

Speed and Mechanical Energy

Teacher Facilitation Notes

In General . . .

- Project the slide deck in edit mode—do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.
- For each investigation, assemble the needed materials for each group and place in a central location for ease of distribution.
- Duplicate copies of the data sheets for each student.

Materials Needed Per Group:

Engage: About Energy/Wind It Up

Wind up toy*	Ruler	Masking tape
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Explore: Mechanical Energy and Speed

Ramp**	Textbooks, 2-3	Large marbles, 2
Masking tape	Meter stick, metric ruler, or tape measure	

Elaborate

Paper towel rolls, 2	Books, 3	Toy cars, 2
Meter stick, 1		

*Wind up toys can be purchased from Oriental Trading Company (\$10-15 per dozen) or Amazon (\$18-20 for 24-25).

**A legal-sized clipboard (about 38 cm or 15 inches long) makes a good sturdy ramp.

Other Materials

Student Data Sheets

Pencils

Speed and Mechanical Energy

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Explore: Wind it Up!

- **NOTE:** Before beginning this investigation, test out the wind up toys to make sure that winding 5 and 10 times make a difference in the distance the toys move. If you need to change the numbers, go to Slide/Edit theme and make the numbers compatible with your toys.
- While showing the first slide, ask students what they already know about energy. Discuss.
- Read through the explanatory slide about energy and mechanical energy.
- Introduce the investigation by reading the paragraph and examining the materials used.
- Read the question and have students record their hypothesis.
- Give students 4-5 minutes to just play around with the wind up toy. Encourage them to think about the toy as a science tool—not a toy—as they complete the investigation.
- Depending on the students' ability levels, let the groups work through the investigation independently or go through it step by step with each group conducting their own investigation.
- Discuss the investigation as desired.

Explore: Mechanical Energy and Speed

- Read the question and have students record their hypotheses on their data sheets.
- Depending on the students' ability levels, let the groups work through the investigation independently or go through it step by step with each group conducting their own investigation.
- Facilitate a class discussion using questions like the ones below:
 - What most affected the speed of the marbles as they rolled down and away from the ramp? (the position of the marble on the ramp)
 - Which marble had more mechanical energy? What is your evidence?
 - Which marble had more speed? How do you know?
 - What can you conclude about the relationship between mechanical energy and speed based on this investigation?

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Explain

- Read through and discuss the explanatory slides as desired.
- Ask questions to make sure students understand the relationships between energy, mechanical energy, and speed

Elaborate

- Read and discuss the question with the students. Call on volunteers to give their hypothesis about how mechanical energy will affect objects that collide.
- Depending on students' ability levels, let the groups work through the activity independently or go step by step as a class. Make sure students are recording their observations on their data sheets.
- Once the students have completed their investigations, call on volunteers to share their results and conclusions with the class.
- Discuss as desired.

Evaluate

- NOTE: This game is a non-violent version of the old game "Hangman".
 - Draw a simple car on the board. Make sure it has at least 8-10 erasable parts.
 - Choose a vocabulary term (see list of possibles below) and draw a line for each letter.
 - Divide the class into teams. Have teams guess the letters or terms. Erase part of the car if the guess is incorrect.
 - Award points for correctly guessed terms. The team with the most points at the end of the game are the "Energy Experts".
- Let students complete the quiz independently.
- Discuss evaluation as desired.

Possible Vocabulary Terms

Collide	Demonstrate	Energy
Investigation	Mechanical energy	Object
Conclusion	Hypothesis	Speed
Plan	Conduct	Related
Observations	Data	Measure

Speed and Mechanical Energy

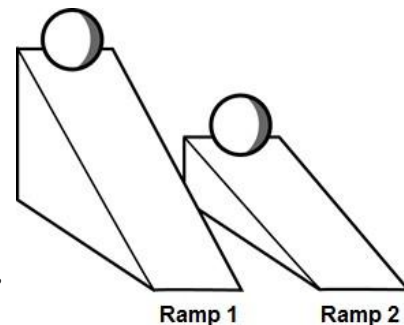
Name: Key

Evaluation

1. An object that is going faster than another object has—

- A more mechanical energy
- B less mechanical energy
- C more frictional energy
- D less pull of gravity

2. The picture shows two marbles on two different ramps. Which of the following is true about the mechanical energy of the marbles?

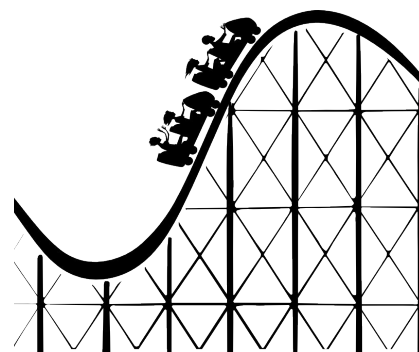


- F Both marbles have the same amount of mechanical energy.
- G Neither marble has mechanical energy.

- H The marble on Ramp 1 has more mechanical energy than the marble on Ramp 2.
- J The marble on Ramp 1 has less mechanical energy than the marble on Ramp 2.

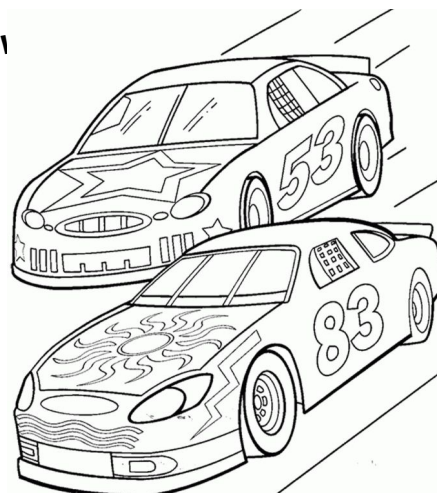
3. The mechanical energy of a roller coaster increases as it moves down a hill. Because of this—

- A the lights on the roller coaster glow brighter
- B the speed of the roller coaster increases
- C the roller coaster uses less electricity
- D the speed of the roller coaster decreases



4. Which car in the picture has more mechanical energy? How do you know? Mark two answers.

- F Car 53 because it is going slower than car 83.
- G Car 53 because it is behind car 83.
- H Car 83 because it is going faster than car 53.
- J Car 83 because it is ahead of car 53.



Speed and Mechanical Energy

Name: _____

Engage: Wind It Up

Question:

How does the mechanical energy of an object affect its movement?

Hypothesis:

	5 turns	10 turns
Trial 1	_____cm	_____cm
Trial 2	_____cm	_____cm
Trial 3	_____cm	_____cm

1. Did more winding make the toy move farther? What is your evidence for your answer?

2. Does more winding require more energy from the person doing it?

My Conclusions:

Speed and Mechanical Energy

Name: _____

Explore: About Energy

Question: Which marble will reach the finish line first—the marble released from the top of the ramp or the marble released from the middle of the ramp?

Hypothesis:

1. As you release the marbles from different places on the ramp, record your data in the table below. Write *first* or *second* in the correct boxes.

Trial	Top of Ramp	Middle of Ramp
Trial #1		
Trial #2		
Trial #3		

2. Which marble crossed the finish line first the most times? Why do you think this is true?
3. Do the marbles released at different points on the ramp travel the same speed or at different speed? How do you know?
4. Which marble traveled the fastest? What is your evidence?

My Conclusions:

Speed and Mechanical Energy

Name: _____

Elaborate: Energy in Collisions

Question: How does mechanical energy affect objects when they collide?

Hypothesis:

1. What happens when the toy car travels down the ramp and collides (hits the back) with the toy car on the floor?
2. Why do you think the car that was at the bottom of the ramp moves when the moving car hits it?
3. How does the amount of mechanical energy the moving car has affect the distance the car at the bottom of the ramp travels? What is your evidence?
4. What happens when the two cars collide, or hit each other head-on? Why do you think this happens?

My Conclusions:

Speed and Mechanical Energy

Name: _____

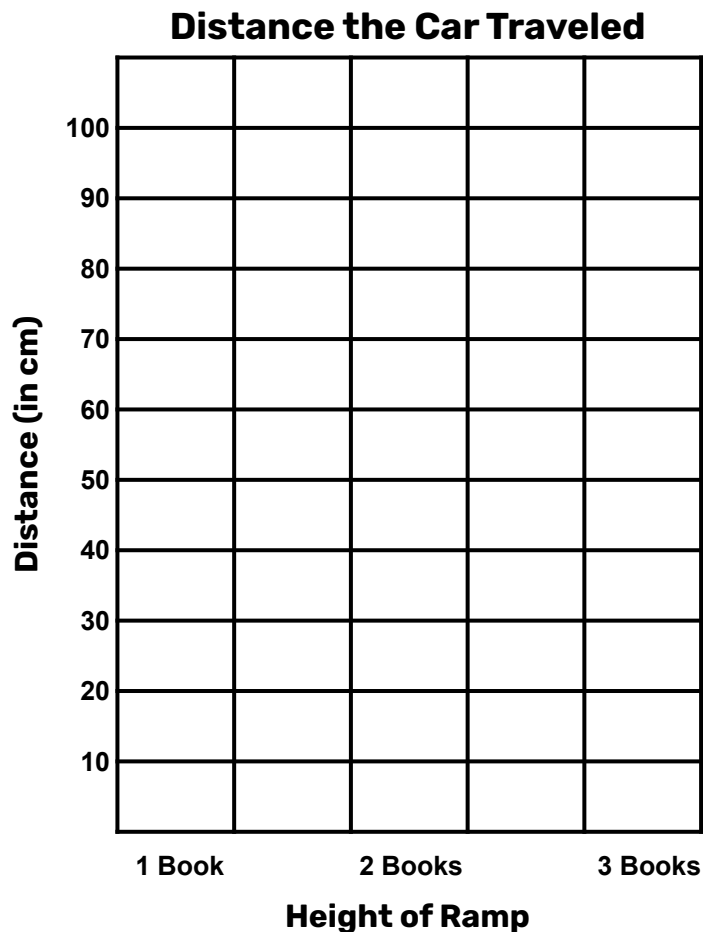
Elaborate: Energy in Collisions

Measure and Graph

Directions: Record the distances the toy car at the bottom of the ramp traveled each trial.

Trial	Distance Traveled 1 Book	Distance Traveled 2 Books	Distance Traveled 3 Books
Trial #1			
Trial #2			
Trial #3			

Directions: Complete the graph below to show how far the car at the bottom of the ramp traveled when the ramp was at three different heights. Use the data collected in Trial #3 to complete the graph.



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Name: _____

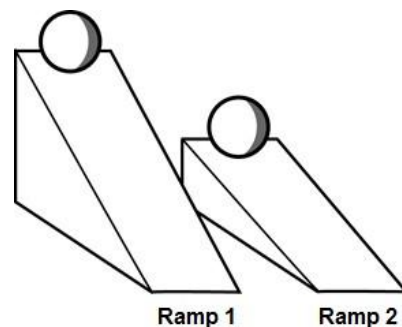
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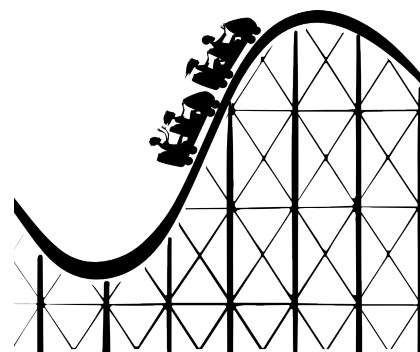
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