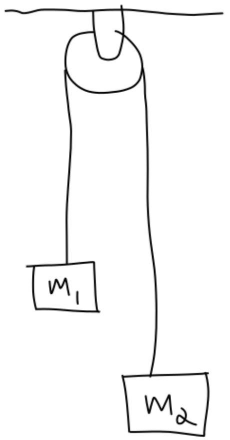
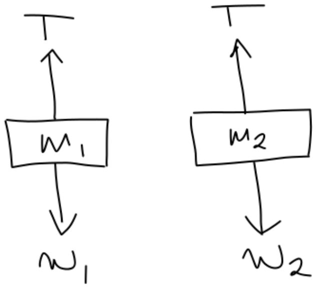
(1)

Dæmi 1, (1-06-42)

a) Find the acceleration a





Same T

$$\underbrace{a_1 = -a_2}_{\text{properties of the rope}}$$

m_1: $\quad T - W_1 = m_1 a$

m_2: $\quad T - W_2 = -m_2 a$

(2)

$m_1 - m_2 \quad \rightarrow \quad -W_1 + W_2 = m_1 a + m_2 a$

$\rightarrow \quad -m_1 g + m_2 g = a(m_1 + m_2)$

$$\rightarrow \quad \boxed{a = \frac{m_2 - m_1}{m_2 + m_1} g}$$

Eq. m_1 indicates a is defined positive when pointed upwards. The Eq. for a shows this remains as long as $m_2 > m_1$

(3)

b) Find T, now add m_1 and m_2

nota a

$$2T - W_1 - W_2 = -a(m_2 - m_1)$$

$$\rightarrow \quad 2T - (m_1 + m_2)g = -\frac{(m_2 - m_1)^2}{m_1 + m_2} g$$

$$\rightarrow \quad 2T - \frac{(m_1 + m_2)^2}{m_1 + m_2} g = -\frac{(m_2 - m_1)^2}{m_1 + m_2} g$$

$$\rightarrow \quad \boxed{T} = \frac{g/2}{m_1 + m_2}\left\{(m_1 + m_2)^2 - (m_2 - m_1)^2\right\}$$

$$= \frac{g/2}{m_1 + m_2} 4 m_1 m_2 = \boxed{\frac{2 g m_1 m_2}{m_1 + m_2}}$$

(4)

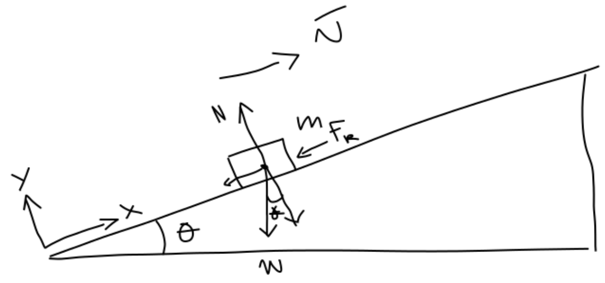
c) Find a and T for $m_1 = 2$ kg, $m_2 = 4$ kg, $g = 9{,}81\ m/s^2$

$$a = \frac{m_2 - m_1}{m_2 + m_1} g = \frac{2}{6} g \approx \underline{3{,}27\ m/s^2}$$

$$T = \frac{2 m_1 m_2}{m_1 + m_2} g = \frac{16\,kg}{6} g \approx \underline{26{,}2\ N}$$

⑤

Dæmi 2, 1-06-54



Find the acceleration opposite to the motion of the snowboarder uphill

$\mu_k = 0{,}1$

$\theta = 5°$

y: $N - mg\cos\theta = 0 \;\rightarrow\; N = mg\cos\theta$

x: $-mg\sin\theta - \mu_k N = ma$

$$-mg\sin\theta - \mu_k mg\cos\theta = ma$$

⑥

m cancles out of the last Eq. and we are left with

$$-g\sin\theta - \mu_k g\cos\theta = a$$

$$\rightarrow \quad a = -g\left[\sin\theta + \mu_k\cos\theta\right]$$

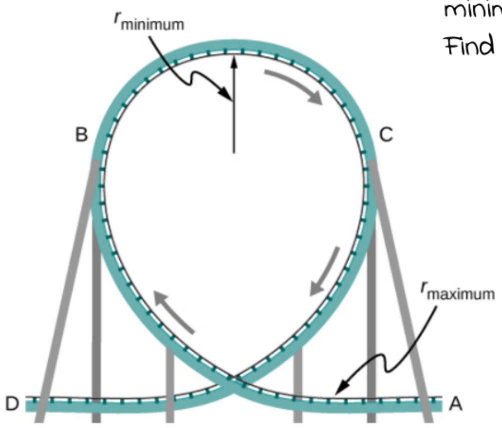
$$\simeq -g\left[0{,}19\right] \simeq -1{,}83 \text{ m/s}^2$$

if $g = 9{,}81 \text{ m/s}^2$

⑦

Dæmi 3, 1-06-72

The needed centripetal acceleration at minimum r has to be greater then g. Find the speed needed to give 1.5g



$r_m = 15{,}0$ m

$$a_c = \frac{v^2}{r_m}$$

$$\rightarrow \quad v^2 = a_c r_m$$

$$v = \sqrt{1{,}5\, g\, r_m}$$

$$= 14{,}9 \text{ m/s}$$

ef $g = 9{,}81 \text{ m/s}^2$

⑧

Dæmi 4, 1-06-86

Spherical bacteria d=2.00 μm falling in water

$\rho_b = 1.10 \cdot 10^3 \text{ kg/m}^3$, Find v_T

Stokes: $F_s = 6\pi r \eta v$ $\qquad r = 1{,}00$ μm

$F_s = bv$, $b = 6\pi r\eta$ $\qquad \eta_{H_2O,\, 20°C} = 1.0016$ mPa·s

$$\simeq 1{,}00 \cdot 10^{-3} \frac{\text{kg}}{\text{m} \cdot \text{s}}$$

$$v_T = \frac{mg}{b} = \frac{mg}{6\pi r\eta}$$

$$m_b = m = \frac{4\pi}{3} r^3 \rho_b$$

$$\rightarrow \quad v_T = \frac{4\pi r^3 \rho_b g}{18\pi r\eta} = \frac{2r^2\rho_b g}{9\eta}$$

$$= \frac{2\cdot(10^{-6})^2\, 1.10\cdot 10^3 \cdot 9{,}81}{9\cdot 10^{-3}} \simeq 2{,}18\cdot 10^{-6} \text{ m/s} \simeq 2{,}18 \text{ μm/s}$$

..en, flotkraftur --> m = ...