Name _____ Date _____

Kinetic and Potential Energy Calculations with Mass, Speed and Height

Directions: In number questions, type only the number; the unit is shown next to the box. When a question needs a value for gravity, it gives you one to use.

1. Kinetic energy = ½ × mass × speed^2. A 4-kilogram bowling ball rolls down the lane at 5 meters per second. What is the kinetic energy of its forward motion?

_____ J

2. Kinetic energy = ½ × mass × speed^2. A cyclist rides her bike at 5 meters per second, and together she and the bike have a mass of 80 kilograms. What is the kinetic energy of their forward motion? Type your answer without a comma.

_____ J

3. Kinetic energy = ½ × mass × speed^2. A toy cart rolls along the floor. Which two changes would each make the kinetic energy of its forward motion four times as large?

☐ A. Make its speed four times as large and keep its mass the same

☐ B. Double both its mass and its speed

☐ C. Double its mass and keep its speed the same

☐ D. Make its mass four times as large and keep its speed the same

☐ E. Double its speed and keep its mass the same

4. Kinetic energy = ½ × mass × speed^2. A loaded wagon rolling at 4 meters per second has 480 joules of kinetic energy from its forward motion. What is the total mass of the wagon and its load?

_____ kg

5. Gravitational potential energy = mass × gravity × height. Use 10 N/kg for gravity. A 3-kilogram flowerpot sits on a balcony 6 meters above the ground. How much gravitational potential energy does it have compared with the ground?

_____ J

6. Four books sit at different heights in a classroom. Which of these four books has the most gravitational potential energy compared with the floor?

A. A 2-kilogram book lying on the floor

B. A 2-kilogram book on a shelf 1 meter above the floor

C. A 1-kilogram book on a shelf 2 meters above the floor

D. A 1-kilogram book on a shelf 3 meters above the floor

7. Gravitational potential energy = mass × gravity × height. Use 10 N/kg for gravity, and ignore air resistance. A 2-kilogram ball is dropped from a height of 5 meters. How much kinetic energy does it have just before it reaches the ground?

_____ J

8. A child sits still on a playground swing as it swings back and forth. Ignore friction and air resistance. Which statement about the swing's energy is true?

A. Kinetic energy is greatest at the lowest point, and gravitational potential energy is greatest at the highest points.

B. Gravitational potential energy is greatest at the lowest point, where the swing moves fastest.

C. Kinetic energy is greatest at the highest points, where the swing stops for an instant.

D. The swing has no energy at the highest points, because it stops moving there.

9. A soccer ball rolls across a flat, grassy field and slowly comes to a stop. What happened to its kinetic energy?

A. It stayed inside the ball as stored motion.

B. It changed into other forms, mostly thermal energy in the ball, the grass and the air, plus a little sound.

C. It was used up, so that energy no longer exists.

D. It turned into gravitational potential energy as the ball slowed.

10. Kai holds two bar magnets with their north poles facing each other, so they push apart. He pushes them closer together. What happens to the potential energy stored in the pair of magnets?

A. It disappears, because Kai's push cancels the magnets' force.

B. It stays the same, because magnets do not store energy.

C. It increases, because Kai has to push against the magnets' repulsion, and that energy is stored in the pair.

D. It decreases, because magnets that are closer always store less energy.