

Roller Ball

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 Date Created: 1994
 Subject: Physics, Energy
 Level: 3rd, 4th, and 5th
 Standards: *New York State- Intermediate Science (www.emsc.nysed.gov/ciai/)*
 Standard 1- Analysis, Inquiry and Design
 Standard 4- The Physical Setting
 Standard 6- Interconnectedness: Common Themes
 Standard 7- Interdisciplinary Problem Solving
Schedule: One 45-minute class period

Objectives:

Learn about potential and kinetic energy, as well as slope and how it affects the distance a ball will roll.

Students will:

- Estimate the distance a ball will roll from 5 cm, 10 cm, and 15 cm
- Measure the actual length of the roll from each height
- Find the difference between the estimate and actual length of the roll
- Record all measurements
- Answer discussion questions with their group members

Vocabulary:

Variable Energy Slope

Potential Energy Kinetic Energy

Materials:

For Each Group:

Activity Sheet 1:
How far does a ball roll downhill?
 2 meter sticks
 Golf ball
 Books or blocks*

*Provided by the teacher

Safety:

This activity does not contain any safety concerns.

Science Content:

Potential vs. Kinetic energy

During this lesson, students will learn about the relationship between Potential and Kinetic energy. Potential energy, as the name implies, is energy that has not yet been used, thus the term potential. Kinetic energy is energy in use (or motion). A tank of gasoline has a certain potential energy that is converted into kinetic energy by the engine. When the potential is used up, you're outta gas! Batteries, when new or recharged, have a certain potential. When placed into a tape recorder and played at loud volume (the only settings for such things), the potential in the batteries is transformed into kinetic energy to drive the speakers. When the potential energy is all used up, the batteries are dead. In the case of rechargeable batteries, their potential is re-elevated or restored. In this activity, the ball's potential energy increases as the height from which it is released increases. After the ball is released, its potential energy is transformed into kinetic energy as it rolls down the slope.

Preparation:

1. Photocopy print materials (*Activity Sheet 1*) for each student.
2. Distribute materials evenly to each student.
3. Stack books or blocks to desired height ahead of time.



Classroom Procedure:

Engage (Time: 10 mins)

Ask students, “How far does a ball roll downhill?” Define and talk about variables with the students. Discuss slope and relate it to cars going uphill and downhill. Discuss estimating and measuring.

Explore (Time: 20 mins)

Split students into groups of three, have groups assign one member each to be an observer, recorder, and ball launcher. Distribute Activity Sheet 1 and the necessary materials. Students will estimate and record the distance of each roll by releasing, not pushing, the ball from 5 cm, 10 cm, and 15 cm. Have them complete the chart on the activity sheet.

Explain (Time: 15 mins)

Review vocabulary terms and have students present their findings (make sure they relate these to slope and energy). Talk over answers to the discussion questions as a class and clear up any misunderstandings.



Assessment:

The following rubric can be used to assess students during each part of the activity. The term “expectations” here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

- 1= exceeds expectations
- 2= meets expectations consistently
- 3= meets expectations occasionally
- 4= not meeting expectations

	Engage	Explore	Explain
1	Shows leadership in the discussion and an understanding of the concept of energy.	Completes work accurately while providing an explanation for what is observed. Works very well with partners.	Provides an in-depth explanation of findings; relates these to slope and energy. Fills out worksheet clearly.
2	Participates in the discussion and shows some understanding of the concept of energy.	Completes work accurately and works cooperatively with partners.	Provides clear explanation of findings and relates them to slope and energy. Fills out worksheet clearly.
3	Contributes to the discussion, but shows little understanding.	Works cooperatively with partners, but makes some mistakes with the procedure.	Provides a limited explanation of findings, relates them to either slope or energy. Fills out some of the worksheet.
4	Does not participate in discussion. Shows no understanding.	Has trouble working with partners. Does little to complete the procedure.	Is not clear in explanation of findings. Does not fill out worksheet.

Extension Activities:

- Challenge students to try using different balls.
- Challenge students to try other slopes.
- Challenge students to try different surfaces.

Safety:

- This activity does not contain any safety concerns.

Acknowledgments:

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