

## Chapter 3: *i*LEAP Science, Grade 6

This section describes the overall design of the *i*LEAP Science test to be administered to students in grade 6. Test specifications and sample test questions are provided so that teachers may align classroom practices with the state assessment.

### Test Structure

The Science test consists of one part and is administered in a single day.

The Science test is a criterion-referenced test (CRT) that includes items based entirely on Louisiana’s science content standards. These items are aligned with Louisiana’s Grade-Level Expectations (GLEs) and were developed specifically for Louisiana.

### Item Types

The test has forty-eight (48) multiple-choice items.

The multiple-choice items consist of an interrogatory stem and four answer options. These items assess a student’s knowledge and conceptual understanding, and responses will be scored 1 if correct and 0 if incorrect.

To maximize the meaningfulness of multiple-choice test items, questions are typically cast in a practical problem-solving context, referring to a single stimulus (e.g., chart) or to a description of a single scenario. The reading difficulty level of test questions is minimized to the extent possible (except for necessary scientific terms) so that students’ reading ability does not interfere with their ability to demonstrate their science knowledge and skills.

### Description of the Science Test

The Science test was developed specifically for Louisiana. Committees of Louisiana educators reviewed all items for content and alignment with Louisiana’s standards, benchmarks, and GLEs. Separate committees reviewed the items for potential bias and sensitive material.

The Science test is **untimed**. About one hour (60 minutes) is the suggested time to allow students to answer the questions.

The grade 6 Science test assesses three of the five science strands delineated in the Louisiana Science Framework and the Comprehensive Curriculum: Science as Inquiry, Physical Science, and Science and the Environment.

## Description of Stimulus Material

The stimulus material may include:

- Data tables or graphs presenting data to be read or interpreted,
- Charts, illustrations, or graphic organizers,
- Descriptions and details of science investigations, and/or
- Maps showing geographical features.

## Scoring Information

The *iLEAP* Science test contains multiple-choice items only. These items have four response options (A, B, C, D) and are scored right or wrong. Correct answers receive a score of 1; incorrect answers receive a score of 0.

## Science Test Specifications

Table 12 provides the test specifications for the grade 6 *iLEAP* Science assessment. The values in the table are approximations due to slight variations in the content across test forms.

**Table 12: Grade 6 Science Specifications**

<b>Strand/Category</b>	<b>% of Total Points</b>
<b>Science as Inquiry</b>	42
A. The Abilities Necessary to Do Scientific Inquiry	
B. Understanding Scientific Inquiry	
<b>Physical Science</b>	42
A. Properties and Changes of Properties in Matter	
B. Motions and Forces	
C. Transformations of Energy	
<b>Science and the Environment</b>	16
<b>Total</b>	<b>100</b>

## Strands, Benchmarks, and GLEs Assessed

Louisiana's Science Framework encompasses five strands: Science as Inquiry, Physical Science, Life Science, Earth and Space Science, and Science and the Environment. At grade 6, only three strands are addressed: Science as Inquiry, Physical Science, and Science and the Environment.

The Louisiana science strands are each associated with a single standard, which present broad goals for what all students in Louisiana should know and be able to do in science:

### **Science as Inquiry (SI) Strand**

**Standard:** Students will do science by engaging in partial and full inquiries that are within their developmental capabilities.

### **Physical Science (PS) Strand**

**Standard:** Students will develop an understanding of the characteristics and interrelationships of matter and energy in the physical world.

### **Science and the Environment (SE) Strand**

**Standard:** In learning environmental science, students will develop an appreciation of the natural environment, learn the importance of environmental quality, and acquire a sense of stewardship. As consumers and citizens, they will be able to recognize how our personal, professional, and political actions affect the natural world.

The focus for grade 6 Louisiana students is Physical Science concepts. The content explored at this grade level includes the nature of matter, elements, simple chemical reactions, the effects of forces on the motions of objects, forms of energy, and characteristics and outcomes of energy transformations. Selected Science and the Environment concepts are integrated with Physical Science content. For this reason, the grade 6 *i*LEAP Science test assesses the following strands: Science as Inquiry, Physical Science, and Science and the Environment.

Science as Inquiry is a **process** strand; the others are **content** strands. The organization into strands does not imply that science should be taught in isolated units. In fact, teachers are encouraged to integrate study units. Inquiry should be integrated across all the science content strands.

GLEs further define the knowledge and skills students are expected to master by the end of each grade or high school course. The GLEs for each grade are developmentally appropriate and increase in complexity to build the knowledge and skills students need.

Most of the grade 6 GLEs are eligible for assessment on the grade 6 *i*LEAP. Some, however, do not lend themselves to testing on a statewide assessment in multiple-choice format. For example, some GLEs require students to use a particular technology, construct models, write the steps in an investigation, or draw a diagram. Other GLEs, in accordance with the Comprehensive Curriculum, may not be taught prior to the spring test administration and therefore will not be assessed. Science as Inquiry GLEs 7, 8, 9, 14, 15, 19, 20, 24, 37, and 40 are not assessed. Physical Science GLEs 1, 3, 6, 7, 20, and 31 are not assessed. It is important, however, that the skills represented by these GLEs are taught at this grade level to prepare students for classroom assessment purposes as well as the grade 8 LEAP test.

## Explanation of Codes

GLEs are numbered consecutively in each grade level and grouped by strand and thematic category. For example:

- Strand:** Physical Science  
**Categories:** A. Properties and Changes of Properties of Matter  
B. Motions and Forces  
C. Transformations of Energy

Benchmarks are coded by strand, grade cluster (E, M, H), and benchmark number. The first term in the code refers to the strand. The second term refers to the grade cluster, and the third term refers to the category and benchmark number. Categories are indicated by letters.

Table 13 provides three examples of benchmark codes.

**Table 13: Examples of Science Codes**

Code	Translation
SI-E-A5	SI strand, Elementary level, category A, benchmark 5
PS-M-B4	PS strand, Middle School level, category B, benchmark 4
SE-H-A6	SE strand, High School level, category A, benchmark 6

For most grade clusters, strands are divided into categories, or major topical areas. However, the SE strand has no substrands for prekindergarten through 4 and 5 through 8.

Science GLEs are numbered consecutively in Science as Inquiry and consecutively within the content strands.

Science as Inquiry—GLEs 1–40

Physical Science—GLEs 1–41

Science and the Environment—GLEs 42–47

## Key Concepts for the Grade 6 Assessment

Key concepts are provided to guide teachers in their classroom instruction as it relates to the assessment. These concepts describe important content emphasis regarding the knowledge and skills eligible for assessment of each strand.

## Science as Inquiry

### 1. Designing an Investigation

- Identify testable questions, questions that guide investigations/experiments, and questions to consider during an investigation
- Identify problems in an investigation
- Identify the components of an investigation
- Use multiple sources to answer questions
- Select appropriate experimental design or setup
- Predict outcomes of an investigation
- Identify correct procedure in an investigation
- Identify independent variable, dependent variable, and variables that should be controlled/constant
- Select appropriate tools, equipment, and technology to use in an investigation
- Measure using appropriate or accurate units of the metric system
- Identify appropriate safety tools and procedures
- Identify correct setup between varying investigations
- Identify ways to improve the investigation
- Identify mistakes in procedures
- Identify alternate methods for investigation using the same tools

### 2. Communication

- Understand and be able to identify the difference between a description and an explanation
- Understand and be able to identify the difference between an observation and an inference
- Use data tables, charts, circle graphs, line graphs, bar graphs, diagrams, scatter plots, and symbols to collect, record, and report data
- Develop an explanation of experimental results
- Identify patterns in data
- Use models to explain natural phenomena or conclusions from investigations
- Predict trends supported by data
- Use multiple ways to interpret data that may result in alternate explanations
- Identify statements not supported by data/faulty reasoning
- Communicate results of investigations
- Identify statements that explain data

### 3. Technology and the Work of Scientists

- Recognize that scientists use logical processes to solve problems
- Review other scientists' work before beginning an investigation
- Recognize that technology expands the human senses
- Recognize that present technology limits answering all questions
- Understand that there is an acceptable range of variation in collected data
- Identify mean, median, mode, and range from a given set of data
- Identify problems in models, experimental design

- Understand how scientists communicate about investigations in progress and findings
- Describe how/why scientific theories change
- Verify experiments through multiple investigation/trials
- Solve problems and form new ideas as a result of scientific investigations
- Identify ways technology has changed human life

## Physical Science

### 1. Matter

#### A. Properties of Matter

- Identify physical properties and chemical properties of substances
- Determine physical and chemical changes
- Describe the movement of atoms in solid, liquid, and gaseous states
- Make comparisons about the temperature at which water changes phases (freezing point, melting point, and boiling point)
- Calculate density from a given set of data

#### B. Chemical Changes of Matter

- Describe the products of chemical reactions
- Describe the properties of reactants
- Identify atomic mass of a given element
- Identify the mass of reactants and products in a given chemical reaction
- Identify how particle size of the same reactant affects the rate of chemical reactions
- Identify elements and compounds from a variety of sources

### 2. Forces and Motion

- Analyze motion graphs and predict future movement
- Identify that velocity is speed and direction.
- Differentiate velocity from speed.
- Identify acceleration, deceleration, and constant speed graphs
- Identify forces acting on objects
- Recognize balanced and unbalanced forces
- Explain net force
- Explain that an object will remain at rest or in a constant motion unless an unbalanced force acts upon it
- Give examples of forces
- Describe friction
- Describe gravity
- Describe how resistance of materials affects electrical flow
- Identify objects with potential and kinetic energy

### 3. Energy

- Identify forms of energy (light, heat, sound, electrical, nuclear, mechanical)
- Explain transmission, reflection, absorption of sound, light, and heat energy
- Explain the law of conservation of energy
- Describe energy transformations in a simple system
- Understand simple machines (relationship of work input to work output)
- Recognize and compare heat transfer (conduction, convection, and radiation)
- Recognize that heat energy flows from a system of higher energy to a system of lower energy
- Explain that electricity is produced from other types of energy (magnetism, solar, mechanical)
- Identify exothermic and endothermic reactions
- Identify wave characteristics (wavelength, frequency, amplitude)
- Predict direction of refracted light waves when passing through transparent materials
- Apply the law of reflection and law of refraction in common objects
- Using experimentation, determine whether light is reflected, transmitted, and/or absorbed
- Explain how humans see an object's color based on the wavelength of light transmitted to the viewer's eye

## **Science and the Environment**

### 1. Energy and Resources

- Identify and classify energy as renewable, nonrenewable, and inexhaustible
- Compare pollutions amounts/capabilities of different energy sources
- Describe how inexhaustible energy is harnessed for energy production
- Identify methods for sustaining renewable resources
- Identify ways to reuse, recycle, and reduce
- Describe how technology influences resource use in an ecosystem (forestry, fishing, and soil conservation)

## Grade 6 Science Standards, Benchmarks, and GLEs

The following chart presents **all** grade 6 science strands and standards, benchmarks, and GLEs.

GRADE 6 SCIENCE STANDARDS, BENCHMARKS, AND GLEs	
<p><b>Science as Inquiry: The students will <u>do</u> science by engaging in partial and full inquiries that are within their developmental capabilities.</b></p>	
<p><i>A. The Abilities Necessary to do Scientific Inquiry</i></p>	
Benchmarks	Grade-Level Expectations
<p><b>SI-M-A1:</b> identifying questions that can be used to design a scientific investigation</p>	<ol style="list-style-type: none"> <li>1. Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)</li> <li>2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)</li> <li>3. Use a variety of sources to answer questions (SI-M-A1)</li> </ol>
<p><b>SI-M-A2:</b> designing and conducting a scientific investigation</p>	<ol style="list-style-type: none"> <li>4. Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)</li> <li>5. Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)</li> </ol>
<p><b>SI-M-A3:</b> using mathematics and appropriate tools and techniques to gather, analyze, and interpret data</p>	<ol style="list-style-type: none"> <li>6. Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)</li> <li>7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)</li> <li>8. Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)</li> <li>9. Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3)</li> </ol>

<p><b>SI-M-A4:</b> developing descriptions, explanations, and graphs using data</p>	<p>10. Identify the difference between description and explanation (SI-M-A4)</p> <p>11. Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)</p> <p>12. Use data and information gathered to develop an explanation of experimental results (SI-M-A4)</p> <p>13. Identify patterns in data to explain natural events (SI-M-A4)</p>
<p><b>SI-M-A5:</b> developing models and predictions using the relationships between data and explanations</p>	<p>14. Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)</p> <p>15. Identify and explain the limitations of models used to represent the natural world (SI-M-A5)</p> <p>16. Use evidence to make inferences and predict trends (SI-M-A5)</p>
<p><b>SI-M-A6:</b> comparing alternative explanations and predictions</p>	<p>17. Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)</p> <p>18. Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (SI-M-A6)</p>
<p><b>SI-M-A7:</b> communicating scientific procedures, information, and explanations</p>	<p>19. Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)</p> <p>20. Write clear step-by-step instructions that others can follow to carry out procedures or conduct investigations (SI-M-A7)</p> <p>21. Distinguish between <i>observations</i> and <i>inferences</i> (SI-M-A7)</p> <p>22. Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)</p>
<p><b>SI-M-A8:</b> utilizing safety procedures during scientific investigations</p>	<p>23. Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)</p> <p>24. Provide appropriate care and utilize safe practices and ethical treatment when animals are involved in scientific field and laboratory research (SI-M-A8)</p>

<b>B. Understanding Scientific Inquiry</b>	
<b>SI-M-B1:</b> recognizing that different kinds of questions guide different kinds of scientific investigations	<p>25. Compare and critique scientific investigations (SI-M-B1)</p> <p>26. Use and describe alternate methods for investigating different types of testable questions (SI-M-B1)</p> <p>27. Recognize that science uses processes that involve a logical and empirical, but flexible, approach to problem solving (SI-M-B1)</p>
<b>SI-M-B2:</b> communicating that current scientific knowledge guides scientific investigations	<p>28. Recognize that investigations generally begin with a review of the work of others (SI-M-B2)</p>
<b>SI-M-B3:</b> understanding that mathematics, technology, and scientific techniques used in an experiment can limit or enhance the accuracy of scientific knowledge	<p>29. Explain how technology can expand the senses and contribute to the increase and/or modification of scientific knowledge (SI-M-B3)</p> <p>30. Describe why all questions cannot be answered with present technologies (SI-M-B3)</p> <p>31. Recognize that there is an acceptable range of variation in collected data (SI-M-B3)</p> <p>32. Explain the use of statistical methods to confirm the significance of data (e.g., mean, median, mode, range) (SI-M-B3)</p>
<b>SI-M-B4:</b> using data and logical arguments to propose, modify, or elaborate on principles and models	<p>33. Evaluate models, identify problems in design, and make recommendations for improvement (SI-M-B4)</p>
<b>SI-M-B5:</b> understanding that scientific knowledge is enhanced through peer review, alternative explanations, and constructive criticism	<p>34. Recognize the importance of communication among scientists about investigations in progress and the work of others (SI-M-B5)</p> <p>35. Explain how skepticism about accepted scientific explanations (i.e., hypotheses and theories) leads to new understanding (SI-M-B5)</p> <p>36. Explain why an experiment must be verified through multiple investigations and yield consistent results before the findings are accepted (SI-M-B5)</p> <p>37. Critique and analyze their own inquiries and the inquiries of others (SI-M-B5)</p>
<b>SI-M-B6:</b> communicating that scientific investigations can result in new ideas, new methods or procedures, and new technologies	<p>38. Explain that, through the use of scientific processes and knowledge, people can solve problems, make decisions, and form new ideas (SI-M-B6)</p>
<b>SI-M-B7:</b> understanding that scientific development/technology is driven by societal needs and funding	<p>39. Identify areas in which technology has changed human lives (e.g., transportation, communication, geographic information systems, DNA fingerprinting) (SI-M-B7)</p> <p>40. Evaluate the impact of research on scientific thought, society, and the environment (SI-M-B7)</p>

**Physical Science: Students will develop an understanding of the characteristics and interrelationships of matter and energy in the physical world.**

***A. Properties and Changes of Properties in Matter***

<b>Benchmarks</b>	<b>Grade-Level Expectations</b>
<b>PS-M-A1:</b> investigating, measuring, and communicating the properties of different substances which are independent of the amount of the substance	<ol style="list-style-type: none"> <li>1. Measure and record the volume and mass of substances in metric system units (PS-M-A1)</li> <li>2. Calculate the density of large and small quantities of a variety of substances (e.g., aluminum foil, water, copper, clay, rock) (PS-M-A1)</li> </ol>
<b>PS-M-A2:</b> understanding that all matter is made up of particles called atoms and that atoms of different elements are different	<ol style="list-style-type: none"> <li>3. Construct models that replicate atomic structure for selected common elements from the periodic table (PS-M-A2)</li> </ol>
<b>PS-M-A3:</b> grouping substances according to similar properties and/or behaviors	<ol style="list-style-type: none"> <li>4. Differentiate between the physical and chemical properties of selected substances (PS-M-A3)</li> <li>5. Compare physical and chemical changes (PS-M-A3)</li> </ol>
<b>PS-M-A4:</b> understanding that atoms and molecules are perpetually in motion	<ol style="list-style-type: none"> <li>6. Draw or model the movement of atoms in solid, liquid, and gaseous states (PS-M-A4)</li> <li>7. Simulate how atoms and molecules have kinetic energy exhibited by constant motion (PS-M-A4)</li> </ol>
<b>PS-M-A5:</b> investigating the relationships among temperature, molecular motion, phase changes, and physical properties of matter	<ol style="list-style-type: none"> <li>8. Determine the temperatures at which water changes physical phases (e.g., freezing point, melting point, boiling point) (PS-M-A5)</li> </ol>
<b>PS-M-A6:</b> investigating chemical reactions between different substances to discover that new substances formed may have new physical properties and do have new chemical properties	<ol style="list-style-type: none"> <li>9. Describe the properties of reactants and products of chemical reactions observed in the lab (PS-M-A6)</li> </ol>
<b>PS-M-A7:</b> understanding that during a chemical reaction in a closed system, the mass of the products is equal to that of the reactants	<ol style="list-style-type: none"> <li>10. Identify the average atomic masses of given elements using the periodic table (PS-M-A7)</li> <li>11. Compare the masses of reactants and products of a chemical reaction (PS-M-A7)</li> </ol>
<b>PS-M-A8:</b> discovering and recording how factors such as temperature influence chemical reactions	<ol style="list-style-type: none"> <li>12. Determine the effect of particle size of the same reactants on the rate of chemical reactions during a lab activity (e.g., powdered vs. solid forms) (PS-M-A8)</li> </ol>
<b>PS-M-A9:</b> identifying elements and compounds found in common foods, clothing, household materials, and automobiles	<ol style="list-style-type: none"> <li>13. Use a variety of resources to identify elements and compounds in common substances (PS-M-A9)</li> </ol>

<b><i>B. Motions and Forces</i></b>	
<b>PS-M-B1:</b> describing and graphing the motions of objects	<p>14. Construct and analyze graphs that represent one-dimensional motion (i.e., motion in a straight line) and predict the future positions and speed of a moving object (PS-M-B1)</p> <p>15. Explain why velocity is expressed in both speed and direction (PS-M-B1)</p> <p>16. Compare line graphs of acceleration, constant speed, and deceleration (PS-M-B1)</p>
<b>PS-M-B2:</b> recognizing different forces and describing their effects (gravity, electrical, magnetic)	<p>17. Describe and demonstrate that friction is a force that acts whenever two surfaces or objects move past one another (PS-M-B2)</p> <p>18. Explain how the resistance of materials affects the rate of electrical flow (PS-M-B2)</p>
<b>PS-M-B3:</b> understanding that, when an object is not being subjected to a force, it will continue to move at a constant speed and in a straight line	<p>19. Identify forces acting on all objects (PS-M-B3)</p> <p>Also see GLE 22</p>
<b>PS-M-B4:</b> describing how forces acting on an object will reinforce or cancel one another, depending upon their direction and magnitude	<p>20. Draw and label a diagram to represent forces acting on an object (PS-M-B4)</p> <p>21. Determine the magnitude and direction of unbalanced (i.e., net) forces acting on an object (PS-M-B4)</p>
<b>PS-M-B5:</b> understanding that unbalanced forces will cause changes in the speed or direction of an object's motion	<p>22. Demonstrate that an object will remain at rest or move at a constant speed and in a straight line if it is not subjected to an unbalanced force (PS-M-B5) (PS-M-B3)</p> <p>23. Predict the direction of a force applied to an object and how it will change the speed and direction of the object (PS-M-B5)</p>
<b><i>C. Transformations of Energy</i></b>	
<b>PS-M-C1:</b> identifying and comparing the characteristics of different types of energy	<p>24. Describe and give examples of how all forms of energy may be classified as potential or kinetic energy (PS-M-C1)</p> <p>25. Compare forms of energy (e.g., light, heat, sound, electrical, nuclear, mechanical) (PS-M-C1)</p> <p>26. Describe and summarize observations of the transmission, reflection, and absorption of sound, light, and heat energy (PS-M-C1)</p>
<b>PS-M-C2:</b> understanding the different kinds of energy transformations and the fact that energy can be neither destroyed nor created	<p>27. Explain the relationship between work input and work output by using simple machines (PS-M-C2)</p> <p>28. Explain the law of conservation of energy (PS-M-C2)</p> <p>29. Compare and/or investigate the relationships among work, power, and efficiency (PS-M-C2)</p> <p>30. Trace energy transformations in a simple system (e.g., flashlight) (PS-M-C2)</p>

<b>PS-M-C3:</b> understanding that the sun is a major source of energy and that energy arrives at the Earth's surface as light with a range of wavelengths	31. Compare types of electromagnetic waves (PS-M-C3)
<b>PS-M-C4:</b> observing and describing the interactions of light and matter (reflection, refraction, absorption, transmission, scattering)	32. Identify and illustrate key characteristics of waves (e.g., wavelength, frequency, amplitude) (PS-M-C4) 33. Predict the direction in which light will refract when it passes from one transparent material to another (e.g., from air to water, from prism to air) (PS-M-C4) 34. Apply the law of reflection and law of refraction to demonstrate everyday phenomena (e.g., how light is reflected from tinted windows, how light is refracted by cameras, telescopes, eyeglasses) (PS-M-C4) 35. Determine through experimentation whether light is reflected, transmitted, and/or absorbed by a given object or material (PS-M-C4) 36. Explain the relationship between an object's color and the wavelength of light reflected or transmitted to the viewer's eyes (PS-M-C4)
<b>PS-M-C5:</b> investigating and describing the movement of heat and the effects of heat in objects and systems	37. Compare how heat is transferred by conduction, convection, and radiation (PS-M-C5) 38. Identify conditions under which thermal energy tends to flow from a system of higher energy to a system of lower energy (PS-M-C5)
<b>PS-M-C6:</b> describing the types of energy that can be involved, converted, or released in electrical circuits	39. Describe how electricity can be produced from other types of energy (e.g., magnetism, solar, mechanical) (PS-M-C6)
<b>PS-M-C7:</b> understanding that energy is involved in chemical reactions	40. Identify heat energy gains and losses during exothermic and endothermic chemical reactions (PS-M-C7)
<b>PS-M-C8:</b> comparing the uses of different energy resources and their effects upon the environment	41. Identify risks associated with the production and use of coal, petroleum, hydroelectricity, nuclear energy, and other energy forms (PS-M-C8)
<b>Life Science: The students will become aware of the characteristics and life cycles of organisms and understand their relationships to each other and to their environment.</b>	
<i>There are no Grade-Level Expectations for benchmarks in grade 6 for this strand.</i>	
<b>Earth and Space Science: The students will develop an understanding of the properties of earth materials, the structure of the Earth system, the Earth's history, and the Earth's place in the universe.</b>	
<i>There are no Grade-Level Expectations for benchmarks in grade 6 for this strand.</i>	

**Science and the Environment: In learning environmental science, students will develop an appreciation of the natural environment, learn the importance of environmental quality, and acquire a sense of stewardship. As consumers and citizens, they will be able to recognize how our personal, professional, and political actions affect the natural world.**

Benchmarks	Grade-Level Expectations
<b>SE-M-A1:</b> demonstrating knowledge that an ecosystem includes living and nonliving factors and that humans are an integral part of ecosystems	Not addressed at grade 6
<b>SE-M-A2:</b> demonstrating an understanding of how carrying capacity and limiting factors affect plant and animal populations	
<b>SE-M-A3:</b> defining the concept of pollutant and describing the effects of various pollutants on ecosystems	
<b>SE-M-A4:</b> understanding that human actions can create risks and consequences in the environment	
<b>SE-M-A5:</b> tracing the flow of energy through an ecosystem and demonstrating a knowledge of the roles of producers, consumers, and decomposers in the ecosystem	
<b>SE-E-A6:</b> distinguishing between renewable and nonrenewable resources and understanding that nonrenewable natural resources are not replenished through the natural cycles and thus are strictly limited in quantity	42. Identify energy types from their source to their use and determine if the energy types are renewable, nonrenewable, or inexhaustible (SE-M-A6) 43. Explain how the use of different energy resources affects the environment and the economy (SE-M-A6) 44. Explain how an inexhaustible resource can be harnessed for energy production (SE-M-A6) 45. Describe methods for sustaining renewable resources (SE-M-A6) 46. Identify ways people can reuse, recycle, and reduce the use of resources to improve and protect the quality of life (SE-M-A6)
<b>SE-M-A7:</b> demonstrating knowledge of the natural cycles, such as the carbon cycle, nitrogen cycle, water cycle, and oxygen cycle	Not addressed at grade 6
<b>SE-M-A8:</b> investigating and analyzing how technology affects the physical, chemical, and biological factors in an ecosystem	47. Illustrate how various technologies influence resource use in an ecosystem (e.g., forestry management, soil conservation, fishery improvement) (SE-M-A8)
<b>SE-M-A9:</b> demonstrating relationships of characteristics of soil types to agricultural practices and productivity	Not addressed at grade 6
<b>SE-M-A10:</b> identifying types of soil erosion and preventive measures	

## Sample Test Items: Grade 6 Science

### Science as Inquiry

#### The Abilities Necessary to Do Scientific Inquiry

**GLE 1**—Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)

1 Julie has the following objects:

- two ice cubes
- an empty glass
- a glass of water at room temperature

Which question could Julie answer **most easily** by conducting a scientific investigation?

- A** What is the temperature of the water?
- B** Does ice melt faster in air or in water?
- C** How long does it take for water to freeze?
- D** Does the mass of an ice cube change when it melts?

**Correct response: B**

*Match to GLE: This item relates to conducting an investigation in physical science. Other grade 6 iLEAP items that measure this GLE may include investigations relating to science and the environment.*

## Science as Inquiry

### The Abilities Necessary to Do Scientific Inquiry

**GLE 3**—Use a variety of sources to answer questions (SI-M-A1)

- 2** In which activity would using the Internet be **most** helpful?
- A** analyzing the results of an experiment
  - B** predicting the outcome of an experiment
  - C** measuring the variables used in an experiment
  - D** performing research before conducting an experiment

**Correct response: D**

*Match to GLE: This item identifies the Internet as a source of science information. Other grade 6 iLEAP items that measure this GLE may include other sources such as encyclopedias, textbooks, lab notebooks, and real-world data.*

## Science as Inquiry

### The Abilities Necessary to Do Scientific Inquiry

**GLE 10**—Identify the difference between description and explanation (SI-M-A4)

- 3** Which statement is an explanation rather than a description?
- A** The elephant weighs over 5 tons.
  - B** The rock has many crystals in it.
  - C** The bird flaps its wings while it is flying.
  - D** The pond became smaller from evaporation.

**Correct response: D**

*Match to GLE: This item asks students to identify an explanation from a set of choices. Other grade 6 iLEAP items that measure this GLE may ask students to identify a description.*

**Science as Inquiry**

**The Abilities Necessary to Do Scientific Inquiry**

**GLE 16**—Use evidence to make inferences and predict trends (SI-M-A5)

Use this data table to answer question 4.

**Insect Species on Different Trees**

Tree	Number of Insects: Species A	Number of Insects: Species B
A	542	3
B	7	1098
C	0	763
D	876	5

- 4** A scientist examined the numbers of two different species of insects on four different kinds of trees in the same forest. The results of her examination are shown on the data table. What inference can the scientist make about the insects?
- A** Species B insects are the main food source for species A insects.
  - B** Species A and species B insects are very closely related.
  - C** There are more of species B insects than species A insects in the entire forest.
  - D** Species A insects prefer different kinds of trees from species B insects.

**Correct response: D**

*Match to GLE: This item asks students to make an inference from data presented in a table. Other grade 6 iLEAP items that measure this GLE may ask students to predict trends and/or use information presented in graphs or verbal descriptions.*

**Science as Inquiry**

**The Abilities Necessary to Do Scientific Inquiry**

**GLE 17**—Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)

Use this data table to answer question 5.

**Temperature and Rainfall**

<b>Town</b>	<b>Average Temperature (degrees Celsius)</b>	<b>Average Annual Rainfall (centimeters)</b>
Farmon	18	33
Davis	25	72

- 5** Jenny compared the average temperature and annual rainfall for two towns in the same state. The results are shown in the data table. From these results, Jenny concluded that hotter weather causes more rain to fall. What is another reasonable interpretation of this data?
- A** Farmon is a very cold place to live.
  - B** Colder weather causes more rain to fall.
  - C** Rain causes the temperature to increase.
  - D** Davis is the rainiest town in the entire state.

**Correct response: C**

*Match to GLE: This item asks students to identify an alternative explanation for data presented in a table. Other grade 6 iLEAP items that measure this GLE may ask students to identify one or more plausible explanations for data presented in other formats.*

## Science as Inquiry

### The Abilities Necessary to Do Scientific Inquiry

**GLE 23**—*Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)*

- 6** While working on a class chemistry experiment, Victor dropped a glass test tube filled with an unknown liquid. What should Victor do **first**?
- A** put on gloves
  - B** inform the teacher
  - C** sweep up the broken glass
  - D** clean up the spilled chemical

**Correct response: B**

*Match to GLE: This item measures students' knowledge of safety procedures. Other grade 6 iLEAP items that measure this GLE may ask students about the use of equipment.*

**Science as Inquiry**

**Understanding Scientific Inquiry**

**GLE 25**—*Compare and critique scientific investigations (SI-M-B1)*

Use this data table to answer question 7.

**Experimental Design for Studying Effects of Pollutant**

Plant	Water (ml/day)	Sunlight (hours/day)	Pollutant (grams)	Initial Height of Plant (meters)
1	100	12	0	0.45
2	200	12	1	0.47
3	300	12	10	0.50
4	400	12	100	0.44

- 7 Chris wanted to determine the effects of a soil pollutant on the growth of a sunflower plant. He designed an experiment and recorded his results in the data table. Where does Chris make a **mistake** in the design of his experiment?
- A The experiment doesn't have a control.
  - B The experiment should use more types of plants.
  - C The amount of water should be the same for each plant.
  - D The amount of pollutant should be the same for each plant.

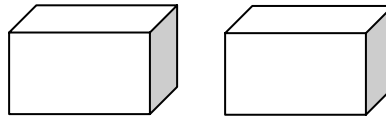
**Correct response: C**

*Match to GLE: This item asks students to identify an error in the design of an experiment. Other grade 6 iLEAP items that measure this GLE may ask students to compare different experiments.*

**Science as Inquiry**  
**Understanding Scientific Inquiry**

**GLE 26**—Use and describe alternate methods for investigating different types of testable questions (SI-M-B1)

- 8** Lamont has two blocks of metal. The blocks are both the same size, as shown below.



**Block 1**

**Block 2**

Lamont wants to show that the blocks are made from **different** metals. One way to do this is to show that Block 2 has a different melting temperature than Block 1. However, this would require a very powerful heat source.

Which of these is another way Lamont could show that the blocks are made from **different** metals?

- A** Show that both blocks conduct electricity.
- B** Show that the blocks weigh different amounts.
- C** Show that both blocks can be picked up by a magnet.
- D** Show that the blocks come from two different regions on Earth.

**Correct response: B**

*Match to GLE: This item asks students to devise an alternate method for testing a scientific question.*

**Science as Inquiry**  
**Understanding Scientific Inquiry**

**GLE 31**—Recognize that there is an acceptable range of variation in collected data (SI-M-B3)

Use this data table to answer question 9.

**Height of Plant**

Measurement	Height of Plant
1	21.2 cm
2	21.5 cm
3	21.4 cm

- 9 Damon measured the height of a plant three times with a metric ruler. He recorded the measurements in the data table above. Which statement **most likely** explains the variation in Damon’s data?
- A The plant was growing while Damon measured it.
  - B Damon used different rulers for each measurement.
  - C Damon made small errors while measuring the plant.
  - D The plant expanded and shrank because of temperature changes.

**Correct response: C**

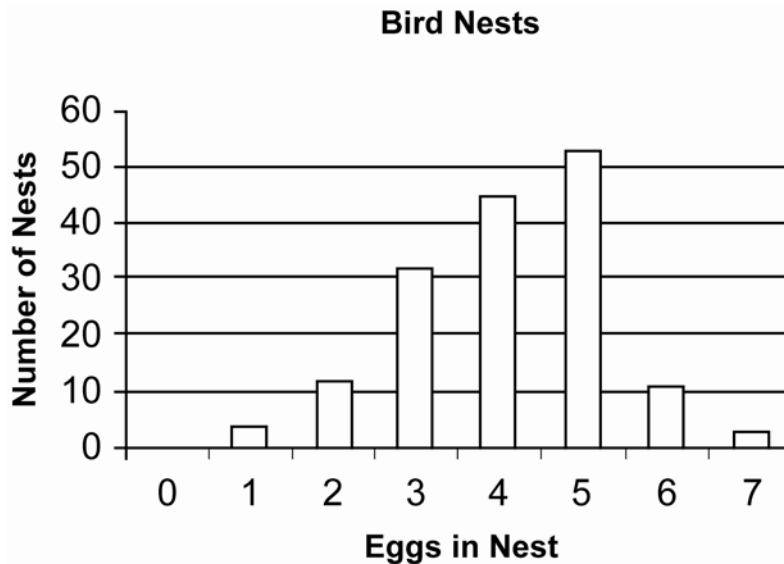
*Match to GLE: This item requires students to recognize that measurements of length can vary due to measurement error. Other grade 6 iLEAP items that measure this GLE may relate to mass, weight, time, or other measurement attributes.*

**Science as Inquiry**

**Understanding Scientific Inquiry**

**GLE 32**—*Explain the use of statistical methods to confirm the significance of data (e.g., mean, median, mode, range) (SI-M-B3)*

Use this graph to answer question 10.



- 10** A scientist studied 160 bird nests and counted the number of eggs in each nest. Her results are shown in the bar graph above. Which statement **best** describes the scientist's results?
- A** The mode is 5, but the median is less than 5.
  - B** The mode is 5, but the median is greater than 5.
  - C** The median is 5, but the mode is less than 5.
  - D** The median is 5, but the mode is greater than 5.

**Correct response: A**

*Match to GLE: This item asks students to identify and compare median and mode from a bar graph. Other grade 6 iLEAP items that measure this GLE may involve mean or range and ask students to draw conclusions based on these measures.*

**Science as Inquiry**  
**Understanding Scientific Inquiry**

**GLE 34**—*Recognize the importance of communication among scientists about investigations in progress and the work of others (SI-M-B5)*

- 11** A scientist makes an important discovery while conducting an experiment. What should the scientist do next?
- A** Tell other scientists about the experiment and the discovery.
  - B** Tell other scientists about the discovery but not about the experiment.
  - C** Tell other scientists about the experiment but not about the discovery.
  - D** Write about the discovery in his or her notebook but not tell any other scientists about it.

**Correct response: A**

*Match to GLE: This item examines the responsibility of scientists to communicate their experiments and discoveries. Other grade 6 iLEAP items that measure this GLE may examine the benefits of communication among scientists.*

**Science as Inquiry**  
**Understanding Scientific Inquiry**

**GLE 36**—*Explain why an experiment must be verified through multiple investigations and yield consistent results before the findings are accepted (SI-M-B5)*

- 12** A scientist performed an experiment that had an unexpected result. Before telling anyone about the result, the scientist performed the experiment again. What is the **most likely** reason the scientist performed the experiment more than once?
- A** The scientist wanted to make sure no one else could do the experiment.
  - B** The scientist had extra chemicals and wanted to use them all.
  - C** The scientist wanted to be sure the results were accurate.
  - D** The scientist wanted to get different results.

**Correct response: C**

*Match to GLE: This item asks students to determine why a scientist might choose to repeat his or her experiment. Other grade 6 iLEAP items that measure this GLE may relate to the repetition of experiments by other groups of scientists (“peer review”).*

**Physical Science**

**Properties and Changes of Properties in Matter**

**GLE 4**—*Differentiate between the physical and chemical properties of selected substances (PS-M-A3)*

- 13** Jeanette is studying a substance. Which property of the substance is chemical?
- A** its density
  - B** its temperature
  - C** its melting point
  - D** its flammability

**Correct response: D**

*Match to GLE: This item asks students to identify a chemical property. Other grade 6 iLEAP items that measure this GLE may ask students to identify or describe physical properties.*

**Physical Science**

**Properties and Changes of Properties in Matter**

**GLE 10**—Identify the average atomic masses of given elements using the periodic table (PS-M-A7)

Use this element from the periodic table to answer question 14.

14
Si
Silicon
28.1

**14** What is the atomic mass for silicon?

- A** 14.0
- B** 14.1
- C** 28.1
- D** 42.1

**Correct response: C**

*Match to GLE: This item asks students to identify the atomic mass for silicon. Other grade 6 iLEAP items that measure this GLE may ask students to identify the atomic masses of other elements in the periodic table.*

## Physical Science

### Properties and Changes of Properties in Matter

**GLE 12**—Determine the effect of particle size of the same reactants on the rate of chemical reactions during a lab activity (e.g., powdered vs. solid forms) (PS-M-A8)

- 15** A scientist has two samples of the same chemical: one sample is a solid block, and the other sample is a powder. The scientist puts the solid block in a beaker of water and observes a reaction.

What would **most likely** happen if the scientist placed the powdered sample into a different beaker of water?

- A** No reaction would occur.
- B** A completely different reaction would occur.
- C** The same reaction would occur but at a faster rate.
- D** The same reaction would occur but at a slower rate.

**Correct response: C**

*Match to GLE: This item asks students to compare the reaction rates of powdered vs. block forms of the same substance.*

## Physical Science

### Motions and Forces

**GLE 15**—Explain why velocity is expressed in both speed and direction (PS-M-B1)

- 16** A scientist is trying to track the movement of a rocket. What information does the scientist need to determine the velocity of the rocket?

- A** the mass and speed of the rocket
- B** the speed of the rocket and the direction the rocket is moving
- C** the time the rocket has been traveling and the mass of the rocket
- D** the time the rocket has been traveling and the direction the rocket is moving

**Correct response: B**

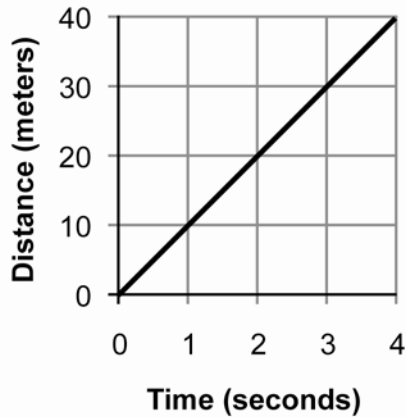
*Match to GLE: This item requires that students understand velocity as both speed and direction. Other grade 6 iLEAP items that measure this GLE may ask students why one or both of these attributes is important in the study of motion.*

**Physical Science**  
**Motions and Forces**

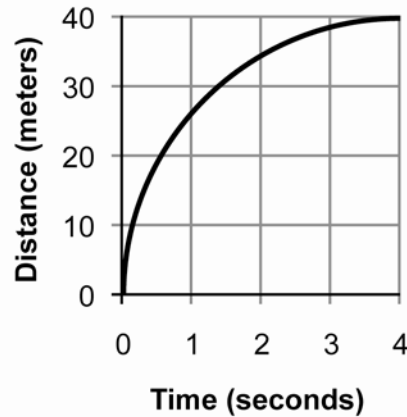
**GLE 16**—Compare line graphs of acceleration, constant speed, and deceleration (PS-M-B1)

- 17 Mrs. Wilson’s science class is graphing the movement of vehicles passing their school. Which line graph shows a vehicle slowing down?

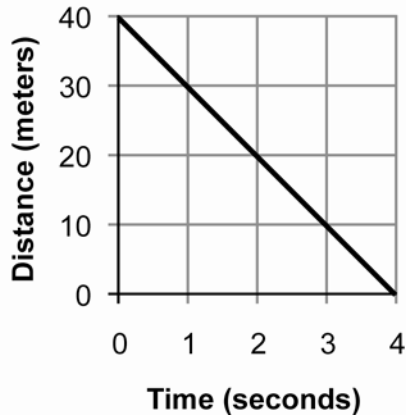
**A** Motion Graph



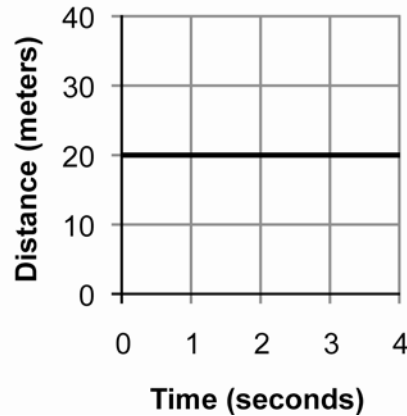
**C** Motion Graph



**B** Motion Graph



**D** Motion Graph



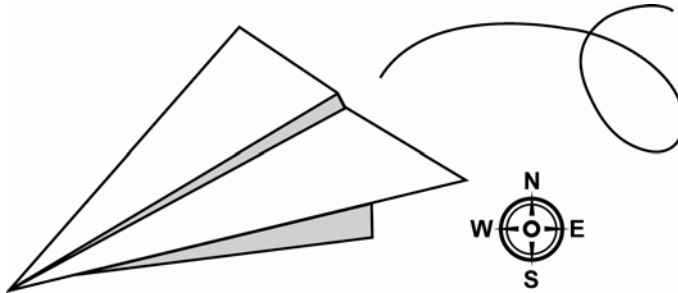
**Correct response: B**

*Match to GLE: This item asks students to identify a line graph that shows deceleration. Other grade 6 iLEAP items that measure this GLE may ask students to analyze line graphs that show constant speed or acceleration.*

**Physical Science**  
**Motions and Forces**

**GLE 23**—Predict the direction of a force applied to an object and how it will change the speed and direction of the object (PS-M-B5)

- 18** Jenny threw a paper airplane toward the west. The wind, however, caused the airplane to move in a southwestern direction.



Which statement **best** describes the direction of the wind?

- A** The wind is blowing from the north.
- B** The wind is blowing from the south.
- C** The wind is blowing from the west.
- D** The wind is blowing from the east.

**Correct response: A**

*Match to GLE: This item asks students to determine the direction of a force based on its effect on a moving object. Other grade 6 iLEAP items that measure this GLE may ask students to predict the effect on the speed and/or direction of a moving object when a force is applied in a particular direction.*

## Physical Science

### Transformations of Energy

**GLE 24**—Describe and give examples of how all forms of energy may be classified as potential or kinetic energy (PS-M-C1)

- 19** Noah carried a skateboard up a hill and then rode the skateboard down the hill. When Noah reached the bottom of the hill, he rolled to a stop. When did Noah have the most **potential energy**?
- A** while carrying the skateboard up the hill
  - B** while standing on the skateboard at the top of the hill
  - C** while riding the skateboard down the hill
  - D** while standing on the skateboard at the bottom of the hill

**Correct response: B**

*Match to GLE: This item asks students to identify a situation where potential energy is greatest. Other grade 6 iLEAP items that measure this GLE may ask students to compare potential and kinetic energy in other ways.*

## Physical Science

### Transformations of Energy

**GLE 26**—Describe and summarize observations of the transmission, reflection, and absorption of sound, light, and heat energy (PS-M-C1)

- 20** What happens to green light and red light when they shine on a green leaf?
- A** Both are absorbed.
  - B** Both are reflected.
  - C** Green light is absorbed, and red light is reflected.
  - D** Green light is reflected, and red light is absorbed.

**Correct response: D**

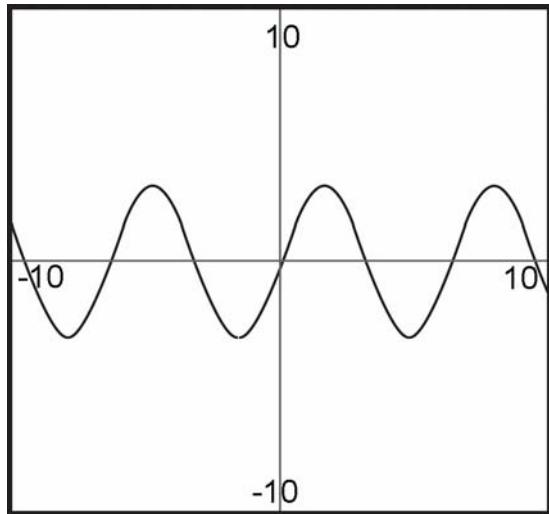
*Match to GLE: This item asks students to describe how light can be reflected and absorbed by an object. Other grade 6 iLEAP items that measure this GLE may relate to sound or heat, and may involve transmission.*

**Physical Science**

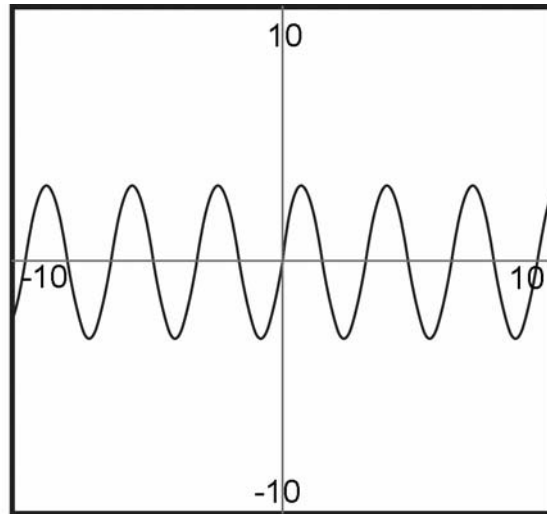
**Transformations of Energy**

**GLE 32**—Identify and illustrate key characteristics of waves (e.g., wavelength, frequency, amplitude) (PS-M-C4)

Use these graphs to answer question 21.



**Wave A**



**Wave B**

- 21** The two waves above are traveling at the same speed. Which statement **best** describes the difference between the waves?
- A** Wave A has a higher frequency than wave B.
  - B** Wave A has a lower frequency than wave B.
  - C** Wave A has a higher amplitude than wave B.
  - D** Wave A has a lower amplitude than wave B.

**Correct response: B**

*Match to GLE: This item asks students to compare waves with different frequencies. Other grade 6 iLEAP items that measure this GLE may relate to amplitude and/or wavelength.*

**Physical Science**

**Transformations of Energy**

**GLE 34**—Apply the law of reflection and law of refraction to demonstrate everyday phenomena (e.g., how light is reflected from tinted windows, how light is refracted by cameras, telescopes, eyeglasses) (PS-M-C4)

- 22** What would be the best use for a material that reflects almost all light?
- A** as a mirror
  - B** as a window
  - C** as a light bulb
  - D** as a sheet of paper

**Correct response: A**

*Match to GLE: This item asks students to relate reflective properties to use of everyday materials. Other grade 6 iLEAP items that measure this GLE may relate to refraction.*

**Physical Science**

**Transformations of Energy**

**GLE 36**—Explain the relationship between an object's color and the wavelength of light reflected or transmitted to the viewer's eyes (PS-M-C4)

- 23** Laura sees a red flower. Which statement **best** describes why the flower is red?
- A** The light that strikes the flower is mostly red.
  - B** The light that is absorbed by the flower is mostly red.
  - C** The light that is reflected from the flower is mostly red.
  - D** The light that passes through the flower is mostly red.

**Correct response: C**

*Match to GLE: This item asks students to relate reflective properties of an object to the color perceived by an observer.*

## Physical Science

### Transformations of Energy

**GLE 40**—Identify heat energy gains and losses during exothermic and endothermic chemical reactions (PS-M-C7)

- 24** Dee adds five grams of a chemical to one liter of liquid and observes a reaction. If the reaction is **endothermic**, what will happen?
- A** The volume of the liquid will increase.
  - B** The volume of the liquid will decrease.
  - C** The temperature of the liquid will increase.
  - D** The temperature of the liquid will decrease.

**Correct response: D**

*Match to GLE: This item asks students to identify a property of endothermic reactions. Other grade 6 iLEAP items that measure this GLE may relate to exothermic reactions.*

## Science and the Environment

**GLE 42**—Identify energy types from their source to their use and determine if the energy types are renewable, nonrenewable, or inexhaustible (SE-M-A6)

- 25** Which nonrenewable energy source comes from the remains of dead organisms?
- A** gasoline
  - B** solar power
  - C** geothermal heat
  - D** hydroelectricity

**Correct response: A**

*Match to GLE: This item asks students to identify an energy type that comes from organic remains. Other grade 6 iLEAP items that measure this GLE may relate to other sources of energy and have students characterize them as renewable, nonrenewable, or inexhaustible.*

### Science and the Environment

**GLE 43**—*Explain how the use of different energy resources affects the environment and the economy (SE-M-A6)*

- 26** Some electricity is made by damming rivers and using the water to push a turbine. What is a potential negative effect of this form of energy?
- A** It can cause the river to be heavily polluted.
  - B** It can destroy the habitat of wildlife that live in the river.
  - C** It can produce toxic waste that must be disposed of.
  - D** It can consume too much water.

**Correct response: B**

*Match to GLE: This item asks students to identify a negative environmental effect of hydroelectric damming. Other grade 6 iLEAP items that measure this GLE may relate to other environmental or economic effects of energy use.*

### Science and the Environment

**GLE 44**—*Explain how an inexhaustible resource can be harnessed for energy production (SE-M-A6)*

- 27** Stanley helped his mother install a solar generator on the roof of their home. Which statement **best** explains the advantage of using a solar generator?
- A** Solar power is easy to store.
  - B** Solar power is readily available.
  - C** Solar generators can produce energy at all times.
  - D** Solar generators can produce very large amounts of energy.

**Correct response: B**

*Match to GLE: This item identifies solar power as an inexhaustible energy resource. Other grade 6 iLEAP items that measure this GLE may relate to other inexhaustible energy sources such as wind.*

### Science and the Environment

**GLE 45**—Describe methods for sustaining renewable resources (SE-M-A6)

- 28** After harvesting, a farmer plowed the remaining vegetation into the soil. What is the **most likely** reason the farmer did this?
- A** to prevent fires
  - B** to prevent erosion
  - C** to save time and energy
  - D** to add nutrients to the soil

**Correct response: D**

*Match to GLE: This item relates to a strategy for maintaining healthy soil. Other grade 6 iLEAP items that measure this GLE may relate to other renewable resources such as forests, fisheries, and wildlife.*

### Science and the Environment

**GLE 46**—Identify ways people can reuse, recycle, and reduce the use of resources to improve and protect the quality of life (SE-M-A6)

- 29** What is the **best** ecological reason for using recycled paper?
- A** Recycled paper lasts longer.
  - B** Recycled paper is safer to use.
  - C** Recycled paper is much cheaper to buy.
  - D** Recycled paper conserves resources.

**Correct response: D**

*Match to GLE: This item asks students to identify a benefit of using recycled paper. Other grade 6 iLEAP items that measure this GLE may relate to other resources that humans can conserve.*

## Science and the Environment

**GLE 47**—*Illustrate how various technologies influence resource use in an ecosystem (e.g., forestry management, soil conservation, fishery improvement) (SE-M-A8)*

- 30** To manage forests, trees are selectively removed. What is the purpose of removing the trees?
- A** to reduce the risk of fires
  - B** to prevent erosion in the forest
  - C** to increase animal populations
  - D** to improve the soil quality of the forest

**Correct response: A**

*Match to GLE: This item asks students to identify one of the purposes of forestry management. Other grade 6 iLEAP items that measure this GLE may relate to other ways that human technologies and practices affect ecosystems.*