Toy Truck

Directions: Use the following information to answer questions 4 through 10.

The toy truck with a key is a system. Damien and Bailey wondered if adding blocks to the toy truck system would affect the distance traveled. They did the following controlled experiment.

Question: What is the effect of blocks with different mass (10 grams, 20 grams, and 30 grams) on the distance a toy truck system with the block will travel?

Prediction: The toy truck system carrying the 10 gram block will travel the farthest distance.
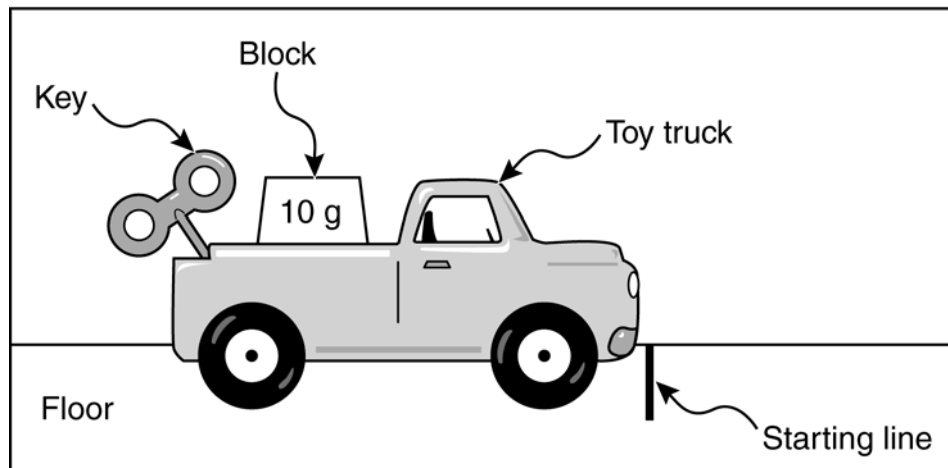
Materials:
toy truck system
3 blocks: 10 grams (g), 20 g, 30 g
tape
meterstick

Controlled Experiment Setup

Procedure:
1. Use the tape to mark a starting line on the floor.
2. Set the toy truck system at the starting line.
3. Put the 10-g block into the back of the toy truck system.
4. Turn the key on the toy truck 15 times and let go.
5. Measure and record the distance the toy truck system and block travel as Trial 1.
6. Repeat steps 2 through 5 two more times as Trials 2 and 3.
7. Repeat steps 2 through 6 for the 20-g block and the 30-g block.
8. Find and record the average distance the toy truck system traveled carrying each block mass.

Data:

Block Mass vs. Distance Traveled

Block Mass (grams)	Distance Traveled (centimeters)			
	Trial 1	Trial 2	Trial 3	Average
10	421	426	428	425
20	402	401	397	400
30	358	363	359	360

7 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:
- Answer the experimental question.
- Include **supporting** data from the Block Mass vs. Distance Traveled table.
- Explain how these data **support** your conclusion.

Question: What is the effect of blocks with different mass (10 grams, 20 grams, and 30 grams) on the distance a toy truck system with the block will travel?
Conclusion:

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Performance Description	Attributes	Typical results: Mean= ~0.79 pts
A **2-point response** demonstrates the student understands the Content Standard INQG: Scientific explanations emphasize evidence, have logically consistent arguments, and use known scientific principles, models, and theories. Item Specification 1: Generate a conclusion for a scientific investigation, including supporting data, given a description of and results from the investigation. Example: *The lower the mass, the greater the distance the toy truck system traveled. With 10 grams the truck traveled 425 centimeters. With 30 grams the truck traveled 360 centimeters. The truck with the highest mass went the shortest distance.*	3-4	~35%
A **1-point response** demonstrates the student has partial understanding of the Content Standard.	2	~9%
A **0-point response** demonstrates the student has little or no understanding of the Content Standard.	0–1	~54% ~2% blank

Block Mass vs. Distance Traveled

Block Mass (grams)	Distance Traveled (centimeters)			
	Trial 1	Trial 2	Trial 3	Average
10	421	426	428	425
20	402	401	397	400
30	358	363	359	360

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Attributes of a Conclusion Note: The italicized print is the part of the "Example" credited for the attribute.		
Description	**Attributes**	**Typical results**
Conclusive statement correctly answers the experimental question (or correctly states whether the prediction was correct): *The lower the mass, the greater the distance the toy truck system traveled.* Attribute Notes: 1. A vague conclusive statement (e.g., *the mass change did affect the distance*) cannot be credited for this attribute, but other attributes can be credited. 2. A response with an incorrect conclusive statement or no conclusive statement may not be credited any attributes. 3. A response with both a correct and an incorrect conclusive statement (e.g., *as mass increased distance decreased … as mass got smaller so did distance*) cannot be credited for this attribute but other attributes can be credited, if separate from any contradictory statements.	1	~48%
Supporting data should <u>at least</u> be over the entire range of the conditions investigated. Thus the minimum reported data are the lowest and highest conditions of the manipulated variable for quantitative data (responding variable when the manipulated variable information is descriptive).		
Supporting data for 10 g block: *With 10 grams the truck traveled 425 centimeters.*	1	~39%
Supporting data for 30 g block: *With 30 grams the truck traveled 360 centimeters.*	1	~39%
Explanatory language, separate from the conclusive statement, is used to connect or compare the supporting data to the conclusive statement: *The truck with the highest mass went the shortest distance.* Attribute Notes: 1. This attribute can only be credited when at least one numeric value (or the text from a descriptive data table) for the manipulated or responding variable is included in the response. 2. A copy of the conclusive statement cannot be credited for explanatory language. However, a re-phrased credited conclusive statement can be credited. 3. Explanatory language comparing the range of the manipulated and/or responding variables may be credited (e.g., *with the 30g block the truck **only** went 360 centimeters.*) 4. If a response misquotes trend data between the highest and lowest conditions, this attribute cannot be credited (e.g., *the 20g block went 399 centimeters*). 5. Transitional words (e.g., *however, therefore, because, so, then, clearly, but*) cannot be credited as explanatory language even when added to a conclusive statement. 6. A compound sentence as a conclusive statement may be read as two separate sentences.	1	~23%
Total Possible Attributes	4	

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General Notes:

1. **Copying the Data Table**: Responses copying the whole data table verbatim may not be credited the supporting data attribute even with a correct conclusive statement and explanatory language.
   a) For grades 4-5, a translation of the whole data table into sentences is acceptable.
   b) For grades 6-8 and high school, a discussion of the whole data table **may** be acceptable when the data table is minimal with a very small number of data cells.

2. **Supporting Data**: Responses must give the precise numerical values or precise descriptive language from the data table for both the manipulated and responding variables.
   a) Average data (if given) or data from the end of the investigation, must be included for grades 6-8 and high school.
   b) For grades 4-5, consistent trial data, or data before the completion of the investigation when measuring a responding variable over time, can be credited.
   c) Rounded numerical values cannot be credited (e.g., *about 400* cannot be credited for 425). However, a zero after a decimal point may be omitted (e.g., NA).
   d) Units are not necessary for credit (e.g., *425* is creditable for *425 centimeters*).
   e) Minor language differences in descriptive data may be acceptable as decided in rangefinding (e.g., NA).
   f) For grades 4-5, the manipulated variable may be implied (e.g., *smallest/lightest block* for 10 g block, *largest/heaviest block* for 30 g block).

3. **Derived Data:** Responses giving their own derived data between conditions can be credited for supporting data **and** explanatory language (e.g., *increasing the mass by 20 grams caused the distance to decrease by 65 centimeters*).
   a) When the derived data uses the lowest and/or highest conditions, one or both supporting data attributes can be credited.
   b) Minor arithmetic errors in derived values can be acceptable as decided in rangefinding (e.g., NA).

Annotated example of a 2-point response to item 7.

7 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:
- Answer the experimental question.
- Include **supporting** data from the Block Mass vs. Distance Traveled table.
- Explain how these data **support** your conclusion.

Question: What is the effect of blocks with different mass (10 grams, 20 grams, and 30 grams) on the distance a toy truck system with the block will travel?
Conclusion:
The more the mass the shorter the truck will travel. The truck with 10 grams went an average of 425 cm. With the 30 g weight the truck only traveled 360 cm. That's 65 cm less than the 10 g weight.

Annotations	Attributes	
Conclusive statement: *The more the mass the shorter the truck will travel.*	1	
Supporting data for 10 g block: *…10 grams went an average of 425 cm.*	1	
Supporting data for 30 g block: *…30 g…traveled 360 cm.*	1	
Explanatory language: *That's* (360 cm traveled by 30g) *65cm less than the 10g weight.* OR *With the 30g weight the car **only** traveled 360cm.* Attribute Note 3.	1	
Total Attributes & Score Points	4	**2**

Annotated example of a 1-point response to item 7.

7 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:
- Answer the experimental question.
- Include **supporting** data from the Block Mass vs. Distance Traveled table.
- Explain how these data **support** your conclusion.

Question: What is the effect of blocks with different mass (10 grams, 20 grams, and 30 grams) on the distance a toy truck system with the block will travel?
Conclusion:
The effect of different amounts of mass will make the truck go farther or closer because with 10 grams the average was 425 centemeters and with 20 grams the average was 400 centemeters so the less weight the farther it moves.

Annotations	Attributes
Conclusive statement: *...different amounts of mass will make the truck go farther or closer...* Vague. Attribute Note 1	0
Supporting data for 10 g block: *...with 10 grams the average was 425 centemeters...*	1
Supporting data for 30 g block: None.	0
Explanatory language: *...so the less weight the farther it* (the truck) *moves.*	1
Total Attributes & Score Points	2 **1**

Annotated example of a 0-point response to item 7.

7 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:
- Answer the experimental question.
- Include **supporting** data from the Block Mass vs. Distance Traveled table.
- Explain how these data **support** your conclusion.

Question: What is the effect of blocks with different mass (10 grams, 20 grams, and 30 grams) on the distance a toy truck system with the block will travel?
Conclusion:
I conclude that the truck slows down with more weight on it and that it speeds up with less weight on it.

Annotations	Attributes	
Conclusive statement: *the truck slows down with more weight on it* (the truck) *and it* (the truck) *speeds up with less weight on it* (the truck). Attribute Note 2 Incorrect Conclusive Statement—speed is commented about instead of distance traveled.	0	
Supporting data for 10 g block: None	0	
Supporting data for 30 g block: None	0	
Explanatory language: None	0	
Total Attributes & Score Points	0	**0**