

Scoring Rubric for Item 4: Foaming Spuds Conclusion (Page 1 of 3)

| Performance Description | Attributes |
|---|------------|
| <p>A 2-point response demonstrates the student understands the Content Standard INQF: It is important to distinguish between the results of a particular investigation and general conclusions drawn from these results. Item Specification 1: Generate a logical conclusion that is supported by evidence from the investigation and/or provide a scientific reason to explain the trend in data given a description of and the results from a scientific investigation.</p> <p><i>Example: Potato juice at an acidity of pH 8 had the greatest volume of foam. The volume of foam produced at pH 6 was only 24 mL. When the pH was 9, the amount of foam was 30 mL. The lowest pH gave the smallest volume of foam. A low pH damages the enzyme.</i></p> | 4-5 |
| A 1-point response demonstrates the student has partial understanding of the Content Standard. | 2-3 |
| A 0-point response demonstrates the student has little or no understanding of the Content Standard. | 0-1 |

Acidity of Potato Juice vs. Volume of Foam

| Acidity of Potato Juice (pH) | Volume of Foam (milliliters) | | | |
|------------------------------|------------------------------|---------|---------|---------|
| | Trial 1 | Trial 2 | Trial 3 | Average |
| 6 | 22 | 25 | 25 | 24 |
| 7 | 32 | 38 | 36 | 35 |
| 8 | 41 | 42 | 42 | 42 |
| 9 | 32 | 29 | 30 | 30 |

Scoring Rubric for Item 4: Foaming Spuds Conclusion (Page 2 of 3)

| Attributes of a Conclusion | |
|--|-------------------|
| Note: The italicized print is the part of the “Example” credited for the attribute. | |
| Description | Attributes |
| <p>Conclusive statement correctly answers the experimental question (or correctly states whether the hypothesis/prediction was correct): <i>Potato juice at an acidity of pH 8 had the greatest volume of foam.</i></p> <p>Attribute Notes:</p> <ol style="list-style-type: none"> 1. A vague conclusive statement (e.g., <i>the acidity did affect the volume of foam</i>) 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., <i>foam increased as acidity increased and the lower the acidity the more foam</i>) cannot be credited for this attribute but other attributes can be credited, if separate from any contradictory statements. | 1 |
| <p>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).</p> | |
| <p>Supporting Data for pH 6: <i>The volume of foam produced at pH 6 was only 24 mL.</i></p> | 1 |
| <p>Supporting Data for pH 9: <i>When the pH was 9, the amount of foam was 30 mL.</i></p> | 1 |
| <p>Explanatory language, separate from the conclusive statement, is used to connect or compare the supporting data to the conclusive statement: <i>The lowest pH gave the smallest volume of foam.</i></p> <p>Attribute Notes:</p> <ol style="list-style-type: none"> 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., <i>When the acidity was pH 6, the volume of foam was the lowest, 24 mL.</i>). 4. If a response misquotes trend data between the highest and lowest conditions, this attribute cannot be credited (e.g., <i>The acidity of pH 7 gave 34 mL foam</i>). 5. Transitional words (e.g., <i>however, therefore, because, so, then, clearly, but</i>) 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. 7. This point can only be credited if the results for pH 8 are included somewhere in the response. (E.g. <i>A pH of 8 produced the greatest volume of foam.</i>) | 1 |

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| Attributes of a Conclusion | |
|---|-------------------|
| Note: The italicized print is the part of the “Example” credited for the attribute. | |
| Description | Attributes |
| <p>Scientific Explanation provides a plausible scientific reason that explains the trend seen in the data table in terms of established scientific knowledge.</p> <p>Examples:</p> <ul style="list-style-type: none"> • <i>A low pH damages the enzyme.</i> • <i>Enzymes are most active at a neutral pH.</i> • <i>Acids/bases denature enzymes.</i> <p>Writing Note: This attribute is only included when the scientific reason is expected knowledge for high school life science students based on the <i>K-12 Science Learning Standards</i> and directly connected to the effect on the dependent variable, as determined in Item Writing and/or Content Review.</p> | 1 |
| Total Possible Attributes | 5 |
| <p>General Notes:</p> <ol style="list-style-type: none"> 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. <ol style="list-style-type: none"> 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. <ol style="list-style-type: none"> 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., <i>about 20 mL</i> cannot be credited for <i>24 mL</i>). However, a zero after a decimal point may be omitted (e.g., <i>30</i> can be credited for <i>30.0</i>). d) Units are not necessary for credit (e.g., <i>30</i> can be credited for <i>30 mL</i>). e) Minor language differences in descriptive data may be acceptable as decided in range finding (e.g., NA). f) For grades 4-5, the manipulated variable may be implied. 3. Derived Data: Responses giving their own derived data between conditions can be credited for supporting data and explanatory language (e.g. <i>Increasing the pH by 3 caused the volume of foam to increase by 6 mL.</i>) <ol style="list-style-type: none"> 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 range finding (e.g., NA). 4. Responses including a misconception about the relationship between pH and acidity may be credited (e.g. <i>higher pH is more acidic</i>). | |

Annotated example of a 2-point response for Item 4

4 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:

- Answer the experimental question.
- Include **supporting** data from the Acidity of Potato Juice vs. Volume of Foam table.
- Explain how these data **support** your conclusion.
- Provide a **scientific** explanation for the trend in the data.

| |
|--|
| Question: What is the effect of the acidity of potato juice on the volume of foam produced when hydrogen peroxide is added to potato juice? |
| <i>In this investigation, the prediction that if the acidity of potato juice is decreased then the volume of foam was increased was proven incorrect. Catalase is damaged by acid. The lowest foam volume was 24 ml with the highest acidity, pH6, However the highest foam volume was an average of 42 ml with the second lowest acidity level, pH8 The third highest volume was 35 ml with the second highest acidity level pH7, and the second lowest foam volume was 30 ml with the lowest acidity level pH9</i> |

| Annotations | Attributes | |
|--|-------------------|----------|
| Conclusive statement: ...the prediction ...was incorrect. | 1 | |
| Supporting data for pH 6: ... the lowest foam volume was 24mL with the highest acidity, pH 6 ... | 1 | |
| Supporting data for pH 9: ... foam volume was 30mL ... pH 9 | 1 | |
| Explanatory language: ... the highest foam volume was an average of 42mL with the second lowest acidity level | 1 | |
| Scientific explanation: Catalase is damaged by acid | 1 | |
| Total Attributes & Score Points | 5 | 2 |

Annotated example of a 1-point response for Item 4

4 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:

- Answer the experimental question.
- Include **supporting** data from the Acidity of Potato Juice vs. Volume of Foam table.
- Explain how these data **support** your conclusion.
- Provide a **scientific** explanation for the trend in the data.

| |
|---|
| Question: What is the effect of the acidity of potato juice on the volume of foam produced when hydrogen peroxide is added to potato juice? |
| <i>In conclusion the acidity of potatoe juice does affect the volume of foam produced. When there is more potatoe juice the volume of foam increases, but at one point the volume of the potatoe jucie starts to decline once again. A beaker with 6pH of potatoe juice had a avg of only 24 foam volume. and the one with 9pH had a volume of 30. The one with 8pH had a volume of 42.</i> |

| Annotations | Attributes | |
|--|-------------------|----------|
| Conclusive statement: ...the acidity of potatoe juice does affect the volume of foam produced. Vague | 0 | |
| Supporting data for pH 6: ...6 pH ... 24 foam volume. | 1 | |
| Supporting data for pH 9: ...9 pH ... 30. | 1 | |
| Explanatory language: ... 6pH of potatoe juice had a avg of only 24 foam volume Note: credited because of reference to 8 pH | 1 | |
| Scientific explanation: None | 0 | |
| Total Attributes & Score Points | 3 | 1 |

Annotated example of a 1-point response for Item 4

4 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:

- Answer the experimental question.
- Include **supporting** data from the Acidity of Potato Juice vs. Volume of Foam table.
- Explain how these data **support** your conclusion.
- Provide a **scientific** explanation for the trend in the data.

| |
|--|
| Question: What is the effect of the acidity of potato juice on the volume of foam produced when hydrogen peroxide is added to potato juice? |
| <i>Ph8 has the most foam at 42. The more Ph does not mean the more foam, but the least Ph does mean the least foam. When the Ph got to 8 it went down again at ph9. Ph7 is higher than Ph9. Ph9 is higher than Ph6. Ph8 caused the most foam than any other.</i> |
| |

| Annotations | Attributes | |
|--|------------|----------|
| Conclusive statement: <i>Ph 8 has the most foam at 42.</i> | 1 | |
| Supporting data for pH 6: None | 0 | |
| Supporting data for pH 9: None | 0 | |
| Explanatory language: <i>...the least Ph does mean the least foam</i> | 1 | |
| Scientific explanation: None | 0 | |
| Total Attributes & Score Points | 2 | 1 |

Annotated example of a 0-point response for Item 4

4 Write a conclusion for this controlled experiment.

In your conclusion, be sure to:

- Answer the experimental question.
- Include **supporting** data from the Acidity of Potato Juice vs. Volume of Foam table.
- Explain how these data **support** your conclusion.
- Provide a **scientific** explanation for the trend in the data.

| |
|---|
| Question: What is the effect of the acidity of potato juice on the volume of foam produced when hydrogen peroxide is added to potato juice? |
| <i>Acidity of potato juice's effect on foam produced by adding hydrogen peroxide is it how quickly the $2H_2O_2$ converts into oxygen and water. The higher the pH, the less amount of bubbles (which means a slower reaction time). Acidity of 9 was 30 mL.</i> |
| |

| Annotations | Attributes |
|---|------------|
| Conclusive statement: <i>The higher the pH, the less amount of bubbles...</i> Incorrect conclusive statement | 0 |
| Supporting data for pH 6: None | 0 |
| Supporting data for pH 9: Conclusive statement attribute note 2: A response with an incorrect conclusive statement or no conclusive statement may not be credited any attributes. | 0 |
| Explanatory language: None | 0 |
| Scientific explanation: None | 0 |
| Total Attributes & Score Points | 0 0 |