

2022 MCAS Sample Student Work and Scoring Guide

Grade 8 Science and Technology/Engineering Question 17: Constructed-Response

Reporting Category: Physical Science

Practice Category: Investigations and Questioning

Standard: [6.PS.1.6](#) - Plan and conduct an experiment involving exothermic and endothermic chemical reactions to measure and describe the release or absorption of thermal energy.

Item Description: Compare wave models and determine which two have the same amplitude.

[View item in MCAS Digital Item Library](#)

Scoring Guide

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

Score*	Description
3A	The response demonstrates a thorough understanding of endothermic chemical reactions. The response correctly identifies the type of energy that was measured by the thermometer. The response correctly identifies whether the reaction was endothermic or exothermic and clearly explains the answer. The response also correctly shows how the data should be recorded.
3B	
2	The response demonstrates a partial understanding of endothermic chemical reactions.
1	The response demonstrates a minimal understanding of endothermic chemical reactions.
0	The response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.

*Letters are used to distinguish between sample student responses that earned the same score (e.g., 3A and 3B).

Score Point 3A**This question has three parts.**

Students investigated what happens when citric acid combines with baking soda in water. They followed these steps:

1. Place a thermometer in a beaker of room-temperature water.
2. Add baking soda to the beaker of water and stir until the baking soda is no longer visible.
3. Add citric acid to the beaker and stir for 5 sec.

The students recorded observations in a lab notebook every 30 sec for 2 min. They made the following observations:

- The temperature decreased.
- Bubbles formed.
- The color did not change.

Part A

Identify the type of energy that was measured by the thermometer.

thermal energy

Part B

Identify whether the reaction in the beaker was endothermic or exothermic. Explain your answer.

It was an endothermic reaction because the temperature decreased which means that energy must have been getting absorbed.

Part C

Drag and drop the row and column headings into the boxes to show how the students should have set up the lab notebook to record their data. Each label may be used once or not at all.

Baking soda

Citric acid

Water

Time	Temperature	Bubbles	Color
0 sec			
30 sec			
60 sec			
90 sec			
120 sec			

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Score Point 3B**This question has three parts.**

Students investigated what happens when citric acid combines with baking soda in water. They followed these steps:

1. Place a thermometer in a beaker of room-temperature water.
2. Add baking soda to the beaker of water and stir until the baking soda is no longer visible.
3. Add citric acid to the beaker and stir for 5 sec.

The students recorded observations in a lab notebook every 30 sec for 2 min. They made the following observations:

- The temperature decreased.
- Bubbles formed.
- The color did not change.

Part A

Identify the type of energy that was measured by the thermometer.

Heat energy was identified by the thermometer.

Part B

Identify whether the reaction in the beaker was endothermic or exothermic. Explain your answer.

It was Endothermic because the tempature got cooler.

Part C

Drag and drop the row and column headings into the boxes to show how the students should have set up the lab notebook to record their data. Each label may be used once or not at all.

Baking soda

Citric acid

Water

Time	Temperature	Color	Bubbles
0 sec			
30 sec			
60 sec			
90 sec			
120 sec			

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Score Point 2**This question has three parts.**

Students investigated what happens when citric acid combines with baking soda in water. They followed these steps:

1. Place a thermometer in a beaker of room-temperature water.
2. Add baking soda to the beaker of water and stir until the baking soda is no longer visible.
3. Add citric acid to the beaker and stir for 5 sec.

The students recorded observations in a lab notebook every 30 sec for 2 min. They made the following observations:

- The temperature decreased.
- Bubbles formed.
- The color did not change.

Part A

Identify the type of energy that was measured by the thermometer.

This is a demonstration of a chemical reaction.

Part B

Identify whether the reaction in the beaker was endothermic or exothermic. Explain your answer.

Endothermic. After/ durring the experiment, the water temperature decreased.

Part C

Drag and drop the row and column headings into the boxes to show how the students should have set up the lab notebook to record their data. Each label may be used once or not at all.

Baking soda

Citric acid

Water

Time	Bubbles	Color	Temperature
0 sec			
30 sec			
60 sec			
90 sec			
120 sec			

Score Point 1

This question has three parts.

Students investigated what happens when citric acid combines with baking soda in water. They followed these steps:

- 1. Place a thermometer in a beaker of room-temperature water.
- 2. Add baking soda to the beaker of water and stir until the baking soda is no longer visible.
- 3. Add citric acid to the beaker and stir for 5 sec.

The students recorded observations in a lab notebook every 30 sec for 2 min. They made the following observations:

- The temperature decreased.
- Bubbles formed.
- The color did not change.

Part A

Identify the type of energy that was measured by the thermometer.

The type of energy that was measured by the thermometer was thermal energy.

Part B

Identify whether the reaction in the beaker was endothermic or exothermic. Explain your answer.

It was endothermic because it did not really change

Part C

Drag and drop the row and column headings into the boxes to show how the students should have set up the lab notebook to record their data. Each label may be used once or not at all.

0 sec 120 sec Bubbles

Temperature	30 sec	60 sec	90 sec
Color			
Time			
Citric acid			
Baking soda			
Water			

Score Point 0

This question has three parts.

Students investigated what happens when citric acid combines with baking soda in water. They followed these steps:

- 1. Place a thermometer in a beaker of room-temperature water.
- 2. Add baking soda to the beaker of water and stir until the baking soda is no longer visible.
- 3. Add citric acid to the beaker and stir for 5 sec.

The students recorded observations in a lab notebook every 30 sec for 2 min. They made the following observations:

- The temperature decreased.
- Bubbles formed.
- The color did not change.

Part A

Identify the type of energy that was measured by the thermometer.

The type of energy that was measured by the thermometer is chemical energy.

Part B

Identify whether the reaction in the beaker was endothermic or exothermic. Explain your answer.

The reaction was exothermic because while the color did not change other physical changes occurred.

Part C

Drag and drop the row and column headings into the boxes to show how the students should have set up the lab notebook to record their data. Each label may be used once or not at all.

- Baking soda
- Bubbles
- Citric acid

Time	Temperature	Color	Water
0 sec			
30 sec			
60 sec			
90 sec			
120 sec			