Physics 301  
Autumn Quarter 1993  
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George Williams

SECOND MIDTERM

Name (print) ___________________________ Name (signed) ___________________________

Discussion Instructor (circle): Chakhabzian  Condella  DiCarlo  Gundlach  Paul  Romer  Wei

Discussion Section # ______

SHOW ALL WORK!!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

For the system shown there is no friction between the blocks and the planes. The string is massless and the pulley is massless and frictionless.

\[ m_1 = 4.00 \, \text{kg} \quad m_2 = 10.00 \, \text{kg} \]

(a) If the positive direction is chosen as shown by the arrow, calculate the acceleration of the system, including sign.

(b) Calculate the tension in the string when the system is accelerated, and moving with a speed of 1.00 \, \text{m/s}.

\[
\begin{align*}
\text{Diagram 1:} & \quad T - m_1 g \cos 12^\circ = m_1 a \\
\text{Diagram 2:} & \quad m_2 g \cos 60^\circ - T = m_2 a
\end{align*}
\]

1) \[ T - m_1 g \cos 12^\circ = m_1 a \]
2) \[ m_2 g \cos 60^\circ - T = m_2 a \]

\[
\begin{align*}
m_2 g \cos 60^\circ - w_1 g \cos 12^\circ &= (w_1 + w_2) a \\
\end{align*}
\]

\[ a = g \frac{m_2 \cos 60^\circ - m_1 \cos 12^\circ}{m_1 + m_2} = \frac{9.8 \cos 60^\circ - 4.9 \cos 12^\circ}{10.00} = 0.75 \, \text{m/s}^2
\]

\[ T = m_1 (a + g \cos 12^\circ) = m_1 g (\cos 12^\circ + \frac{w_2 \cos 60^\circ - w_1 \cos 12^\circ}{m_1 + m_2})
\]

\[ = \frac{m_1 m_2}{m_1 + m_2} g (\cos 17^\circ + \cos 60^\circ) = \frac{m_1 m_2}{m_1 + m_2} g \left( \frac{1}{2} 0.64 + 0.50 \right) = 47.4 \, \text{N}
\]