Suggested problems

Chapter 05

The quiz questions will be same or very similar to the following text-book problems.

Refer to the course website for the latest version of this document.

You are encouraged to seek the help of your instructor during his office hours.

7. There are two forces on the 2.00 kg box in the overhead view of Fig. 5-31, but only one is shown. For $F_1 = 20.0 \text{ N}$, $a = 12.0 \text{ m/s}^2$, and $\theta = 30.0^\circ$, find the second force (a) in unit-vector notation and as (b) a magnitude and (c) an angle relative to the positive direction of the x axis.

Answer: (a) $-\left(32.0 \text{ m/s}^2\right) \hat{i} - \left(20.8 \text{ m/s}^2\right) \hat{j} \text{ N}$ (b) 38.2 N, (c) 213°

34. In Fig. 5-40, a crate of mass $m = 100 \text{ kg}$ is pushed at constant speed up a frictionless ramp ($\theta = 30.0^\circ$) by a horizontal force $\vec{F}$. What are the magnitudes of (a) $\vec{F}$ and (b) the force on the crate from the ramp?

Answer: (a) 566 N, (b) $1.13 \times 10^3 \text{ N}$

45. An elevator cab that weighs 27.8 kN moves upward. What is the tension in the cable if the cab’s speed is (a) increasing at a rate of 1.22 m/s$^2$ and (b) decreasing at a rate of 1.22 m/s$^2$?

Answer: (a) $3.13 \times 10^4 \text{ N}$ (b) $2.43 \times 10^4 \text{ N}$

50. In Fig. 5-46, three ballot boxes are connected by cords, one of which wraps over a pulley having negligible friction on its axle and negligible mass. The three masses are $m_A = 30.0 \text{ kg}$, $m_B = 40.0 \text{ kg}$, and $m_C = 10.0 \text{ kg}$. When the assembly is released from rest, (a) what is the tension in the cord connecting B and C, and (b) how far does A move in the first 0.250 s (assuming it does not reach the pulley)?

Answer: (a) 36.8 N, (b) 0.191 m

53. In Fig. 5-48, three connected blocks are pulled to the right on a horizontal frictionless table by a force of magnitude $T_3 = 65.0 \text{ N}$. If $m_1 = 12.0 \text{ kg}$, $m_2 = 24.0 \text{ kg}$, and $m_3 = 31.0 \text{ kg}$, calculate (a) the magnitude of the system’s acceleration, (b) the tension $T_1$, and (c) the tension $T_2$.

Answer: (a) 0.970 m/s$^2$, (b) 11.6 N (c) 34.9 N
55. Two blocks are in contact on a frictionless table. A horizontal force is applied to the larger block, as shown in Fig. 5-50. (a) If \( m_1 = 2.3 \text{ kg} \), \( m_2 = 1.2 \text{ kg} \), and \( F = 3.2 \text{ N} \), find the magnitude of the force between the two blocks. (b) Show that if a force of the same magnitude \( F \) is applied to the smaller block but in the opposite direction, the magnitude of the force between the blocks is \( 2.1 \text{ N} \), which is not the same value calculated in (a). (c) Explain the difference.

Answer: (a) 1.1 N (b) 2.1 N

78. In Fig. 5-64, a force \( \vec{F} \) of magnitude 12 N is applied to a FedEx box of mass \( m_2 = 1.0 \text{ kg} \). The force is directed up a plane tilted by \( \theta = 37^\circ \). The box is connected by a cord cord to a UPS box of mass \( m_1 = 3.0 \text{ kg} \) on the floor. The floor, plane, and pulley are frictionless, and the masses of the pulley and cord are negligible. What is the tension in the cord?

Answer: 4.6 N

82. In the overhead view of Fig. 5-65, five forces pull on a box of mass \( m = 4.0 \text{ kg} \). The force magnitudes are \( F_1 = 11 \text{ N} \), \( F_2 = 17 \text{ N} \), \( F_3 = 3.0 \text{ N} \), \( F_4 = 14 \text{ N} \), and \( F_5 = 5.0 \text{ N} \), and angle \( \theta_4 \) is 30°. Find the box’s acceleration (a) in unit-vector notation and as (b) a magnitude and (c) an angle relative to the positive direction of the x axis.

Answer: (a) \( (1.0 \text{ m/s}^2) \hat{i} - (1.3 \text{ m/s}^2) \hat{j} \) (b) 1.6 m/s² (c) −50°