

2025 MCAS Sample Student Work and Scoring Guide

High School Biology

Question 37: Constructed-Response

Reporting Category: Molecules to Organisms

Practice Category: Evidence, Reasoning, and Modeling

Standard: [HS.LS.1.2](#) - Develop and use a model to illustrate the key functions of animal body systems, including (a) food digestion, nutrient uptake, and transport through the body; (b) exchange of oxygen and carbon dioxide; (c) removal of wastes; and (d) regulation of body processes.

Item Description: Describe what would most likely happen to an organism with a mutation that affects the esophagus, describe how an organism's blood would be affected by mutations in the small intestine and liver, and explain the reasoning for each description.

This item can be found in the released item sets on the [MCAS Resource Center](#).

Scoring Guide

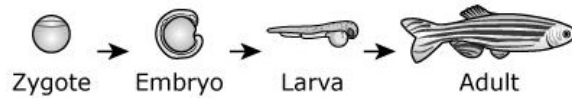
Select a score point in the table below to view the sample student response.

Score*	Description
3A	The response demonstrates a thorough understanding of the key functions of animal body systems. The response clearly describes what would most likely happen to a zebrafish with mutation Y and clearly explains the reasoning. The response also clearly describes one way the blood of a zebrafish with mutation W and one way the blood of a zebrafish with mutation Z would be different than the blood of a zebrafish without the mutations and clearly explains the reasoning.
3B	
2	The response demonstrates a partial understanding of the key functions of animal body systems.
1	The response demonstrates a minimal understanding of the key functions of animal body systems.
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

Zebrafish are small freshwater fish that are often used in scientific research. Zebrafish develop from a zygote into an adult in only three months. A model of zebrafish development is shown.

**Digestive System Research**

A group of scientists identified some mutations that affect how the organs of the digestive system develop in zebrafish larvae. The table describes four mutations, W, X, Y, and Z, in zebrafish.

Mutation	Effect on Digestive System Development
W	small intestine wall is thin and lacks villi
X	pancreas does not develop
Y	<u>esophagus</u> does not fully develop
Z	liver does not fully develop

Respiratory System Research

Another group of scientists studied how exercise affects the respiratory system of zebrafish. Gas exchange between the bloodstream and the environment occurs in the gills of zebrafish.

The scientists randomly assigned zebrafish into either an experimental group or a control group. The average masses of the fish were the same in each group at the beginning of the experiment. The fish in the experimental group were placed in a tank with flowing water for several hours each day. When the water was flowing, the fish swam faster. The fish in the control group swam in a tank without flowing water.

After several weeks, the scientists measured the body masses and gill sizes of the zebrafish. They also measured the amounts of oxygen (O₂) the zebrafish took in. The data for each group are shown in the table.

Variable Measured	Control Group	Experimental Group
average body mass	0.39 g	0.44 g
average gill size	0.49 mm ³	0.55 mm ³
average amount of oxygen taken in	0.79 mg/L	1.03 mg/L

This question has three parts.

The mutations described in the digestive system research table result in the abnormal development of digestive organs.

Part A

Describe what would most likely happen to a zebrafish with mutation **Y**. Explain your reasoning.

A zebrafish with mutation Y would likely die of starvation. If the esophagus cannot function properly, the zebrafish's food would not be able to travel from the oral cavity to the stomach where digestion primarily happens. This means that the zebrafish, as it cannot properly digest, would not receive the nutrients it needs to survive and would have very little sources of glucose for cellular respiration to make ATP, which would eventually cause its death.

Part B

The blood of zebrafish with the mutations is different than the blood of zebrafish without the mutations.

Describe one way the blood of a zebrafish with mutation **W** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

The blood of a zebrafish with mutation W would likely lack the nutrients and vitamins the zebrafish needs to stay healthy. If the small intestine's wall is thin and lacks villi, it cannot transport nutrients from food to the bloodstream as efficiently as its surface area has decreased. Therefore, this zebrafish's blood would not have as many nutrients and vitamins as a healthy zebrafish.

Part C

Describe one way the blood of a zebrafish with mutation **Z** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

The blood of a zebrafish with mutation Z would likely be higher in toxins than the blood of a zebrafish without the mutation. If the liver is not fully developed, then it cannot detoxify the blood as efficiently. Therefore, this zebrafish's blood would have a higher concentration of toxins than a healthy zebrafish as the liver will not be as successful at detoxification.

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

The mutations described in the digestive system research table result in the abnormal development of digestive organs.

Part A

Describe what would most likely happen to a zebrafish with mutation **Y**. Explain your reasoning.

A zebrafish with mutation **Y** would most likely have a smaller esophagus, and therefore would have a harder time consuming food. This could also lead to problems like not being able to swallow food, or simply making eating a chunk of food much harder to swallow. This is definitely a genetic disadvantage, and would most likely die out.

Part B

The blood of zebrafish with the mutations is different than the blood of zebrafish without the mutations.

Describe one way the blood of a zebrafish with mutation **W** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

As the small intestine is the organ responsible for gathering the most nutrients, if the villi did not exist, the nutrients would not be gathered and diffused into the bloodstream. This means the blood of a zebrafish with mutation **W** would lack the proper nutrients it needed to gather from the small intestine.

Part C

Describe one way the blood of a zebrafish with mutation **Z** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

The blood of zebrafish with mutation **Z** would be more toxic, as the liver is designed to filter out toxic compounds from the blood. If the liver is not fully developed, you would most likely see more toxicity in the bloodstream of a zebrafish with mutation **Z**.

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

The mutations described in the digestive system research table result in the abnormal development of digestive organs.

Part A

Describe what would most likely happen to a zebrafish with mutation **Y**. Explain your reasoning.

A zebrafish with mutation y would most likely not be able to eat and would die in the early stages of its life. The esophagus is needed to transport food from the mouth to the stomach for digestion. Without this, the organism wouldn't be able to eat.

Part B

The blood of zebrafish with the mutations is different than the blood of zebrafish without the mutations.

Describe one way the blood of a zebrafish with mutation **W** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

The blood of the zebrafish with mutation W would have less villi, therefor different blood.

Part C

Describe one way the blood of a zebrafish with mutation **Z** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

The liver is used to filter toxins. Without it, the zebrafish's blood would be contaminated with toxins.

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Score Point 1

This question has three parts.

The mutations described in the digestive system research table result in the abnormal development of digestive organs.

Part A

Describe what would most likely happen to a zebrafish with mutation **Y**. Explain your reasoning.

The zebrafish wouldnt be able to breath properly .

Part B

The blood of zebrafish with the mutations is different than the blood of zebrafish without the mutations.

Describe one way the blood of a zebrafish with mutation **W** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

since the small intestine wall is thin and lacks villi the blood isnt as healthy.

Part C

Describe one way the blood of a zebrafish with mutation **Z** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

since the liverisnt fully developed it cant clean the toxic stuff out the blood properly making the zebrafish's blood more toxic than it normally would be.

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Score Point 0**This question has three parts.**

The mutations described in the digestive system research table result in the abnormal development of digestive organs.

Part A

Describe what would most likely happen to a zebrafish with mutation **Y**. Explain your reasoning.

A zebrafish with mutation Y will not get enough energy and might die of a disease easier than the other zebrafish in the population.

Part B

The blood of zebrafish with the mutations is different than the blood of zebrafish without the mutations.

Describe one way the blood of a zebrafish with mutation **W** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

The blood of a zebrafish with mutation W will be different in the DNA which we could see in the genome but the blood of a zebrafish without the mutation will look normal in the genome.

Part C

Describe one way the blood of a zebrafish with mutation **Z** would most likely be different from the blood of a zebrafish without the mutation. Explain your reasoning.

A zebrafish with mutation Z will be more likely to get a disease or die off in general with the genome looking unusual while a zebrafish without this mutation is more likely to live a full life and its genome looks relatively normal.

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