

2025 MCAS Sample Student Work and Scoring Guide

High School Biology

Question 20: Constructed-Response

Reporting Category: Evolution

Practice Category: Mathematics and Data

Standard: [HS.LS.4.5](#) - Evaluate models that demonstrate how changes in an environment may result in the evolution of a population of a given species, the emergence of new species over generations, or the extinction of other species due to the processes of genetic drift, gene flow, mutation, and natural selection.

Item Description: Identify environmental factors that could result in differences in plant height, describe evidence from an investigation to show if genetics plays a role in plant height, identify the process that causes adaptations, and describe an investigation to determine if two populations are the same species.

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 how natural selection can result in changes in biodiversity within a population. The response correctly identifies two environmental factors that vary by location on a mountain and could result in yarrow plants having different heights. The response correctly determines whether genetics play a role in determining the height of yarrow plants in a garden and clearly describes evidence from an investigation to support the answer. The response correctly identifies the process that resulted in yarrow plants adapting to different elevations and clearly describes an investigation scientists can perform to determine whether two populations of yarrow plants are the same species.
4B	
3	The response demonstrates a general understanding of how natural selection can result in changes in biodiversity within a population.
2	The response demonstrates a limited understanding of how natural selection can result in changes in biodiversity within a population.
1	The response demonstrates a minimal understanding of how natural selection can result in changes in biodiversity within a population.
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.

Yarrow plants are flowering plants that grow in the Sierra Nevada Mountains in California. The average height of the yarrow plant decreases as the elevation increases.

Part A

Identify **two** environmental factors that vary by location on a mountain and could result in yarrow plants having different heights.

↶ ↷ B I U ☰ ☷ ☹ ☺ ☻ ☼ ☽ ☿

Temperature and nutrient availability (soil/water) could result in the hinderance of growth for the Yarrow plants.

Maximum number of characters: 1500 || Characters remaining: 1401

Part B

Scientists conducted an investigation to determine if the height of yarrow plants is genetically determined. The scientists collected five sets of seeds from yarrow plant populations living at different elevations and planted the seeds in a garden at an elevation of 100 m. The plants received the same amount of water and sunlight. After several weeks, the scientists measured the plants and calculated the average height of the plants in each set. The data are shown in the table.

Seed Set	Elevation Where Seeds Were Collected (m)	Average Height of Plants in Garden (cm)
1	1,100	80
2	1,800	55
3	2,200	40
4	2,700	25
5	3,200	20

Does genetics play a role in determining the height of the yarrow plants in the garden? Describe evidence from the investigation to support your answer.

↶ ↷ B I U ☰ ☷ ☹ ☺ ☻ ☼ ☽ ☿

Yes, according to the data, it does seem that genetics do play a role in Yarrow plant height. As the elevation of the seeds gathered grew bigger; the average height in centimeters for the plants grew shorter. For example, seed set 1 was collected at the elevation 1,100 meters, and set set 5 was collected at the elevation of 3,200 meters. Both were planted at the same time, with the same elevation, and with the same amount of water and sunlight. The hypothesis here is that both plants will grow at the same rate. But weeks later, both plants have varying heights. Seed set 1 with 80cm and seed set 5 with 20cm. Therefore, Yarrow plant height is influenced by genetics.

Maximum number of characters: 1500 || Characters remaining: 948

Part C

Identify the process that resulted in yarrow plant populations adapting to different elevations.

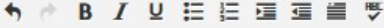


The process that resulted in yarrow plant populations adapting different heights is natural selection.

Maximum number of characters: 1500 || Characters remaining: 1411

Part D

Describe an investigation scientists can perform to determine whether two populations of yarrow plants growing at different elevations are the same species.



If two populations of yarrow plants are a species, then they should be able to produce fertile offspring with each other, because different species can not produce fertile offspring together.

Maximum number of characters: 1500 || Characters remaining: 1339

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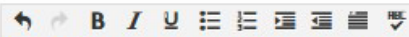
Score Point 4B

This question has four parts.

Yarrow plants are flowering plants that grow in the Sierra Nevada Mountains in California. The average height of the yarrow plant decreases as the elevation increases.

Part A

Identify **two** environmental factors that vary by location on a mountain and could result in yarrow plants having different heights.



Two factors that vary by location on a mountain and could cause differen heights of yarrow plants are average rainfall and hours of sunlight received in a location.


Maximum number of characters: 1500 || Characters remaining: 1363

Part B

Scientists conducted an investigation to determine if the height of yarrow plants is genetically determined. The scientists collected five sets of seeds from yarrow plant populations living at different elevations and planted the seeds in a garden at an elevation of 100 m. The plants received the same amount of water and sunlight. After several weeks, the scientists measured the plants and calculated the average height of the plants in each set. The data are shown in the table.

Seed Set	Elevation Where Seeds Were Collected (m)	Average Height of Plants in Garden (cm)
1	1,100	80
2	1,800	55
3	2,200	40
4	2,700	25
5	3,200	20

Does genetics play a role in determining the height of the yarrow plants in the garden? Describe evidence from the investigation to support your answer.

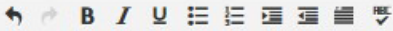


Yes, genetics does play a role becuaese all the seed sets in the investigation were planted at the same elevation, and still showed height differences. This shows that each seed was genetically adapted for its respective elevation.

Maximum number of characters: 1500 || Characters remaining: 1306

Part C

Identify the process that resulted in yarrow plant populations adapting to different elevations.




The process that caused yarrow plants to adapt to different elevations is natural selection.

Maximum number of characters: 1500 || Characters remaining: 1421

Part D

Describe an investigation scientists can perform to determine whether two populations of yarrow plants growing at different elevations are the same species.



To see if two populations of yarrow plants are the same species, scientists could pollenate one plant from one population with a plant from the other population and see if they create fertile offspring together.

Maximum number of characters: 1500 || Characters remaining: 1323

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Score Point 3

This question has four parts.

Yarrow plants are flowering plants that grow in the Sierra Nevada Mountains in California. The average height of the yarrow plant decreases as the elevation increases.

Part A

Identify **two** environmental factors that vary by location on a mountain and could result in yarrow plants having different heights.



Two environmental factors that vary by location on a mountain that could change the heights of the plant could be precipitation and the amount of sun light there is.


Maximum number of characters: 1500 || Characters remaining: 1363

Part B

Scientists conducted an investigation to determine if the height of yarrow plants is genetically determined. The scientists collected five sets of seeds from yarrow plant populations living at different elevations and planted the seeds in a garden at an elevation of 100 m. The plants received the same amount of water and sunlight. After several weeks, the scientists measured the plants and calculated the average height of the plants in each set. The data are shown in the table.

Seed Set	Elevation Where Seeds Were Collected (m)	Average Height of Plants in Garden (cm)
1	1,100	80
2	1,800	55
3	2,200	40
4	2,700	25
5	3,200	20

Does genetics play a role in determining the height of the yarrow plants in the garden? Describe evidence from the investigation to support your answer.



No, genetics does not play a role in the height of the yarrow plants because the data proves that the height decreases as elevation increases.

Maximum number of characters: 1500 || Characters remaining: 1382

Part C

Identify the process that resulted in yarrow plant populations adapting to different elevations.

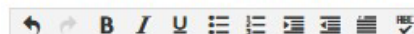


Natural selection is the process where plants adapt to diffeerent environments.

Maximum number of characters: 1500 || Characters remaining: 1431

Part D

Describe an investigation scientists can perform to determine whether two populations of yarrow plants growing at different elevations are the same species.



Scientists can compare DNA sequences between yarrow plants at different elevation. If they are similar, then they are the same species.

Maximum number of characters: 1500 || Characters remaining: 1385

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Score Point 2

This question has four parts.

Yarrow plants are flowering plants that grow in the Sierra Nevada Mountains in California. The average height of the yarrow plant decreases as the elevation increases.

Part A

Identify **two** environmental factors that vary by location on a mountain and could result in yarrow plants having different heights.



The amount of water it recieves and the amount of sunlight it recieves.

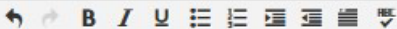
Maximum number of characters: 1500 || Characters remaining: 1441

Part B

Scientists conducted an investigation to determine if the height of yarrow plants is genetically determined. The scientists collected five sets of seeds from yarrow plant populations living at different elevations and planted the seeds in a garden at an elevation of 100 m. The plants received the same amount of water and sunlight. After several weeks, the scientists measured the plants and calculated the average height of the plants in each set. The data are shown in the table.

Seed Set	Elevation Where Seeds Were Collected (m)	Average Height of Plants in Garden (cm)
1	1,100	80
2	1,800	55
3	2,200	40
4	2,700	25
5	3,200	20

Does genetics play a role in determining the height of the yarrow plants in the garden? Describe evidence from the investigation to support your answer.




No genetics does not play a role in determining the height of the yarrow plants. I say this because if it was genetics they would all be the same size, not different.

Maximum number of characters: 1500 || Characters remaining: 1365

Part C

Identify the process that resulted in yarrow plant populations adapting to different elevations.



Natural selection

Maximum number of characters: 1500 || Characters remaining: 1484

Part D

Describe an investigation scientists can perform to determine whether two populations of yarrow plants growing at different elevations are the same species.



Put them in the same area and monitor how they grow.

Maximum number of characters: 1500 || Characters remaining: 1458

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Score Point 1

This question has four parts.

Yarrow plants are flowering plants that grow in the Sierra Nevada Mountains in California. The average height of the yarrow plant decreases as the elevation increases.

Part A

Identify **two** environmental factors that vary by location on a mountain and could result in yarrow plants having different heights.

 sunlight
water (rain)

Part B

Scientists conducted an investigation to determine if the height of yarrow plants is genetically determined. The scientists collected five sets of seeds from yarrow plant populations living at different elevations and planted the seeds in a garden at an elevation of 100 m. The plants received the same amount of water and sunlight. After several weeks, the scientists measured the plants and calculated the average height of the plants in each set. The data are shown in the table.


Seed Set	Elevation Where Seeds Were Collected (m)	Average Height of Plants in Garden (cm)
1	1,100	80
2	1,800	55
3	2,200	40
4	2,700	25
5	3,200	20

Does genetics play a role in determining the height of the yarrow plants in the garden? Describe evidence from the investigation to support your answer.

No. The only things that were used to determine the height was a set of seed elevation.

Part C

Identify the process that resulted in yarrow plant populations adapting to different elevations.

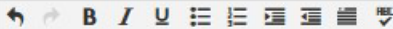


adaptation. Was placed in different elevations.

Maximum number of characters: 1500 || Characters remaining: 1458

Part D

Describe an investigation scientists can perform to determine whether two populations of yarrow plants growing at different elevations are the same species.



Scientist can check if they both grow the same in the same environment.

Maximum number of characters: 1500 || Characters remaining: 1441

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Score Point 0

This question has four parts.

Yarrow plants are flowering plants that grow in the Sierra Nevada Mountains in California. The average height of the yarrow plant decreases as the elevation increases.

Part A

Identify **two** environmental factors that vary by location on a mountain and could result in yarrow plants having different heights.

yarrow plants would increase because, it's flowering other plants that grows in the Sierra Nevada Mountains in California. Also the yarrow plant is still the average height because, it stays the same.

Part B

Scientists conducted an investigation to determine if the height of yarrow plants is genetically determined. The scientists collected five sets of seeds from yarrow plant populations living at different elevations and planted the seeds in a garden at an elevation of 100 m. The plants received the same amount of water and sunlight. After several weeks, the scientists measured the plants and calculated the average height of the plants in each set. The data are shown in the table.

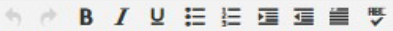
Seed Set	Elevation Where Seeds Were Collected (m)	Average Height of Plants in Garden (cm)
1	1,100	80
2	1,800	55
3	2,200	40
4	2,700	25
5	3,200	20

Does genetics play a role in determining the height of the yarrow plants in the garden? Describe evidence from the investigation to support your answer.

No because, the scientist isn't giving you the answer or the specific numbers to use, they are just showing you where the seeds were collected, and the height of plants in the Garden.

Part C

Identify the process that resulted in yarrow plant populations adapting to different elevations.

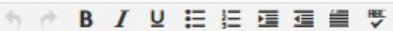


The yarrow plants all have all kinds of different heights. you have the biggest which is 80, then you have the smallest 20.

Maximum number of characters: 1500 || Characters remaining: 1399

Part D

Describe an investigation scientists can perform to determine whether two populations of yarrow plants growing at different elevations are the same species.



If their growing at different elevations the cannot be the same.

Maximum number of characters: 1500 || Characters remaining: 1446

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