Homework Solutions
9/11/2007

Problems

17.

$$\Sigma F_x = 0N$$
$$T_1 \cos 30 - T_2 \cos 60 = 0$$
$$T_1 \cos 30 = T_2 \cos 60$$
$$T_2 = 1.73T_1$$
$$\Sigma F_y = 0N$$
$$150N - T_1 \sin 30 - (1.73T_1)\sin 60 = 0$$
$$150N = 2T_1$$
$$T_1 = 75N$$
$$T_2 = 130N$$

19.

$$\Sigma F_{topblock} = T_{AB} - T_{CD} - 98N$$
$$\Sigma F_{bottomblock} = T_{CD} - 98N$$
$$\Sigma F_{topblock} = ma \rightarrow T_{AB} - T_{CD} - 98N = (10kg)2.0\frac{m}{s^2}$$
$$T_{AB} - T_{CD} = 20N + 98N = 118N$$

$$\Sigma F_{bottomblock} = ma \rightarrow T_{CD} - 98N = (10kg)2.0\frac{m}{s^2}$$

$$T_{CD} = 118N$$

$$T_{AB} = 236N$$

26.

$$W_1 = m_1 g = 10kg \bullet 9.81\frac{m}{s^2} = 98.1N$$

$$W_2 = m_2 g = 5kg \bullet 9.81\frac{m}{s^2} = 49.05N$$

$$W_{2,parallel} = W_2 \sin 40.0° = 31.53N$$

$$W_{2,\perp} = W_2 \cos 40.0° = 37.57N$$

$$a_1 = \frac{m_1 g - T}{m_1}$$

$$a_2 = \frac{T - W_{2,parallel}}{m_2} = \frac{T - m_2 g \sin\theta}{m_2}$$

$$a_1 = a_2$$

$$\frac{m_1 g - T}{m_1} = \frac{T - m_2 g \sin\theta}{m_2}$$

$$m_2 m_1 g - m_2 T = m_1 T - m_1 m_2 g \sin\theta$$

$$m_2 m_1 g + m_1 m_2 g \sin\theta = m_1 T + m_2 T$$

$$m_2 m_1 g(1 + \sin\theta) = (m_1 + m_2)T$$

$$T = \frac{m_2 m_1 g(1+\sin\theta)}{(m_1+m_2)} = \frac{(50kg^2)\left(9.81\frac{m}{s^2}\right)(1+\sin 40°)}{15kg}$$

$$T = \frac{805.79kg^2\frac{m}{s^2}}{15kg} = 53.7N$$

27. a.

$$a_{system} = \frac{\Sigma F}{m} = \frac{42N}{6kg} = 7.0\frac{m}{s}$$

b.

$$a_{3kg} = \frac{42N - T}{3kg}$$

$$a_{1kg+3kg} = \frac{T}{3kg}$$

$$a_{3kg} = a_{1kg+3kg}$$

$$\frac{42N - T}{3kg} = \frac{T}{3kg}$$

$$(42N - T)3kg = T3kg$$

$$126Nkg = 6kgT$$

$$T = 21N$$

c.

$$F = ma$$

$$F = 2kg \bullet 7\frac{m}{s^2} = 14N$$