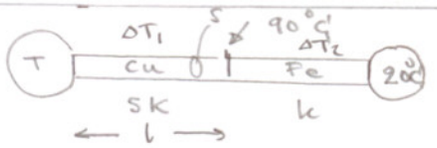
CA

Tentamen i Fysik del 1 för I1. 2013-05-30

①



$\Delta T_1 + \Delta T_2 = T - 20$, $\Delta T_1 = T - 90$

$k_{Cu} \cdot \Delta T_1 = k_{Fe} \Delta T_2$,

$\Rightarrow \Delta T_2 = \frac{k_{Cu}}{k_{Fe}} \Delta T_1 \Rightarrow \Delta T_2 = 5\Delta T_1$

$\because \Delta T_1 + 5\Delta T_1 = T - 20 \Rightarrow 6\Delta T_1 = T - 20$

$\Rightarrow 6(T-90) = T-20$

$\Rightarrow T = 104^\circ C$

$Q = k_{Cu} \cdot S \frac{\Delta T_1}{l} \cdot t = 400 \cdot 1 \cdot 10^{-4} \cdot \frac{14}{0,5} \cdot 1 =$

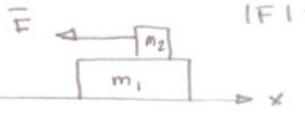
$= 1,12 \text{ J}$

②

$\mu_s = 0,60$

$\mu_k = 0,40$

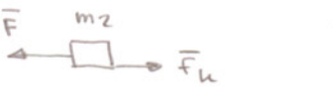
$|\bar{F}| = 120 \text{ N}$



$m_2 = 12 \text{ kg} \Rightarrow f_{s,max} = 12 \cdot 9,81 \cdot 0,60 =$

$= 70,6 \text{ N}$

$\because$ m_2 kommer att accelereras. $\Rightarrow \mu_k$



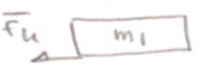
$f_k = 12 \cdot 9,81 \cdot 0,40 =$

$= 47,1 \text{ N}$

$\bar{F} + \bar{f}_k = m_2 \bar{a}_2 \Rightarrow a_2 = -\frac{120 - 47,1}{12} =$

$= -6,076 \text{ m/s}^2$

$= -6,1 \text{ m/s}^2$



$\bar{a}_1$: $f_k = m_1 a_1 \Rightarrow a_1 = -\frac{f_k}{m_1} = -\frac{47,1}{40} =$

$= -1,178 \text{ m/s}^2 = -1,2 \text{ m/s}^2$

③

a) $mgd = \frac{1}{2}mv^2 + fd$

$\Rightarrow v = \sqrt{2 \cdot 9,81 \cdot 3,7 - \frac{2 \cdot 4400 \cdot 3,7}{1800}}$ (m, d)

$= 7,38 \text{ m/s} = 7,4 \text{ m/s}$

b) $\frac{1}{2}mv^2 = \frac{1}{2}kx^2 + fx - mgx$

$\Rightarrow x = 0,68 \text{ m}$

c) $mgd = fd + 2xf + fy + mgy$

$\Rightarrow y = 1,94 \text{ m}$

④

L bevaras $L = 0$

rälsen kan ersättas med en punkt med massan 1,1 M

tåget med en partikel med massan M

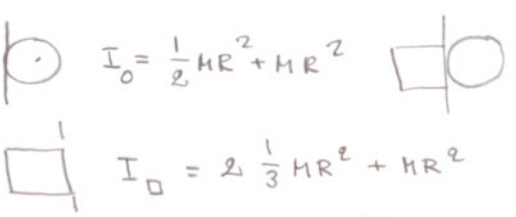
$L = 0$, v = rälsens per. fart

$1,1MvR + M(v + 0,15)R = 0$

$\Rightarrow v = -\frac{0,15}{2,1} = -0,071 \text{ m/s}$

$\omega = \frac{v}{R} = -\frac{0,071}{0,43} = -0,166 \text{ rad/s}$

⑤



$I_O = \frac{1}{2}MR^2 + MR^2$

$I_\square = 2 \cdot \frac{1}{3}MR^2 + MR^2$

$\Rightarrow I_{tot} = \frac{19}{6}MR^2 =$

$= \frac{19}{6} \cdot 2,0 \cdot 0,50^2 = 1,583 \text{ kgm}^2$

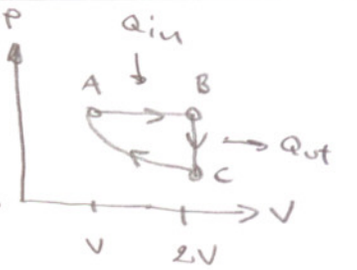
$\tau = I\alpha$ $\tau = FR = 12 \cdot 0,5 = 6 \text{ Nm}$

$\Rightarrow \alpha = \frac{6}{I} \Rightarrow \omega = 3 \cdot \frac{6}{I} = 11,37 \text{ rad/s}$

$= 11 \text{ rad/s}$

⑥

$e = \frac{Q_{in} + Q_{ut}}{Q_{in}}$



$Q_{in} = nC_p(T_B - T_A) =$

$= n\frac{5}{2}R(2T_A - T_A) = n\frac{5}{2}RT_A$

$Q_{ut} = nC_V(T_C - T_B)$

$T_C V_C^{\gamma-1} = T_A V_A^{\gamma-1} \Rightarrow T_C = T_A \left(\frac{V_A}{V_C}\right)^{\gamma-1}$

$C_p = \frac{5}{2}R$ $C_V = \frac{3}{2}R \Rightarrow \gamma = \frac{5}{3} \Rightarrow \gamma - 1 = \frac{2}{3}$

$\Rightarrow T_C = T_A \left(\frac{1}{2}\right)^{2/3}$

$\Rightarrow e = \frac{\frac{5}{2} + \frac{3}{2}\left[\left(\frac{1}{2}\right)^{2/3} - 2\right]}{\frac{5}{2}} = 0,178 =$

$= 18\%$