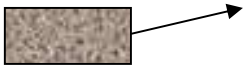
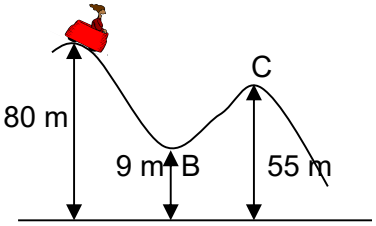
1. Dilbert Dimbulb wants to move a 500-kg rock with his bare hands. He pushes on the rock for 2 hours (7200 seconds), but the rock doesn't budge. How much work did Dilbert do on the rock?
2. Dilbert's brother Donald found a 50-kg rock and wanted to prove how strong he was, so he held it above his head for 2 hours at a height of 2 meters.
   a. How much work did Donald do to get the rock above his head?
   b. How much work did Donald do while holding the rock above his head for 2 hours?
3. A tugboat exerts a constant force of 5000 N on a ship moving at a constant speed through a harbor. How much work does the tugboat do on the ship in a distance of 3.0 km?
4. A 100-kg box of sand needs to be moved 5 meters. Which method of pulling will use the least force?

   a. 
   b. 
   c. 
5. What are the SI units for measuring energy?
6. Indicate whether each item is an example of kinetic or potential energy:
   a. The chemical energy in a hamburger sitting on a plate
   b. The mechanical energy of the earth orbiting the sun
   c. The electrical energy of electrons moving through a wire
   d. The heat energy of a burning log
   e. The chemical energy of your cell phone battery
7. Can the kinetic energy of an object be negative?
8. If the speed of an object is doubled, by what factor does the kinetic energy change?
9. One bullet has twice the mass of another bullet. If both bullets are fired at the same speed, what is the ratio of the kinetic energies of the two bullets?
10. A 5-kg rock is at rest on the edge of a 20-meter cliff, about ready to fall off.
    a. What is the PE of the rock on the edge of the cliff?
    b. What is the KE of the rock just before it hits the ground after falling?
    c. When is the PE equal to the KE?
    d. What is the speed of the rock just before it hits the ground?
11. A 250-kg rollercoaster car is at the top of the first hill, as shown below. Find the speed of the car at the bottom of the hill (Point B) and the top of the next hill (Point C). Assume there is no friction.



12. Honors: A 15-kg block is pulled on a frictionless surface with a cord that is not parallel to the surface. The block is pulled 2.5 meters and 154 Joules of work was done on the block. If the force used to pull the block was 64 Newtons, what is the angle of the cord?

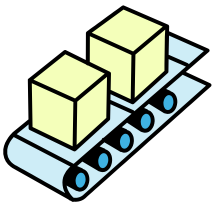
Bonus: List three things that James Joule discovered.

13. In science, what is power?

14. What is the metric unit for measuring power?

15. A 135-gram box of crackers is shoved across the countertop with an initial speed of 3.4 m/s. When the box comes to a stop, how much work has friction performed?

16. Fed Ex uses a large ramp to move packages quickly in their warehouse. A 2.3-kg package is at the top of a 1.85-meter tall ramp. When the package slides to the bottom ramp, its speed is 3.5 m/s. How much work did friction do?



17. You slide your 0.87-kg Physics book across the table. The coefficient of kinetic friction between the table and your book is 0.45. If the book's initial speed is 3.4 m/s, how far will the book slide before coming to a halt?

18. You use a force of 58 N to move a box 6.42 meters in 39 seconds. How much power have you exerted?

19. A 700-N Marine in basic training climbs a 10.0-m vertical rope at a constant speed in 8.0 s. What is his power output?

20. Honors: A man cleaning a floor pulls a vacuum cleaner with a force of 50 N at an angle of 30° with the floor. How much work does he do if the vacuum cleaner is displaced horizontally 3.0 meters?



21. Honors: A force of (5i + 2j) N causes an object to have a displacement of (2i + 3j) meters. Calculate the work done by the force.

22. Honors: A particle had a displacement of (-42.6i + 18.9 j) meters after it was acted on by a force of (-25.1i + 37.6j) N.

    a. Calculate the work done on the particle.

    b. If the work was done in 0.14 seconds, what was the power of the force?