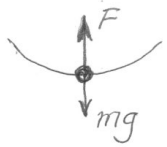
Tenta Mekanik för FYP01M, ht 06

061215

Lösn-skisser

1. Bilen beskriver en cirkelbana:



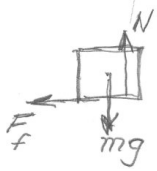
$F - mg = m\frac{v^2}{r}$

F = kraften på bilens fjädring

$F = m\cdot\left(\frac{v^2}{r} + g\right) = \underline{3.2\cdot 10^4\ N}$

---

2. Krafterna som verkar på tvättmaskinen:



$F_f = \mu_s \cdot N$

$N = mg$

$F_f = m\cdot a$

$a = \mu_s \cdot g$ (retardationen)

Bromssträckan s

$s = \frac{v^2 - v_0^2}{2a} = \frac{v_0^2}{2\cdot\mu_s\cdot g} = 19{,}6\ m$

3.

a) Rörelsemängden bevaras:

$$\begin{cases} m_A v_{Ax} + m_B v_{Bx} = (m_A + m_B) v_{ABx} \\ m_A v_{Ay} + m_B v_{By} = (m_A + m_B) v_{ABy} \end{cases}$$

$v_{ABx} = 0{,}34\ m/s$

$v_{ABy} = 0{,}22\ m/s$

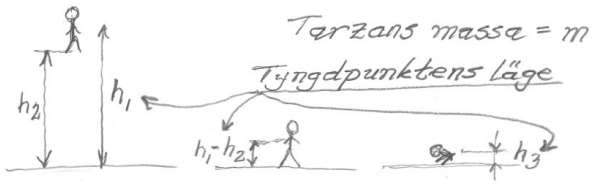
$\underline{\vec{v}_{AB} = \langle 0{,}34,\ 0{,}22,\ 0\rangle}$

b) $\Delta E = K_{före} - K_{efter}$

$= \frac{1}{2} m_A v_A^2 + \frac{1}{2} m_B v_B^2 - \frac{1}{2}(m_A + m_B) v_{AB}^2$

$\underline{\Delta E = 19{,}6\ J}$

4.



a) Potentiell energi blir kinetisk energi

$mgh_2 = \frac{1}{2}mv^2$

$v = \sqrt{2gh_2}$

b) Punkt-massa-modellen:

F_N = kraften på fötterna från marken

$\Delta K_{trans} = -(F_N - mg)(h_1 - h_2 - h_3)$

Verkliga systemet:

$\Delta E = \Delta K_{trans} + \Delta E_{inre}$

$\Delta E = W$ (F_N uträttar inget arbete)

$\Delta E = mg(h_1 - h_2 - h_3)$

$\Big\} \Delta E_{inre} = F_N(h_1 - h_2 - h_3)$

$U + K = konst \Rightarrow F_N = \frac{h_1 - h_3}{h_1 - h_2 - h_3} \cdot mg \Rightarrow \underline{\Delta E_{inre} = mg(h_1 - h_3)}$

---

5. Rörelsemängdsmomentet bevaras:

$L_{före} = L_{efter}$ $\quad m_1 = 0.003\ kg,\ m_2 = 1.6\ kg,\ m_3 = 0.6\ kg$

$m_1 v_1 \cdot 0.41 = [(m_1 + 2m_2) \cdot 0.5^2 + 2m_3 \cdot 0.3^2] \cdot \omega$

$\underline{\omega = 0.54\ s^{-1}}$

---

6. $F_S = k_S \cdot x$

$k_S = 3\ N/m$

Harmonisk osc.: $T = 2\pi\sqrt{\frac{m}{k_S}}$

$\longleftrightarrow$ amplitud = 4 cm = x_0

a) Välj $m = \frac{T^2}{4\pi^2} \cdot k_S = \underline{0.076\ kg}$

b) $U = \frac{1}{2}k_S \cdot x^2$

Totala energin = $\frac{1}{2}k_S \cdot x_0^2 \Rightarrow U = K = \frac{1}{4}k_S \cdot x_0^2 \Rightarrow \underline{x = \pm 2\sqrt{2}\ cm}$

c) $F = k_S \cdot x = \pm 3 \cdot 2\sqrt{2} = \underline{\pm 6\sqrt{2}\ N}$