PHYSICS IN MOTION
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Unit 4E

Kinetic Energy and Gravitational Potential Energy

Energy Skate Park Lab

Name:

Date:

For this lab activity, you will be using PhET's Energy Skatepark Simulation found here:
https://phet.colorado.edu/sims/html/energy-skate-park-basics/latest/energy-skate-park-basics_en.html

A half-pipe course is being constructed at a local park in your town. You have been asked to analyze the types of energy used by skaters on the half-pipe and to recommend how they can achieve the greatest velocity while skating the course.

The law of conservation of energy states that energy can be converted from one form to another. This lab will explore the law of conservation of energy via the gravitational potential energy and kinetic energy of skaters on a half-pipe.

Gravitational Potential Energy (PE_G)

1. **Open the simulation in Intro mode, and select both Grid and Bar Graph. What happens to the PE_G of your skater as you click and drag her vertically? What affects how much the PE_G changes?**

2. **Increase the mass of your skater and repeat step one. Does this change her gravitational potential energy?**

3. **Knowing that the acceleration due to gravity (g) on earth affects an object's gravitational potential energy, and taking into account your observations from steps one and two, write an equation for PE_G.**

$PE_G =$

Kinetic Energy (KE)

4. **Set the skater's mass back to the middle, and drag her to some height above the ground. Click the play button. What happens to her kinetic energy as she skates downhill? When does she have maximum kinetic energy?**

5. **Increase the skater's mass and repeat step four. What happens to her maximum amount of kinetic energy?**

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Kinetic Energy (KE)

6. Place the skater on the half-pipe, and click play.

   a. Explain what happens to her kinetic energy and gravitational potential energy as she skates.

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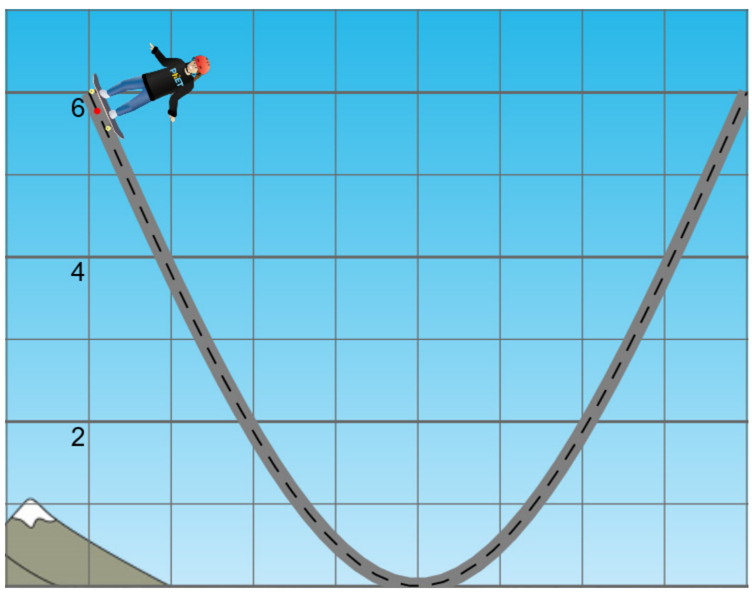
   b. On the diagram below, show where the skater has maximum KE, maximum PE_G, minimum KE, and minimum PE_G:



7. Based on your observations of the simulated skater and the relationship between her gravitational potential energy and kinetic energy, what can you conclude mathematically about the amount of energy present at the top of the half-pipe versus at the bottom?

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Questions to consider:

1. If the skater has a mass of 60 kg, what is her gravitational potential energy at the top of the 4 m high half-pipe?

2. Negating any loss due to friction, what is her kinetic energy at the bottom of the half-pipe?

3. Using the equation for kinetic energy ($KE = 1/2\ mv^2$) and your answer from question two, calculate the skater's velocity at the bottom of the half-pipe.

4. Based on your findings, list at least two ways to modify the skaters or the course to achieve maximum velocity at the bottom of the half-pipe.

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Courtesy of:
PhET Interactive Simulations
University of Colorado Boulder
https://phet.colorado.edu