

$$R = 0.4 \cdot 10^{-3} \text{ m} \quad T = 24 \text{ h} \quad \theta = 43^\circ$$

$$V_e = \frac{2\pi R}{T} = 1.8 \cdot 10^{-3} \frac{\text{km}}{\text{s}}$$

$$V_f = \frac{2\pi R \cos \theta}{T} = 1.2 \cdot 10^{-3} \frac{\text{km}}{\text{s}}$$

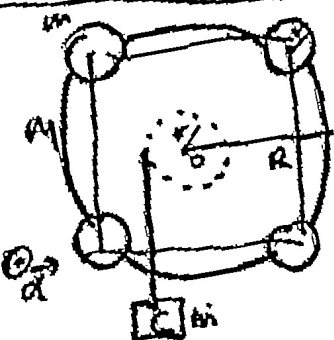
$m_1 = 2 \text{ kg} \quad m_2 = 6 \text{ kg} \quad \mu = 0.3$
 $a_r = a - a_r = 0$
 $\frac{m_1}{m_2} F \leq (1 + \frac{m_1}{m_2}) \mu g$
 $F \leq (m_1 + m_2) g \mu = 78.4 \text{ N} = F_{\text{max}}$

$$F = \frac{F_{\text{max}}}{2}$$

$$a = \frac{F - f}{m_2} = \frac{F - m_1 g \mu}{m_2} = 1.3 \text{ m/s}^2$$



$m_1 a = T_1 - m_1 g \sin \theta$
 $m_2 a = m_2 g - T_2$
 $I \alpha = T_2 R - T_1 R$
 $T_1 = m_1 a + m_1 g \sin \theta$
 $T_2 = m_2 g - m_2 a$
 $\frac{1}{2} M R^2 \frac{a}{R} = R(T_2 - T_1)$
 $\frac{M}{2} a = m_2 g - m_2 a - m_1 a \sin \theta$
 $a = \frac{g(m_2 - m_1 \sin \theta)}{m_1 + m_2 + \frac{M}{2}}$



$$R = 3 \text{ m} \quad M = 4 \text{ m} \quad m = 2 \text{ kg} \quad t = 1 \text{ s}$$

$I = \frac{1}{2} M R^2 + 4(\frac{1}{2} m R^2 + m R^2) = 2 M R^2 + 2 m R^2 + 4 m R^2 = 2 m (9 R^2 + R^2 + 18 R^2)$
 $I = 56 m R^2$
 $M a = m g - T$
 $T = m g - m a$
 $I \alpha = 56 m R^2 \frac{a}{R} = T R$

$$56 \mu a = g(g - a) \quad a = \frac{g}{57} = 0.17 \text{ m/s}^2 \quad v(t) = a t = 0.17 \frac{\text{m}}{\text{s}}$$

$$\omega(t) = \alpha t = \frac{a}{R} t \quad E_k = \frac{1}{2} m v^2 + \frac{1}{2} I \omega^2 = \frac{1}{2} m v^2 + \frac{1}{2} \cdot 56 m R^2 \cdot \frac{a^2}{R^2} t^2$$

$$E_k = \frac{57}{2} m v^2 = 1.68 \text{ J}$$

$I = \frac{1}{2} M R^2 + 4 m R^2 = 2 m R^2 + 4 m R^2 = 6 m R^2$
 $54 a = g - a \quad a = \frac{g}{55} = 0.18 \text{ m/s}^2 \quad E_k = 1.8 \text{ J}$



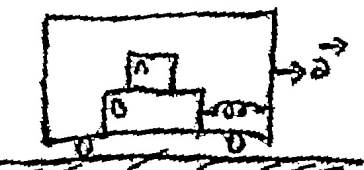
$$m R V_0 \cos \theta + I \frac{V_0}{R} = I \omega \quad I = \frac{3}{5} m R^2 + m R^2 = \frac{8}{5} m R^2$$

$$\frac{8}{5} m R^2 \frac{V_0}{R} \cos \theta + \frac{3}{5} m R^2 \frac{V_0}{R} = \frac{8}{5} m R^2 \omega$$

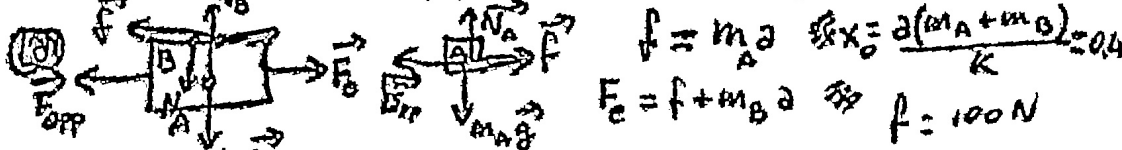
$$\omega = \frac{5 V_0}{7 R} (\cos \theta + \frac{3}{5}) = \frac{V_0}{R} (\frac{5}{7} \cos \theta + 1)$$

$$R \omega \sin \theta + h = R \quad \cos \theta = \frac{R - h}{R} \quad \omega = \frac{V_0}{R} \left(\frac{5R - 5h + 7R}{7R} \right) = \frac{V_0}{7R^2} (12R - 5h)$$

$$\frac{1}{2} I \omega^2 = m g h \quad \frac{7}{10} m R^2 \frac{V_0^2}{R^2} (12R - 5h)^2 = m g h \quad V_0 = \sqrt{\frac{10 g h}{7(12R - 5h)^2}}$$



$$a = 2 \text{ m/s}^2 \quad m_A = 50 \text{ kg} \quad m_B = 30 \text{ kg} \quad \mu_s = 0.3 \quad K = 400 \text{ N/m}$$

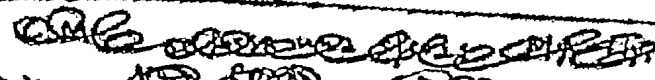
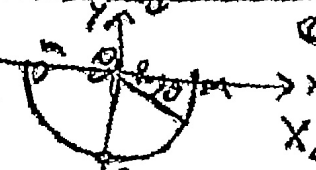


$$m_{\text{min}}: K x_0 = m_A g \mu + m_B a$$

$$m_{\text{min}} = \frac{K x_0 - m_B a}{m_A g} = 0.2$$

$$m_B x'' = -K p - m_B a - f = -K(x_0 + x) - m_B a - f = -K x \quad x = R \cos(\sqrt{\frac{K}{m}} t + \phi)$$

$$K x_{\text{max}} = m_A g \mu + m_B a \quad x_{\text{max}} = \frac{m_A g \mu + m_B a}{K} = 0.52 \text{ m}$$



$$x_{\text{cm}} = \frac{m R}{m + M}$$

$$V_c = \sqrt{2 g R} \quad m V_c = M V \quad \Delta x = x_{\text{cm}}$$

$$M = 260 \text{ kg} \quad m = 75 \text{ kg} \quad a = 0.8 \text{ m/s}^2$$

$$(M + m) a_{\text{cm}} = R_{\text{ext}} = 0 \quad V_{\text{cm}} = \text{constante} \Rightarrow V_{\text{cm}} = 0$$

$$m a_r = M a_r \quad a_r = \frac{m}{M} a = 0.24 \text{ m/s}^2$$