

2022 MCAS Sample Student Work and Scoring Guide

Grade 8 Science and Technology/Engineering Question 5: Constructed-Response

Reporting Category: Physical Science

Practice Category: Mathematics and Data

Standard: [7.PS.3.1](#) - Construct and interpret data and graphs to describe the relationships among kinetic energy, mass, and speed of an object.

Item Description: Compare the kinetic energy of two students when given their speed and mass and explain the reasoning; identify the graph that shows the relationship between speed and kinetic energy and explain the reasoning.

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Scoring Guide

Select a score point in the table below to view the sample student response.

Score	Description
2	The response demonstrates a thorough understanding of the relationship among kinetic energy, mass, and speed of an object. The response correctly compares the kinetic energy of student R with the kinetic energy of student S and clearly explains the reasoning. The response also correctly identifies the graph that best represents the relationship between student R's speed and kinetic energy and clearly explains the reasoning.
1	The response demonstrates a partial understanding of the relationship among kinetic energy, mass, and speed of an object.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

Score Point 2

This question has two parts.

Two students are riding identical bicycles on a level sidewalk. Student R has a mass of 55 kg and student S has a mass of 40 kg.

Part A

Both students are traveling at a speed of 3 m/s.

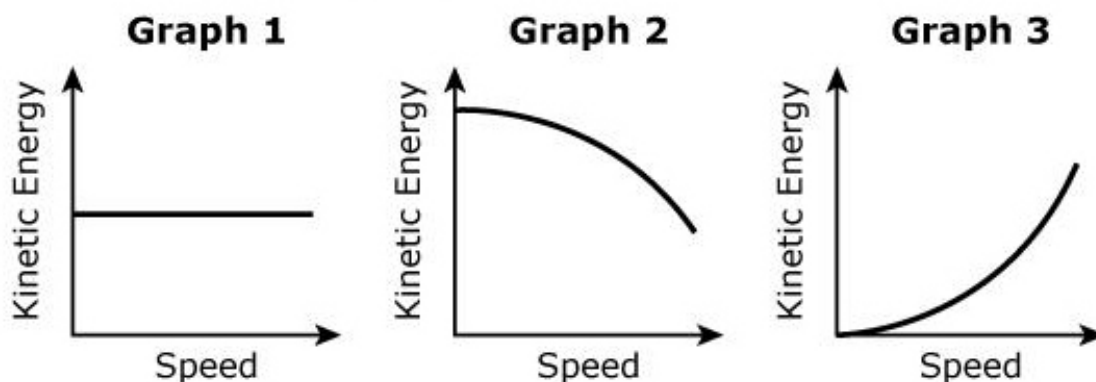
Determine whether student R has a larger, a smaller, or an equal amount of kinetic energy compared to student S. Explain your reasoning.

Student R has a larger amount of kinetic energy compared to student S because student R has a higher amount of mass and is going at the same speed.

Part B

Student R is at rest, begins to ride, and then moves faster and faster.

Identify which graph (1, 2, or 3) best represents the relationship between student R's speed and kinetic energy. Explain your reasoning.



Graph 3 because as the student speeds up his kinetic energy gradually gets higher and that is what is displayed on the graph.

Score Point 1

This question has two parts.

Two students are riding identical bicycles on a level sidewalk. Student R has a mass of 55 kg and student S has a mass of 40 kg.

Part A

Both students are traveling at a speed of 3 m/s.

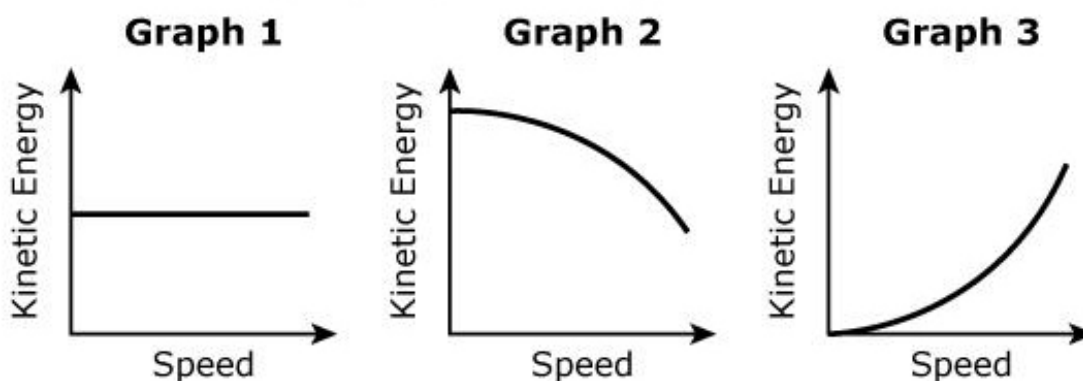
Determine whether student R has a larger, a smaller, or an equal amount of kinetic energy compared to student S. Explain your reasoning.

Student R has an equal amount of kinetic energy to student S. This is because they are both traveling at the same speed of 3 m/s.

Part B

Student R is at rest, begins to ride, and then moves faster and faster.

Identify which graph (1, 2, or 3) best represents the relationship between student R's speed and kinetic energy. Explain your reasoning.



Graph 3 best shows the relationship between student R's speed and kinetic energy, because as the speed increases, the kinetic energy also increases.

Score Point 0

This question has two parts.

Two students are riding identical bicycles on a level sidewalk. Student R has a mass of 55 kg and student S has a mass of 40 kg.

Part A

Both students are traveling at a speed of 3 m/s.

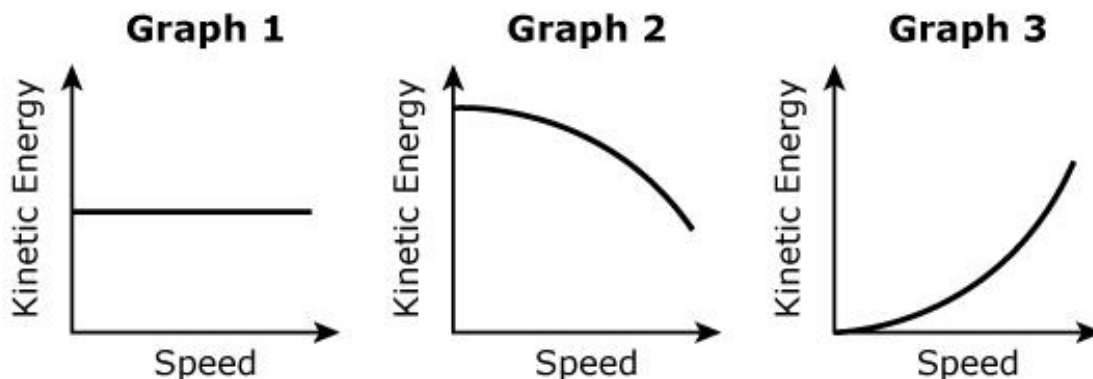
Determine whether student R has a larger, a smaller, or an equal amount of kinetic energy compared to student S. Explain your reasoning.

Student R has less kinetic energy, because it takes more to push his extra mass.

Part B

Student R is at rest, begins to ride, and then moves faster and faster.

Identify which graph (1, 2, or 3) best represents the relationship between student R's speed and kinetic energy. Explain your reasoning.



Graph 2 is the one that best represents. Graph 2 starts at the top of the kinetic energy line, indicating student R's rest, then the line gradually does down and right, showing his acceleration at the loss of his kinetic energy.