156.

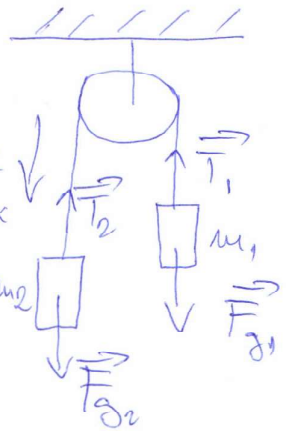
Laxi kotur!
Neistegljivi konac

$m_1 = 10g = 10^{-2}kg$

$m_2 = 30g = 3 \cdot 10^{-2}kg$

$a_1 = ?\quad a_2 = ?$

$T_1 = ?\quad T_2 = ?$

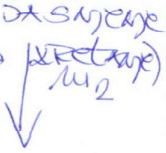


Neistegljiva nit

$a_1 = a_2 = a$

$T_1 = T_2 = T$ (obješenje vezano za rotacijsko kretanje)

$m_2 > m_1$



$$\vec{F} = m\vec{a}$$

1. Tijelo

$$\vec{T}_1 + \vec{F}_{g1} = m_1\vec{a}_1$$

$$F_{g1} = m_1 g$$

$$F_{g2} = m_2 g$$

x: $\vec{T}_1 + \vec{F}_{g1} = m_1\vec{a}_1$

$$T_1 - F_{g1} = m_1 a_1$$

(1) $$\boxed{T - m_1 g = m_1 a}$$

2. Tijelo

$$\vec{T}_2 + \vec{F}_{g2} = m_2\vec{a}_2$$

x: $\vec{T}_2 + \vec{F}_{g2} = m_2\vec{a}_2$

$$F_{g2} - T_2 = m_2 a_2$$

(2) $$\boxed{m_2 g - T = m_2 a}$$

iz (1)+(2) $\Rightarrow$ $(m_2 - m_1)g = a(m_1 + m_2)$

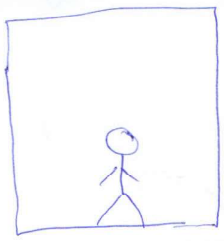
$$\boxed{a = \frac{(m_2 - m_1)g}{m_1 + m_2}}$$

iz (1) $\Rightarrow$ $$\boxed{T = m_1(a + g)}$$

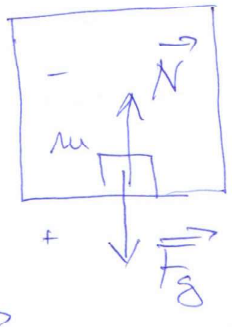
158.

$m = 70\,kg$

$N = ?$



a) $\vec{v}_L = \vec{0}$



$\vec{a}_L = \vec{a}_t$

$\vec{v}_L = \vec{0} \Rightarrow \vec{a}_L = \vec{0} \Rightarrow \vec{a}_t = \vec{0}$

$\vec{F}_t = m\vec{a}_t$

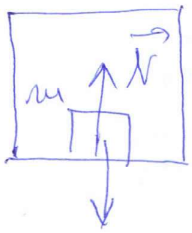
$\vec{N} + \vec{F}_g = m\vec{a}_t$ ($\vec{a}_t = \vec{0}$)

$F_g - N = 0 \quad ; \quad F_g = mg$

$\boxed{N = mg}$

b) $v_L = const.$

$\vec{a}_L = \vec{a}_t$



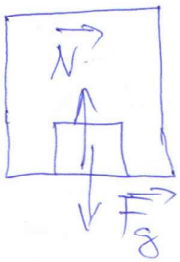
$\vec{v}_L = const \Rightarrow \vec{a}_L = \vec{0} = \vec{a}_t$

$\vec{F}_t = m\vec{a}_t$

$\vec{N} + \vec{F}_g = m\vec{a}_t$ ($\vec{a}_t = \vec{0}$)

$F_g - N = 0 \Rightarrow N = mg$

c) $a = 3\,\frac{m}{s^2}$ ↑



x +

↑ $\vec{a}_L$

−

$\vec{a}_L = \vec{a}_t$

$F_g = mg$

$\vec{F}_t = m\vec{a}_t$

$\vec{N} + \vec{F}_g = m\vec{a}_t$

$N - F_g = ma_t \Rightarrow N = m(g + a_t)$

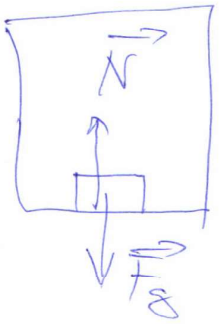
158 nast.

d)

$\vec{F}_t = m\vec{a}_t$

$\vec{N} + \vec{F}_g = m\vec{a}_t$

$F_g - N = ma_t$

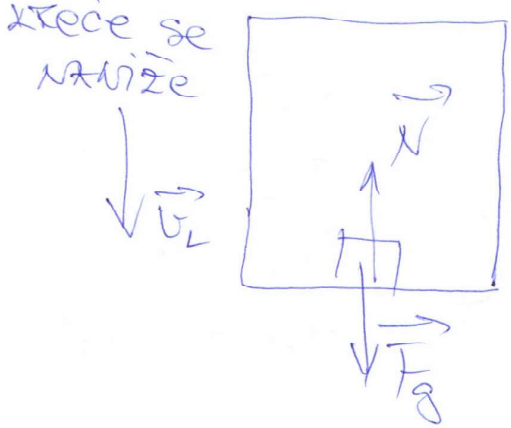


$\vec{a}_t = \vec{a}_L$

$N = mg - ma_t = m(g - a_t)$

e) NAVIŽE USPORENO

+↑ x



kod usporenog kretanja $\vec{v}$ i $\vec{a}$ imaju suprotan smjer

$\vec{a}_t = \vec{a}_L$

$F_g = mg$

$\vec{F}_t = m\vec{a}_t$

$\vec{N} + \vec{F}_g = m\vec{a}_t$

$N - F_g = ma_t$

$N = F_g + ma_t = m(g + a_t)$

163.

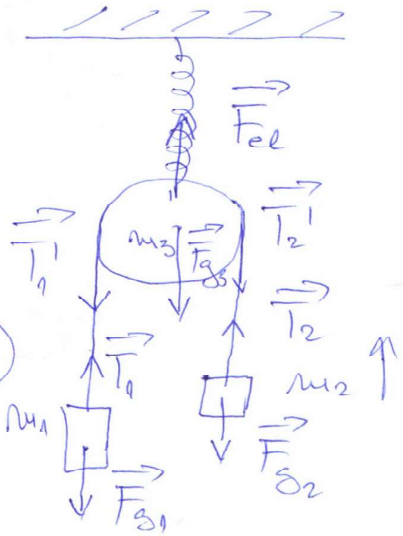
$m_3 \approx 0\,kg$

$m_x \approx 0$

$F_3 = ?$ $F_{el} = ?$

Kotur miruje (tranzl.)

$\vec{F}_3 = \vec{0}$



Nit neistegljiva

$a_1 = a_2 = a$

III Newtonov zakon

$T_1' = T_1$

$T_2' = T_2$

a) $m_1 = m_2 = 100\,g$

$F_{el} = ?$

$\vec{F}_3 = m_3 \vec{a}_3 = \vec{0}$

$\vec{F}_{el} + \vec{T}_1' + \vec{T}_2' = \vec{0}$

$F_{el} - T_1' - T_2' = 0$

$F_{el} = 2T$

$T_1' = T_2' = T_1 = T_2 = T$

$m_1 = m_2 = m$

$a_1 = a_2 = a$

1. telo

$\vec{F}_1 = m_1 \vec{a}_1$

$\vec{T}_1 + \vec{F}_{g1} = m_1 \vec{a}_1$

$F_{g1} - T_1 = m_1 a_1$

(1) $\boxed{m g - T = m a}$

2. telo

$\vec{F}_2 = m_2 \vec{a}_2$

$\vec{T}_2 + \vec{F}_{g2} = m_2 \vec{a}_2$

$T_2 - F_{g2} = m_2 a_2$

(2) $\boxed{T - mg = ma}$

(1) + (2) $\Rightarrow$ $0 = 2ma \Rightarrow a = 0$

iz (1) $T = mg \Rightarrow \boxed{F_{el} = 2mg}$

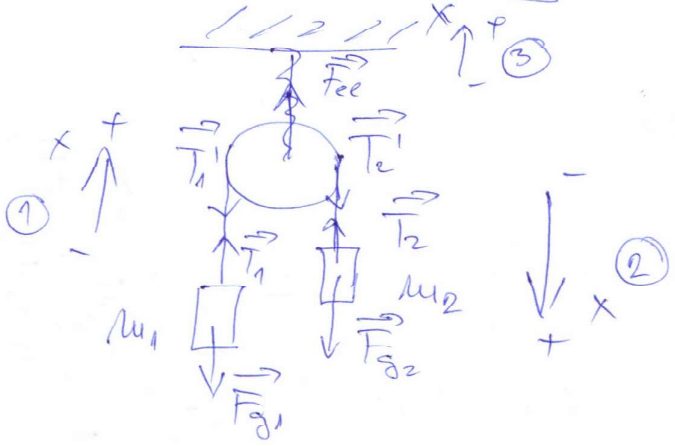
b) $m_1 = 0{,}1\,kg$

$m_2 = 0{,}3\,kg$

$F_{el} = ?$

$a_1 = a_2 = a$

$T_1 = T_1' = T_2 = T_2' = T$



163. ~~nastavak~~

~~Fel=?~~

③ $\vec{F}_3 = m_3 \vec{a}_3 = \vec{0}$

$\vec{F}_{el} + \vec{T}_1' + \vec{T}_2' = \vec{0}$

$F_{el} - T_1' - T_2' = 0$

$\boxed{F_{el} = 2T}$

① tijelo $\vec{F}_1 = m_1 \vec{a}_1$

$\vec{F}_{g1} + \vec{T}_1 = m_1 \vec{a}_1$

$T_1 - F_{g1} = m_1 a_1$

① $\boxed{T - m_1 g = m_1 a}$

② tijelo $\vec{F}_2 = m_2 \vec{a}_2$

$\vec{F}_{g2} + \vec{T}_2 = m_2 \vec{a}_2$

$F_{g2} - T_2 = m_2 a_2$

② $\boxed{m_2 g - T = m_2 a}$

iz ① + ② $\Rightarrow$ $m_2 g - m_1 g = m_1 a + m_2 a$

$$a = \frac{(m_2 - m_1)}{m_1 + m_2} g$$

iz ① $\Rightarrow$ $T = m_1 (g + a)$

$$T = m_1 \left(g + \frac{(m_2 - m_1)}{m_1 + m_2} g \right)$$

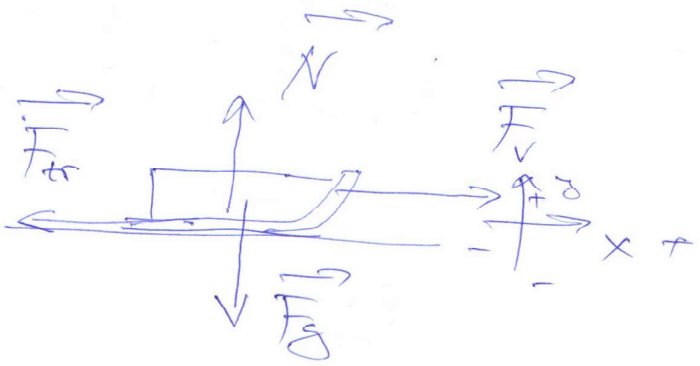
$$\boxed{T = \frac{2 m_1 m_2}{m_1 + m_2} g} \Rightarrow \boxed{F_{el} = \frac{4 m_1 m_2}{m_1 + m_2} g}$$

1164.

$m = 50\,kg$

$F_v = 200\,N$

$\mu = 0{,}3$



$N = ?$ $a = ?$

$\vec{F} = m\vec{a}$ $\qquad \vec{a} = \vec{a}_x$

$\vec{F}_{tr} + \vec{F}_g + \vec{F}_v + \vec{N} = m\vec{a}$

x osa: $\vec{F}_{tr} + \vec{F}_v = m\vec{a}$ $\qquad - \longrightarrow + \; x$

$F_v - F_{tr} = ma$

$F_{tr} = \mu \cdot N \Rightarrow$ ① $\boxed{F_v - \mu N = ma}$

y osa: $\vec{F}_g + \vec{N} = \vec{0}$ $\qquad + \uparrow y \; -$

$N - F_g = 0 \Rightarrow N = F_g = mg$

② $\boxed{N = mg}$

iz ① i ② $\Rightarrow F_v - \mu mg = ma$

$$\boxed{a = \frac{F_v - \mu mg}{m}}$$

167.

$\mu = 0{,}05$

$v_{01} = 0\ \frac{m}{s}$

$a_1 = 0{,}8\ \frac{m}{s^2}$

$t_1 = 12\ s$

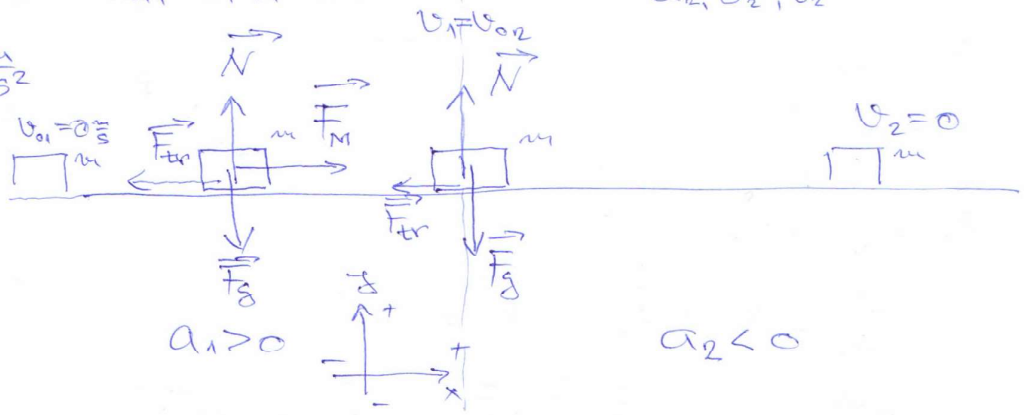
$v_2 = 0\ \frac{m}{s}$

$v_{max} = ?$

$s_u = ?$

1. kretanje
RAVNO. UBR.
a_1, s_1, t_1

2. kretanje
RAVNO USPO.
a_2, s_2, t_2



$v_{max} = v_1$

$v_1 = \cancel{v_{01}^{0}} + a_1 t_1$

$v_1 = a_1 t_1$

$v_1 = 0{,}8\ \frac{m}{s^2} \cdot 12\ s$

$v_1 = 9{,}6\ \frac{m}{s}$

$\boxed{v_{max} = 9{,}6\ \frac{m}{s}}$

$s_u = (s_1) + (s_2)$? ?

$s_1 = \cancel{v_{01}^{0} t_1} + \frac{a_1 t_1^2}{2}$

$s_1 = \frac{0{,}8\ \frac{m}{s^2} \cdot (12\ s)^2}{2}$

$s_1 = \frac{0{,}8\ \frac{m}{s^2} \cdot 144\ s^2}{2}$

$s_1 = 57{,}6\ m$

$v_{02} = v_1 = 9{,}6\ \frac{m}{s}$

$v_2 = 0$

$s_2 = ?$

$\cancel{v_2^{2}}^{0} = v_{02}^2 - 2|a_2| s_2$

$s_2 = \frac{v_{02}^2}{2|a_2|}$

Za nalaženje a_2 koristimo II Njut. z. za 2. kretanje

$\vec{N} + \vec{F}_g + \vec{F}_{tr} = m\vec{a}_2$

x: $\vec{F}_{tr} = m\vec{a}_2$

$-F_{tr} = m a_2$ (1)

$F_{tr} = \mu \cdot N \Rightarrow -\mu N = m a_2$

y: $\vec{N} + \vec{F}_g = \vec{0}$

$N - F_g = 0 \ ; \ F_g = mg$

$\boxed{N = mg}$ (2)

iz (1) : (2)

$-\mu \cancel{m} g = \cancel{m} a_2$

$a_2 = -\mu g \Rightarrow a_2 = -0{,}5\ \frac{m}{s^2}$

$|a_2| = 0{,}5\ \frac{m}{s^2}$; "−" USPORENO

$s_2 = \frac{v_{02}^2}{2|a_2|}$ $\Rightarrow$ $s_u = s_1 + s_2$

$\boxed{s_u = s_1 + \frac{v_{02}^2}{2|a_2|}}$

338.

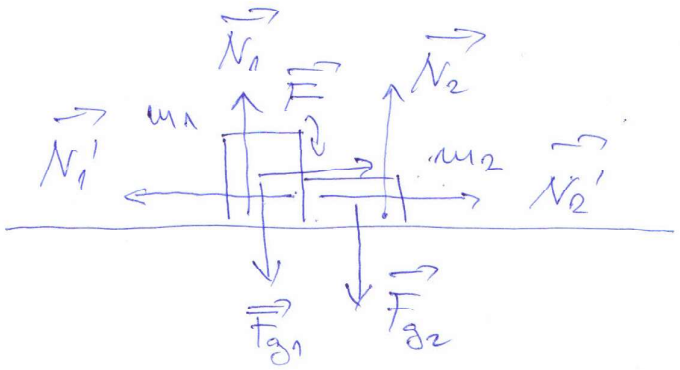
$m_1 = 3\,kg$

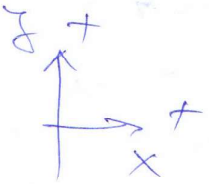
$m_2 = 1\,kg$

$F = 1{,}6\,N$

$a_1 = ?\ a_2 = ?$

$\vec{N_1}' = ?\ N_2' = ?$





Podloga glatka $\Rightarrow$ NEMA sile trenja

Tijela 1 i 2 međusobno djeluju silama otpora podloge $\vec{N_1}'$ i $\vec{N_2}'$ i vrijedi (III Njut. zak.) $\vec{N_1}' = -\vec{N_2}'$

odnosno $N_1' = N_2'$; tijela se kreću zajedno $\Rightarrow \vec{a_1} = \vec{a_2} = \vec{a}$

1. tijelo II Njutnov zakon $\vec{F}_{u1} = m_1 \vec{a}_1$; $a_1 = a_2 = a$

$$\vec{N_1}' + \vec{F}_{g1} + \vec{F} + \vec{N_1} = m_1 \vec{a}_1$$

x osa $\quad \vec{N_1}' + \vec{F} = m_1 \vec{a}_1$

$$\boxed{F - N_1' = m_1 a} \quad (1)$$

2. tijelo $\vec{F}_{u2} = m_2 \vec{a}_2 \Rightarrow \vec{N_2} + \vec{F}_{g2} + \vec{N_2}' = m_2 \vec{a}_2$

x osa $\quad \vec{N_2}' = m_2 \vec{a}_2 \Rightarrow N_2' = m_2 a_2$

$$\boxed{N_1' = m_2 a} \quad (2)$$

iz (1) i (2) $\Rightarrow$ $F - m_2 a = m_1 a$

$$F = a(m_1 + m_2)$$

$$\boxed{a = \frac{F}{m_1 + m_2}} \quad (3)$$

iz (2) i (3)

$$\boxed{N_1' = N_2' = \frac{m_2 F}{m_1 + m_2}}$$

352.

$m = 4\,kg$

$M = 5\,kg$

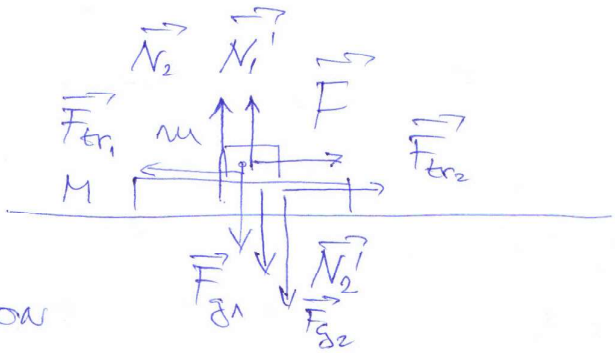
$\mu_1 = 0{,}3$

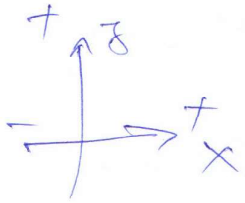
$\mu_2 = 0$

a)

Ne xlizi m poM

$\Rightarrow a_1 = a_2 = a$





III Njutnov zakon

$\vec{N_1}' = -\vec{N_2}' \Rightarrow N_1' = N_2'$

$\vec{F}_{tr_1} = -\vec{F}_{tr_2} \Rightarrow \boxed{F_{tr_1} = F_{tr_2}}$ (1')

Telo m (TORBA) II Njutnov zakon

$\vec{F}_1 = m\vec{a}_1 \Rightarrow \vec{F}_{tr_1} + \vec{N_1}' + \vec{F}_{g1} + \vec{F} = m\vec{a}_1$

x-osa $\vec{F}_{tr_1} + \vec{F} = m\vec{a}_1$ $\quad F_{tr_1} = \mu_1 \cdot N_1' = \mu_1 mg$

$F - F_{tr_1} = ma_1 \Rightarrow \boxed{F - \mu_1 N_1' = ma}$ (1)

y-osa: $\vec{N_1}' + \vec{F}_{g1} = \vec{0} \Rightarrow N_1' - F_{g1} = 0 \Rightarrow \boxed{N_1' = F_{g1} = mg}$ (2)

iz (1) i (2) $\boxed{F - \mu_1 mg = ma}$ (3)

Telo M

$\vec{F}_{tr_2} + \vec{N_2} + \vec{F}_{g2} = M\vec{a}_2$

x osa $\vec{F}_{tr_2} = M\vec{a}_2$

$F_{tr_2} = Ma_2$

iz (1') $\Rightarrow F_{tr_1} = Ma$

$\mu_1 mg = Ma \Rightarrow \boxed{a = \frac{\mu_1 m}{M} g}$ (4)

Zamenom (4) u (3) dobijamo

$F = \mu_1 mg + m \cdot \mu_1 \frac{m}{M} g$

$\boxed{F = \mu_1 mg\left(1 + \frac{m}{M}\right)}$