2024 MCAS Sample Student Work and Scoring Guide

High School Biology
Question 21: Constructed-Response

Reporting Category: Molecules to Organisms
Practice Category: Mathematics and Data
Standard: HS.LS.1.7 - Use a model to illustrate that aerobic cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new bonds form, resulting in new compounds and a net transfer of energy.
Item Description: Identify the gas consumed and the gas produced during cellular respiration, analyze a graph to determine when organisms are moving and at rest, and analyze another graph to determine whether a prediction is correct and explain the reasoning.

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Scoring Guide

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

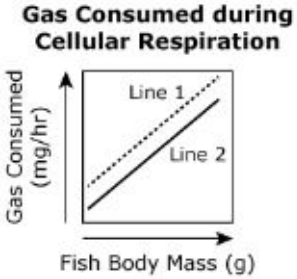
Score*	Description
4A	The response demonstrates a thorough understanding of the reactants, products, and basic purposes of cellular respiration. The response correctly identifies the gas consumed by the fish and the line on the graph that represents the actively swimming fish and clearly explains the reasoning. The response also correctly identifies the gas produced by the fish and correctly determines if the student's prediction is correct and clearly explains the reasoning.
4B	
3	The response demonstrates a general understanding of the reactants, products, and basic purposes of cellular respiration.
2	The response demonstrates a limited understanding of the reactants, products, and basic purposes of cellular respiration.
1	The response demonstrates a minimal understanding of the reactants, products, and basic purposes of cellular respiration.
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., 4A and 4B).

Score Point 4A

This question has four parts.

A scientist measured the cellular respiration rates of zebrafish while at rest and while actively swimming. The incomplete graph shows the data collected by the scientist.



Part A

Identify the gas consumed by the fish, represented by the *y*-axis of the graph.

oxygen

Part B

Identify the line that most likely shows the data from actively swimming zebrafish. Explain your reasoning.

1286

The line that would most likely represent an actively swimming zebrafish is line 1. It is line one because when active the zebrafish needs more oxygen to gain energy back and line 1 shows a higher intake of oxygen.

Part C

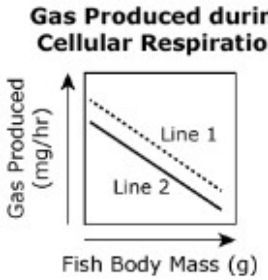
The scientist repeats the experiment, but instead of measuring the gas consumed by the fish, the scientist measures the gas produced by the fish.

Identify the gas that is produced by the fish while at rest and while actively swimming.

carbon dioxide

Part D

A student predicts that a graph showing the gas produced during cellular respiration will look like the graph shown.



Is the student's prediction correct? Explain your reasoning.

1369

The students prediction is incorrect because the bigger the fishes body mass (g) it would produce more CO2 in cellular respiration.

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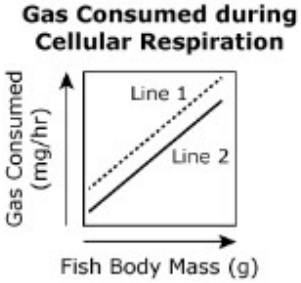
Score Point 4B

This question has four parts.

A scientist measured the cellular respiration rates of zebrafish while at rest and while actively swimming. The incomplete graph shows the data collected by the scientist.



Part A

Identify the gas consumed by the fish, represented by the *y*-axis of the graph.

oxygen

Part B

Identify the line that most likely shows the data from actively swimming zebrafish. Explain your reasoning.

1369

the fish undergo cellular respiration, which uses oxygen. line 1 because the fish needs more oxygen to produce more energy to swim.

Part C

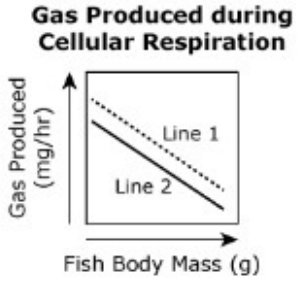
The scientist repeats the experiment, but instead of measuring the gas consumed by the fish, the scientist measures the gas produced by the fish.

Identify the gas that is produced by the fish while at rest and while actively swimming.

carbon dioxide

Part D

A student predicts that a graph showing the gas produced during cellular respiration will look like the graph shown.



Is the student's prediction correct? Explain your reasoning.

1387

No because cellular respiration should be increasing as the fish's mass increases, producing more carbon dioxide.

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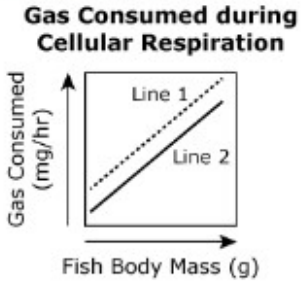
Score Point 3

This question has four parts.

A scientist measured the cellular respiration rates of zebrafish while at rest and while actively swimming. The incomplete graph shows the data collected by the scientist.



Part A

Identify the gas consumed by the fish, represented by the *y*-axis of the graph.

oxygen

Part B

Identify the line that most likely shows the data from actively swimming zebrafish. Explain your reasoning.

1377

Line 1, because the more you move, the more oxygen your tissues need, and Line 1 has more oxygen being consumed than Line 2

Part C

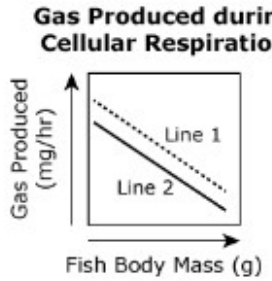
The scientist repeats the experiment, but instead of measuring the gas consumed by the fish, the scientist measures the gas produced by the fish.

Identify the gas that is produced by the fish while at rest and while actively swimming.

carbon dioxide

Part D

A student predicts that a graph showing the gas produced during cellular respiration will look like the graph shown.



Is the student's prediction correct? Explain your reasoning.

1439

Yes, because when you're resting, your body uses less oxygen.

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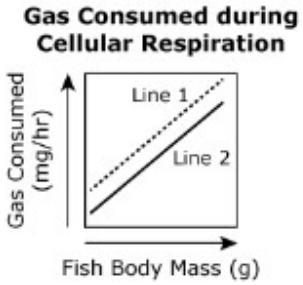
Score Point 2

This question has four parts.

A scientist measured the cellular respiration rates of zebrafish while at rest and while actively swimming. The incomplete graph shows the data collected by the scientist.



Part A

Identify the gas consumed by the fish, represented by the *y*-axis of the graph.

oxygen

Part B

Identify the line that most likely shows the data from actively swimming zebrafish. Explain your reasoning.

1344

The line that represents the active swimming zebrafish is the solid line because it is closer to zero and lines usually don't start two inches up the graph.

Part C

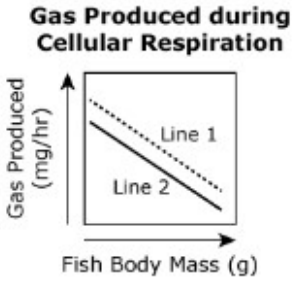
The scientist repeats the experiment, but instead of measuring the gas consumed by the fish, the scientist measures the gas produced by the fish.

Identify the gas that is produced by the fish while at rest and while actively swimming.

carbon dioxide

Part D

A student predicts that a graph showing the gas produced during cellular respiration will look like the graph shown.



Is the student's prediction correct? Explain your reasoning.

1385

Yes the student is right because breathing out the gas would make the graph go down and the way the fish swims too.

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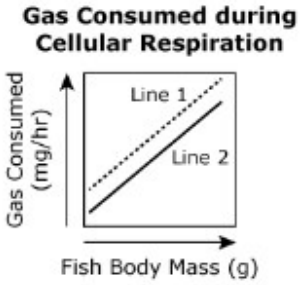
Score Point 1

This question has four parts.

A scientist measured the cellular respiration rates of zebrafish while at rest and while actively swimming. The incomplete graph shows the data collected by the scientist.



Part A

Identify the gas consumed by the fish, represented by the *y*-axis of the graph.

oxygen

Part B

Identify the line that most likely shows the data from actively swimming zebrafish. Explain your reasoning.

1416

The line that most likely shows the data from actively swimming zebrafish is line 1.

Part C

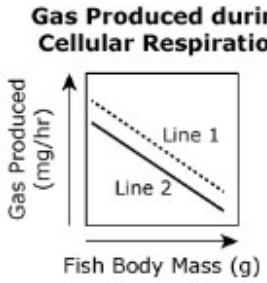
The scientist repeats the experiment, but instead of measuring the gas consumed by the fish, the scientist measures the gas produced by the fish.

Identify the gas that is produced by the fish while at rest and while actively swimming.

oxygen

Part D

A student predicts that a graph showing the gas produced during cellular respiration will look like the graph shown.



Is the student's prediction correct? Explain your reasoning.

1459

Yes, the student's prediction is correct.

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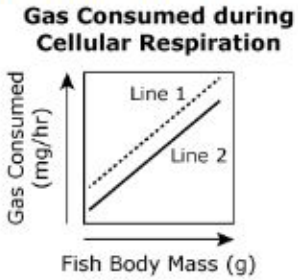
Score Point 0

This question has four parts.

A scientist measured the cellular respiration rates of zebrafish while at rest and while actively swimming. The incomplete graph shows the data collected by the scientist.



Part A

Identify the gas consumed by the fish, represented by the *y*-axis of the graph.

carbon dixode

Part B

Identify the line that most likely shows the data from actively swimming zebrafish. Explain your reasoning.

1396

The line that most likely shows the data from actively swimming zebrafish is line 1 because it increase.

Part C

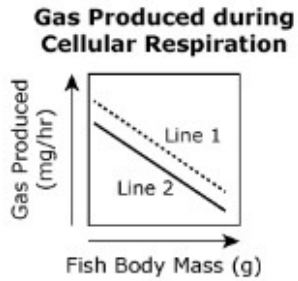
The scientist repeats the experiment, but instead of measuring the gas consumed by the fish, the scientist measures the gas produced by the fish.

Identify the gas that is produced by the fish while at rest and while actively swimming.

nuclear gas

Part D

A student predicts that a graph showing the gas produced during cellular respiration will look like the graph shown.



Is the student's prediction correct? Explain your reasoning.

1405

The student's prediction is correct because it is the same graph at the top but different ways.

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