LOUISIANA DEPARTMENT OF EDUCATION

Office of Assessments, Analytics, and Accountability

LEAP Released Item Guide for Biology

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Purpose

The LEAP released item guide is intended to be used as an instructional tool and not to predict performance on the summative test. These items are meant to help teachers better understand how the achievement level descriptors are used in creating assessment items.

How to Use and Not Use

The recommendations and cautions that follow are meant to help teachers better understand the achievement level descriptors and help administrators better understand what should and should not be done with the released items.

How to Use

- Learn how achievement level descriptors work with the dimensions in an item;
- Provide guidance when selecting assessment items in terms of rigor, content, and item types

How Not to Use

- Avoid prioritizing the PEs used in the released items because they do not represent all of the content eligible for the operational test;
- Avoid limiting instructional strategies to the released items (creating instructional sets using only the PEs found in the document);
- Do not use only the stimulus materials provided in the released items for classroom instruction;
- Avoid creating assessment items that mirror the released items;
- Avoid designing instructional tasks and sets based on only one PE.

Assessment Design

Supporting Science Instruction

The LEAP tests will assess students' understanding of the LSS for Science, reflecting the multiple dimensions of the standards.

Apply content knowledge and skills (Disciplinary Core Idea, DCI)

On the LEAP test, students answer questions which require content knowledge and skills aligned to PE bundles (groupings of PEs) and the corresponding DCIs.

Investigate, evaluate, and reason scientifically (Science and Engineering Practice, SEP)

On the LEAP test, students do more than answer recall questions about science; they apply the practices, or behaviors, of scientists and engineers to investigate each real-world phenomenon and design solutions to problems.

Connect ideas across disciplines (Crosscutting Concept, CCC)

On the LEAP test, sets of questions assess student application of knowledge across the domains of science for a comprehensive picture of student readiness for their next grade or course in science.

Set Based Design

The biology tests include item sets, task sets, and standalone items.

Item Sets

Item sets consist of four items that have a common stimulus. There are two one-point items and two two-point items in each item set on the LEAP test. For three of the item sets, one of the two-point items will be a Constructed Response item. In the released item sets, there may be more than four items or fewer than four items with a common stimulus.

Task Sets

Task sets consist of five items that have a common stimulus. There are two one-point items, two two-point items, and one nine-point Extended Response item. In the released task sets, there may be more than five items or fewer than five items with a common stimulus.

Standalone Items

Standalone items are one-point or two-point items that do not share a stimulus with other items.

Achievement-Level Definitions

Achievement-level definitions briefly describe the expectations for student performance at each of Louisiana's five achievement levels:

- Advanced: Students performing at this level have **exceeded** college and career readiness expectations and are well prepared for the next level of study in this content area.
- Mastery: Students performing at this level have **met** college and career readiness expectations and are prepared for the next level of study in this content area.
- Basic: Students performing at this level have **nearly met** college and career readiness expectations and may need additional support to be fully prepared for the next level of study in this content area.
- Approaching Basic: Students performing at this level have **partially met** college and career readiness expectations and will need much support to be prepared for the next level of study in this content area.
- Unsatisfactory: Students performing at this level have **not yet met** the college and career readiness expectations and will need extensive support to be prepared for the next level of study in this content area.

Achievement Level Descriptors

Achievement Level Descriptors (ALDs) indicate what a typical student at each level should be able to demonstrate based on his or her command of grade-level standards. ALDs are written for the three assessment reporting categories. Access the ALDs on the Assessment Resources Webpage for a breakdown of the knowledge, skills, and practices associated with each achievement level.

Released Items

This section includes released test items. With each item, item set, and task set, is a table containing alignment information and the answer key, where possible. Additionally, analyses of the multi-dimensional alignment, achievement level descriptor, rationales for answers, and rubrics for CRs and ERs are included with the items. An asterisk (*) denotes correct answer(s).

The achievement level descriptor provides information about how students who answer the item correctly are performing.

For example, an item is aligned to the SEP and DCI for HS-LS2-7:

Performance Expectation	Level 5: Advanced	Level 4: Mastery	Level 3: Basic	Level 2: Approaching Basic
HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. CCC: S/C SEP: 6	Evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	Design a solution for reducing the impacts of human activities on the environment and biodiversity.	Compare solutions for reducing the impacts of human activities on the environment and biodiversity.	Identify solutions for reducing the impacts of human activities on the environment and biodiversity.

Identifies the performance level of students who answer the question correctly.

Achievement Level Descriptor: Students who answer this item correctly are performing at a level of 3 or higher. The student can compare solutions for human activities on the environment and biodiversity.

In some countries, human developments have been built in animals' migration patterns or habitats. In Costa Rica, where monkeys are native, monkeys use electrical wires to navigate through towns, and they are sometimes electrocuted in the process.

Which suggestion is the **best** possible solution to this problem?

D. Insulate power lines and cover transformers.*

Identifies how the item aligns to the dimensions.

Items Released:
Standalone Items
Item Set: The Galapagos Islands
Item Set: Viruses Attack
Item Set: Ebola Virus
Task Set: Migration of Pink Salmon

Standalone Items

Item Type	PE	DCI	SEP	CCC	Points	Achievement Level
MC	HS-LS2-7	HS.ETS1B.a	6. E/S		1	3
TEI	HS-LS3-3	HS.LS3B.a	4. DATA	SPQ	1	3
MS	HS-LS4-4	HS.LS4B.a	6. E/S	C/E	1	3

SEP = blue; DCI = orange; CCC = green An asterisk (*) denotes correct answer(s).

Multiple Choice
Performance Expectation
HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Use the information and your knowledge of science to answer the question.

In some countries, human developments have been built in animals' migration patterns or habitats. In Costa Rica, where monkeys are native, monkeys use electrical wires to navigate through towns, and they are sometimes electrocuted in the process.

Which suggestion is the **best** possible solution to this problem?

A. Remove monkeys and place them back into their native habitat.
B. Remove all of the power lines and place them underground.
C. Build special roads and paths for the monkeys to use.
D. Insulate power lines and cover transformers.*

Multi-Dimensional Alignment: While effectively applying the science practice of designing, evaluating, and refining a solution, the student demonstrates knowledge of human activities on the environment and biodiversity.

Achievement Level Descriptor: Students who answer this item correctly are performing at a level of 3 or higher. The student can compare solutions for human activities on the environment and biodiversity.

In some countries, human developments have been built in animals' migration patterns or habitats. In Costa Rica, where monkeys are native, monkeys use electrical wires to navigate through towns, and they are sometimes electrocuted in the process.

Which suggestion is the **best** possible solution to this problem?

D. Insulate power lines and cover transformers.*

Rationales
A. Monkeys are in their native habitat.
B. impacts to humans and habitat
C. something monkeys may not use
D. Correct.

Technology-Enhanced Item
Performance Expectation
HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Use the information and your knowledge of science to answer the question.

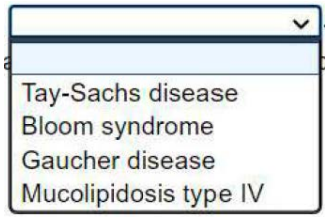
Couples often get tested for several genetic diseases before having children. This helps to reduce the chances that offspring will inherit a disease. Information about some common autosomal recessive inheritable diseases in a specific ethnic group is shown in the table.

Condition	Disease Incidence	Carrier Frequency	Carrier Detection Rate
Tay-Sachs disease	$\frac{1}{3,000}$	$\frac{1}{30}$	98%
Cystic Fibrosis	$\frac{1}{3,000}$	$\frac{1}{29}$	97%
Bloom syndrome	$\frac{1}{40,000}$	$\frac{1}{100}$	97%
Gaucher disease	$\frac{1}{900}$	$\frac{1}{15}$	95%
Mucolipidosis type IV	$\frac{1}{62,500}$	$\frac{1}{27}$	95%
Glycogen Storage 1a	$\frac{1}{20,000}$	$\frac{1}{71}$	99%

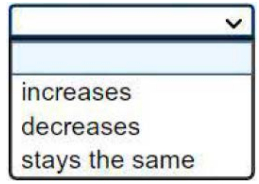
Source: UCSF Health.

Select the best answer from each drop-down menu to complete the sentences.

The disease with the greatest number of carriers is



The risk that an offspring will inherit a disease



as the carrier frequency increases for a disease.

Multi-Dimensional Alignment: The item requires the student to apply the science practice of applying concepts of statistics and probability, and knowledge that sexual reproduction results in genetic variation to demonstrate an understanding of scale, proportion, and quantity.

Achievement Level Descriptor Alignment: Students who answer this item correctly are performing at an achievement level of 3 or higher. The student can apply concepts of statistics and probability to explain patterns related to the distribution of expressed traits in a population.

Scoring

The disease with the greatest number of carriers is [Gaucher disease ▾]. The risk that an offspring will inherit a disease [increases ▾] as the carrier frequency increases for a disease.

Rationales

Response	Rationale
The disease with the greatest number of carriers is **Gaucher disease**. The risk that an offspring will inherit a disease **increases** as the carrier frequency increases for a disease.	Correct.
The disease with the greatest number of carriers is **Tay-Sachs disease**. The risk that an offspring will inherit a disease **increases** as the carrier frequency increases for a disease.	Tay-Sachs has the highest carrier detection rate, which would decrease the risk of inheritance.
The disease with the greatest number of carriers is **Gaucher disease**. The risk that an offspring will inherit a disease **decreases** as the carrier frequency increases for a disease.	The more carriers there are for a disease, the higher the risk of offspring inheriting the disease.
The disease with the greatest number of carriers is **Bloom syndrome**. The risk that an offspring will inherit a disease **increases** as the carrier frequency increases for a disease.	Bloom syndrome has a lower carrier frequency, which would decrease the risk of inheritance.

Multiple Select
Performance Expectation
HS-LS4-4 Construct an explanation based on evidence for how natural selection and other mechanisms lead to genetic changes in populations.

Use the information and your knowledge of science to answer the question. The rainy season in California lasts from winter to early spring, and the typical summer conditions are dry and sunny. Flowering earlier allows a field mustard plant to produce seeds during the rainy season, giving its seeds a better chance of surviving. Scientists studied field mustard plants in California before and after a drought. They noticed that the seeds from plants collected in 2004 (post-drought) flowered earlier, while field mustard plants grown from seeds collected in 1997 (pre-drought) flowered later. Researchers also found genetic differences between the ancestors and descendants of two separate populations of field mustard.	Which factors **most likely** caused the differences observed in seed production over time? Select the **two** correct answers. A. Plants that survived the drought produced seeds that could withstand any drought conditions. B. Plants that produced seeds earlier were more likely to flower in the rainy season and therefore reproduce, passing on this genetic advantage.* C. Plants with later flowering seeds missed the rainy season and did not reproduce as often.** D. Plants that went through the drought were weakened and did not produce healthy seeds. E. Plants that flowered earlier had to withstand drought conditions longer, whereas plants that flowered later did not have to withstand drought conditions as long.

Multi-Dimensional Alignment: The item requires the student to apply the science and engineering practice of constructing an explanation based on evidence, and knowledge of: how natural selection and other mechanisms lead to genetic changes in populations to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at a level of 3 or higher. The student can compare explanations based on evidence for how natural selection leads to genetic changes in populations.

Which factors most likely caused the differences observed in seed production over time?

B. Plants that produced seeds earlier were more likely to flower in the rainy season and therefore reproduce, passing on this genetic advantage.*

C. Plants with later flowering seeds missed the rainy season and did not reproduce as often.**

Rationales

A. Seeds produced during a drought may not survive all drought conditions.
B. Correct.
C. Correct.
D. Drought does not weaken seeds or produce seeds.
E. Plants are flowering earlier after the drought.

Item Set: The Galapagos Islands

Item Type	PE	DCI	SEP	CCC	Points	Achievement Level
TPD	HS-LS4-5	HS.LS3A.b	7 ARG	C/E	2	4
TPD	HS-LS4-5	HS.LS1A.c	7 ARG	C/E	2	3
MC	HS-LS4-5	HS.LS3A.a	7 ARG	C/E	1	3
MC	HS-LS4-5	HS.LS1A.c	7 ARG	C/E	1	5
MC	HS-LS4-3	HS.LS3B.a		PAT	1	2
TEI	HS-LS4-5	HS.LS3B.a		C/E	2	4

SEP = blue; DCI = orange; CCC = green An asterisk (*) denotes correct answer(s).

Use the information about the Galápagos Islands and your knowledge of science to answer the questions.

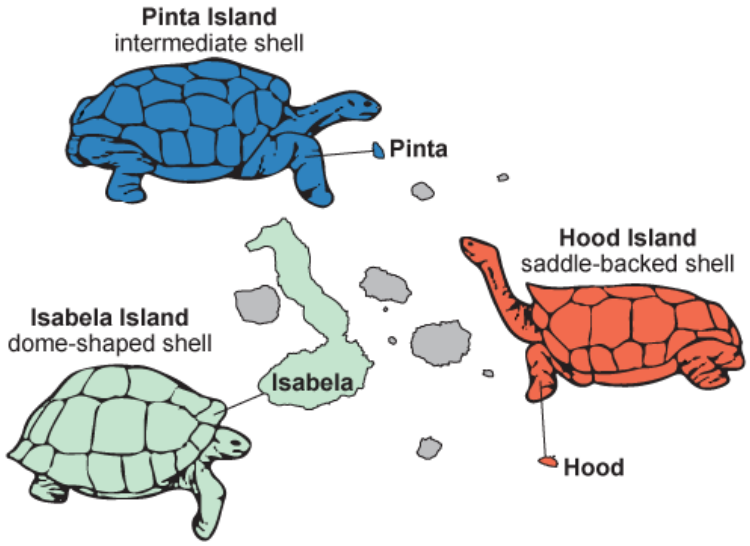
The Galápagos Islands

The Galápagos Islands are found off the coast of South America at the equator. The climate of each island varies, depending on location and elevation. Islands that are lower in elevation tend to be much drier than those that are higher in elevation. Dry areas are covered with plants, such as cacti, that have adapted to desert-like conditions. The higher, wetter areas are covered with lush vegetation that grows lower to the ground. The Galápagos Islands are home to many unique animal species, but two of the most studied are Darwin's finches — a type of small bird — and the Galápagos tortoises.

There are about 10 species of giant tortoises found in the Galápagos Islands, but only seven islands have tortoises. All Galápagos tortoises eat a plant-based diet. They have slow metabolisms that allow them to survive for up to a year or more without food or water. Most Galápagos tortoises have lifespans longer than 100 years. Galápagos tortoises are slow to reach sexual maturity.

Tortoise shell shape is often attributed to feeding habits. The flatter shells of the saddle-backed tortoises allow tortoises to stretch their necks to eat plants that grow higher off the ground. The tortoises with rounder, dome-shaped shells eat plants that grow closer to the ground. Figure 1 shows the types of tortoises found on different islands.

Figure 1. Giant Tortoises of the Galápagos Islands



Source: Savvas Learning Company LLC.

Similar to tortoises' shell shapes, the beak shapes of finches are also related to feeding habits. Finches with larger, stronger beaks eat seeds with thicker protective coatings. Finches with smaller beaks eat thinner, smaller seeds. Finches with longer, thinner beaks eat cactus flowers and insects.

Scientists were conducting a study on an island in the late 1970s when a significant drought occurred. Figure 2 shows the results the scientists observed on the size and hardness of seeds on the island as a result of the drought from 1976 to 1978. Figure 3 shows the observed trend in beak shape among finches on the island during the same time period.

Figure 2. Size and Hardness of Seeds

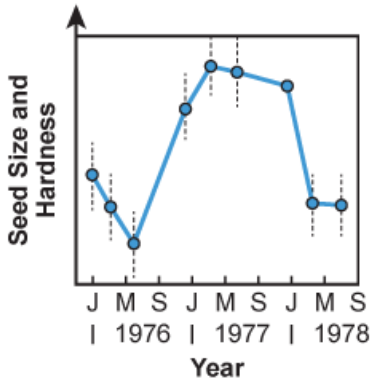
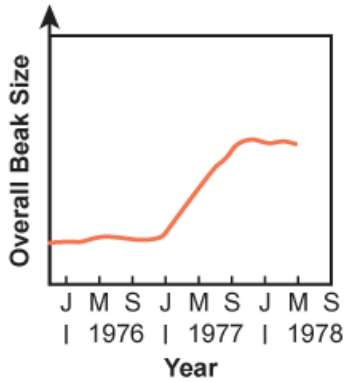


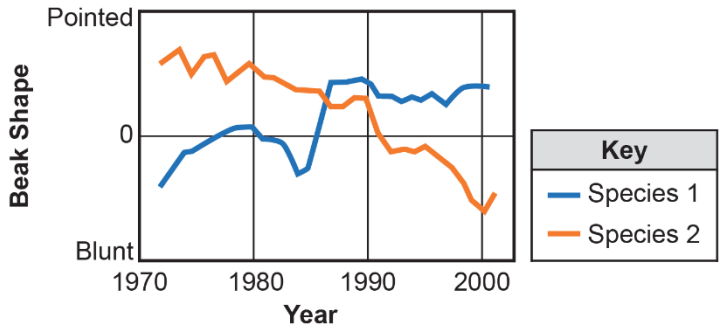
Figure 3. Large-Beaked Birds over Time



Source: Princeton University Press.

In another study, scientists observed how the beak shapes of two different species of finch changed on an island over time. Graph 1 shows the results.

Graph 1. Beak Shape over Time for Two Species of Galápagos Finches



Source: from Grant et al., Science, 2002. Reprinted with permission from AAAS.

In 1981, scientists witnessed the emergence of a new subspecies of finch when a different species of finch immigrated from a neighboring island. The immigrated finch was quite large, had an extra-wide beak, and had an unusual song compared to the existing finches on the island. The immigrated finch bred successfully with a local female finch.

Male finches attract mates through song. Males learn their songs as juveniles in the nest, so the hybrid male offspring had the same song as their male parents. This likely affected which females were willing to mate with them. In addition, female finches tend to choose mates with beak sizes similar to their own, so the extra-wide beaks of the new lineage may have encouraged mating among the individuals in the new subspecies.

Two-Part Dependent
Performance Expectation
HS-LS4-5 Evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Part A	Part B
Which claim is supported by the information about Galápagos tortoises? A. Both saddle-backed and dome-shaped tortoises are best suited for islands with humid, lush climates. B. Saddle-backed tortoises are best suited for islands with dry, arid climates, whereas dome-shaped tortoises are best suited for islands with humid climates.* C. Dome-shaped tortoises are best suited to islands with dry, arid climates, whereas saddle-backed tortoises are best suited for islands with humid climates. D. Dome-shaped tortoises are better suited to both islands with dry, arid climates and islands with more humid climates than saddle-backed tortoises.	Which statements are evidence to support the answer to Part A? Select **all** that apply. A. Cacti and other plants that grow high above ground are found in dry, arid climates.* B. Lush and low-lying vegetation grows in areas with high elevation and humid climates.* C. Dome-shaped tortoises are able to reach higher than saddle-backed tortoises because of the shape of their shells. D. Saddle-backed tortoises are able to reach higher than dome-shaped tortoises because of the shape of their shells.* E. Taller plants grow in areas with high elevation and humid climates. F. Low-lying vegetation grows mainly in areas with low elevation.

Multi-dimensional Alignment: The item requires the student to apply the science and engineering practices of evaluating evidence supporting claims and knowledge of changes in environmental conditions to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 4 or higher. The student can evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing increases in the number of individuals of some species.

Part A
Which claim is supported by the information about Galápagos tortoises?

B. Saddle-backed tortoises are best suited for islands with dry, arid climates, whereas dome-shaped tortoises are best suited for islands with humid climates.*

Part B
Which statements are evidence to support the answer to Part A?

Select **all** that apply.

A. Cacti and other plants that grow high above ground are found in dry, arid climates.*

B. Lush and low-lying vegetation grows in areas with high elevation and humid climates.*

D. Saddle-backed tortoises are able to reach higher than dome-shaped tortoises because of the shape of their shells.*

Rationales

Part A

A. The shell shape would be more similar if they were both suited for islands with humid, lush climates.
B. Correct.
C. Dome-shaped tortoises eat food that is closer to the ground than saddle-backed tortoises.
D. Dome-shaped tortoises are only found on one island.

Part B

A. Correct.
B. Correct.
C. Dome-shaped tortoises are only able to reach lower down.
D. Correct.
E. Plants in wetter areas are lower to the ground.
F. Plants in low elevation areas can be higher from the ground.

Two-Part Dependent
Performance Expectation
HS-LS4-5 Evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Part A	Part B
Which claim about how a change in climate could affect finch populations is **best** supported by the information provided about Galápagos finches? A. A significantly wetter climate would increase the number of thinner-beaked finches on higher-elevation islands. B. A significantly wetter climate would increase the number of blunt-beaked finches on lower-elevation islands. C. A significantly drier climate would increase the number of large-beaked finches on higher-elevation islands.* D. A significantly drier climate would increase the number of small-beaked finches on higher-elevation islands.	Which statements provide evidence to support the answer to Part A? Select **all** that apply. A. Drier climates cause insect populations to increase. B. Wetter climates cause more cacti to grow in all elevations. C. Smaller beaks are better suited to eat thicker seeds. D. Wetter climates cause more plants to grow in lower elevations. E. Drier climates cause the number of small seeds to decrease.* F. Larger beaks are better suited to eat tougher seeds.

Multi-dimensional Alignment: The item requires the student to apply the science and engineering practices of evaluating evidence supporting claims and knowledge of changes in environmental conditions to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 4 or higher. The student can evaluate evidence supporting claims that changes in environmental conditions can affect the number of traits in a population causing increases in the number of individuals of some species.

Part A
Which claim about how a change in climate could affect finch populations is **best** supported by the information provided about Galápagos finches?

C. A significantly drier climate would increase the number of large-beaked finches on higher-elevation islands.*

Part B
Which statements provide evidence to support the answer to Part A?

E. Drier climates cause the number of small seeds to decrease.*

F. Larger beaks are better suited to eat tougher seeds.*

Rationales

Part A

A. Thin beaks provide a disadvantage to birds.
B. Blunt beaks were not found on the islands.
C. Correct.
D. The number of small-beaked finches would decrease in a drier climate.

Part B

A. Drier climates decrease insect populations.
B. Cacti grow in dry climates.
C. Smaller beaks are better for eating thinner seeds.
D. Wetter climates cause more plant growth in all elevations.
E. Correct.
F. Correct.

Multiple Choice
Performance Expectation
HS-LS4-5 Evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Which claim is supported by the results in Figures 2 and 3?

A. The decrease in seed size and hardness in late 1977 caused finches with larger beaks to outcompete finches with smaller beaks in 1978.
B. The increase in seed size caused finches with larger beaks to survive and reproduce better during the drought than finches with smaller beaks.*
C. There is no relationship between beak size and seed size, since smaller seeds were more common in 1978 but beak size was larger in 1977.
D. There is a direct relationship between the increase in seed size and the increase in beak size, since they increase and decrease at the same time.

Multi-Dimensional Alignment: The item requires the student to apply the science and engineering practices of evaluating evidence supporting claims and knowledge of changes in environmental conditions to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can compare evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing increases in the number of individuals of some species.

Which claim is supported by the results in Figures 2 and 3?

B. The increase in seed size caused finches with larger beaks to survive and reproduce better during the drought than finches with smaller beaks.*

Rationales

A. A decrease in seed size and hardness would improve the ability of finches with smaller beaks to compete for food.
B. Correct.
C. Beak size determines the size of seed a bird can eat.
D. The increase in beak size occurs over time, while the availability of seeds of different sizes changes.

Multiple Choice
Performance Expectation
HS-LS4-5 Evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

A student read the information about the emergence of the new subspecies observed by scientists in 1981. The student made the claim that speciation only occurs when the right combination of behavioral, physical, and genetic conditions is present, and when the species is geographically isolated.

Which argument best explains whether or not the student's claim is correct?

A. The claim is correct because the immigrant finch became geographically isolated from its main population on a different island.
B. The claim is correct because the immigrant finch and the local finches had the same physical and behavioral characteristics.
C. The claim is incorrect because the environmental conditions did not remain constant when the new subspecies first appeared.
D. The claim is incorrect because the new subspecies was not geographically isolated from the native species.*

Multi-Dimensional Alignment: The item requires the student to apply the science and engineering practices of evaluating evidence supporting claims and knowledge of changes in environmental conditions to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 4 or higher. The student can evaluate evidence supporting claims that changes in environmental conditions can affect the number of traits in a population causing increases in the number of individuals of some species.

A student read the information about the emergence of the new subspecies observed by scientists in 1981. The student made the claim that speciation only occurs when the right combination of behavioral, physical, and genetic conditions is present, and when the species is geographically isolated.

Which argument best explains whether or not the student's claim is correct?

D. The claim is incorrect because the new subspecies was not geographically isolated from the native species.*

Rationales
A. The immigrant finch was able to breed with finches on the island.
B. The immigrant finch had a different song compared to the finches on the island.
C. The environmental conditions change each year.
D. Correct.

Multiple Choice
Performance Expectation
HS-LS4-3 Apply concepts of statistics and probability to support explanations that populations of organisms adapt when an advantageous heritable trait increases in proportion to organisms lacking this trait.

Scientists continued to study changes in beak shape after the data in Figures 2 and 3 were recorded.

Which statement **best** explains why scientists continued to study the changes in beak shape past 1978?

A. Scientists needed to look for patterns within data that could be used to understand what causes beak shape to change.*
B. Scientists needed to understand how regular drought can lead to the extinction of a species.
C. Scientists needed to find patterns in data that explained why droughts occur on the island.
D. Scientists needed to understand why the finches stayed on the island during periods of significant drought.

Multi-Dimensional Alignment: The item requires the student to apply knowledge that populations of organisms adapt when an advantageous heritable trait increases in proportion to organisms lacking this trait to demonstrate an understanding of patterns.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 2 or higher. The student can interpret patterns related to populations of organisms adapting when an advantageous heritable trait increases in proportion to organisms lacking this trait.

Scientists continued to study changes in beak shape after the data in Figures 2 and 3 were recorded.

Which statement **best** explains why scientists continued to study the changes in beak shape past 1978?

A. Scientists needed to look for patterns within data that could be used to understand what causes beak shape to change.*

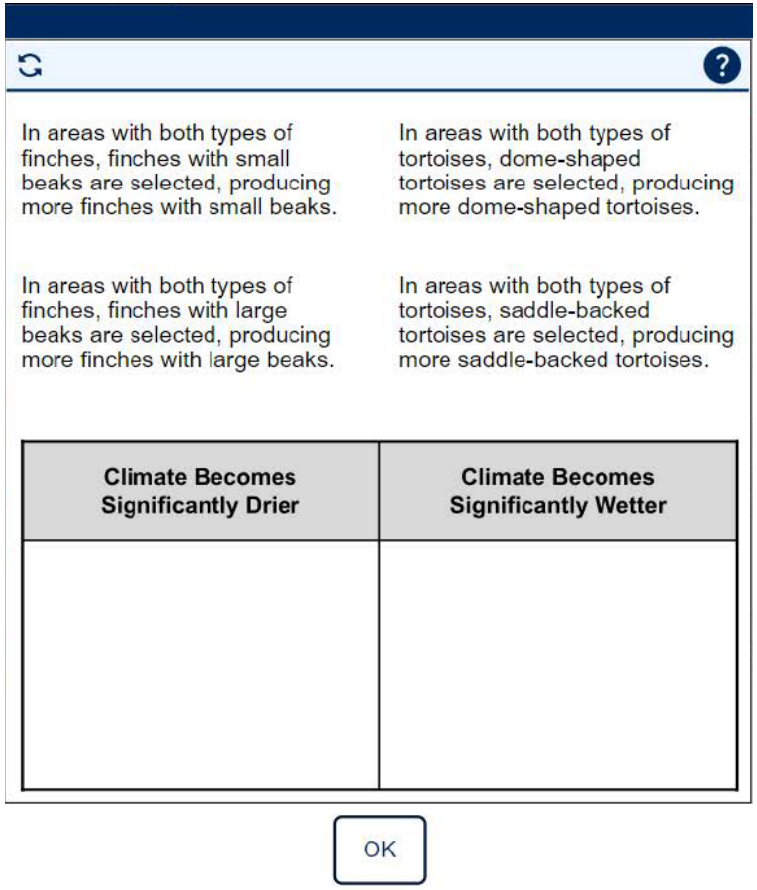
Rationales

A. Correct.
B. Scientists found that drought leads to changes in characteristics of a species.
C. Scientists collect weather data to study the causes of droughts.
D. Finches were not able to leave the islands easily.

Technology Enhanced Item
Performance Expectation
HS-LS4-5 Evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Selective pressures have different effects on different populations of Galápagos tortoises and finches.

Drag **each** statement into the correct box to identify its cause.



Multi-Dimensional Alignment: The item requires the student to apply knowledge of changes in environmental conditions to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 4 or higher. The student can evaluate evidence supporting claims that changes in environmental conditions can affect the distribution of traits in a population causing increases in the number of individuals of some species and the extinction of other species.

Scoring

Selective pressures have different effects on different populations of Galápagos tortoises and finches.

Drag **each** statement into the correct box to identify its cause.

Climate Becomes Significantly Drier	Climate Becomes Significantly Wetter
In areas with both types of finches, finches with large beaks are selected, producing more finches with large beaks. In areas with both types of tortoises, saddle-backed tortoises are selected, producing more saddle-backed tortoises.	In areas with both types of finches, finches with small beaks are selected, producing more finches with small beaks. In areas with both types of tortoises, dome-shaped tortoises are selected, producing more dome-shaped tortoises.

OK

Rationales

Response		Rationale
Climate Becomes Significantly Drier	Climate Becomes Significantly Wetter	
• In areas with both types of finches, finches with large beaks are selected, producing more finches with large beaks. • In areas with both types of tortoises, saddle-backed tortoises are selected, producing more saddle-backed tortoises.	• In areas with both types of finches, finches with small beaks are selected, producing more finches with small beaks. • In areas with both types of tortoises, dome-shaped tortoises are selected, producing more dome shaped tortoises.	Correct.
• In areas with both types of finches, finches with large beaks are selected, producing more finches with large beaks. • In areas with both types of tortoises, dome-shaped tortoises are selected, producing more dome shaped tortoises.	• In areas with both types of finches, finches with small beaks are selected, producing more finches with small beaks. • In areas with both types of tortoises, saddle-backed tortoises are selected, producing more saddle-backed tortoises.	Dome-shaped tortoises will be selected in wetter areas and saddle-backed tortoises will be selected in drier areas.
• In areas with both types of finches, finches with small beaks are selected, producing more finches with small beaks. • In areas with both types of tortoises, saddle-backed tortoises are selected, producing more saddle-backed tortoises.	• In areas with both types of finches, finches with large beaks are selected, producing more finches with large beaks. • In areas with both types of tortoises, dome-shaped tortoises are selected, producing more dome shaped tortoises.	Finches with small beaks will be selected in wetter areas and finches with large beaks will be selected in drier areas.
• In areas with both types of finches, finches with large beaks are selected, producing more finches with large beaks. • In areas with both types of finches, finches with small beaks are selected, producing more finches with small beaks.	• In areas with both types of tortoises, saddle-backed tortoises are selected, producing more saddle-backed tortoises. • In areas with both types of tortoises, dome-shaped tortoises are selected, producing more dome shaped tortoises.	Some finches and some tortoises are selected in wetter areas and other finches and tortoises are selected in drier areas.

Item Set: Viruses Attack

Item Type	PE	DCI	SEP	CCC	Points	Achievement Level
TPI	HS-LS1-4	HS.LS1B.a		SYS	2	3
TEI	HS-LS1-4	HS.LS1B.c		SYS	2	4
TPD	HS-LS1-8	HS.LS1E.b	8. INFO		2	5
TEI	HS-LS1-8	HS.LS1E.b	8. INFO	SPQ	2	3

SEP = blue; DCI = orange; CCC = green An asterisk (*) denotes correct answer(s).

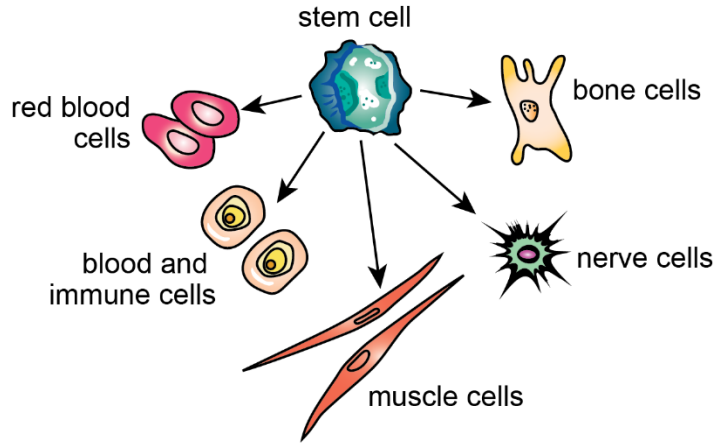
Use the information about viruses and your knowledge of science to answer the questions.

Viruses Attack

Many human diseases, such as chicken pox and influenza, are caused by viruses that attack the body. Cells in the body are often damaged or destroyed during a viral attack. These cells must be replaced for the body to function normally.

Figure 1 shows how stem cells can differentiate into different types of cells.

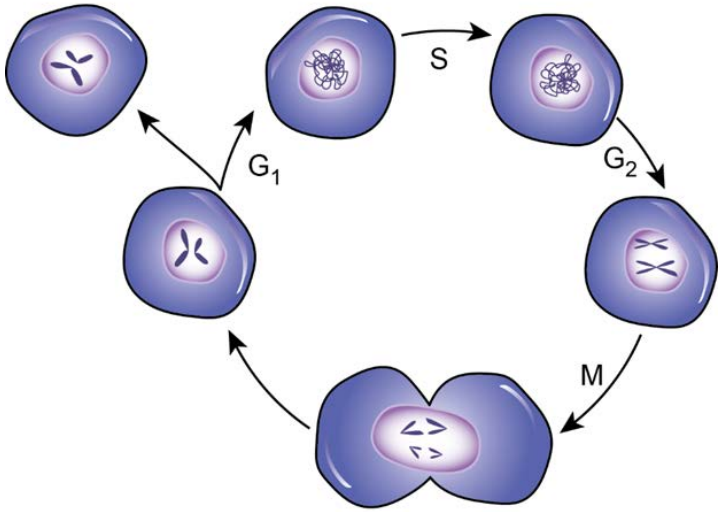
Figure 1. Cell Differentiation



Source: BioCat.

Figure 2 shows the cell cycle that allows the body to repair itself after a viral attack.

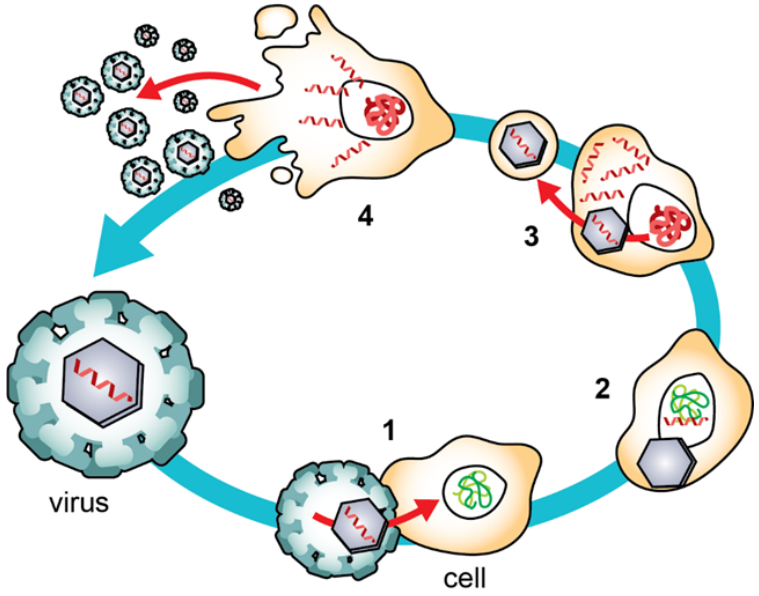
Figure 2. Cell Cycle



Source: Nature Education.

Figure 3 shows the process that occurs when viruses attack cells.

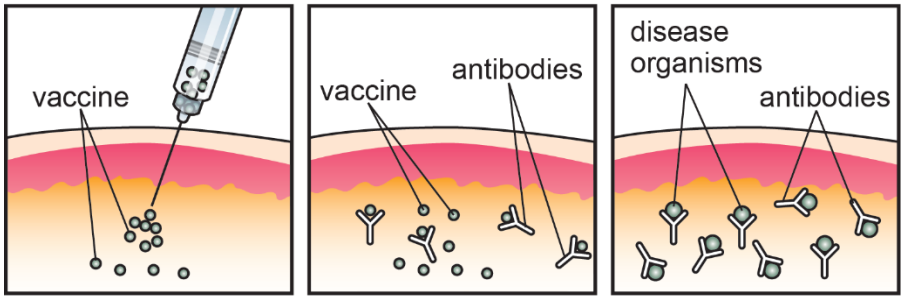
Figure 3. Virus Attacking Cells



Source: HowStuffWorks.

Some viral attacks, such as chicken pox, influenza, and whooping cough, can be prevented by vaccinations. Vaccinations use attenuated (weakened so that they stimulate an immune response but do not cause the disease) or inactivated viruses that are injected into the body. The vaccine triggers an immune response in which the body learns to recognize and destroy the virus. The body is then capable of recognizing and fighting off future attacks. Figure 4 can be used to explain the vaccination process.

Figure 4. Vaccination Process



Source: Mayo Foundation for Medical Education and Research.

Two-Part Dependent
Performance Expectation
HS-LS1-4 Use a model to illustrate the role of the cell cycle and differentiation in producing and maintaining complex organisms.

Part A	Part B
The model in Figure 2 can be used to explain how the body can repair itself after a viral attack, but some additional information is needed. Which additional information could be included with the model so that the model more accurately represents how the body repairs itself after a viral attack? A. Many healthy body cells replicate and divide to each produce two cells that can replace damaged cells.* B. Only one body cell is needed to replace all of the specialized cells damaged by the attack. C. Each damaged cell is repaired as it replicates and divides to produce two healthy daughter cells. D. Each damaged body cell produces one healthy offspring that replaces the damaged cell.	Which statement **best** explains how understanding systems and system models helps determine what the model in Figure 2 represents? A. The model can be used to show how many different systems work together to achieve a single desired outcome. B. The model shows the interactions of parts that all belong to different systems. C. The model can be used to explain how the interactions within one part of a system affect the larger system.* D. The model shows how different systems interact at various scales to achieve an outcome.

Multi-Dimensional Alignment: The item requires the student to apply knowledge of the role of the cell cycle and differentiation to demonstrate an understanding of systems and system models.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can describe the changes that occur as cells differentiate to produce tissues that will ultimately maintain complex organisms.

Part A
The model in Figure 2 can be used to explain how the body can repair itself after a viral attack, but some additional information is needed. Which additional information could be included with the model so that the model more accurately represents how the body repairs itself after a viral attack?

A. Many healthy body cells replicate and divide to each produce two cells that can replace damaged cells.*

Part B
Which statement **best** explains how understanding systems and system models helps determine what the model in Figure 2 represents?

C. The model can be used to explain how the interactions within one part of a system affect the larger system.*

Rationales
Part A
A. Correct.
B. A specialized cell is needed to replace the damaged specialized cells.
C. Cells that are damaged by viruses are unable to be repaired.
D. Damaged cells are unable to divide.

Part B
A. The model shows a single cell dividing.
B. The model shows a cell in a single system dividing.
C. Correct.
D. The model shows a single scale.

Technology Enhanced Item
Performance Expectation
HS-LS1-4 Use a model to illustrate the role of the cell cycle and differentiation in producing and maintaining complex organisms.

Figures 1 and 2 model two subsystems that are part of a larger system.

Select the correct word or words from each drop-down menu to complete the sentence to describe how the subsystems work together.

Multicellular organisms need [ ] to create [ ] to allow [ ] to produce different cell types that produce systems of tissues and organs that work together to support the organism.

		differentiation
the cell cycle	stem cells	mitosis
cell destruction	nerve cells	meiosis
daughter cells	immune cells	

Multi-Dimensional Alignment: The item requires the student to apply knowledge of the role of the cell cycle and differentiation to demonstrate an understanding of systems and system models.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 4 or higher. The student can explain the role of the cell cycle and differentiation to produce systems that maintain complex organisms.

Scoring

Multicellular organisms need [the cell cycle] to create [stem cells] to allow [differentiation] to produce different cell types that produce systems of tissues and organs that work together to support the organism.

Rationales

Response	Rationale
Multicellular organisms need the cell cycle to create stem cells to allow differentiation to produce different cell types that produce systems of tissues and organs that work together to support the organism.	Correct.
Multicellular organisms need the cell cycle to create stem cells to allow mitosis to produce different cell types that produce systems of tissues and organs that work together to support the organism.	Mitosis produces new cells after differentiation.
Multicellular organisms need the cell cycle to create immune cells to allow mitosis to produce different cell types that produce systems of tissues and organs that work together to support the organism.	Immune cells are produced through differentiation.
Multicellular organisms need the cell cycle to create immune cells to allow differentiation to produce different cell types that produce systems of tissues and organs that work together to support the organism.	Differentiation occurs before the cell cycle produces additional immune cells.

Two-Part Dependent
Performance Expectation
HS-LS1-8 Obtain, evaluate, and communicate information about (1) viral and bacterial reproduction and adaptation, (2) the body's primary defenses against infection, and (3) how these features impact the design of effective treatment.

The immune system response is different when a virus known to the immune system enters the body than when an unknown virus enters the body. Part A Which statement **best** explains how the body responds when a known virus is recognized? A. Vaccines cause antibodies to quickly replicate in all parts of the body. B. Cells that produce antibodies are quickly replicated so that more antibodies can be released.* C. The presence of antibodies triggers the body to produce more copies of the vaccine. D. The presence of a virus triggers antibodies to become specialized cells that release additional vaccine.	Part B Which figure provides the best evidence to support the answer to Part A? A. Figure 1, because it shows how stem cells can differentiate into immune cells. B. Figure 2, because it shows the steps involved in replicating a cell. C. Figure 3, because it shows the results of a virus attacking cells. D. Figure 4, because it shows how vaccines cause a reaction in the immune system.*

Multi-Dimensional Alignment: The item requires the student to apply the science and engineering practices of obtaining, evaluating, and communicating information, and knowledge of (1) viral and bacterial reproduction and adaptation, (2) the body's primary defenses against infection, and (3) how these features impact the design of effective treatment to demonstrate scale, proportion, and quantity.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 5 or higher. The student can evaluate and communicate complex evidence, concepts, or processes about viral reproduction and adaptation and the body's primary defenses against infection.

The immune system response is different when a virus known to the immune system enters the body than when an unknown virus enters the body.

Part A
Which statement **best** explains how the body responds when a known virus is recognized?

B. Cells that produce antibodies are quickly replicated so that more antibodies can be released.*

Part B
Which figure provides the **best** evidence to support the answer to Part A?

D. Figure 4, because it shows how vaccines cause a reaction in the immune system.*

Rationales
Part A
A. Antibodies are produced in the body as a response to a vaccine.
B. Correct.
C. The presence of antibodies triggers an immune response.
D. The vaccine triggers the production of antibodies.

Part B
A. Figure 1 shows the process of differentiation.
B. Figure 2 shows the life cycle of a cell.
C. Figure 3 shows the effect of a virus on a cell.
D. Correct.

Technology Enhanced Item
Performance Expectation
HS-LS1-8 Obtain, evaluate, and communicate information about (1) viral and bacterial reproduction and adaptation, (2) the body's primary defenses against infection, and (3) how these features impact the design of effective treatment.

Select the correct word or words from the drop-down menus to complete the sentences.

The model in Figure 4 shows how exposure to a vaccine causes an increase in [▾ antibodies / disease organisms]

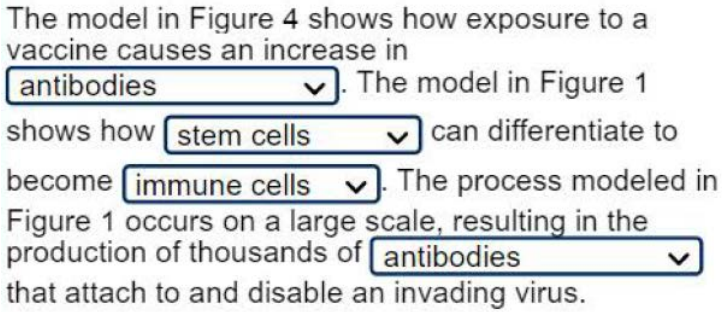
The model in Figure 1 shows how [▾ antibodies / immune cells / stem cells] can differentiate to become [▾ antibodies / immune cells / stem cells].

The process modeled in Figure 1 occurs on a large scale, resulting in the production of thousands of [▾ antibodies / stem cells / disease organisms / vaccines] that attach to and disable an invading virus.

Multi-Dimensional Alignment: While effectively applying the science practice of obtaining, evaluating, and communicating information, the student demonstrates knowledge of (1) viral and bacterial reproduction and adaptation, (2) the body's primary defenses against infection, and (3) how these features impact the design of effective treatment to demonstrate scale, proportion, and quantity.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can compare information about viral reproduction and adaptation and the body's primary defenses against infection.

Scoring



Rationales

Response	Rationale
The model in Figure 4 shows how exposure to a vaccine causes an increase in **antibodies**. The model in Figure 1 shows how **stem cells** can differentiate to become **immune cells**. The process modeled in Figure 1 occurs on a large scale, resulting in the production of thousands of **antibodies** that attach to and disable an invading virus.	Correct.
The model in Figure 4 shows how exposure to a vaccine causes an increase in **antibodies**. The model in Figure 1 shows how **stem cells** can differentiate to become **immune cells**. The process modeled in Figure 1 occurs on a large scale, resulting in the production of thousands of **vaccines** that attach to and disable an invading virus.	Vaccines result in the production of antibodies.
The model in Figure 4 shows how exposure to a vaccine causes an increase in **antibodies**. The model in Figure 1 shows how **stem cells** can differentiate to become **immune cells**. The process modeled in Figure 1 occurs on a large scale, resulting in the production of thousands of **stem cells** that attach to and disable an invading virus.	Stem cells differentiate into many types of cells.
The model in Figure 4 shows how exposure to a vaccine causes an increase in **antibodies**. The model in Figure 1 shows how **stem cells** can differentiate to become **immune cells**. The process modeled in Figure 1 occurs on a large scale, resulting in the production of thousands of **disease organisms** that attach to and disable an invading virus.	Differentiation produces specialized cells.

Item Set: Ebola Virus

Item Type	PE	DCI	SEP	CCC	Points	Achievement Level
TEI	HS-LS2-1	HS.LS2A.a		SPQ	2	4
MC	HS-LS2-1	HS.LS2A.a		SPQ	1	2
MS	HS-LS2-1	HS.LS2A.a		SPQ	1	2
CR	HS-LS2-1	HS.LS2A.a	5. MCT	SPQ	2	3

SEP = blue; DCI = orange; CCC = green An asterisk (*) denotes correct answer(s).

Use the information about the Ebola virus and your knowledge of science to answer the questions.

Ebola Virus

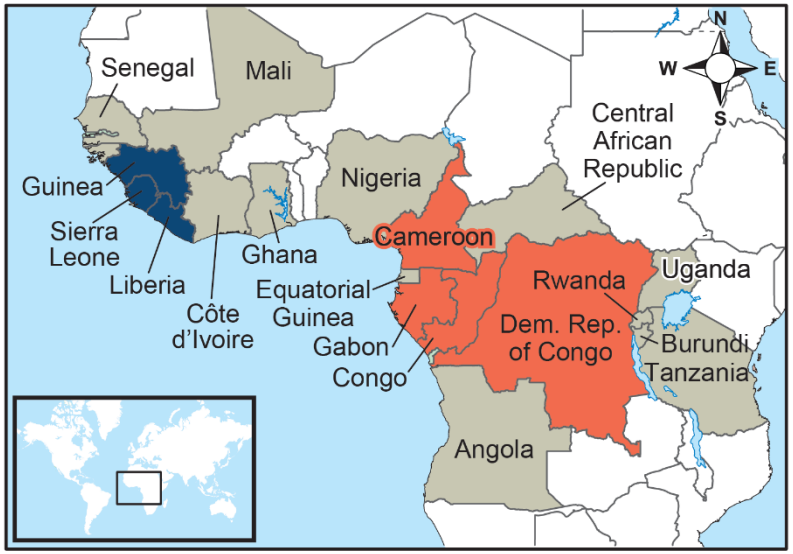
The Ebola virus is a severe and often fatal disease in humans. The virus is transmitted from wild animals, such as bats and monkeys, to humans and from human to human by way of direct contact with infected body fluids. An outbreak occurs when the virus spreads quickly within a population. The outbreaks tend to occur periodically in certain locations in Africa.

Great apes, which include gorillas and chimpanzees, are also susceptible to the Ebola virus. As with humans, Ebola is severe and often fatal. The mortality rates for infected gorillas and chimpanzees are 95% and 77% respectively. It is hard to come up with an exact number since dead individuals are often eaten quickly by other animals. Ebola is considered the greatest threat, after human activity, to the survival of gorillas and chimpanzees. During one Ebola outbreak in a national park, scientists estimate that 25% of the chimpanzee population died in just one month.

Gorillas and chimpanzees live in small family groups of up to 30 individuals. Historically, these groups roamed in large habitats and had little contact with one another. Today, human activities, such as urbanization, deforestation, and ranching, have reduced the habitat of gorillas and chimpanzees. As a result, many of these groups now live closer together in small, isolated pockets and come into contact with one another much more frequently. The reduced habitat results in increased competition among different groups for resources, including territory, mates, and food. Gorillas are primarily vegetarian, eating mostly plants and some insects. Chimpanzees, while primarily vegetarian, are known to hunt and eat small mammals, such as bats and monkeys. As many as four different groups of great apes may feed from the same fruit trees on a single day, drastically increasing the chances of coming into contact with viruses, including Ebola.

Because Ebola causes so many deaths, the virus can affect the biodiversity of an ecosystem. Current estimates suggest that a third of the world's gorillas and chimpanzees have died from Ebola since the 1990s. Map 1 shows the location of great ape populations in Africa and the countries with recent Ebola outbreaks among humans.

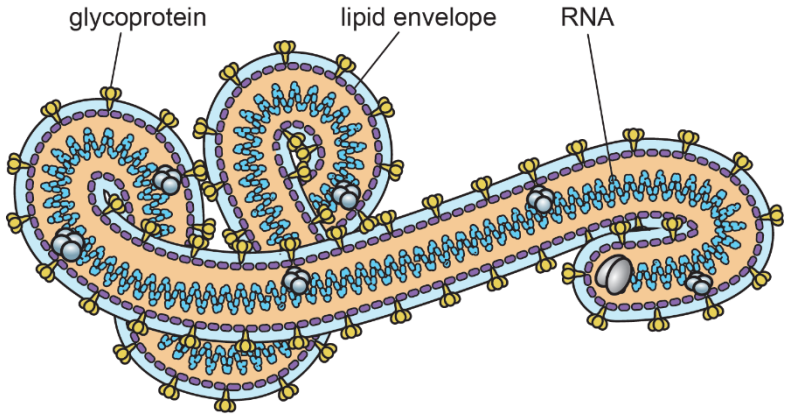
Map 1. Great Ape Populations and Ebola in Africa



Source: International Union for Conservation of Nature.

Individuals infected with Ebola may not begin to show signs for 2 to 21 days. The Ebola virus has a genome made of RNA that is wrapped in a lipid envelope with a sugar-protein complex (glycoprotein) on its outer surface, as shown in Figure 1.

Figure 1. Structure of the Ebola Virus



Source: Ian M. Mackay, Virology Down Under.

Scientists are developing and testing an Ebola vaccine that is proving effective at preventing the spread of the disease among great apes. Vaccinating wildlife, however, is proving very difficult for many reasons, including the shy nature of the great apes.

Technology Enhanced Item
Performance Expectation
HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity, biodiversity, and populations of ecosystems at different scales.

Use Map 1 to answer the question.

Select from the drop-down menus to complete the statements to predict how recent human activities may affect the current Ebola outbreak shown in Map 1.

The populations of western lowland gorillas in the immediate area of the Ebola outbreak will likely [▾]
- increase
- decrease
- stay the same

due to the increase in [▾] the great apes in the area. As a result of human activities, the diversity

- territory available to
- rates of contact among
- isolated areas to feed

among gorillas in countries surrounding the outbreak will likely [▾] .

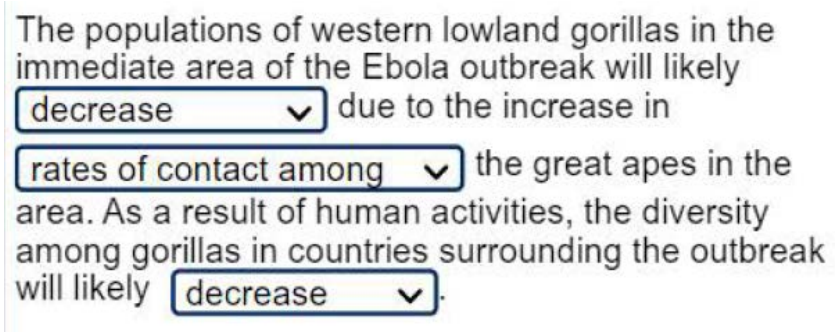
- increase
- decrease
- not change

Multi-Dimensional Alignment: The item requires the student to apply knowledge of factors that affect carrying capacity, biodiversity, and populations of ecosystems to demonstrate an understanding of scale, proportion, and quantity.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 4 or higher. The student can describe factors that affect carrying capacity, biodiversity, and populations of ecosystems at different scales.

Scoring

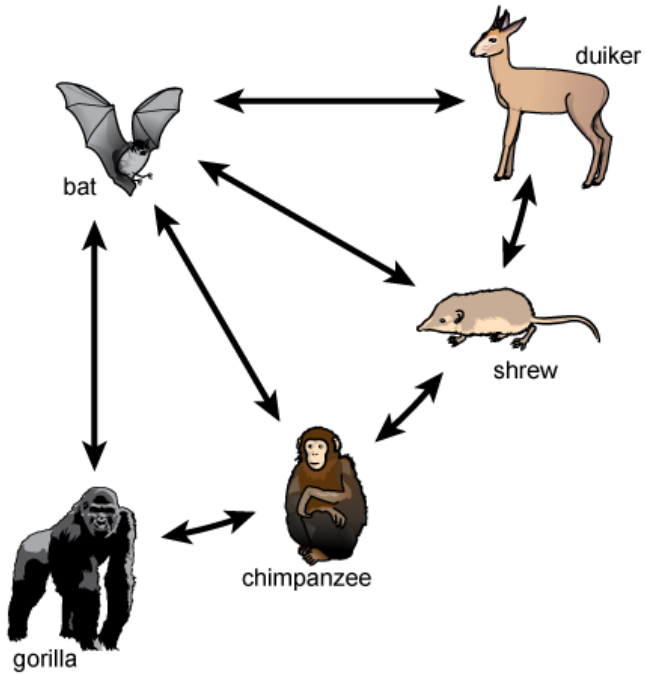
Select from the drop-down menus to complete the statements to predict how recent human activities may affect the current Ebola outbreak shown in Map 1.



Rationales

Response	Rationale
The populations of western lowland gorillas in the immediate area of the Ebola outbreak will likely **decrease** due to the increase in **rates of contact among** the great apes in the area. As a result of human activities, the diversity among gorillas in countries surrounding the outbreak will likely **decrease**.	Correct.
The populations of western lowland gorillas in the immediate area of the Ebola outbreak will likely **increase** due to the increase in **rates of contact among** the great apes in the area. As a result of human activities, the diversity among gorillas in countries surrounding the outbreak will likely **decrease**.	Populations will decrease when there is more contact between populations in the area.
The populations of western lowland gorillas in the immediate area of the Ebola outbreak will likely **decrease** due to the increase in **rates of contact among** the great apes in the area. As a result of human activities, the diversity among gorillas in countries surrounding the outbreak will likely **increase**.	Diversity decreases when populations decrease.
The populations of western lowland gorillas in the immediate area of the Ebola outbreak will likely **increase** due to the increase in **rates of contact among** the great apes in the area. As a result of human activities, the diversity among gorillas in countries surrounding the outbreak will likely **increase**.	Populations and diversity within a population will decrease when there is more contact between populations in the area.

Multiple Choice
Performance Expectation
HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity, biodiversity, and populations of ecosystems at different scales.

To understand the carrying capacity and biodiversity of an ecosystem, it is important to know how, and the speed at which, a disease can be transmitted within and across populations. The model shows one theory about how Ebola may be transmitted across different populations.  	In this model, which animal is **most likely** to spread the Ebola virus rapidly across different populations? A. gorilla B. chimpanzee C. shrew D. bat*

Multi-Dimensional Alignment: The item requires the student to apply knowledge of factors that affect carrying capacity, biodiversity, and populations of ecosystems to demonstrate an understanding of scale, proportion, and quantity.

Achievement Level Descriptor: Students who answer this question correctly are performing at a level of 2 or higher. The student can use graphical representations to identify factors that affect populations of ecosystems at different scales.

In this model, which animal is most likely to spread the Ebola virus rapidly across different populations?

D. bat*

Rationales

A. The gorilla could spread a disease to two populations slowly.
B. The chimpanzee could spread a disease to three populations slowly.
C. The shrew could spread a disease to three populations quickly.
D. Correct.

Multiple Select
Performance Expectation
HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity, biodiversity, and populations of ecosystems at different scales.

Use Map 1 to answer the question.

Which statements explain why certain areas of gorilla and chimpanzee habitat are not infected with Ebola, despite the ongoing outbreak?

Select the two correct answers.

A. Great ape populations in certain areas are physically separated from other infected populations.*
B. Great ape populations in certain areas are too small to become infected during an outbreak.
C. Great ape populations in certain areas developed antibodies to Ebola when exposed during a recent outbreak.*
D. The Ebola virus is only found in some areas and cannot spread to other regions.
E. The Ebola virus is infecting all great ape populations, so certain areas must not contain any apes.

Multi-Dimensional Alignment: The item requires the student to apply knowledge of factors that affect carrying capacity, biodiversity, and populations of ecosystems to demonstrate an understanding of scale, proportion, and quantity.

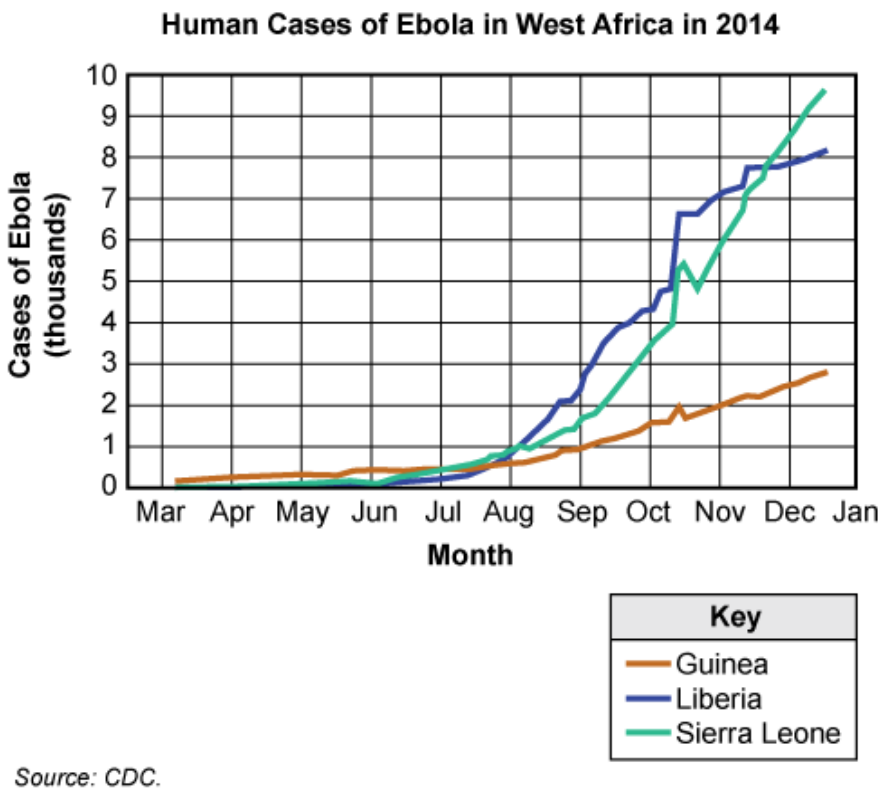
Achievement Level Descriptor: Students who answer this question correctly are performing at a level of 2 or higher. The student can identify factors that affect populations of ecosystems at different scales.

Which statements explain why certain areas of gorilla and chimpanzee habitat are not infected with Ebola, despite the ongoing outbreak?

A. Great ape populations in certain areas are physically separated from other infected populations.*
C. Great ape populations in certain areas developed antibodies to Ebola when exposed during a recent outbreak.*

Rationales
A. Correct.
B. Small populations can become infected during an outbreak.
C. Correct.
D. The Ebola virus is able to spread to other regions.
E. The Ebola virus is not infecting all great ape populations.

Constructed Response
Performance Expectation
HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity, biodiversity, and populations of ecosystems at different scales.

Use Map 1 and the graph shown to answer the question.  *Source: CDC.*	One person claims that the ongoing Ebola outbreak among humans in Sierra Leone, Guinea, and Liberia is likely caused by the transmission of Ebola from gorillas to humans. Explain how information from Map 1 and the graph shown can be used to show that the claim may not be correct. Include data to support your explanation.

Multi-Dimensional Alignment: The item requires the student to apply the science and engineering practices of using mathematical and/or computational representations to support explanations and knowledge of factors that affect carrying capacity, biodiversity, and populations of ecosystems to demonstrate an understanding of scale, proportion, and quantity.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can use graphical representations of mathematical relationships to describe factors that affect carrying capacity and populations of ecosystems at different scales.

One person claims that the ongoing Ebola outbreak among humans in Sierra Leone, Guinea, and Liberia is likely caused by the transmission of Ebola from gorillas to humans.

Explain how information from Map 1 and the graph shown can be used to show that the claim may not be correct. Include data to support your explanation.

Scoring Information	
Score	Description
2	Student's response correctly explains how information from Map 1 and/or the graph shown can be used to show that the claim may not be correct and includes data to support the explanation.
1	Student's response correctly explains how information from Map 1 and/or the graph shown can be used to show that the claim may not be correct, but does not include data to support the explanation.
0	Student's response does not explain how information from Map 1 and/or the graph shown can be used to show that the claim may not be correct or include data to support the explanation.

Scoring Notes:

- Explanation to show claim may not be correct (1 point)
- Data to support explanation (1 point)

Examples include:

Scoring notes	Examples
Explanation of how information from Map 1 and/or the graph can be used to show that the claim may not be correct (1 point)	• The great ape Ebola outbreak was from 1990 to 2005. The human outbreak in Guinea, Sierra Leone, and Liberia happened in 2014. OR • Countries with an ongoing Ebola epidemic among humans are geographically separated from countries

Scoring notes	Examples
	that had Ebola outbreaks among the great apes.
Data to support explanation (1 point)	• The data does not list a great ape outbreak during 2014, or in the year or two prior, so transmission from apes to humans is unlikely to have caused the 2014 human outbreak. OR • According to the map, surrounding areas do not have Ebola, although apes are present.

Accept other reasonable answers.

Student Responses (CR)

Explain how information from Map 1 and the graph shown can be used to show that the claim may not be correct. Include data to support your explanation.

Response 1

The claim cannot be correct because the Ebola epidemic among humans and the ebola outbreak among the great apes are in two different parts of Africa. If that was the case then Nigeria would more then likely have been infected as well as Ghana and Cote d'Ivoire. The locations are a fast distance away from each other and have territories in between them which would've been infected first.

Score: 2

This response earns a 2. It accurately explains how information from Map 1 or the graph can be used to show that the claim may not be correct: "The claim cannot be correct because the Ebola epidemic among humans and the ebola outbreak among the great apes are in two different parts of Africa." The response also accurately describes data to support the explanation: "The locations are a fast distance away from each other and have territories in between them which would've been infected first."

Response 2

In the countries Guinea, Sierra Leone, and Liberia, there are outbreaks over the human population. The surrounding countries have populations of Great Apes. The persons claims says that: "The outbreak over the humans is likely caused by the gorillas." That is wrong because the countries with the Ebola outbreaks among the apes is no where near the outbreak with humans. The only thing that is surrounding the outbreak in the human populations are countries with populations of apes.

Score: 1

This response earns a 1. It accurately explains how information from Map 1 or the graph can be used to show that the claim may not be correct: “That is wrong because the countries with the Ebola outbreaks among the apes is no where near the outbreak with humans.” The response does not describe data that supports the explanation.

Response 3

This information on Map 1 and the graph shown can be used to show that the claim may not be correct. Because in the map it says the countries with great ape populations which doesn’t mean the transmission of ebola from gorillas to humans is correct.

Score: 0

This response earns a 0. It does not accurately explain why the claim is not correct: “This information on Map 1 and the graph shown can be used to show that the claim may not be correct.” It does not provide accurate evidence to support the claim: “Because in the map it says the countries with great ape populations which doesn’t mean the transmission of ebola from gorillas to humans is correct.”

Task Set: Migration of Pink Salmon

Item Type	PE	DCI	SEP	CCC	Points	Achievement Level
MC	HS-LS3-1	HS.LS3A.b		C/E	1	3
MC	HS-LS3-1	HS.LS1A.c	1 Q/P		1	3
TEI	HS-LS3-1	HS.LS3A.a		C/E	2	3
TEI	HS-LS3-1	HS.LS1A.c		C/E	1	5
TEI	HS-LS3-2	HS.LS3B.a	7 ARG		2	3
ER	HS-LS3-2	HS.LS3B.c	7 ARG	C/E	9	5

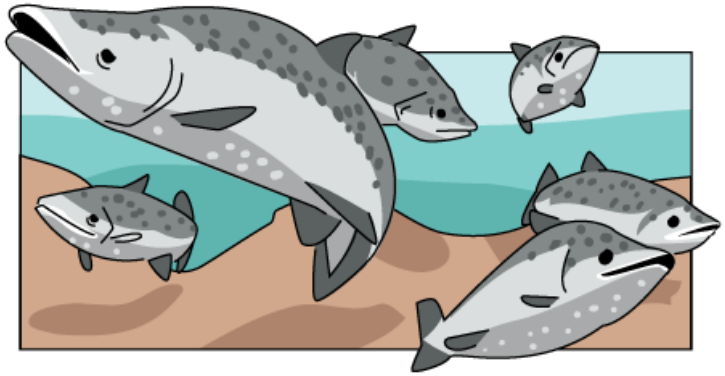
SEP = blue; DCI = orange; CCC = green An asterisk (*) denotes correct answer(s).

Use the information about the migration of pink salmon and your knowledge of science to answer the questions.

Migration of Pink Salmon

Pink salmon are cold-water fish that begin their life in freshwater rivers and streams. Image 1 displays a group of pink salmon that are migrating upstream to spawn.

Image 1. Pink Salmon



Pink salmon migrate to the ocean where they spend most of their adult life, before returning to freshwater rivers and streams to spawn (lay eggs). Map 1 shows the natural habitat of pink salmon, which is highlighted in orange.

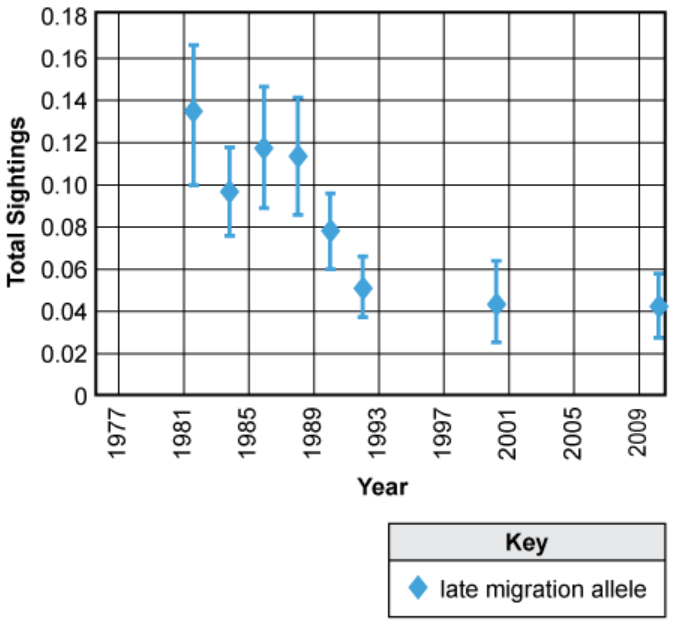
Map 1. Pink Salmon Habitat

Source: Gary Marston, Native Trout Fly Fishing.

Genetics play a key role in determining the exact time that salmon will leave the oceans to migrate upriver.

Graph 1 shows the frequency changes in the allele for late migration.

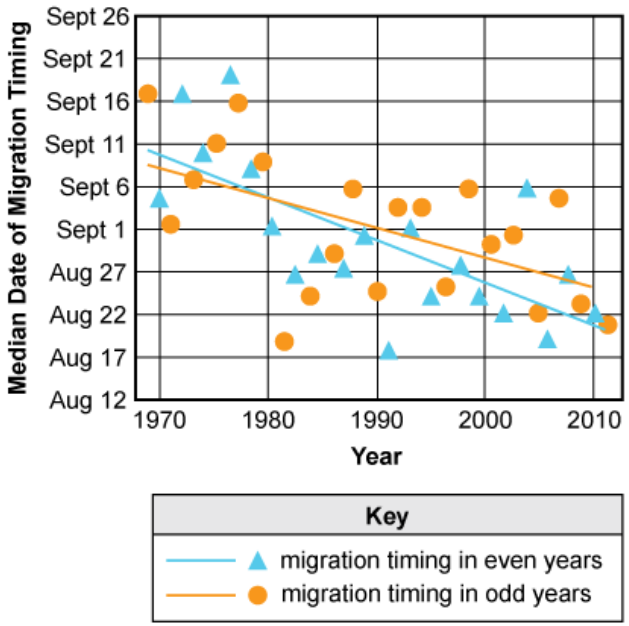
Graph 1. Frequency Changes in Allele for Late Migration



Source: Royal Society Publishing.

This trend of early pink salmon migration has been observed since the 1970s. Salmon that migrate earlier have a greater chance of surviving the journey upstream to spawn. Graph 2 shows the migration dates of pink salmon from 1970 to 2010.

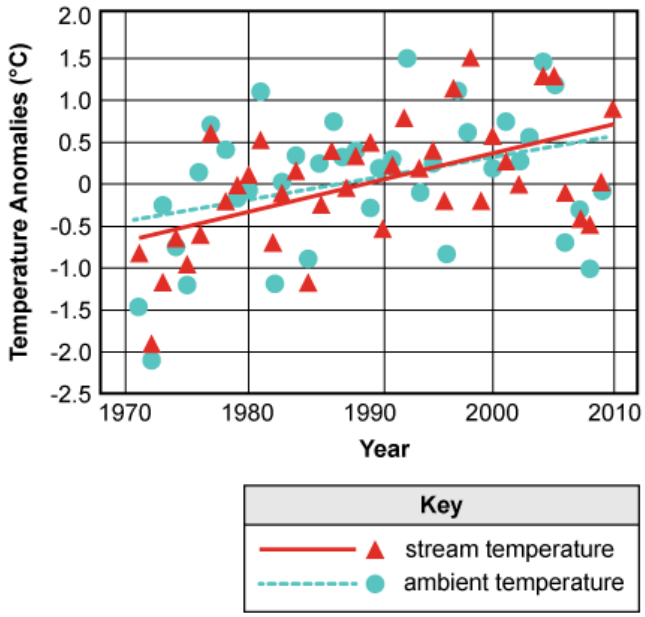
Graph 2. Migration Timing of Pink Salmon, 1970–2010



Source: Royal Society Publishing.

Scientists are investigating possible reasons why salmon are migrating earlier in the year than they were in the 1970s. They are uncertain whether genetic mutations or increases in water temperatures are responsible for this changing migration pattern. Graph 3 shows changing temperatures in a river in Alaska from 1970 to 2010.

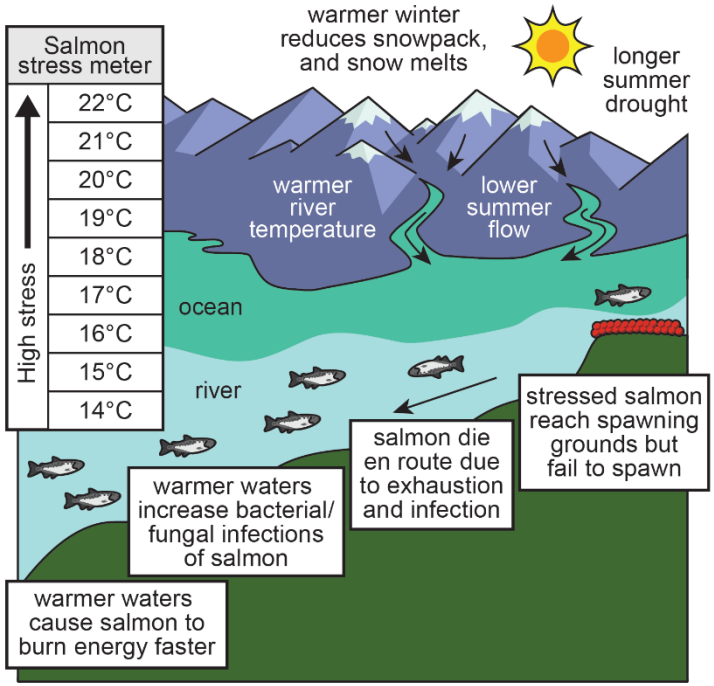
Graph 3. Temperature Anomalies in Rivers, 1970–2010



Source: Royal Society Publishing.

Salmon swim from the ocean into freshwater rivers. The swim up the river causes the salmon to move uphill and use up energy. While looking at changing water temperatures in rivers, scientists discovered that warmer water causes salmon to use even more energy, which increases stress levels in the salmon.

Figure 1. Salmon Migration and Environmental Changes



Source: Natural Resources Canada.

Multiple Choice
Performance Expectation
HS-LS3-1 Formulate, refine, and evaluate questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Use Graph 1 to answer the question.

Using only the information in Graph 1, which statement about genetic variations in pink salmon is **most likely** correct?

A. The late migration alleles of salmon are less likely to be passed down to future generations.*
B. Genetic alleles are passed down to offspring in a random manner.
C. Environmental stresses cause the selection of alleles to be passed down in future salmon.
D. The salmon with late migration alleles have a selective advantage.

Multi-Dimensional Alignment: The item requires the student to apply knowledge of relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can clarify trends observed in the characteristic traits passed from parents to offspring.

Using only the information in Graph 1, which statement about genetic variations in pink salmon is **most likely** correct?

A. The late migration alleles of salmon are less likely to be passed down to future generations.*

Rationales

A. Correct.
B. Chromosomes are passed down to offspring.
C. Alleles are passed down during reproduction.
D. Late migration alleles provide a selective disadvantage.

Multiple Choice
Performance Expectation
HS-LS3-1 Formulate, refine, and evaluate questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Use Graph 1 to answer the question.

Which is the **best** question a student can ask to gather more information about the allele frequency of late-migrating salmon between 1977 and 2009?

A. What causes the genetic mutation resulting in late migration?
B. What causes late migration in pink salmon?
C. Why would the frequency of an allele for late migration be decreasing in pink salmon?*
D. How can the frequency of the allele for late migration be changed?

Multi-Dimensional Alignment: While effectively applying the science practice of formulating, refining, and evaluating questions, the student demonstrates knowledge of the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Achievement Level Descriptor: Students who answer this item correctly are performing at an achievement level of 3 or higher. The student can ask questions that can be used to clarify trends observed in the characteristic traits passed from parents to offspring.

Which is the **best** question a student can ask to gather more information about the allele frequency of late-migrating salmon between 1977 and 2009?

C. Why would the frequency of an allele for late migration be decreasing in pink salmon?*

Rationales
A. Asks about a cause of mutation.
B. Asks about a cause for late migration.
C. Correct.
D. Asks about a way to change the allele frequency.

Technology Enhanced Item
Performance Expectation
HS-LS3-1 Formulate, refine, and evaluate questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Select from the drop-down menus to correctly complete each sentence.

As global average temperatures [▾], there is an increased stress on the environment in which the pink salmon live.

- increase
- decrease
- stay the same

Due to the increased temperature of the water, the salmon are more likely to die on their journey upstream or not be able to spawn at the end of their journey. However, there appear to be certain [▾] within salmon DNA that can be activated, which causes them to migrate upstream [▾]. This gives the salmon a chance to migrate upstream and spawn before they use up too much energy.

- proteins
- amino acids
- alleles
- pieces of RNA

- later
- earlier

Multi-Dimensional Alignment: The item requires the student to apply knowledge of relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring to demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can clarify trends observed in the characteristic traits passed from parents to offspring.

Scoring

As global average temperatures [increase] , there is an increased stress on the environment in which the pink salmon live. Due to the increased temperature of the water, the salmon are more likely to die on their journey upstream or not be able to spawn at the end of their journey. However, there appear to be certain [alleles] within salmon DNA that can be activated, which causes them to migrate upstream [earlier] . This gives the salmon a chance to migrate upstream and spawn before they use up too much energy.

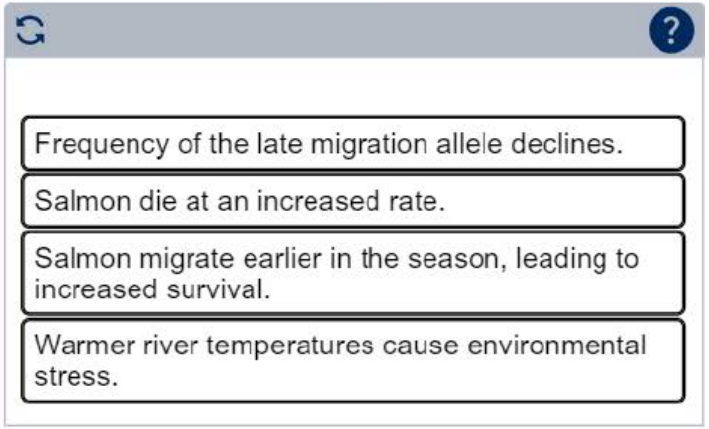
Rationales

Responses	Rationale
As global average temperatures **increase**, there is an increased stress on the environment in which the pink salmon live. Due to the increased temperature of the water, the salmon are more likely to die on their journey upstream or not be able to spawn at the end of their journey. However, there appear to be certain **alleles** within salmon DNA that can be activated, which causes them to migrate upstream **earlier**. This gives the salmon a chance to migrate upstream and spawn before they use up too much energy.	Correct.
As global average temperatures **increase**, there is an increased stress on the environment in which the pink salmon live. Due to the increased temperature of the water, the salmon are more likely to die on their journey upstream or not be able to spawn at the end of their journey. However, there appear to be certain **alleles** within salmon DNA that can be activated, which causes them to migrate upstream **later**. This gives the salmon a chance to migrate upstream and spawn before they use up too much energy.	Activation of these alleles results in earlier migration.

Responses	Rationale
As global average temperatures **decrease**, there is an increased stress on the environment in which the pink salmon live. Due to the increased temperature of the water, the salmon are more likely to die on their journey upstream or not be able to spawn at the end of their journey. However, there appear to be certain **alleles** within salmon DNA that can be activated, which causes them to migrate upstream **earlier**. This gives the salmon a chance to migrate upstream and spawn before they use up too much energy.	Decreases in temperatures would result in later migration.
As global average temperatures **increase**, there is an increased stress on the environment in which the pink salmon live. Due to the increased temperature of the water, the salmon are more likely to die on their journey upstream or not be able to spawn at the end of their journey. However, there appear to be certain **proteins** within salmon DNA that can be activated, which causes them to migrate upstream **earlier**. This gives the salmon a chance to migrate upstream and spawn before they use up too much energy.	Alleles are activated to produce proteins.

Technology Enhanced Item
Performance Expectation
HS-LS3-1 Formulate, refine, and evaluate questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Place the steps in the correct order in which they occur to explain how the environment can affect the allele frequency of pink salmon.

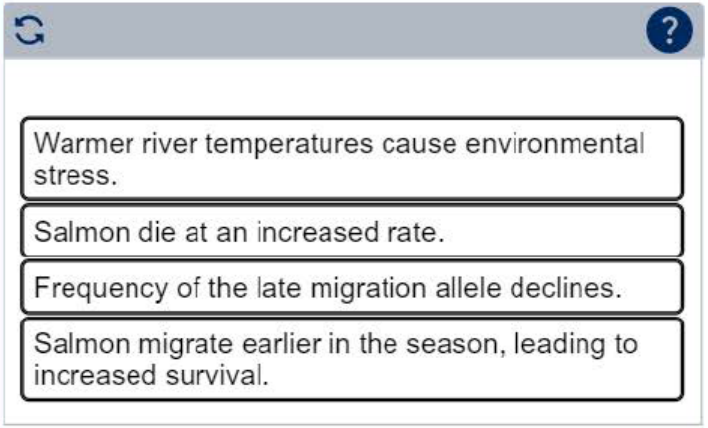


Multi-Dimensional Alignment: The item requires the student to apply knowledge of relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring demonstrate an understanding of cause and effect.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 5 or higher. The student can evaluate how the DNA and chromosome coding from parents combine to create the characteristic traits expressed in their offspring.

Scoring

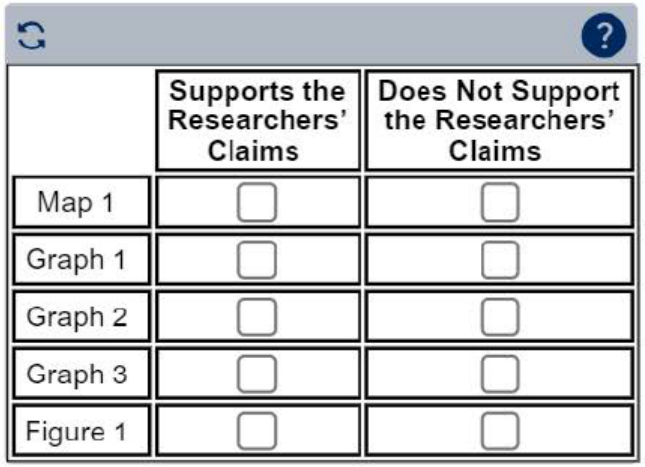
Place the steps in the correct order in which they occur to explain how the environment can affect the allele frequency of pink salmon.



Rationales

Response	Rationale
Warmer river temperatures cause environmental stress. Salmon die at an increased rate. Frequency of the late migration allele declines. Salmon migrate earlier in the season, leading to increased survival.	Correct.
Salmon migrate earlier in the season, leading to increased survival. Warmer river temperatures cause environmental stress. Frequency of the late migration allele declines. Salmon die at an increased rate.	Earlier migration does not occur until the temperatures increase.
Salmon migrate earlier in the season, leading to increased survival. Frequency of the late migration allele declines. Warmer river temperatures cause environmental stress. Salmon die at an increased rate.	The behavior changes after an environmental change affects the frequency of alleles in the population.
Warmer river temperatures cause environmental stress. Salmon die at an increased rate. Salmon migrate earlier in the season, leading to increased survival. Frequency of the late migration allele declines.	Allele frequency changes before the behavior changes.

Technology-Enhanced Item
Performance Expectation
HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Use the information and data given to answer the question. Researchers theorize that the early migration phenomenon may be explained by selective pressures in the environment. This external pressure is changing the genetic allele frequency that triggers salmon migration. Look at the information listed under the evidence column. Select the correct box next to the evidence to indicate whether the map, graph, or figure supports or does not support the researchers' claims.	

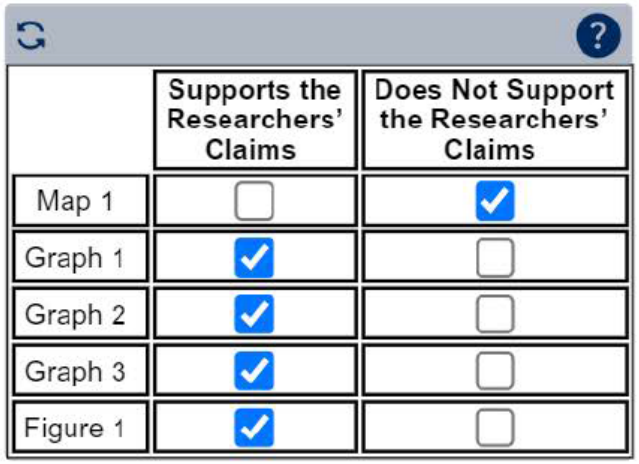
Multi-Dimensional Alignment: While effectively applying the science practice of making and defending a claim based on evidence, the student demonstrates knowledge of inheritable genetic variations from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Achievement Level Descriptor: Students who answer this question correctly are performing at an achievement level of 3 or higher. The student can compare evidence supporting claims that inheritable genetic variations may result from mutations caused by environmental factors.

Scoring

Researchers theorize that the early migration phenomenon may be explained by selective pressures in the environment. This external pressure is changing the genetic allele frequency that triggers salmon migration.

Look at the information listed under the evidence column. Select the correct box next to the evidence to indicate whether the map, graph, or figure supports or does not support the researchers' claims.



	Supports the Researchers' Claims	Does Not Support the Researchers' Claims
Map 1	☐	☑
Graph 1	☑	☐
Graph 2	☑	☐
Graph 3	☑	☐
Figure 1	☑	☐

Rationales

Response	Rationale
Supports: Graph 1, Graph 2, Graph 3, Figure 1 Does not support: Map 1	Correct.
Supports: Graph 1, Graph 3, Figure 1 Does not support: Map 1, Graph 2	Graph 2 provides evidence of the change in migration time.
Supports: Graph 1, Graph 2, Figure 3 Does not support: Map 1, Graph 3	Graph 3 provides evidence of the change in water temperatures.
Supports: Graph 2, Graph 3, Figure 1 Does not support: Map 1, Graph 1	Graph 1 provides evidence of the change in allele frequency for late migration.

Extended Response Item
Performance Expectation
HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

As you respond to Part A and Part B, follow the directions below.

- Address all parts of the instructions in each prompt.
- Use evidence from the information provided and your own knowledge of science to support your responses.

Part A

Scientists look for correlations among data. The scientists want to know if the different sets of data show the same overall trends (a positive correlation) or if the data do not have the same trends (a negative correlation).

Explain the trends in the data among Graphs 1, 2, and 3 and the type of correlation **each** graph has with the other two graphs.

Part B

A study performed in Alaska found that migrating salmon avoided warm water temperatures. In this particular population of pink salmon, the earlier-migrating salmon were better adapted for survival during warm years.

Using the information from the answer to Part A, explain if the claim that salmon avoid warm water temperatures is **likely**. As evidence for your explanation, describe the trend of at least one graph and the correlation of that graph to the claim.

Multi-Dimensional Alignment: The item requires the student to apply the science and engineering practices of making and defending a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Achievement Level Description: Students who answer this item correctly are performing at an achievement level of 4 or higher. The student can defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Part A

Scientists look for correlations among data. The scientists want to know if the different sets of data show the same overall trends (a positive correlation) or if the data do not have the same trends (a negative correlation).

Explain the trends in the data among Graphs 1, 2, and 3 and the type of correlation **each** graph has with the other two graphs.

Part B

A study performed in Alaska found that migrating salmon avoided warm water temperatures. In this particular population of pink salmon, the earlier-migrating salmon were better adapted for survival during warm years.

Using the information from the answer to Part A, explain if the claim that salmon avoid warm water temperatures is likely. As evidence for your explanation, describe the trend of at least one graph and the correlation of that graph to the claim.

Score Points

PART A (0-6 points maximum)

For each of three graphs:

- 1 point for explaining the trend for each graph (up to 3 points)
- 1 point for describing the correlation with each of the other two graphs (up to 3 points)

PART B (0-3 points maximum)

- 1 point for explaining whether the claim is likely or unlikely
- 1 point for describing the trend or correlation of at least one graph
- 1 point for explaining how the trend or correlation show that salmon are migrating earlier to avoid warm water

Sample Response:

Scoring Notes	Examples
Part A	
Explanation of the trend in Graph 1 (1 point)	• Graph 1 shows a decline in the allele frequency for late migration.
Description of the correlations for Graph 1 (1 point)	• Graph 1 has a positive correlation with graph 2 and a negative correlation with graph 3.
Explanation of the trend in Graph 2 (1 point)	• Graph 2 shows earlier migration of pink salmon.
Description of the correlations for Graph 2 (1 point)	• Graph 2 has a positive correlation with graph 1 and a negative correlation with graph 3.
Explanation of the trend in Graph 3 (1 point)	• Graph 3 shows river temperatures rising over time.
Description of the correlations for Graph 3 (1 point)	• Graph 3 has a negative correlation with the other two graphs.

Part B	
Explanation of whether the claim is likely or not (1 point)	• The claim is likely that salmon will avoid warm water temperatures.
Description of the trend or correlation of one graph supports the claim (1 point)	• Graph 2 shows that pink salmon are migrating earlier and graph 3 shows that temperatures are increasing.
Explaining how the trend or correlation show that salmon are migrating earlier to avoid warm water (1 point)	• The correlation indicates that salmon may be migrating earlier to avoid the rising temperature.

Student Responses for ER

Part A

Scientists look for correlations among data. The scientists want to know if the different sets of data show the same overall trends (a positive correlation) or if the data do not have the same trends (a negative correlation).

Explain the trends in the data among Graphs 1, 2, and 3 and the type of correlation each graph has with the other two graphs.

Response 1

Graph 1 shows that as the years progress, the late migration allele does not appear as much as it did in the pervious years. This graph has a positive correlation with graph two and a negative correlation with graph three.

Graph 2 shows that as the years progress, the migrations in odd and even years become earlier and earlier, but more so in even years. There are a few estrangements that are out place from the early timing, but it still continues to occur sooner than later. This graph has a positive correlation with graph one and a negative correlation with graph three.

Graph 3 demonstrates that the graph appears to show that the stream has a constant change of temperature from low to high then back to low again as the years progress, but it has become a lot warmer than it used to be. It continues to fluctuate, yet it is still warmer than in past years. This graph has a negative correlation with graphs one and three.

Score: 6

This response earns a 6. The response accurately explains the trend in graph 1: “Graph 1 shows that as the years progress, the late migration allele does not appear as much as it did in the pervious years.” It accurately describes the correlation between graph 1 and graphs 2 and 3: “This graph has a positive correlation with graph two and a negative correlation with graph three.” The response accurately explains the trend in graph 2: “Graph 2 shows that as the years progress, the migrations in odd and even years become earlier and earlier, but more so in even years.” It accurately describes the correlation between graph 2 and graphs 1 and 3: “This graph has a positive correlation with graph one and a negative correlation with graph three.” The response accurately explains the trend in graph 3: “Graph 3 demonstrates that the graph appears to show that the stream has a constant change of temperature from low to high then back to low again as the years progress,

but it has become a lot warmer than it used to be." It accurately describes the correlation between graph 3 and graphs 1 and 2: "This graph has a negative correlation with graphs one and three."

Response 2

In graph 1, after the year 1985 the total number of sighting continuously decreased. This graph has a positive correlation with graph 2, and also a positive correlation with 3 because it shows that the decrease was likely caused but the temperature rising because as stated in the background information given about the pink salmon, they are fond of cold water temperatures.

In graph 2, migration in both and even years decreased. this graph has positive correlation to graph 1 but not graph 3.

In graph 3, both the ambient and stream temperatures rose. This graph has negative correlation with graph 2 because it isnt showing the temperatures in which those months held.

Score 5

This response earns a 5. The response accurately explains the trend in graph 1: "In graph 1, after the year 1985 the total number of sighting continuously decreased." It accurately describes the correlation between graph 1 and graph 2: "This graph has a positive correlation with graph 2" but does not accurately describe the correlation between graph 1 and graph 3:" and also a positive correlation with 3." The response accurately explains the trend in graph 2: "In graph 2, migration in both and even years decreased." It accurately describes the correlation between graph 1 and graphs 2 and 3: "this graph has positive correlation to graph 1 but not graph 3." The response accurately explains the trend in graph 3: "In graph 3, both the ambient and stream temperatures rose." It accurately describes the correlation between graph 3 and graph 2: "This graph has negative correlation with graph 2."

Response 3

In Graph 1, it is shown that the frequency for the late migration allele of salmon is decreasing over time. This has a positive correlation with Graph 2, in which it displays that salmon tend to migrate earlier over the course of time. In Graph 3, it relays the information that the streams and rivers in Alaska have had a steadily increasing temperature from 1970 to 2010. This is likely a factor of the earlier migration of salmon over time. This being the case, Graph 3 has a positive correlation with both previous graphs.

Score 4

This response earns a 4. It accurately explains the trend in graph 1: "In Graph 1, it is shown that the frequency for the late migration allele of salmon is decreasing over time." It accurately describes the correlation between graph 1 and graph 2: "This has a positive correlation with Graph 2." The response accurately explains the trend in graph 2: "Graph 2, in which it displays that salmon tend to migrate earlier over the course of time." The response accurately explains the trend in Graph 3: "In Graph 3, it relays the information that the streams and rivers in Alaska have had a steadily increasing temperature from 1970 to 2010." The response does not accurately describe the correlation between Graph 1 and Graph 3 or Graph 2 and Graph 3: "Graph 3 has a positive correlation with both previous graphs."

Response 4

According to the graphs there is a pattern of the late migration allele declining as the years go on. Graph one show this starting at point fourteen where the allele was at its highest before dropping to point four in 2009 where the allele was at a low.

This leads into graph two which shows that as the years went on the timing began to stay in even years as the allele declined. It was almost as if the salmon started moving more often or at regular intervals instead of waiting until later in the year to move which would lead to their survival.

Graph three shows the temperature increase in the river and makes the reasoning behind the allele decline understandable. The temperature would increase so the fish would try to get away earlier to avoid death. This would occur more often during the years and soon the allele would stop being used as all salmon would start moving earlier to avoid the heat of the river.

Score 3

This response earns a 3. The response accurately explains the trend in graph 1: "Graph one show this starting at point fourteen where the allele was at its highest before dropping to point four in 2009 where the allele was at a low." It accurately explains the trend in graph 2: "This leads into graph two which shows that as the years went on the timing began to stay in even years as the allele declined. It was almost as if the salmon started moving more often or at regular intervals instead of waiting until later in the year to move which would lead to their survival." The response accurately explains the trend in graph 3: "Graph three shows the temperature increase in the river." The response does not describe the correlation between the three graphs.

Response 5

In Graph 1, it shows us that the total sightings of a late migration allele decline and get smaller as the years go on. In Graph 3, it shows us the stream/ambient temperature in rivers rising which would likely be a trend in the salmon migration and be a big factor in why this is happening. The salmon are not well adapted to swimming in those rising temperatures.

Score 2

This response earns a 2. The response accurately explains the trend in graph 1: "In Graph 1, it shows us that the total sightings of a late migration allele decline and get smaller as the years go on." The response accurately explains the trend in graph 3: "In Graph 3, it shows us the stream/ambient temperature in rivers rising which would likely be a trend in the salmon migration and be a big factor in why this is happening." The response does not explain the trend in graph 2 and does not describe the correlations between graphs 1, 2 or 3.

Response 6

Graphs 1 , 2 and 3 all show changes in the environment that affect the pink salmons' migration rate. Graph 1 shows that the allele for late migration decreases over time, which explains why the pink salmon are migrating later as showed in graph 2, and shows that graph 3 does have an affect. Graph 2 shows the exact time that they migrate, and that the migration decreases, as shown why in graph 1. Graph 3 shows the temperature anomalies in rivers, and with the give years we can conclude that this may have affected the late migration alleles.

Score 1

This response earns a 1. The response accurately explains the trend in graph 1: "Graph 1 shows that the allele for late migration decreases over time." It does not accurately explain the trend in graph 2: "which explains why the pink salmon are migrating later as showed in graph 2." The response does not explain the trend in Graph 3 and does not describe the correlations between graph 1 and graph 2, graph 1 and graph 3, or graph 2 and graph 3.

Response 7

Graph 1 is showing the late alleles. Graph 2 shows the migration years in even years and odd years. Graph 3 shows stream temp. and ambient temp. Graph 1 has a negative correlation and graphs 2 and 3 have a positive.

Score 0

This response earns a 0. The response does not accurately explain the trend in graph 1: "Graph 1 is showing the late alleles." It does not accurately explain the trend in graph 2: "Graph 2 shows the migration years in even years and odd years." It does not accurately explain the trend in graph 3: "Graph 3 shows stream temp. and ambient temp." The response does not accurately describe the correlations between the graphs: "Graph 1 has a negative correlation and graphs 2 and 3 have a positive."

Part B

A study performed in Alaska found that migrating salmon avoided warm water temperatures. In this particular population of pink salmon, the earlier-migrating salmon were better adapted for survival during warm years.

Using the information from the answer to Part A, explain if the claim that salmon avoid warm water temperatures is likely. As evidence for your explanation, describe the trend of at least one graph and the correlation of that graph to the claim.

Response 1

The claim that salmon avoid warm water temperatures is likely. For an example, in graph 2 the migration timing is getting earlier and in graph three the temperature is getting higher. Therefore, since the temperature is getting higher the migration time is getting earlier because the salmon want to avoid the warm temperatures later in the year.

Score 3

This response earns a 3. It accurately explains whether the claim is likely or not: "The claim that salmon avoid warm water temperatures is likely." It accurately describes a trend of at least one graph: "For an example, in graph 2 the migration timing is getting earlier and in graph

three the temperature is getting higher." The response accurately explains how the trend or correlation shows that salmon are migrating earlier to avoid warm water: "Therefore, since the temperature is getting higher the migration time is getting earlier because the salmon want to avoid the warm temperatures later in the year."

Response 2

The claim that salmon avoid warm water temperatures is very likely because, as shown in Graph 1, sightings of salmon migration decreased dramatically while, in Graph 3, temperatures in streams steadily rose higher.

Score 2

This response earns a 2. It accurately explains whether the claim is likely or not: "The claim that salmon avoid warm water temperatures is very likely." The response accurately describes a trend of at least one graph: "because, as shown in Graph 1, sightings of salmon migration decreased dramatically while, in Graph 3, temperatures in streams steadily rose higher." The response does not describe the correlation of that graph to the claim.

Response 3

The claim that salmon avoid warm water temperature is most likely true. This is most likely true because according to Figure one the salmon already use a lot of energy to travel up the river. The warm water temperatures only make the salmon use up more energy which makes them stressed and then they're not able to spawn. The salmon can also die because of bacterial infection due to the temperature. So it makes sense that the salmon would want to avoid warmer water so they start to migrate in the colder months.

Score 1

This response earns a 1. It accurately explains whether the claim is likely or not "The claim that salmon avoid warm water temperature is most likely true." The response does not accurately describe a trend in a graph or accurately describe the correlation of that graph to the claim: "This is most likely true because according to Figure one the salmon already use a lot of energy to travel up the river. The salmon can also die because of bacterial infection due to the temperature. So it makes sense that the salmon would want to avoid warmer water so they start to migrate in the colder months."

Response 4

Salmon avoid warm water temperatures because in figure 1 it shows ocean water with warm water flowing into it and the river water has cooler temperature. The text in figure one says that warmer water causes salmon to burn energy faster. That is why they stay in colder water. warmer water also increase bacterial fungal infections of salmon. Then the salmon die due to exhaustion and infection. The salmon can also get stressed reaching spawning grounds but fail to spawn.

Score 0

This response earns a 0. It does not accurately explain whether the claim is likely or not. The response does not accurately describe a trend in a graph or accurately describe the correlation of that graph to the claim: "Salmon avoid warm water temperatures because in figure 1 it shows ocean water with warm water flowing into it and the river water has cooler temperature."

Resources

Contact the LDOE

- assessment@la.gov for assessment questions
- STEM@la.gov for instructional or curriculum implementation support
- AskLDOE for general questions
- ldoecommunications@la.gov to subscribe to newsletters; include the newsletter(s) you want to subscribe to in your email

Updates Log

The table below lists any updates made to this document after the original posting date.

Available	Description of Updates
July 2025	Document original posting.

Email assessment@la.gov with any questions or comments about this released item guide.