Problem 13-30

Given:

Required: Determine the tension developed in the cords attached to each block and the acceleration of the blocks. Neglect the mass of the pulleys and cords.

Equations of Motion:

1. \[ T_A = 78.48N \]
2. \[ T_B = 58.86N \]

Equations of Motion continued:

1. \[ T_A - 78.48N = (8kg)(9.81)x \]
2. \[ T_B - 58.86N = (6kg)(9.81)x \]

Position Coordinate Equation:

1. \[ l_1 = s_A + (s_B - s_C) \]
2. \[ l_2 = 2s_C - s_B \]

Eliminate \( s_C \) because we are only interested in \( A \) and \( B \):

1. \[ s_C = 2s_A - 1 \]
2. \[ l_2 = 2(2s_A - 1) + s_B \]
3. \[ l_2 = 4s_A - 2 + s_B \]
4. \[ l_2 = 4s_A + 5 + s_A \]

First derivative:

1. \[ 2 = 4V_A + V_B \]
2. \[ 2 = 4V_A + V_B \]

Second derivative:

1. \[ 0 = 4V_A - V_B \]
2. \[ 0 = 4V_A - 5V_B \]
Problem 13-30 continued

Solve Equations 1, 2, 3, and 4.

Substituting 3 into 1 yields:
\[ 4T_b - 78.98N = \left(\frac{8 \text{ kg}}{6 \text{ m}}\right)(-20) \Rightarrow 0 = -5T_b + 9.81 \]

Substituting 4 into 2 yields:
\[ T_a - 58.86N = \left(\frac{6 \text{ m}}{3 \text{ m}}\right)(-40A) = 240A \]

\[ T_b = 58.86N = 24\left[-5T_b + 9.81\right] \]
\[ 13T_b = 294.3N \]
\[ T_b = 22.6N \]
\[ T_a = 4(22.6N) \]
\[ T_a = 90.6N \]

and \[ 0 = -5T_b + 9.81 \]
\[ 0 = -5(22.6) + 9.81 \]
\[ 0 = -1.49 \text{ m/s}^2 \quad \text{or} \quad 0 = 1.49 \text{ m/s}^2 \]

and \[ a_6 = -40A \]
\[ a_6 = -4(-1.49 \text{ m/s}^2) \]
\[ a_6 = 5.96 \text{ m/s}^2 \quad \text{or} \quad a_6 = 5.96 \text{ m/s}^2 \]