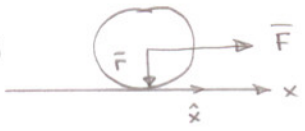
Lösningar till Fysik för I1 (TIF190) 2013-01-19

①

$\Sigma \bar{F}_{ext} = M\bar{a}_{CM}$ (1)

$\Sigma \bar{\tau}_{ext} = I\bar{\alpha}$ (2)



(1) $\Rightarrow \bar{F} + \bar{f} = M\bar{a}_{CM} \Rightarrow F + f = Ma_{CM}$

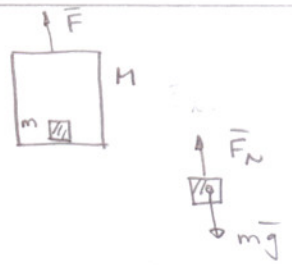
$\Rightarrow f = Ma_{CM} - F = 10 \cdot 1{,}20 - 20 = -8\ N$

$\Rightarrow \underline{\bar{f} = -8\hat{x}\ N}$

(2) $\Rightarrow \tau = fr = I\alpha = I\frac{a_{CM}}{r}$

$\Rightarrow I = \frac{fr^2}{a_{CM}} = \frac{8 \cdot 0{,}30^2}{1{,}2} = \underline{0{,}6\ kgm^2}$

②



a) $W = \bar{F}\cdot\bar{d} = Fd$

$F - (M+m)g = (M+m)a$

bestäm a! $F_N - mg = ma$

$\Rightarrow a = \frac{F_N - mg}{m}$

$F = (M+m)(a+g)$

$\Rightarrow W = (M+m)\left(\frac{F_N - mg}{m} + g\right)\cdot d =$

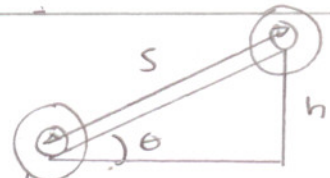
$= 900{,}5\left(\frac{3{,}00 - 0{,}250\cdot 9{,}81}{0{,}250} + 9{,}81\right)2{,}40 = \underline{25{,}9\ kJ}$

$M+m \approx M$

b) $\left.\begin{aligned} F - Mg &= Ma \\ F\cdot l &= W \end{aligned}\right\} \Rightarrow a = \frac{W}{lM} - g$ $\underline{2{,}45\ N}$

$F_N - mg = ma \Rightarrow F_N = m(a+g) = m\frac{W}{lM} =$

③



$h = s\cdot\sin\theta$

$\Delta U = Mgh$

$\Delta U = \Delta K = \frac{1}{2}I\omega^2 + \frac{1}{2}MV^2$

Hjulradie: R axelradie: r $\omega = \frac{V}{r}$

$\Rightarrow Mgs\cdot\sin\theta = \frac{1}{2}I\frac{V^2}{r^2} + \frac{1}{2}MV^2$

$\Rightarrow V^2 = \frac{2Mgs\cdot\sin\theta}{\frac{I}{r^2} + M} = \frac{2\cdot 10\cdot 2\cdot \sin 30^\circ 9{,}81}{\frac{0{,}600}{0{,}2^2} + 10} =$

$= 7{,}848\ (m/s)^2$

$\Rightarrow K_{trans} = \frac{1}{2}MV^2 = \underline{39{,}2\ J}$.

$Mgs\cdot\sin\theta = 98{,}1\ J \Rightarrow K_{rot} = 98{,}1 - 39{,}2$

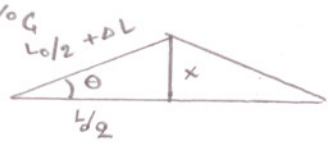
$= \underline{58{,}8\ J}$

④

$\Delta T = 32^\circ C$

$\alpha = 24\cdot 10^{-6}/^\circ C$

$L_0/2 = \frac{3{,}77}{2}\ m$



$\frac{L_0}{2} + \Delta L = \frac{L_0}{2}(1 + \alpha\cdot\Delta T) = \frac{L_0}{2}(1 + 24\cdot 10^{-6}\cdot 32)$

$\cos\theta = \frac{L_0/2}{L_0/2 + \Delta L} = 1/(1 + 24\cdot 10^{-6}\cdot 32)$

$\Rightarrow \theta$

$\tan\theta = \frac{x}{L_0/2} \Rightarrow x = \frac{L_0}{2}\cdot\tan\theta =$

$= \frac{3{,}77}{2}\cdot\tan\theta = 0{,}074\ m$

$= \underline{7{,}4\ cm}$

⑤

$\Delta E_{int} = mc\cdot\Delta T$

kyleffekt ↓

$\Rightarrow \frac{\Delta E_{int}}{\Delta t} = mc\frac{\Delta T}{\Delta t} = \frac{\Delta Q}{\Delta t} = P$

$\Rightarrow c = \frac{P}{m\frac{dT}{dt}} = \frac{2{,}81}{0{,}3\ \frac{25}{1200}} =$

ur figuren

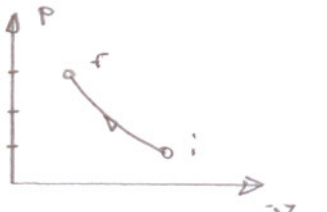
$= \underline{450\ J/kg\cdot K}$

$\frac{dT}{dt} = \frac{\Delta T}{\Delta t} = \frac{25}{20\cdot 60}$

⑥ Tvåat. gas.

$C_V = \frac{5}{2}R \quad C_P = \frac{7}{2}R$

$\gamma = \frac{7}{5}$



$W_{i\to f} = -\Delta E_{in} =$

$= -nC_V(T_f - T_i) \qquad PV = nRT$

Adiabat: $PV^\gamma = konst \Rightarrow V_f = V_i\left(\frac{P_i}{P_f}\right)^{5/7}$

$\Rightarrow V_f = 91{,}25$ liter

$\Rightarrow W_{i\to f} = -n\frac{5}{2}R\left(\frac{P_fV_f}{nR} - \frac{P_iV_i}{nR}\right) =$

$= \frac{5}{2}1{,}013\cdot 10^5\left(3{,}6\cdot 0{,}09125 - 1{,}2\cdot 0{,}200\right) =$

$= \underline{-22{,}4\ kJ}$