



Maine
Department of
Education

HIGH SCHOOL

Maine Science Assessment
Released Items (2022)



New Meridian

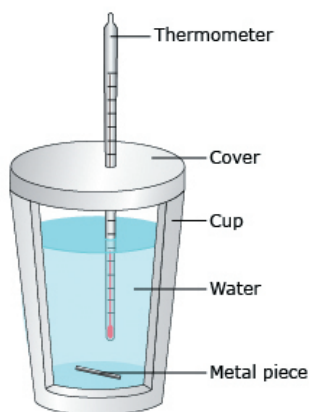
Use the information from Calorimetry to answer **questions 1–3**.

Calorimetry

On a cold day, Maria fills two mugs with hot water and places each container on the table. The mugs are identical, except that one is made of aluminum and the other copper. After some time, she finds that the aluminum mug feels hotter to the touch than the copper mug. The mugs are the same shape and size and contain water at the same temperature. Maria wonders why one mug feels hotter than the other. She thinks it has to do with the type of metal each mug is made of.

Maria sets up a calorimetry experiment to investigate how the different metals might affect the temperature of the water. She creates a calorimeter by pouring water into an insulated cup fitted with a cover and a thermometer. Pieces of hot aluminum and copper of a known mass are dropped into the calorimeter. She records the initial and final temperatures of each piece of metal.

Cross Section of the Calorimeter



Investigation Record			
Component	Mass (g)	Initial Temperature (°C)	Final Temperature of Water + Metal (°C)
water	100	25	-----
aluminum	100	100	38.17
copper	100	100	31.25

To compare and quantify the amount of heat transfer between various substances and water, Maria collects data on specific heat values of common substances used to make containers.

Specific Heat Values of Common Substances	
Substance	Specific Heat Values (J/g °C)
steel	0.47
copper	0.38
iron	0.41
silver	0.23
tempered glass	0.75

1. Which statements can be supported by the calorimetry experiment? Mark **True** or **False** for each statement.

Water transferred energy to the metal.	<input type="radio"/> True	<input type="radio"/> False
The metal transferred energy to the water.	<input type="radio"/> True	<input type="radio"/> False
The aluminum transferred less energy than the copper.	<input type="radio"/> True	<input type="radio"/> False
The copper transferred less energy than the aluminum.	<input type="radio"/> True	<input type="radio"/> False

2. Maria analyzes the data from the calorimetry experiment related to the 100 grams of copper and 100 grams of water.

How does thermal energy transfer between the copper and the water inside the insulated cup? Describe what happens to the thermal energy of copper, water, and the closed system of the calorimetry cup.

3. Based on Maria's setup of the calorimetry investigation, which variable is the dependent variable?

- (A) the mass of the metal
- (B) the mass of the water
- (C) the final temperature
- (D) the initial temperature

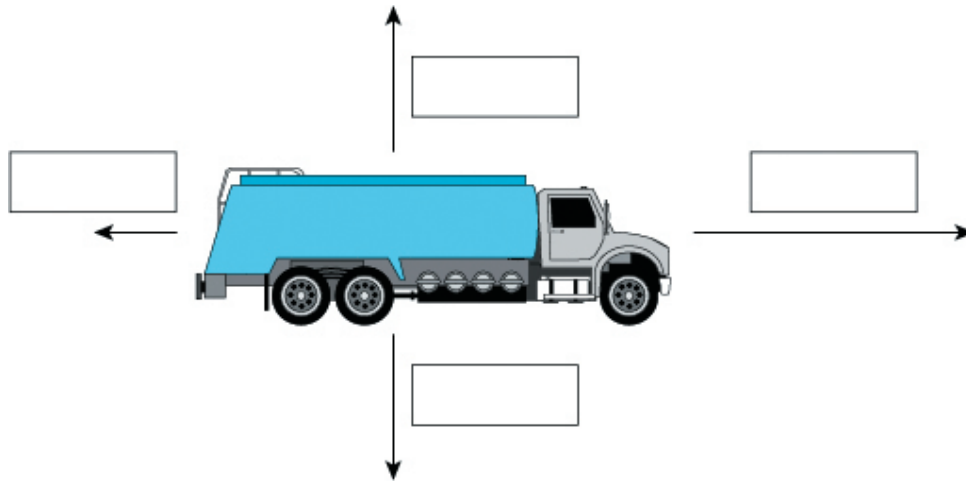
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Use the information from Toy Truck to answer **questions 4-5**.

Toy Truck

Andrea pushes a toy truck across the rug of her living room. She also pushes the same truck using the same amount of force across the tile in her kitchen. She wonders why the truck travels farther on certain surfaces.

4. What forces are acting on the truck? Complete the diagram by writing the letter for the force in each box.



- A. Applied
- B. Friction
- C. Gravity
- D. Normal

5. Which statement explains why the truck travels farther on certain surfaces?
- (A) The normal force is less.
 - (B) The air resistance is less.
 - (C) The force of friction is less.
 - (D) The force of gravity is less.

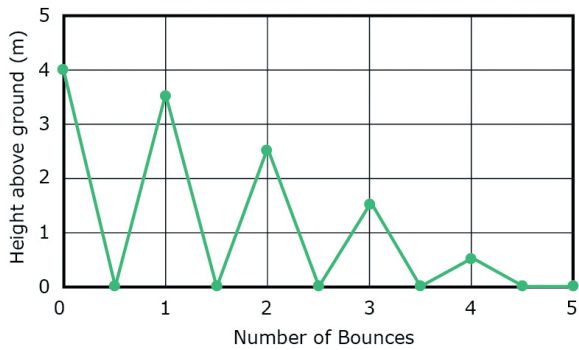
Use the information from Bouncing Balls to answer **questions 6–7**.

Bouncing Balls

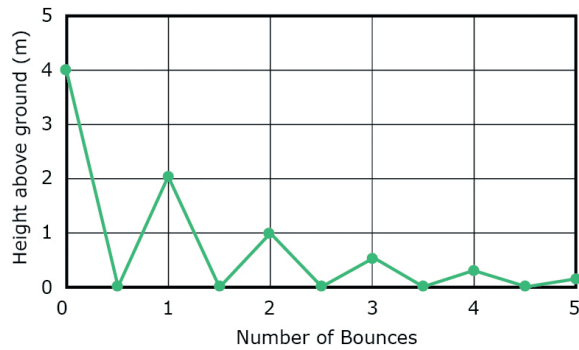
Tamara and Donna are carrying out an investigation to determine the bounciness of five volleyballs of different brands in order to make a recommendation of which ball to use for the volleyball team. The five balls all have similar masses and sizes. They begin by releasing the first ball from a height of 4 meters. They take digital recordings of the height of each bounce for five bounces. They then repeat this process for the remaining four balls. To record their findings, they draw five graphs, each showing the bounce results for one of the five balls.

While Tamara and Donna make their presentation to the volleyball team, a team member, Todd, tells them there is an error in two of their graphs.

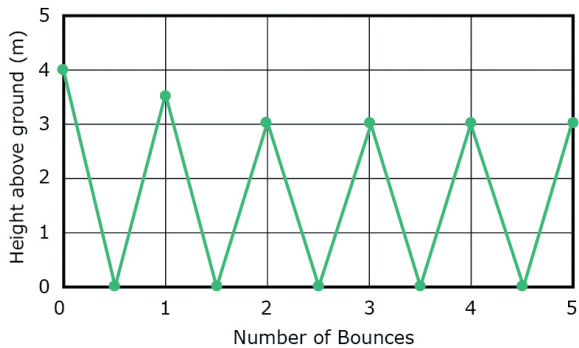
A.



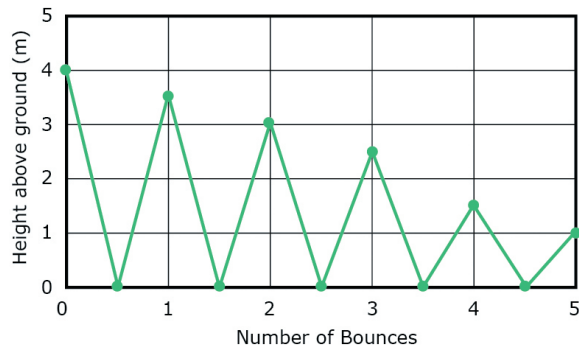
B.



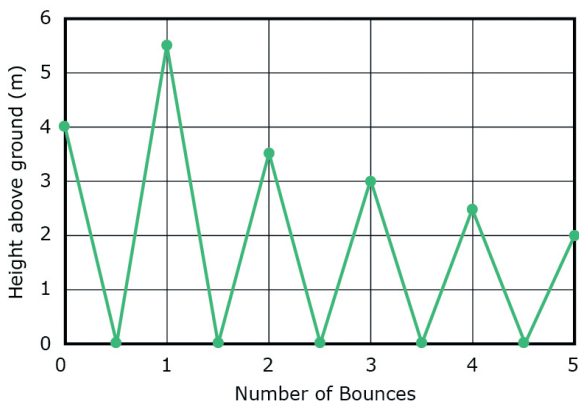
C.



D.



E.



6. Which graphs have an **error**? Select **all** that apply.

Ⓐ Graph A

Ⓑ Graph B

Ⓒ Graph C

Ⓓ Graph D

Ⓔ Graph E

7. How does Todd know there is an error in the graphs?

