pennsylvania
DEPARTMENT OF EDUCATION

PENNSYLVANIA
KEYSTONE EXAMS

Biology
Item and Scoring Sampler
2019

Pennsylvania Department of Education Bureau of Curriculum, Assessment and Instruction—September 2019

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INTRODUCTION

The Pennsylvania Department of Education (PDE) provides districts and schools with tools to assist in delivering focused instructional programs aligned to the Pennsylvania Core Standards. These tools include the standards, Assessment Anchor documents, Keystone Exams Test Definition, Classroom Diagnostic Tool, Standards Aligned System, and content-based item and scoring samplers. This 2019 Biology Item and Scoring Sampler is a useful tool for Pennsylvania educators in preparing students for the Keystone Exams.

This Item and Scoring Sampler contains released operational multiple-choice and constructed-response items that have appeared on previously administered Keystone Exams. These items will not appear on any future Keystone Exams. Released items provide an idea of the types of items that have appeared on operational exams and that will appear on future operational Keystone Exams. Each item has been through a rigorous review process to ensure alignment with the Assessment Anchors and Eligible Content. This sampler includes items that measure a variety of Assessment Anchor or Eligible Content statements, but it does not include sample items for all Assessment Anchor or Eligible Content statements.

The items in this sampler may be used as examples for creating assessment items at the classroom level and may be copied and used as part of a local instructional program.[1] Classroom teachers may find it beneficial to have students respond to the constructed-response items in this sampler. Educators can then use the sampler as a guide to score the responses either independently or together with colleagues.

This Item and Scoring Sampler is available in Braille format. For more information regarding Braille, call (717) 901-2238.

ABOUT THE KEYSTONE EXAMS

The Keystone Exams are end-of-course assessments currently designed to assess proficiencies in Algebra I, Biology, and Literature. For detailed information about how the Keystone Exams are being integrated into the Pennsylvania graduation requirements, please contact the Pennsylvania Department of Education or visit the PDE website at http://www.education.pa.gov.

Alignment

The Biology Keystone Exam consists of questions grouped into **two modules**: Module 1—Cells and Cell Processes and Module 2—Continuity and Unity of Life. Each module corresponds to specific content, aligned to statements and specifications included in the course-specific Assessment Anchor documents. The Biology content included in the Keystone Biology multiple-choice questions will align with the Assessment Anchors as defined by the Eligible Content statements. The process skills, directives, and action statements will also specifically align with the Assessment Anchors as defined by the Eligible Content statements.

The content included in Biology constructed-response items aligns with content included in the Eligible Content statements. The process skills, directives, and action statements included in the performance demands of the Biology constructed-response items align with specifications included in the Assessment Anchor statements, the Anchor Descriptor statements, and/or the Eligible Content statements. In other words, the verbs or action statements used in the constructed-response items or stems can come from the Eligible Content, Anchor Descriptor, or Assessment Anchor statements.

[1] The permission to copy and/or use these materials does not extend to commercial purposes.

Depth of Knowledge

Webb's Depth of Knowledge (DOK) was created by Dr. Norman Webb of the Wisconsin Center for Education Research. Webb's definition of DOK is the cognitive expectation demanded by standards, curricular activities, and assessment tasks. Webb's DOK includes four levels, from the lowest (recall) level to the highest (extended thinking) level.

Depth of Knowledge	
Level 1	Recall
Level 2	Basic Application of Skill/Concept
Level 3	Strategic Thinking
Level 4	Extended Thinking

Each Keystone item has been through a rigorous review process and is assigned a DOK level. For additional information about DOK, please visit the PDE website at http://www.pdesas.org/Static/StaticContent/LoadDoc?id=Keystone_Exams_Understanding_Depth_of_Knowledge_and_Cognitive_Complexity.pdf.

Exam Format

The Keystone Exams are delivered in a paper-and-pencil format as well as in a computer-based online format. The multiple-choice questions require students to select the best answer from four possible answer options and record their answers in the spaces provided. The correct answer for each multiple-choice question is worth one point. The constructed-response items require students to develop and write (or construct) their responses. Constructed-response items in Biology are scored using item-specific scoring guidelines based on a 0–3-point scale. Each multiple-choice question is designed to take about one minute to one-and-a-half minutes to complete. Each constructed-response item is designed to take about eight minutes to complete. The estimated time to respond to a test question is the same for both test formats. During an actual exam administration, students are given additional time as necessary to complete the exam.

ITEM AND SCORING SAMPLER FORMAT

This sampler includes the test directions and scoring guidelines that appear in the Keystone Exams. Each sample multiple-choice question is followed by a table that includes the alignment, the answer key, the DOK, the percentage[2] of students who chose each answer option, and a brief answer option analysis or rationale. Each constructed-response item is followed by a table that includes the item alignment, the DOK, and the mean student score. Additionally, each of the included item-specific scoring guidelines is combined with sample student responses representing each score point to form a practical, item-specific scoring guide. The General Description of Scoring Guidelines for Biology used to develop the item-specific scoring guidelines should be used if any additional item-specific scoring guidelines are created for use within local instructional programs.

Example Multiple-Choice Question Information Table

Item Information	
Alignment	Assigned AAEC
Answer Key	Correct Answer
Depth of Knowledge	Assigned DOK
p-value A	Percentage of students who selected option A
p-value B	Percentage of students who selected option B
p-value C	Percentage of students who selected option C
p-value D	Percentage of students who selected option D
Option Annotations	Brief answer option analysis or rationale

Example Open-Ended Item Information Table

Alignment	Assigned AAEC	**Depth of Knowledge**	Assigned DOK	**Mean Score**	

[2] All *p*-value percentages listed in the item information tables have been rounded.

BIOLOGY EXAM DIRECTIONS

Directions:

Below are the exam directions available to students. These directions may be used to help students navigate through the exam.

On the following pages of this test booklet are the Keystone Biology Exam questions for Module 1 [or Module 2].

There are two types of questions in this module.

Multiple-Choice Questions:

These questions will ask you to select an answer from among four choices.

- Read each question, and choose the correct answer.
- Only one of the answers provided is correct.
- Record your answer in the Biology answer booklet.

Constructed-Response Questions:

These questions will require you to write your response.

- Be sure to read the directions carefully.
- You cannot receive the highest score for a constructed-response question without following all directions.
- If the question asks you to do multiple tasks, be sure to complete all tasks.
- If the question asks you to explain, be sure to explain. If the question asks you to analyze, describe, or compare, be sure to analyze, describe, or compare.
- All responses must be written in the appropriate location within the response box in the Biology answer booklet. If you use scratch paper to write your draft, be sure to transfer your final response to the Biology answer document.

In addition, a module may also include scenarios. A scenario contains text, graphics, charts, and/or tables describing a biological concept, an experiment, or other scientific research. You can use the information contained in a scenario to answer certain exam questions. Before responding to any scenario questions, be sure to study the entire scenario and follow the directions for the scenario. You may refer back to the scenario at any time when answering the scenario questions.

If you finish early, you may check your work in Module 1 [or Module 2] only.

- Do not look ahead at the questions in Module 2 [or back at the questions in Module 1] of your exam materials.
- After you have checked your work, close your exam materials.

You may refer to this page at any time during this portion of the exam.

GENERAL DESCRIPTION OF SCORING GUIDELINES FOR BIOLOGY

3 Points

- The response demonstrates a *thorough* understanding of the scientific content, concepts, and/or procedures required by the task(s).
- The response provides a clear, complete, and correct response as required by the task(s). The response may contain a minor blemish or omission in work or explanation that does not detract from demonstrating a thorough understanding.

2 Points

- The response demonstrates a *partial* understanding of the scientific content, concepts, and/or procedures required by the task(s).
- The response is somewhat correct with partial understanding of the required scientific content, concepts, and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

1 Point

- The response demonstrates a *minimal* understanding of the scientific content, concepts, and/or procedures required by the task(s).
- The response is somewhat correct with minimal understanding of the required scientific content, concepts, and/or procedures demonstrated and/or explained. The response may contain some work that is incomplete or unclear.

0 Points

- The response provides *insufficient* evidence to demonstrate any understanding of the scientific content, concepts, and/or procedures as required by the task(s).
- The response may show only information copied or rephrased from the question or insufficient correct information to receive a score of 1.

Special Categories within zero reported separately:

Blank.....Blank, entirely erased, entirely crossed out, or consists entirely of whitespace

Refusal.....Refusal to respond to the task

Off Task.....Makes no reference to the item but is not an intentional refusal

Foreign Language.....Written entirely in a language other than English

Illegible .....Illegible or incoherent

BIOLOGY MODULE 1
MULTIPLE-CHOICE QUESTIONS

1. Which of the following is essential to proper functioning of **all** prokaryotic and eukaryotic organisms?

A. O_2

B. CO_2

C. ATP

D. NaCl

Item Information	
Alignment	BIO.A.1.1.1
Answer Key	C
Depth of Knowledge	2
p-value A	20%
p-value B	16%
p-value C	60% (correct answer)
p-value D	4%
Option Annotations	A. Anaerobic organisms can function without oxygen. B. Carbon dioxide is not a necessary input for all organisms. C. Key: ATP is the essential molecule for transferring chemical energy within all cells. D. Sodium chloride is not a necessary input for all organisms.

2. Which statement **best** compares eukaryotic cells and prokaryotic cells?

A. Eukaryotic cells are smaller than prokaryotic cells.

B. Prokaryotic cells are more complex than eukaryotic cells.

C. Prokaryotic cells contain a distinct central organelle, and eukaryotic cells do not.

D. Eukaryotic cells contain membrane-bound organelles, and prokaryotic cells do not.

Item Information	
Alignment	BIO.A.1.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	7%
p-value B	15%
p-value C	16%
p-value D	62% (correct answer)
Option Annotations	A. Most eukaryotic cells are larger than prokaryotic cells. B. Prokaryotic cells are less complex than eukaryotic cells. C. Prokaryotic cells do not contain a nucleus or distinct central organelle. D. Key: Membrane-bound organelles such as the nucleus, mitochondria, and chloroplasts are not found in prokaryotes.

3. Lungs and capillaries both have porous linings that allow certain substances to move into or out of the structures. Which function do these porous linings **most likely** serve in living organisms?

A. heat release

B. gas exchange

C. carbohydrate absorption

D. osmotic pressure regulation

Item Information	
Alignment	BIO.A.1.2.2
Answer Key	B
Depth of Knowledge	2
p-value A	12%
p-value B	53% (correct answer)
p-value C	17%
p-value D	18%
Option Annotations	A. Heat release occurs primarily through outer structures, such as skin. B. Key: Oxygen and carbon dioxide molecules are transferred into and out of capillaries in the lungs. C. Carbohydrate absorption occurs primarily in the small intestine. D. Osmotic pressure is the force of water in a plant's central vacuole.

4. Which property of water is **most** responsible for plants being able to transport water from their roots to their leaves?

A. the attraction between molecules

B. a capacity to dissolve many substances

C. the ability to form a low-density crystalline structure when frozen

D. a capacity to absorb large amounts of energy as temperature increases

Item Information	
Alignment	BIO.A.2.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	68% (correct answer)
p-value B	8%
p-value C	6%
p-value D	18%
Option Annotations	A. Key: Hydrogen bonds form between water molecules, and capillary action draws the water up the roots and stem to leaves. B. Water is not transported by dissolving substances. C. Water is not transported by being frozen. D. Having a high heat capacity is not responsible for transporting water.

5. The element carbon has multiple bonding patterns. Which bonding pattern **cannot** be formed by carbon?

A. C—C

B. C—C—C

C. C═C═C

D. C≡C≡C

Item Information	
Alignment	BIO.A.2.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	21%
p-value B	8%
p-value C	10%
p-value D	61% (correct answer)
Option Annotations	A. Carbon can form single bonds with one other carbon atom. B. Carbon can form single bonds with two other carbon atoms. C. Carbon can form two double bonds with two other carbon atoms. D. Key: Carbon has only four valence electrons and the pattern shown would require six valence electrons.

6. Which process **best** describes the assembly of proteins from amino acids?

A. Atoms are linked to form a compound.

B. Monomers are linked to form a polymer.

C. Atoms are added to a monomer until it becomes a polymer.

D. Molecules are added to a compound until it becomes a monomer.

Item Information	
Alignment	BIO.A.2.2.2
Answer Key	B
Depth of Knowledge	2
p-value A	16%
p-value B	61% (correct answer)
p-value C	13%
p-value D	10%
Option Annotations	A. Amino acids, not atoms, are complex molecules. B. Key: Amino acids are monomers that link together to form complex protein polymers. C. Adding atoms to a monomer does not make it a polymer. D. Proteins are polymers, not monomers.

7. Which statement **best** compares a carbohydrate and a nucleic acid?

A. The sequence of monomers in a carbohydrate stores genetic information, and the bonds in a nucleic acid store energy.

B. The bonds in a carbohydrate store energy, and the sequence of nucleotides in a nucleic acid stores genetic information.

C. A carbohydrate has a unique structure to assist diffusion across a plasma membrane, and a nucleic acid has a unique structure to assist chemical reactions.

D. A carbohydrate has a unique structure to assist chemical reactions, and a nucleic acid has a unique structure to assist diffusion across a plasma membrane.

Item Information	
Alignment	BIO.A.2.2.3
Answer Key	B
Depth of Knowledge	2
p-value A	9%
p-value B	58% (correct answer)
p-value C	21%
p-value D	12%
Option Annotations	A. Monomers of carbohydrates store energy in their bonds. The sequence of nucleotides stores genetic information. B. Key: Energy is stored in the bonds of carbohydrates such as glucose. The genetic code of DNA is determined by the sequence of nucleic acid monomers called nucleotides. C. Channel proteins, not carbohydrates, help facilitate diffusion. Enzymes, not nucleic acids, assist in chemical reactions. D. Enzymes, not carbohydrates, assist in chemical reactions. Channel proteins, not nucleic acids, help facilitate diffusion.

8. Each cell in the human body contains thousands of different enzymes responsible for regulating reactions within the cell. Which statement explains why a single enzyme is unable to regulate a variety of reactions?

A. The binding of a product and an enzyme is specific.

B. The binding of a substrate and an enzyme is specific.

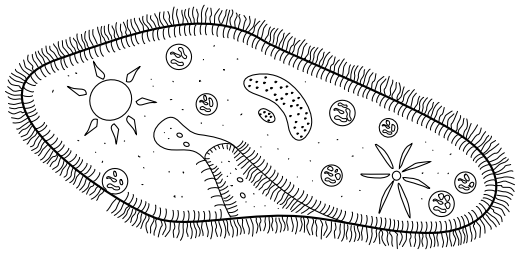
C. The enzyme is consumed by the products of the reactions.

D. The enzyme is consumed by the substrates of the reactions.

Item Information	
Alignment	BIO.A.2.3.1
Answer Key	B
Depth of Knowledge	2
p-value A	16%
p-value B	51% (correct answer)
p-value C	16%
p-value D	17%
Option Annotations	A. The enzyme binds to the substrate and releases the product. B. Key: The active site on an enzyme fits only a specific substrate. C. The enzyme is a catalyst, and catalysts are not consumed in a reaction. D. The enzyme is a catalyst, and catalysts are not consumed in a reaction.

9. Use the drawing below to answer the question.

Paramecium



Which statement **best** describes a direct role of ATP in a paramecium?

A. ATP provides the energy to move cilia.

B. ATP stores the genetic code for replication.

C. ATP signals the presence of other nearby organisms.

D. ATP senses changes in the surrounding aquatic environment.

Item Information	
Alignment	BIO.A.3.2.2
Answer Key	A
Depth of Knowledge	2
p-value A	75% (correct answer)
p-value B	13%
p-value C	7%
p-value D	5%
Option Annotations	A. Key: ATP is the primary molecule of energy transfer in a cell. B. DNA stores the genetic code, not ATP. C. Signals are sent and received by receptor proteins, not ATP. D. Environmental changes are sensed by receptor proteins, not ATP.

10. Which statement **best** describes a function of the proteins embedded in the plasma membrane of cells?

A. They provide instructions for the processes in the cell.

B. They selectively allow certain particles into and out of the cell.

C. They attract charges in the cell's environment to give the cell a net charge.

D. They store the energy required by the rest of the membrane to perform its functions.

Item Information	
Alignment	BIO.A.4.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	10%
p-value B	51% (correct answer)
p-value C	8%
p-value D	31%
Option Annotations	A. The nucleic acids such as DNA and RNA provide cellular instructions. B. Key: Channel proteins and protein pumps regulate the movement of materials, such as gases and nutrients, across the plasma membrane. C. The unequal distribution of ions inside and outside the cell causes the cell's net charge, not the embedded proteins. D. Lipid molecules store energy, not proteins.

11. How does a mitochondrion facilitate the movement of some materials between cells?

A. It supplies the energy needed for moving molecules through membranes.

B. It manufactures the proteins needed to form channels in cell membranes.

C. It supplies digestive substances that break large molecules into smaller units.

D. It produces fibers that attach to molecules and move them through the cytoplasm.

Item Information	
Alignment	BIO.A.4.1.3
Answer Key	A
Depth of Knowledge	2
p-value A	59% (correct answer)
p-value B	19%
p-value C	11%
p-value D	11%
Option Annotations	A. Key: Mitochondria convert glucose to ATP, the primary molecule of energy transfer for cells. B. Ribosomes, not mitochondria, build proteins. C. Lysosomes, not mitochondria, help digest molecules. D. The cytoskeleton, not mitochondria, helps move molecules through the cytoplasm.

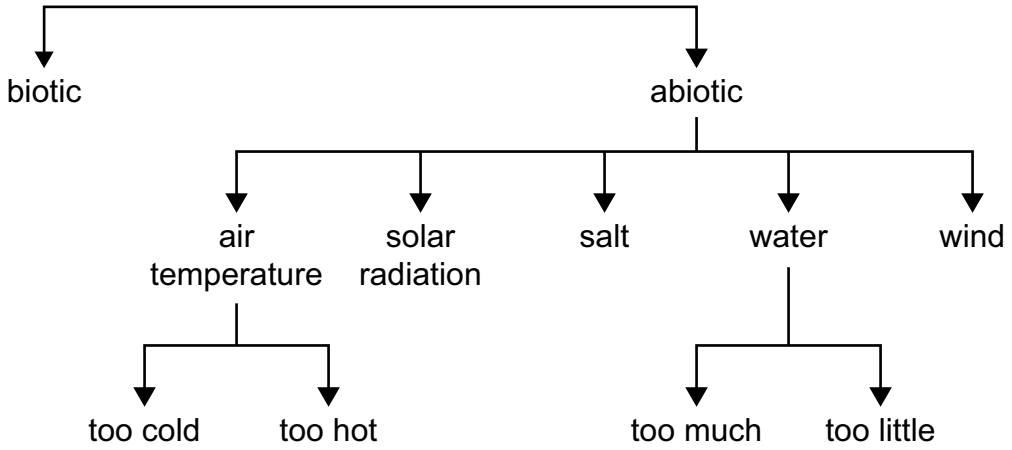
Directions: Use the information presented on page 17 to answer questions 12 and 13.

Stress on Plants

Plant researchers are currently investigating the concept that crop plants are negatively affected by environmental stress. Researchers propose that reducing a plant's susceptibility to stress could result in increased crop yields.

Environmental stresses affect the molecular signals that initiate the biochemical pathways of plants. By identifying exactly which signals and which pathways are affected by specific stresses, scientists propose that a minor amount of genetic manipulation could produce healthier crops.

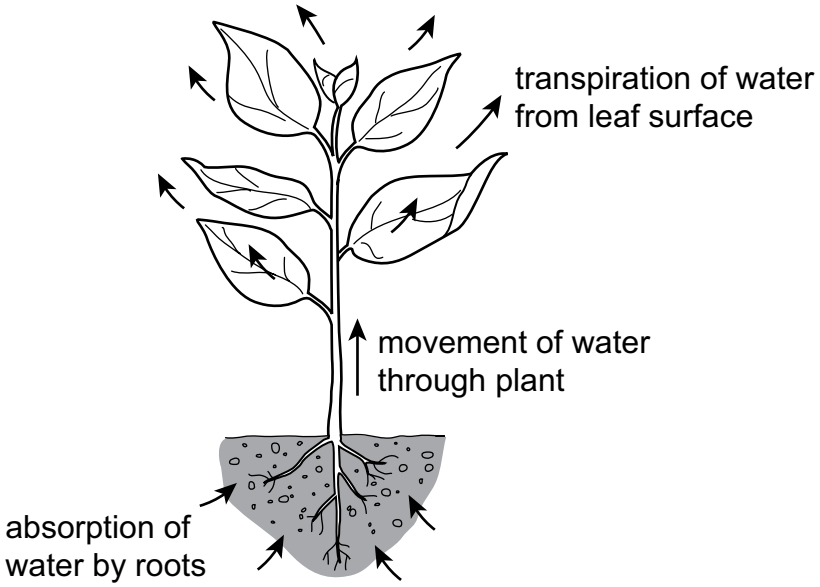
Environmental Stress Factors on Plants



To study plant stress, plant researchers use molecular indicators within the cytoplasm of specific cells. These indicators provide the researchers with the stress "warning bells" needed to identify the cause of the stress and the reaction of the plants. The most common warning bells that have been observed in stressed plants are proteins that have been folded incorrectly. These misfolded proteins are bulky and crowd the cell, interrupting multiple cell processes. When these misfolded proteins are present, the cell is signaled to activate certain genes that will benefit future protein folding. The production of these "folding helpers" then helps to alleviate the plant's stress signals and returns the plant to normal operating conditions.

12. Use the diagram below to answer the question.

Capillary Action in a Plant



Plants are dependent on water. In most plants, water is absorbed by the roots and then moves up the stem of the plant and into the leaves by capillary action. Which properties of water are **most** responsible for the capillary action in plants?

A. adhesion and cohesion

B. low density and adhesion

C. polarity and high specific heat

D. high specific heat and cohesion

Item Information	
Alignment	BIO.A.2.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	65% (correct answer)
p-value B	14%
p-value C	8%
p-value D	13%
Option Annotations	A. Key: Capillary action is the result of hydrogen bonds forming between water molecules and the water molecules being attracted to the molecules inside the stem. B. The density of water is not the cause of water molecules sticking together. C. Polarity of water causes the cohesion, but high specific heat does not impact capillary action. D. Cohesion attracts water molecules to each other, but high specific heat does not impact capillary action.

13. What is the main purpose for initiating the production of folding helpers in a cell?

A. DNA replication

B. forming gametes

C. passive transport

D. maintaining homeostasis

Item Information	
Alignment	BIO.A.4.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	14%
p-value B	10%
p-value C	17%
p-value D	59% (correct answer)
Option Annotations	A. DNA replication does not involve “folding helpers”. B. Meiosis does not use “folding helpers” to produce gametes. C. “Folding helpers” are not involved in diffusion or osmosis. D. Key: “Folding helpers” ensure the correct folding of proteins to return the plant to normal operating conditions, which is homeostasis.

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CONSTRUCTED-RESPONSE ITEM

14. Students were asked to select a location at a local park and make observations of organisms. The observations from one student are shown in the list.

Observations in a Park

1. A rabbit is eating grass.
2. A robin is resting on a nest of blue eggs.
3. A turtle resting on a rock moves into the pond water.
4. A bee transfers pollen between flowers as it collects nectar.

Part A: Some characteristics of life are shared by all organisms on Earth. Select two observations from the list and explain how each observation provides evidence to support a specific characteristic of life.

Observation Number: _____

Characteristic of life supported by the observation: _____

_____

_____

_____

Observation Number: _____

Characteristic of life supported by the observation: _____

_____

_____

_____

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Some scientists include the ability to adapt and evolve as a characteristic of life. Explain why the student would not likely make an observation at the park that would provide evidence to support this as a characteristic of life.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.

STOP

Item-Specific Scoring Guideline

#14 Item Information

Alignment	BIO.A.1.1.1	**Depth of Knowledge**	3	**Mean Score**	1.77

Scoring Guide

Score	Description
3	The response demonstrates a *thorough* understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms by • explaining how one of four student observations from a local park supports a characteristic of life. • explaining how a second of four student observations from a local park supports a characteristic of life. • explaining why the student would not likely make an observation at the park that would provide evidence to support that the ability to adapt and evolve is a characteristic of life. The response is clear, complete, and correct.
2	The response demonstrates a *partial* understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms by fulfilling **two** of the bullets under the 3-point response. The response may contain some work that is incomplete or unclear.
1	The response demonstrates a *minimal* understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms by fulfilling **one** of the bullets listed under the 3-point response. The response may contain some work that is incomplete or unclear.
0	The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested.
Non-scorables	B – No response written or refusal to respond F – Foreign language K – Off task U – Unreadable

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit:

Part A (2 points; 1 point for each of two observations and the characteristic of life it supports):

- Observation 1: The rabbit is eating grass to obtain energy
  OR
- Observation 1: Living organisms are made of cells and the rabbit is eating grass to obtain the organic molecules needed to build cells

- Observation 2: Living organisms reproduce, and the robin reproduces by laying eggs
  OR
- Observation 2: Living organisms reproduce, and the robin is incubating her eggs as part of the reproductive process

- Observation 3: The turtle uses energy to move into the water
  OR
- Observation 3: Living organisms maintain homeostasis, and the turtle moves into the water to maintain an efficient body temperature

- Observation 4: The bee is collecting nectar for energy
  OR
- Observation 4: Living organisms are made of cells and the bee is collecting nectar to obtain the organic molecules needed to build cells
  OR
- Observation 4: Living organisms reproduce, and the flowers use pollen for reproduction
  OR
- Observation 4: Living organisms reproduce, and the flowers attract bees to help them reproduce

Part B (1 point):

- The process of evolving generally takes a long time and is carried out by a group of organisms over many generations, so this could not be observed during one park visit
  OR
- The process of evolving and adapting is not carried out by an individual organism, but by a population of organisms over a long time period, so this could not be observed during one park visit

Background Information:

- Evolution can be observed over short time periods, as when a bacterial population is treated with an antibiotic and only the few resistant bacteria survive, so the population has evolved. But this is still not something the students would observe in a park.

STUDENT RESPONSE

Response Score: 3 points

14. Students were asked to select a location at a local park and make observations of organisms. The observations from one student are shown in the list.

Observations in a Park

1. A rabbit is eating grass.
2. A robin is resting on a nest of blue eggs.
3. A turtle resting on a rock moves into the pond water.
4. A bee transfers pollen between flowers as it collects nectar.

Part A: Some characteristics of life are shared by all organisms on Earth. Select two observations from the list and explain how each observation provides evidence to support a specific characteristic of life.

Observation Number: 1

Characteristic of life supported by the observation: The rabbit eating grass would be obtaining the energy needed to live

Observation Number: 3

Characteristic of life supported by the observation: The turtle resting on a rock that then moves into the pond water would be maintaining a survivable temperature to live.

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Some scientists include the ability to adapt and evolve as a characteristic of life. Explain why the student would not likely make an observation at the park that would provide evidence to support this as a characteristic of life.

Evolution is a process of change over a long period of time. Therefore evolution is not something the student would be able to witness in a short period of time.

The response demonstrates a thorough understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms. In Part A, the response correctly explains how two of the four student observations from a local park support a characteristic of life (*Observation Number 1 . . . obtaining the energy needed to live; Observation Number 3 . . . maintaining a survivable temperature to live*). In Part B, the response correctly explains why the student would not likely make an observation at the park that would provide evidence to support the ability to adapt and evolve as a characteristic of life (*Evolution is a process of change over a long period of time . . . not something the student would be able to witness in a short period of time*). The response is clear, complete, and correct.

STUDENT RESPONSE

Response Score: 2 points

14. Students were asked to select a location at a local park and make observations of organisms. The observations from one student are shown in the list.

Observations in a Park

1. A rabbit is eating grass.
2. A robin is resting on a nest of blue eggs.
3. A turtle resting on a rock moves into the pond water.
4. A bee transfers pollen between flowers as it collects nectar.

Part A: Some characteristics of life are shared by all organisms on Earth. Select two observations from the list and explain how each observation provides evidence to support a specific characteristic of life.

Observation Number: 4

Characteristic of life supported by the observation: The ability to survive and reproduce.

Observation Number: 3

Characteristic of life supported by the observation: The ability to maintain a stable internal environment.

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Some scientists include the ability to adapt and evolve as a characteristic of life. Explain why the student would not likely make an observation at the park that would provide evidence to support this as a characteristic of life.

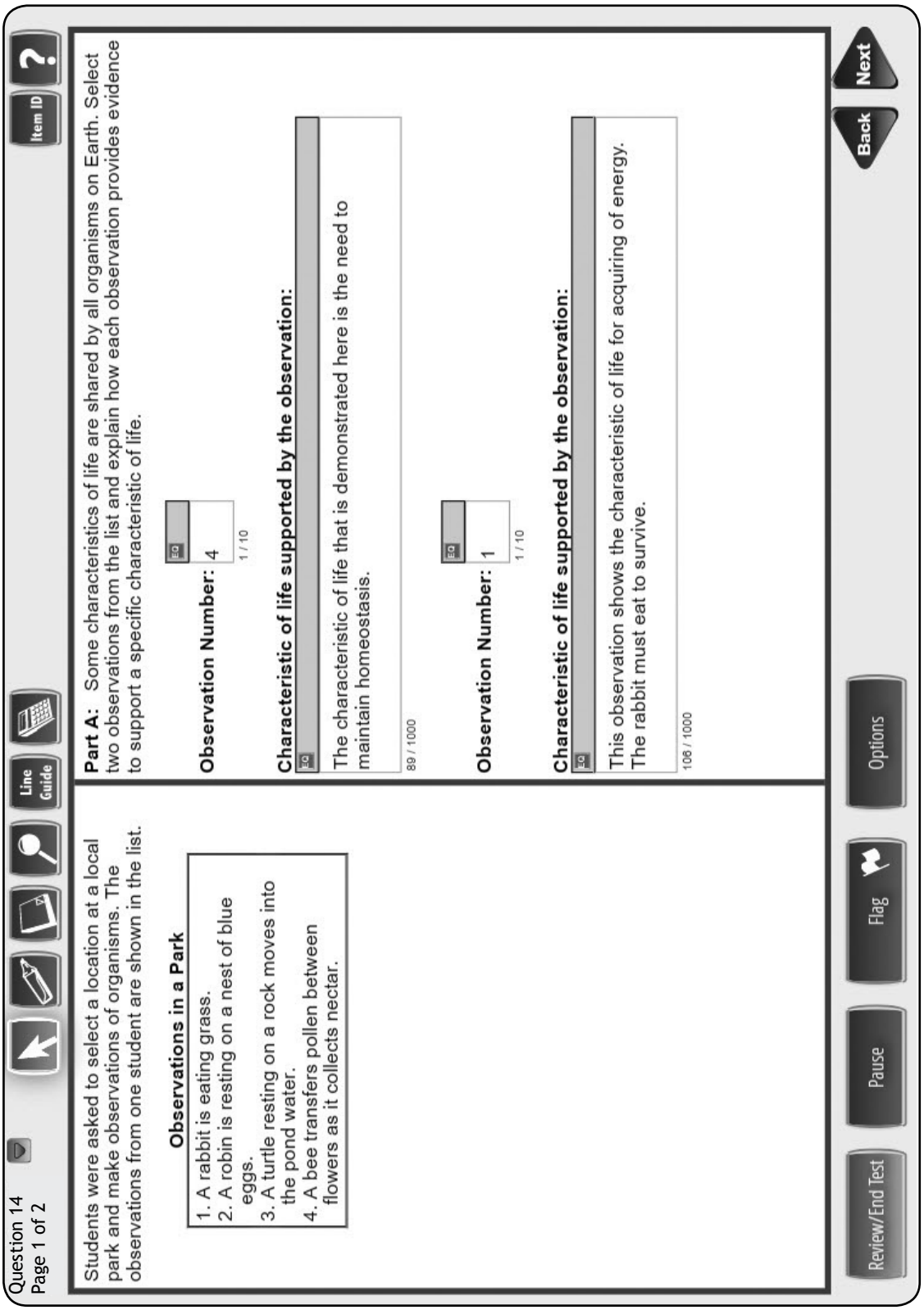
The student wouldn't find an animal that could evolve, only an animal that could adapt. There would be no evidence to support this as a characteristic of life.

The response demonstrates a partial understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms. In Part A, the response correctly explains how two of the four student observations from a local park support a characteristic of life (*Observation Number 4 . . . The ability to reproduce; Observation Number 3 . . . maintain a stable internal environment*). In Part B, the response does not correctly explain why the student would not likely make an observation at the park that would provide evidence to support the ability to adapt and evolve as a characteristic of life (*only find an animal that could adapt*) and does not receive any credit.

STUDENT RESPONSE

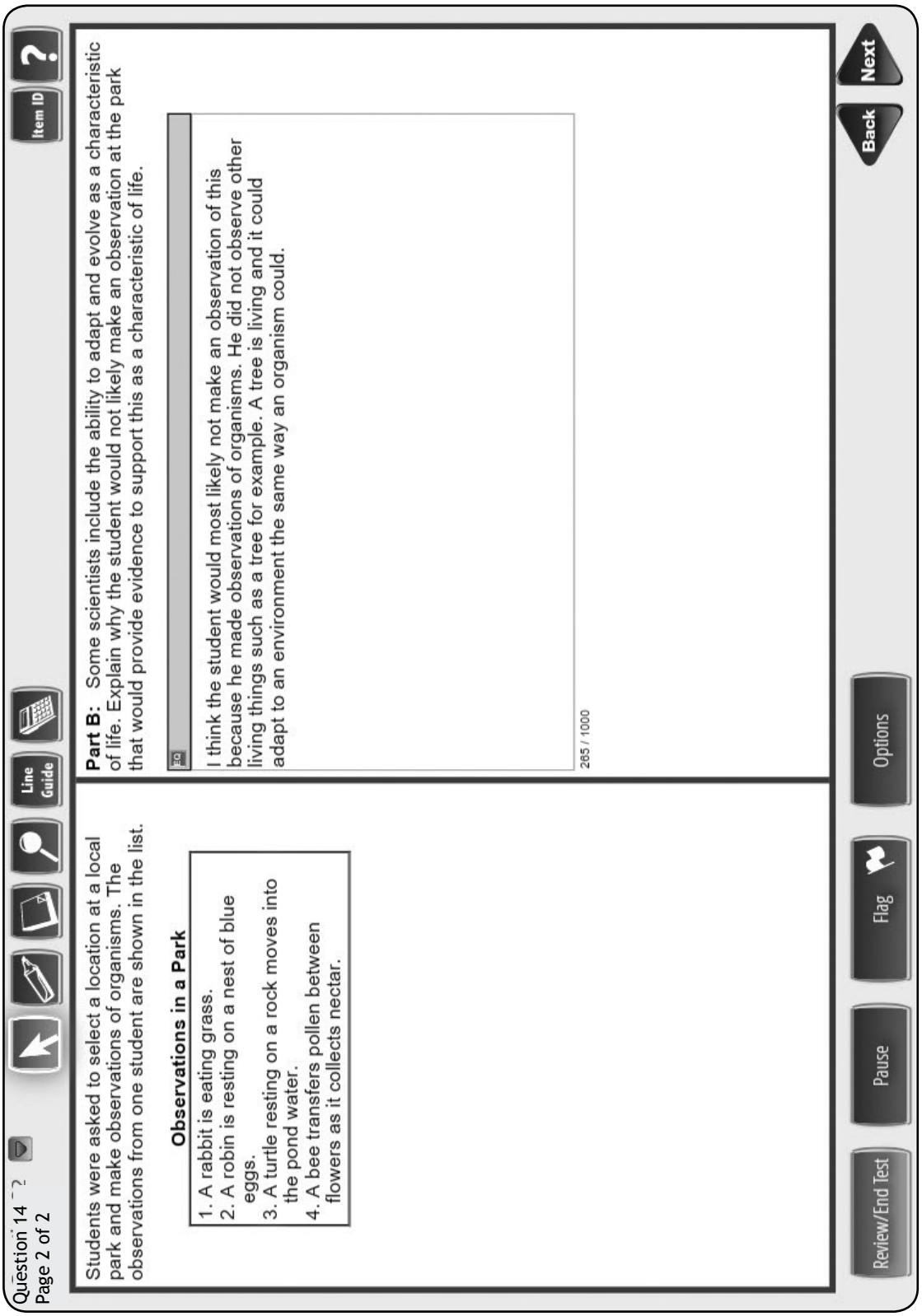
Response Score: 1 point

Part A



STUDENT RESPONSE

Part B



The response demonstrates a minimal understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms. In Part A, the response correctly explains how only one of the four student observations from a local park supports a characteristic of life (*Observation Number 1 . . . the acquiring of energy*). The student's response concerning Observation Number 4 (*need to maintain homeostasis*) is incorrect for the bee transferring pollen and does not receive any credit. In Part B, the response does not correctly explain why the student would not likely make an observation at the park that would provide evidence to support the ability to adapt and evolve as a characteristic of life (*. . . because he made observations of organisms. He did not observe other living things*) and does not receive any credit.

STUDENT RESPONSE

Response Score: 0 points

14. Students were asked to select a location at a local park and make observations of organisms. The observations from one student are shown in the list.

Observations in a Park

1. A rabbit is eating grass.
2. A robin is resting on a nest of blue eggs.
3. A turtle resting on a rock moves into the pond water.
4. A bee transfers pollen between flowers as it collects nectar.

Part A: Some characteristics of life are shared by all organisms on Earth. Select two observations from the list and explain how each observation provides evidence to support a specific characteristic of life.

Observation Number: 2

Characteristic of life supported by the observation: It shows the mother protecting her babies, how she is making life itself.

Observation Number: 4

Characteristic of life supported by the observation: It spreads the pollen needed for one another plus the nectar should be removed.

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Some scientists include the ability to adapt and evolve as a characteristic of life. Explain why the student would not likely make an observation at the park that would provide evidence to support this as a characteristic of life.

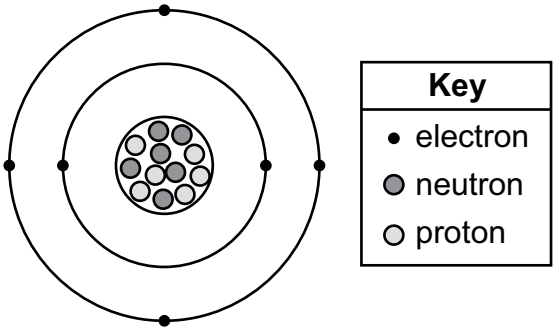
Because their so many people so the animals wouldn't come out

The response provides insufficient evidence to demonstrate any understanding of the characteristics of life shared by all prokaryotic and eukaryotic organisms. In Part A, the response does not correctly explain how any of the student observations from a local park support a characteristic of life (*Observation Number 2 . . . protecting her babies; Observation Number 3 . . . it spreads the pollen needed*) and does not receive any credit. In Part B, the response does not correctly explain why the student would not likely make an observation at the park that would provide evidence to support the ability to adapt and evolve as a characteristic of life (*. . . so the animals wouldn't come out*) and receives no credit.

CONSTRUCTED-RESPONSE ITEM

15. A model is shown.

Carbon Atomic Model



Part A: Identify the maximum number of bonds one carbon atom can form.

Part B: Describe how electrons are involved in the formation of biological macromolecules.

Go to the next page to finish question 15.

GO ON

15. ***Continued.*** Please refer to the previous page for task explanation.

Part C: Carbon is often considered the backbone of biological macromolecules. However, hydrogen is the most abundant element in the universe.

Explain why the backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.

STOP

Item-Specific Scoring Guideline

#15 Item Information

Alignment	BIO.A.2.2.1	**Depth of Knowledge**	3	**Mean Score**	1.20

Scoring Guide

Score	Description
3	The response demonstrates a *thorough* understanding of how carbon is uniquely suited to form biological macromolecules by • identifying the maximum number of bonds that one carbon atom can form. • describing how electrons are involved in the formation of biological macromolecules. • explaining why the backbone of large macromolecules is made of carbon atoms rather than the more abundant hydrogen atoms. The response is clear, complete, and correct.
2	The response demonstrates a *partial* understanding of how carbon is uniquely suited to form biological macromolecules by fulfilling **two** of the bullets under the 3-point response. The response may contain some work that is incomplete or unclear.
1	The response demonstrates a *minimal* understanding of how carbon is uniquely suited to form biological macromolecules by fulfilling **one** of the bullets listed under the 3-point response. The response may contain some work that is incomplete or unclear.
0	The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested.
Non-scorables	B – No response written or refusal to respond F – Foreign language K – Off task U – Unreadable

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit:

Part A (1 point):

- One carbon atom can form a maximum of four bonds

Part B (1 point):

- Electrons are involved in forming covalent bonds between atoms, and covalent bonds are required to form biological macromolecules.
  OR
- In strong chemical bonds such as those found in biological macromolecules, electrons are shared between atoms.
  OR
- Covalent bonds are formed when electrons are shared between a pair of atoms, and biological macromolecules are formed using covalent bonds
  OR
- Electrons are constantly moving around atoms and this results in transient charges at various locations on a molecule. The brief attraction between opposite transient charges helps proteins to keep their proper shape.
  OR
- Ionic bonds can help a protein fold into the correct shape. These bonds form due to the attraction of oppositely charged ions, which result from a loss or gain of an electron.
  OR
- Hydrogen bonds help a protein fold into the correct shape and allow base pairing in nucleic acids. These bonds form due to the attraction of partially charged regions of polar molecules, which result from unequal sharing of electrons in polar covalent bonds.

Part C (1 point):

- Because carbon atoms make four covalent bonds, they can form many types of backbones with many other atoms attached. Hydrogen can only make one covalent bond, so it cannot form chains or backbones.
  OR
- Carbon atoms have four valence electrons and can therefore make four bonds. Hydrogen atoms have only one valence electron and therefore can make only one bond. In order to make a chain or backbone, each atom must be able to make multiple bonds, not just one.

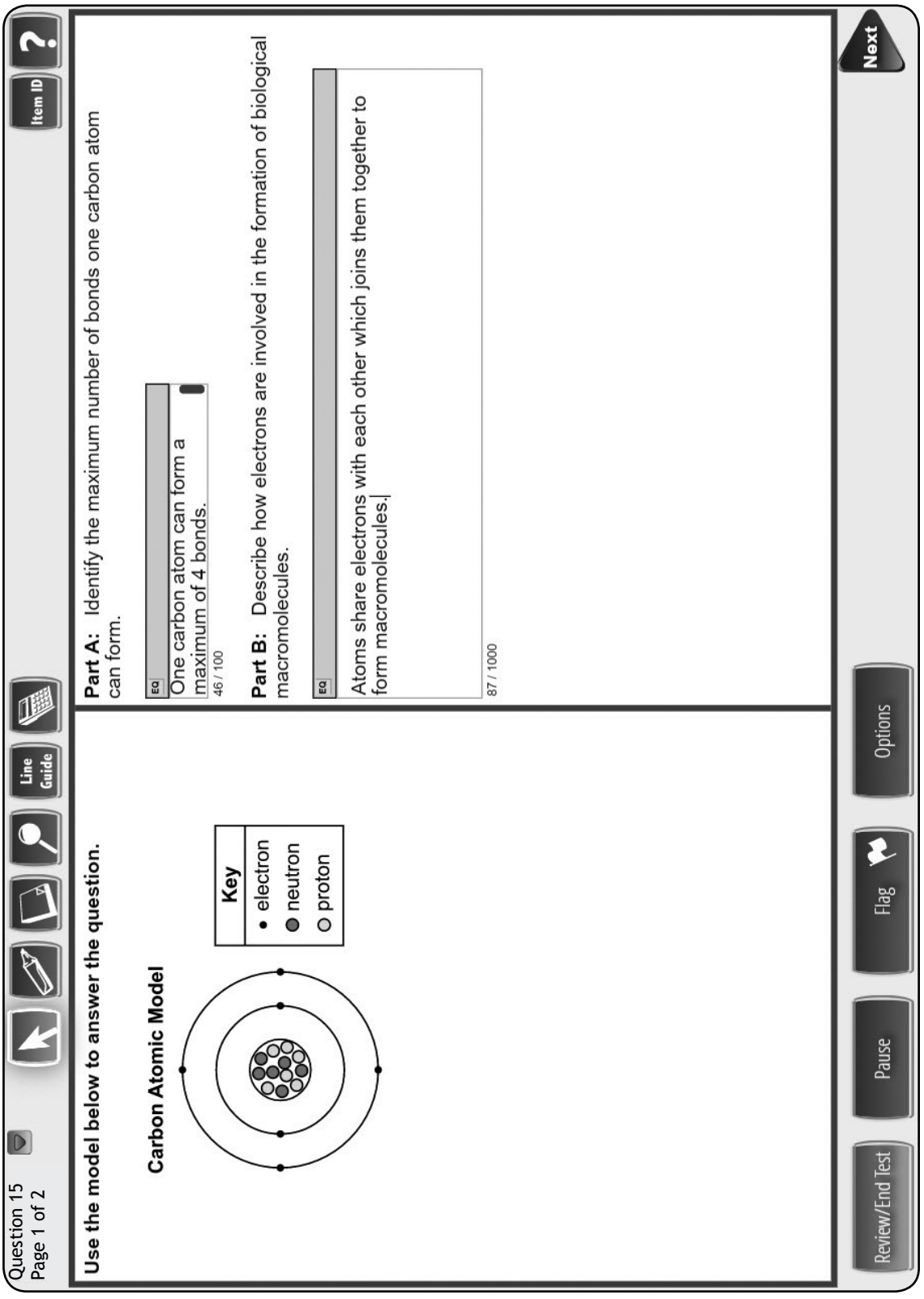
Background Information:

- When electrons are shared equally between two atoms, this forms a nonpolar covalent bond, which is the strongest type of bond.
- Biological macromolecules generally have both polar and nonpolar covalent bonds.

STUDENT RESPONSE

Response Score: 3 points

Parts A and B



STUDENT RESPONSE

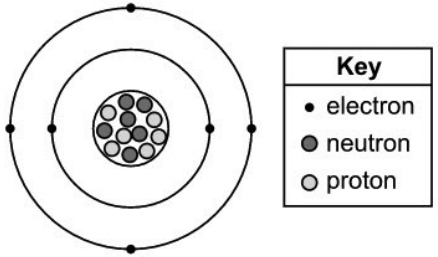
Part C

Question 15
Page 2 of 2

Line Guide | Item ID | ?

Use the model below to answer the question.

Carbon Atomic Model



Part C: Carbon is often considered the backbone of biological macromolecules. However, hydrogen is the most abundant element in the universe.

Explain why the backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms.

EQ

The backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms because they can form more bonds than a hydrogen atom can.

146 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

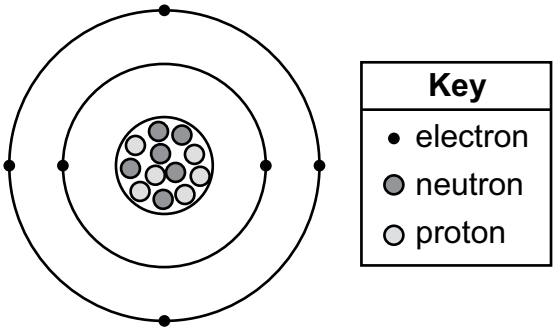
This response demonstrates a thorough understanding of how carbon is uniquely suited to form biological macromolecules. In Part A, the response correctly identifies the maximum number of bonds that one carbon atom can form (*"4 bonds"*). In Part B, the response correctly describes how electrons are involved in the formation of biological macromolecules (*"Atoms share electrons with each other which joins them together to form macromolecules"*). In Part C, the response correctly explains why the backbone of large macromolecules is made of carbon atoms rather than the more abundant hydrogen atoms (*"because they can form more bonds than a hydrogen atom can"*). The response is clear, complete and correct.

STUDENT RESPONSE

Response Score: 2 points

15. A model is shown.

Carbon Atomic Model



Part A: Identify the maximum number of bonds one carbon atom can form.

A carbon atom can form up to four bonds.

Part B: Describe how electrons are involved in the formation of biological macromolecules.

The same amount of protons and neutrons used is equal to the number of electrons used.

Go to the next page to finish question 15.

GO ON

15. ***Continued.*** Please refer to the previous page for task explanation.

Part C: Carbon is often considered the backbone of biological macromolecules. However, hydrogen is the most abundant element in the universe.

Explain why the backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms.

The backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms, because carbon is able to from more bonds.

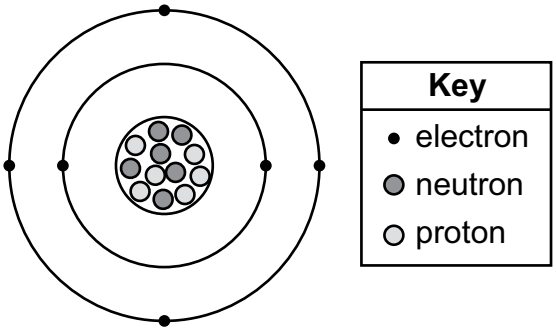
This response demonstrates a partial understanding of how carbon is uniquely suited to form biological macromolecules. In Part A, the response correctly identifies the maximum number of bonds that one carbon atom can form (*"up to four bonds"*). In Part B, the response incorrectly describes how electrons are involved in the formation of biological macromolecules (*"The same amount of protons and neutrons used is equal to the number of electrons used"*). In Part C, the response correctly explains why the backbone of large macromolecules is made of carbon atoms rather than the more abundant hydrogen atoms (*"because carbon is able to from more bonds"*). The response contains some work that is unclear.

STUDENT RESPONSE

Response Score: 1 point

15. A model is shown.

Carbon Atomic Model



Part A: Identify the maximum number of bonds one carbon atom can form.

4

Part B: Describe how electrons are involved in the formation of biological macromolecules.

electrons are involved in formation of biological macromolecules through evolution and time,

Go to the next page to finish question 15.

GO ON

15. ***Continued.*** Please refer to the previous page for task explanation.

Part C: Carbon is often considered the backbone of biological macromolecules. However, hydrogen is the most abundant element in the universe.

Explain why the backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms.

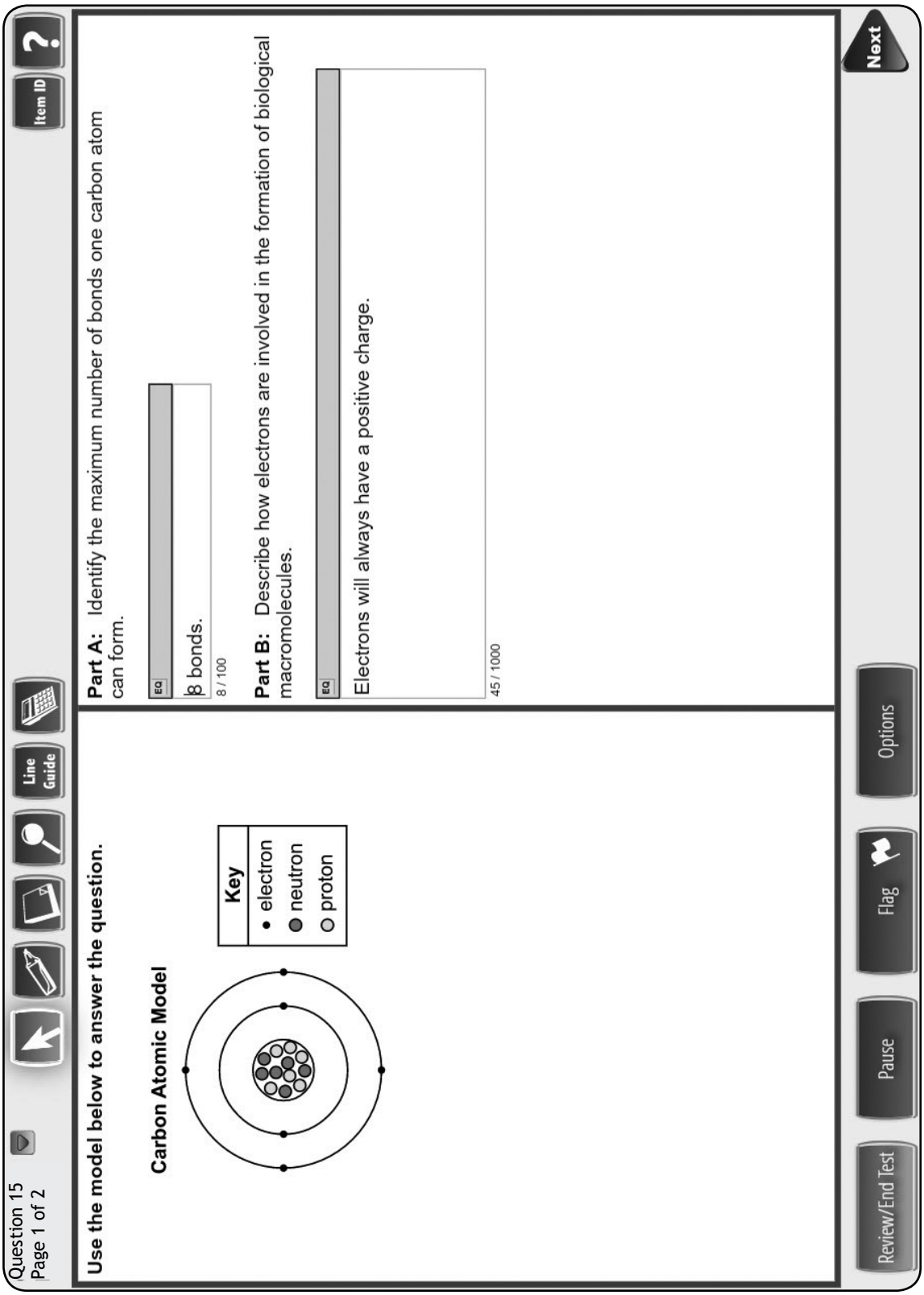
Backboneof large carbon atoms connect to other atoms.

This response demonstrates a minimal understanding of how carbon is uniquely suited to form biological macromolecules. In Part A, the response correctly identifies the maximum number of bonds that one carbon atom can form (*"4"*). In Part B, the response incorrectly describes how electrons are involved in the formation of biological macromolecules (*"through evolution and time"*). In Part C, the response incorrectly explains why the backbone of large macromolecules is made of carbon atoms rather than the more abundant hydrogen atoms (*"Backboneof large carbon atoms connect to other atoms"*). Some of the work in this response is incomplete and unclear.

STUDENT RESPONSE

Response Score: 0 points

Parts A and B



STUDENT RESPONSE

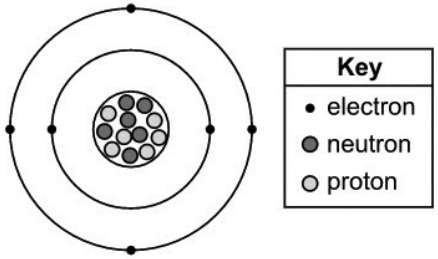
Part C

Question 15
Page 2 of 2

Line Guide | Item ID | ?

Use the model below to answer the question.

Carbon Atomic Model



Part C: Carbon is often considered the backbone of biological macromolecules. However, hydrogen is the most abundant element in the universe.

Explain why the backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms.

EQ

The backbone of large macromolecules is made of carbon atoms rather than hydrogen atoms, because carbon atoms are a lot more dense than hydrogen atoms.

151 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

This response provides insufficient evidence to demonstrate any understanding of how carbon is uniquely suited to form biological macromolecules. In Part A, the response incorrectly identifies the maximum number of bonds that one carbon atom can form (*"8 bonds"*). In Part B, the response incorrectly describes how electrons are involved in the formation of biological macromolecules (*"Electrons will always have a possitive charge"*). In Part C, the response incorrectly explains why the backbone of large macromolecules is made of carbon atoms rather than the more abundant hydrogen atoms (*"because carbon atoms are a lot more dense than hydrogen atoms"*).

BIOLOGY MODULE 1—SUMMARY DATA

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-value A	*p*-value B	*p*-value C	*p*-value D
1	BIO.A.1.1.1	C	2	20%	16%	60%	4%
2	BIO.A.1.2.1	D	2	7%	15%	16%	62%
3	BIO.A.1.2.2	B	2	12%	53%	17%	18%
4	BIO.A.2.1.1	A	2	68%	8%	6%	18%
5	BIO.A.2.2.1	D	2	21%	8%	10%	61%
6	BIO.A.2.2.2	B	2	16%	61%	13%	10%
7	BIO.A.2.2.3	B	2	9%	58%	21%	12%
8	BIO.A.2.3.1	B	2	16%	51%	16%	17%
9	BIO.A.3.2.2	A	2	75%	13%	7%	5%
10	BIO.A.4.1.1	B	2	10%	51%	8%	31%
11	BIO.A.4.1.3	A	2	59%	19%	11%	11%
12 (P)	BIO.A.2.1.1	A	2	65%	14%	8%	13%
13 (P)	BIO.A.4.2.1	D	2	14%	10%	17%	59%

CONSTRUCTED-RESPONSE

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
14	BIO.A.1.1.1	3	3	1.77
15	BIO.A.2.2.1	3	3	1.20

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BIOLOGY MODULE 2
MULTIPLE-CHOICE QUESTIONS

1. Use the list below to answer the question.

Cell Observations

- chromatin has condensed into visible chromosomes
- nuclear envelope has disappeared
- nucleolus is no longer visible

A student looking through a microscope records observations about a cell. Which stage of the cell cycle has the student described?

A. prophase

B. anaphase

C. interphase

D. telophase

Item Information	
Alignment	BIO.B.1.1.1
Answer Key	A
Depth of Knowledge	2
p-value A	46% (correct answer)
p-value B	22%
p-value C	17%
p-value D	15%
Option Annotations	A. Key: The events listed occur during prophase of the cell cycle. B. During anaphase, spindle fibers pull sister chromatids apart toward opposite centrioles. C. During interphase, DNA is spread out as chromatin, so individual chromosomes are not visible because the nucleolus is clearly visible. D. During telophase, nuclear envelopes begin to form around the two new nuclei at opposite poles, and evidence of cytokinesis may be visible.

2. Before cellular division, the cell must duplicate its DNA so that daughter cells will contain complete copies of the DNA. Which characteristic of DNA makes it **most** suitable as a molecule for this role?

A. DNA is located in the nucleus.

B. DNA is a large macromolecule.

C. DNA is made of repeating sugar-phosphate subunits.

D. DNA is made of two strands of complementary nucleotides.

Item Information	
Alignment	BIO.B.1.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	18%
p-value B	7%
p-value C	10%
p-value D	65% (correct answer)
Option Annotations	A. Location is not critical. Prokaryotic DNA is located in the cytoplasm and replication still occurs. B. A larger size helps in information storage capability but is not unique to DNA. C. A repetitive, polymeric structure is advantageous but is not unique to DNA. D. Key: The complementary nature of the two strands allows each strand to serve as a template during replication.

3. Which statement **best** explains how organisms accomplish passing on traits to their offspring?

A. Traits are acquired when parents care for their offspring.

B. Offspring inherit traits when DNA is replicated during mitosis.

C. Traits are inherited by the transfer of genetic material from parent to offspring.

D. Offspring acquire traits when cells become specialized for certain functions.

Item Information	
Alignment	BIO.B.1.2.2
Answer Key	C
Depth of Knowledge	2
p-value A	4%
p-value B	18%
p-value C	73% (correct answer)
p-value D	5%
Option Annotations	A. Acquired traits are not passed from parent to offspring. B. DNA replication occurs before mitosis. C. Key: DNA is the genetic material transferred from parent to offspring, and it codes for an organism's inherited traits. D. Acquired traits are not passed from parent to offspring.

4. During a cell division cycle, chromosome segments from two homologous chromosomes exchange places. Which result is **most likely** to occur following this cycle?

A. Genetic material will be lost.

B. The number of chromosomes will increase.

C. The total number of genes in the cell will decrease.

D. A change in gene location will occur on both chromosomes.

Item Information	
Alignment	BIO.B.2.1.2
Answer Key	D
Depth of Knowledge	2
p-value A	12%
p-value B	18%
p-value C	9%
p-value D	61% (correct answer)
Option Annotations	A. The sum total of genetic information is most likely conserved and just translocated. B. Translocating pieces of chromosomes will not change the number of chromosomes. C. The number of genes will likely not change during translocation. D. Key: Translocation is an exchange of pieces of homologous chromosomes.

5. Which statement **best** describes how organisms use DNA and amino acids to synthesize a protein?

A. DNA is transcribed into mRNA, which is translated by the ribosome to produce an amino acid chain.

B. DNA is translated into mRNA, which is transcribed by the ribosome to produce an amino acid chain.

C. Amino acids are transcribed into mRNA, which is translated in the nucleus to produce a molecule of DNA.

D. Amino acids are translated into mRNA, which is transcribed in the nucleus to produce a molecule of DNA.

Item Information	
Alignment	BIO.B.2.2.1
Answer Key	A
Depth of Knowledge	2
p-value A	49% (correct answer)
p-value B	32%
p-value C	11%
p-value D	8%
Option Annotations	A. Key: The two key stages of protein synthesis are described. B. DNA into mRNA is transcription, and mRNA into amino acids is translation. C. DNA, not amino acids, is transcribed into mRNA. Translation occurs in cytoplasm and produces an amino acid chain, not DNA. D. The steps and molecules are reversed.

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6. Use the information below to answer the question.

RNA Codon Chart

First Base in Codon	Second Base in Codon: U	Second Base in Codon: C	Second Base in Codon: A	Second Base in Codon: G	Third Base in Codon
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	stop	stop	A
	Leu	Ser	stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

Original RNA Sequence of Organism

AUG–GCU–UGU

Which mutation would **most likely** affect the organism's phenotype?

A. AUG–GC**C**–UGU

B. AUG–GC**G**–UGU

C. AUG–GCU–UG**A**

D. AUG–GCU–UG**C**

Item Information	
Alignment	BIO.B.2.3.1
Answer Key	C
Depth of Knowledge	2
p-value A	12%
p-value B	12%
p-value C	64% (correct answer)
p-value D	12%
Option Annotations	A. Both the original and mutated sequence would code for Ala. B. Both the original and mutated sequence would code for Ala. C. Key: The original sequence codes for Cys, while the mutated sequence codes for a stop. This could result in a change in the organism's phenotype. D. Both the original and mutated sequence would code for Cys.

7. Two closely related shrimp species have habitats and niches that partially overlap. Which factor **most likely** caused the divergence of the shrimp into separate species?

A. reproductive isolation

B. reduction of food supply

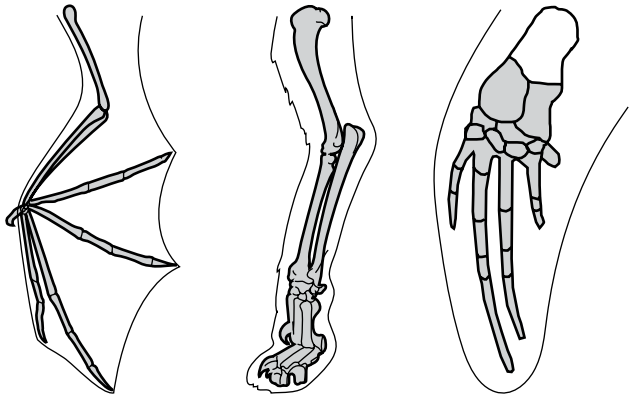
C. a series of rapid mutations

D. large initial population size

Item Information	
Alignment	BIO.B.3.1.2
Answer Key	A
Depth of Knowledge	2
p-value A	42% (correct answer)
p-value B	16%
p-value C	28%
p-value D	14%
Option Annotations	A. Key: Shrimp that occupy separate habitats and niches are more likely to reproduce with nearby shrimp, eventually leading to speciation. B. Reduction of the food supply is not indicated and would not likely cause speciation. C. Mutations accumulate slowly over time. D. The initial population size would not cause this speciation.

8. Use the diagram below to answer the question.

Animal Forelimbs



bat cat whale

The diagram shows the forelimbs of three animals. Which statement **best** describes the bones in the animals?

A. All organisms on Earth have the same bones.

B. Different bones in similar species serve the same function.

C. The species that are the most evolved have the longest bones.

D. Similar bones in different organisms may have different functions.

Item Information	
Alignment	BIO.B.3.2.1
Answer Key	D
Depth of Knowledge	2
p-value A	3%
p-value B	19%
p-value C	4%
p-value D	74% (correct answer)
Option Annotations	A. Not all organisms have bones. B. Homologous features are similar in structure, but serve different functions. C. This is not a fact, and it is not consistent with the diagram. D. Key: This is the definition of homologous structures.

9. Which sequence **best** orders ecological categories from the one with the fewest number of individuals to the one with the greatest number of individuals?

A. ecosystem, population, community, biome

B. population, community, ecosystem, biome

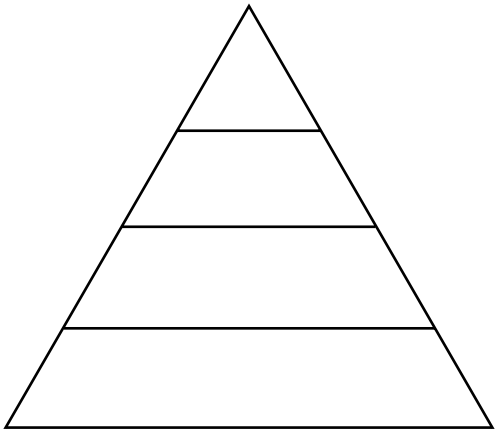
C. biome, population, community, ecosystem

D. community, biome, population, ecosystem

Item Information	
Alignment	BIO.B.4.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	9%
p-value B	67% (correct answer)
p-value C	13%
p-value D	11%
Option Annotations	A. A population would contain the fewest number of organisms compared to the other levels, and an ecosystem is composed of various communities. B. Key: Populations of different species interact in communities, communities of organisms interact with abiotic factors in an ecosystem, and similar ecosystems in a large area make up a biome. C. A biome would contain the largest number of organisms compared to the other levels of organization. D. A biome would contain the largest number of organisms and a population the smallest number of organisms compared to the other levels.

10. Use the energy pyramid below to answer the question.

Energy Pyramid



Energy pyramids describe food and energy relationships within an ecosystem. Which factor **most likely** limits the number of levels an energy pyramid can have?

A. biomass of the top-level organisms

B. predation by the top-level organisms

C. energy loss between each level of organisms

D. chemical energy being decomposed at each level of organisms

Item Information	
Alignment	BIO.B.4.2.1
Answer Key	C
Depth of Knowledge	2
p-value A	9%
p-value B	23%
p-value C	58% (correct answer)
p-value D	10%
Option Annotations	A. The biomass of top-level organisms may define the width of the base of the pyramid, not the number of energy levels. B. Predation of top-level organisms will affect the size of prey populations, not the number of energy levels. C. Key: The number of levels in an energy pyramid is limited by the amount of energy available for the next level of consumers. D. Decomposition will affect the starting biomass, not the number of energy levels.

11. Orchids living in tropical rainforests often grow on the branches of trees to access sunlight. The trees are not affected by the orchids. Which term **best** classifies the relationship between the orchids and the trees?

A. predation

B. parasitism

C. competition

D. commensalism

Item Information	
Alignment	BIO.B.4.2.2
Answer Key	D
Depth of Knowledge	2
p-value A	6%
p-value B	12%
p-value C	7%
p-value D	75% (correct answer)
Option Annotations	A. The orchids do not feed on the trees. B. The orchids do not harm the trees. C. Neither the orchids nor the trees are harmed by the relationship. D. Key: The orchids benefit from the trees without harming them.

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Directions: Use the information presented on page 62 to answer questions 12 and 13.

Horizontal Gene Transfer

Genes are passed from parent to offspring through a process called vertical gene transfer (VGT). In contrast, horizontal gene transfer (HGT) can transfer genes across species. HGT most commonly occurs between prokaryotes because their DNA is not in a protective nucleus. This allows genetic material to more easily be exchanged. However, there is evidence of HGT and the exchange of genetic material between bacteria, plants, fungi, and animals.

HGT can help to explain how some bacteria species acquire antibiotic resistance from another species and the method by which some insects have acquired the ability to digest certain foods because they can produce enzymes that are typically only observed in bacteria. Another example is the genetic material known as BovB, which was first observed in cows and is present in many animals such as opossums, horses, silkworms, and zebra fish. VGT could not explain BovB's presence in such distantly related animals that do not share habitats or interbreed. Researchers think that organisms such as ticks and flatworms may be one of the links between all the organisms that have BovB. When the ticks and flatworms obtain nutrients from their hosts, they can transfer some of their genetic material to the host, which can then become incorporated into the host's genome.

One of the most researched instances of HGT is between a fungus and the pea aphid. Pea aphids are small insects that can appear green or red depending on the presence of certain chemicals called carotenoids in their bodies. The color of pea aphid populations can change in response to certain environmental threats. Red aphids are more susceptible to ladybird beetle predation, and green aphids are more susceptible to parasitic wasps. It was previously thought that fungi, plants, and bacteria were the only organisms to have genes that encode for carotenoids and that animals with carotenoids acquired them only from their diet. However, scientists observed a gene for the carotenoids in the pea aphid genome. The pea aphid carotenoid gene is more similar to the genes in a fungus than to the genes in the plants they consume. Scientists think that at some point millions of years ago HGT occurred between the fungi and the pea aphids.

12. HGT can occur naturally in the wild but can also be accomplished in a laboratory setting. Which laboratory procedure most closely resembles the process of HGT?

A. inserting DNA from a bacterium into a corn plant

B. selectively breeding corn plants for desired traits

C. using radiation to induce genetic mutations in bacteria

D. cloning a bacterium to produce an identical strain of cells

Item Information	
Alignment	BIO.B.2.4.1
Answer Key	A
Depth of Knowledge	2
p-value A	61% (correct answer)
p-value B	17%
p-value C	12%
p-value D	10%
Option Annotations	A. Key: Genetic material from one species is introduced into the genome of individuals from a different species. B. Selective breeding only affects the genetic outcome of one species. C. Radiating bacteria only affects the genetic outcome of one species. D. Cloning a bacterial cell only affects the genetic outcome of one species.

13. Which statement **best** explains why the carotenoid gene has been present in pea aphids for millions of years?

A. Environmental selection pressures prevented the carotenoid gene from mutating in the pea aphids.

B. The HGT process introduced a benefit for survival and led to greater reproductive success in pea aphids with the carotenoid gene.

C. Because genes acquired by HGT are less susceptible to selection pressures, the carotenoid gene remained in the pea aphid genome.

D. The carotenoid gene had a long time to evolve before being introduced into the pea aphids, which led to a stable gene that can be successfully inherited.

Item Information	
Alignment	BIO.B.3.1.1
Answer Key	B
Depth of Knowledge	2
p-value A	11%
p-value B	50% (correct answer)
p-value C	22%
p-value D	17%
Option Annotations	A. Environmental selection pressures do not prevent mutations from occurring in the pea aphid's genome. B. Key: Genes that code for traits conferring a selective advantage for organisms are likely to remain in the organism's genome. C. Natural selection pressures affect genes acquired through HGT as well as VGT. D. The evolutionary age of the carotenoid gene does not help or harm its ability to be inserted into pea aphids.

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CONSTRUCTED-RESPONSE ITEM

14. An ecologist wanted to know how many plants lived in a particular prairie. Instead of counting all the plants, the ecologist used a sample area. The ecologist placed a grid that was ten meters by ten meters in a random location in the prairie and counted the number of individual plants of the various species. Data were collected and recorded.

Prairie Sample Study

Plant Name	Number of Individuals	Percentage of Sample Area Covered by Plant (%)
black-eyed Susan	1	1
wild bergamot	2	1
mountain mint	26	15
goldenrod	13	5
compass dock hybrid	5	9
daisy fleabane	1	1
big bluestem	150	60

Part A: Describe an observation from the prairie sample study.

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Describe an inference from the prairie sample study.

Part C: Describe a difference between any observation and any inference.

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.

STOP

Item-Specific Scoring Guideline

#14 Item Information

Alignment	BIO.B.3.3.1	**Depth of Knowledge**	3	**Mean Score**	1.42

Scoring Guide

Score	Description
3	The response demonstrates a *thorough* understanding of scientific terms, like hypothesis, inference, law, theory, principle, fact, and observation, by completing all **three** of the following tasks: • describing an observation from the prairie sample study **AND** • describing an inference from the prairie sample study **AND** • describing **one** difference between any observation and any inference. The response is clear, complete, and correct.
2	The response demonstrates a *partial* understanding of scientific terms, like hypothesis, inference, law, theory, principle, fact, and observation, by completing any set of the following **two** tasks: • describing an observation **AND** • an inference from the prairie sample study. **OR** • describing an observation from the prairie sample study **AND** • describing **one** difference between any observation and any inference. **OR** • describing an inference from the prairie sample study **AND** • describing **one** difference between any observation and any inference. The response may contain some work that is incomplete or unclear.
1	The response demonstrates a *minimal* understanding of scientific terms, like hypothesis, inference, law, theory, principle, fact, and observation, by completing any **one** of the following tasks: • describing an observation from the prairie sample study **OR** • describing an inference from the prairie sample study **OR** • describing **one** difference between any observation and any inference. The response may contain some work that is incomplete or unclear.
0	The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested.
Non-scorables	B – No response written or refusal to respond F – Foreign language K – Off task U – Unreadable

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit:

Part A (1 point):

Examples of observations include the following:

- Describing the number of plant individuals in the prairie (e.g., there are 2 wild bergamot in the prairie sample area)
- Describing the percent coverage data (e.g., 15% of the sample area was covered with mountain mint)
- Comparing numbers or percentages of different plant types (e.g., there is more goldenrod than compass dock hybrid within the sample area)
- Describing the types/species of plants in the sample area.
- Any other description of an observation made from the available data

Part B (1 point):

Examples of inferences include the following:

- A statement that relates the sample area to the entire prairie (e.g., The plants that have the most individuals in the prairie sample area have the most individuals in the entire prairie.)
- A statement that relates the number of individuals in the sample area to growth conditions and/or reproductive success (e.g., Black-eyed Susan and daisy fleabane do not produce as many seeds as goldenrod or mountain mint).
- A statement that relates the animal life present (e.g., herbivores) based on the plant life present.
- Any other description of an inference that can be reasonably made from the available data.

Part C (1 point):

- An observation is a statement about the data that were measured, collected, perceived, or noticed using one of the five senses, but an inference is an assumption, not necessarily a fact, that is based on evidence gathered through observation.

Background Information:

Observation: a statement about the data that were measured, collected, perceived, or noticed, often during an investigation or experiment, using one or more of the five senses

Inference: an assumption based on evidence gathered through observation

STUDENT RESPONSE

Response Score: 3 points

Part A

Question 14
Page 1 of 3

An ecologist wanted to know how many plants lived in a particular prairie. Instead of counting all the plants, the ecologist used a sample area. The ecologist placed a grid that was ten meters by ten meters in a random location in the prairie and counted the number of individual plants of the various species. Data were collected and recorded.

Prairie Sample Study

Plant Name	Number of Individuals	Percentage of Sample Area Covered by Plant (%)
black-eyed Susan	1	1
wild bergamot	2	1
mountain mint	26	15
goldenrod	13	5
compass dock hybrid	5	9
daisy fleabane	1	1
big bluestem	150	60

Part A: Describe an observation from the prairie sample study.

The "big bluestem" species is clearly the dominant species in the prarie. The majorityof the population is big bluestem. By examining the chart, the population of big bluestem plants in the community is very large.

214 / 1000

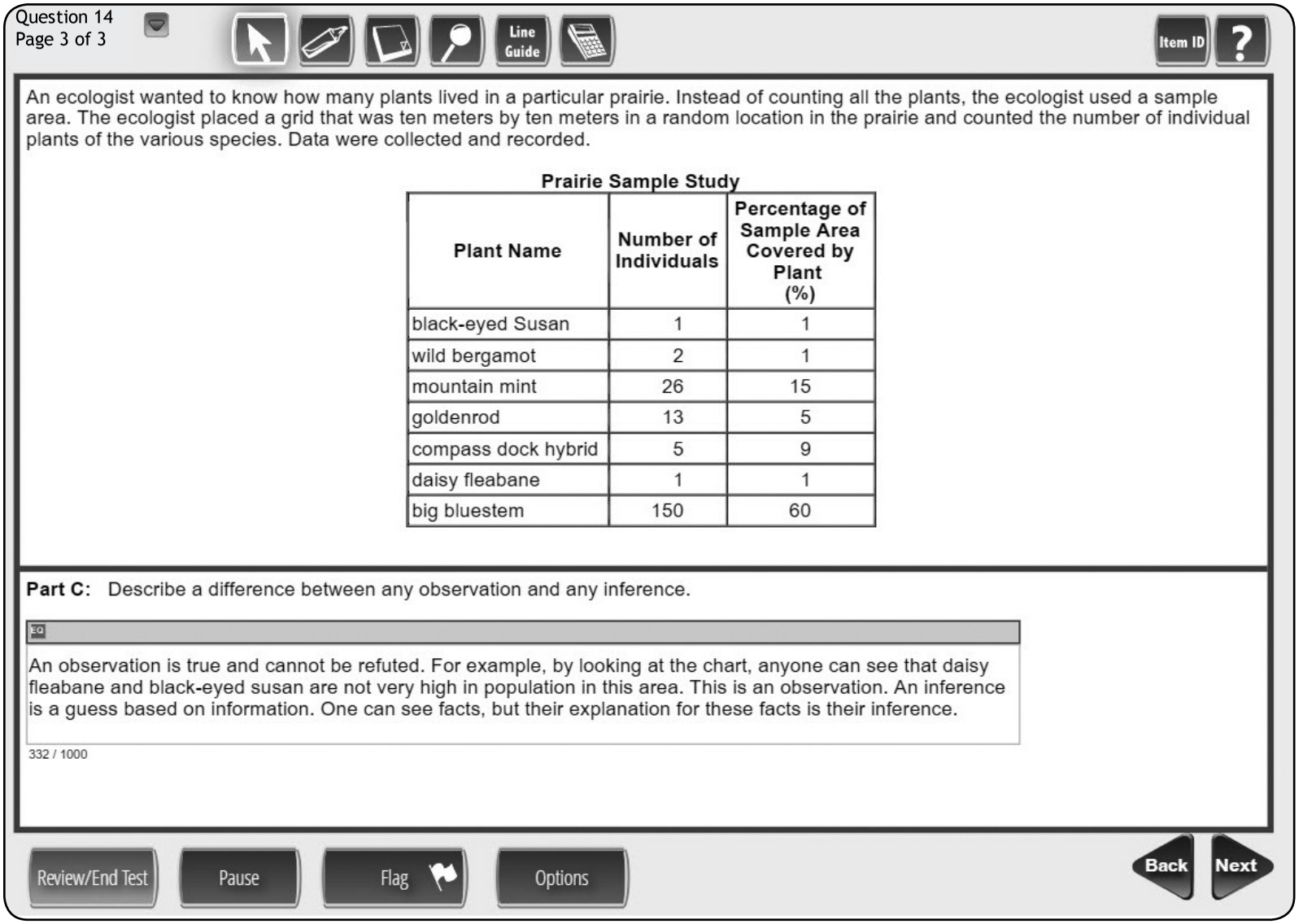
Review/End Test | Pause | Flag | Options | Next

STUDENT RESPONSE

Part B

STUDENT RESPONSE

Part C



The response demonstrates a thorough understanding of scientific terms. In Part A, the response correctly describes an observation from the prairie sample study (*The population of big bluestem plants . . . is very large*). In Part B, the response correctly describes an inference from the prairie sample study (*This could mean that black-eyed susan are living in the shadows of the big bluestem. This means that they are not very tall and cannot get sunlight.*). In Part C, the response correctly describes one difference between any observation and any inference (*An observation is true and cannot be refuted, An inference is a guess based on information.*). The response is clear, complete, and correct.

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STUDENT RESPONSE

Response Score: 2 points

14. An ecologist wanted to know how many plants lived in a particular prairie. Instead of counting all the plants, the ecologist used a sample area. The ecologist placed a grid that was ten meters by ten meters in a random location in the prairie and counted the number of individual plants of the various species. Data were collected and recorded.

Prairie Sample Study

Plant Name	Number of Individuals	Percentage of Sample Area Covered by Plant (%)
black-eyed Susan	1	1
wild bergamot	2	1
mountain mint	26	15
goldenrod	13	5
compass dock hybrid	5	9
daisy fleabane	1	1
big bluestem	150	60

Part A: Describe an observation from the prairie sample study.

In the prairie there were 7 different types of plants that the ecologist observed. He noticed that the big bluestem covered 60% of the land whereas the black-eyed susan, the wild bergamot and the daisy fleabane only covered 1% each.

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Describe an inference from the prairie sample study.

The plants that cover less land may be a food source to animals living on the prairie.

Part C: Describe a difference between any observation and any inference.

An observation he made was that the land was covered by 1% blackeyed susan, I might infer that the blackeyed susan is just as much a potential food source as the daisy fleabane.

The response demonstrates a partial understanding of scientific terms. In Part A, the response correctly describes an observation from the prairie sample study (*big bluestem covered 60%, the black-eyed susan, the wild bergamot and the daisy fleabane only covered 1% each*). In Part B, the response correctly describes an inference from the prairie sample study (*The plants that cover less land may be a food source to animals living on the prairie*). In Part C, the response does not correctly describe one difference between any observation and any inference (*An observation he made . . . the land was covered by 1% black-eyed susan, I might infer . . . black-eyed susan is just as much a potential food source as the daisy fleabane*).

STUDENT RESPONSE

Response Score: 1 point

Part A

Question 14
Page 1 of 3

An ecologist wanted to know how many plants lived in a particular prairie. Instead of counting all the plants, the ecologist used a sample area. The ecologist placed a grid that was ten meters by ten meters in a random location in the prairie and counted the number of individual plants of the various species. Data were collected and recorded.

Prairie Sample Study

Plant Name	Number of Individuals	Percentage of Sample Area Covered by Plant (%)
black-eyed Susan	1	1
wild bergamot	2	1
mountain mint	26	15
goldenrod	13	5
compass dock hybrid	5	9
daisy fleabane	1	1
big bluestem	150	60

Part A: Describe an observation from the prairie sample study.

In the praire in a sample area on a grid ten meters by ten meters theree was 150 of the big bluestem that covered 60% of the area.

130 / 1000

Review/End Test | Pause | Flag | Options | Next

STUDENT RESPONSE

Part B

STUDENT RESPONSE

Part C

Question 14
Page 3 of 3

Line Guide | Item ID | ?

An ecologist wanted to know how many plants lived in a particular prairie. Instead of counting all the plants, the ecologist used a sample area. The ecologist placed a grid that was ten meters by ten meters in a random location in the prairie and counted the number of individual plants of the various species. Data were collected and recorded.

Prairie Sample Study

Plant Name	Number of Individuals	Percentage of Sample Area Covered by Plant (%)
black-eyed Susan	1	1
wild bergamot	2	1
mountain mint	26	15
goldenrod	13	5
compass dock hybrid	5	9
daisy fleabane	1	1
big bluestem	150	60

Part C: Describe a difference between any observation and any inference.

EQ

There are more big bluestem in the area than any other plant it covers 60% of the area. The black-eye Susan was the least present in the area covering only 1 % of the total area covered.

186 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

The response demonstrates a minimal understanding of scientific terms. In Part A, the response correctly describes an observation from the prairie sample study (*150 of the big bluestem that covered 60% of the area*). In Part B, the response does not correctly describe an inference from the prairie sample study (*the water supply and heat of the sun. These plants probsally need both . . . to grow*). In Part C, the response does not correctly describe one difference between any observation and any inference (*There are more big bluestem in the area than any other plant it covers 60% of the area. The black-eye Susan was the least present in the area covering only 1 % of the total area covered.*).

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STUDENT RESPONSE

Response Score: 0 points

14. An ecologist wanted to know how many plants lived in a particular prairie. Instead of counting all the plants, the ecologist used a sample area. The ecologist placed a grid that was ten meters by ten meters in a random location in the prairie and counted the number of individual plants of the various species. Data were collected and recorded.

Prairie Sample Study

Plant Name	Number of Individuals	Percentage of Sample Area Covered by Plant (%)
black-eyed Susan	1	1
wild bergamot	2	1
mountain mint	26	15
goldenrod	13	5
compass dock hybrid	5	9
daisy fleabane	1	1
big bluestem	150	60

Part A: Describe an observation from the prairie sample study.

One observation was that mountain mint had the highest percentage of sample area covered by plants.

Go to the next page to finish question 14.

GO ON

14. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Describe an inference from the prairie sample study.

The black-eyed susan and the daisy fleabane had the same number of individuals.

Part C: Describe a difference between any observation and any inference.

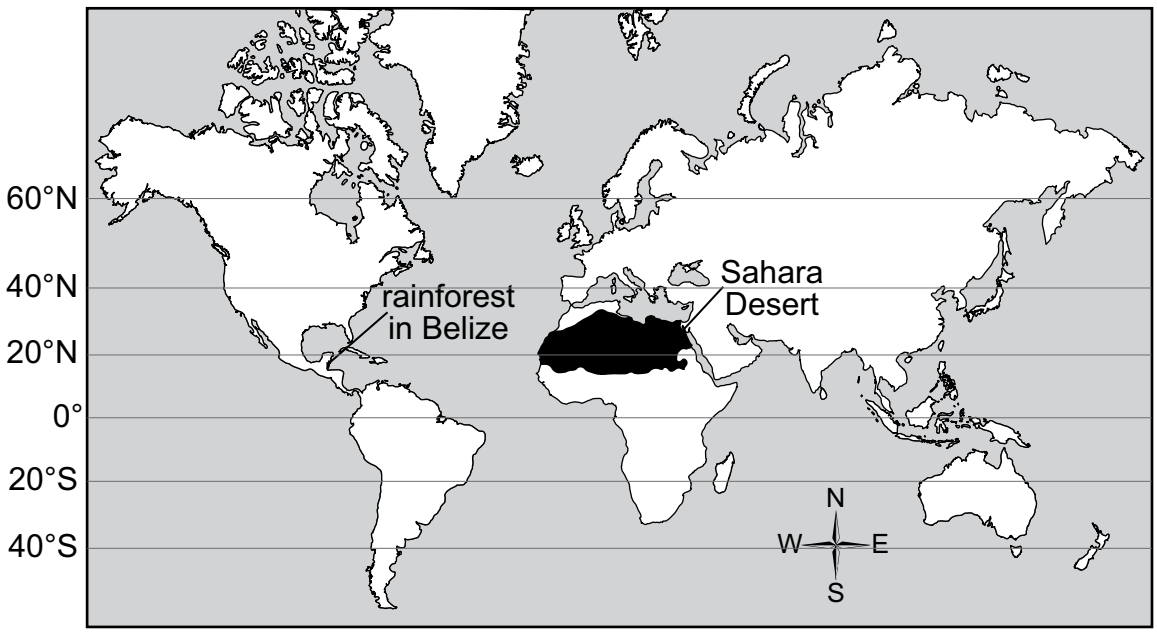
An observation is studying something and an inference is comparing two observations.

The response provides insufficient evidence to demonstrate any understanding of scientific terms. In Part A, the response does not correctly describe an observation from the prairie sample study (*mountain mint had the highest percentage of sample area covered*). In Part B, the response does not correctly describe an inference from the prairie sample study (*The black-eyed susan and the daisy fleabane had the same number of individuals*). In Part C, the response does not correctly describe one difference between any observation and any inference (*An observation is studying something and an inference is comparing two observations*).

CONSTRUCTED-RESPONSE ITEM

15. The map shows some information about two ecosystems.

Location of Two Types of Ecosystems



Part A: Describe an abiotic characteristic that is similar in both the desert and the rainforest.

Go to the next page to finish question 15.

GO ON

15. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Describe a biotic characteristic that is unique to either a desert or a rainforest ecosystem.

Ecosystem: _____

Unique biotic characteristic:

_____

_____

_____

_____

Part C: Describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem.

Ecosystem: _____

Relationship:

_____

_____

_____

_____

AFTER YOU HAVE CHECKED YOUR WORK, CLOSE YOUR ANSWER BOOKLET AND TEST BOOKLET SO YOUR TEACHER WILL KNOW YOU ARE FINISHED.

Item-Specific Scoring Guideline

#15 Item Information

Alignment	BIO.B.4.1.2	**Depth of Knowledge**	3	**Mean Score**	1.49

Scoring Guide

Score	Description
3	The response demonstrates a *thorough* understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems by • describing an abiotic characteristic that is similar in both a desert and a rainforest. • describing a biotic characteristic that is unique to either a desert or a rainforest ecosystem. • describing a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem. The response is clear, complete, and correct.
2	The response demonstrates a *partial* understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems by fulfilling **two** of the bullets under the 3-point response. The response may contain some work that is incomplete or unclear.
1	The response demonstrates a *minimal* understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems by fulfilling **one** of the bullets listed under the 3-point response. The response may contain some work that is incomplete or unclear.
0	The response provides *insufficient* evidence to demonstrate any understanding of the concept being tested.
Non-scorables	B – No response written or refusal to respond F – Foreign language K – Off task U – Unreadable

Note: No deductions should be taken for misspelled words or grammatical errors.

Responses that will receive credit:

Part A (1 point):

- The presence of air is an abiotic characteristic that is similar in both a desert and a rainforest
  OR
- The presence of soil is an abiotic characteristic that is similar in both a desert and a rainforest
  OR
- The presence of sunlight is an abiotic characteristic that is similar in both a desert and a rainforest
  OR
- A warm climate is an abiotic characteristic that is similar in both a desert and a rainforest
  OR
- The position of the sun as it appears to move across the sky is an abiotic characteristic that is similar in both the desert and the rainforest, since they are at the same latitude
  OR
- The movement of air is an abiotic characteristic that is similar in both a desert and a rainforest
  OR
- The presence of rocks is an abiotic characteristic that is similar in both a desert and a rainforest
  OR
- The presence of water is an abiotic characteristic that is similar in both a desert and a rainforest

Part B (1 point):

- A biotic characteristic that is unique to a rainforest ecosystem is the presence of bromeliads
  OR
- A biotic characteristic that is unique to a rainforest ecosystem is the presence of kapok trees
  OR
- A biotic characteristic that is unique to a rainforest ecosystem is the presence of orchids
  OR
- A biotic characteristic that is unique to a rainforest ecosystem is the presence of ferns
  OR
- A biotic characteristic that is unique to a rainforest ecosystem is the presence of salamanders
  OR
- A biotic characteristic that is unique to a rainforest ecosystem is the presence of monkeys
  OR
- A biotic characteristic that is unique to a desert ecosystem is the presence of kangaroo rats
  OR
- A biotic characteristic that is unique to a desert ecosystem is the presence of cactuses
  OR
- A biotic characteristic that is unique to a desert ecosystem is the presence of succulents
  OR
- A biotic characteristic that is unique to a desert ecosystem is the presence of scorpions
  OR
- A biotic characteristic that is unique to a desert ecosystem is the presence of antelope

Part C (1 point):

- Water is an abiotic component that must be ingested by all animals in either a desert or rainforest ecosystem
  OR
- Soil is an abiotic component that must be present for plants to grow in either a desert or rainforest ecosystem; the soil provides needed minerals and a surface to anchor the plant
  OR
- Air is an abiotic component that provides oxygen for all animals in either a desert or rainforest ecosystem
  OR
- Air is an abiotic component that provides carbon dioxide for all plants in either a desert or rainforest ecosystem
  OR
- Sunlight is an abiotic component that provides energy for all plants to use in photosynthesis in either a desert or rainforest ecosystem
  OR
- Water is an abiotic component that is used by all plants for photosynthesis in either a desert or rainforest ecosystem

Background Information:

- For Part B, other reasonable responses are acceptable for 1 point.

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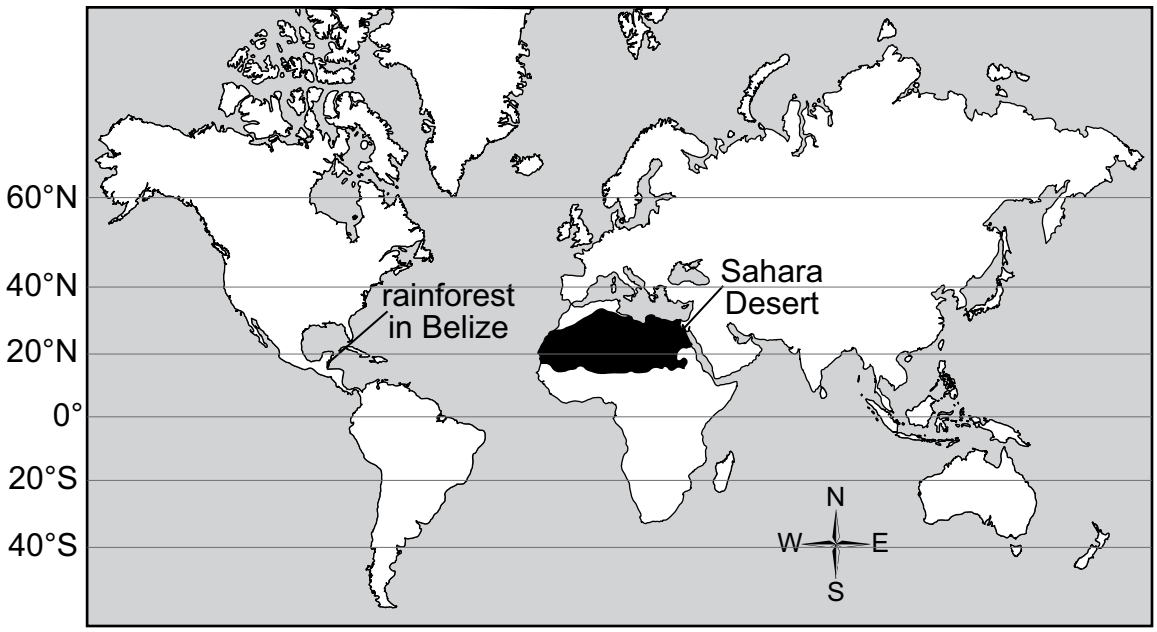
STUDENT RESPONSE

Response Score: 3 points

15. The map shows some information about two ecosystems.

Location of Two Types of Ecosystems



Part A: Describe an abiotic characteristic that is similar in both the desert and the rainforest.

An abiotic characteristic that is similar in the desert and the rainforest is the hot temperatures. The temperatures are similar because they are near the equator.

Go to the next page to finish question 15.

GO ON

15. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Describe a biotic characteristic that is unique to either a desert or a rainforest ecosystem.

Ecosystem: Rainforest

Unique biotic characteristic:

Rainforests have many unique varities of trees, plants, and flowers that only grow there because they survive best in climates that are hot and moist.

Part C: Describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem.

Ecosystem: Desert

Relationship:

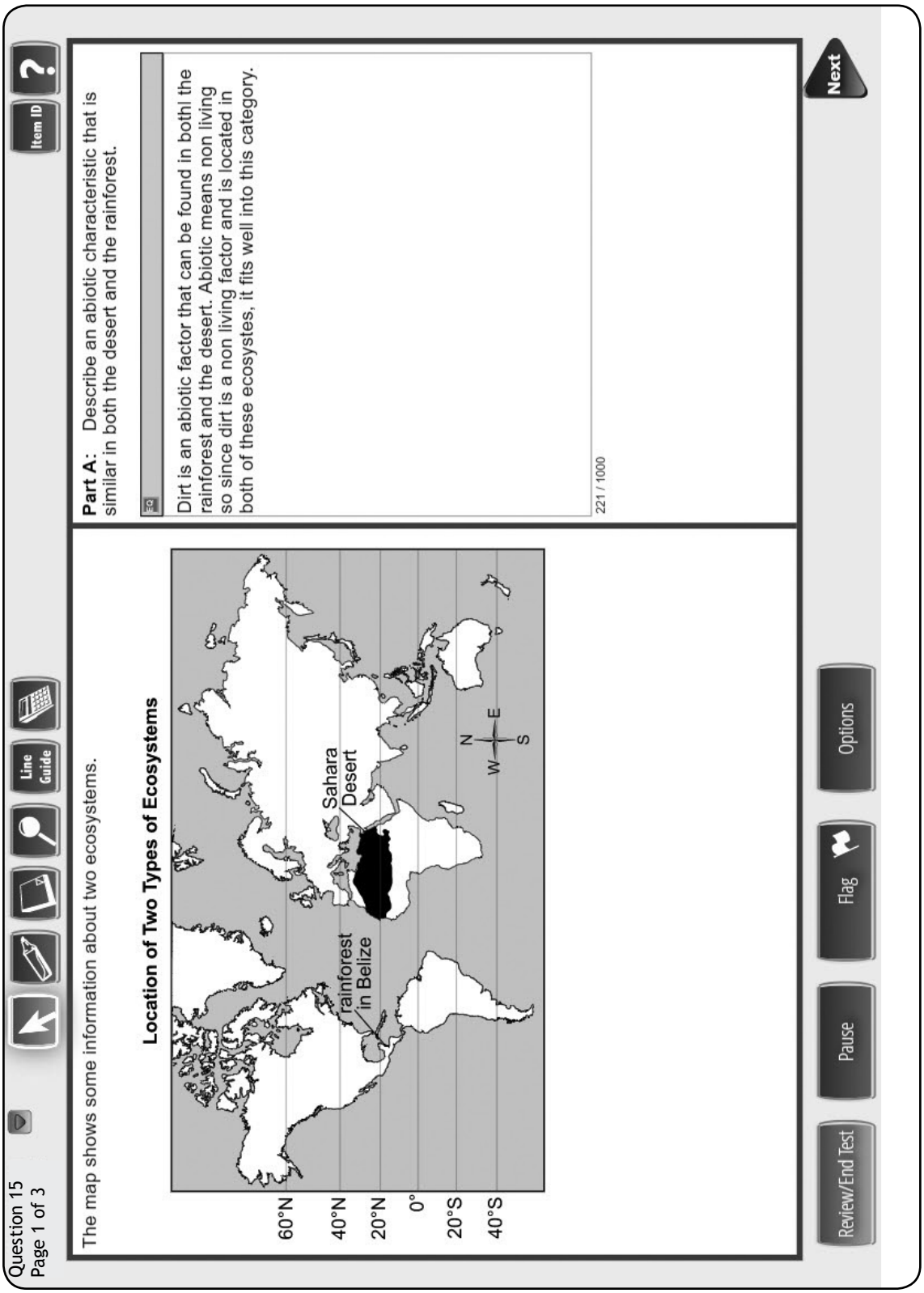
The sand (abiotic) in deserts provides camoflage for some species of spiders and snakes (biotic) so they can captnre their prey easier.

The response demonstrates a thorough understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. In Part A, the response correctly describes an abiotic characteristic that is similar in both a desert and a rainforest (*the hot temperatures,* or *they are near the equator*). In Part B, the response correctly describes a biotic characteristic that is unique to either a desert or a rainforest ecosystem (*Rainforest, unique varieties of trees, plants and flowers . . . because they survive best in climates that are hot and moist*). In Part C, the response correctly describes a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem (*Desert, sand . . . provides camoflauge for . . . spiders and snakes so they can capture their prey easier*). The response is clear, complete, and correct.

STUDENT RESPONSE

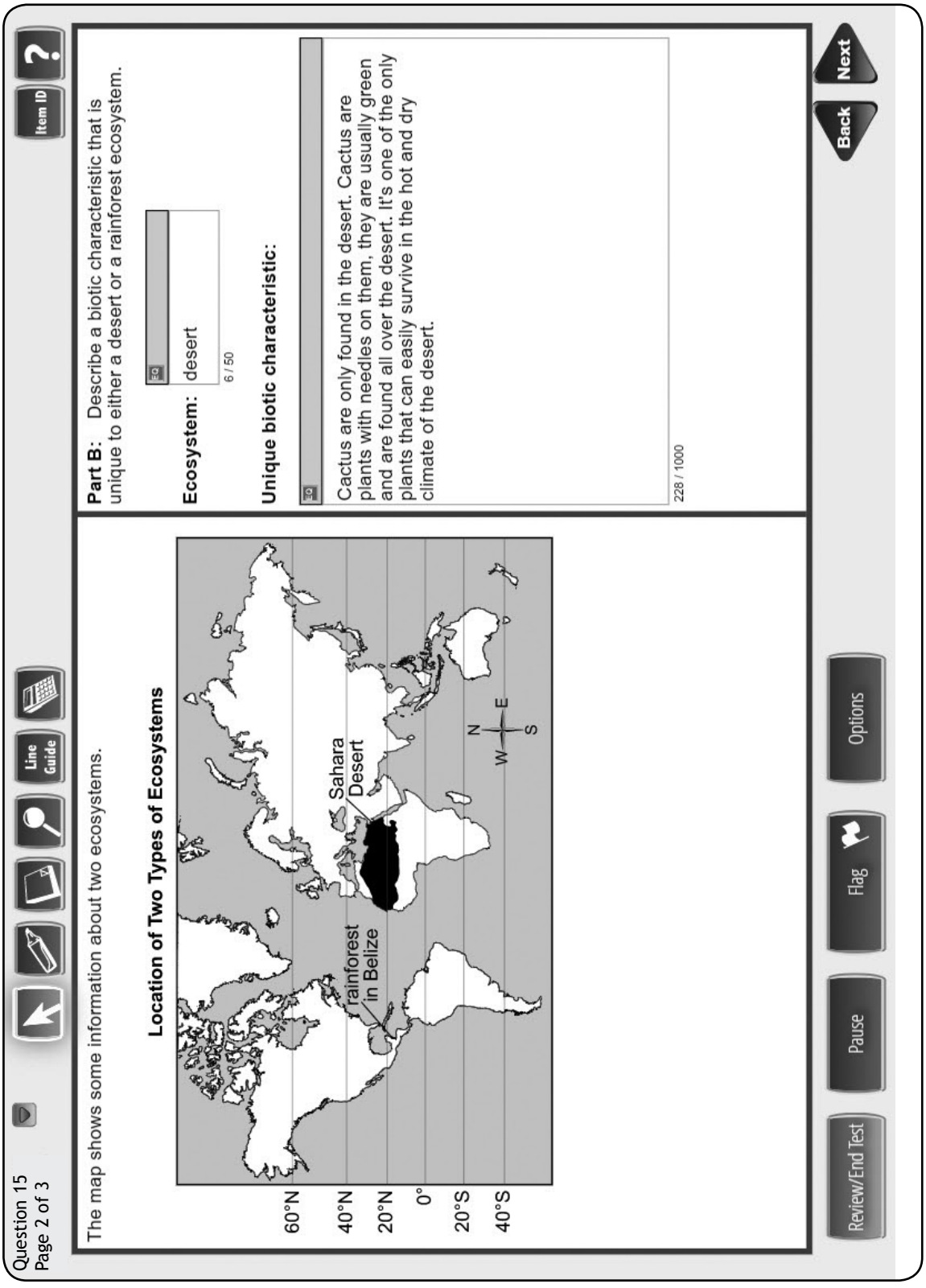
Response Score: 2 points

Part A



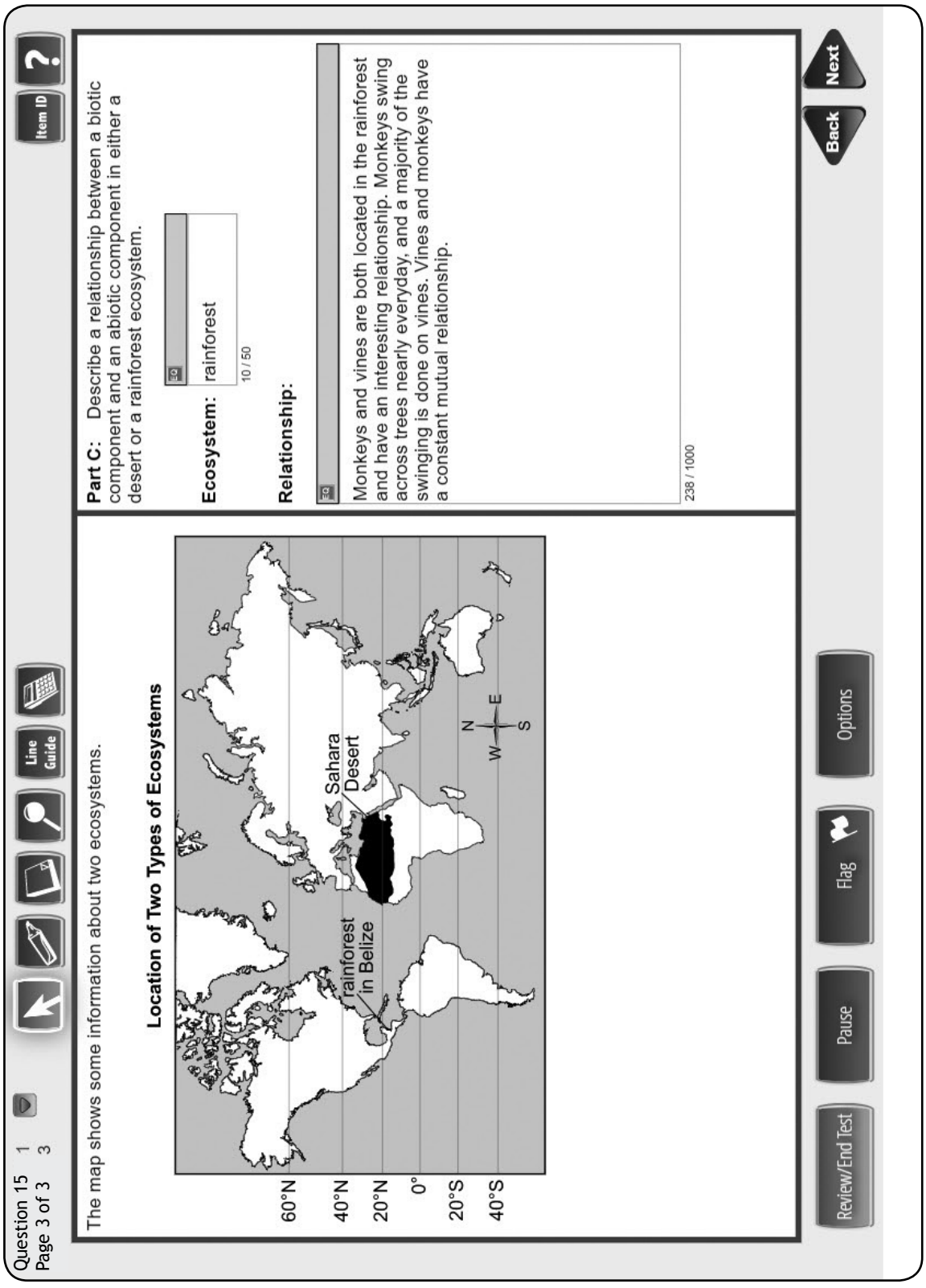
STUDENT RESPONSE

Part B



STUDENT RESPONSE

Part C



The response demonstrates a partial understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. In Part A, the response correctly describes an abiotic characteristic that is similar in both a desert and a rainforest (*dirt*). In Part B, the response correctly describes a biotic characteristic that is unique to either a desert or a rainforest ecosystem (*desert, Cactus*). In Part C, the response does not correctly describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem (*rainforest, monkeys and vines . . . have an interesting relationship . . . monkeys swing across trees . . . on vines*).

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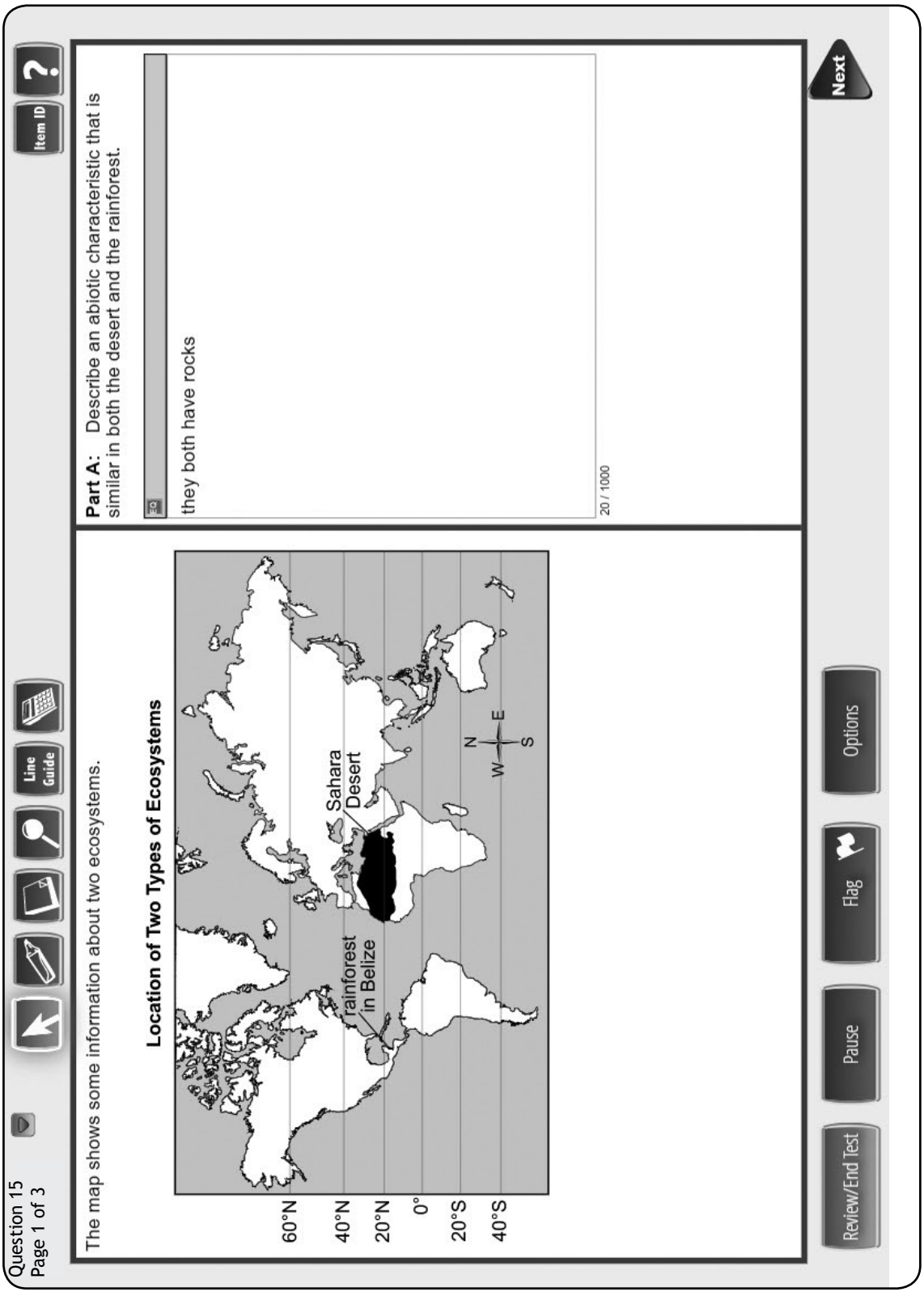
STUDENT RESPONSE

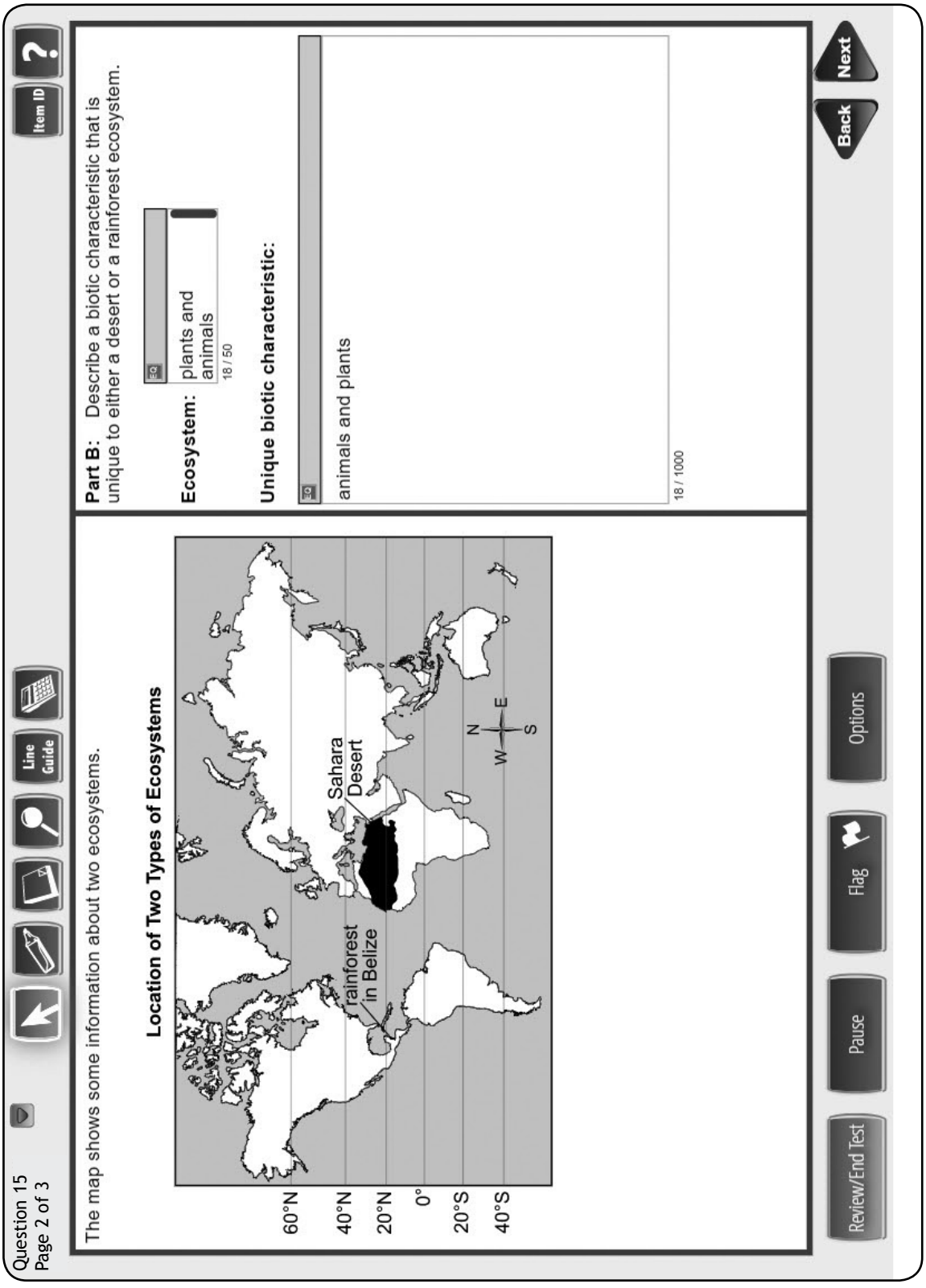
Response Score: 1 point

Part A



STUDENT RESPONSE

Part B



STUDENT RESPONSE

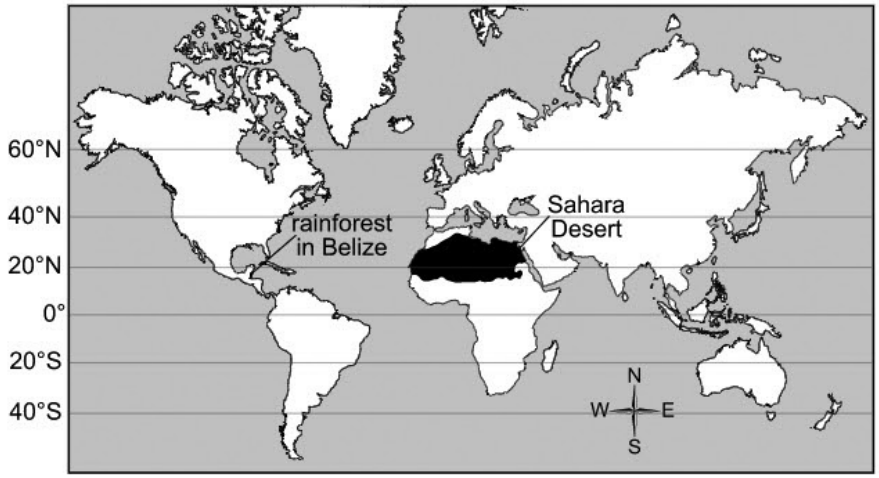
Part C

Question 15
Page 3 of 3

Line Guide | Item ID | ?

The map shows some information about two ecosystems.

Location of Two Types of Ecosystems



Part C: Describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem.

Ecosystem: ones living one is non-living

29 / 50

Relationship:

both have one of each

21 / 1000

Review/End Test | Pause | Flag | Options | Back | Next

The response demonstrates a minimal understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. In Part A, the response correctly describes an abiotic characteristic that is similar in both a desert and a rainforest (*rocks*). In Part B, the response does not correctly describe a biotic characteristic that is unique to either a desert or a rainforest ecosystem as no ecosystem is identified (*plants and animals, animals and plants*). In Part C, the response does not correctly describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem as no ecosystem is identified (*ones living one is non-living . . . both have one of each*).

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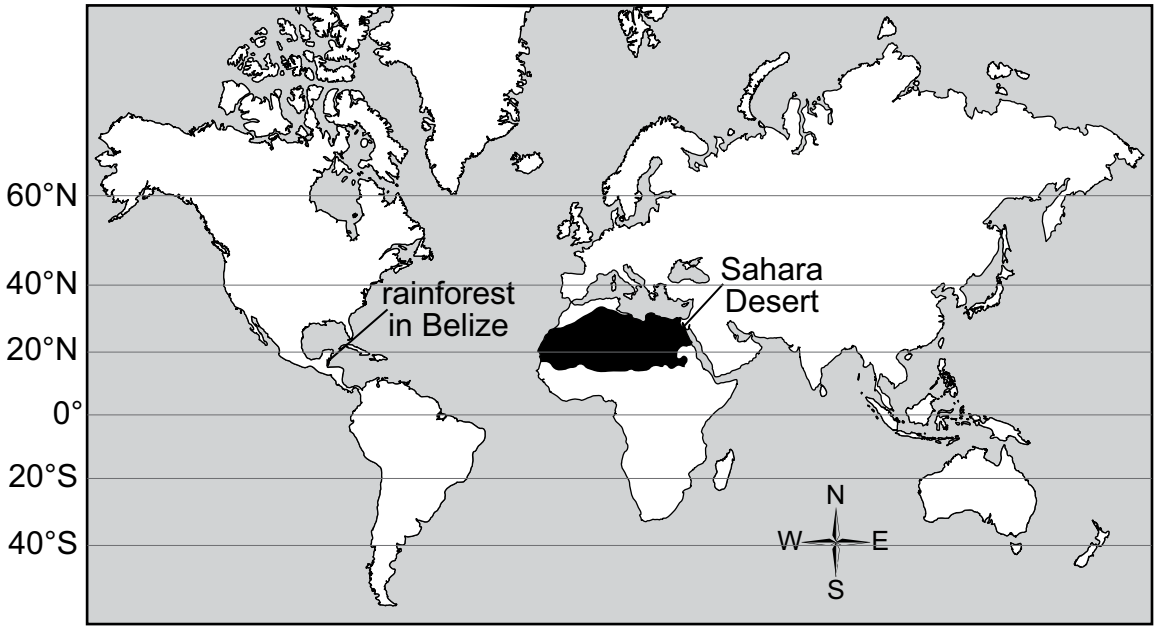
STUDENT RESPONSE

Response Score: 0 points

15. The map shows some information about two ecosystems.

Location of Two Types of Ecosystems



Part A: Describe an abiotic characteristic that is similar in both the desert and the rainforest.

One abiotic characteristic that is similar in both the desert & the rainforest is that they're both located by 20 degree's South.

Go to the next page to finish question 15.

GO ON

15. ***Continued.*** Please refer to the previous page for task explanation.

Part B: Describe a biotic characteristic that is unique to either a desert or a rainforest ecosystem.

Ecosystem: rainforest

Unique biotic characteristic:

the rainforest has many biotic characteristics one would be the rain. The rain helps all the trees & plants grow and those parts of the rainforest are also biotic.

Part C: Describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem.

Ecosystem: Desert

Relationship:

In the desert there are many abiotic and biotic things. A biotic feature in the desert would be the cactus & some plants that rarely grow. Abiotic features in the desert would be rocks and cliffs.

The response provides insufficient evidence to demonstrate any understanding of the characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. In Part A, the response does not correctly describe an abiotic characteristic that is similar in both a desert and a rainforest (*both located by 20 degree's South*). In Part B, the response does not correctly describe a biotic characteristic that is unique to either a desert or a rainforest ecosystem (*Rainforest, rain*). In Part C, the response does not describe a relationship between a biotic component and an abiotic component in either a desert or a rainforest ecosystem (*Desert, A biotic feature . . . cactus . . . Abiotic features . . . rocks and cliffs*).

BIOLOGY MODULE 2—SUMMARY DATA

MULTIPLE-CHOICE

Sample Number	Alignment	Answer Key	Depth of Knowledge	*p*-value A	*p*-value B	*p*-value C	*p*-value D
1	BIO.B.1.1.1	A	2	46%	22%	17%	15%
2	BIO.B.1.2.1	D	2	18%	7%	10%	65%
3	BIO.B.1.2.2	C	2	4%	18%	73%	5%
4	BIO.B.2.1.2	D	2	12%	18%	9%	61%
5	BIO.B.2.2.1	A	2	49%	32%	11%	8%
6	BIO.B.2.3.1	C	2	12%	12%	64%	12%
7	BIO.B.3.1.2	A	2	42%	16%	28%	14%
8	BIO.B.3.2.1	D	2	3%	19%	4%	74%
9	BIO.B.4.1.1	B	2	9%	67%	13%	11%
10	BIO.B.4.2.1	C	2	9%	23%	58%	10%
11	BIO.B.4.2.2	D	2	6%	12%	7%	75%
12 (P)	BIO.B.2.4.1	A	2	61%	17%	12%	10%
13 (P)	BIO.B.3.1.1	B	2	11%	50%	22%	17%

CONSTRUCTED-RESPONSE

Sample Number	Alignment	Points	Depth of Knowledge	Mean Score
14	BIO.B.3.3.1	3	3	1.42
15	BIO.B.4.1.2	3	3	1.49

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Keystone Exams
Biology

Item and Scoring Sampler 2019