Chapter 8 Potential Energy and Conservation of Energy
8.4.1. A donkey pulls a crate up a rough, inclined plane at constant speed. Which one of the following statements concerning this situation is false?

a) The gravitational potential energy of the crate is increasing.

b) The net work done by all the forces acting on the crate is zero joules.

c) The work done on the crate by the normal force of the plane is zero joules.

d) The donkey does "positive" work in pulling the crate up the incline.

e) The work done on the object by gravity is zero joules.
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8.4.2. Larry’s gravitational potential energy is 1870 J as he sits 2.20 m above the ground in a sky diving airplane. What is his gravitational potential energy when he begins to jump from the airplane at an altitude of 923 m?

a) $3.29 \times 10^4$ J

b) $9.36 \times 10^2$ J

c) $4.22 \times 10^6$ J

d) $1.87 \times 10^3$ J

e) $7.85 \times 10^5$ J
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8.4.3. A mountain climber pulls a supply pack up the side of a mountain at constant speed. Which one of the following statements concerning this situation is false?

a) The net work done by all the forces acting on the pack is zero joules.

b) The work done on the pack by the normal force of the mountain is zero joules.

c) The work done on the pack by gravity is zero joules.

d) The gravitational potential energy of the pack is increasing.

e) The climber does "positive" work in pulling the pack up the mountain.
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e) The climber does "positive" work in pulling the pack up the mountain.
8.5.1. After an ice storm, ice falls from one of the top floors of a 65-story building. The ice falls freely under the influence of gravity. Which one of the following statements concerning this situation is true? Ignore any effects due to non-conservative forces.

a) The kinetic energy of the ice increases by equal amounts for equal distances.

b) The kinetic energy of the ice increases by equal amounts for equal times.

c) The potential energy of the ices decreases by equal amounts for equal times.

d) The total energy of the block increases by equal amounts over equal distances.

e) As the block falls, the net work done by all of the forces acting on the ice is zero joules.
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d) The total energy of the block increases by equal amounts over equal distances.

e) As the block falls, the net work done by all of the forces acting on the ice is zero joules.
8.5.2. Two balls of equal size are dropped from the same height from the roof of a building. One ball has twice the mass of the other. When the balls reach the ground, how do the kinetic energies of the two balls compare?

a) The lighter one has one fourth as much kinetic energy as the other does.

b) The lighter one has one half as much kinetic energy as the other does.

c) The lighter one has the same kinetic energy as the other does.

d) The lighter one has twice as much kinetic energy as the other does.

e) The lighter one has four times as much kinetic energy as the other does.
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e) The lighter one has four times as much kinetic energy as the other does.
8.5.3. Determine the amount of work done in firing a 2.0-kg projectile with an initial speed of 50 m/s. Neglect any effects due to air resistance.

a) 900 J

b) 1600 J

c) 2500 J

d) 4900 J

e) This cannot be determined without knowing the launch angle.
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a) 900 J

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d) 4900 J

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8.5.4. A roller coaster car travels down a hill and is moving at 18 m/s as it passes through a section of straight, horizontal track. The car then travels up another hill that has a maximum height of 15 m. If frictional effects are ignored, determine whether the car can reach the top of the hill. If it does reach the top, what is the speed of the car at the top?

a) No, the car doesn’t make it up the hill. It is going too slow.

b) Yes, the car just barely makes it to the top and stops. The final speed is zero m/s.

c) Yes, the car not only makes it to the top, but it is moving at 5.4 m/s.

d) Yes, the car not only makes it to the top, but it is moving at 9.0 m/s.

e) Yes, the car not only makes it to the top, but it is moving at 18 m/s.
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8.5.5. You are investigating the safety of a playground slide. You are interested in finding out what the maximum speed will be of children sliding on it when the conditions make it very slippery (assume frictionless). The height of the slide is 2.5 m. What is that maximum speed of a child if she starts from rest at the top?

a) 1.9 m/s

b) 2.5 m/s

c) 4.9 m/s

d) 7.0 m/s

e) 9.8 m/s
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d) 7.0 m/s
e) 9.8 m/s
8.5.6. A quarter is dropped from rest from the fifth floor of a very tall building. The speed of the quarter is $v$ just before striking the ground. From what floor would the quarter have to be dropped from rest for the speed just before striking the ground to be approximately $2v$? Ignore all air resistance effects to determine your answer.

a) 14
b) 25
c) 20
d) 7
e) 10
8.5.6. A quarter is dropped from rest from the fifth floor of a very tall building. The speed of the quarter is $v$ just before striking the ground. From what floor would the quarter have to be dropped from rest for the speed just before striking the ground to be approximately $2v$? Ignore all air resistance effects to determine your answer.

a) 14
b) 25
c) 20
d) 7
e) 10
8.5.7. Two identical balls are thrown from the same height from the roof of a building. One ball is thrown upward with an initial speed $v$. The second ball is thrown downward with the same initial speed $v$. When the balls reach the ground, how do the kinetic energies of the two balls compare? Ignore any air resistance effects.

a) The kinetic energies of the two balls will be the same.

b) The first ball will have twice the kinetic energy as the second ball.

c) The first ball will have one half the kinetic energy as the second ball.

d) The first ball will have four times the kinetic energy as the second ball.

e) The first ball will have three times the kinetic energy as the second ball.
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8.7.1. A car is being driven along a country road on a dark and rainy night at a speed of 20 m/s. The section of road is horizontal and straight. The driver sees that a tree has fallen and covered the road ahead. Panicking, the driver locks the brakes at a distance of 20 m from the tree. If the coefficient of friction between the wheels and road is 0.8, determine the outcome.

a) The car stops 5.5 m before the tree.

b) The car stops just before reaching the tree.

c) As the car crashes into the tree, its speed is 18 m/s.

d) As the car crashes into the tree, its speed is 9.3 m/s.

e) This problem cannot be solved without knowing the mass of the car.
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8.7.2. A rubber ball is dropped from rest from a height $h$. The ball bounces off the floor and reaches a height of $2h/3$. How can we use the principle of the conservation of mechanical energy to interpret this observation?

a) During the collision with the floor, the floor did not push hard enough on the ball for it to reach its original height.

b) Some of the ball’s potential energy was lost in accelerating it toward the floor.

c) The force of the earth’s gravity on the ball prevented it from returning to its original height.

d) Work was done on the ball by the gravitational force that reduced the ball’s kinetic energy.

e) Work was done on the ball by non-conservative forces that resulted in the ball having less total mechanical energy after the bounce.
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e) Work was done on the ball by non-conservative forces that resulted in the ball having less total mechanical energy after the bounce.
8.7.3. The Jensens decided to spend their family vacation white water rafting. During one segment of their trip down a horizontal section of the river, the raft (total mass = 544 kg) has an initial speed of 6.75 m/s. The raft then drops a vertical distance of 14.0 m, ending with a final speed of 15.2 m/s. How much work was done on the raft by non-conservative forces?

a) −12 100 J
b) −18 200 J
c) −24 200 J
d) −36 300 J
e) −48 400 J
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a) $-12,100 \text{ J}$

b) $-18,200 \text{ J}$

c) $-24,200 \text{ J}$

d) $-36,300 \text{ J}$

e) $-48,400 \text{ J}$
8.8.1. A dam blocks the passage of a river and generates electricity. Approximately, 57,000 kg of water fall each second through a height of 19 m. If one half of the gravitational potential energy of the water were converted to electrical energy, how much power would be generated?

a) $2.7 \times 10^6$ W

b) $5.3 \times 10^6$ W

c) $1.1 \times 10^7$ W

d) $1.3 \times 10^8$ W

e) $2.7 \times 10^8$ W
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b) 5.3 \times 10^6 W

c) 1.1 \times 10^7 W

d) 1.3 \times 10^8 W

e) 2.7 \times 10^8 W
8.8.2. If the amount of energy needed to operate a 100 W light bulb for one minute were used to launch a 2-kg projectile, what maximum height could the projectile reach, ignoring any resistive effects?

a) 20 m
b) 50 m
c) 100 m
d) 200 m
e) 300 m
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a) 20 m
b) 50 m
c) 100 m
d) 200 m
e) 300 m
8.8.3. A 65-kg hiker eats a 250 C-snack. Assuming the body converts this snack with an efficiency of 25%, what change of altitude could this hiker achieve by hiking up the side of a mountain before completely using the energy in the snack? One food calorie (C) is equal to 4186 joules.

a) 270 m
b) 410 m
c) 650 m
d) 880 m
e) 1600 m
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