8.5

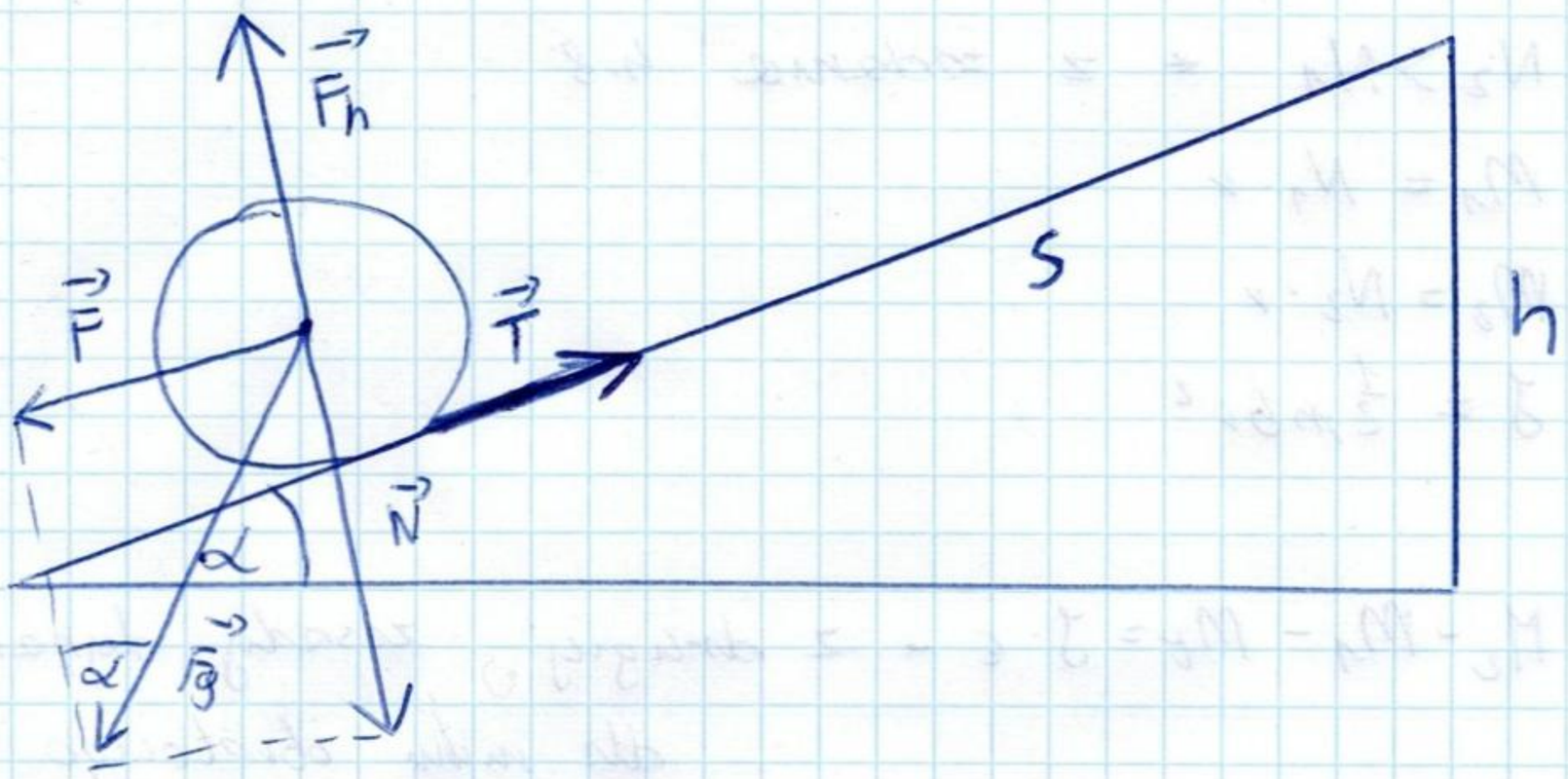
DANE:

$m = 0{,}2\,kg$

$v = 2\frac{m}{s}$

$\alpha = 10^{\circ}$

$g = 10\frac{m}{s^2}$



Z FUNKCJI TRYGONOMETRYCZNEJ:

$\sin\alpha = \frac{h}{s} \Rightarrow h = s\sin\alpha$

$\sin\alpha = \frac{F}{F_g} \Rightarrow F = F_g \sin\alpha$

$\cos\alpha = \frac{N}{F_g} \Rightarrow N = F_g \cos\alpha$

$F_g = mg$

$\vec{M} = \vec{r} \times \vec{T}$

$M = rT \sin 90^2$

$M = rT \cdot 1$

$M = rT$

$J\varepsilon = M$

$\frac{2}{5} mr^2 \frac{a}{r} = rT$

$\frac{2}{5} mra = rm(g \sin\alpha - a) \quad / : mr$

$\frac{2}{5} a = g \sin\alpha - a \quad / + a$

$\frac{7}{5} a = g \sin\alpha \quad / \cdot \frac{5}{7}$

$a = \frac{5}{7} g \sin\alpha$

PODSTAWIAMY

$a = \frac{5}{7} \cdot 10 \frac{m}{s^2} \cdot \sin 10° = \frac{5}{7} \cdot 10 \frac{m}{s^2} \cdot 0{,}1736 =$

$= 1{,}24 \frac{m}{s^2} \approx 1{,}2 \frac{m}{s^2}$

$T = 0{,}25 kg \cdot (10 \frac{m}{s^2} \cdot \sin 10° - 1{,}24 \frac{m}{s^2}) =$

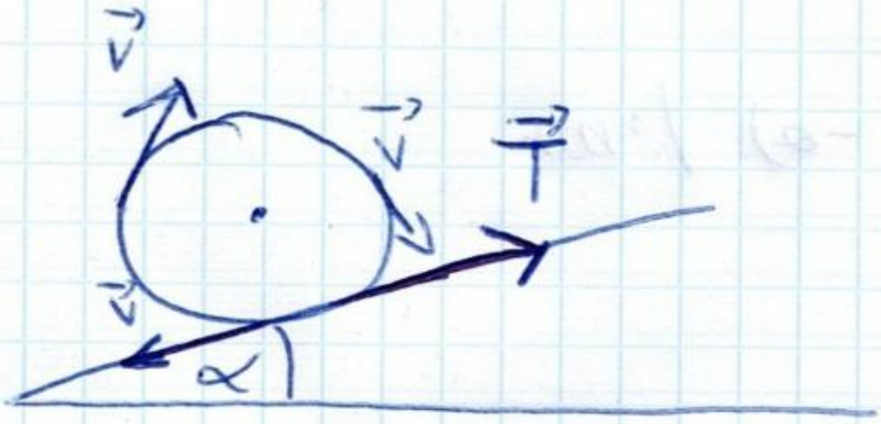
$= 0{,}25 kg \cdot (10 \frac{m}{s^2} \cdot 0{,}1736 - 1{,}24 \frac{m}{s^2}) =$

$= 0{,}25 kg \cdot (1{,}736 \frac{m}{s^2} - 1{,}24 \frac{m}{s^2}) =$

$= 0{,}25 kg \cdot 0{,}496 \frac{m}{s^2} = 0{,}124 kg \cdot \frac{m}{s^2} = 0{,}124 N \approx 0{,}1 N$

a)

siła tarcia ma zwrot przeciwny do wektora prędkości ciała w danym punkcie



Zwrot siły tarcia statecznego skierowany jest ku górze

b)

Z drugiej zasady dynamiki
(ruch jednostajnie opóźniony)

$T - f = -m \cdot a \quad / + F$

$T = F - ma$

$T = F_g \sin\alpha - ma$

$T = mg \sin\alpha - ma$

$T = m(g \sin\alpha - a)$

$J \cdot \varepsilon = M$ - DRUGA ZASADA DYNAMIKI DLA RUCHU OBROTOWEGO

$J = \frac{2}{5} m r^2$ - MOMENT BEZWŁADNOŚCI KULI TOCZĄCEJ SIĘ Z RÓWNI POCHYŁEJ

$\varepsilon = \frac{a}{r}$ - PRZYŚPIESZENIE KĄTOWE

$\vec{M} = \vec{T} \times \vec{r}$ - MOMENT SIŁY

c)

$$s = v_0 t - \frac{1}{2} a t^2$$

$$t = \frac{v_0}{a}$$

$$s = v_0 t - \frac{1}{2} a t^2$$

$$s = v_0 \cdot \frac{v_0}{a} - \frac{1}{2} a \cdot \left(\frac{v_0}{a}\right)^2$$

$$s = \frac{v_0^2 a}{a} - \frac{1}{2} a \cdot \frac{v_0^2}{a^2}$$

$$s = \frac{2v_0^2}{2a} - \frac{v_0^2}{2a}$$

$$s = \frac{v_0^2}{2a}$$

$$h = s \sin\alpha$$

$$h = \frac{v_0^2}{2a} \sin\alpha$$

$$h = \frac{v_0^2}{2 \cdot \frac{5}{7} g \sin\alpha} \cdot \sin\alpha$$

$$h = \frac{v_0^2}{\frac{10}{7} g} \cdot$$

$$h = \frac{7 v_0^2}{10 g}$$

$$h = \frac{7 \cdot (2\frac{m}{s})^2}{10 \cdot 10\frac{m}{s^2}} \Leftarrow \frac{7 \cdot 4\frac{m^2}{s^2}}{100\frac{m}{s^2}} = \frac{28\frac{m^2}{s^2}}{100\frac{m}{s^2}} = 0{,}28\,m$$

d)

$$E_k = \frac{mv^2}{2}$$

$$E_{kobr} = \frac{J\omega^2}{2}$$

$$J = \frac{2}{5} m r^2$$

$$\omega = \frac{v}{r}$$

$$E_{k\,obr} = \frac{J\omega^2}{2}$$

$$E_{k\,obr} = \frac{\frac{2}{5} m r^2 \left(\frac{v}{r}\right)^2}{2}$$

$$E_{k\,obr} = \frac{\frac{2}{5} m v^2 \cdot \frac{v^2}{r^2}}{2}$$

$$E_{kobr} = \frac{\frac{2}{5} m v^2}{2}$$

$$E_{kobr} = \frac{mv^2}{5}$$

$$E_p = mgh$$

$$E_p = E_k + E_{kobr}$$

$$mgh = \frac{mv^2}{2} + \frac{mv^2}{5}$$

$$mgh = \frac{5mv^2}{10} + \frac{2mv^2}{10}$$

$$mgh = \frac{7mv^2}{10} \quad / : m$$

$$gh = \frac{7v^2}{10} \quad / : g$$

$$h = \frac{7v^2}{10g}$$

$$h = \frac{7 \cdot (2\frac{m}{s})^2}{10 \cdot 10\frac{m}{s^2}} = \frac{7 \cdot 4\frac{m^2}{s^2}}{100\frac{m}{s^2}} =$$

$$= \frac{28\frac{m^2}{s^2}}{100\frac{m}{s^2}} = 0{,}28\,m$$