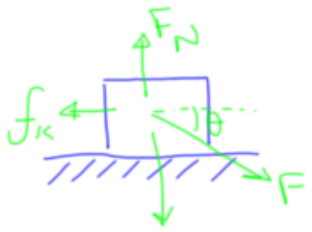
Exercícios do Capítulo 6: (Halliday & Resnick)

9



$m = 3{,}5\,kg$

$F = 15\,N$

$\theta = 40°$

$\mu_k = 0{,}25$

a) $f_k = ?$ $\quad f_k = \mu_k . F_N$

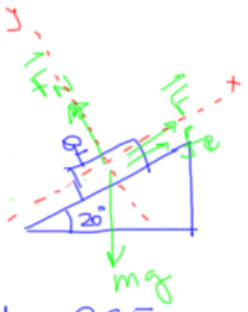
em y: $F_N = mg + F \sin\theta = 44N$

$\Rightarrow f_k = 0{,}25 \times 44 = 11\,N$

b) em x: $F\cos\theta - f_k = ma$

$$\Rightarrow a = \frac{15 . \cos 40° - 11}{3{,}5} = 0{,}14\ m/s^2$$

16



$\mu_e = 0{,}25$

$\mu_k = 0{,}15$

a) $F - mg\sin\theta + f_e = 0$ → pois se o carrinho está parado, o atrito está ajudando a segurar o carrinho.

$F = mg\sin\theta - f_e$

$f_e = \mu_e F_N$

$F_N = mg\cos\theta$

$\Rightarrow F = mg\sin\theta - \mu_e \cdot mg\cos\theta$

$= mg(\sin\theta - \mu_e\cos\theta)$

$\Rightarrow F = 8{,}6\ N$

b) agora f_s está apontando para $-x$:

$\Rightarrow F = mg(\sin\theta + \mu_s\cos\theta) = 46\ N$

c) agora f_k aponta para $-x$:

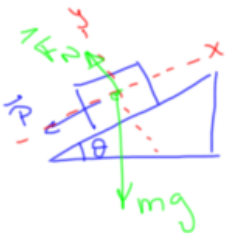
$F - mg - f_k = ma$ pois $v = cte$, $a = 0$

$F_N - mg\cos\theta = 0$

$\Rightarrow F = mg(\sin\theta + \mu_k\cdot\cos\theta)$

$\Rightarrow F = 39\ N$

17



$mg = 45\,N$

$\theta = 15°$

$\mu_s = 0{,}5$

$\mu_k = 0{,}34$

$f = ?$

a) $\vec{P} = -5\hat{i}\ N$

A máxima força de atrito é $f_s = \mu_s \cdot mg\cos\theta$

$\Rightarrow f_{smax} = 21{,}7\,N$

$P + mg\sin\theta = f_s$

$5 + 45.\sin 15° = f_s \Rightarrow \vec{f_s} = 16{,}6\hat{i}\ N$

$f_s < f_{smax} \Rightarrow$ está parado

b) $P = -8\hat{i}$

$\Rightarrow f_s = P + mg.\sin\theta = 8 + 45\sin 15°$

$\Rightarrow f_s = 20\,N \Rightarrow \vec{f_s} = 20\hat{i}\ N$ — continua parado

c) $P = -15\,N \Rightarrow$ está parado

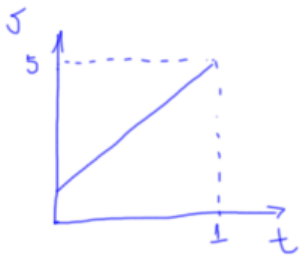
$\Rightarrow f_s = P + mg.\sin\theta = 15 + 45\sin 15°$

$\Rightarrow \vec{f_s} = 27\hat{i}\ N$

$f_s > f_{smax} \Rightarrow$ está se movendo

$\Rightarrow f_k = \mu_k \cdot mg = 15\hat{i}\ N$

24



$$a = \frac{\Delta v}{\Delta t} = \frac{5 - 0{,}5}{1 - 0} = 4{,}5\ m/s^2$$

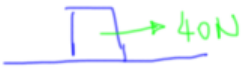
$$F - f_k = ma$$

$$40 - \mu_k \cdot mg = ma$$

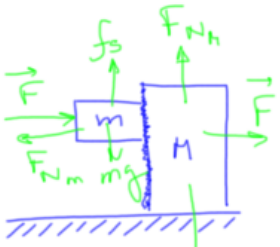
$$\Rightarrow \mu_k = \frac{-4{,}1 \times 4{,}5 + 40}{4{,}1 \times 9{,}8} = 0{,}54$$

$m = 4{,}1\ kg$

$\mu_k = ?$



35



$m = 16\ kg$

$M = 88\ kg$

$\mu_s = 0{,}38$

$\vec{F} = ?$

$$F = (m+M)a \Rightarrow a = \frac{F}{m+M}$$

bloco m:

$$F - F_{Nm} = ma \Rightarrow F_{Nm} = F - m\left(\frac{F}{m+M}\right) \quad (I)$$

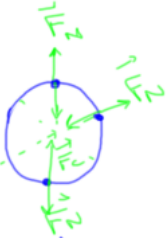
$$f_s - mg = 0 \Rightarrow \mu_s F_{Nm} = mg \Rightarrow F_{Nm} = \frac{mg}{\mu_s} \quad (II)$$

$\Rightarrow$ Dividindo (I) por (II):

$$1 = \frac{F - m\left(\frac{F}{m+M}\right)}{mg/\mu_s}$$

$$\Rightarrow F = 4{,}9 \times 10^2\ N$$

47



$m = 80\,kg$

$R = 10\,m$

$v = 6{,}1\,m/s$

a) $T = \frac{2\pi R}{v} = \frac{2\pi \times 10}{6{,}1} = 10{,}3\,s$

b) $F_R = m \cdot a_c$

$mg - F_N = m\frac{v^2}{R} \Rightarrow F_N = m\left(g - \frac{v^2}{R}\right) = 486\,N$

c) $mg + F_N = \frac{mv^2}{R} \Rightarrow F_N = m\left(g + \frac{v^2}{R}\right) = 1081\,N$