

## 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?  $9800\text{ J}$

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?  $W = (1900\text{ N})(2000\text{ m}) = 3,800,000\text{ J}$

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?  $F = \frac{W}{d} = \frac{60\text{ J}}{5\text{ m}} = 12\text{ N}$

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

5. The diagram below shows a 50-kg crate on a frictionless plane at an angle  $\theta$  to the horizontal. The crate is pushed at constant speed up the incline from point A to point B by force F. If angle  $\theta$  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?



- W would remain the same and the magnitude of F would decrease.
- W would remain the same and the magnitude of F would increase.
- W would increase and the magnitude of F would decrease.
- 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?  $P = \frac{W}{t} = \frac{(12\text{ N})(8\text{ m})}{2\text{ s}} = 48\text{ W}$

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?  $W = P \cdot t = (4000\text{ W})(16\text{ s}) = 64000\text{ J} = F \cdot d \Rightarrow d = \frac{64000\text{ J}}{800\text{ N}} = 80\text{ m}$

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?

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