9. A 170 kg crate hangs from the end of a rope of length L = 12.0 m. You push horizontally on the crate with a varying force $\vec{F}$ to move it distance d = 3.50 m to the side (Fig. 7-20). (a) What is the magnitude of $\vec{F}$ when the crate is in this final position? During the crate's displacement, what are (b) the total work done on it, (c) the work done by the gravitational force on the crate, and (d) the work done by the pull on the crate from the rope? (e) Knowing that the crate is motionless before and after its displacement, use the answers to (b), (c), and (d) to find the work your force $\vec{F}$ does on the crate. (f) Why is the work of your force not equal to the product of the horizontal displacement and the answer to (a)?

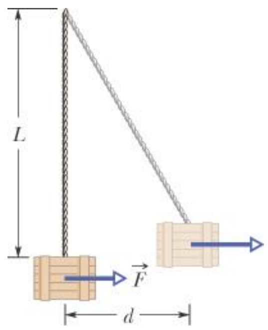

Figure 7-20 Problem 9.

10. A freight elevator has a cab with a total mass of 1400 kg, which is required to travel upward 54 m in 3.0 min, starting and ending at rest. The elevator's counterweight has a mass of only 900 kg, and so the elevator motor must help. What average power is required of the force the motor exerts on the cab via the cable?

14. In Fig. 7-22, a horizontal force $\vec{F}_a$ of magnitude 20.0 N is applied to a 2.00 kg psychology book as the book slides a distance d = 0.700 m up a frictionless ramp at angle θ = 25.0°. (a) During the displacement, what is the net work done on the book by $\vec{F}_a$, the gravitational force on the book, and the normal force on the book? (b) If the book has zero kinetic energy at the start of the displacement, what is its speed at the end of the displacement?

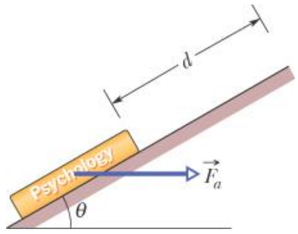

Figure 7-22 Problem 14.

18. In Fig. 7-24, a block of ice slides down a frictionless ramp at angle θ = 50° while an ice worker pulls on the block (via a rope) with a force $\vec{F}_r$ that has a magnitude of 70 N and is directed up the ramp. As the block slides through distance d = 0.60 m along the ramp, its kinetic energy increases by 80 J. How much greater would its kinetic energy have been if the rope had not been attached to the block?

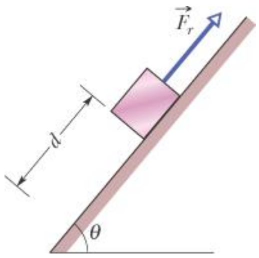

Figure 7-24 Problem 18.

24. A 400 g block is dropped onto a relaxed vertical spring that has a spring constant of k = 2.5 N/cm (Fig. 7-27). The block becomes attached to the spring and compresses the spring 18.0 m before momentarily stopping. While the spring is being compressed, what work is done on the block by (a) the gravitational force on it and (b) the spring force? (c) What is the speed of the block just before it hits the spring? (Assume that friction is negligible.) (d) If the speed at impact is doubled, what is the maximum compression of the spring?

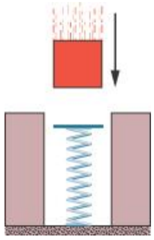

Figure 7-27 Problem 24.

40. In the block–spring arrangement of Fig. 7-10, the block's mass is 3.20 kg and the spring constant is 650 N/m. The block is released from position x_i = 0.400 m. What are (a) the block's speed at x = 0, (b) the work done by the spring when the block reaches x = 0, (c) the instantaneous power due to the spring at the release point x_i, (d) the instantaneous power at x = 0, and (e) the block's position when the power is maximum?