MOSA MACK SCIENCE

Potential and Kinetic Energy Lesson 1: "The Solve"

Educator's Resource Guide

The Solve contains two mini lessons: The live video lesson and the animation lesson For the most comprehensive learning experience, conduct both. If you're short on time, choose one. Which lesson?

- For a more structured lesson, choose the animation (the lesson below).
- For a more inquiry-based lesson, choose the live video lesson and assign the animation for homework.

Objective:
In The Solve, students will:

1. Solve a mystery that demonstrates the understanding that kinetic energy is related to both potential energy and the mass of an object.
2. Create a mind map to explore relationships among complex potential and kinetic energy vocabulary

Time Required: 40-75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
• Student Guide (*includes student agenda and vocabulary handout)* • Potential and Kinetic Energy Episode • Computer with speakers • Scissors • Glue or Tape	None	• Developing and Using Models • Constructing Explanations or Arguments From Evidence

Episode Description:
Despite everything they try, the engineers at Kinetic Kars can't figure out why their new roller coaster can't seem to make it to the end of its ride, so they call Mosa to help solve the mystery. When Mosa arrives, she conducts a series of experiments to try to get the roller coaster to its destination. Soon, they figure out the perfect solution to this engineering dilemma.

Inquiry Scale: Leveling Information

The Solve can be completed in various settings, including presentation-style, small groups, or individually. In the case of a flipped or blended classroom, it can be completed entirely at home.

Level 1: Most teacher-driven (*recommended for grades 4–5)*

View the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video as needed to answer the episode questions as a group. Project and complete the Mind Map as a class-wide activity. This can be done digitally or on paper. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 2 (*recommended for grades 5–6)*

View the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play the mystery a second time, pausing the video to discuss each question. Direct students to complete the Mind Map in small groups, either digitally or on paper. Come back as a class to review correct answers, as needed. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 3 (*recommended for grades 6–7)*

Provide students with their student URL and have students view the animated mystery in small groups. Have students play the animated mystery once in full and then answer episode questions in their table groups to the best of their ability. Then, as a class, project the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. Have students complete the Mind Map in table groups, either digitally or on paper. Have students quiz each other on the vocabulary until you feel they're familiar with the terms. In table groups, have students go through the discussion questions on their own, and review answers as a class. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 *(recommended for grades 7–8)*

Provide students with their student URL and have students view the animated mystery and complete episode questions in pairs. Have students review their answers with a neighboring table group. Have students complete the Mind Map in pairs, either digitally or on paper. Have students quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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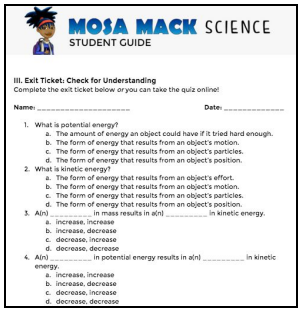
Agenda

I. Solve the Potential and Kinetic Energy Video Mystery (20 minutes)

Differentiation Tip: The Video Mystery can be viewed as a class, in small groups, individually, or completed for homework. For additional support, students can view the episode twice: once before completing the questions and once with teacher guidance, pausing the video to discuss each answer.

1. Play the animated Mosa Mack Mystery on Potential and Kinetic Energy.
2. Students answer questions either digitally on the Mosa Mack platform or on paper in the Student Guide as they watch. Encourage students to cite the specific time codes in the episode to promote writing with supporting evidence. Answers can be found in the key below.
3. View the answer video to confirm student understanding.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STUDENT GUIDE

III. Exit Ticket: Check for Understanding
Complete the exit ticket below or you can take the quiz online!

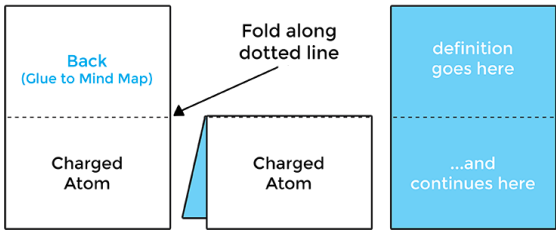
Name: _____ Date: _____

1. What is potential energy?
   a. The amount of energy an object could have if it tried hard enough.
   b. The form of energy that results from an object's motion.
   c. The form of energy that results from an object's particles.
   d. The form of energy that results from an object's position.
2. What is kinetic energy?
   a. The form of energy that results from an object's effort.
   b. The form of energy that results from an object's motion.
   c. The form of energy that results from an object's particles.
   d. The form of energy that results from an object's position.
3. A(n) _____ in mass results in a(n) _____ in kinetic energy.
   a. increase, increase
   b. increase, decrease
   c. decrease, increase
   d. decrease, decrease
4. A(n) _____ in potential energy results in a(n) _____ in kinetic energy.
   a. increase, increase
   b. increase, decrease
   c. decrease, increase
   d. decrease, decrease

II. Vocabulary Mind Map Activity (15–45 minutes)

Differentiation Tip: The Mind Map can be done as a class, in small groups, individually, or completed for homework. It can be done digitally or on paper.

1. Students may complete the Mind Map **digitally**. Follow directions below. (15 minutes)
   a. Go to https://mosamack.com/home/potential-kinetic-energy
   b. Select **Lesson 1: *The Solve***.
   c. Select **Vocabulary** and complete **Part 1:** matching terms with definitions.
   d. Complete **Part 2:** matching terms and definitions with images on a diagram.
2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
   a. Print and pass out the Student Guide: Potential and Kinetic Energy Lesson 1: *The Solve*.
   b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Potential and Kinetic Energy unit.
   c. Model the directions carefully, emphasizing the following. Students should:
      - **cut** out the vocabulary cards on the solid lines only
      - **fold** the cards at the dotted lines
      - write the definition of the term on the inside of the card using definitions provided



   d. Students use the clues from the Mind Map images, definitions, and terms to place the cards in the correct location in the Mind Map.
   e. Check that the students have matched their cards correctly before moving on.
   f. Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
   g. Students discuss the questions with their group or as a class when they have completed the Mind Map.

Teacher Tips:

- Since this is the first time many of the students will have seen these vocabulary terms, have students work together to use the images, definitions, and collaborative thinking to figure out where the terms go.
- Check in on student groups throughout this process. When you see students or groups who have placed their card in the correct place, ask a facilitating question such as, “Why do you think that term goes there?” or, “What evidence leads you to believe that term goes there?” When students explain their thinking, this is a great opportunity to provide positive reinforcement. Then, encourage them to share their reasoning to the class or to other groups who may have trouble identifying the location of that specific term.
- If you do not have access to a color printer, provide students with black and white copies and project the colored Mind Map at the front of the room so that students can reference both images.

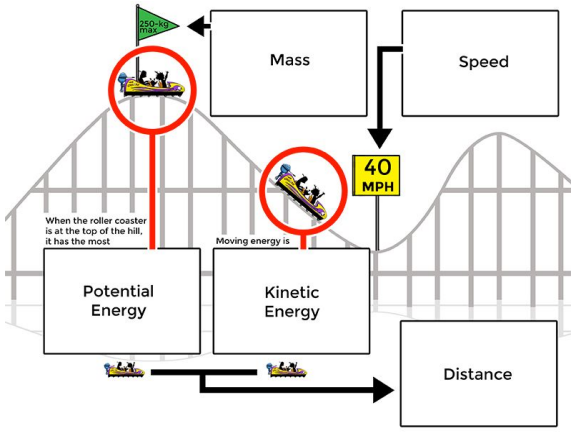
III. Exit Ticket: Check for Understanding (10–15 minutes)

Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

1. Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the Answer Key section below.

Answer Key

Mind map



Episode Questions

1. What is unique about the Cyclops Coaster?
It has a giant glowing eyeball, powered by the roller coaster itself.

2. What is the problem with the rollercoaster?
At the top of the last hill, the Eyeball goes out, and the car stops moving.

3. How does the energy box describe kinetic energy? When is kinetic energy highest?
It's the energy something has when it's moving. When the car of the roller coaster moves the most, the kinetic energy is at its highest.

4. How can more kinetic energy be added in order to get the car over the hill?
Add more mass to the car.

5. Besides mass, what else do Mosa and her team need to add to the Cyclops Coaster?
Speed!

6. After observing the Caterpillar Rollercoaster, Mosa decides kinetic energy is coming from what?
Potential Energy!

7. When Billy holds his cone higher, what does that do?
It increases the potential energy.

8. What did Mosa figure out? How can they fix the Cyclops? (Answer Video)
Increasing the amount of mass in the car as well as creating a taller hill for more potential energy.

Quiz:

1. What is potential energy?
    a. The amount of energy an object could have if it tried hard enough.
    b. Moving energy
    c. Active energy
    d. Stored energy

2. What is kinetic energy?
    a. Stored energy
    b. Moving energy
    c. Potential Energy
    d. All of the above

3. A(n) _____ in mass results in a(n) _____ in kinetic energy.
    a. increase, increase
    b. increase, decrease
    c. decrease, increase

4. When a ball rolls down hill, its potential energy _____ and its kinetic energy _____.
    a. increases, increases
    b. increases, decreases
    c. decreases, decreases
    d. decreases, increases

5. There is a roller coaster car at the top of the hill, one at the middle of the hill, and one at the bottom of the hill. Which has the most potential energy?
    a. The car at the bottom of the hill
    b. The car in the middle of the hill
    c. The car at the top of the hill
    d. All of the cars have zero potential energy

6. Blaine and her sister are identical twins riding roller coasters at Kinetic Kars. They each ride the roller coaster on their own once. Next time, they ride the roller coaster together. On which ride do they have the most kinetic energy?
    a. The first ride
    b. The second ride
    c. It is the same on both rides
    d. There is no kinetic energy on either ride