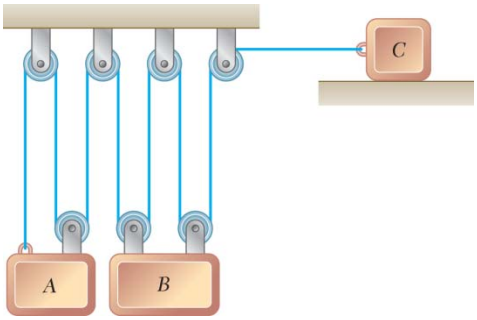
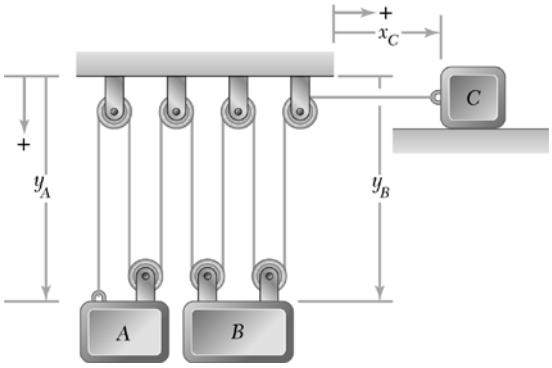


PROBLEM 11.58

Block B moves downward with a constant velocity of 20 mm/s. At $t = 0$, block A is moving upward with a constant acceleration, and its velocity is 30 mm/s. Knowing that at $t = 3$ s slider block C has moved 57 mm to the right, determine (*a*) the velocity of slider block C at $t = 0$, (*b*) the accelerations of A and C, (*c*) the change in position of block A after 5 s.

SOLUTION



From the diagram

$$3y_A + 4y_B + x_C = \text{constant}$$

Then
$$3v_A + 4v_B + v_C = 0 \qquad (1)$$

and
$$3a_A + 4a_B + a_C = 0 \qquad (2)$$

Given:
$$\mathbf{v}_B = 20 \text{ mm/s} \downarrow;$$
$$(\mathbf{v}_A)_0 = 30 \text{ mm/s} \uparrow$$

(*a*) Substituting into Eq. (1) at $t = 0$

$$3(-30 \text{ mm/s}) + 4(20 \text{ mm/s}) + (v_C)_0 = 0$$

$$(v_C)_0 = 10 \text{ mm/s} \quad \text{or} \quad (\mathbf{v}_C)_0 = 10.00 \text{ mm/s} \rightarrow \blacktriangleleft$$

(*b*) We have
$$x_C = (x_C)_0 + (v_C)_0 t + \frac{1}{2} a_C t^2$$

At $t = 3$ s:
$$57 \text{ mm} = (10 \text{ mm/s})(3 \text{ s}) + \frac{1}{2} a_C (3 \text{ s})^2$$

$$a_C = 6 \text{ mm/s}^2 \quad \text{or} \quad \mathbf{a}_C = 6.00 \text{ mm/s}^2 \rightarrow \blacktriangleleft$$

Now
$$\mathbf{v}_B = \text{constant} \rightarrow a_B = 0$$

PROBLEM 11.58 (Continued)

Then, substituting into Eq. (2)

$$3a_A + 4(0) + (6 \text{ mm/s}^2) = 0$$

$$a_A = -2 \text{ mm/s}^2 \quad \text{or} \quad \mathbf{a}_A = 2.00 \text{ mm/s}^2 \uparrow \blacktriangleleft$$

(*c*) We have $y_A = (y_A)_0 + (v_A)_0 t + \frac{1}{2} a_A t^2$

At $t = 5$ s: $y_A - (y_A)_0 = (-30 \text{ mm/s})(5 \text{ s}) + \frac{1}{2}(-2 \text{ mm/s}^2)(5 \text{ s})^2$

$$= -175 \text{ mm}$$

or $\mathbf{y}_A - (\mathbf{y}_A)_0 = 175.0 \text{ mm} \uparrow \blacktriangleleft$