MASSACHUSETTS
Department of Elementary
and Secondary Education

Release of Spring 2022 Sample Task Items

from the

Grade 8 Innovative Science Assessment Paper-Based Test

November 2022
Massachusetts Department of Elementary and Secondary Education

MASSACHUSETTS
Department of Elementary
and Secondary Education

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Overview of Grade 8 Innovative Science Assessment

The Department of Elementary and Secondary Education (DESE) is developing an innovative science assessment for grades 5 and 8 that uses a new type of performance task for students. Students engage with meaningful problems, conduct investigations, create and explore models, and solve science or engineering challenges. In Spring of 2022, DESE piloted the assessment with over 100 schools serving about 12,000 students in grades 5 and 8. The spring 2022 pilot was administered in two primary formats: a computer-based version and a paper-based version. The vast majority of students took the computer-based test. The paper-based test was offered as an accommodation for students who needed it. In places where a technology-enhanced item was used on the computer-based test, an adapted version of the item was created for use on the paper test. These adapted paper items were multiple-choice or multiple-select items that tested the same STE content and assessed the same standard as the technology-enhanced item. DESE is publishing one paper-based performance task per grade as a sample task.

Sample items from the pilot test are available online at ma-innov-sci.mypearsonsupport.com/practice-tests.

This document provides information about each item from the sample task, including the following:

- science content area (reporting category)
- standard covered
- practice category
- item type
- item description
- correct answer (for selected-response and technology-enhanced items)
- percentage of students in the pilot who answered the item correctly (percent correct)

Scoring rubrics are provided for constructed-response items.

Standards and Reporting Categories

The grade 8 innovative science assessment test was based on learning standards in the four major content strands in the April 2016 version of the *Massachusetts Science and Technology/Engineering Curriculum Framework*. The four content strands are listed below.

- Earth and Space Science
- Life Science
- Physical Science
- Technology/Engineering

The 2016 *Massachusetts Science and Technology/Engineering Curriculum Framework* is available on the Department website at www.doe.mass.edu/frameworks/current.html.

Most items on the grade 8 innovative science assessment are aligned to one of three MCAS Science and Engineering Practice Categories. The three practice categories are listed below.

- Practice Category A: Investigations and Questioning
- Practice Category B: Mathematics and Data
- Practice Category C: Evidence, Reasoning, and Modeling

More information about the practice categories is available on the Department website at www.doe.mass.edu/mcas/tdd/practice-categories.html.

The tables at the conclusion of this document provide the following information about each released and unreleased operational item: reporting category, standard covered, practice category covered (if any), item type, and item description. The correct answers for released selected-response questions are also displayed in the released item table.

Reference Materials

Each student taking the paper-based version of the grade 8 STE test was provided with a plastic ruler. An image of the ruler is not reproduced in this document. Each student also had sole access to a calculator.

During both STE test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English learner students.

Grade 8
Innovative Science Assessment
SESSION 2

Directions

Read each question carefully and then answer it as well as you can. You must record all answers in this Test & Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Test & Answer Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided. Only responses written within the provided space will be scored.

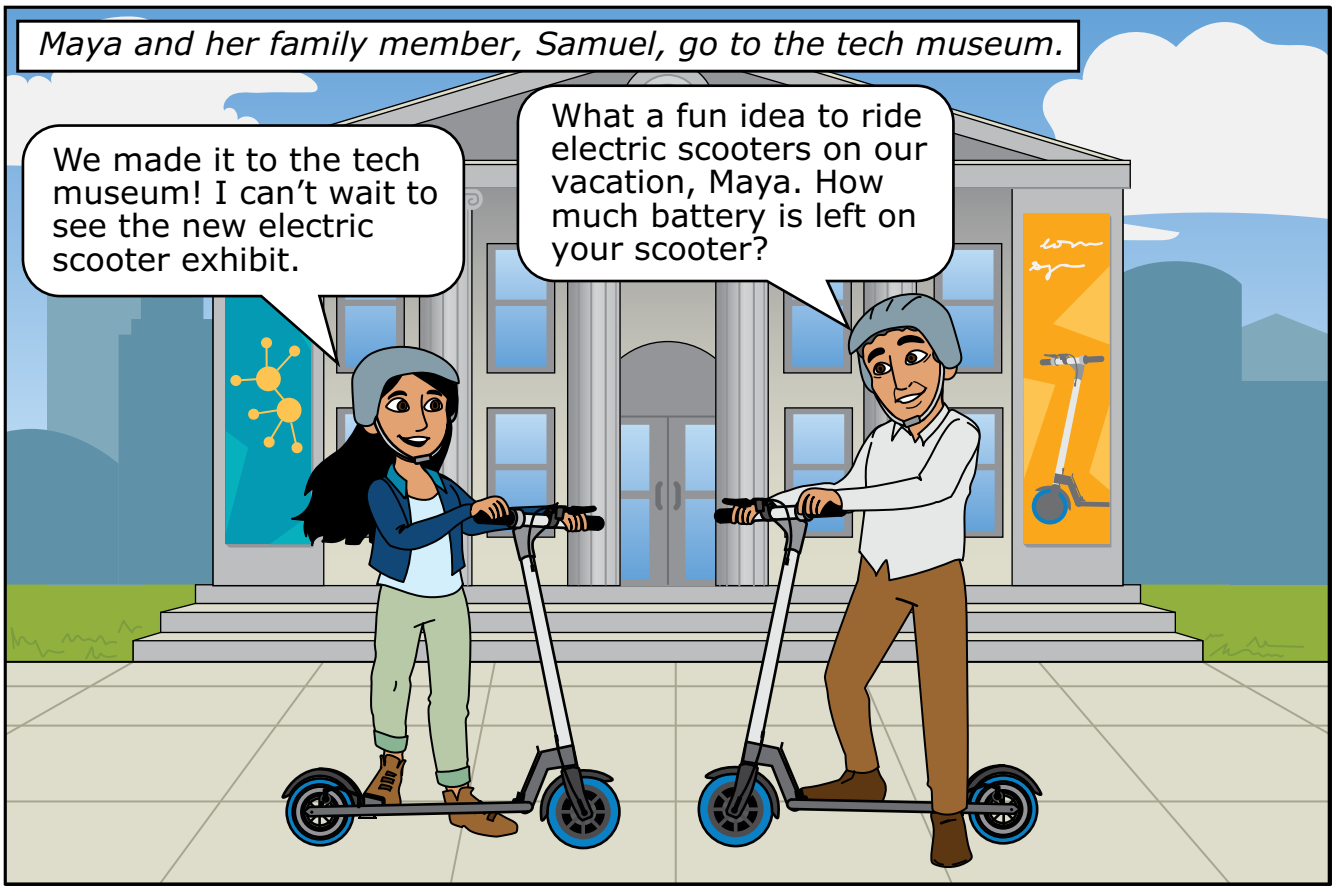
If you do not know the answer to a question, you may go on to the next question. When you are finished, you may review your answers and go back to any questions you did not answer in this session only.

Go On ➡

The following section includes a new type of performance task.
Use the information provided in the performance task to answer the six selected-response questions and one constructed-response question.

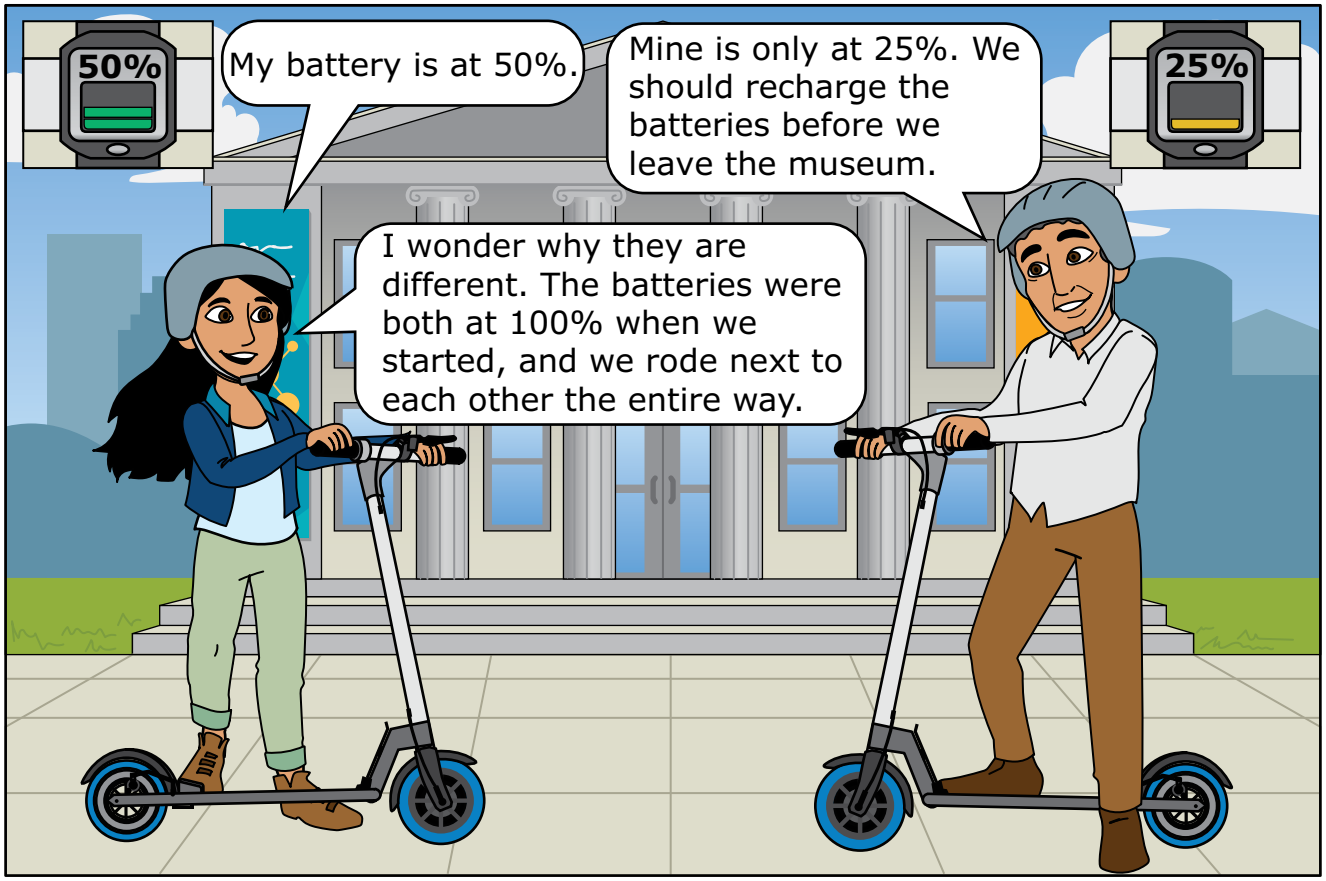
Go On ➡

Story Scene 1



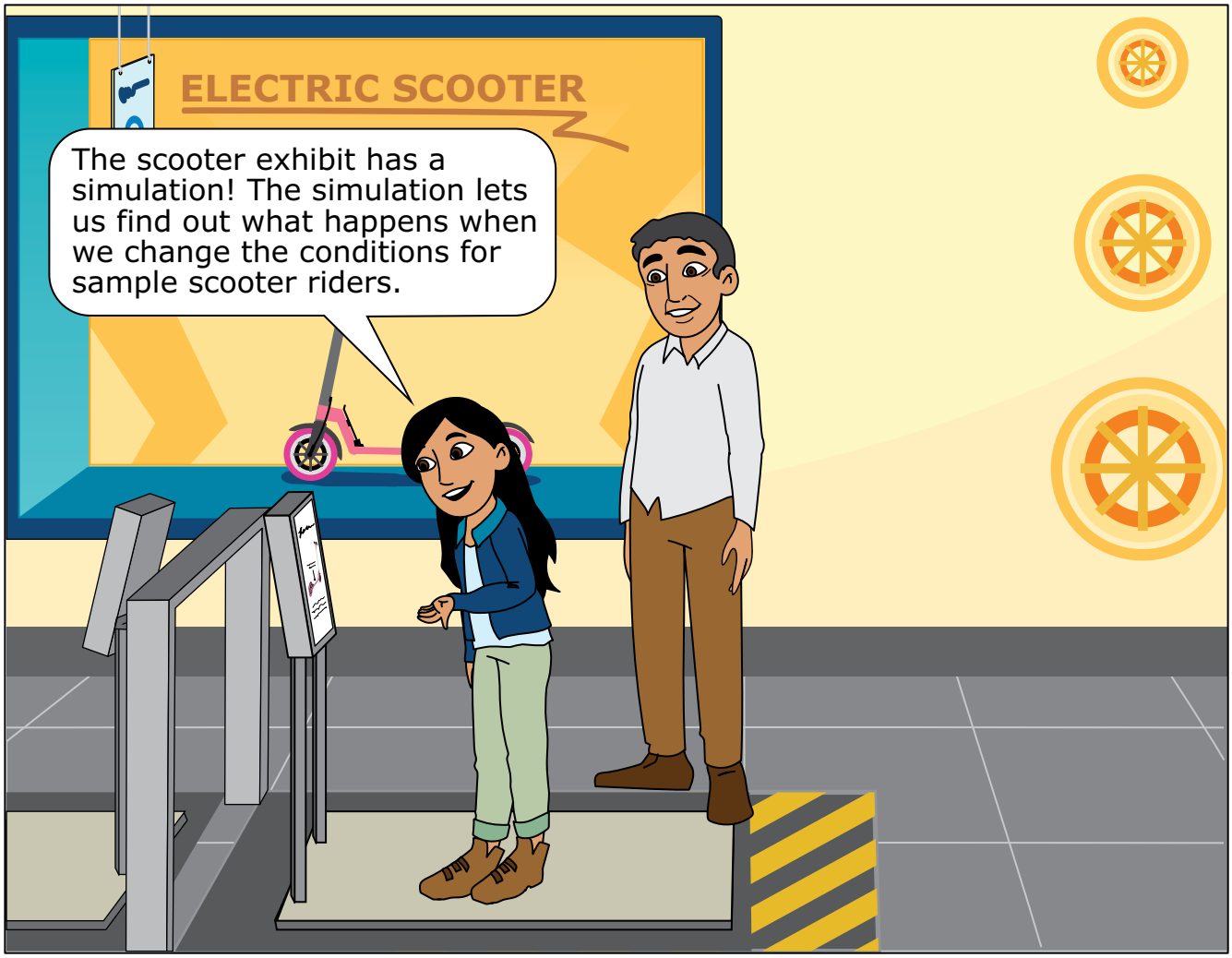
Go On ➡

Story Scene 2



Go On ➡

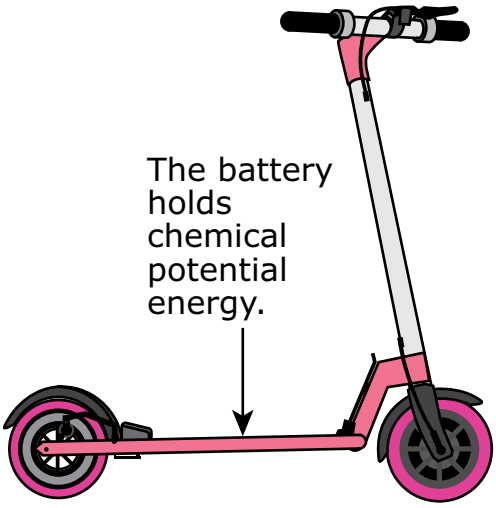
Story Scene 3



Go On ➡

Story Scene 4

Welcome to the Electric Scooter Simulation!

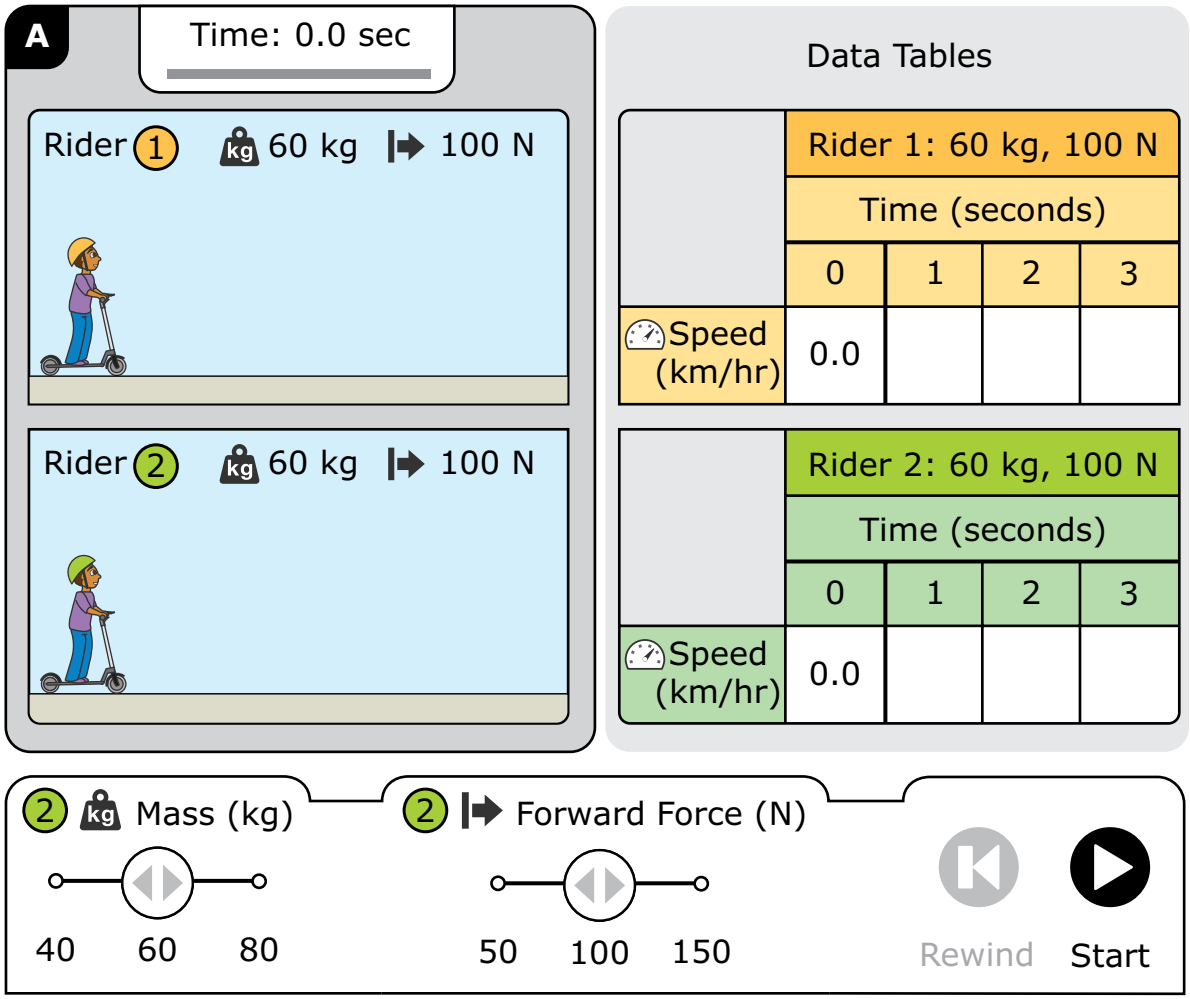


The battery provides energy to make the electric scooter move. The percentage of energy left in the battery is the battery level.

Go On ➡

1 Maya observes that the simulation will let her model how mass and forward force affect how quickly the scooter changes speed. The diagram shows the simulation.

Simulation 1



Data Tables

	Rider 1: 60 kg, 100 N			
	Time (seconds)			
	0	1	2	3
Speed (km/hr)	0.0			

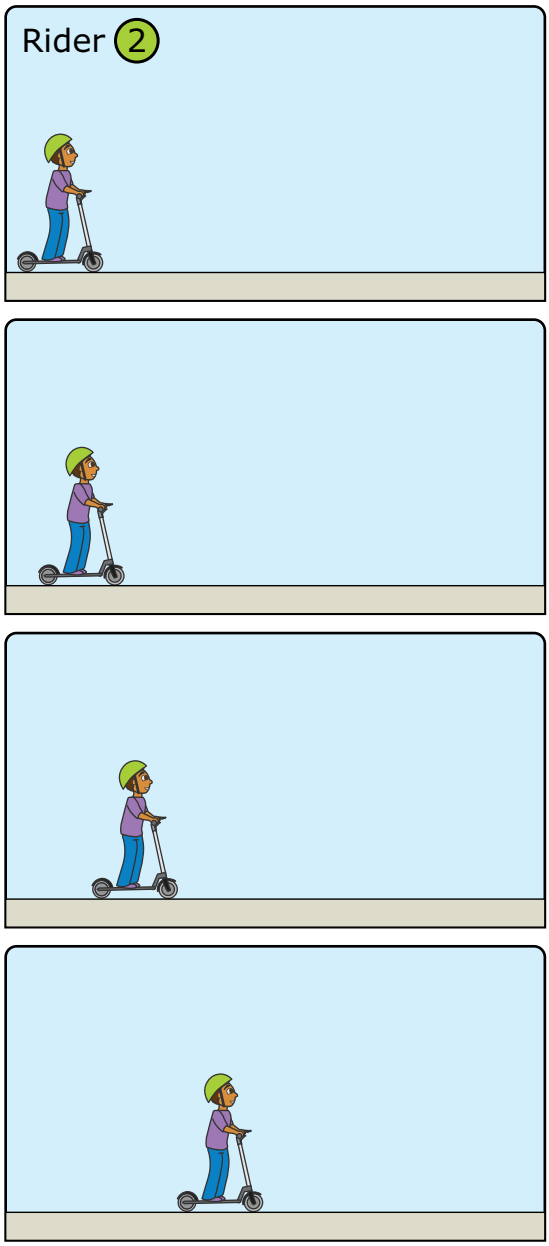
	Rider 2: 60 kg, 100 N			
	Time (seconds)			
	0	1	2	3
Speed (km/hr)	0.0			

Go On ➡

Maya chooses a mass of 60 kg and a forward force of 100 N for Rider 2 and runs the simulation. The following diagram shows how the speed of Rider 2 changes over time.

Rider 2 Data

Time	Speed
0 s	0 km/hr
1 s	4.2 km/hr
2 s	8.5 km/hr
3 s	12.7 km/hr



Go On

Which statement describes the net force on the scooter and Rider 2 while Rider 2 is not moving?

Ⓐ The net force equals zero.

Ⓑ The net force is in the opposite direction as the scooter and Rider 2's motion.

Ⓒ The net force is in the same direction as the scooter and Rider 2's motion.

Which statement describes the net force on the scooter and Rider 2 from 1 to 2 s?

Ⓐ The net force equals zero.

Ⓑ The net force is in the opposite direction as the scooter and Rider 2's motion.

Ⓒ The net force is in the same direction as the scooter and Rider 2's motion.

Go On ➡

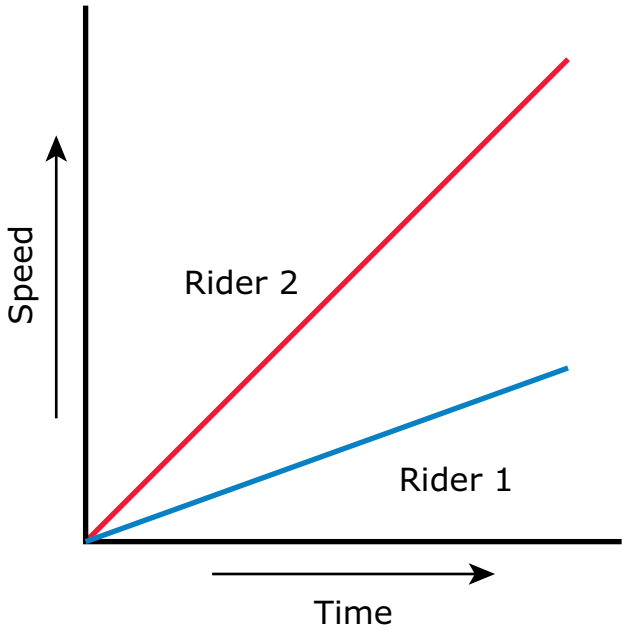
This question has two parts. Use the following information to answer the questions.

2 **Part A**

In the previous question, you observed how the speed of Rider 2 changes as the rider travels.

The graph shows one way that the speed of each rider and scooter could change over time.

Change in Speed over Time



The tables show data for Rider 1 and for four different mass and forward force combinations of settings for Rider 2.

Rider 1 Data

	Mass (kg)	**Forward Force (N)**	**Speed (km/hr) at *t* = 3 s**
Rider 1	60	100	12.7

Rider 2 Data

Combination	**Mass (kg)**	**Forward Force (N)**	**Speed (km/hr) at *t* = 3 s**
P	40	50	8.2
Q	40	150	35.2
R	60	100	12.7
S	80	50	1.5

Which combination of settings for Rider 2 could be used to produce the shown Change in Speed over Time graph?

Ⓐ P

Ⓑ Q

Ⓒ R

Ⓓ S

Part B

When the same net force is applied to two objects with different masses for the same amount of time, which of the following correctly compares the change in speed of the two objects?

Ⓐ The object with less mass experiences a smaller change in speed.

Ⓑ The object with less mass experiences a greater change in speed.

Ⓒ The two objects experience the same change in speed.

When different net forces act on objects that have the same mass for the same amount of time, which of the following correctly compares the forces on the two objects?

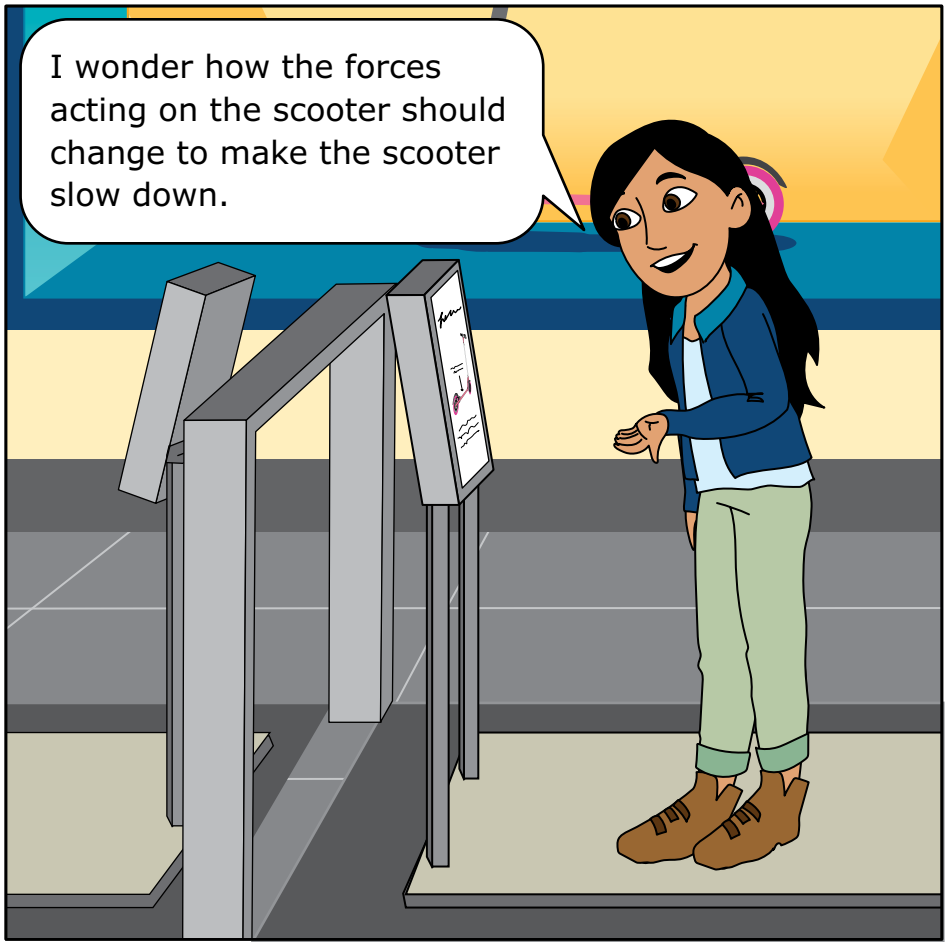
Ⓐ The object with the greater change in speed must be experiencing a smaller net force.

Ⓑ The object with the greater change in speed must be experiencing a larger net force.

Ⓒ The two objects must be experiencing the same net force.

Go On ➡

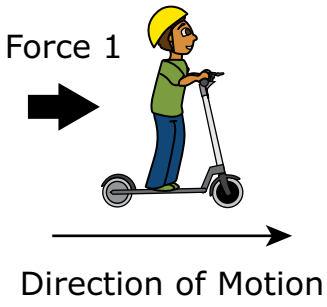
Story Scene 5



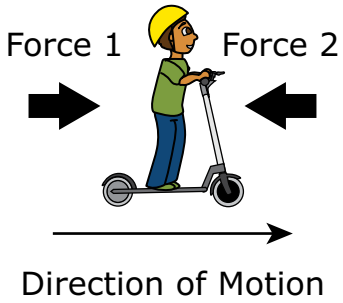
Go On ➡

3 Which of the following diagrams **best** models a situation that would cause the scooter to slow down? In the diagrams, longer arrows represent larger forces.

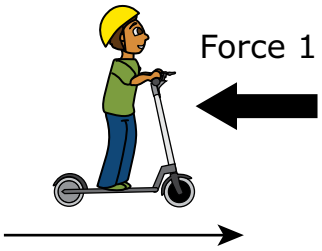
Ⓐ



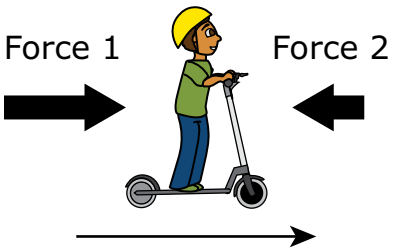
Ⓑ



Ⓒ

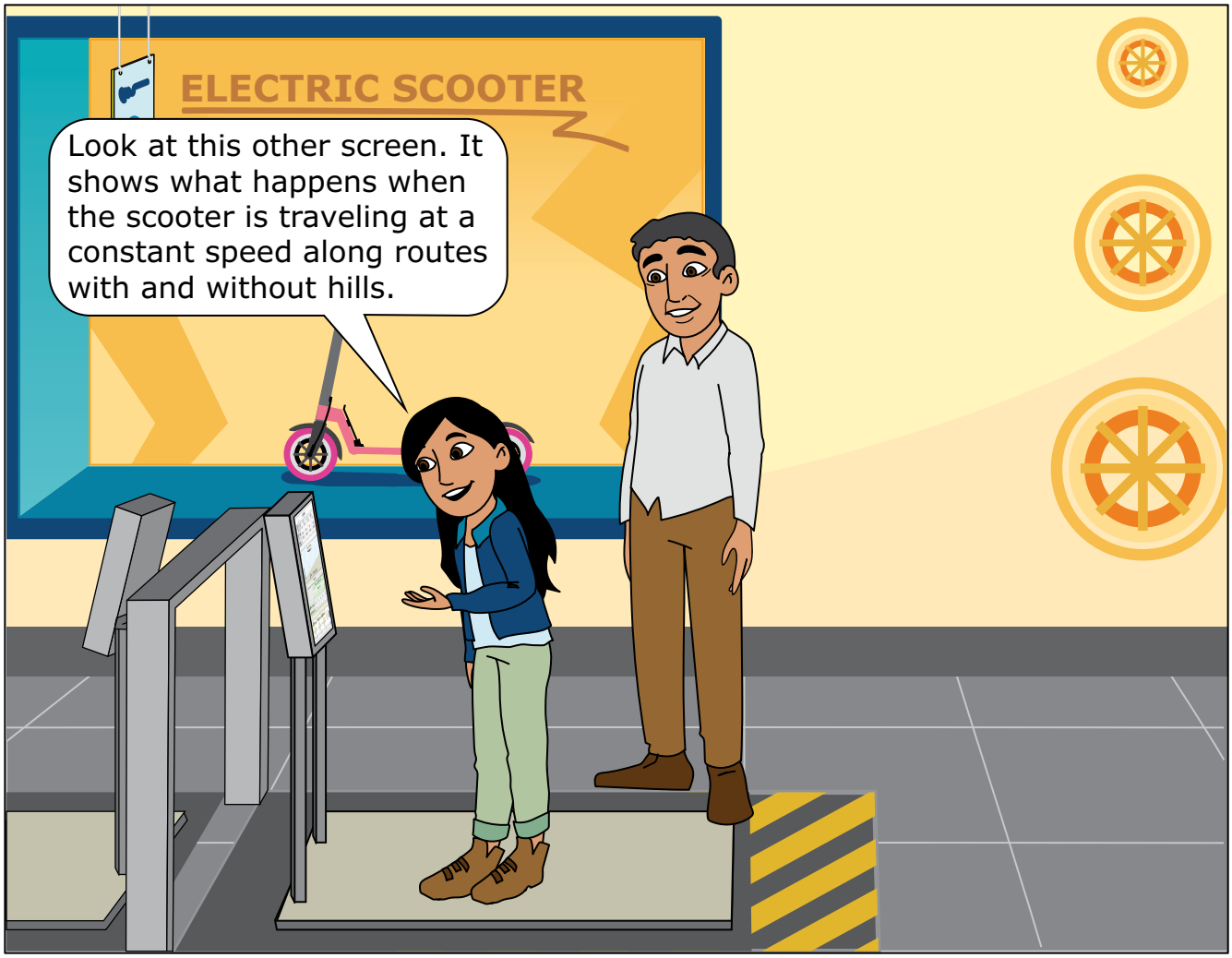


Ⓓ



Go On ➡

Story Scene 6

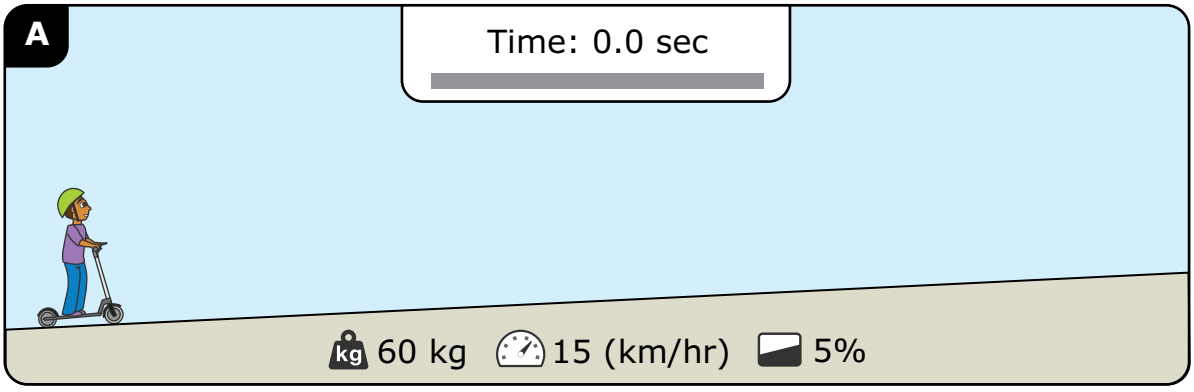


Go On ➡

This question has two parts. Use the following information to answer the questions.

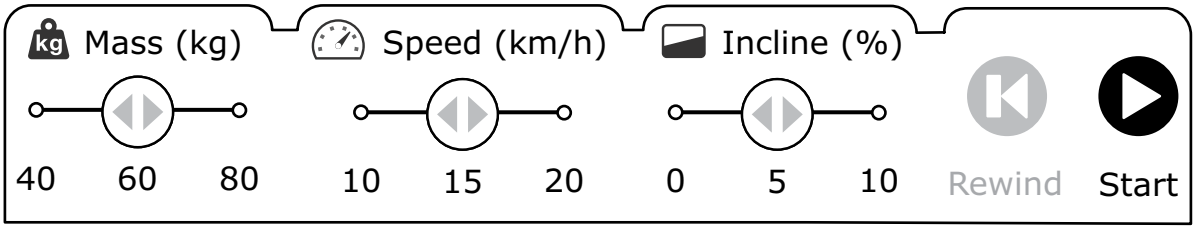
4 Maya observes that the new simulation screen allows her to investigate how mass, speed, and incline affect the kinetic energy of the rider and the scooter and the potential energy of the scooter's battery. Maya would like to determine the relationship between mass and kinetic energy of the rider and the scooter. Maya uses the simulation to generate five different models. The diagrams show the new simulation screen and the five models.

Simulation 2

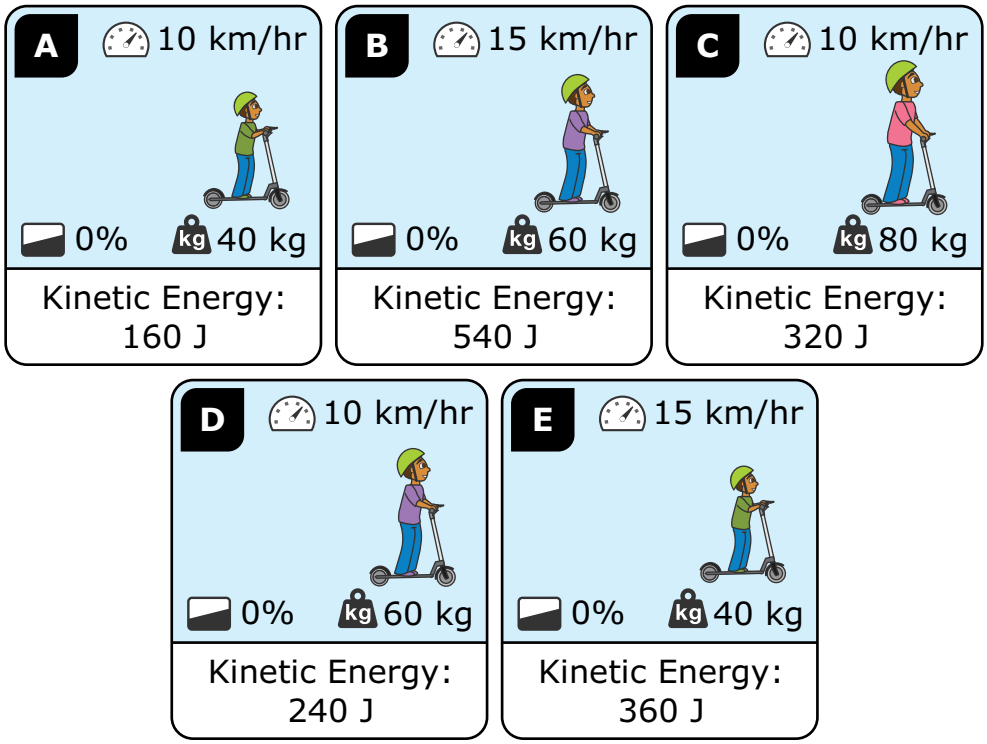


Data Table

	Rider: 60 kg, 15 km/hr, 5%				
	Time (minutes)				
	0	5	10	15	20
KE Kinetic Energy (J)	540				
Battery Level (%)	100%				



Mass and Kinetic Energy Models



Part A

Select the **three** models that **best** show the relationship between the mass and the kinetic energy of the rider and scooter.

Ⓐ Model A

Ⓑ Model B

Ⓒ Model C

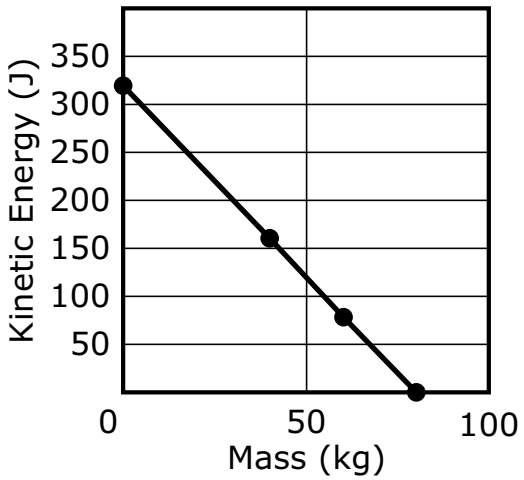
Ⓓ Model D

Ⓔ Model E

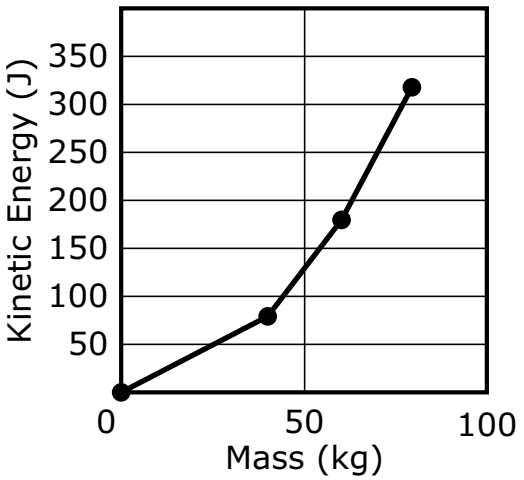
Part B

Which graph represents data from the three models that **best** show the relationship between the mass and the kinetic energy of the rider and scooter?

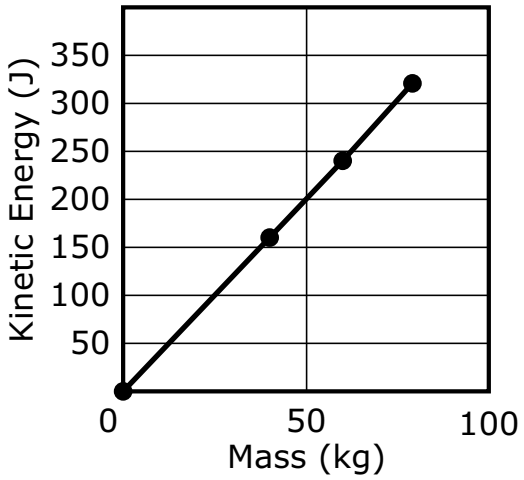
Ⓐ



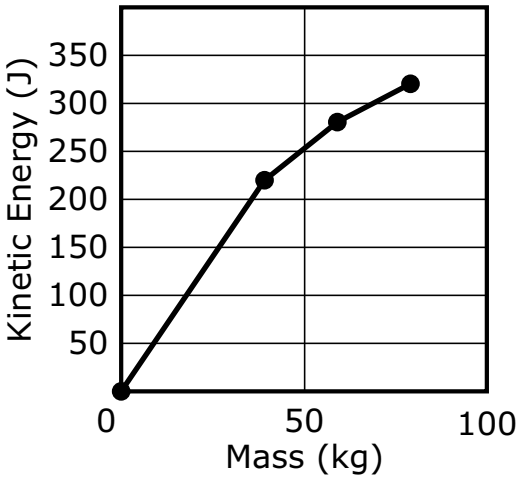
Ⓑ



Ⓒ



Ⓓ



Go On ➡

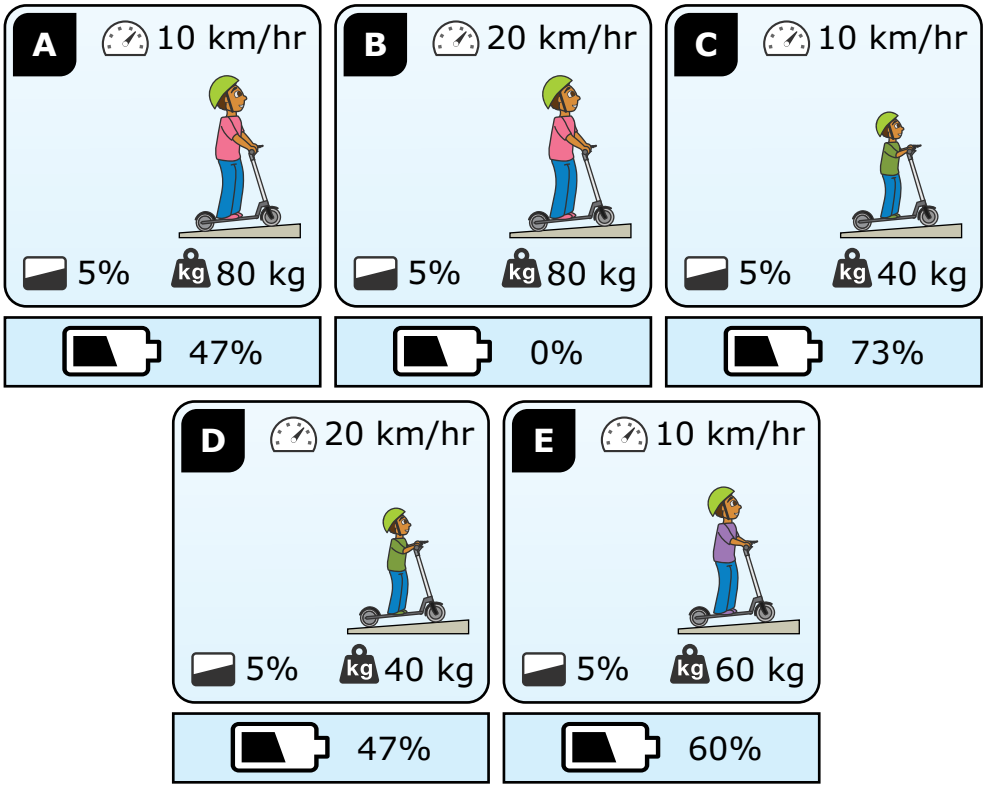
This question has two parts. Use the following information to answer the questions.

5 **Part A**

Chemical potential energy in the battery is used to make the scooter move.

Maya wants to develop a model that shows the greatest chemical potential energy of the battery at the end of a route. She sets the incline to 5% and then adjusts the mass and speed controls to generate five different models. The diagram shows the five models.

Chemical Potential Energy Models



Which model or models have the greatest chemical potential energy at the end of the route?

Ⓐ Model B only

Ⓑ Model C only

Ⓒ Models B and D only

Ⓓ Model A, Model C, and Model D only

Which **two** factors were most important in creating a model with the greatest chemical potential energy at the end of the route?

Ⓐ slowest speed

Ⓑ fastest speed

Ⓒ smallest mass

Ⓓ greatest mass

Part B

The table provides information about a trip that a third rider, Rider X, took on an electric scooter.

Information about Rider X's Scooter Trip

Mass	50 kg
Speed	10 km/hr
Incline	5%

Which is the most likely battery percentage at the end of Rider X's trip? Use the information in the table and the five models in Part A to determine your answer.

Ⓐ 73%

Ⓑ 66%

Ⓒ 47%

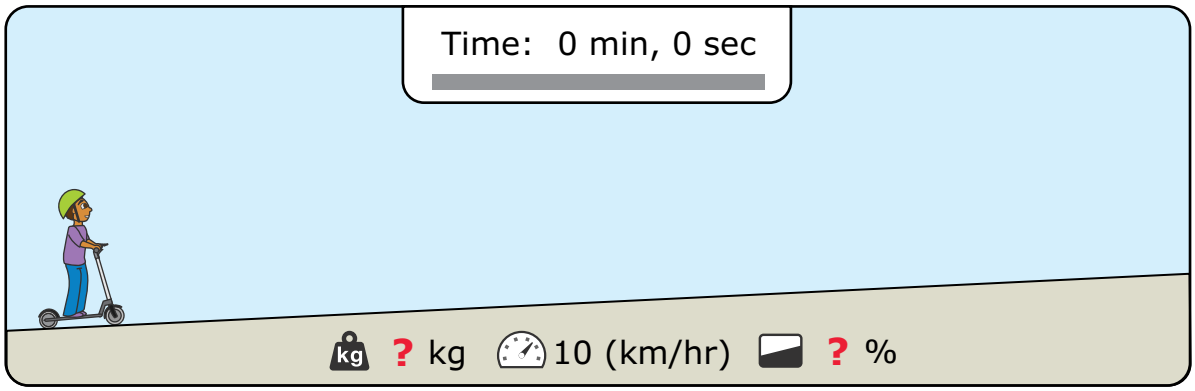
Ⓓ 40%

Ⓔ 35%

6 The rider and the scooter also experience gravitational potential energy.

Maya sets the speed of the rider and the scooter to 10 km/hr and runs the simulation using different mass and incline settings. The diagram shows the simulation.

Simulation 2



Maya's goal is to develop a model that shows the greatest gravitational potential energy of the rider and the scooter at the end of the route. The rider and scooter travel for the same time and distance in each model.

Maya can choose from three different mass settings for the rider and scooter: 40 kg, 60 kg, or 80 kg. Which mass for the rider and scooter would have the greatest gravitational potential energy at the end of the route?

Ⓐ 40 kg, because at a specific height, the object with less mass has more gravitational potential energy

Ⓑ 60 kg, because masses that are too large or too small decrease gravitational potential energy

Ⓒ 80 kg, because at a specific height, the object with more mass has more gravitational potential energy

Ⓓ any mass, because mass does not affect gravitational potential energy

Go On ➡

Maya can choose from three different incline settings: 0% incline, 5% incline, or 10% incline. Which incline setting would lead to the highest gravitational potential energy for the rider and the scooter at the end of the route?

Ⓐ 0% incline, because for a specific mass, the object with less height has more gravitational energy

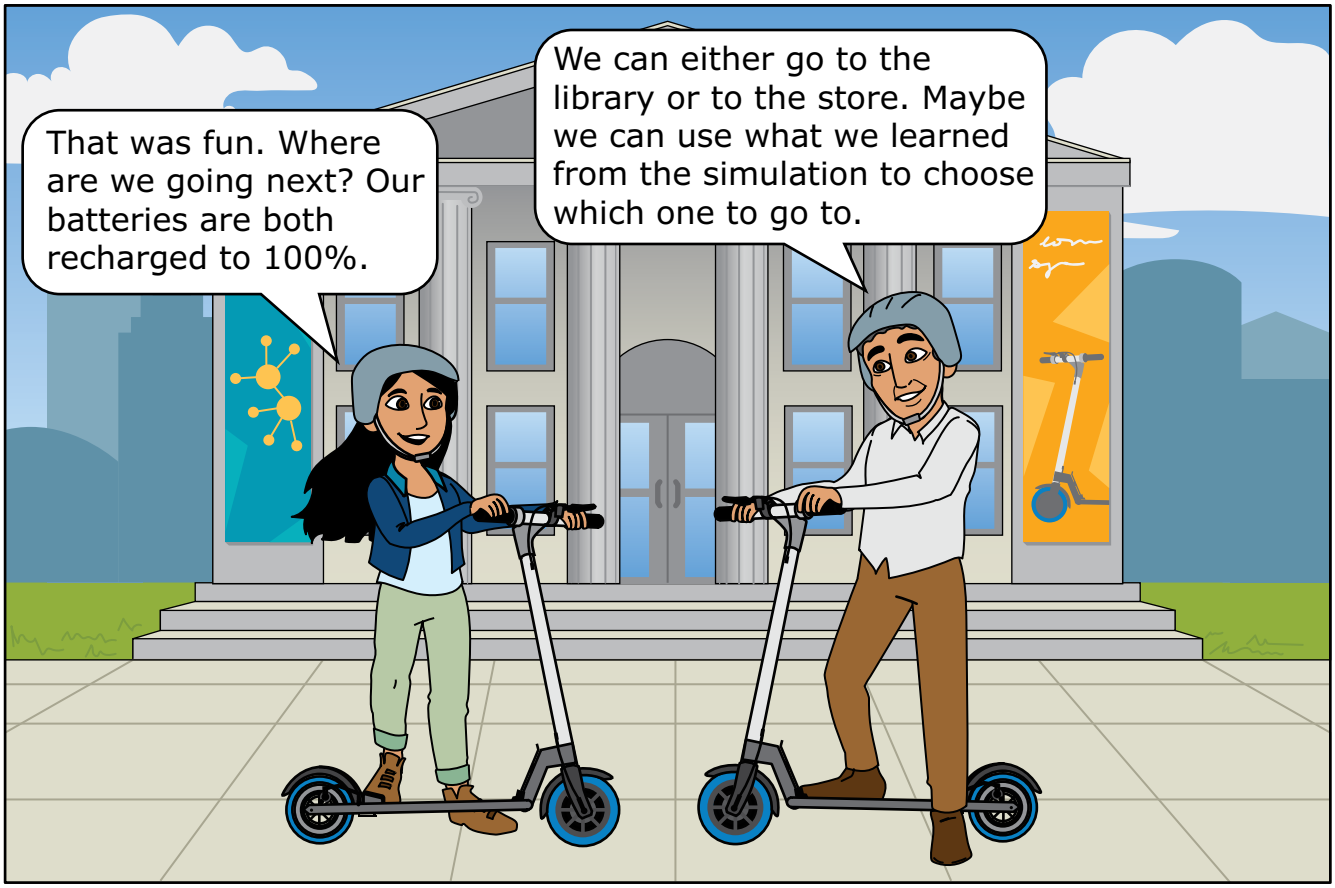
Ⓑ 5% incline, because for a specific mass, the object with medium height has more gravitational energy

Ⓒ 10% incline, because for a specific mass, the object with more height has more gravitational energy

Ⓓ any incline, because height does not affect gravitational potential energy

Go On ➡

Story Scene 7



Go On ➡

This question has three parts. Write your response on the next page. Be sure to label each part of your response.

7 A. Identify one form of energy the battery's chemical potential energy was converted into when Maya rode her scooter to the tech museum. Explain how you know the energy conversion took place.

B. Explain why the battery on Samuel's scooter had less energy than the battery on Maya's scooter after they traveled together to the tech museum.

C. After the tech museum, Maya and Samuel are deciding to go to either the library or the store. The table below shows the distance and incline of the two routes and of their original route to the tech museum.

Route	Beginning Battery Level (%)	Distance (km)	Incline of Route (%)
Scooter Station to Tech Museum	100	5	3
Tech Museum to Library	100	5	5
Tech Museum to Store	100	5	10

Identify whether Samuel would be **more likely** to reach the library or the store without running out of battery. Explain your answer using data from the table.

Go On ➡

7

This is the end of the session. You may check your work for this session only.

STOP!

Grade 8 Innovative Science Assessment
Spring 2022 Released Sample Task Items

Task Set Item Number	Reporting Category	Standard		Science and Engineering Practice Category	Item Type	Item Description	Correct Answer and Number of Points
1	*Physical Science*	8.PS.2.2		C. Evidence, Reasoning, and Modeling	SR	Students will observe the position of the rider at various times to determine the net force acting on the rider.	A, C (1 point)
2	*Physical Science*	Part A	8.PS.2.2	C. Evidence, Reasoning, and Modeling	SR	Students will observe the position of the rider at various times to determine the net force acting on the rider.	B (1 point)
		Part B					B, B (1 point)
3	*Physical Science*	8.PS.2.2		C. Evidence, Reasoning, and Modeling	SR	Students will determine the types of forces required for a scooter to slow down using models.	C (1 point)
4	*Physical Science*	Part A	7.PS.3.1	C. Evidence, Reasoning, and Modeling	SR	Students will analyze five models to determine which three best show the relationship between the mass and the kinetic energy of the rider and scooter.	A, C, D (1 point)
		Part B					C (1 point)
5	*Physical Science*	Part A	7.PS.3.1	C. Evidence, Reasoning, and Modeling	SR	Students will analyze five models to determine which best model(s) represents the greatest chemical potential energy at the end of the route.	B (1 point) A, C (1 point)
		Part B					B (1 point)
6	*Physical Science*	7.PS.3.2		C. Evidence, Reasoning, and Modeling	SR	Students will determine the mass for the rider and scooter that would have the greatest potential energy at the end of the route based on their knowledge of forces.	C (1 point) C (1 point)
7	*Physical Science*	7.PS.3.7		C. Evidence, Reasoning, and Modeling	CR	Students will identify and explain different types of energy conversions that occurred in the two students' scooters into based on the simulation outputs and their knowledge of energy conversions.	See scoring guide. (Maximum of 3 points)

Scoring Guide	
Score	**Description**
3	The response demonstrates a thorough understanding of the task by: • explaining that potential energy is transferred from the battery to cause the scooter to have kinetic energy as it moves • using evidence from the simulation to support an explanation that a difference in mass most likely caused the difference in battery levels • using the relationship between incline and battery level to determine the likelihood of reaching different locations
2	The response demonstrates a general understanding of the task by correctly responding to two of the three bullets.
1	The response demonstrates a minimal understanding of the task by correctly responding to one of the three bullets.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.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