Conceptual Questions

1. A girl with a heavy backpack wants to climb to the top of a hill. The path straight up the hill is 100 m long. Rather than going straight up she chooses a zigzag path 200 m long. The work she does on the backpack is ___ the work she does on the backpack going up in a straight line.

a) ¼ of b) ⅓ of c) ½ of d) equal to e) twice

2. Can the normal force on an object ever do work? Explain.
3. A woman swimming upstream s not moving with respect to the shore
   a) Is she doing work?
   b) If she stops swimming and merely floats, is work done on her?
4. A friend of yours describes holding a bucket of water steady with your arms straight out in front of you as hard work. Why would this statement be incorrect? Explain.
5. A sailboat on a lake is slowing down.
   a) Is work being done on the boat? Explain.
   b) Recognizing that the wind propels the boat forward and the water resists the boat's motion, what does your answer in part a) imply about the work done by the wind's force compared to the work done by the water's resistive force?

Problems

6. How much work does a boy do if he exerts a net force of 55 N to push a box 18 m along the ground?
7. If a girl uses 1.0 J of work to lift a 1.0 kg book vertically, how high can she lift the book?
8. A baseball (m=150 g) travelling at 40 m/s [→] enters a baseball glove horizontally. If the catcher moves his glove backwards a distance of 12 cm while bringing the ball to rest, calculate:
   a) the work required to stop the ball
   b) the force that the glove exerts on the ball as the ball comes to rest
   c) the force the ball exerts on the glove.
9. A box of mass 5.0 kg is accelerated from rest across a floor at a rate of 2.0 m/s^2 for 0.70 s. Find the total work done on the box.
10. Eight books, each 4.3 cm thick with mass 1.7 kg, lie flat on a table. How much work is required to stack them one on top of the other?

11. A wagon full of newspapers is pulled at a constant velocity of 0.50 m/s for a distance of 100. m. If the forces of friction add up to 20. N and the papers and the wagon have a combined mass of 40. kg, calculate
    a) the net force on the wagon.
    b) the applied force on the wagon.
    c) the work done on the wagon.
    d) the work done by the "puller".
12. An object A moving horizontally with a kinetic energy of 0.80 kJ experiences a constant horizontal opposing force of magnitude of 100. N while moving from a place X to a place Y, where XY is 2.0 m.
    a) What is the energy of A at Y?
    b) In what further distance will A come to rest, if this opposing force continues to act on A?
13. A husband and wife take turns pulling their child in a wagon along a horizontal sidewalk. Each exerts a constant force and pulls the wagon through the same displacement. They do the same amount of work, but the husband's pulling force is directed 58° above the horizontal, and the wife's pulling force is directed 38° above the horizontal. The husband pulls with a force whose magnitude is 67 N. What is the magnitude of the pulling force exerted by his wife?
14. A 35-kg box needs to be lifted to the top of a loading dock, which is also accessible by ramp. The ramp is 5.0 m long and has a vertical height of 1.7 m.
    a) What minimum force is required to lift the box straight up onto the loading dock?
    b) What minimum amount of work is required to lift the crate straight up onto the loading dock?
    c) What force is required to push the crate up the ramp such that the amount of work is the same as in b)? Assume no friction.