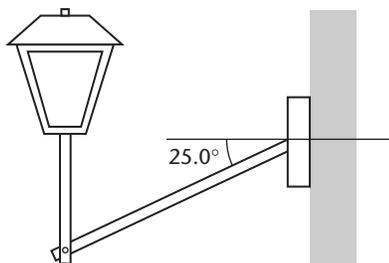# 7 Forces and Motion in Two Dimensions

1. A dog tugs forward with force of 28 N on a taut leash at an angle of 15° from the horizontal. What is the magnitude of the tension in the leash?

2. A rod supports a 2.35-kg lamp as shown below.

25.0°

a. What is the magnitude of the tension in the rod?

b. Calculate the components of the force that the bracket exerts on the rod?

3. A 20.0-N box is resting on a frictionless surface as shown below.

55.0°
Wire
Frictionless surface
20.0 N
Frictionless pulley
m
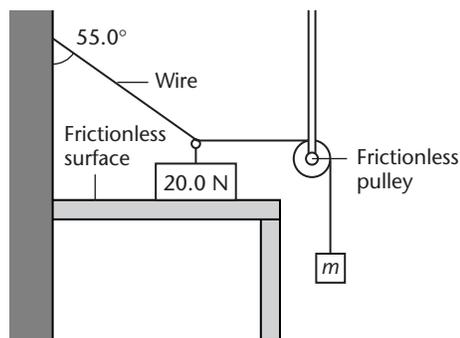
a. If the magnitude of the tension in the wire is 12.0 N, what is the value of the mass, m?

b. The table supporting the box is removed and the height of the pulley is adjusted so that the string connecting mass, m, and the box remains parallel to the floor. What is the magnitude and orientation of the tension in the wire?

4. A 25.0-kg crate has an adjustable handle so that it can be pushed or pulled by the handle at various angles.

F = 70.0 N at 0.0°

F = 70.0 N at 330.0°

m = 25.0 kg
(a)   (b)
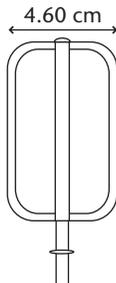
F = 70.0 N at 30.0°

(c)
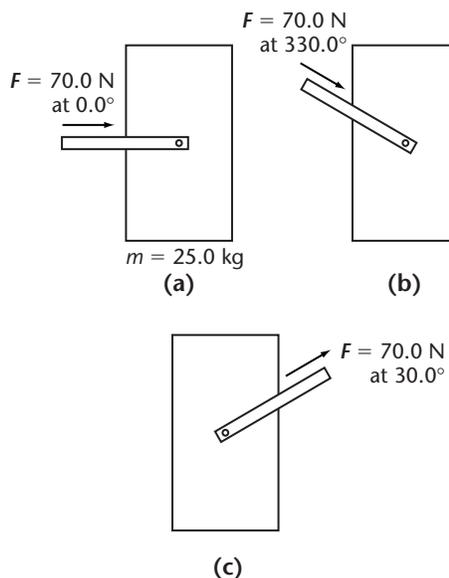
Determine the acceleration of the crate for each situation shown in the diagram knowing that the coefficient of sliding friction between the floor and the bottom of the crate is 0.20.

5. A child shoves a small toboggan weighing 100.0-N up a snowy hill, giving the toboggan an initial speed of 6.0 m/s. If the hill is inclined at an angle of 32° above the horizontal, how far along the hill will the toboggan slide? Assume the coefficient of sliding friction between the toboggan and the snow is 0.15.

6. A nozzle in a fountain is angled 23° below the horizontal and is located 2.0 m above the edge of the basin. If the water is ejected at a speed of 4.2 m/s from the nozzle, how far from the edge of the basin does the water fall?

7 Forces and Motion in Two Dimensions

7. A juggler tosses a ball from his right hand to his left hand, which is at the same level as his right hand and 0.60 m to the side. If the ball reaches a height of 0.80 m above the level of his hands, with what velocity does the ball leave his right hand?

8. A skateboarder is slowing down at a rate of 0.70 m/s². At the moment he is moving 1.5 m/s forward, he throws a basketball upward a distance of 3.0 m and catches it at the same level it was thrown without changing his position on the skateboard. Determine the vertical and horizontal components of the ball's velocity relative to the skateboard when the ball left his hand.

9. The beaters of an electric mixer are shown below.

4.60 cm

What is the acceleration of the outer part of a blade as it rotates at a rate of 1200 revolutions per minute?

10. A clown rides a small car at a speed of 15 km/h along a circular path with a radius of 3.5 m.

   a. What is the magnitude of the centripetal force on a 0.18-kg ball held by the clown?

   b. At the point where the car is headed due north, the clown throws the ball vertically upward with a speed of 5.0 m/s relative to the moving car. To where must a second clown run to catch the ball the same distance above the ground as it was thrown?

Physics: Principles and Problems