2023 MCAS Sample Student Work and Scoring Guide

High School Biology Question 42: Constructed-Response

Reporting Category: Molecules to Organisms **Practice Category:** Mathematics and Data

Standard: <u>HS.LS.1.5</u> - Use a model to illustrate how photosynthesis uses light energy to transform water and carbon dioxide into oxygen and chemical energy stored in the bonds of sugars and other carbohydrates.

Item Description: Determine that photosynthesis is a process performed only by plants and that cellular respiration is a process performed by both plants and animals; analyze data to determine whether flasks in an experiment contain plants, animals, or both and explain the reasoning.

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					
<u>4A</u>	The response demonstrates a thorough understanding of photosynthesis and cellular respiration. The response correctly identifies the cellular process only the flowering plants perform and also correctly identifies the cellular process that both the flowering					
<u>4B</u>	plants perform and also correctly identifies the cellular process that both the flowering plants and insects perform. The response correctly identifies the contents of each flas and clearly explains the reasoning.					
3	The response demonstrates a general understanding of photosynthesis and cellular respiration.					
<u>2</u>	The response demonstrates a limited understanding of photosynthesis and cellular respiration.					
1	The response demonstrates a minimal understanding of photosynthesis and cellular respiration.					
<u>0</u>	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., 4A and 4B).

Score Point 4A

This question has three parts.

A student is studying how flowering plants and insects affect oxygen (O₂) and carbon dioxide (CO₂) concentrations in the air.

Part A

Identify the cellular process performed **only** by the flowering plants that affects the concentrations of O_2 and CO_2 in the air.



Part B



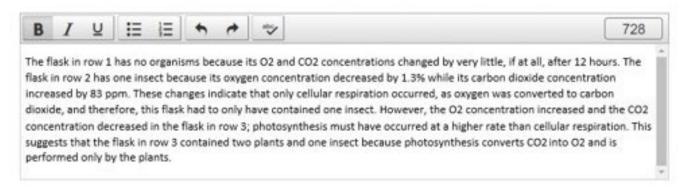
During an experiment, the student measured the initial concentrations of O₂ and CO₂ in three flasks, added organisms to some of the flasks, sealed the flasks, and placed them under a light. After 12 hours, the student measured the concentrations of O₂ and CO₂ in the flasks. The results for each flask are shown in the table.

Row	Flask Contents	Initial O ₂ Concentration (%)	Final O ₂ Concentration (%)	Initial CO ₂ Concentration (ppm)*	Final CO ₂ Concentration (ppm)*
1	?	20.8	20.8	373	375
2	?	20.9	19.6	371	454
3	?	20.7	22.1	374	267

^{*}parts per million

During the experiment, the student had forgotten to identify the contents of each flask. Each of the three flasks contained one of the following: two plants and one insect; one insect; or no organisms.

Identify the contents of **each** flask based on the data in rows 1, 2, and 3. Explain your reasoning using data from the table and the processes you identified in Parts A and B. Include the row numbers in your response.



Back to Scoring Guide

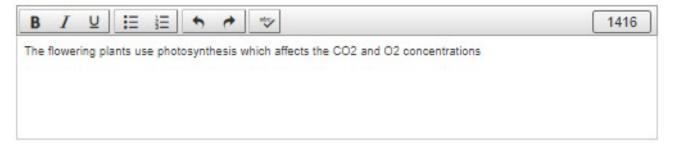
Score Point 4B

This question has three parts.

A student is studying how flowering plants and insects affect oxygen (O₂) and carbon dioxide (CO₂) concentrations in the air.

Part A

Identify the cellular process performed only by the flowering plants that affects the concentrations of O_2 and CO_2 in the air.



Part B



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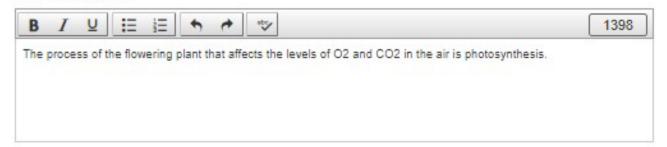
one insect because the oxygen levels decreased but the CO2 levels increased due to cellular respiration. Row 3 had 2 plants and one insect because the O2 levels increased as there was more oxygen being made than used and the CO2 levels decreased due to photosynthesis.

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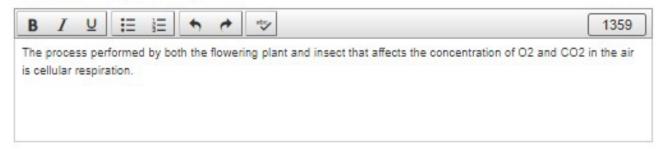
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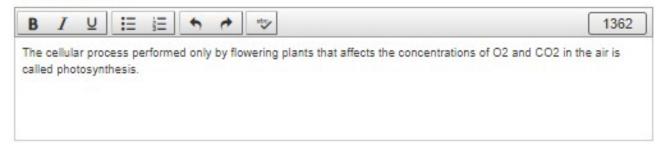
The contents of flask one was no organisms because the oxygen levels did not change at all. The contents of flask two was one insects because the oxygen levels went down and the carbon dioxide levels went up considerably. The contents of flask three was two plants and one insect because the oxygen levels went up slightly and the carbon dioxide levels went down significantly.

This question has three parts.

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Part B



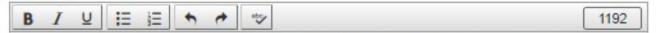
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There were two plants and one insect in each flask. The data table shows that there is oxygen and carbon dioxide being produced. The plants produce the oxygen and the insect produces carbon dioxide. If there was one insect or no organisms in each then there would be little to none carbon dioxide and oxygen.

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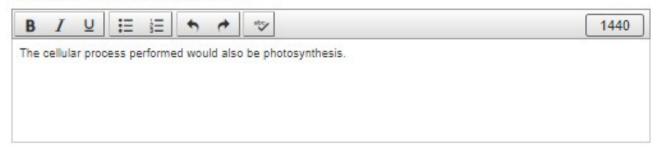
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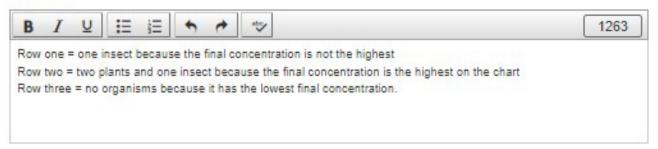
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