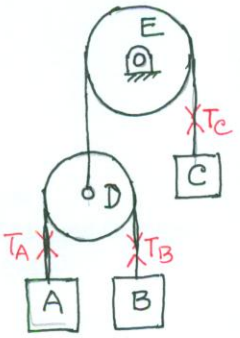
1146 / P. 329



$W_A = 1$ slug
$W_B = 2$ slug
$W_C = 4$ slug
$a_A = ?$
$v_A = ?$
$S_A = ?$
} absolute values at $t = 2$ s.

Sheaves D & E weightless
Chords are weightless & flexible
Released from at rest condⁿ.

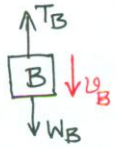
Solⁿ

$W_A + W_B < W_C$, so C will move down & sheave D will move up

But $W_B > W_A$, so B moves down and A moves up relative to B.

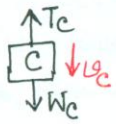
From free body of A
$\Sigma F_y = ma$ gives ($\uparrow$ +ve)

$$T_A - W_A = m_A \cdot a_A \quad \text{——} (1)$$



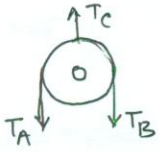
From freebody of B, ($\downarrow$ +ve)

$$W_B - T_B = m_B \cdot a_B \quad \text{——} (2)$$



From freebody of C, ($\downarrow$ +ve)

$$W_C - T_C = m_C \cdot a_C \quad \text{——} (3)$$



Since the sheaves are frictionless and chords are weightless & frictionless

$$T_A = T_B \quad \text{——} (4)$$

$$T_C = T_A + T_B = 2T_A \quad \text{——} (5)$$

Displacements of A & B are same (though opposite) and their acclⁿ should be same (also opposite)

$\therefore a_A - a_C = a_B + a_C$

$\Rightarrow 2a_C = a_A - a_B \quad \text{——} (6)$

Substituting T_C from (5) and a_C from (6) into eqⁿ (3)

$$W_C - 2T_A = \frac{m_C}{2}(a_A - a_B) \quad \text{——} (7)$$

Substituting T_B from (4) in eqⁿ (2)

$$W_B - T_A = m_B a_B \quad \text{——} (8)$$

Contd....

① + ⑧ gives

$$W_B - W_A = m_A a_A + m_B a_B$$

$$\Rightarrow (2-1)\times 32.2 = 1 \cdot a_A + 2 \cdot a_B$$

$$\therefore \; a_A + 2a_B = 32.2 \qquad \text{——— ⑨}$$

2 × ① + ⑦ gives

$$W_C - W_A = 2m_A a_A + \frac{m_C}{2}(a_A - a_B)$$

$$\Rightarrow (4-2)\times 32.2 = 2\times 1 \times a_A + \frac{4}{2}(a_A - a_B)$$

$$\Rightarrow \; 64.4 = 2a_A + 2a_A - 2a_B$$

$$\Rightarrow \; 2a_A - a_B = 32.2 \qquad \text{——— ⑩}$$

$2 \times ⑨ - ⑩ \Rightarrow 5a_B = 32.2$

$$\therefore a_B = 6.44 \text{ fps}^2$$

$\therefore$ from ⑨ $a_A = 32.2 - 2\times 6.44 = \boxed{19.32 \text{ fps}^2}$

Now $v_{A2} = v_{0A} + a_A t = 0 + 19.32 \times 2 = \boxed{38.64 \text{ fps}}$

$$S_{A2} = v_0 t + \frac{1}{2} a_A t^2 = 0 + \frac{1}{2}\times 19.32 \times 2^2 = \boxed{38.64 \text{ ft}}$$