

KINETIC AND POTENTIAL ENERGY WORKSHEET Name: \_\_\_\_\_

Determine whether the objects in the following problems have kinetic or potential energy.

Remember, kinetic energy is the energy of motion and potential energy is stored energy due to an object's shape or position. Then, choose the correct formula to use:

$$\text{Kinetic Energy} = \frac{1}{2} \times \text{mass} \times \text{velocity}^2$$

(in Kg)      (m/s)

$$\text{Potential Energy} = \text{Mass} \times \text{gravity} \times \text{Height}$$

(in Kg)      (9.8 m/s<sup>2</sup>)      (in meters)

For each problem, write the formula used, show your work, & write your answer with correct units.

Example: An 80kg man is jogging at a rate of 4m/s. He has kinetic energy. Calculate it:

$$\text{Kinetic Energy} = \frac{1}{2} \times \text{mass} \times \text{velocity}^2$$

$$\text{Kinetic Energy} = \frac{1}{2} \times 80\text{kg} \times (4\text{m/s})^2$$

$$\text{Kinetic Energy} = \frac{1}{2} \times 80 \times 16$$

$$\text{Kinetic Energy} = 40 \times 16$$

$$\text{Kinetic Energy} = 640 \text{ J}$$

1. You serve a volleyball with a mass of 2.1 Kg. The ball leaves your hand with a speed of 30m/s. The ball has \_\_\_\_\_ energy. Calculate it.

2. A baby carriage is sitting at the top of a hill that is 21 m high. The carriage with the baby weighs 12 Kg. The carriage has \_\_\_\_\_ energy. Calculate it.

3. A car is traveling with a velocity of 40 m/s and has a mass of 1120 Kg. The car has \_\_\_\_\_ energy. Calculate it.

4. A cinder block is sitting on a platform 20 m high. It weighs 79 Kg. The block has \_\_\_\_\_ energy. Calculate it.

5. There is a bell at the top of a tower that is 45 m high. The bell weighs 190 Kg. The bell has \_\_\_\_\_ energy. Calculate it.

6. A roller coaster is at the top of a 72 m hill and weighs 966 Kg. The coaster (at this moment) has \_\_\_\_\_ energy. Calculate it.

7. Determine the amount of potential energy of a 5.0Kg book that is moved to three different shelves on a bookcase. The height of each shelf is 1.0 m, 1.5 m, and 2.0 m.

8. You are on in-line skates at the top of a small hill. Your potential energy is equal to 1,000. J. The last time you checked, your mass was 60.0 kg.

a. What is the height of the hill?

b. If you start rolling down this hill, your potential energy will be converted to kinetic energy. At the bottom of the hill, your kinetic energy will be equal to your potential energy at the top. Calculate your speed at the bottom of the hill.

9. **(BONUS!!)** A 1.0-Kg ball is thrown into the air with an initial velocity of 30. m/s.

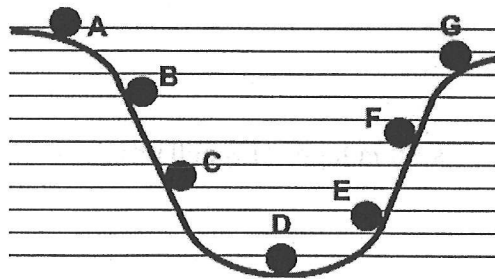
a. How much kinetic energy does the ball have?

b. How much potential energy does the ball have when it reaches the top of its ascent?

c. How high into the air did the ball travel?

10. What is the kinetic energy of a 2,000.-Kg boat moving at 5.0 m/s?

This graph shows a ball rolling from A to G. The ball starts at point A and rolls to point G.



11. At what letter does the ball have the greatest kinetic energy? \_\_\_\_\_

12. Which letter shows the ball when it has the maximum potential energy? \_\_\_\_\_

13. Which letter shows the ball when it has the least potential energy? \_\_\_\_\_

14. Why is point G slightly lower than point A? In other words, why couldn't the ball go back to the same height at which it started?

## Calculating Kinetic Energy and Potential Energy

Use with textbook pages 209-214.

Complete the following calculations in the space provided. Show your work and include proper units for your answers.

1. You kick a 1.2 kg soccer ball at 24 m/s. What is the mechanical kinetic energy of the soccer ball?
2. A 70 kg person is riding a 200 kg motorcycle at 30 m/s. What is the total mechanical kinetic energy of the rider and motorcycle?
3. A bear has a mass of 500 kg and 100 000 J of mechanical kinetic energy. What is the speed of the bear?
4. In a shot-put competition, a shot moving at 15 m/s has 450 J of mechanical kinetic energy. What is the mass of the shot?
5. What is the gravitational potential energy of a 5 kg box if it is lifted 3 m from the floor?

6. A 2.2 kg rock rests on the edge of a bridge that is 3.3 m above a river. What is the gravitational potential energy of the rock when measured from the surface of the river? What is the gravitational potential energy when measured from the edge of the bridge?
7. A 0.30 kg apple hangs from a branch. If the apple has 7.35 J of gravitational potential energy, what is the height of the apple above the ground?
8. A box is suspended from a crane at a height of 32 m from the ground. The box has 7840 J of gravitational potential energy.
- What is the mass of the box?
  - If this box were to fall from this height, what speed would it be travelling just before it hit the ground? Ignore friction.