Phys 121 Fall 2011 – Practice Problem P14

PHYS 121: Practice Problem of the Day:
Sept 16, 2011

P14. Tension and Buckets. Difficulty: Medium-Easy, Exam class question: Yes

Note: This is problem 8-1 from RWB In-Class Notes for Physics 121

Problem 8-1 One paint bucket with mass \( m_1 \) is hanging by a massless cord from another paint bucket with mass \( m_2 \), as shown. The two are being pulled by a massless cord attached to the upper bucket upward by a moving support with a given acceleration of \( a \).

a) Guess which of the tensions \( T_1 \) and \( T_2 \) is larger - or are they equal? As always in these initial guesses, any honest attempt is given full credit.

b) Now calculate the tensions \( T_1 \) and \( T_2 \) in lbs. for the two cords by drawing FBD’s for each mass, then using the second law to get an equation from each FBD, and finally solving the two equations for the two unknowns \( T_1 \) and \( T_2 \) in terms of \( a \), \( g \), \( m_1 \) and \( m_2 \).

c) Compare your answer in (b) to your guess in (a). If your guess was wrong, please examine your previous reasoning to try to improve it.

Solution by RWB on Next Page...
Solution to Problem P14: (by RWB)

a) Well, this example on p 8 suggests $T_1 > T_2$ and now $a \neq 0$ up doesn't change that relative relationship. You might guess because $m_1$ will exert some $m_2$ in the time we get to.

b) FBD to same as on p. 8-1, but now $a \neq 0$ of all up positive

\[ T_1 - T_2 - m_1 g = m_1 a \]
\[ T_1 = m_1 a + m_1 g + T_2 \]
\[ T_2 = m_2 a + m_2 g \]

1. $T_1 = (m_1 + m_2) (a + g)$

2. $T_1 > T_2$ as long as $g + a > 0$.

(c) Well, tell no right away that $T_1 = T_2 + m_1 (g + a)$.

\[ T_2 > T_1 \] if $a < -g$, this will reverse them.

\( a \text{ accel. downward} \) greater than gravity! Then $T_2 > T_1$. 