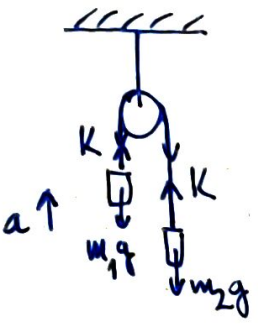
F1



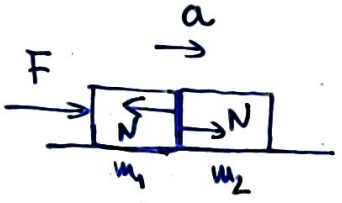
$$\left.\begin{aligned} K - m_1 g &= m_1 a \\ m_2 g - K &= m_2 a \end{aligned}\right\} \oplus$$

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

$$K = m_1 a + m_1 g = m_1 g \left(\frac{m_2 - m_1}{m_1 + m_2} + 1 \right) = m_1 g \cdot \frac{2m_2}{m_1 + m_2}$$

F2.

$m_1 = 2\,kg$
$m_2 = 8\,kg$
$F = 20\,N$

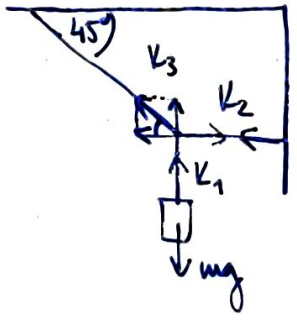


$$\left.\begin{aligned} F - N &= m_1 \cdot a \\ N &= m_2 \cdot a \end{aligned}\right\} \oplus$$

$$F = (m_1 + m_2)a \rightarrow a = \frac{F}{m_1 + m_2} = 2\,\frac{m}{s^2}$$

$$N = \frac{m_2 \cdot F}{m_1 + m_2} = 16\,N$$

F3

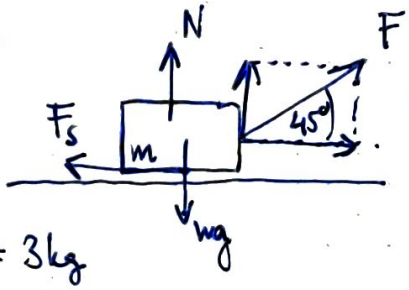


$$mg = K_1 = 50\,N$$

$$K_3 \cdot \sin 45^\circ = K_1 = mg \rightarrow K_3 = \frac{mg}{\sin 45^\circ} = 71\,N$$

$$K_2 = K_3 \cdot \cos 45^\circ = \frac{mg}{\operatorname{tg} 45^\circ} = mg = 50\,N$$

F4



$m = 3\,kg$
$\mu_0 = 0{,}5$
$\mu = 0{,}4$

a, elinduláskor még $a = 0$ és a tapadási súrlódási erő maximumra hat.

$$x: \; F \cdot \cos 45^\circ = F_s^{(tap)} \quad (1)$$

$$y: \; mg = N + F \cdot \sin 45^\circ \rightarrow N = mg - F \sin 45^\circ \quad (2)$$

$$F_s^{(tap)} \leq \mu_0 N \quad (3)$$

(3): $F\cos 45° \leq \mu_0 (mg - F\sin 45°)$

$F(\cos 45° + \mu_0 \sin 45°) \leq \mu_0 mg$

$$F \leq \frac{\mu_0 mg}{\mu_0 \sin 45° + \cos 45°} \approx 14N$$

b)

x: $F\cos 45° - F_S^{(rs)} = ma$ (1)

y: $mg = F\sin 45° + N \rightarrow N = mg - F\sin 45°$ (2)

$F_S^{(rs)} = \mu N$ (3)

(1): $F\cdot\cos 45° - \mu(mg - F\sin 45°) = ma$

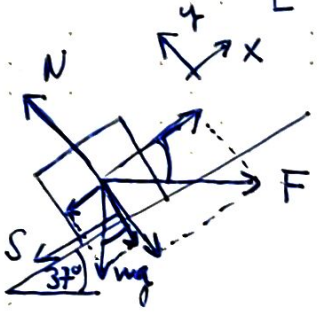
$$a = \frac{F(\cos 45° + \mu \sin 45°) - \mu mg}{m} = \left[\frac{\mu_0(\cos 45° + \mu \sin 45°)}{\cos 45° + \mu_0 \sin 45°} - \mu\right] g \approx 0{,}7 \frac{m}{s^2}$$

F5

$m = 20kg$

$F = 400N$

$\mu_0 = \mu = 0{,}2$



a)

y: $N = mg\cos\alpha + F\sin\alpha \approx 400N$

$S = \mu N \approx 80N$

b) $F\cos\alpha - S - mg\sin\alpha = ma \rightarrow a \approx 6{,}1 m/s^2$

c) $a = 0$; $N = mg\cos\alpha + F\sin\alpha$ (1)

x: $F\cos\alpha = S + mg\sin\alpha$ (3)

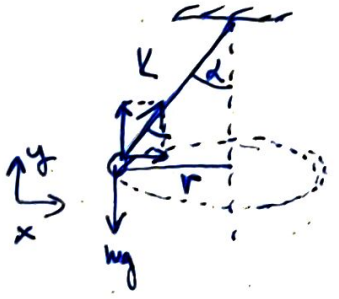
(2) $S = \mu_0 N$ (max. a maximum hat)

(3): $F\cos\alpha = \mu_0(mg\cos\alpha + F\sin\alpha) + mg\sin\alpha$

$F\cos\alpha - \mu_0 F\sin\alpha = \mu_0 mg\cos\alpha + mg\sin\alpha$

$$F = mg \cdot \frac{\mu_0\cos\alpha + \sin\alpha}{\cos\alpha - \mu_0\sin\alpha} \approx 220\,N$$

F6) $m = 300\,g$
$L = 50\,cm$
$T = 1\,s$



y: $K\cos\alpha = mg$ (1)

x: $K\sin\alpha = m\frac{v^2}{r}$

$r = L\sin\alpha$

$$\frac{\cos\alpha}{\sin\alpha} = \frac{gr}{v^2} = \frac{gr}{\left(\frac{2\pi r}{T}\right)^2} =$$

$$= \frac{gr}{4\pi^2 r^2}\cdot T^2 = \frac{gT^2}{4\pi^2 \cdot L\sin\alpha} \Rightarrow$$

$\Rightarrow$ sinα-val egyszerűsítve:

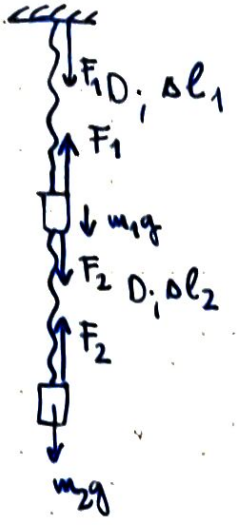
$$\cos\alpha = \frac{gT^2}{4\pi^2 L} \rightarrow \alpha \approx 60°$$

(1): $$K = \frac{mg}{\cos\alpha} = \frac{4\pi^2 mL}{T^2} \approx 6\,N$$

F7.

$m_1 = 1\,kg$

$m_2 = 2\,kg$



a) egyensúly:

$$D\Delta l_1 = m_1 g + D\Delta l_2$$

$$D\Delta l_2 = m_2 g$$

$$\frac{\Delta l_1}{\Delta l_2} = \frac{m_1 + m_2}{m_2} = \frac{3}{2}$$

b) $F_1 = 0$ lesz, de a másik rugó hossza az elvágást követő pillanatban még nem változik meg:

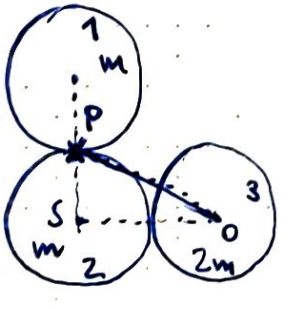
$$\left.\begin{aligned} D\Delta l_2 + m_1 g &= m_1 a \\ \text{és } D\Delta l_2 &= m_2 g \text{ most is igaz} \end{aligned}\right\} \quad a = \frac{m_1 + m_2}{m_1} g = 3g$$

c) Most $F_2 = 0$ és $F_1 = D\Delta l_1$ marad:

$$\left.\begin{aligned} \underbrace{D\Delta l_1}_{(m_1+m_2)g} - m_1 g &= m_1 a \end{aligned}\right\} \rightarrow \quad a = \frac{m_2}{m_1} g = 2g$$

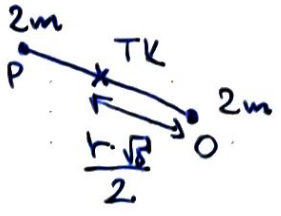
F8

$r = 1\,dm$

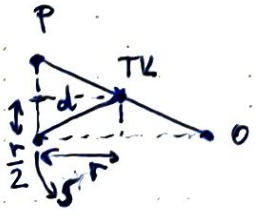


P: 1 és 2. körös TK-ja

$\overline{PO} = r \cdot \sqrt{5}$



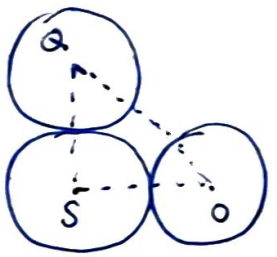
$\rightarrow d = \frac{r\sqrt{5}}{2}$ (tűhöröés)



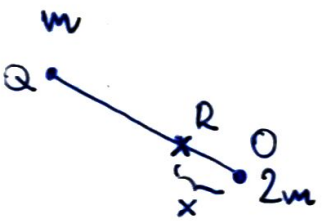
vagy kiszámolva:

$$d = \sqrt{r^2 + \left(\frac{r}{2}\right)^2} = r \cdot \frac{\sqrt{5}}{2}$$

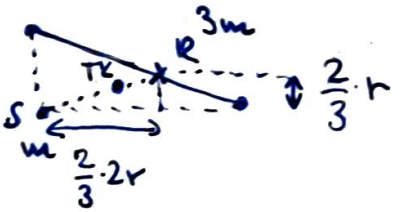
másik mód (pl.)



$\overline{OQ} = r \cdot 2\sqrt{2}$



$$2mx = m(r \cdot 2\sqrt{2} - x)$$
$$2x = r2\sqrt{2} - x$$
$$3x = r \cdot 2\sqrt{2}$$
$$x = r \cdot \frac{2\sqrt{2}}{3}$$



$$\overline{RS} = \sqrt{\left(\frac{2}{3}r\right)^2 + \left(\frac{4}{3}r\right)^2} = \frac{\sqrt{20}}{3}r$$

S-TK távolság:

$$md = 3m \cdot (\overline{RS} - d)$$

$$d = \frac{3m}{4m}\overline{RS} = \frac{3}{4} \cdot \frac{\sqrt{20}}{3}r = \frac{\sqrt{5}}{2}r$$