Work, Power, and Energy

1. How much work is done on a downhill skier by an average braking force of 980N to stop her in a distance of 10 meters? 9800 J

2. A constant force of 1900N is required to keep an automobile having a mass of 1000kg moving at a constant speed of 20 m/s. What is the work done in moving the automobile a distance of 2000m? $W = (1900N)(2000m) =$ 3,800,000 J

3. A student does 60J of work pushing a 3-kg box up the full length of a ramp that is 5m long. What is the magnitude of the force applied to the box to do this work? $F = \frac{W}{d} = \frac{60J}{5m} = 12N$

4. Which action would require no work to be done on an object?
   a. Lifting the object from the floor to the ceiling
   b. Pushing the object along a horizontal floor against a frictional force
   c. Decreasing the speed of the object until it comes to rest
   (d.) Holding the object stationary above the ground

5. The diagram below shows a 50-kg crate on a frictionless plane at an angle θ to the horizontal. The crate is pushed at constant speed up the incline from point A to point B by force F. If angle θ were increased, what would be the effect on the magnitude of force F and the total work W done on the crate as it is moved from A to B?

   a. W would remain the same and the magnitude of F would decrease.
   b. W would remain the same and the magnitude of F would increase.
   c. W would increase and the magnitude of F would decrease.
   (d.) W would increase and the magnitude of F would increase.

6. A 3-kg block is initially at rest on a frictionless horizontal surface. The block is moved 8m in 2 seconds by the application of a 12N horizontal force. What is the average power developed while moving the block? $P = \frac{W}{t} = \frac{(12N)(8m)}{2s} = 48$ watts

7. A 4000W motor applies a force of 800N to move a boat at constant speed. How far does the boat move in 16 seconds? $W = P \cdot t = (4000W)(16s) = 64000J = F \cdot d = 7d = \frac{64000J}{800N} = 80m$

8. A motor having a power rating of 500W is used to lift an object weighing 100N. How much time does the motor take to lift the object a vertical distance of 10m?

$$P = \frac{E}{t} \Rightarrow t = \frac{E \cdot d}{P} = \frac{(100N)(10m)}{500W} = 2s$$