

Potential and Kinetic Energy

Objectives:

- Define the terms “potential energy” and “kinetic energy,” and explain the difference between the two
- Observe potential and kinetic energy of various sized marbles
- Discover that the heavier and larger an object is, the more potential energy it has

Missouri Curriculum Frameworks:

3-4:

Strand I Scientific Inquiry (B. Investigations)

2a. plan and conduct a simple experiment that is repeated and properly controlled; then discuss and respond thoughtfully to a variety of conclusions and determine whether the claims are logical arguments based on results of the experiment (1.5, 1.7, 2.3, 3.4, 3.6, 3.7)

Strand IV. Force, Motion, and Mechanical Energy (A. Relative Motion)

2a. compare one object’s position and motion relative to another object (1.6, 3.2, 3.3)

Strand IV. Force, Motion, and Mechanical Energy (C. Interactions of Forces and Motions)

3a. evaluate data and describe the relationship of the amount of force applied to an object, the mass of the object, and the amount of change in the object’s motion (1.4, 1.6, 2.5, 3.1, 4.1)

5-8:

Strand I. Scientific Inquiry (A. Processes of Scientific Inquiry)

1a. apply mathematical procedures to investigations and data sets in order to determine patterns, relationships, and predictions (1.6)

Strand I. Scientific Inquiry (B. Investigations)

1a. design and conduct investigations that include an adequate number of repeated trials, unbiased sampling, accurate measurement and recordkeeping, and a comparison to a control (1.3, 3.1, 3.2, 3.3, 3.4)

Strand IV. Force, Motion, and Mechanical Energy (A. Relative Motion)

3a. explain how an objects’ acceleration is affected by outside forces and its mass (3.1, 3.3, 4.1)

Strand IV. Force, Motion, and Mechanical Energy (B. Types and Properties of Forces and Motion)

2a. recognize and define the forces necessary for an object to move or to be in equilibrium (1.4, 1.7, 2.1, 3.5, 3.7, 4.1)

Strand IV. Force, Motion, and Mechanical Energy (C. Interactions of Forces and Motions)

1a. interpret and explain the relationship among kinetic energy, potential energy, and mechanical advantage (1.6, 1.8, 2.1, 2.3, 2.5, 4.1)

1b. analyze the changes in kinetic and potential energy in common activities (1.5, 4.1, 4.10)

Materials:

Rubber band for each participant
3 different sized marbles
Wood for a ramp
Meter stick
Milk carton
Rubber bands (one for each student)

Discussion:

Energy is the ability to do work. Try stretching the rubber band between your thumb and forefinger and keep it stretched without any motion. How long can you hold it this way? After a short while, as your fingers become tired, you become aware of the energy in the rubber band. Yet the rubber band is not moving! This is because the energy of the stretched rubber band is stored in it. Release your thumb and observe what happens. The rubber band moves back to its original shape. As the rubber band moves back to its original shape, it does work. The energy you felt when you stretched the rubber band was different from the energy displayed when the rubber band snapped back to its original shape. There are two different states of energy: potential energy and kinetic energy. Potential energy is the energy stored when objects are at rest. Kinetic energy is energy of motion.

Activity:

1. Cut the top off the milk carton.
2. Set up the ramp with the cut milk carton at the bottom (the open end of the carton should face the top of the ramp).
3. Place a meter stick at the bottom of the ramp beside the milk carton.
4. Hold the medium-sized marble at the top of the ramp. Ask students to predict how far the marble will push the carton once it gets to the bottom of the ramp.
5. Let the marble go. Record the distance that the marble was able to push the carton.
6. Hold the largest marble at the top of the ramp. Ask students to predict whether the marble will push the carton farther than or not as far as the previous marble.
7. Let the marble go. Record the distance that the marble was able to push the carton.
8. Repeat with the smallest marble.

Discussion: Review the results of the experiment with the students. Explain to them that the marble, when held at the top of the ramp, had potential energy. The energy was waiting to be used. Once the marble was let go, its energy changed into kinetic energy—moving energy. This kinetic energy was then transferred to the milk carton, which caused it to also move. Additionally, the heavier and larger the marble is, the more potential energy it would have, the faster it would travel, and the farther the milk carton would move.

9. Try the experiment again, and this time, raise the incline of the ramp. Ask the students to make predictions. Discuss the students' observations. Ask them to explain what happened and why. (The higher the object sits above the ground, the greater its potential energy. Increasing the height from which the marble rolled gave it more energy, causing it to strike the carton with more force.)



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Lab Write Up

Name _____

Date _____

1. In the following table, record the distances the marbles were able to push the carton:

	Small Marble	Medium Marble	Large Marble
Distance			

2. What is potential energy?

3. What is kinetic energy?

4. In the following table, make predictions about how much farther the marbles will push the carton when the incline of the ramp is increased:

	Small Marble	Medium Marble	Large Marble
Distance			

5. In the following table, record the distances the marbles were able to push the carton in the second experiment:

	Small Marble	Medium Marble	Large Marble
Distance			

