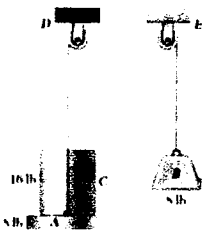
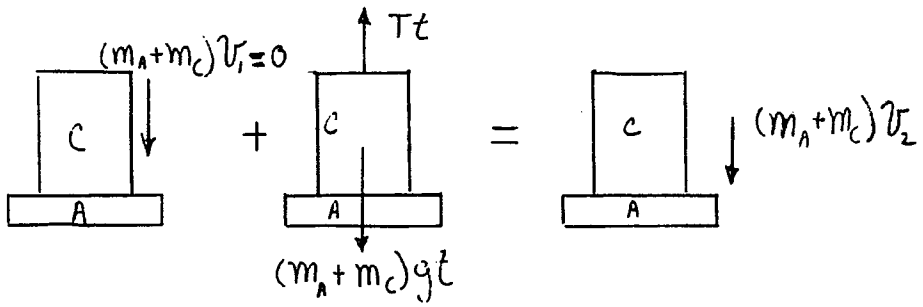
PROBLEM 13.132



A 16-lb cylinder C rests on an 8-lb platform A supported by a cord which passes over the pulleys D and E and is attached to an 8-lb block B. Knowing that the system is released from rest, determine (a) the velocity of block B after 0.8 s, (b) the force exerted by the cylinder on the platform.

SOLUTION

Blocks A and C

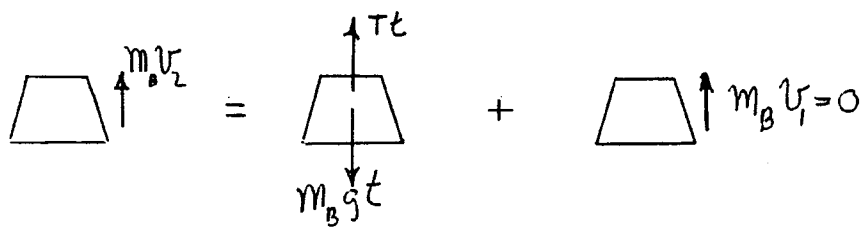


$$(m_A + m_B)v_1 + (m_A + m_C)gt - Tt = (m_A + m_C)v_2$$

$$0 + (16 + 8)t - Tt = \frac{(16 + 8)}{(32.2)}v_2$$

$$(24 - T)(0.8) = 0.7453v_2 \qquad (1)$$

Block B



$$m_Bv_2 = (T - m_Bg)t + 0; \qquad \frac{8}{32.2}v_2 = (T - 8)t$$

$$0.24845v_2 = (T - 8)(0.8) \qquad (2)$$

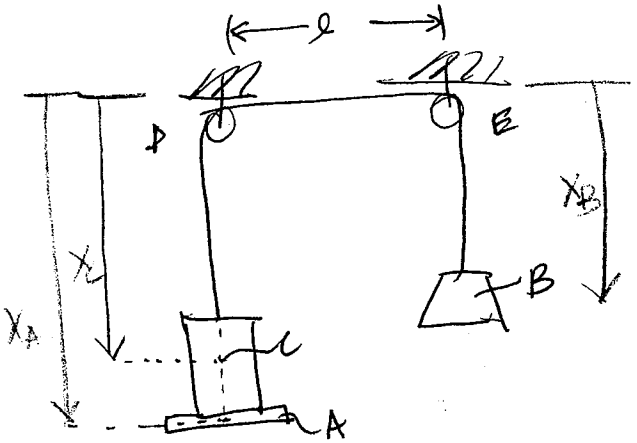
From (1) $$24 - T = 0.931677v_2 \Rightarrow T = 24 - 0.931677v_2$$

$$0.24845v_2 = 0.8[24 - 0.931677v_2 - 8]$$

$$1.242236v_2 = 16 \Rightarrow v_2 = 12.88$$

$$v_B = 12.88 \text{ ft/s} \blacktriangleleft$$

#13.132



$m_A = 5\,lb$

$m_B = 8\,lb$

$m_C = 15\,lb$

$V_0 = 0$ of system

- Find V_B $(t = 0.8\,s)$.
- $F_{C\text{ on }A}$.

- Constraint of cable:

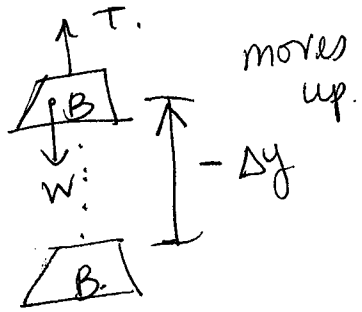
$$x_C + (x_A - x_C) + \ell + x_B = \text{const}$$

$$x_A + x_B = \text{const}$$

$$v_A + v_B = 0$$

$$a_A + a_B = 0$$

- External force acting on system: gravity.
  On each block: gravity & tensile force from cable.



$$\Sigma F_y = m a_{y,B}$$

$a = \text{const} = 32.2\,ft/s^2$

$$x = x_0 + v_0 t + \frac{1}{2} g t^2$$

$$\Delta y = \frac{1}{2}(-32.2)(0.8)^2$$

$$= -10.3\,ft$$

$$v = v_0 + at = -(32.2)(0.8)$$

$$= -25.76$$

or:

$$v^2 = v_0^2 + 2a(\Delta y)$$

$$v = \sqrt{2(-32.2)(-10.3)} = 25.76$$ ✓