Science

The grade 4 LEAP 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 inquiry-based short-answer items and one extended constructed-response item, 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 extended constructed-response item.

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 extended constructed-response item 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 student's 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 student's 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.

It is important to recognize that score points for constructed-response items and LEAP 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 extended constructed-response item.

It is possible for a grade 4 student to earn a total of 58 points on the LEAP Science test. The number of raw score points 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 2009 raw score range for each achievement level is shown below.

Spring 2009 Science Test, Grade 4

Achievement Level	Raw Score Range
Advanced	51 – 58 points
Mastery	46 – 50 points
Basic	35 – 45 points
Approaching Basic	26 – 34 points
Unsatisfactory	0 – 25 points

The following section of this document presents four multiple-choice items, each taken from four of the five science strands: **Science as Inquiry, Physical Science, Life Science,** and **Earth and Space Science**. The items were selected because they illustrate results from four of the five achievement levels used to report LEAP results—*Advanced, Mastery, Basic,* and *Approaching Basic*. Examples of *Unsatisfactory* work are not included; by definition, work classified as *Unsatisfactory* exhibits a narrower range of knowledge and skills than work classified as *Approaching Basic*. Information shown for each item includes

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

Grade 4—Science
Multiple-Choice Items

Strand: Science as Inquiry

Benchmark SI-E-A3: communicating that observations are made with one's senses

Achievement Level: ***Advanced***

Sophie investigates the water supply at her school and the things that affect it. Which action is a direct observation?

* A. tasting water from a water fountain

B. reading water test results

C. studying the rules for purifying water

D. investigating causes of water pollution

** correct answer*

This item would most likely be answered correctly by students who score at the *Advanced* level. The item requires students to know the difference between direct observation and other skills used in scientific investigations. Students who choose option B (reading water test results) do not recognize the difference between direct observations (using the senses to test the quality of the water) and examining data (reading the results produced from a scientific test). Students who choose option C or D are confusing direct observations with complex tasks (studying rules or conducting investigations) that require higher-level cognitive processes (analysis). Students who choose the correct answer, option A, understand that direct observations are made using the empirical or natural senses (sight, hearing, taste, touch, smell, etc.).

Strand: Physical Science

Benchmark PS-E-A3: observing and describing the objects by the properties of the materials from which they are made (paper, wood, metal)

Achievement Level: ***Mastery***

Use the data table below to answer question XX.

Observations of Unknown Object
is shiny
conducts electricity
is not magnetic

According to the evidence in the data table, which material **most likely** makes up this object?

A. iron

B. polished wood

* C. copper

D. plastic wrap

* *correct answer*

This item would most likely be answered correctly by students who score at the *Mastery* level and above. The item requires students to recognize objects by the properties of the materials from which they are made. Students who choose option A may not recognize that iron has magnetic properties. Students who choose option B or D may not recognize that polished wood and plastic wrap do not conduct electricity. Students who choose the correct answer, option C, recognize that copper is shiny, conducts electricity, and is not magnetic.

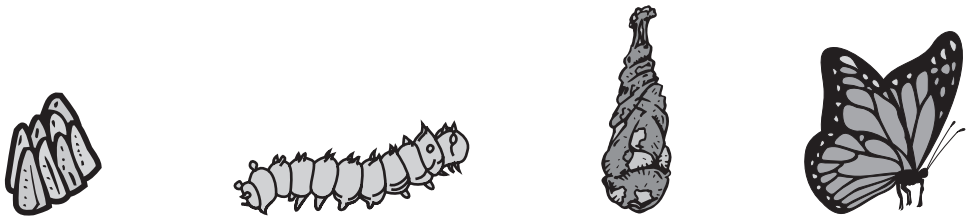
Strand: Life Science

Benchmark LS-E-B1: observing and describing the life cycles of some plants and animals

Achievement Level: ***Basic***

Use the picture below to answer question XX.

Four Stages of a Butterfly



1 2 3 4

What happens in stage 2 of a butterfly's life cycle?

A. It hatches into a larva.

B. It changes its body shape.

C. It mates with other butterflies.

* D. It eats and grows.

* *correct answer*

This item would most likely be answered correctly by students who score at the *Basic* level and above. The item requires students to know the four stages of the life cycle of the butterfly. Students who choose option A or B do not understand what happens during each stage of the life cycle. Students who choose option C do not know that only adult butterflies (stage 4) mate to produce fertilized eggs. Students who choose the correct answer, option D, understand that caterpillars eat and grow during stage 2.

Strand: Earth and Space Science

Benchmark ESS-E-A6: observing and describing variations in soil

Achievement Level: ***Approaching Basic***

Mrs. Tucker gives her class samples of different soil types. Which action **best** helps Tanisha identify each soil type?

A. smelling it

* B. touching it

C. weighing it

D. measuring it

** correct answer*

This item would most likely be answered correctly by students who score at the *Approaching Basic* level and above. The item requires students to recognize the best way to identify different soil types. Students who choose option C or D do not recognize that weighing or measuring the soil only quantifies the amount of soil and does not help differentiate between soil types. Students who choose option A understand that smelling different soil types helps to differentiate between them but using smell is not the best option since the organic components of soil are the primary sources of soil odor. Odor will not help differentiate between soils with high sand or clay concentrations because these soils typically have low organic concentrations. Students who choose the correct answer, option B, recognize that touch is the best way to differentiate between different soil types because sandy soil is coarse and easily falls apart, clay soils are smooth and slippery, and loamy soils hold together when squeezed into a ball.

Grade 4—Science
Short-Answer Item

A science short-answer item for a LEAP test may require students to reflect on an idea, demonstrate understanding of the unifying concepts and processes of science, make meaning of a given set of data, or critique the design or interpretation of results from an experiment. Frequently, the short-answer items have more than one part. In addition to writing, students may be asked to work with graphics, tables, or other materials.

The item, scoring rubric, and sample student work are shown on the following pages. The student responses at each score point (0 to 2) are annotated to explain how each score was derived and to identify the strengths and weaknesses of the responses.

Strand: Life Science

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

Use the information below to answer question XX.

Beavers are natural builders. They build their homes from tree branches and often lay branches across a stream to build a dam. They use mud to seal any open spaces. To keep out other animals, the doors to their homes are underwater. There may be several rooms inside their homes. One room may be used for storing food for winter, such as plants and tree bark.

Explain how a beaver's environment meets **two** of its basic needs.

1. _____

_____

2. _____

_____

Scoring Rubric

Score	Description
2	The student gives two correct key elements. There are no errors.
1	The student gives one correct key element. There are one or more errors.
0	The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Scoring Notes

The student specifically explains how the environment provides food, shelter, and protection for a beaver.

The student explains that tree bark and other plants are a food source for beavers.

The student explains that the beavers' home provides shelter and/or protection.

The student explains that beavers build a dam across a stream to make the water deeper for protection.

Score Point 2

Use the information below to answer question XX.

Beavers are natural builders. They build their homes from tree branches and often lay branches across a stream to build a dam. They use mud to seal any open spaces. To keep out other animals, the doors to their homes are underwater. There may be several rooms inside their homes. One room may be used for storing food for winter, such as plants and tree bark.

Explain how a beaver's environment meets **two** of its basic needs.

1. The beaver's get their shelter from tree Branches.

2. They also get their food from plants and tree bark.

The student earns 1 point for explaining that the beavers can use the tree branches from their environment to meet the basic need of shelter. The student also earns 1 point for explaining that the beavers can use plants and tree bark from their environment to meet the basic need of food.

Score Point 1

Use the information below to answer question XX.

Beavers are natural builders. They build their homes from tree branches and often lay branches across a stream to build a dam. They use mud to seal any open spaces. To keep out other animals, the doors to their homes are underwater. There may be several rooms inside their homes. One room may be used for storing food for winter, such as plants and tree bark.

Explain how a beaver's environment meets **two** of its basic needs.

1. The water helps keep out other animals from coming in the dam.

2. The tree branches and mud builds the dam in the water.

The student receives no points for the first part of the response because the explanation is only partially correct. The water alone does not necessarily protect the beaver from its predators. In actuality, it is the underwater placement of the entrance to their homes which requires predators to swim under the water that protects a beaver from being attacked. The student earns 1 point for explaining that dams are built from tree branches and mud found in a beaver's environment (shelter).

Score Point 0

Use the information below to answer question XX.

Beavers are natural builders. They build their homes from tree branches and often lay branches across a stream to build a dam. They use mud to seal any open spaces. To keep out other animals, the doors to their homes are underwater. There may be several rooms inside their homes. One room may be used for storing food for winter, such as plants and tree bark.

Explain how a beaver's environment meets **two** of its basic needs.

1. They can build their own house.

2. They can store food for winter.

The student receives no credit for this response. The student states what beavers can do to meet their basic needs ("build their own house" and "store food for winter") but does not explain how the beaver's environment is specifically utilized.