

## Work, Energy, and Power Practice Problems

Name: \_\_\_\_\_

1. Renatta Gass is out with her friends. Misfortune occurs and Renatta and her friends find themselves getting a *workout*. They apply a cumulative force of 1080 N to push the car 218 m to the nearest fuel station. Determine the work done on the car.
2. Hans Full is pulling on a rope to drag his backpack to school across the ice. He pulls upwards and rightwards with a force of 22.9 Newtons at an angle of 35 degrees above the horizontal to drag his backpack a horizontal distance of 129 meters to the right. Determine the work (in Joules) done upon the backpack.
3. Lamar Gant, U.S. powerlifting star, became the first man to deadlift five times his own body weight in 1985. Deadlifting involves raising a loaded barbell from the floor to a position above the head with outstretched arms. Determine the work done by Lamar in deadlifting 300 kg to a height of 0.90 m above the ground.
4. During the Powerhouse lab, Jerome runs up the stairs, elevating his 102 kg body a vertical distance of 2.29 meters in a time of 1.32 seconds at a constant speed.
  - a. Determine the work done by Jerome in climbing the staircase.
  - b. Determine the power generated by Jerome.
5. A 78-kg skydiver has a speed of 62 m/s at an altitude of 870 m above the ground.
  - a. Determine the kinetic energy possessed by the skydiver.
  - b. Determine the potential energy possessed by the skydiver.
  - c. Determine the total mechanical energy (kinetic energy + potential energy) possessed by the skydiver.
6. Justin Thyme is traveling down Lake Avenue at 32.8 m/s in his 1510-kg 1992 Camaro. He spots a police car with a radar gun and quickly slows down to a legal speed of 20.1 m/s.
  - a. Determine the initial kinetic energy of the Camaro.
  - b. Determine the kinetic energy of the Camaro after slowing down.
  - c. Determine the amount of work done on the Camaro during the deceleration.

7. The first asteroid to be discovered is Ceres. It is the largest and most massive asteroid in our solar system's asteroid belt, having an estimated mass of  $3.0 \times 10^{21}$  kg and an orbital speed of 17900 m/s. Determine the amount of kinetic energy possessed by Ceres.
8. The Taipei 101 in Taiwan is a 1667-foot tall, 101-story skyscraper. The skyscraper is the home of the world's fastest elevator. The elevators transport visitors from the ground floor to the Observation Deck on the 89th floor at speeds up to 16.8 m/s. Determine the power delivered by the motor to lift the 10 passengers at this speed. The combined mass of the passengers and cabin is 1250 kg.
9. Suzie Lavtanski ( $m=56$  kg) is skiing at Bluebird Mountain. She is moving at 16 m/s across the crest of a ski hill located 34 m above ground level at the end of the run.
- Determine Suzie's kinetic energy.
  - Determine Suzie's potential energy relative to the height of the ground at the end of the run.
  - Determine Suzie's total mechanical energy at the crest of the hill.
  - If no energy is lost or gained between the top of the hill and her initial arrival at the end of the run, then what will be Suzie's total mechanical energy at the end of the run?
  - Determine Suzie's speed as she arrives at the end of the run and prior to braking to a stop.
10. The ski slopes at Bluebird Mountain make use of tow ropes to transport snowboarders and skiers to the summit of the hill. One of the tow ropes is powered by a 22-kW motor which pulls skiers along an icy incline of  $14^\circ$  at a constant speed. Suppose that 18 skiers with an average mass of 48 kg hold onto the rope and suppose that the motor operates at full power.
- Determine the cumulative weight of all these skiers.
  - Bonus:** Determine the force required to pull this amount of weight up a  $14^\circ$  incline at a constant speed.
  - Bonus:** Determine the speed at which the skiers will ascend the hill.

11. A substance with a mass of 10 kg gains 57,200 J of heat when its temperature increases 15°C. What is this substance's specific heat?
12. The temperature of a block of iron increases by 3 K when 2700 J of energy are added to it. What is the mass of this block of iron?
13. A 38 kg block of lead (specific heat = 130 J/kg K) is heated from -26 °C to 180° C. How much heat is absorbed?