Science

The grade 4 LEAP 21 Science test is composed of forty multiple-choice items, four independent short-answer items, and one comprehensive science task. The science task consists of three short-answer items and one essay, all based on a manipulated task. A student earns 1 point for each correct answer to a multiple-choice item, from 0 to 2 points for the answer and work shown for each short-answer item, and from 0 to 4 points for the answer and work shown for the essay.

The short-answer items are scored using the following rubric:

Score	Description
2	• The student's response provides a complete and correct answer.
1	• The student's response is partially correct. • The student's response demonstrates limited awareness or contains errors.
0	• The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

The essay is scored using the following rubric:

Score	Description
4	• The student's response demonstrates in-depth understanding of the relevant content and/or procedures. • The student completes all important components of the task accurately and communicates ideas effectively. • Where appropriate, the student offers insightful interpretations and/or extensions. • Where appropriate, the student uses more sophisticated reasoning and/or efficient procedures.
3	• The student completes most important aspects of the task accurately and communicates clearly. • The response demonstrates an understanding of major concepts and/or processes, although less important ideas or details may be overlooked or misunderstood. • The student's logic and reasoning may contain minor flaws.
2	• The student completes some parts of the task successfully. • The response demonstrates gaps in conceptual understanding.
1	• The student completes only a small portion of the task and/or shows minimal understanding of the concepts and/or processes.
0	• The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Note: It is important to recognize that the score points for constructed-response items and the LEAP 21 achievement levels do not share a one-to-one correspondence. For example, it should *not* be assumed that a student who scores at the *Advanced* achievement level in the assessment has earned a score of 4 on the essay.

It is possible for a 4th-grade student to earn a total of 58 points on the LEAP 21 Science test. The number of raw score points that a student would have to achieve to reach each achievement level may change slightly from year to year given the difficulty of that particular form of the test. The spring 2004 raw score range for each achievement level is listed below.

Spring 2004 Science Test, Grade 4

Achievement Level	Raw Score Range
Advanced	53 – 58 points
Mastery	46 – 52 points
Basic	34 – 45 points
Approaching Basic	24 – 33 points
Unsatisfactory	0 – 23 points

The following section of this document presents four multiple-choice items taken from four strands in the *Teachers' Guide to Statewide Assessment—Science:* **Physical Science, Life Science, Earth and Space Science,** and **Science and the Environment.** One comprehesive science task is included. The science task comprises three short-answer items and one essay item, with scoring guides for each item. Student work at each score point (0 to 2 for the short-answer items and 0 to 4 for the essay) is annotated to explain how the score was derived and the strengths and weaknesses of the response.

The multiple-choice items were selected because they illustrate results from four of the five achievement levels used to report LEAP 21 results—*Approaching Basic, Basic, Mastery,* and *Advanced*. Examples of *Unsatisfactory* work are not included; by definition, work classified as *Unsatisfactory* exhibits a narrower range of knowledge and skills than the work classified as *Approaching Basic*. Information shown for each item includes

- the correct answer,
- the achievement level or score point,
- the standard and benchmark each item measures, and
- commentary on the skills/knowledge measured by the item.

Note: Test items may have been reduced in size for this document. Font size on the LEAP 21 assessments is typically 12 point.

Grade 4—Science
Multiple-Choice Items

Reporting Category: Physical Science

Benchmark PS-E-C5: Investigating and communicating that magnetism and gravity can exert forces on objects without touching the objects

Achievement Level: ***Advanced***

Which type of force requires **contact** between two objects for one to push or pull the other?

* A. frictional forces slowing down a rolling soccer ball

B. the magnetic force pulling paper clips to a powerful electromagnet

C. the magnetic force pushing two magnets apart

D. the force of gravity acting on raindrops that fall to Earth

* correct answer

This Physical Science item would most likely be answered correctly by students who score at the *Advanced* level. It requires students to correctly understand that friction is a force that opposes motion between two object surfaces that are in contact with each other. The force of friction can prevent motion from starting, or it can oppose motion that is already in progress. In this item, frictional forces are slowing down a rolling soccer ball. Magnetic forces involve the attraction and repulsion of atoms due to the arrangement of electrons. These magnetic forces can be attractive (pulling the objects together) or repulsive (pushing the objects apart). Magnetic forces existing between objects do not require the objects to be in contact with each other. Options B and C in this item would be identified as examples of these magnetic forces. Gravity is the force of attraction between two objects that have mass. The force of gravity does not always oppose motion as friction does. Students who score at the *Advanced* level can recognize and understand that friction is a force that requires contact between two objects that are pushing or pulling the other.

Reporting Category: Life Science

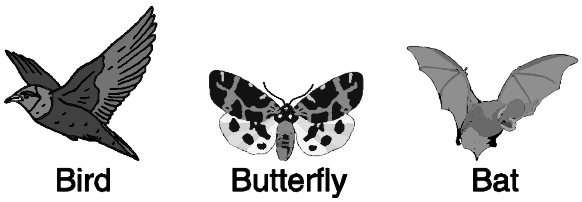
Benchmark LS-E-B2: Observing, comparing, and grouping plants and animals according to likenesses and/or differences

Achievement Level: ***Mastery***

Which group of living things shares the **most** characteristics?

* A. 

B. 

C. 

D. 

* correct answer

This Life Science item would most likely be answered correctly by students who score at the *Mastery* level and above. It requires students to observe, compare, and classify animals according to their common characteristics. Animals can be separated into different groups on the basis of common features and similar structures. Three of the options in this item contain both a vertebrate (animals with backbones) and an invertebrate (multicellular but less complex animals without backbones). In option A, the correct response, the animals are all mammals. Most characteristics that distinguish mammals from other animals could be used to identify that the animals in this example share the most characteristics. Students who score at the *Mastery* level recognize that animals such as the cat, dog, and rabbit share the most common characteristics because they are vertebrates and/or more specifically mammals.

Reporting Category: Earth and Space Science

Benchmark ESS-E-B1: Observing and describing the characteristics of objects in the sky

Achievement Level: ***Basic***

Which object in the sky is a satellite of the planet Earth?

A. Sun
* B. Moon
C. Mars
D. Saturn

* correct answer

This Earth and Space Science item would most likely be answered correctly by students who score at the *Basic* level and above. A minimal knowledge of the characteristics of moving objects in our solar system is needed to answer this question correctly. This requires a student to identify the major types of objects found in our solar system based upon where they are located, how they move, and their relationship to planet Earth. Students should be able to differentiate between rotation and revolution of an object. Rotation is the spinning of an object around its own axis, while revolution is the orbiting of an object around another object. Students often confuse these two terms. Two of the incorrect options, C and D, identify planets in the solar system that revolve around the Sun, not the Earth. A third option, A, is the Sun, around which Earth revolves. Students who score at the *Basic* level understand that the Moon is an object that revolves around Earth and is identified as a satellite of Earth.

Reporting Category: Science and the Environment

Benchmark SE-E-A3: Identifying ways in which humans have altered their environment, both in positive and negative ways, either for themselves or for other living things

Achievement Level: ***Approaching Basic***

What is one way people are **helping** the environment?

* A. They are planting trees to replace the ones that are cut.

B. They are building more roads so more people can see natural areas.

C. They are building more dumps to hold the trash we create.

D. They are using their cars more to get to places faster.

* correct answer

This Science and the Environment item would most likely be answered correctly by students who score at the *Approaching Basic* level and above. A minimal level of knowledge is required to determine how people, acting as citizens and consumers, can be good stewards of the environment. Students should be able to recognize that certain activities can be beneficial or harmful to the environment. All of the incorrect options identify activities that are harmful to the natural world. Students who score at the *Approaching Basic* level will most likely recognize the correct option, identifying that people planting trees to replace ones that are cut is a way people can help the environment.

Grade 4 Science
Comprehensive Science Task

A comprehensive science task on the LEAP 21 Science test is made up of three short-answer items and one essay, which are all related to a manipulated task. Some grade 4 tasks, such as the one included here, require that students work with materials or manipulatives that are provided to them.

The items, scoring rubrics, materials required, and sample student work are shown in this section. The student responses at each score point (0 to 2 for the short-answer items and 0 to 4 for the essay) are annotated to explain how each score was derived and the strengths and weaknesses of the responses.

Note: These items have been reduced in size to fit here. Font size on the LEAP 21 test is typically 12 point.

Session 3: Science Task

Please write your answers to questions XX through XX on the lines or in the spaces provided below each question. Write your answers clearly. Some of the questions have more than one part. Even if you cannot answer all parts, answer as many as you can. When you finish Session 3, you may review your work in this session, but do NOT work on any other test session.

TASK DESCRIPTION: Pond Community
MATERIALS NEEDED: Pond Community Data Sheet

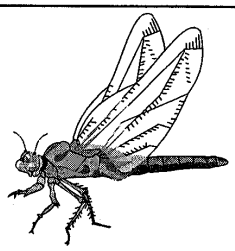
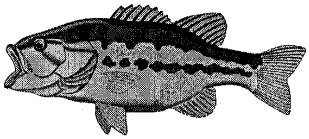
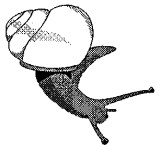
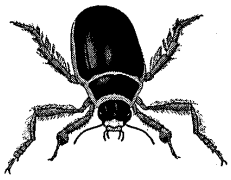
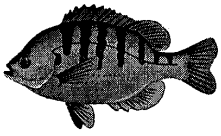
For this task you will consider different organisms. Look at the Pond Community Data Sheet. Then use it to do the following activities.

A reduced-size copy of the material provided for the Science Task (the "Pond Community Data Sheet") is on the following page.

Science Task

Materials Required: Pond Community Data Sheet

Pond Community Data Sheet

Name of Organism	Illustration	Antennae	Number of Legs	What They Eat	Color
Water plants		no	0	nothing—they make their own food	green
Dragonfly		yes	6	snails	brown
Bass		no	0	bluegill fish	gray-green
Snail		yes	0	water plants	gray
Water bug		yes	6	snails	black
Bluegill fish		no	0	dragonflies	blue-green

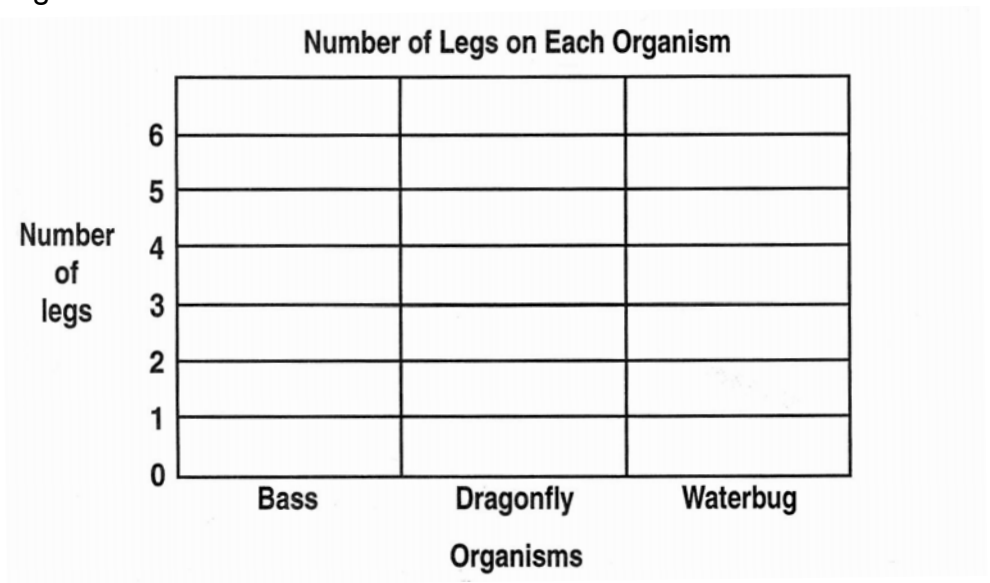
Short-Answer Item (Science Task)—Sample 1

Reporting Category: Science as Inquiry

Benchmark: SI-E-A5: Using data, including numbers and graphs, to explain observations and experiments

Session 3: Science Task (continued)

Construct a bar graph showing the number of legs on the bass, dragonfly, and water bug.



Scoring Rubric

Score	Description
2	Student correctly completes graph for three organisms. Response contains no errors.
1	Student correctly completes the graph for one or two of the organisms.
0	Response is totally incorrect or irrelevant or blank.

Scoring Notes:

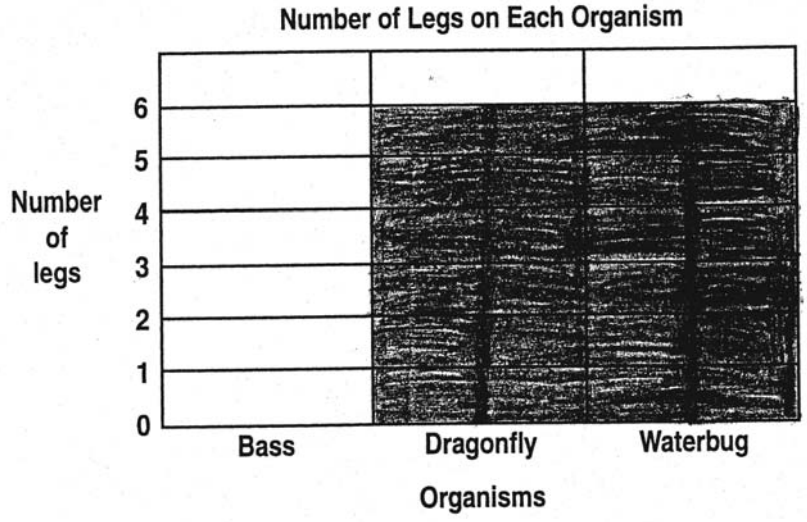
Score 2 (3 correct organisms, correct bar graph)

Score 1 (2 correct organisms, correct graph)
OR
(1 correct organism, correct graph)
OR
(3 correct organisms, indicate number of legs)

Note: For the bass, shading a number-of-legs bar less than the level of .5 is acceptable. More than the level of .5 is not acceptable.

Score Point 2
Short-Answer Item—Sample 1

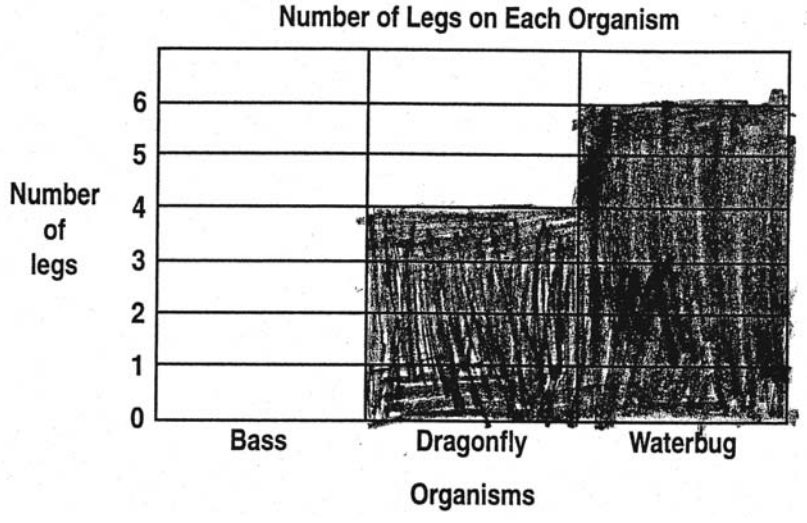
Construct a bar graph showing the number of legs on the bass, dragonfly, and water bug.



The student earns 2 points for correctly plotting the three bars of the graph.

Score Point 1
Short-Answer Item—Sample 1

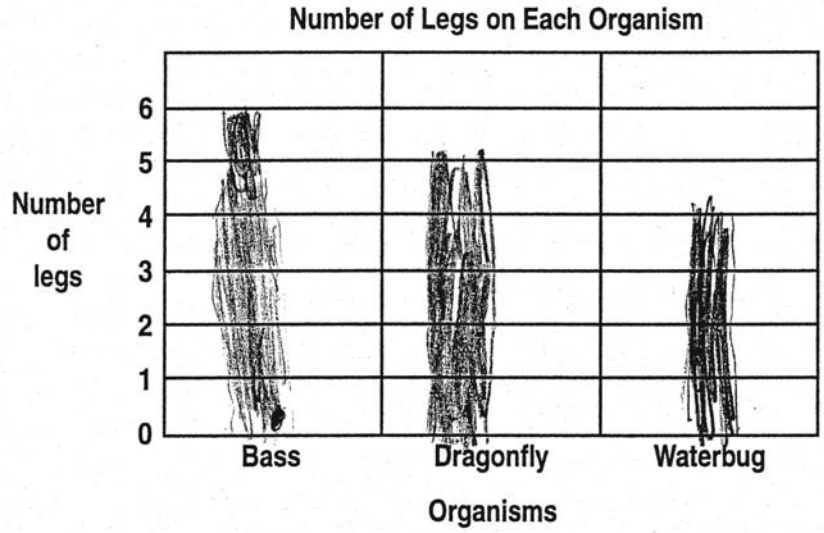
Construct a bar graph showing the number of legs on the bass, dragonfly, and water bug.



The student earns 1 point for correctly plotting two of the bars of the graph (the bass and the water bug).

Score Point 0
Short-Answer Item—Sample 1

Construct a bar graph showing the number of legs on the bass, dragonfly, and water bug.



The student does not earn any points; all three bars of the graph are plotted incorrectly.

Short-Answer Item (Science Task)—Sample 2

Reporting Category: Science as Inquiry

Benchmark: SI-E-A4: Employing equipment and tools to gather data and extend the sensory observations.

List the organisms from your Data Sheet that have antennae.

_____

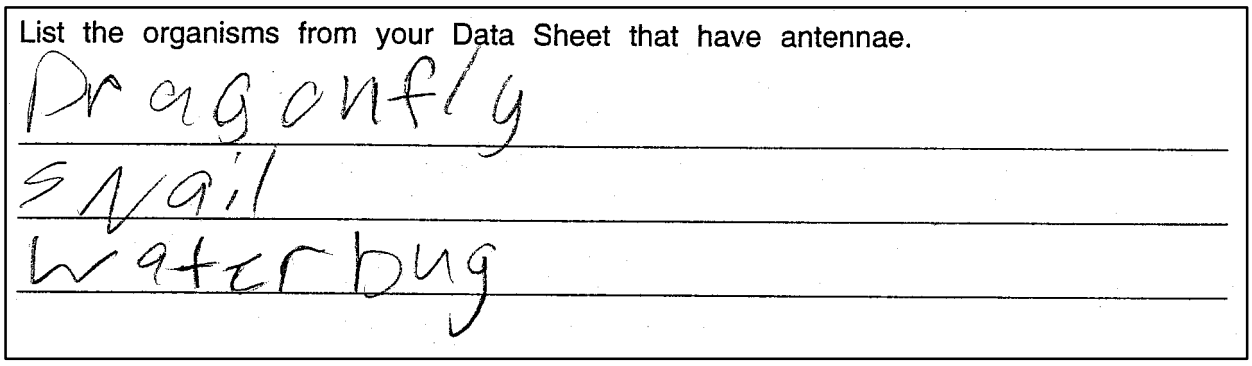
_____

_____

Scoring Rubric

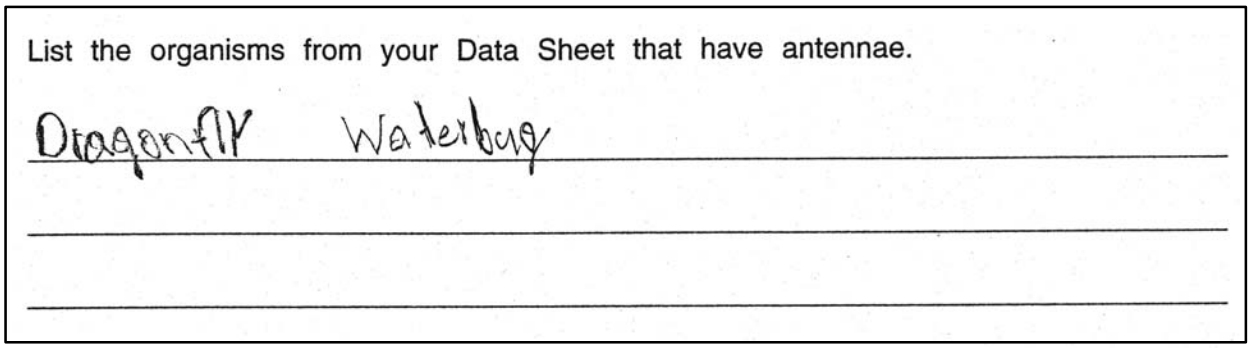
Score	Description
2	Student correctly lists dragonfly, snail, and water bug. Response contains no errors.
1	Student lists one or two of the following: dragonfly, snail, or water bug.
0	Response is totally incorrect or irrelevant or blank.

Score Point 2
Short-Answer Item—Sample 2



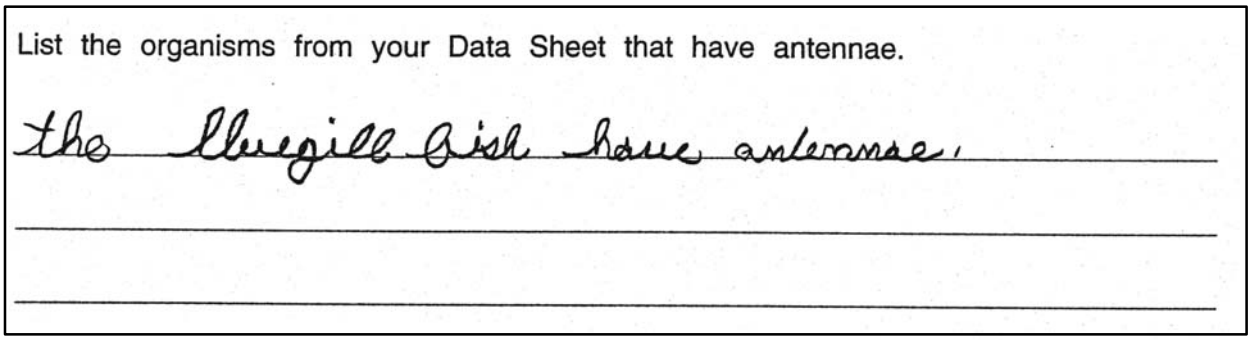
The student earns 2 points for listing three correct organisms: dragonfly, snail, and water bug.

Score Point 1
Short-Answer Item—Sample 2



The student earns 1 point for listing two correct organisms: dragonfly and water bug.

Score Point 0
Short-Answer Item—Sample 2



No credit is given for naming an incorrect organism. The bluegill fish does not have antennae.

Short-Answer Item (Science Task)—Sample 3

Reporting Category: Science as Inquiry

Benchmark: SI-E-A5: Using data, including numbers and graphs, to explain observations and experiments

Give **two** reasons why the dragonfly and water bug are similar.

1. _____

_____

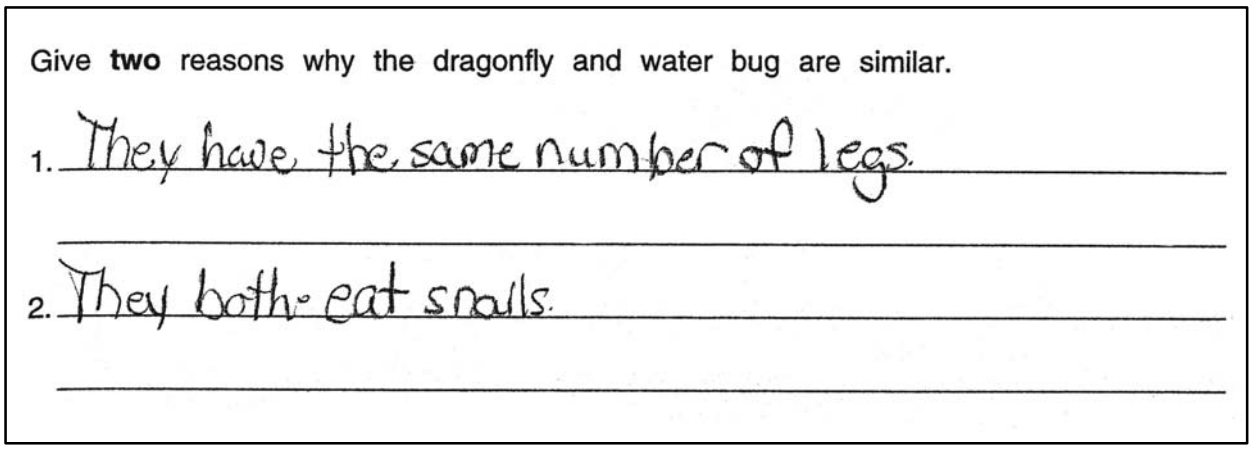
2. _____

_____

Scoring Rubric

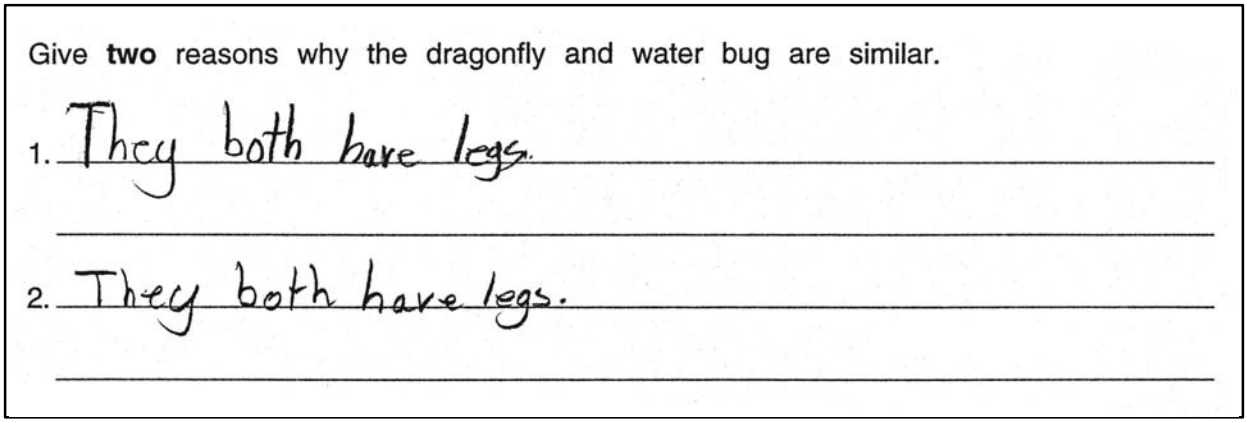
Score	Description
2	Answer includes two of the following reasons: both live in the water both have antennae both have six legs both eat snails Response contains no errors.
1	Answer gives one of the above reasons.
0	Response is totally incorrect or irrelevant or blank.

Score Point 2
Short-Answer Item—Sample 3



The student earns 2 points for correctly stating two reasons why the dragonfly and water bug are similar: "They have the same number of legs" and "they both eat snails."

Score Point 1
Short-Answer Item—Sample 3



The student earns 1 point for stating one similarity between the dragonfly and the water bug: "They both have legs."

Score Point 0
Short-Answer Item—Sample 3

Give **two** reasons why the dragonfly and water bug are similar.

1. The bass was Bron from a big family.

2. The dragonfly was Bron from a small family

The student does not get credit for irrelevant answers.

Short-Answer Item (Science Task)—Sample 4

Reporting Category: Life Science

Benchmark: LS-E-C1: Examining the habitats of plants and animals and determining how basic needs are met within each habitat

Here is a food chain for a pond.

What would happen to the largemouth bass if all the algae were removed from the pond? Describe what would happen to all **four** parts of this food chain.

Scoring Rubric

Score	Description
4	The student correctly responds to all four parts of the question by: • stating that the bass will die/go hungry/have no food; • explaining the relationship between the algae and insects; • explaining the relationship between the insects and bluegills; and • explaining the relationship between the bluegills and bass. Response contains no errors.
3	The student correctly responds to all four parts of the question, but the response contains minor errors or misconceptions. **OR** The student correctly responds to three parts of the question.
2	The student correctly responds to two parts of the question. Response may contain major errors or misconceptions.
1	The student correctly responds to one part of the question, or response shows evidence of minimal understanding of food chains.
0	Response is totally incorrect or irrelevant, or blank.

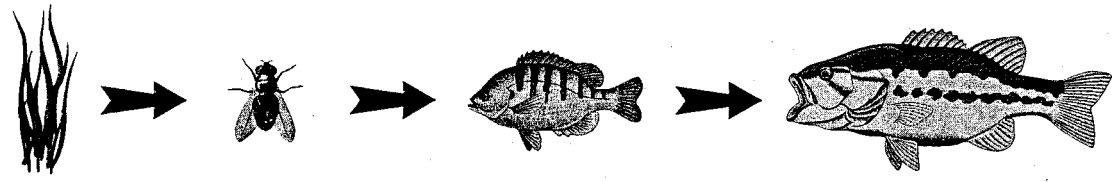
Training Notes

Sample Answer: The bass will all die. If there are no algae for the insect to eat, the insect will die. If there are no insects, the bluegills will die. If all the bluegills die, the bass will starve.

NOTE: As written, the above response would receive 4 points if the first line were omitted. The fate of the bass is covered in the last statement.

Score Point 4
Short-Answer Item—Sample 4

Here is a food chain for a pond.



algae insect bluegill largemouth bass

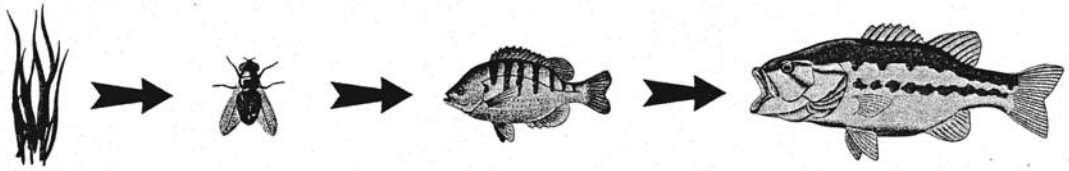
What would happen to the largemouth bass if all the algae were removed from the pond? Describe what would happen to all **four** parts of this food chain.

If all the algae was gone all the insects would die because they ~~eat~~ that & if the insects died the blue gill fish would die too because they eat insects & if the blue gill fish would die then the bass would die too because they eat that. Thats what would happen.

The student earns 4 points for correctly stating that the bass will die and for using the steps in the food chain to explain why: if the algae dies, the insects die for lack of food; then the blue gill fish will die because there are no insects; and finally the bass will die for lack of blue gill fish to consume.

Score Point 3
Short-Answer Item—Sample 4

Here is a food chain for a pond.



algae insect bluegill largemouth bass

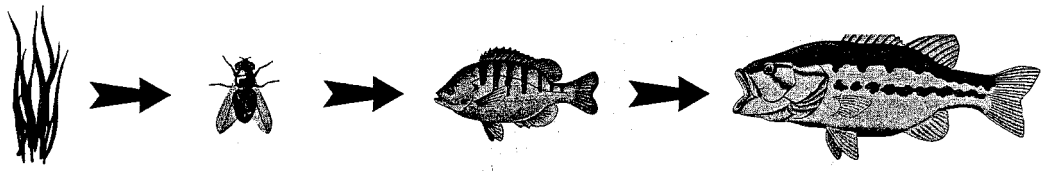
What would happen to the largemouth bass if all the algae were removed from the pond? Describe what would happen to all **four** parts of this food chain.

First the insects will die because they have no food. Then the blue gill would die because it has no food. Last the largemouth bass will die because the blue gill is dead.

The student earns 3 points for stating that the bass will die and using the food chain to explain why. The explanation does not name the specific organism that is missing as a primary food source; it only refers to "food" missing.

Score Point 2
Short-Answer Item—Sample 4

Here is a food chain for a pond.



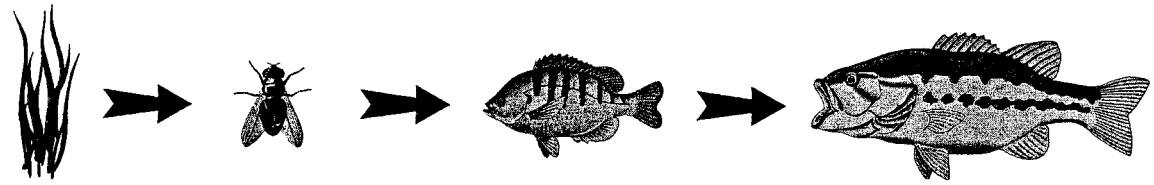
What would happen to the largemouth bass if all the algae were removed from the pond? Describe what would happen to all **four** parts of this food chain.

They would all die. The largemouth Bass would die because it has nothing to feed it. The Foodchain would change.

The student earns 2 points for stating that the bass will die and for making a correct reference to the food chain.

Score Point 1
Short-Answer Item—Sample 4

Here is a food chain for a pond.



What would happen to the largemouth bass if all the algae were removed from the pond? Describe what would happen to all **four** parts of this food chain.

The large mouth bass will die.

The student earns 1 point for stating that the bass will die.

Score Point 0
Short-Answer Item—Sample 4

Here is a food chain for a pond.

What would happen to the largemouth bass if all the algae were removed from the pond? Describe what would happen to all **four** parts of this food chain.

If all of the algae was removed he wouldn't have anything to eat unlease he or she eat other fishes.

No credit is earned because the student does not address the fact that the bass will die and because the food chain reference is incorrect.