Module 4: Energy
Topic 4 Application: Energy Skate Park Scientific Investigation

Before you begin this scientific investigation, make sure to download the Energy Skate Park Scientific Investigation Report. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

Total mechanical energy is the sum of potential energy and kinetic energy. Work changes total mechanical energy when done by non-conservative forces. Work done by conservative forces does not change total mechanical energy, but merely transforms energy between potential and kinetic forms. When only conservative forces are involved, you say that mechanical energy is conserved. The total quantity of mechanical energy remains the same.

Objectives

In this scientific investigation, you will:

- explain the Conservation of Mechanical Energy concept using kinetic and gravitational potential energy.

Hypothesis

Using the Procedure and Data Collection section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop your own hypotheses which describe your expected results. Record your hypotheses in the Hypothesis section of your Energy Skate Park Scientific Investigation Report.

Required Simulation

[Energy Skate Park Simulation](http://phet.colorado.edu)

Provided by:
PhET Interactive Simulations
University of Colorado
http://phet.colorado.edu

Procedure and Data Collection

1. Open the simulation.
2. Click *Pause* and then *Show Pie Chart*. Using your cursor, grab the skater and drag him up and down. Record your observations about the pie chart and the location of the skater in the Notes area in the Data section of your Energy Skate Park Scientific Investigation Report.
3. Drag the skater to the top of the left side of the ramp. Click *Play* to release the skater and watch the pie chart change. Record your observations about the pie chart and the location of the skater in the Notes area in the Data section of your Energy Skate Park Scientific Investigation Report.
4. Click *Pause* then *Step* several times to get the skater to his highest point at the left. Record your observations about the pie chart and the location of the skater in the Notes area in the Data section of your Energy Skate Park Scientific Investigation Report.
5. Click *Go* then click *Pause* and *Step* to get the skater to the lowest point of his path.
6. Click *Go* and watch for the maximum height of the skater on either end.

7. Click *Energy vs. Time* to view the Energy vs. Time graph, then *Pause* the skater at various points. For each point, write the values of KE and PE in the data table in the Data section of your Energy Skate Park Scientific Investigation Report. Then calculate the TME for each point.
8. Click *Energy vs. Time* to close the Energy vs. Time graph and uncheck *with Thermal*. Click *Track Friction*. Set the "Coefficient of Friction" as shown in the image to the right. Click *Go*.

Data

Use the notes area and data table in the Data section of your Energy Skate Park Scientific Investigation Report to record your data from this scientific investigation. The data table is also shown below:

PE	KE	TME

Data Analysis

In the Data Analysis section of your Energy Skate Park Scientific Investigation Report, provide responses to the following questions based on items in the simulation and the data that you collected. Make sure to completely answer each question and to show all of your work.

1. What does the size of the circle represent?
2. In the pie chart, what does the blue represent?
3. In the pie chart, what does the green represent?
4. After Step 4 of the Procedure, what types of energy exist?
5. After Step 5 of the Procedure, what types of energy exist?
6. Explain why there is still potential energy after Step 5 of the Procedure.
7. Pick any point in the path of the skater and write an expression for the TME using other variables like mass, speed, and height.
8. At Step 6 of the Procedure, explain in terms of PE, KE and TME why the skater's maximum height is the same on either end.
9. Examine your data table. What do you notice about the values in the table?
10. Assume the skater has a mass of 75 kg. For the highest point in the path, using the value for potential energy, calculate the height, and for the lowest point in the path, using the value for kinetic energy, calculate the speed.
11. After Step 8, use the terms TME, Friction, Work and Energy to explain what happens to the size of the pie chart.

Conclusion

Using the Conclusion section of your Energy Skate Park Scientific Investigation Report, compose three to four sentences describing an overall conclusion based on your data. Were your hypotheses true or false, and how do you know? Use the data and notes that you collected from your experience to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

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Experimental Sources of Error

On your Energy Skate Park Investigation Report, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?

Once you have completed the Energy Skate Park Scientific Investigation Report, please submit your work to the dropbox.