2025 MCAS Sample Student Work and Scoring Guide

High School Biology
Question 21: Constructed-Response

Reporting Category: Heredity
Practice Category: Mathematics and Data
Standard: HS.LS.3.3 - Apply concepts of probability to represent possible genotype and phenotype combinations in offspring caused by different types of Mendelian inheritance patterns.
Item Description: Identify genotypes of a phenotype, complete a Punnett square of a given cross, determine the percentage of offspring with the phenotype, and explain why the frequency of alleles for the phenotype would be more or less common in a certain environment.

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
4A	The response demonstrates a thorough understanding of genotypes and phenotypes for a dominant-recessive inheritance pattern. The response correctly identifies genotypes for lizards light in color. The response correctly completes a Punnett square for a cross between a lizard light in color and a lizard dark in color and correctly identifies the expected percentage of offspring light in color. The response also correctly identifies whether the allele for light color in lizards is expected to be more common in areas with dark or light soil and clearly explains the answer using knowledge of natural selection.
4B	
3	The response demonstrates a general understanding of genotypes and phenotypes for a dominant-recessive inheritance pattern.
2	The response demonstrates a limited understanding of genotypes and phenotypes for a dominant-recessive inheritance pattern.
1	The response demonstrates a minimal understanding of genotypes and phenotypes for a dominant-recessive inheritance pattern.
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 three parts.

Fence lizards can be light or dark in color. The color of fence lizards is determined by a single gene with two alleles. The allele for light color (**R**) is dominant to the allele for dark color (**r**).

Part A

Identify the **two** possible genotypes for fence lizards that are light in color.

genotype 1: Rr

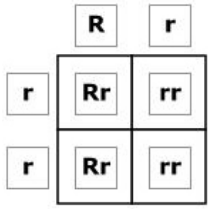
genotype 2: RR

Part B

A fence lizard that is heterozygous for light color is crossed with a fence lizard that is dark in color.

Drag and drop an allele or allele pair into each box to complete the Punnett square for this cross. Each allele or allele pair may be used once, more than once, or not at all.

R r RR Rr rr



Identify the percentage of the offspring from this cross that are expected to be light in color.

50 %

Part C

Owls and hawks eat fence lizards.

Identify whether the allele for light color in fence lizards is expected to be more common in areas with dark soil or in areas with light soil. Explain your answer using your knowledge of natural selection.

The allele for light color fence lizards will be in areas with light soil because they can blend into their envornment which makes them more likely to survive, reproduce, and pass down the trait of light color.

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Score Point 4B

This question has three parts.

Fence lizards can be light or dark in color. The color of fence lizards is determined by a single gene with two alleles. The allele for light color (**R**) is dominant to the allele for dark color (**r**).

Part A

Identify the **two** possible genotypes for fence lizards that are light in color.

genotype 1: RR

genotype 2: Rr

Part B

A fence lizard that is heterozygous for light color is crossed with a fence lizard that is dark in color.

Drag and drop an allele or allele pair into each box to complete the Punnett square for this cross. Each allele or allele pair may be used once, more than once, or not at all.

R r RR Rr rr

	R	r
r	Rr	rr
r	Rr	rr

Identify the percentage of the offspring from this cross that are expected to be light in color.

50 %

Part C

Owls and hawks eat fence lizards.

Identify whether the allele for light color in fence lizards is expected to be more common in areas with dark soil or in areas with light soil. Explain your answer using your knowledge of natural selection.

The allele for light color fence lizards is going to be more common in light soil. This is due to the lizards being able to blend into the surroundings better and not be eatten. Then all the light lizards that survive will be able to pass down that allele.

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Score Point 3

This question has three parts.

Fence lizards can be light or dark in color. The color of fence lizards is determined by a single gene with two alleles. The allele for light color (**R**) is dominant to the allele for dark color (**r**).

Part A

Identify the **two** possible genotypes for fence lizards that are light in color.

genotype 1: RR

genotype 2: Rr

Part B

A fence lizard that is heterozygous for light color is crossed with a fence lizard that is dark in color.

Drag and drop an allele or allele pair into each box to complete the Punnett square for this cross. Each allele or allele pair may be used once, more than once, or not at all.

R r RR Rr rr

	R	r
r	Rr	rr
r	Rr	rr

Identify the percentage of the offspring from this cross that are expected to be light in color.

50 %

Part C

Owls and hawks eat fence lizards.

Identify whether the allele for light color in fence lizards is expected to be more common in areas with dark soil or in areas with light soil. Explain your answer using your knowledge of natural selection.

It is expected to be more common in area with light soil because they would blend in with the enviroment a lot better than dark soil. They want to blend in to the enviroment so that they are not found very easily by pretadors like the owls and hawks.

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Score Point 2

This question has three parts.

Fence lizards can be light or dark in color. The color of fence lizards is determined by a single gene with two alleles. The allele for light color (**R**) is dominant to the allele for dark color (**r**).

Part A

Identify the **two** possible genotypes for fence lizards that are light in color.

genotype 1: RR

genotype 2: Rr

Part B

A fence lizard that is heterozygous for light color is crossed with a fence lizard that is dark in color.

Drag and drop an allele or allele pair into each box to complete the Punnett square for this cross. Each allele or allele pair may be used once, more than once, or not at all.

R r RR Rr rr

	R	r
R	RR	Rr
R	RR	Rr

Identify the percentage of the offspring from this cross that are expected to be light in color.

75 %

Part C

Owls and hawks eat fence lizards.

Identify whether the allele for light color in fence lizards is expected to be more common in areas with dark soil or in areas with light soil. Explain your answer using your knowledge of natural selection.

The allele for light color in fence lizards is expected to be more common in areas with light soil because that gaves them more camoflauge. If they were to go to an area with dark soil they would be spotted and then be killed. If they are in a place with light soil and they are light color fence lizards they have more oppurtunity of survival.

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Score Point 1

This question has three parts.

Fence lizards can be light or dark in color. The color of fence lizards is determined by a single gene with two alleles. The allele for light color (**R**) is dominant to the allele for dark color (**r**).

Part A

Identify the **two** possible genotypes for fence lizards that are light in color.

genotype 1: Rr

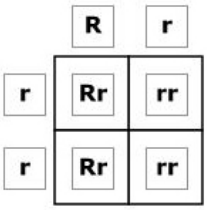
genotype 2: rr

Part B

A fence lizard that is heterozygous for light color is crossed with a fence lizard that is dark in color.

Drag and drop an allele or allele pair into each box to complete the Punnett square for this cross. Each allele or allele pair may be used once, more than once, or not at all.

R r RR Rr rr



Identify the percentage of the offspring from this cross that are expected to be light in color.

50% %

Part C

Owls and hawks eat fence lizards.

Identify whether the allele for light color in fence lizards is expected to be more common in areas with dark soil or in areas with light soil. Explain your answer using your knowledge of natural selection.

one parent is heterozygous but the other is only dark meaning ressesive so it would be 50% becuase one parent has no dominant trait

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Score Point 0

This question has three parts.

Fence lizards can be light or dark in color. The color of fence lizards is determined by a single gene with two alleles. The allele for light color (**R**) is dominant to the allele for dark color (**r**).

Part A

Identify the **two** possible genotypes for fence lizards that are light in color.

genotype 1: rr

genotype 2: Rr

Part B

A fence lizard that is heterozygous for light color is crossed with a fence lizard that is dark in color.

Drag and drop an allele or allele pair into each box to complete the Punnett square for this cross. Each allele or allele pair may be used once, more than once, or not at all.

R r RR Rr rr

	R	r
R	RR	Rr
r	Rr	rr

Identify the percentage of the offspring from this cross that are expected to be light in color.

50 %

Part C

Owls and hawks eat fence lizards.

Identify whether the allele for light color in fence lizards is expected to be more common in areas with dark soil or in areas with light soil. Explain your answer using your knowledge of natural selection.

i would say light color is more common

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