Potential and Kinetic Energy

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Target Grade: 6th grade science

Time Required: 70 minutes

Standards:

- **6.PS3.2: Energy** 2) Construct a scientific explanation of the transformations between potential and kinetic energy
- **6.PS3.3: Energy** 3) Analyze and interpret data to show the relationship between kinetic energy and the mass of an object in motion and its speed
- **6.ETS1: Engineering Design** 2) Design and test different solutions that impact energy transfer

Lesson Objectives:

The learner will:

- Conduct an investigation demonstrating the relationship between kinetic and potential energy
- Draw conclusions from data about the relationship between kinetic energy and the mass of an object in motion and its speed.

Central Focus:

Use specific tools to measure potential and kinetic energy.

Materials:

- Smart-board
- Dry-Erase Board/ Markers
- Tennis ball or Other ball
- Distance Measuring Device (Yard stick or measuring tape)
- Time Measuring Device (Stop Watches, Phones etc...)
- Potential and Kinetic Energy Calculator Excel File
- Science Journals
- A good height to drop a ball/object

Background Information:

The concept of the law of conservation of energy states that energy can be neither created nor destroyed. This means energy is transferred from one object to another instead of being created and destroyed. In theory, the amount of energy transferred remains constant in a closed system with energy either being stored or in motion. Energy that is stored is known as potential energy, and energy in motion is known as kinetic energy. The amount of kinetic energy an object has is related to the object's speed and mass.

Instruction:

Introduction (10 minutes)

- Motivator: Ask students what they want to do in life and then link their responses to the importance of science. Example: state that almost every path requires at least some skills in taking data, analyzing, forming conclusions, making decisions, and testing ideas. Explain students will have the opportunity to practice these skills in this lesson.
- Refer to objective: Our two objectives for the day include 1) conducting an investigation demonstrating the difference between kinetic and potential energy and 2) drawing conclusions from data about the relationship between kinetic energy and the mass of an object in motion and its speed

Activity (30 minutes)

Set up: pass timers to each group of students and pull up an excel chart on the smartboard so we as a class can observe the data put into a working order.

Experiment:

Step 1: students measure the height of a pre-weighed object (ball) and record the height the ball will be dropped from to obtain potential energy. (The better the height, the easier it is to take time trials). Teacher identifies this is potential energy.

Step 2: students observe the dropping of a ball from the point measured; the students will collect data of the amount of time it took the ball to drop. Explain to students this data will allow us to find the velocity, which will be used in the calculation of kinetic energy. Teacher identifies this step as kinetic energy.

Step 3: Using the excel file, students enter their data values to determine the amount of energy converted from potential to kinetic. Teacher questions groups asking the purpose of the steps completed, how the data is relevant to the lesson, how they determined the data values, and how they will analyze the data to draw a conclusion.

Step 4: students discuss in groups and write in their journals their conclusions from the data about the relationship between potential and kinetic energy as well as the relationship between kinetic energy and the mass and speed of an object.

Reflection (20 minutes)

Have students individually write the answers to the following questions in their notebooks, and then discuss answers as a class.:

1. What type of energy involves energy in motion? How do you know?
2. What kinds of energy did we investigate with today?
3. Where might you see kinetic and potential energy in your everyday experiences?
4. Why are we comparing the two types of energy?
5. Why are we measuring time?
6. Why are we measuring height?
7. When did energy transform from potential energy to kinetic energy? How do you know?
8. How would you design an experiment demonstrating potential and kinetic energy?
9. What is the relationship between kinetic energy, the mass of the object, and the speed of the object?
10. Do you think that the kinetic energy will change if the mass of the object increases? Why or why not?
11. What other examples can you give that demonstrates the relationship between kinetic energy, the mass of an object, and the speed of an object?

Closure (10 minutes)

Revisit the lesson's objectives: 1) Conduct an investigation demonstrating the difference between kinetic and potential energy, and 2) Draw conclusions from data about the relationship between kinetic energy and the mass of an object in motion and its speed. Students have the opportunity to ask any remaining questions they have regarding the objectives.

Finally, leave students with brainteasing questions to have an answer for the following day's class: How is it possible that the ball's energy is not completely conserved? What would happen if our experiment used elastic objects? What would happen if our experiment used inelastic objects? When thinking about the transfer of energy of an object on impact, what is the relationship among sound, thermal energy, kinetic energy, and potential energy?

Assessment

1. Performance-based assessment of students' completion of the experiment. Students who do not demonstrate a mastery of collecting data, analyzing data, and drawing conclusions will be asked to partner with students who have demonstrated mastery.
2. Formative assessment of students' drawn conclusions and answers to the reflection questions in their notebooks. Students who do not demonstrate a mastery of understanding kinetic and potential energy will be put in small groups during next lesson to review the concepts.