2023 MCAS Sample Student Work and Scoring Guide

High School Biology
Question 21: Constructed-Response

Reporting Category: Evolution
Practice Category: Evidence, Reasoning, and Modeling
Standard: HS.LS.4.2 - Construct an explanation based on evidence that Darwin's theory of evolution by natural selection occurs in a population when the following conditions are met: (a) more offspring are produced than can be supported by the environment, (b) there is heritable variation among individuals, and (c) some of these variations lead to differential fitness among individuals as some individuals are better able to compete for limited resources than others.
Item Description: Determine a genotype for a trait based on an inheritance pattern, describe the expected allele frequencies in a population, and explain how changes in allele frequencies can be a result of natural selection.

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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 inheritance patterns. The response correctly identifies the genotype of a chicken with a pea comb, clearly describes the expected frequencies of the alleles in a chicken population that lives in a cold climate, and clearly explains how these frequencies would be produced as a result of natural selection.
4B	
3	The response demonstrates a general understanding of inheritance patterns.
2	The response demonstrates a limited understanding of inheritance patterns.
1	The response demonstrates a minimal understanding of inheritance patterns.
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.

The comb on the top of a chicken's head may be full size, intermediate size, or small size. The small-size comb is called a pea comb. A chicken with a pea comb is shown.

Part A

The allele for a full-size comb (H) and the allele for the pea comb (h) show incomplete dominance.

Using allele symbols, identify the genotype of a chicken with a pea comb.

hh

Part B

Chickens with pea combs have an advantage in cold climates because the pea comb reduces the amount of heat loss the chicken experiences.

Describe how the frequencies of the H allele and the h allele are expected to compare in a wild chicken population that lives in a cold climate.

1313

In a cold climate where having a pea comb on a chicken would be benificial then that would become the more frequent allele due to natural selection. The "h" allele would be more present.

Part C

Explain how the allele frequencies you described in Part B could be produced as a result of natural selection.

1036

The "h" allele would be more present in the population because having the "h" allele, or the pea comb, give that chicken a higher fitness. Having a higher fitness means you have a higher chance to survive and reproduce. If the chicken can reproduce then it can pass on it's "h" allele, and if more chicken with the "h" allele are reproducing and more chickens with the "H" allele are dying and not reproducing then there will be more chicken having the "h" allele.

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Score Point 4B

This question has three parts.

The comb on the top of a chicken's head may be full size, intermediate size, or small size. The small-size comb is called a pea comb. A chicken with a pea comb is shown.

Part A

The allele for a full-size comb (H) and the allele for the pea comb (h) show incomplete dominance.

Using allele symbols, identify the genotype of a chicken with a pea comb.

hh

Part B

Chickens with pea combs have an advantage in cold climates because the pea comb reduces the amount of heat loss the chicken experiences.

Describe how the frequencies of the H allele and the h allele are expected to compare in a wild chicken population that lives in a cold climate.

1351

Most likely, the h allele will become more frequent in the chicken population because chickens with pea combs have an advantage in cold enviornments.

Part C

Explain how the allele frequencies you described in Part B could be produced as a result of natural selection.

1180

Since the chickens with pea combs have an advantage over chickens with full size combs, the chickens with pea combs are more likely to survive long enough to reproduce and send their genes onto the next generation. This process is called natural selection, and the end result would be a higher frequency of the h allele.

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Score Point 3

This question has three parts.

The comb on the top of a chicken's head may be full size, intermediate size, or small size. The small-size comb is called a pea comb. A chicken with a pea comb is shown.

Part A

The allele for a full-size comb (H) and the allele for the pea comb (h) show incomplete dominance.

Using allele symbols, identify the genotype of a chicken with a pea comb.

hh

Part B

Chickens with pea combs have an advantage in cold climates because the pea comb reduces the amount of heat loss the chicken experiences.

Describe how the frequencies of the H allele and the h allele are expected to compare in a wild chicken population that lives in a cold climate.

1380

The h allele would have a greater frequency than the H allele in a wild chicken population that lives in a cold climate.

Part C

Explain how the allele frequencies you described in Part B could be produced as a result of natural selection.

1107

The frequency of h would be greater than the frequency of H because h, the allele for the pea comb, is the most favorable in cold climates. Pea combs (hh) reduces the most heat loss compared to the intermediate-sized comb (Hh) and the full-sized comb (HH). Those chickens with the h allele would be better suited to the cold enviroment and survive compared to those chickens with the H allele.

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Score Point 2

This question has three parts.

The comb on the top of a chicken's head may be full size, intermediate size, or small size. The small-size comb is called a pea comb. A chicken with a pea comb is shown.

Part A

The allele for a full-size comb (H) and the allele for the pea comb (h) show incomplete dominance.

Using allele symbols, identify the genotype of a chicken with a pea comb.

hh

Part B

Chickens with pea combs have an advantage in cold climates because the pea comb reduces the amount of heat loss the chicken experiences.

Describe how the frequencies of the H allele and the h allele are expected to compare in a wild chicken population that lives in a cold climate.

1344

In a cold climate the frequency of the h allele would be much higher than the H allele, because the h allele gives off less heat & keeps the chicken warmer

Part C

Explain how the allele frequencies you described in Part B could be produced as a result of natural selection.

1279

The frequency of the allele h being more could be produced as a result from natural selection because it keeps the bird warmer and uses less energy, so over time the h allele became more popular through natural selection

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Score Point 1

This question has three parts.

The comb on the top of a chicken's head may be full size, intermediate size, or small size. The small-size comb is called a pea comb. A chicken with a pea comb is shown.

Part A

The allele for a full-size comb (H) and the allele for the pea comb (h) show incomplete dominance.

Using allele symbols, identify the genotype of a chicken with a pea comb.

hh

Part B

Chickens with pea combs have an advantage in cold climates because the pea comb reduces the amount of heat loss the chicken experiences.

Describe how the frequencies of the H allele and the h allele are expected to compare in a wild chicken population that lives in a cold climate.

1404

In a cold climate wild chickens will have a pea comb. this helps reduce the amount of heat loss.

Part C

Explain how the allele frequencies you described in Part B could be produced as a result of natural selection.

1309

The chickens in a cold climate would have pea combs because it helps them reduce the amount of heat loss. This is natural selection because the chickens know their pea comb will protect them.

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Score Point 0

This question has three parts.

The comb on the top of a chicken's head may be full size, intermediate size, or small size. The small-size comb is called a pea comb. A chicken with a pea comb is shown.

Part A

The allele for a full-size comb (H) and the allele for the pea comb (h) show incomplete dominance.

Using allele symbols, identify the genotype of a chicken with a pea comb.

Hh, hh

Part B

Chickens with pea combs have an advantage in cold climates because the pea comb reduces the amount of heat loss the chicken experiences.

Describe how the frequencies of the H allele and the h allele are expected to compare in a wild chicken population that lives in a cold climate.

1410

The chickens without pea combs will decrease because they will get cold. get sick and die.

Part C

Explain how the allele frequencies you described in Part B could be produced as a result of natural selection.

1444

It's because the population will change in the chickens.

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