Additional Exercises

A-1: On a ski weekend in Colorado, Bob, whose mass is 75.0 kg, skis down a hill that is inclined at an angle of 15.0° to the horizontal and has a vertical rise of 25.0 m. How much work is done by gravity on Bob as he goes down the hill?

A-2: A pile driver is a device used to drive stakes into the ground. While building a fence, Adam drops a pile driver of mass 3000. kg through a vertical distance of 8.0 m. The pile driver is opposed by a resisting force of 5.0×10^6 N. How far is the stake driven into the ground on the first stroke?

A-3: At Six Flags New England in Agawam, Massachusetts, a ride called the Cyclone is a giant roller coaster that ascends a 34.1-m hill and then drops 21.9 m before ascending the next hill. The train of cars has a mass of 4727 kg. a) How much work is required to get an empty train of cars from the ground to the top of the first hill? b) What power must be generated to bring the train to the top of the first hill in 30.0 s? c) How much PE is converted into KE from the top of the first hill to the bottom of the 21.9-m drop?

A-4: A flea gains 1.0×10^{-7} J of PE jumping up to a height of 0.030 m from a dog's back. What is the mass of the flea?

A-5: At target practice, Diana holds her bow and pulls the arrow back a distance of 0.30 m by exerting an average force of 40.0 N. What is the potential energy stored in the bow the moment before the arrow is released?

A-6: The coyote, whose mass is 20.0 kg, is chasing the roadrunner when the coyote accidentally runs off the edge of a cliff and plummets to the ground 30.0 m below. What force does the ground exert on the coyote as he makes a coyote-shaped dent 0.420 m deep in the ground?

A-7: A 0.080-kg robin, perched on a power line 6.0 m above the ground, swoops down to snatch a worm from the ground and then returns to an 8.0-m-high tree branch with his catch. a) By how much did the bird's PE increase in its trip from the power line to the tree branch? b) How would your answer have changed if the bird had flown around a bit before landing on the tree branch?

A-8: Blackie, a cat whose mass is 5.45 kg, is napping on top of the refrigerator when he rolls over and falls. Blackie has a KE of 85.5 J just before he lands on his feet on the floor. How tall is the refrigerator?

A-9: Calories measure energy we get from food, and one dietary Calorie is equal to 4187 J. The average food energy intake for human beings is 2000. Calories/day. Assume you have a mass of 55.0 kg and you want to burn off all the Calories you consume in one day. How high a mountain would you have to climb to do so? (Note: This calculation ignores the large amount of energy the body continually loses to heat.)

A-10: From a height of 2.15 m above the floor of Boston's Fleet Center, forward Paul Pierce tosses a shot straight up next to the basketball hoop with a KE of 5.40 J. If his regulation-size basketball has a mass of 0.600 kg, will his shot go as high as the 3.04-m hoop? Use the law of conservation of energy.

A-11: Mr. Macintosh, a computer technician, uses a screwdriver with a handle of radius 1.2 cm to remove a screw in the back of a computer. The screw moves out 0.20 cm on each complete turn. What is the ideal mechanical advantage of the screwdriver?

A-12: Tom's favorite pastime is fishing. a) How much work is required for Tom to reel in a 10.0-kg bluefish from the water's surface to the deck of a fishing boat, 5.20 m above the water, if the reel of his fishing pole is 85.0% efficient? b) If Tom applies a force of 15 N to the reel's crank handle, what is the actual mechanical advantage of the fishing pole? c) What is the ideal mechanical advantage of the fishing pole?

A-13: A nutcracker 16 cm long is used to crack open a Brazil nut that is placed 12 cm from where your hand is squeezing the nutcracker. What is the ideal mechanical advantage of the nutcracker?

A1. 18 800 J
A3. a) 1 610 000 J
b) 53 700 W
c) 1 040 000 J
A5. 12 J
A7. a) 1.6 J
A9. 15 200 m
A11. 38
A13. 3