\[ N = 340 \]
\[ \text{Average Credits: 14.81} \]

**SECOND MIDTERM**

Name (print) __________________________ Name (signed) __________________________

Discussion Instructor (circle): Basko Chakhbazian Condella Hasan McMurray Paul Zhukov

Discussion Section # ______

**SHOW ALL WORK!!!!!!**

**REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!**

Use the conversion constants and data given on the front page.

In the diagram shown P is applied to block 2 in a horizontal direction. \( \mu_s \) and \( \mu_k \) apply to ALL surfaces.

\[ m_1 = 2.30 \text{ kg} \]
\[ m_2 = 4.75 \text{ kg} \]
\[ \mu_s = 0.60 \]
\[ \mu_k = 0.50 \]

(a) Draw clear, labeled free body and force diagrams for block 1.
(b) Draw clear, labeled free body and force diagrams for block 2.
(c) Calculate the maximum value of \( P \) such that block 1 does not slide with respect to block 2.

\[ \theta = 20.0^\circ \]

\[ \text{(a). FBD:} \]
\[ \text{(b). FBD:} \]
\[ \text{(c). For Block 1, } N_1 = m_1 g \cos \theta \quad f_{1s} = \mu_s m_1 g \cos \theta \]
\[ a_x = \frac{f_{1s} - m_1 g \sin \theta}{m_1} = \mu_s g \cos \theta - g \sin \theta = 2.17 \text{ m/s}^2 \]

For block 2,
\[ N_2 = N_1 + P \sin \theta + m_2 g \cos \theta \quad f_{2k} = \mu_k N_2 \]
\[ P \cos \theta - \mu_k N_2 - \mu_s m_2 g \cos \theta - m_2 g \sin \theta = m_2 a_x \]
\[ P \cos \theta - \mu_k m_2 g \cos \theta - \mu_k P \sin \theta - m_2 g \cos \theta - m_2 g \sin \theta - m_2 a_x = 0 \]
\[ P = \frac{m_2 a_x + \mu_k (m_1 + m_2) g \cos \theta + \mu_s m_1 g \cos \theta + m_2 g \sin \theta}{\cos \theta - \mu_k \sin \theta} \approx 92.9 \text{ N} \]