Grade 8 Innovative Science and Technology/Engineering Sample Task

Spring 2022

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 through interactive computer simulations to conduct investigations, create and explore models, and solve science or engineering challenges. DESE is publishing one pilot performance task per grade as a sample task.

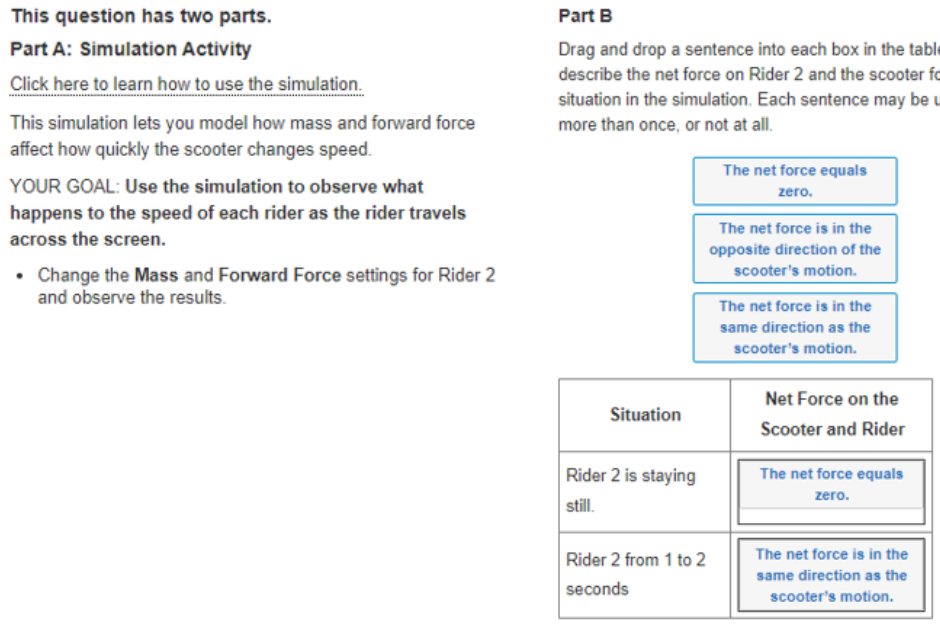
Sample items from the pilot test are available online at https://ma-innov-sci.mypearsonsupport.com/practice-tests/. The sample items are collected from a mini test called an ePAT (electronic practice assessment tool). Items in the ePAT are displayed in TestNav 8, the testing platform used for the computer-based 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 and simulation items.

Task Set Item Number	Reporting Category	Standard	Practice Category	Item Type*	Item Description	Answer	Percent Correct
(1)	Physical Science	8.PS.2.2	Evidence, Reasoning and Modeling	TE	Students will observe the position of the rider at various times to determine the net force acting on the rider.	*See Image*	54%



This question has two parts.

Part A: Simulation Activity

Click here to learn how to use the simulation.

This simulation lets you model how mass and forward force affect how quickly the scooter changes speed.

YOUR GOAL: **Use the simulation to observe what happens to the speed of each rider as the rider travels across the screen.**

- Change the **Mass** and **Forward Force** settings for Rider 2 and observe the results.

Part B

Drag and drop a sentence into each box in the table to describe the net force on Rider 2 and the scooter for each situation in the simulation. Each sentence may be used once, more than once, or not at all.

The net force equals zero.

The net force is in the opposite direction of the scooter's motion.

The net force is in the same direction as the scooter's motion.

Situation	Net Force on the Scooter and Rider
Rider 2 is staying still.	The net force equals zero.
Rider 2 from 1 to 2 seconds	The net force is in the same direction as the scooter's motion.

(2)	Physical Science	8.PS.2.2	Mathematics and Data	TE	Students will use the simulation to generate data that compares the speed of the two riders.	Part B is simulation dependent Part C *See Image*	45%

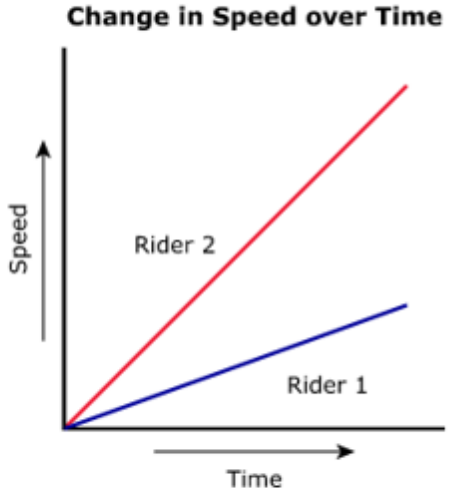
This question has three parts.

Part A: Simulation Activity

Click here to learn how to use the simulation.

In the previous question, you observed how the speeds of the riders change as they travel.

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



YOUR GOAL: **Generate data that could be used to produce a version of the graph above in which the difference in the change in speed of the two riders is the greatest.**

- Use the settings for Rider 2 to generate data in each new model you test.

Part B

The model that could be used to produce the graph above and that shows the greatest difference in the change in speed of the two riders is [Choose.] .

Part C

Complete the statements by selecting from the drop-down menus to correctly explain your choice of model in Part B.

When the same net force is applied to two objects with different masses for the same amount of time, the object with less mass will experience a [larger] change in speed.

When different net forces act on objects that have the same mass for the same amount of time, the object with the greater change in speed must be experiencing a [larger] net force.

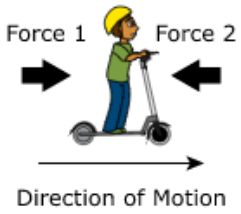
Performance (Points)
In the model identified by the students in Part B, the mass is set to 40 kg and the forward force is set to 150 N. (1) In the model identified by the students in Part B, the mass is set to 60 kg or 80 kg and/or the forward force is set to 50 N or 100 N (0).

(3)	Physical Science	8.PS.2.2	Evidence, Reasoning and Modeling	SR	Students will determine the types of forces required for a scooter to slow down using models.	B	44%

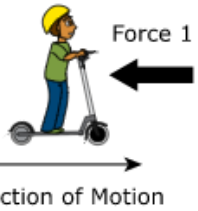
Which of the following diagrams **best** models a situation that would cause the scooter to slow down? In the diagrams, longer arrows represent larger forces.

A.

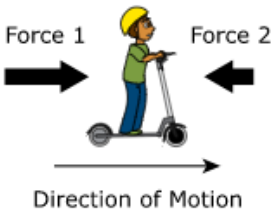
B.



C.



D.



(4)	Physical Science	7.PS.3.1	Mathematics and Data	TE	Students will use the simulation to generate models that show the relationship between the mass and the kinetic energy of the rider and scooter.	*See Image*	48%

This question has two parts.

Part A: Simulation Activity

Click here to learn how to use the simulation.

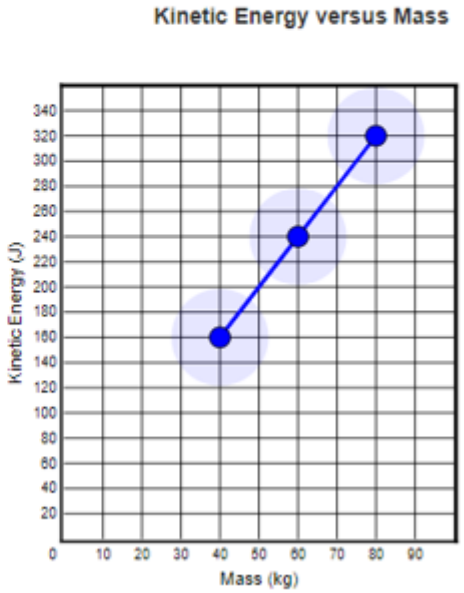
This simulation will help you investigate how mass, speed, and the incline of the route affect the kinetic energy of the rider and scooter and the potential energy of the scooter's battery.

YOUR GOAL: **Use the simulation to generate THREE models that can be used to create a graph that shows the relationship between the mass and the kinetic energy of the rider and scooter.**

- Set the **Speed** to 10 kilometers per hour (km/hr) and the **Incline** to 0% in your models.

Part B

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



(5)	Physical Science	7.PS.3.1	Evidence, Reasoning and Modeling	TE	Students will use the simulation to develop a model that shows the greatest chemical potential energy of the battery at the end of a route with a 5% incline.	Part B is simulation dependent Part C *See Image*	48%

This question has three parts.

Part A: Simulation Activity

Click here to learn how to use the simulation.

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

YOUR GOAL: **Develop a model that shows the greatest chemical potential energy of the battery at the end of a route with a 5% incline.**

- Use the **Mass** and **Speed** settings to develop a model that shows the battery's greatest chemical potential energy.
- Set the **Incline** to 5% in each new model you test.

Part B

Select from the drop-down menu to identify the model with the greatest chemical potential energy.

The saved model that has the greatest chemical potential energy at the end of a route with a 5% incline is Choose. .

Part C

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

Select from the drop-down menu to correctly complete the table.

Information about Rider X's Scooter Trip

Mass	50 kg
Speed	10 km/hr
Incline	10%
Battery Level at the End of the Route	50%

Performance (Points)
In the model identified by the students in Part B, the mass is set to 40 kg. (1) In the model identified by the students in Part B, the mass is set to 60 kg or 80 kg.(0)
In the model identified by the students in Part B, the speed is set to 10 km/hr. (1) In the model identified by the students in Part B, speed is set to 15 km/hr or 20 km/hr.(0)

(6)	Physical Science	7.PS.3.2	Evidence, Reasoning and Modeling	TE	Students will use the simulation the create a model that represents the greatest chemical potential energy at the end of the route.	Part B is simulation dependent	48%

This question has two parts.

Part A: Simulation Activity

Click here to learn how to use the simulation.

The rider and scooter also experience gravitational potential energy.

YOUR GOAL: **Develop a model that shows the greatest gravitational potential energy of the rider and scooter at the end of the route.**

- Set **Speed** to 10 km/hr.
- Use the **Mass** and **Incline** settings to develop your model.

Part B

The model that shows the greatest gravitational potential energy of the rider and scooter at the end of the route is Choose. .

Performance (Points)
In the model identified by the students in Part B, the mass is set to 80 kg. (1) In the model identified by the students in Part B, the mass is set to 10 kg or 60 kg.(0)
In the model identified by the students in Part B, the incline is set to 10%. (1) In the model identified by the students in Part B, the incline is set to 0% or 5%.(0)

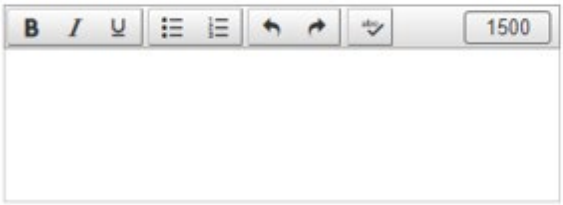
(7)	Physical Science	7.PS.3.7	Evidence, Reasoning and Modeling	CR	Students will identify and explain different types of energy conversions that occurred in the two students' scooters into based on the simulation outputs and their knowledge of energy conversions.	*See Scoring Guide*

This question has three parts.

Click here to learn how to use the simulation.

Part 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.



Part B

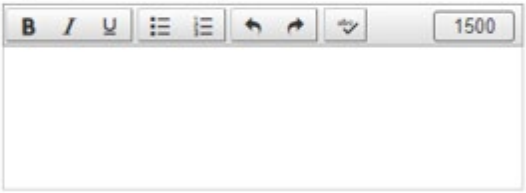
Explain why the battery on Samuel's scooter had less energy than the battery on Maya's scooter after they traveled together to the tech museum.

Part C

After the tech museum, Maya and Samuel plan to go to either the library or a store. The table 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 using all the charge in the battery. Explain your answer using data from the table.



Number of Points Received	Percentage of Test-takers
0 pt.	28.0%
1 pt.	22.0%
2 pt.	27.0%
3 pt.	23.0%
Omitting	0.0%

Scoring Guide for Parts A, B, and C (7.PS.3.7, CEDS)	
Score	Description
3	The response demonstrates a thorough understanding of the task by: • explaining that chemical potential energy in the battery is converted to another form of energy • using evidence to support an explanation that a difference in mass most likely caused the different use of energy from the battery • using the relationship between incline and energy 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.

* Item types are selected-response (SR), technology-enhanced (TE), and constructed-response (CR).
** Sample responses and scoring guidelines for constructed-response items will be posted to the Department's website later this year.
*** Please note that the displayed values for kinetic energy in the simulation have been simplified to facilitate student graphing for one of the test questions. Students in grade 8 are not expected to calculate kinetic energy from mass and speed.