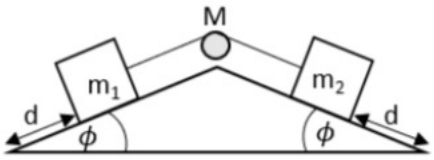
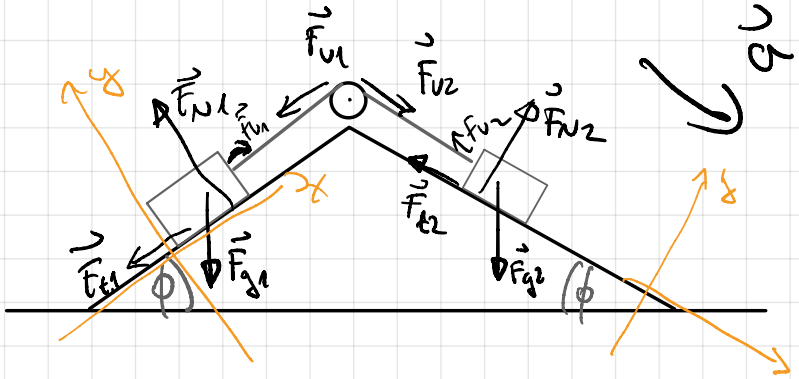
4.) Dve kladi (m_1=1kg in m_2=5kg) položimo na dvojni klanec z naklonom φ=30° in ju povežemo z lahko neraztegljivo vrvjo preko valjastega škripca z maso M=4kg (glej sliko). Vsaka klada se nahaja na razdalji d=8m od najbljižjega vznožja. Izračunaj hitrost padajoče klade, ko doseže vznožje klanca, če je koeficient trenja za obe kladi $k_{tr}=1/(2\sqrt{3})$. Na začetku vsi trije predmeti mirujejo in vrv na škripcu ne spodrsava.





II. Newtonov zakon: $\sum_i \vec{F}_i = m\vec{a}$ za vsako telo 5

II Newton zakon $\sum_i \vec{M}_i = J\alpha$ za škripec 5

Sile 2. telo:

$$m_2\vec{a} = -\vec{F}_{g2} + \vec{F}_{N2} - \vec{F}_{t2} - \vec{F}_{v2}$$

x: $m_2 a = m_2 g \sin\ell - k_t F_{N2} - F_{v2}$ 3

y: $0 = -m_2 g \cos\ell + F_{N2}$

$\rightarrow F_{N2} = m_2 g \cos\ell$

potem še x povstavi:

$m_2 a = m_2 g \sin\ell - k_t m_2 g \cos\ell - F_{v2}$

Sile 1. telo:

$$m_1\vec{a} = -\vec{F}_{g1} + \vec{F}_{N1} - \vec{F}_{t1} + \vec{F}_{v1}$$

x: $m_1 a = -m_1 g \sin\ell - k_t F_{N1} + F_{v1}$ 3

y: $0 = -m_1 g \cos\ell + F_{N1}$

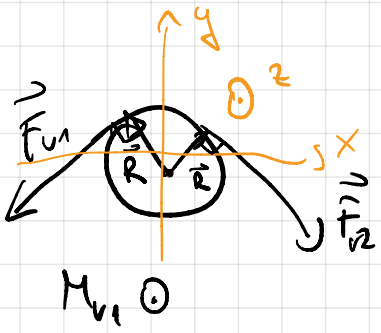
$$F_{N1} = m_1 g \cos\alpha$$

plam α x postavi:

$$x: \quad m_1 a = -m_1 g \sin\alpha - k_t m_1 g \cos\alpha + F_{t1}$$

Navori na škripec:

$$\sum_i M_i = J\alpha$$



$$R F_{t1} - R F_{t2} = -J \cdot \alpha \qquad 3$$

J za valj: $\frac{1}{2} m R^2$ 1

$$R F_{t1} - R F_{t2} = -\frac{1}{2} m R^2 \alpha$$

$$F_{t1} - F_{t2} = -\frac{1}{2} m R \alpha \qquad \text{upoštevaj} \quad a = \alpha \cdot R$$

$$= -\frac{1}{2} m a$$

↑ masa valja

⇒ Torej imamo 3 enačbe:

2. telo: $m_2 a = m_2 g \sin\alpha - k_t m_2 g \cos\alpha - F_{t2}$

1. telo $m_1 a = -m_1 g \sin\alpha - k_t m_1 g \cos\alpha + F_{t1}$

Škripec $F_{t1} - F_{t2} = -\frac{1}{2} m a$

iz škripca izrazim $F_{t2} = F_{t1} + \frac{1}{2} m a$

1. telo + škripec: $m_2 a = m_2 g(\sin\varphi - k_t\cos\varphi) - F_{v1} - \frac{1}{2} m a$

2. telo: 2 $m_1 a = -m_1 g(\sin\varphi + k_t\cos\varphi) + F_{v1}$

(oz. karkoli nasprotnega)

} + da se znebim F_{v1}

$$(m_1 + m_2) a = m_2 g(\sin\varphi - k_t\cos\varphi) - \frac{1}{2} m a - m_1 g(\sin\varphi + k_t\cos\varphi)$$

$$\left(m_1 + m_2 + \frac{1}{2} m\right) a = (m_2 - m_1) g \sin\varphi - (m_1 + m_2) g\, k_t \cos\varphi$$

$$= g\left\{ m_2(\sin\varphi - k_t\cos\varphi) - m_1(\sin\varphi + k_t\cos\varphi)\right\}$$

$$= g\left\{ m_2\left(\frac{1}{2} - \frac{1}{4}\right) - m_1\left(\frac{1}{2} + \frac{1}{4}\right)\right\}$$

$m_1 = 1\,kg$

$m_2 = 5\,kg$

$m = 4\,kg$

$\sin\varphi = \sin 30° = \frac{1}{2}$

$k_t\cos\varphi = \frac{\cos 30°}{2\sqrt{3}} = 0{,}25$

$$\Rightarrow a = g\,\frac{\frac{1}{4} m_2 - \frac{3}{4} m_1}{m_1 + m_2 + \frac{1}{2} m}$$

$$a = g\,\frac{\frac{5}{4} - \frac{3}{4}}{8} = g\,\frac{\frac{2}{4}}{8}$$

1 $$a = \frac{g}{16} = \underline{0{,}625\,m/s^2}$$

hitrost na dnu?

→ čas do dna

$$d = \frac{1}{2} a t^2 \rightarrow t = \sqrt{\frac{2d}{a}} = \underline{5{,}06\,s}$$

$$v = a \cdot t = \sqrt{2da} = \underline{3{,}16\,m/s}$$

2

Selected text | 4.)

Andrej Lozar
9:34 PM Nov 30

1/2MR^2 * a / R = m2*g*(sin(fi) - ktr*cos(fi)) - a * (m2+m1) - m1*g*(sin(fi) + ktr*cos(fi))
a = g * (m2*(sin(fi) - ktr*cos(fi)) - m1 * (sin(fi) + ktr*cos(fi))) / (M/2 + m1 + m2)
a = g / 32
v=5m/s

Žiga Gosar
9:15 PM Dec 1 (edited 9:15 PM Dec 1)

morda še en vmesen rezultat za a:
a * (M/2 + m1 + m2) = g (m2/4 - 3/4*m1)
---
vmesen rezultat za čas do dna
t = 7.155s (7.224 če g = 9.81)
---
v = sqrt(5) = 2.236m/s (2.2147 m/s če g = 9.81)

Reply or add others with @

ST: $F = ma$
$M = J\alpha$
ST: ΣF 1. telo
ST: ΣF 2. telo
ST: M_v
ST rezultat