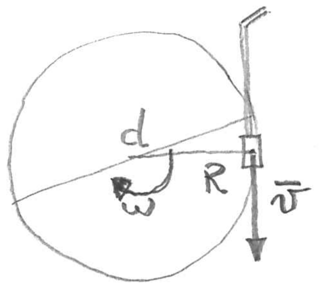
FISICA APPLICATA - III PROVA SCRITTA - TLB - 18/02/2019

(1)




$d = 7'' = 17,78 \text{ cm} = 1,778 \cdot 10^{-1} \text{ m}$

$R = \dfrac{d}{2} = 8,89 \cdot 10^{-2} \text{ m}$

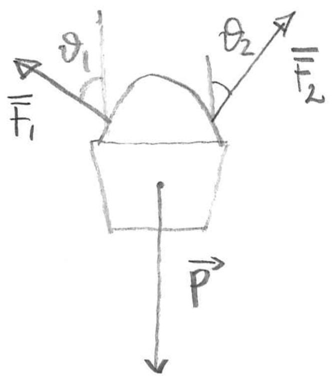
$\omega = 45 \text{ giri/minuto}$

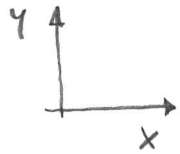
a) $\omega = \dfrac{45 \text{ giri}}{\text{minuto}} = \dfrac{45 \cdot 2\pi \text{ rad}}{60 \text{ s}} = \dfrac{90}{60}\pi \dfrac{\text{rad}}{\text{s}} = \dfrac{3}{2}\pi \dfrac{\text{rad}}{\text{s}} = 4,7 \dfrac{\text{rad}}{\text{s}}$

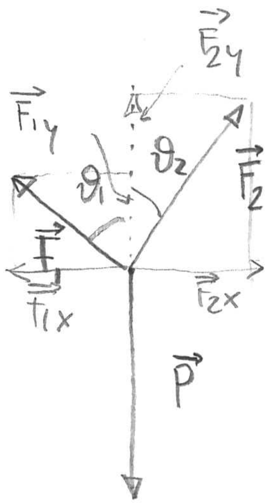
b) $v = \omega R = \dfrac{3}{2}\pi \dfrac{\text{rad}}{\text{s}} \cdot 8,89 \cdot 10^{-2} \text{ m} = 42 \dfrac{\text{cm}}{\text{s}}$

c) $n = \dfrac{45 \text{ giri}}{\cancel{\text{minuto}}} \cdot 6 \cancel{\text{minuti}} = 270 \text{ giri}$

(2)




$m = 5,2 \text{ kg}$

$\vartheta_1 = ?$

$\vartheta_2 = 28°$

$F_1 = 28 \text{ N}$

$F_2 = 44 \text{ N}$

$P = mg = 5.2 \cdot 9,8 \text{ N} = 50,96 \text{ N}$

a) " il secchio accelera dritto verso l'alto "

Quindi la componente orizzontale (x) delle forze applicate sul secchio deve essere nulla. Poiché $\vec{P}$ non ha componente orizzontale, deve essere:

$$\vec{F}_{1x} + \vec{F}_{2x} = 0$$

$$F_1 \operatorname{sen} \vartheta_1 = F_2 \operatorname{sen} \vartheta_2$$

$$\operatorname{sen} \vartheta_1 = \frac{F_2}{F_1} \operatorname{sen} \vartheta_2$$

$$\vartheta_1 = \arcsin\left[\frac{F_2}{F_1} \operatorname{sen} \vartheta_2\right] = \arcsin\left[\frac{44}{28} \operatorname{sen} 28°\right] = 47,5°$$

b) Per calcolare $a$ è necessario calcolare la risultante delle forze verticali ($y$):

$$\vec{F}_{1y} + \vec{F}_{2y} + m\vec{g} = m\vec{a}$$

($\vec{F}_{1y}, \vec{F}_{2y}$ ed $\vec{a}$ verso l'alto, $\bar{g}$ verso il basso)

$$F_{1y} + F_{2y} - mg = ma$$

$$F_1 \cos\vartheta_1 + F_2 \cos\vartheta_2 - mg = ma$$

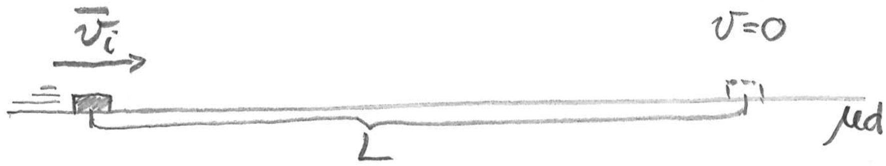
$$a = \frac{F_1 \cos\vartheta_1 + F_2 \cos\vartheta_2}{m} - g$$

$$= \frac{28\,N \cos 47{,}5° + 44\,N \cos 28°}{5{,}2\,kg} - 9{,}8\,\frac{m}{s^2}$$

$$= \frac{57{,}75\,N}{5{,}2\,kg} - 9{,}8\,\frac{m}{s^2}$$

$$= 11{,}1\,\frac{m}{s^2} - 9{,}8\,\frac{m}{s^2} = 1{,}3\,\frac{m}{s^2}$$

(3)




$\mu d = 0{,}12$

Per il teorema dell'energia cinetica il lavoro $\mathcal{L}$ è:

$$\mathcal{L} = \Delta K = \underbrace{K_f}_{=0} - K_i = -K_i = -\frac{1}{2} m v_i^2$$

L'unica forza a compiere lavoro è l'attrito:

$$F_a = \mu d\, N = \mu d\, mg$$

$$\mathcal{L} = -F_a \cdot D = -\mu d\, mg D$$

Uguagliando le due espressioni per $\mathcal{L}$ si ha:

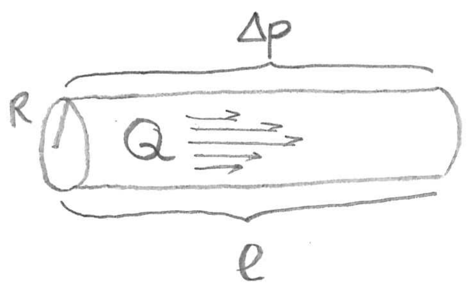
$$-\frac{1}{2}\cancel{m}v_i^2 = -\mu_d \cancel{m} g D$$

(ovvero il risultato non dipende dalla massa del disco)

$$D = \frac{1}{2}\frac{v_i^2}{\mu_d g} = \frac{1}{2}\frac{\left(7{,}2\ \frac{m}{s}\right)^2}{0{,}12 \cdot 9{,}8\ \frac{m}{s^2}} = 22\ m$$

4

$$Q = \frac{5{,}0\ \ell}{min} = \frac{5{,}0 \cdot 10^{-3}\ m^3}{60\ s} = 8{,}33 \cdot 10^{-5}\ \frac{m^3}{s}$$




$R = 3{,}0 \cdot 10^{-3}\ m$

$\ell = 6.3 \cdot 10^{-2}\ m$

$\Delta p = 450\ Pa$

La legge di Poiseville prevede che:

$$Q = \frac{\pi}{8}\frac{R^4}{\eta}\frac{\Delta p}{\ell}$$

Quindi:

$$\eta = \frac{\pi}{8}\frac{R^4}{Q}\frac{\Delta p}{\ell}$$

$$= \frac{3{,}14}{8}\frac{(3{,}0 \cdot 10^{-3}\ m)^4}{8{,}33 \cdot 10^{-5}\ \frac{m^3}{s}} \cdot \frac{450\ Pa}{6.3 \cdot 10^{-2}\ m}$$

$$= \frac{3{,}14 \cdot 81 \cdot 450}{8 \cdot 8{,}33 \cdot 6{,}3} \cdot \frac{10^{\cancel{-12}\ -5}}{10^{\cancel{-7}}} \frac{\cancel{m^4}\ Pa}{\frac{\cancel{m^4}}{s}}$$

$$= 2{,}73\ 10^2 \cdot 10^{-5}\ Pa \cdot s = 2{,}73 \cdot 10^{-3}\ Pa \cdot s$$