

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	<ul style="list-style-type: none"> The student's response provides a complete and correct answer.
1	<ul style="list-style-type: none"> The student's response is partially correct. The student's response demonstrates limited awareness or contains errors.
0	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> The student completes some parts of the task successfully. The student's response demonstrates gaps in conceptual understanding.
1	<ul style="list-style-type: none"> The student completes only a small portion of the task and/or shows minimal understanding of the concepts and/or processes.
0	<ul style="list-style-type: none"> 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 2008 raw score range for each achievement level is shown below.

Spring 2008 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, each taken from four of the five science strands: **Science as Inquiry, Earth and Space Science, Science and the Environment**, and **Life 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*. In addition, two short-answer items with their scoring rubrics and sample student responses at score points 0 to 2 are included. For these items, each student response is annotated to explain how the score was derived and to identify the strengths and weaknesses of the response. 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-B2:** Using appropriate experiments depending on the questions to be explored
- Achievement Level:** *Advanced*

Choose the investigation that would **best** answer the question: Does the length of a string change how fast a pendulum swings?

- * A. Tie identical weights to two strings of different lengths.
- B. Tie two different weights to a string.
- C. Tie identical weights to a long string.
- D. Tie two different weights to two identical strings.

* *correct answer*

This item would most likely be answered correctly by students who score at the *Advanced* level. The item requires students to know that only one variable can be tested during an investigation. Choosing option B, C, or D indicates insufficient analysis of the investigation to determine which variable is being manipulated. Options B and C can be eliminated because a comparison cannot be observed. Students who choose option D may not realize that more than one variable changes. Students who choose option A understand that the comparison of string length is necessary for this investigation and that the mass of the weight must be controlled.

Strand: Earth and Space Science

Benchmark ESS-E-A7: Investigating fossils and describing how they provide evidence about plants and animals that lived long ago and the environment in which they lived

Achievement Level: *Mastery*

Anne and her father find a 30-million-year-old tropical plant fossil in Louisiana. Which question does the fossil help them answer?

- A. Were there mountains in Louisiana 30 million years ago?
- * B. What was the climate like in Louisiana 30 million years ago?
- C. Were there earthquakes in Louisiana 30 million years ago?
- D. What kind of animals lived in Louisiana 30 million years ago?

* *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 use provided information to draw conclusions. Students who choose option A create an incorrect association between tropical plants or fossils and mountain ranges. Students who choose option C may believe that catastrophic events happened in the past 30 million years, but they do not use the information in the item stem (plant fossil) for their analysis of the problem. Students who choose option D are overthinking the question by reasoning that if certain types of plants were available then certain types of animals might be attracted to these plants for food. This type of extrapolation is similar to guessing rather than analyzing the facts. Students who choose option B associate the type of plant with the appropriate climate. These students understand that only specific climatic conditions support tropical plants.

Strand: Science and the Environment

Benchmark SE-E-A5: Understanding that most plant and animal species are threatened or endangered today due to habitat loss or change

Achievement Level: *Basic*

How does too much fishing in an area affect its ecosystem?

- A. The fish will lay many more eggs to replace the fish that were caught.
- *B. Organisms that eat the fish could become endangered due to starvation.
- C. Organisms that the fish eat will become endangered.
- D. People could eat too many fish and become ill.

* *correct answer*

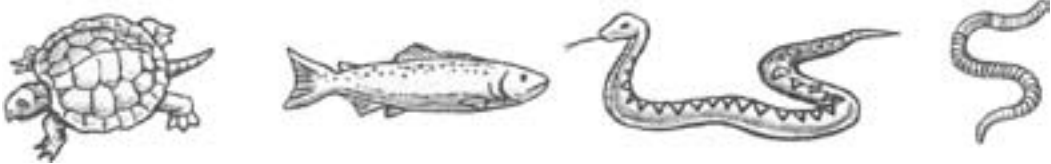
This item would most likely be answered correctly by students who score at the *Basic* level and above. The item requires students to know that too many demands on a system will be harmful to that system. Students who choose option A believe fish can adjust to the environmental strain caused by too much fishing. Students who select option C are confused about which organism becomes endangered. Students who select option D did not understand that the question was about the general health of an ecosystem. Students who select option B understand that the fish are food for other organisms in the ecosystem and that a reduction in the food supply (fish) could result in starvation for the other organisms.

Strand: Life Science

Benchmark LS-E-A4: Recognizing that there is great diversity among organisms

Achievement Level: *Approaching Basic*

Which of these animals does **not** have a backbone?



A. B. C. *D.

The image shows four animals labeled A, B, C, and D. A is a turtle, B is a fish, C is a snake, and D is an earthworm. The question asks which animal does not have a backbone.

* 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 and compare physical characteristics of animals. Students who choose option A may believe that because the shell is an exoskeleton, no backbone is necessary. Similarly, students who select options B or C may believe that animals with scales don't need backbones. Students may also believe that only animals that walk have backbones (a misconception). Students who select option D correctly identify the animal that does not have a backbone.

Grade 4—Science Short-Answer Items

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.

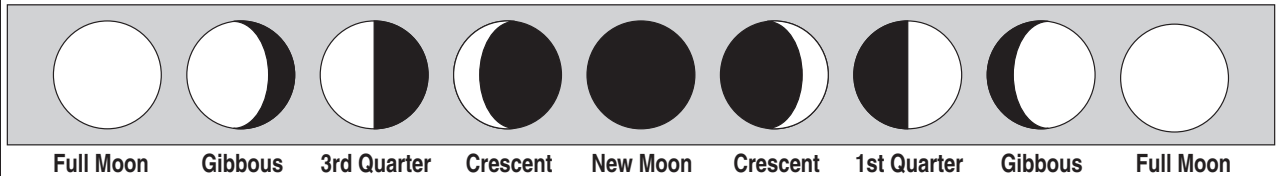
The items, scoring rubrics, and sample student work are shown on the following pages. The student responses at each score point (0 to 2) are annotated to explain how each score was derived and to identify the strengths and weaknesses of the responses.

Sample 1

Strand: Earth and Space Science

Benchmark ESS-E-B3: Observing and recording the changing appearances and positions of the moon in the sky at night and determining the monthly pattern of lunar change

These are pictures of how the Moon appears at different times.



- A. How long does it take for all the phases shown above to take place?
- B. Explain why the Moon looks different at different times.

Scoring Rubric

Score	Description
2	Parts A and B are answered correctly.
1	Either A or B is answered correctly.
0	The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Scoring Information:**Part A**

- 28 days

OR

- 29+ days

OR


- 1 month

Part B

- The changing position of the Moon in the sky.

Score Point 2

These are pictures of how the Moon appears at different times.



Full Moon Gibbous 3rd Quarter Crescent New Moon Crescent 1st Quarter Gibbous Full Moon

a. How long does it take for all the phases shown above to take place?

28 days


b. Explain why the Moon looks different at different times.

THE MOON rotates around the earth so the sun hits it in different spots and some spots it doesn't hit so you can't see that part.

The student earns 1 point in part A for answering that it takes 28 days for all phases of the Moon to take place. The student earns 1 point in part B for stating that the Moon's rotation affects the way the Sun hits different spots of the Moon and therefore affects the way the Moon looks.

Score Point 1

These are pictures of how the Moon appears at different times.



Full Moon Gibbous 3rd Quarter Crescent New Moon Crescent 1st Quarter Gibbous Full Moon

a. How long does it take for all the phases shown above to take place?

It take 29 days.


b. Explain why the Moon looks different at different times.

because they chage every night

The student earns 1 point in part A for answering that it takes the Moon 29 days for all phases to take place. Part B receives no credit because of its ambiguous usage of “they” and for not explaining what type of change occurs.

Score Point 0

These are pictures of how the Moon appears at different times.



Full Moon Gibbous 3rd Quarter Crescent New Moon Crescent 1st Quarter Gibbous Full Moon

a. How long does it take for all the phases shown above to take place?

9 night

b. Explain why the Moon looks different at different times.

Because clouds cover up part of it some times it dont cover it up

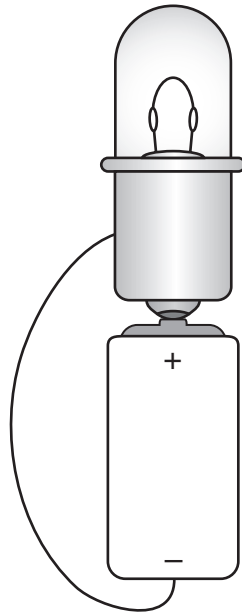
Both parts A and B are incorrect and receive no credit. In part A, the student appears to have simply counted the number of Moon pictures given in the item. In part B, the student’s answer is not specific to the item, which essentially asks about why we have different phases of the moon.

Sample 2

Strand: Physical Science

Benchmark PS-E-C6: Exploring and describing simple energy transformations

Use the picture below to answer question XX.



- A. How does the form of energy change when energy moves from the battery through the wire to the lightbulb?
- B. What two forms of energy are produced by the lightbulb?

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 Information:**Part A**

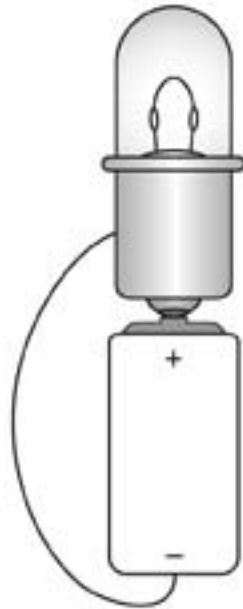
- The energy in the battery is changed to electrical (kinetic) energy through the wires to the lightbulb.

Part B

- The lightbulb produces heat and light.

Score Point 2

Use the picture below to answer question XX.



- A. How does the form of energy change when energy moves from the battery through the wire to the lightbulb?

It changes by becoming electrical
energy.

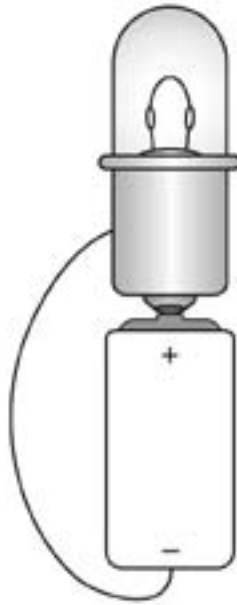
- B. What two forms of energy are produced by the lightbulb?

light energy heat energy

The student earns 1 point in part A for stating that the energy changes to electrical energy when it moves from the battery through the wires to the lightbulb. The student earns 1 point in part B for giving two correct forms of energy produced by the lightbulb: light and heat.

Score Point 1

Use the picture below to answer question XX.



- A. How does the form of energy change when energy moves from the battery through the wire to the lightbulb?

The energy travels from the battery
through the wire into the light bulb.

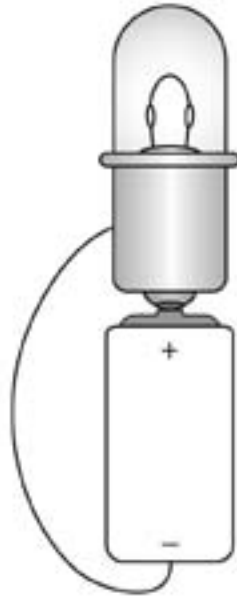
- B. What two forms of energy are produced by the lightbulb?

heat _____ light _____

The student receives no credit for part A because the response only addresses the path energy travels, but does not identify how the form of energy changes. The student earns 1 point in part B for giving two correct forms of energy produced by the lightbulb: heat and light.

Score Point 0

Use the picture below to answer question XX.



- A. How does the form of energy change when energy moves from the battery through the wire to the lightbulb?

because the energy from
the battery to the wire.

- B. What two forms of energy are produced by the lightbulb?

wire battery

Both answers are incorrect and receive no credit.