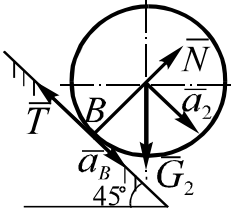


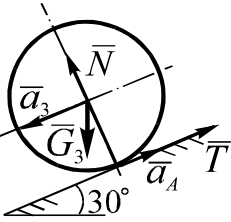
## Problem D-2 2020



$$m_2 a_2 = m_2 g \sin 45^\circ - T; \quad J_2 \varepsilon_2 = TR$$

$$J_2 = \frac{1}{2} m_2 R^2; \quad \varepsilon_2 = \frac{1}{R} (a_2 - a_B)$$

$$m a_2 = m g \sin 45^\circ - T; \quad \frac{1}{2} m R (a_2 - a_B) = TR$$



$$m_3 a_3 = m_3 g \sin 30^\circ - T; \quad J_3 \varepsilon_3 = TR$$

$$\varepsilon_3 = \frac{1}{R} (a_3 + a_A) = \frac{1}{R} (a_3 + a_B);$$

$$m a_3 = m g \sin 30^\circ - T; \quad \frac{1}{2} m R (a_3 + a_B) = TR$$

$$T = \frac{1}{2} m (a_2 - a_B); \quad T = \frac{1}{2} m (a_3 + a_B)$$

$$2T = \frac{1}{2} m (a_3 + a_2)$$

$$T = \frac{1}{4} m a_2 + \frac{1}{4} m a_3$$

$$\begin{cases} m a_2 = m g \sin 45^\circ - \frac{1}{4} m a_2 - \frac{1}{4} m a_3 \\ m a_3 = m g \sin 30^\circ - \frac{1}{4} m a_2 - \frac{1}{4} m a_3 \end{cases}$$

$$\begin{cases} 4a_2 = 4g \sin 45^\circ - a_2 - a_3 \end{cases}$$

$$\begin{cases} 4a_3 = 4g \sin 30^\circ - a_2 - a_3 \end{cases}$$

$$\begin{cases} 5a_2 + a_3 = 4g \sin 45^\circ \end{cases}$$

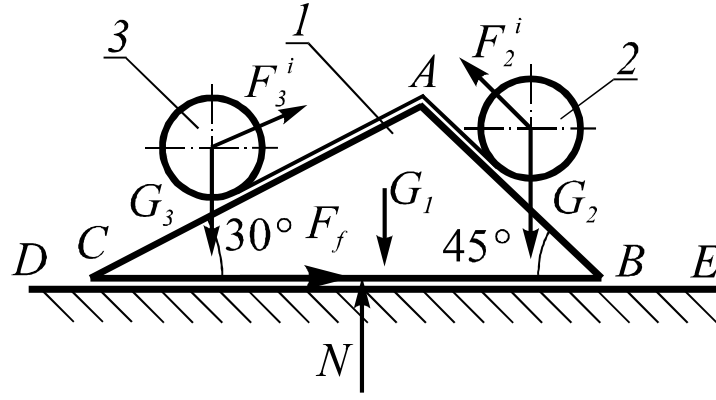
$$\begin{cases} 5a_3 + a_2 = 4g \sin 30^\circ \end{cases}$$

$$a_3 = 4g \sin 45^\circ - 5a_2$$

$$20g \sin 45^\circ - 25a_2 + a_2 = g \sin 30^\circ$$

$$a_2 = \frac{g}{24} (20 \sin 45^\circ - 4 \sin 30^\circ)$$

$$a_3 = 4g \sin 45^\circ - \frac{5g}{24} (20 \sin 45^\circ - 4 \sin 30^\circ) = \frac{g}{24} (20 \sin 30^\circ - 4 \sin 45^\circ)$$



$$F_2^i = m_2 a_2 = \frac{mg}{24} (20 \sin 45^\circ - 4 \sin 30^\circ);$$

$$F_3^i = \frac{mg}{24} (20 \sin 30^\circ - 4 \sin 45^\circ);$$

$$\sum F_{ix} = 0; F_3^i \cos 30^\circ - F_2^i \cos 45^\circ + F_f = 0;$$

$$\sum F_{iy} = 0; F_3^i \sin 30^\circ + F_2^i \sin 45^\circ + N - G_1 - G_2 - G_3 = 0;$$

$$F_f = F_2^i \cos 45^\circ - F_3^i \cos 30^\circ =$$

$$= \frac{mg}{24} \left( 20 \frac{\sqrt{2}}{2} - 4 \cdot \frac{1}{2} \right) \cdot \frac{\sqrt{2}}{2} - \frac{mg}{24} \left( 20 \cdot \frac{1}{2} - 4 \frac{\sqrt{2}}{2} \right) \cdot \frac{\sqrt{3}}{2} = \frac{mg}{24} (10 - \sqrt{2} - 5\sqrt{3} + \sqrt{6})$$

$$N = G_1 + G_2 + G_3 - F_3^i \sin 30^\circ - F_2^i \sin 45^\circ =$$

$$= 4mg - \frac{mg}{24} \left( 20 \cdot \frac{1}{2} - 4 \frac{\sqrt{2}}{2} \right) \cdot \frac{1}{2} - \frac{mg}{24} \left( 20 \frac{\sqrt{2}}{2} - 4 \cdot \frac{1}{2} \right) \cdot \frac{\sqrt{2}}{2} =$$

$$= \frac{mg}{24} (96 - 5 + \sqrt{2} - 10 + \sqrt{2}) = \frac{(81 + 2\sqrt{2})mg}{24};$$

$$f \geq \frac{F_f}{N} = \frac{\frac{mg}{24} (10 - \sqrt{2} - 5\sqrt{3} + \sqrt{6})}{\frac{(81 + 2\sqrt{2})mg}{24}} = \frac{10 - \sqrt{2} - 5\sqrt{3} + \sqrt{6}}{81 + 2\sqrt{2}} = 0,028$$