

Potential Energy in Roller Coasters

Name: _____

Answer Key

Date: _____

Vocabulary

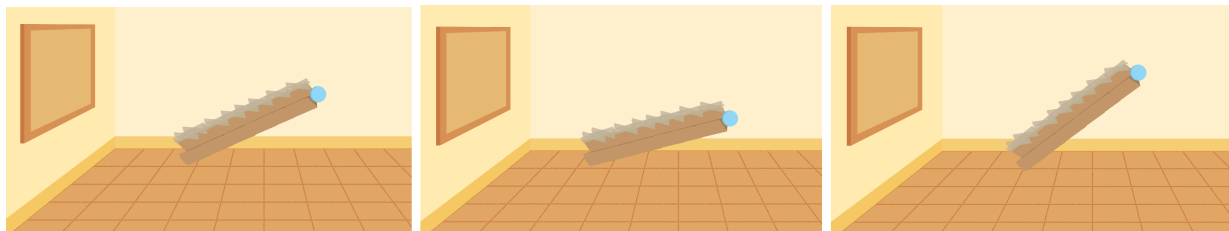
Potential Energy - the energy of a particle based on its position

Gravitational Potential Energy - the energy an object possesses due to its position in a gravitational field

Mass - the measure of the amount of material a body contains that causes it to have weight in a gravitational field

Activity 1

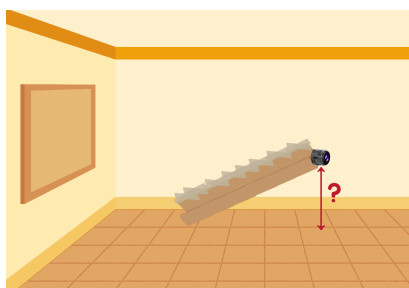
Using the provided Supplemental Materials and the diagrams below as reference, construct three different roller coaster tracks. The tracks should be taped to a large sheet of paper, a wall, or a board so that they are attached to a wall at varying heights.



Allow a marble to travel down the roller coaster track.

Measure the distance from the height of the roller coaster track to the floor and record it below *using inches*.

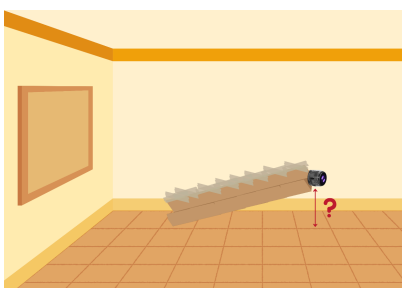
1



Distance from the tallest point of the track to the floor:

Answers will vary

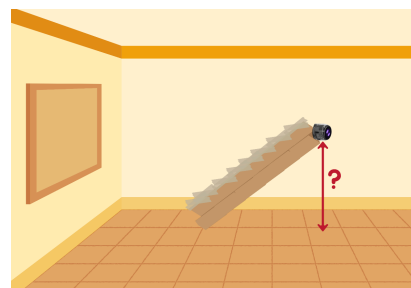
2



Distance from the tallest point of the track to the floor:

Answers will vary

3



Distance from the tallest point of the track to the floor:

Answers will vary

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Activity 2

Convert the Ari's distance measurement from inches to meters to be used to calculate the gravitational potential energy of the marble at the top of the track. Use the formula below:

$$1 \text{ meter} = 39.4 \text{ inches}$$

Calculate the gravitational potential energy of the marble at the top of the track using the formula:

$$9.8 \text{ m/s}^2 \times \text{mass (kg)} \times \text{height (meters)}$$

Use the mass of your marble provided by your teacher.

Answers will vary based on the constructed track and measurements recorded.
Below are example calculations.

1

Distance (inches) = 10 inches

Distance (meters) = 0.254 meters

Gravitational Potential Energy = $9.8 \text{ m/s}^2 \times$ 0.004 kg $\times$ 0.254 meters

Gravitational Potential Energy = 0.0099 joules

2

Distance (inches) = 7 inches

Distance (meters) = 0.177 meters

Gravitational Potential Energy = $9.8 \text{ m/s}^2 \times$ 0.004 kg $\times$ 0.177 meters

Gravitational Potential Energy = 0.0069 joules

3

Distance (inches) = 15 inches

Distance (meters) = 0.381 meters

Gravitational Potential Energy = $9.8 \text{ m/s}^2 \times$ 0.004 kg $\times$ 0.381 meters

Gravitational Potential Energy = 0.0149 joules

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Exit Ticket

Please respond to the following prompts.

1. Question 1: What are the factors impacting the gravitational potential energy of an object on a roller coaster?

The mass of the object that has the potential energy, Earth's acceleration due to gravity rate, and the height of the object from the ground.

2. Question 2: How did the height of the roller coaster tracks affect the marble's overall gravitational potential energy?

The taller the roller coaster; the greater the gravitational potential energy.

3. Question 3: We created inclined roller coaster tracks. What, if anything, would change about the marble's gravitational potential energy if you were to create loops in your track?

If the initial height of the marble at the top of the roller coaster remains unchanged, the gravitational potential energy would remain the same whether the roller coaster had loops or not.

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Supplemental Materials

Cut along the perimeter and fold 90° along the red dotted line.

