^2$

$mgh - mgR = \frac{1}{2}mv_c^2$

$v_c = \sqrt{2g(h-R)}$

$\boxed{v_c = 31{,}32\,m/s}$

$\boxed{a_{tan} = g = 9{,}81\,m/s^2}$

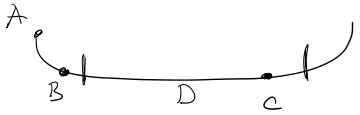
$a_k = \frac{v_c^2}{R}$ $\quad \boxed{a_k = 49\,m/s^2}$

7.47) $m_k = 2kg$

$D = 30m$

$\mu_D = 0{,}2$

$y_0 = h = 4m$



A – 0

B – 1 $\quad 2^{\circ}\ \cancel{Ek_1}^{\,0} + \cancel{D_1}^{\,0} + A_{12}^{\vec{F}_{tr}} = \cancel{Ek_2}^{\,0} + \cancel{D_2}^{\,0}$

$Ek_1 = -A_{12}^{\vec{F}_{tr}}$

$\boxed{A_{12}^{\vec{F}_{tr}} = -mgh = -78{,}48\,J}$

b) a) $v_0 = 0$

$1^{\circ}\ \cancel{Ek_0}^{\,0} + \Pi_0 = Ek_1 + \cancel{D_1}^{\,0}$

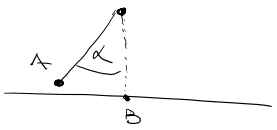
$\boxed{Ek_1 = \Pi_0 = mgh}$

$A_{12}^{\vec{F}_{tr}} = -\mu_D mg\,\Delta l$ $\quad \Delta l = \frac{78{,}48}{\mu_D mg}$ $\quad \boxed{\Delta l = 20m}$

7.82) $m_k = 0{,}12kg$

$l_{\vec{z}} = 0{,}8m$

$\alpha = 45^{\circ}$



a) $v_{iB} = ?$

$\cos\alpha = \frac{h_A}{l_{\vec{z}}}$

$h_A = \cos\alpha\, l_{\vec{z}}$

$v_A = 0$

$h_B = \cos(0^{\circ})\, l_{\vec{z}}$

$\Pi_A + \cancel{Ek_A}^{\,0} = \Pi_B + Ek_B$

$mg\cos\alpha\, l_{\vec{z}} = \frac{1}{2}mv_B^2 + mhg$

$v_{iB} = \sqrt{2g\,|\cos\alpha - 1|\, l_{\vec{z}}}$

$\boxed{v_B = 2{,}14\,m/s}$

b) $\boxed{T = mg\cos\alpha = 0{,}83N}$

c) $\vec{F} = m\vec{a} = m\vec{g} + \vec{T}$

$ma = -mg + T$

$T = ma + mg = m\left(\frac{v_B^2}{R} + g\right)$

$\boxed{T = 1{,}86N}$

$a_k = \frac{v_B^2}{R} = \frac{v_B^2}{l_{\vec{z}}}$