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### Sunshine State Standards Benchmark

**STRAND A: THE NATURE OF MATTER**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SC.A.1.3.1</strong></td>
<td>The student identifies various ways in which substances differ (e.g., mass, volume, shape, density, texture, and reaction to temperature and light). AA; MC, GR, SR. &lt;br&gt; <em>Also covers A.1.3.2, A.1.3.6</em></td>
</tr>
<tr>
<td><strong>SC.A.1.3.2</strong></td>
<td>The student understands the difference between weight and mass. <em>Covered as A.1.3.1</em></td>
</tr>
<tr>
<td><strong>SC.A.1.3.3</strong></td>
<td>The student knows that temperature measures the average energy of motion of the particles that make up the substance. CS; MC</td>
</tr>
<tr>
<td><strong>SC.A.1.3.4</strong></td>
<td>The student knows that atoms in solids are close together and do not move around easily; in liquids, atoms tend to move farther apart; in gas, atoms are quite far apart and move around freely. CS; MC</td>
</tr>
<tr>
<td><strong>SC.A.1.3.5</strong></td>
<td>The student knows the difference between a physical change in a substance (i.e., altering the shape, form, volume, or density) and a chemical change (i.e., producing new substances with different characteristics). CS; MC</td>
</tr>
<tr>
<td><strong>SC.A.1.3.6</strong></td>
<td>The student knows that equal volumes of different substances may have different masses. <em>Covered as A.1.3.1</em></td>
</tr>
<tr>
<td><strong>SC.A.2.3.1</strong></td>
<td>The student describes and compares the properties of particles and waves. CS; MC</td>
</tr>
<tr>
<td><strong>SC.A.2.3.2</strong></td>
<td>The student knows the general properties of the atom (a massive nucleus of neutral neutrons and positive protons surrounded by a cloud of negative electrons) and accepts that single atoms are not visible. CS; MC</td>
</tr>
<tr>
<td><strong>SC.A.2.3.3</strong></td>
<td>The student knows that radiation, light, and heat are forms of energy used to cook food, treat diseases, and provide energy. <em>Covered as B.1.3.1</em></td>
</tr>
</tbody>
</table>

**STRAND B: ENERGY**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>SC.B.1.3.1</strong></td>
<td>The student identifies forms of energy and explains that they can be measured and compared. AA; MC, GR, SR, ER. &lt;br&gt; <em>Also covers A.2.3.2, B.1.3.2, B.1.3.3</em></td>
</tr>
<tr>
<td><strong>SC.B.1.3.2</strong></td>
<td>The student knows that energy cannot be created or destroyed, but only changed from one form to another. <em>Covered as B.1.3.1</em></td>
</tr>
<tr>
<td><strong>SC.B.1.3.3</strong></td>
<td>The student knows the various forms in which energy comes to Earth from the sun (e.g., visible light, infrared, and microwave). <em>Covered as B.1.3.1</em></td>
</tr>
<tr>
<td><strong>SC.B.1.3.4</strong></td>
<td>The student knows that energy conversions are never 100% efficient (i.e., some energy is transformed to heat and is unavailable for further useful work). CS; MC, GR</td>
</tr>
<tr>
<td><strong>SC.B.1.3.5</strong></td>
<td>The student knows the processes by which thermal energy tends to flow from a system of higher temperature to a system of lower temperature. CS; MC</td>
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<tr>
<td>Standard Code</td>
<td>Description</td>
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<td>---------------</td>
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</tbody>
</table>
| SC.B.1.3.6    | The student knows the properties of waves (e.g., frequency, wavelength, and amplitude); that each wave consists of a number of crests and troughs; and the effects of different media on waves. AA; MC, GR, SR  
*Also covers C.1.3.2* |
| SC.B.2.3.1    | The student knows that most events in the universe (e.g., weather changes, moving cars, and the transfer of a nervous impulse in the human body) involve some form of energy transfer and that these changes almost always increase the total disorder of the system and its surroundings, reducing the amount of useful energy. AA; MC |
| SC.B.2.3.2    | The student knows that most of the energy used today is derived from burning stored energy collected by organisms millions of years ago (i.e., nonrenewable fossil fuels). *Covered as G.2.3.1* |
| **STRAND C: FORCE AND MOTION** | |
| SC.C.1.3.1    | The student knows that the motion of an object can be described by its position, direction of motion, and speed. CS; MC, GR |
| SC.C.1.3.2    | The student knows that vibrations in materials set up wave disturbances that spread away from the source (e.g., sound and earthquake waves). *Covered as B.1.3.6* |
| SC.C.2.3.1    | The student knows that many forces (e.g., gravitational, electrical, and magnetic) act at a distance (i.e., without contact). CS; MC |
| SC.C.2.3.2    | The student knows common contact forces. *Covered as C.2.3.6* |
| SC.C.2.3.3    | The student knows that if more than one force acts on an object, then the forces can reinforce or cancel each other, depending on their direction and magnitude. *Covered as C.2.3.6* |
| SC.C.2.3.4    | The student knows that simple machines can be used to change the direction or size of a force. CS; MC, GR |
| SC.C.2.3.5    | The student understands that an object in motion will continue at a constant speed and in a straight line until acted upon by a force and that an object at rest will remain at rest until acted upon by a force. *Covered as C.2.3.6* |
| SC.C.2.3.6    | The student explains and shows the ways in which a net force (i.e., the sum of all acting forces) can act on an object (e.g., speeding up an object traveling in the same direction as the net force, slowing down an object traveling in the direction opposite of the net force). AA; MC, GR, SR  
*Also covers C.2.3.2, C.2.3.3, C.2.3.5* |
| SC.C.2.3.7    | The student knows that gravity is a universal force that every mass exerts on every other mass. CS; MC |
| **STRAND D: PROCESSES THAT SHAPE THE EARTH** | |
| SCD.1.3.1     | The student knows that mechanical and chemical activities shape and reshape the Earth’s land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers. CS; MC |
| SCD.1.3.2     | The student knows that over the whole Earth, organisms are growing, dying, and decaying as new organisms are produced by the old ones. *Covered as D.1.3.4* |
| SC.D.1.3.3 | The student knows how conditions that exist in one system influence the conditions that exist in other systems. CS; MC |
| SC.D.1.3.4 | The student knows the ways in which plants and animals reshape the landscape (e.g., bacteria, fungi, worms, rodents, and other organisms add organic matter to the soil, increasing soil fertility, encouraging plant growth, and strengthening resistance to erosion). AA; MC  
**Also covers D.1.3.2** |
| SC.D.1.3.5 | The student understands concepts of time and size relating to the interaction of Earth’s processes (e.g., lightning striking in a split second as opposed to the shifting of the Earth’s plates altering the landscape, distance between atoms measured in Angstrom units as opposed to distance between stars measured in light-years). CS; MC, GR |
| SC.D.2.3.1 | The student understands that quality of life is relevant to personal experience.  
**Not covered** |
| SC.D.2.3.2 | The student knows the positive and negative consequences of human action on the Earth’s systems. **Covered as G.2.3.4** |

**STRAND E: EARTH AND SPACE**

| SC.E.1.3.1 | The student understands the vast size of our Solar System and the relationship of the planets and their satellites. AA; MC, GR, SR  
**Also covers E.1.3.2** |
| SC.E.1.3.2 | The student knows that available data from various satellite probes show the similarities and differences among planets and their moons in the Solar System.  
**Covered as E.1.3.1** |
| SC.E.1.3.3 | The student understands that our sun is one of many stars in our galaxy. **Covered as E.2.3.1** |
| SC.E.1.3.4 | The student knows that stars appear to be made of similar chemical elements, although they differ in age, size, temperature, and distance. CS; MC |
| SC.E.2.3.1 | The student knows that thousands of other galaxies appear to have the same elements, forces, and forms of energy found in our Solar System. CS; MC  
**Also covers E.1.3.3** |

**STRAND F: PROCESSES OF LIFE**

| SC.F.1.3.1 | The student understands that living things are composed of major systems that function in reproduction, growth, maintenance, and regulation. AA; MC, SR |
| SC.F.1.3.2 | The student knows that the structural basis of most organisms is the cell and most organisms are single cells, while some, including humans, are multicellular. CS; MC |
| SC.F.1.3.3 | The student knows that in multicellular organisms cells grow and divide to make more cells in order to form and repair various organs and tissues. CS; MC |
| SC.F.1.3.4 | The student knows that the levels of structural organization for function in living things include cells, tissues, organs, systems, and organisms. CS; MC |
| SC.F.1.3.5 | The student explains how the life functions of organisms are related to what occurs within the cell. CS; MC |
| SC.F.1.3.6 | The student knows that the cells with similar functions have similar structures, whereas those with different structures have different functions. CS; MC |
| SC.F.1.3.7 | The student knows that behavior is a response to the environment and influences growth, development, maintenance, and reproduction. CS; MC |
| SC.F.2.3.1 | The student knows the patterns and advantages of sexual and asexual reproduction in plants and animals. CS; MC |
| SC.F.2.3.2 | The student knows that the variation in each species is due to the exchange and interaction of genetic information as it is passed from parent to offspring. AA; MC, SR |
| SC.F.2.3.3 | The student knows that generally organisms in a population live long enough to reproduce because they have survival characteristics. CS; MC |
| SC.F.2.3.4 | The student knows that the fossil record provides evidence that changes in the kinds of plants and animals in the environment have been occurring over time. CS; MC |

**STRAND G: HOW LIVING THINGS INTERACT WITH THEIR ENVIRONMENT**

<p>| SC.G.1.3.1 | The student knows that viruses depend on other living things. Covered as G.1.3.4 |
| SC.G.1.3.2 | The student knows that biological adaptations include changes in structures, behaviors, or physiology that enhance reproductive success in a particular environment. CS; MC |
| SC.G.1.3.3 | The student understands that the classification of living things is based on a given set of criteria and is a tool for understanding biodiversity and interrelationships. CS; MC |
| SC.G.1.3.4 | The student knows that the interactions of organisms with each other and with the nonliving parts of their environments result in the flow of energy and the cycling of matter throughout the system. AA; MC, SR Also covers G.1.3.1, G.1.3.5 |
| SC.G.1.3.5 | The student knows that life is maintained by a continuous input of energy from the sun and by the recycling of the atoms that make up the molecules of living organisms. Covered as G.1.3.4 |
| SC.G.2.3.1 | The student knows that some resources are renewable and others are nonrenewable. CS; MC Also covers B.2.3.2 |
| SC.G.2.3.2 | The student knows that all biotic and abiotic factors are interrelated and that if one factor is changed or removed, it impacts the availability of other resources within the system. CS; MC, GR |
| SC.G.2.3.3 | The student knows that a brief change in the limited resources of an ecosystem may alter the size of a population or the average size of individual organisms and that long-term change may result in the elimination of animal and plant populations inhabiting the Earth. CS; MC, GR |
| SC.G.2.3.4 | The student understands that humans are a part of an ecosystem and their activities may deliberately or inadvertently alter the equilibrium in ecosystems. AA; MC, SR | Also covers D.2.3.2 |
| STRAND H: THE NATURE OF SCIENCE |
| SC.H.1.3.1 | The student knows that scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way. AA; MC, SR |
| SC.H.1.3.2 | The student knows that the study of the events that led scientists to discoveries can provide information about the inquiry process and its effects. CS; MC |
| SC.H.1.3.3 | The student knows that science disciplines differ from one another in topic, techniques, and outcomes, but that they share a common purpose, philosophy, and enterprise. CS; MC |
| SC.H.1.3.4 | The student knows that accurate record keeping, openness, and replication are essential to maintaining an investigator’s credibility with other scientists and society. AA; MC, SR | Also covers H.1.3.7 |
| SC.H.1.3.5 | The student knows that a change in one or more variables may alter the outcome of an investigation. AA; MC, GR, SR, ER |
| SC.H.1.3.6 | The student recognizes the scientific contributions that are made by individuals of diverse backgrounds, interests, talents, and motivations. Not covered |
| SC.H.1.3.7 | The student knows that when similar investigations give different results, the scientific challenge is to verify whether the differences are significant by further study. Covered as H.1.3.4 |
| SC.H.2.3.1 | The student recognizes that patterns exist within and across systems. CS; MC |
| SC.H.3.3.1 | The student knows that science ethics demand that scientists must not knowingly subject coworkers, students, the neighborhood, or the community to health or property risks. CS; MC | Also covers H.3.3.2, H.3.3.3 |
| SC.H.3.3.2 | The student knows that special care must be taken in using animals in scientific research. Covered as H.3.3.1 |
| SC.H.3.3.3 | The student knows that in research involving human subjects, the ethics of science require that potential subjects be fully informed about the risks and benefits associated with the research and of their right to refuse to participate. Covered as H.3.3.1 |
| SC.H.3.3.4 | The student knows that technological design should require taking into account constraints such as natural laws, the properties of the materials used, and economic, political, social, ethical, and aesthetic values. CS; MC | Also covers H.3.3.6, H.3.3.7 |</p>
<table>
<thead>
<tr>
<th>SC.H.3.3.5</th>
<th>The student understands that contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times, and are an intrinsic part of the development of human culture. <em>Not covered</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>SC.H.3.3.6</td>
<td>The student knows that no matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone. <em>Covered as H.3.3.4</em></td>
</tr>
<tr>
<td>SC.H.3.3.7</td>
<td>The student knows that computers speed up and extend people’s ability to collect, sort, and analyze data; prepare research reports; and share data and ideas with others. <em>Covered as H.3.3.4</em></td>
</tr>
</tbody>
</table>
# Student Recording Chart

**Directions** Mark an × by each question from the Pretest and Posttest that you answered incorrectly. If there are one or two ×s marked for a benchmark, write Yes in the Need Practice? box. Then complete the practice pages for that benchmark.

## Strand A: The Nature of Matter

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SC.A. 1.3.1</th>
<th>SC.A. 1.3.3</th>
<th>SC.A. 1.3.4</th>
<th>SC.A. 1.3.5</th>
<th>SC.A. 2.3.1</th>
<th>SC.A. 2.3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Questions</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Pretest</strong></td>
<td>4 ×</td>
<td>3 ×</td>
<td>18 ×</td>
<td>23 ×</td>
<td>28 ×</td>
<td>29 ×</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>6 ×</td>
<td>3 ×</td>
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</tr>
<tr>
<td><strong>Need Practice?</strong></td>
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<tr>
<td><strong>Practice Pages</strong></td>
<td>15</td>
<td>16</td>
<td>16</td>
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## Strand B: Energy

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SC.B. 1.3.1</th>
<th>SC.B. 1.3.4</th>
<th>SC.B. 1.3.5</th>
<th>SC.B. 1.3.6</th>
<th>SC.B. 2.3.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Questions</strong></td>
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</tr>
<tr>
<td><strong>Pretest</strong></td>
<td>22 ×</td>
<td>5 ×</td>
<td>24 ×</td>
<td>13 ×</td>
<td>20 ×</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>19 ×</td>
<td>4 ×</td>
<td>22 ×</td>
<td>16 ×</td>
<td>18 ×</td>
</tr>
<tr>
<td><strong>Need Practice?</strong></td>
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<tr>
<td><strong>Practice Pages</strong></td>
<td>18–19</td>
<td>20</td>
<td>20</td>
<td>21–22</td>
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</table>

## Strand C: Force and Motion

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SC.C. 1.3.1</th>
<th>SC.C. 2.3.1</th>
<th>SC.C. 2.3.4</th>
<th>SC.C. 2.3.6</th>
<th>SC.C. 2.3.7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test Questions</strong></td>
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<tr>
<td><strong>Pretest</strong></td>
<td>31 ×</td>
<td>30 ×</td>
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<td>6 ×</td>
<td>19 ×</td>
</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>21 ×</td>
<td></td>
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<td>5 ×</td>
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</tr>
<tr>
<td><strong>Need Practice?</strong></td>
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<tr>
<td><strong>Practice Pages</strong></td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>25–26</td>
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</table>

## Strand D: Processes that Shape the Earth

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SC.D. 1.3.1</th>
<th>SC.D. 1.3.3</th>
<th>SC.D. 1.3.4</th>
<th>SC.D. 1.3.5</th>
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<tbody>
<tr>
<td><strong>Test Questions</strong></td>
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</tr>
<tr>
<td><strong>Pretest</strong></td>
<td>7 ×</td>
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</tr>
<tr>
<td><strong>Posttest</strong></td>
<td>7 ×</td>
<td>15 ×</td>
<td>20 ×</td>
<td>12 ×</td>
</tr>
<tr>
<td><strong>Need Practice?</strong></td>
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</tr>
<tr>
<td><strong>Practice Pages</strong></td>
<td>28</td>
<td>28</td>
<td>29</td>
<td>30</td>
</tr>
<tr>
<td>Strand E: Earth and Space</td>
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</tr>
<tr>
<td>Benchmark</td>
<td>SC.E. 1.3.1</td>
<td>SC.E. 1.3.4</td>
<td>SC.E. 2.3.1</td>
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<td>Need Practice?</td>
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<tr>
<td>Practice Pages</td>
<td>31–32</td>
<td>33</td>
<td>33</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand F: Processes of Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark</td>
</tr>
<tr>
<td>Pretest</td>
</tr>
<tr>
<td>Posttest</td>
</tr>
<tr>
<td>Need Practice?</td>
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<tr>
<td>Practice Pages</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand G: How Living Things Interact with Their Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark</td>
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<tr>
<td>Pretest</td>
</tr>
<tr>
<td>Posttest</td>
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<tr>
<td>Need Practice?</td>
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<tr>
<td>Practice Pages</td>
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</table>

<table>
<thead>
<tr>
<th>Strand H: The Nature of Science</th>
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<tbody>
<tr>
<td>Benchmark</td>
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<tr>
<td>Pretest</td>
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<tr>
<td>Posttest</td>
</tr>
<tr>
<td>Need Practice?</td>
</tr>
<tr>
<td>Practice Pages</td>
</tr>
</tbody>
</table>
How to Complete the Response Grids

Science test questions that have the gridded response symbol require you to fill in the grid to the right of the question. Sometimes there is more than one way to complete the response grid. In this section, you will learn the different ways the grids can be filled in.

**Directions**
1. Read the question and work the problem. For gridded response questions, your answer will always be a number.
2. Once you have your answer, write it in the answer boxes.
   - Write your answer with the first digit in the left box OR with the last digit in the right box.
   - Use only one digit or symbol in each box. Do NOT leave a blank answer box in the middle of an answer.
   - If your answer is a decimal or fraction, be sure to include the decimal point or the fraction bar in the correct answer box.
3. Under each answer box, fill in the correct bubble for the number you wrote.
   • Fill in one bubble for each answer box. Do NOT fill in a bubble under an unused answer box.
   • Each bubble must be filled in completely.
   • You MUST correctly fill in the bubbles for your answer in order to receive credit.

Examples
Whole Number
95 - 15 =

Decimal
Show the decimal equivalent of $\frac{8}{100}$.
Fraction

NOTE: You cannot have a mixed number as an answer. If you have a mixed number, you must convert your answer to an improper fraction or a decimal number. For example, if you fill in $17\frac{1}{2}$, it would be read as $\frac{35}{2}$. This is not a correct answer, and you will not receive credit.
Decimal or Fraction
Many answers may be shown as either a decimal or a fraction.
Taking the FCAT Science Test

Hints for Taking the FCAT Science Test

✔ There are four kinds of questions on the FCAT Science Test. These are:
  multiple choice, gridded response, short response, and extended response.
  Learn how to recognize and answer these different types of questions.

✔ Read each question and answer choice carefully.

✔ Make sure that when choosing an answer choice, your answer is the one that
  is correct.

✔ If you come to a question that seems too difficult, move on to the next
  question. You can come back to the question later.

✔ When answering multiple choice and gridded response questions, make sure
  you have completely and correctly filled in the bubbles. Avoid any stray
  marks, and if you accidentally make one, be sure to erase it.

✔ After answering a question, double-check to make sure that your answer
  choice answers the question.

✔ Get a good night’s sleep the night before test day. On test day, just relax and
  do your best.
How to Answer "Read, Inquire, Explain" Questions

You can receive full or partial credit for your answers to short response and extended response questions. Even if you do not feel that you can find the complete answer for these types of questions, you should write as much as you can and show all your work. This way, you may receive credit for a portion that is correct.

When you see this symbol next to a question, it signals a short response question. For these types of questions, you should use about five minutes to write your answers.

You will receive 2 points for an answer that is completely correct and 1 point for an answer that is partially correct.

When you see this symbol next to a question, it signals an extended response question. The answers for these questions will be longer than those for short response. You will see questions with a Part A and a Part B. You should use about 10–15 minutes to answer extended response questions.

You will receive 4 points for an answer that is completely correct and 1, 2, or 3 points for an answer that is partially correct.

When you see this symbol next to a question, it signals a gridded response question. For this type of question you will need to fill in a grid. There is more than one correct way to record your answer on the grid. You MUST write your numerical answer in the answer boxes and then fill in the correct bubbles for all of the digits and symbols.

You will receive 1 point for a correct answer. There are no partial points for incomplete gridded response questions.
FCAT Science Reference Sheet

Equations

<table>
<thead>
<tr>
<th>Equation</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration ($\vec{a}$)</td>
<td>$\frac{\text{change in velocity (m/s)}}{\text{time taken for this change (s)}}$</td>
</tr>
<tr>
<td>Average speed ($\bar{v}$)</td>
<td>$\frac{\text{distance}}{\text{time}}$</td>
</tr>
<tr>
<td>Density ($D$)</td>
<td>$\frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}}$</td>
</tr>
<tr>
<td>Percent efficiency ($e$)</td>
<td>$\frac{\text{Work out (J)}}{\text{Work in (J)}} \times 100$</td>
</tr>
<tr>
<td>Force in newtons ($F$)</td>
<td>$\text{mass (kg)} \times \text{acceleration (m/}^2\text{s)}$</td>
</tr>
<tr>
<td>Frequency in hertz ($f$)</td>
<td>$\frac{\text{number of events (waves)}}{\text{time (s)}}$</td>
</tr>
<tr>
<td>Momentum ($p$)</td>
<td>$\text{mass (kg)} \times \text{velocity (m/}^2\text{s)}$</td>
</tr>
<tr>
<td>Wavelength ($\lambda$)</td>
<td>$\frac{\text{velocity (m/}^2\text{s)}}{\text{frequency (Hz)}}$</td>
</tr>
<tr>
<td>Work ($W$)</td>
<td>$\text{Force (N)} \times \text{distance (m)}$</td>
</tr>
</tbody>
</table>

Units of Measure

<table>
<thead>
<tr>
<th>Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>centimeter</td>
<td>cm</td>
</tr>
<tr>
<td>hertz</td>
<td>Hz</td>
</tr>
<tr>
<td>gram</td>
<td>g</td>
</tr>
<tr>
<td>joule (newton-meter)</td>
<td>J</td>
</tr>
<tr>
<td>kilogram</td>
<td>kg</td>
</tr>
<tr>
<td>meter</td>
<td>m</td>
</tr>
<tr>
<td>newton</td>
<td>N</td>
</tr>
<tr>
<td>second</td>
<td>s</td>
</tr>
</tbody>
</table>
Using a Calculator

This is a diagram of a generic calculator and its parts.

Helpful Hints for Using a Calculator on the FCAT Science Test

1. Decide if you need a calculator to solve the problem by reading the question very carefully.
2. Always clear your calculator by pressing the clear key before starting a new problem.
3. If you see an \( E \) in the display, clear the error before you begin.
4. If you see an an \( M \) in the display, clear the memory before you begin.
5. If you get an answer that does not match an answer choice or seems unreasonable, check your work and re-enter the problem into the calculator.
6. Remember to enter your problem into the calculator using the correct order of operations. The calculator will NOT do this automatically.
7. Take your time when using the calculator. Make sure you are pressing the correct keys.
8. Always check your answer and your work before writing or selecting your final answer.
Periodic Table of the Elements
(based on $^{12}_6$C = 12.0000)

Period 1

1 1A
H
Hydrogen

2 2A
Si
Silicon

Group 14

Period 2

3 1B
Li
Lithium

4 2B
Be
Beryllium

5 3B
B
Boron

6 4B
C
Carbon

7 5B
N
Nitrogen

8 6B
O
Oxygen

9 7B
F
Fluorine

10 8B
Ne
Neon

Period 3

11 1B
Na
Sodium

12 2B
Mg
Magnesium

13 3B
Al
Aluminium

14 4B
Si
Silicon

15 5B
P
Phosphorus

16 6B
S
Sulfur

17 7B
Cl
Chlorine

18 8B
Ar
Argon

Period 4

19 1B
K
Potassium

20 2B
Ca
Calcium

21 3B
Sc
Scandium

22 4B
Ti
Titanium

23 5B
V
Vanadium

24 6B
Cr
Chromium

25 7B
Mn
Manganese

26 8B
Fe
Iron

27 1B
Co
Cobalt

28 2B
Ni
Nickel

29 3B
Cu
Copper

30 4B
Zn
Zinc

31 5B
Ga
Gallium

32 6B
Ge
Germanium

33 7B
As
Arsenic

34 8B
Se
Selenium

35 1B
Br
Bromine

36 2B
Kr
Krypton

Period 5

37 1B
Rb
Rubidium

38 2B
Sr
Strontium

39 3B
Y
Yttrium

40 4B
Zr
Zirconium

41 5B
Nb
Niobium

42 6B
Mo
Molybdenum

43 7B
Tc
Technetium

44 8B
Ru
Ruthenium

45 1B
Rh
Rhodium

46 2B
Pd
Palladium

47 3B
Ag
Silver

48 4B
Cd
Cadmium

49 5B
In
Indium

50 6B
Sn
Tin

51 7B
Sb
Antimony

52 8B
Te
Tellurium

53 1B
I
Iodine

54 2B
Xe
Xenon

Period 6

55 1B
Cs
Cesium

56 2B
Ba
Barium

57 3B
La
Lanthane

58 4B
Ce
Lanthanum

59 5B
Pr
Praseodymium

60 6B
Nd
Neodymium

61 7B
Pm
Promethium

62 8B
Sm
Samarium

63 1B
Eu
Europium

64 2B
Gd
Gadolinium

65 3B
Tb
Terbium

66 4B
Dy
Dysprosium

67 5B
Ho
Holmium

68 6B
Er
Erbium

69 7B
Tm
Thulium

70 8B
Yb
Ytterbium

71 1B
Lu
Lutetium

Period 7

72 2B
Hf
Hafnium

73 3B
Ta
Tantalum

74 4B
W
Tungsten

75 5B
Re
Rhenium

76 6B
Os
Osmium

77 7B
Ir
Iridium

78 8B
Pt
Platinum

79 1B
Au
Gold

80 2B
Hg
Mercury

81 3B
Tl
Thallium

82 4B
Pb
Lead

83 5B
Bi
Bismuth

84 6B
Po
Polonium

85 7B
At
Astatine

86 8B
Rn
Radon

Inner Transition Metals

Lanthanide Series

58 Ce

59 Pr

60 Nd

61 Pm

62 Sm

63 Eu

64 Gd

65 Tb

66 Dy

67 Ho

68 Er

69 Tm

70 Yb

71 Lu

Actinide Series

90 Th

91 Pa

92 U

93 Np

94 Pu

95 Am

96 Cm

97 Bk

98 Cf

99 Es

100 Fm

101 Md

102 No

103 Lr

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Pretest

1. Robert conducted an experiment to bake a type of bread with the right texture for making sandwiches. In all trials he used the same amount of flour, water, and the same baking temperature. In the first trial, he altered the amount of yeast and kept the baking time the same. In the second trial, he altered the baking time and kept the quantity of yeast the same. How many variables did he alter in his experiment?
   
   A. 1  
   B. 2  
   C. 3  
   D. 5

2. Trilobites, shown below, are a family of arthropods that has been extinct for over 250 million years. Arthropods are animals with jointed legs such as insects, lobsters, and spiders. What can scientists learn by studying the fossil records of trilobites?

   F. how many arthropods are now living  
   G. how arthropods have changed over time  
   H. how feeding habits of animals have changed over time  
   I. how the number of living species has changed over time

3. Water has different physical properties at different temperatures. In which of the following forms of water do the molecules have the greatest amount of thermal energy?

   A. boiling water  
   B. glass of water  
   C. ice cubes  
   D. snowball
4. Tim is conducting an experiment with the following liquids: water, vegetable oil, vinegar, and orange juice. He has a scale, a graduated 100-milliliter cylinder, and a 100-milliliter beaker. Given the tools available, how can he determine the density of each liquid?

5. The kinetic energy of a ball just before it hits the ground is directly proportional to the height from which it is dropped. Each time the ball bounces on the ground, a fraction of its kinetic energy is lost as heat so that each bounce will be a little lower than the previous one. If a basketball is dropped from a height of 1 meter and reaches a height of 0.56 meters, what percentage of the kinetic energy was lost to heat?

6. An airplane is flying from Dallas, Texas to Pensacola, Florida. Flying at maximum velocity, it encounters strong winds moving at half the speed of the plane in the opposite direction. How long will it take the plane to arrive in Pensacola, relative to the original arrival time?
   F. It will take half the time.
   G. It will take twice as long.
   H. It will take 1.5 times as long.
   I. It will take three times as long.
Carlsbad Caverns is a group of caves found in New Mexico. What geologic process carved these caves from limestone over a long period of time?

A. movement of magma  
B. movement of glaciers  
C. a series of earthquakes  
D. movement of groundwater

The table below lists the diameters of the planets in the solar system in kilometers. To the nearest tenth, how many times larger is Saturn’s diameter compared to that of Earth?

<table>
<thead>
<tr>
<th>Planet</th>
<th>Diameter (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>4878</td>
</tr>
<tr>
<td>Venus</td>
<td>12 104</td>
</tr>
<tr>
<td>Earth</td>
<td>12 756</td>
</tr>
<tr>
<td>Mars</td>
<td>6787</td>
</tr>
<tr>
<td>Jupiter</td>
<td>142 800</td>
</tr>
<tr>
<td>Saturn</td>
<td>120 000</td>
</tr>
<tr>
<td>Uranus</td>
<td>51 118</td>
</tr>
<tr>
<td>Neptune</td>
<td>49 528</td>
</tr>
<tr>
<td>Pluto</td>
<td>2300</td>
</tr>
</tbody>
</table>

A forest is composed of four main biotic layers: the canopy, the understory and shrub, leaf litter, and soil. Leaf litter is the layer of the forest that is made up of dead leaves, dead plants, and other organisms. Why is this layer important to the cycle of the forest?

F. This layer is the main site of photosynthesis.  
G. This layer is the waste that is generated by the forest.  
H. This layer is where nitrogen is captured from the atmosphere.  
I. This layer can be broken down into nutrients to be used again by producers in the forest.
About two percent of Earth’s water is stored in solid form such as icebergs and glaciers. Ice reflects a large portion of the Sun’s energy that enters Earth’s atmosphere keeping Earth’s surface temperature in balance. If the solid forms of water began to melt due to global warming, how might Earth be affected?

Scientists have been exploring the nature of light for at least two thousand years. In the past, some scientists thought light was emitted by the eyes and by the objects we see. Light now is understood to be electromagnetic radiation with frequencies that the eyes are capable of sensing. If the nature of light has not changed, why do we understand it differently now?
Madeleine just got a new telescope for her birthday. While using it for the first time, she noticed two stars in the Milky Way galaxy and identified them as supergiants. What else would she be able to determine based on this knowledge?

A. The two stars are the same age.
B. The two stars have about the same temperature.
C. The two stars have very similar chemical compositions.
D. The two stars are approximately the same distance from Earth.

Sound travels through air at 330 meters per second (m/s) and through seawater at 1500 m/s. Blue whales can communicate at long distances. If a blue whale emits an ultrasound at 30 hertz, what will be its wavelength in meters?

Bacteria are very successful at making the substances they need with just a few simple nutrients. Myxobacteria, for example, live in the soil breaking down organic molecules. On the other hand, oak trees can be physically large and gather nutrients from the air and from the soil. What do the structures of these organisms have in common?

F. They both have tissues.
G. They both consist of cells.
H. They both have organ systems.
I. They both have specialized organs.
Plate tectonics is the theory developed to explain how the plates that make up the lithosphere move around the surface of Earth. According to the theory of plate tectonics, how is a mountain range created?

A. Mountain ranges are created by the collision of two continental plates.
B. Mountain ranges are created by the separation of two continental plates.
C. Mountain ranges are created by the interaction of the lithosphere with the biosphere.
D. Mountain ranges are created by the interaction of the lithosphere with the atmosphere.

Scientists are investigating ways to control the spread of a non-native ant species. The ant is taking over the habitats of native ant species and altering the ecosystem. How should the scientists handle their research data?

F. They should only publish data that reflect desired results.
G. They should keep accurate and open records in order to ensure they get the results that are best for the ecosystem.
H. They should keep accurate and open records to discourage other scientists from repeating the same experiment.
I. They should keep accurate and open records, allowing other scientists to replicate the experiments and contribute to the knowledge of this topic.

How do the organs and tissues within this system work together?

A. They remove wastes from the body.
B. They carry nerve signals throughout the body.
C. They are responsible for breaking down food into usable energy.
D. They transport oxygen to the cells and carry away carbon dioxide.
Which of the following is NOT a chemical change?

F. juice that ferments  
G. salt being mixed into water  
H. silver tarnishing in the open air  
I. antacid that neutralizes stomach acid

Susan is driving down the road at a constant speed. Explain the forces acting on the car and their relative magnitudes.
20 Which of the following processes correctly describes ice melting into liquid?
A. The ice molecules gain entropy as they become water.
B. The ordered ice molecules become more disordered as water.
C. The disordered ice molecules become more ordered as water.
D. The ice molecules lose entropy as they become water molecules.

21 The diagram below shows the offspring of a dark-haired guinea pig and a light-haired guinea pig.

Why does the offspring of the guinea pigs have both dark and white hair?
F. because brown is the recessive trait
G. because brown is the dominant trait
H. because brown and white are co-dominant traits
I. because brown and white are incomplete dominant traits

22 A house in southern Florida has solar panels on its roof. The panels are connected to a television inside the house. What type of energy occurs in this setup?
A. Solar energy transfers into chemical energy.
B. Solar energy transfers into electrical energy.
C. Solar energy transfers into mechanical energy.
D. Solar energy transfers into geothermal energy.
23. Four sound waves reached a source at the same time, as shown in the picture below. Which of the following do the waves NOT have in common?

F. amplitude
G. frequency
H. speed
I. wavelength

24. Shastri’s family relies on a wood stove to heat their home. The hot air from around the stove rises upstairs and displaces the cooler air upstairs. The cooler air falls downstairs so that it is warmed by the wood stove. What kind of heat transfer is this?

A. condensation
B. conduction
C. convection
D. radiation

25. The heart is a muscle that pumps oxygenated blood throughout the body. Which of the following describes the heart?

F. It is a cell.
G. It is a tissue.
H. It is an organ.
I. It is a system.
Chelsea wants to know which brand of potting soil is most nutritious for plants. She decides to design an experiment to test different types of soil. Which of the following is an important step in designing her reliable experiment?

A. making sure there have not been experiments like it  
B. making a guess as to the outcome, without prior research  
C. making sure that the outcome matches the expected results  
D. making sure to test one variable while controlling all others

Fossil fuels are the remains of organisms that have been compressed in layers of sediment over a long period of time. These fuels can be burned to produce many kinds of energy. What are fossil fuels an example of?

F. clean-burning fuel  
G. recyclable products  
H. renewable resources  
I. nonrenewable resources

A single ray of white light enters into a triangular prism and exits as multiple colors. This separation of colors is known as dispersion through the refraction of different wavelengths of light at different angles.

Which of the following is the cause of this dispersion?

A. The intensity of the light changes when it exits the prism.  
B. The frequency of the light changes when it passes through the prism.  
C. The light travels at different speeds through the air and through the prism.  
D. The different wavelengths of light gain different charges and are repelled by each other.
Pretest

A chlorine (Cl) atom has 17 protons, 17 neutrons, and 18 electrons. What is this atom’s electric charge?

F. It has a charge of –2.
G. It has a charge of –1.
H. It has a charge of +1.
I. It has a charge of +2.

A black hole is an astronomical phenomenon that is so massive that even light cannot escape from it. What is the force that pulls the light into the black hole?

A. electrical force
B. gravitational force
C. magnetic force
D. nuclear force

Kyle notices a train passing by. He is curious to know how fast the train is traveling so he notes several positions and times of the engine as shown in the table below.

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>Position (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>200</td>
</tr>
<tr>
<td>1.0</td>
<td>400</td>
</tr>
<tr>
<td>1.5</td>
<td>600</td>
</tr>
<tr>
<td>2.0</td>
<td>800</td>
</tr>
</tbody>
</table>

How fast is the train traveling in meters per minute?
A Beluga whale lives in cold salt water. Which of the following characteristics is an adaptation for cold water?

F. echolocation
G. large fins to swim with
H. thick layer of blubber fat
I. long ridge along their back

The following chart shows the high and low tides of Alligator Reef, Florida, on Saturday, January 22, 2005.

Assuming today is January 10, 2005, how can scientists provide such charts well in advance of the dates and times of the tides?

A. Since the Moon’s orbit is predictable, they can predict the tide changes.
B. They provide their best guess for the tide changes due to seasonal variation in weather patterns.
C. Since they calculate average rainfall in a particular region, they know when the tides will be high or low.
D. Evaporation causes the tide to decrease during the day and condensation causes the tide to increase at night.
Dennis decides to test the effect of light exposure on the growth rate of a particular species of plant. He sets up his experiment as shown below and measures the height of the plants each day for a month. He makes sure to water the plants daily, each with the same amount of water. After collecting and analyzing the data, he notices that there is little variation in the height of the plants. Even though the plants received different amounts of light, they are all the same height. Dennis is surprised by these results.

**Part A** Which variable or variables did Dennis keep constant in his experiment?

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________

**Part B** What would be a better design for his experiment?

________________________________________

________________________________________

________________________________________

________________________________________

________________________________________
Benchmark Practice
Strand A: The Nature of Matter

1. Which liquid in the table below has the greatest density? SC.A.1.3.1

<table>
<thead>
<tr>
<th>Object</th>
<th>Mass (grams)</th>
<th>Volume (milliliters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid A</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Liquid B</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Liquid C</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>Liquid D</td>
<td>54</td>
<td>20</td>
</tr>
</tbody>
</table>

A. Liquid A  
B. Liquid B  
C. Liquid C  
D. Liquid D

2. If an object has a mass of 39 grams and a density of 3 grams per milliliter, what is its volume in milliliters? SC.A.1.3.1

3. Explain how two cubes can be exactly the same size with the same dimensions but have very different densities. SC.A.1.3.1
Benchmark Practice

Strand A: The Nature of Matter

4 Which of the following objects has the **slowest** moving molecules?  
**SC.A.1.3.3**  
- F. fresh snow  
- G. warm bread  
- H. a melted ice cube  
- I. a hot cup of coffee

5 In the picture below, a pot of water is being boiled. Which of the following describes what is happening to the water molecules just above the surface line of the water?  
**SC.A.1.3.4**  
- A. The molecules are breaking down into atoms.  
- B. The molecules are moving faster and farther apart.  
- C. The molecules are moving slower and closer together.  
- D. The molecules have stopped moving by the time the water boils.

6 Which of the following is an example of a chemical change?  
**SC.A.1.3.5**  
- F. ice melting in a glass  
- G. wood burning in a fireplace  
- H. defrosting food in a microwave oven  
- I. the addition of food coloring to a glass of water
Benchmark Practice

Strand A: The Nature of Matter

7. When the wavelength of a wave changes, which of the following characteristics must also change? SC.A.2.3.1
   A. amplitude
   B. frequency
   C. intensity
   D. wave speed

8. The table below provides the number of waves over a specific period of time for four different waves. Which wave has the greatest frequency? SC.A.2.3.1

<table>
<thead>
<tr>
<th>Wave Data</th>
<th>Number of Waves</th>
<th>Time elapsed (in seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wave A</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>Wave B</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>Wave C</td>
<td>20</td>
<td>240</td>
</tr>
<tr>
<td>Wave D</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>

   F. Wave A          H. Wave C
   G. Wave B          I. Wave D

9. The drawing below shows the atomic structure of four elements. Two of them are in their neutral state and the other two are ionized. Which of the elements in this chart would be attracted to one another in a chemical reaction? SC.A.2.3.2

   sodium (Na)          chlorine (Cl)         helium (He)              oxygen (O)
   protons = 11          protons = 17          protons = 2               protons = 8
   electrons = 10        electrons = 18         electrons = 2             electrons = 8

   A. oxygen and helium
   B. sodium and helium
   C. chlorine and oxygen
   D. chlorine and sodium
Strand B: Energy

10 Which of the following is a type of energy Earth receives from the Sun? 
   **SC.B.1.3.1**
   F. infrared energy
   G. mechanical energy
   H. nuclear energy
   I. potential energy

11 The specific heat capacity (c) of a substance is the thermal energy required to raise one gram of the substance by one degree Celsius. The total amount of thermal energy (Q) added to a sample of a substance can be calculated by multiplying the specific heat capacity (c) by the mass of the sample (m) and the temperature change (T): Q = c \cdot m \cdot T. It takes 125 kilojoules (kJ) of energy to heat a cup of water, increasing its temperature by 1°C. What is the temperature change in °C of the cup of water after 750 kJ of energy are used? **SC.B.1.3.1**

12 Describe the different types of energy changes that take place when a light switch is turned on. **SC.B.1.3.1**
The drawing below displays the motion of a bouncing ball for its first four bounces. Use the drawing to answer the questions that follow.

SC.B.1.3.1

From the time the ball is dropped until after it takes its fourth bounce, describe the role of potential and kinetic energy. Include points of greatest and least potential and points of kinetic energy.
Benchmark Practice

**Strand B: Energy**

14 When a car engine is powered by energy, which of the following types of energy is lost during this process?  \textbf{SC.B.1.3.4}  
A. electrical energy  
B. light energy  
C. potential energy  
D. thermal energy

15 A motorcycle uses 50 000 kilojoules per minute. If 15 percent of the energy generated by its engine is lost in the first few seconds, how much energy, in kilojoules, remains to power the motorcycle?  \textbf{SC.B.1.3.4}  

16 A gallon of ice cream is left in a car on a hot summer day. In a few hours it has melted. The thermal energy had been flowing in which direction?  \textbf{SC.B.1.3.5}  
F. from the metal on the car to the ice cream  
G. from the ice cream to the metal on the car  
H. from the air in the car to the gallon of ice cream  
I. from the gallon of ice cream to the air in the car
The diagram below shows that a glass rod placed in a beaker appears bent or broken from the side view. Which of the following causes this appearance? SC.B.1.3.6

A. Light is reflected off of the water’s surface in the beaker.
B. Light is diffused as it travels from the air through the water.
C. Light is refracted as it travels from the water through the air.
D. Light is scattered in the water causing the rod to appear bent.

An ultrasound device uses sound waves to map out an image of an object. The time it takes for the waves to leave the ultrasound and return is used to create an image. This technology is based on which of the following actions of waves? SC.B.1.3.6

F. diffraction  
H. reflection
G. diffusion  
I. refraction

Use the diagram below to calculate the frequency, in hertz (Hz), of the sound wave. SC.B.1.3.6

Sound Wave

Time (in seconds)
A dentist uses an X-ray machine to examine teeth. X rays are considered harmful when used in large quantities, so a lead apron is placed on the patient’s chest. What is the purpose of the lead apron and how does it work? 

SC.B.1.3.6

---

Describe several similar characteristics of ocean waves, light waves from a lightbulb, and sound waves from a radio. 

SC.B.1.3.6

---
Strand B: Energy

22. Electrical wires are usually covered by plastic insulators. Which of the following describes the purpose of the insulator? **SC.B.2.3.1**

A. to reduce harmful effects of the current traveling down the wire  
B. to reduce the loss of thermal energy as the current travels down the wire  
C. to reduce the amount of electrons lost as the current travels down the wire  
D. to reduce the amount of light energy lost as the current travels down the wire

F. A hurricane requires water to maintain its energy level.  
G. The temperature on land causes a hurricane to lose energy.  
H. Weather patterns on land interfere with the energy of a hurricane.  
I. A hurricane loses some energy due to friction when hitting the land.

24. When water flows through the dam in this diagram, its energy is transformed into electricity. **SC.B.2.3.2**

What kind of energy does the water have in the reservoir before it enters the turbine?  
A. chemical energy  
B. kinetic energy  
C. mechanical energy  
D. potential energy

Go on
A truck travels at a constant speed of 45 kilometers per hour. How far does the truck travel in 20 minutes? \textbf{SC.C.1.3.1}

- F. 15 kilometers
- G. 20 kilometers
- H. 25 kilometers
- I. 30 kilometers

In what way are gravitational and electrical forces similar? \textbf{SC.C.2.3.1}

- A. Both occur between objects with large masses.
- B. Both occur between objects with large charges.
- C. Both occur between objects that have opposite poles.
- D. Both occur between objects independently whether they are in contact or not.

The lever in the figure below accomplishes 5.0 newton-meters of work raising a 25 newton weight. How far, in meters, is the weight raised? \textbf{SC.C.2.3.4}

**Gridded Response**

![Lever Diagram]
Various forces act on the wagon as shown in the figure below. What is the net force acting on the wagon in newtons (N)? \[ \text{SC.C.2.3.6} \]

- **F.** 45 N uphill
- **G.** 45 N downhill
- **H.** 70 N uphill
- **I.** 70 N downhill

A train moves forward at a constant speed. What is true about the forces acting on the train? \[ \text{SC.C.2.3.6} \]

- **A.** The forward forces are equal to the forces acting in the backward direction.
- **B.** The forward forces are greater than the forces acting in the backward direction.
- **C.** The forward forces are smaller than the forces acting in the backward direction.
- **D.** There can never be any force acting on the train when it moves at a constant speed.

An airplane is accelerating forward due to a force of 3320 newtons acting on it. Then it encounters wind resistance that exerts a backward force of 550 newtons. What is the net force, in newtons, acting on the airplane? \[ \text{SC.C.2.3.6} \]
31. An automobile approaching a traffic signal comes to a complete stop. What is the direction of the force acting on the automobile with respect to the motion of the automobile? Explain your answer. **SC.C.2.3.6**

---

32. In a tug-of-war, the forces exerted on the rope are shown in the figure below. Describe the motion, if any, of the rope in terms of net force and acceleration. **SC.C.2.3.6**

---
Benchmark Practice

Strand C: Force and Motion

33 Which of the following statements describes the results of gravitational force on a planet in our solar system? SC.C.2.3.7

F. The planet has a tilted rotational axis.
G. The planet rotates at a constant speed.
H. The planet follows a curved path around the Sun.
I. The temperature on the surface of the planet is nearly constant.

34 In the table below, which planetary system has the greatest gravitational force acting between the planet and its moon? SC.C.2.3.7

<table>
<thead>
<tr>
<th>Planetary System</th>
<th>Planet mass ($\times 10^{22}$ kilograms)</th>
<th>Moon mass ($\times 10^{22}$ kilograms)</th>
<th>Moon distance from planet ($\times 10^6$ kilometers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>600</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>600</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>600</td>
<td>12</td>
<td>1</td>
</tr>
</tbody>
</table>

A. 1
B. 2
C. 3
D. 4

35 Before traveling to Planet X, a backpack full of books weighs 38 newtons on Earth. The backpack weighs 45 newtons on Planet X. Which statement describes the reason for the difference in weight? SC.C.2.3.7

F. Planet X is less dense than Earth.
G. Planet X has more mass than Earth.
H. Planet X is farther from the Sun than Earth.
I. Planet X has a larger circumference than Earth.
**Benchmark Practice**

**Strand D: Processes that Shape the Earth**

36. Beach A is a sandy beach. Beach B is rocky with many stones and pebbles. Which of the following would cause the differences between the beaches? **SC.D.1.3.1**
   
   A. Beach B is more traveled by people than beach A.  
   B. Beach B has stronger, rougher waves than beach A.  
   C. Beach B is more protected from the sea than beach A.  
   D. The weather pattern at beach B is calmer than at beach A.

37. Sediments can be moved from one location to another by wind, water, or ice. Which of the following results from sediment deposits? **SC.D.1.3.1**
   
   F. aquifer  
   G. cavern  
   H. glacier  
   I. rock

38. The diagram below shows the striations of a rock formation and when they formed. Which of the following correctly describes the events that occurred in this area over time? **SC.D.1.3.3**
   
   A. The rocks moved past one another followed by 25 million years of sediment deposit.  
   B. Stress above rock layers caused the rocks to crack over a period of 25 million years.  
   C. Sediment was deposited for 25 million years before forces below the ground caused a fault.  
   D. Ice, rain, and snow caused a crack in the rocks after 25 million years of sediment deposit.
Artificial sand dunes are often placed along the coast between the beach and the oceanfront homes. Which statement describes why homeowners would do this? **SC.D.1.3.4**

- F. Sand dunes provide a habitat for local bird populations.
- G. Sand dunes create a barrier against pollutants reaching the ocean.
- H. Sand dunes offer the homes protection by reducing beach erosion.
- I. Sand dunes prevent ocean craft such as boats and ships from damaging homes.

Without fertilization, plant growth can be reduced or eliminated over time. Which of the following correctly describes an impact of fertilization on a lawn? **SC.D.1.3.4**

- A. Fertilization provides more nutrients to the lawn.
- B. Fertilization causes the soil to retain more water.
- C. Fertilization discourages bacterial growth in the soil.
- D. Fertilization keeps rodents from feeding on the lawn.

What is the **primary** role that fungi play as a part of the habitat shown below? **SC.D.1.3.4**

- F. Fungi act as a nutrient and are digested by the tree.
- G. Fungi act as natural barriers for the tree by releasing toxins.
- H. Fungi provide a habitat for earthworms and other invertebrates.
- I. Fungi act as decomposers of dead plant material, turning it into nutrients for the tree.
**Benchmark Practice**

**Strand D: Processes that Shape the Earth**

**42** Which of the following is an example of nature changing the face of Earth over a long period of time? **SC.D.1.3.5**

A. A frontal boundary triggers several tornadoes.  
B. A hurricane destroys much of the vegetation in a city.  
C. Chemical weathering eats away limestone formations.  
D. An earthquake of a 5.0 magnitude strikes a rural community.

**43** The table below contains data about activity on a fault line over a period of two years. What occurred between 1974 and 1975? **SC.D.1.3.5**

<table>
<thead>
<tr>
<th>Date</th>
<th>Rock Slip measurement (millimeters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>5 mm</td>
</tr>
<tr>
<td>1974</td>
<td>8 mm</td>
</tr>
<tr>
<td>1975</td>
<td>300 mm</td>
</tr>
<tr>
<td>1976</td>
<td>10 mm</td>
</tr>
</tbody>
</table>

F. an earthquake  
G. a hurricane  
H. a mudslide  
I. a tsunami

**44** The diagram below shows the movement of Earth’s crust along a fault line over many years. If one centimeter (cm) is equal to 80 cm of actual rock movement, how far have the rocks moved along the fault line? **SC.D.1.3.5**

Go on
45 Mars has many similarities to our planet. Which of the following is one of the ways that Mars and Earth are similar? **SC.E.1.3.1**

- **A.** Mars and Earth both have seasons.
- **B.** Mars and Earth both have one moon.
- **C.** Mars and Earth have about the same diameter.
- **D.** Mars and Earth are close to the same average distance from the Sun.

46 The diagram below shows Earth in relation to the Sun. Which solstice or equinox is represented by this diagram? **SC.E.1.3.1**

- **F.** spring equinox
- **G.** summer solstice
- **H.** fall equinox
- **I.** winter solstice

47 The table below shows the average distances from the Sun for the outer planets. Approximately how many times farther from the Sun is Pluto than Jupiter? Round your answer to the nearest tenth. **SC.E.1.3.1**

<table>
<thead>
<tr>
<th>Planet</th>
<th>Average Distance from Sun (kilometers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jupiter</td>
<td>778 000 000</td>
</tr>
<tr>
<td>Saturn</td>
<td>1 427 000 000</td>
</tr>
<tr>
<td>Uranus</td>
<td>2 871 000 000</td>
</tr>
<tr>
<td>Neptune</td>
<td>4 498 000 000</td>
</tr>
<tr>
<td>Pluto</td>
<td>5 906 000 000</td>
</tr>
</tbody>
</table>
Several unmanned space missions to the outer solar system have led to the discovery of additional moons for Jupiter and Saturn. Why do you think it is so difficult to find all the moons for these large planets? **SC.E.1.3.1**

Scientists are always looking for evidence of life or the conditions that could support life in other parts of our solar system. What conditions on Venus make it difficult to support organisms found on Earth? **SC.E.1.3.1**
The color of a star is determined by its surface temperature. The coolest stars are about 3200°C. To what stellar color does this correspond?

SC.E.1.3.4

A. blue
B. red
C. white
D. yellow

The diagram below is a modified Hertzsprung-Russell diagram. Describe the characteristics of the star Rigel. SC.E.2.3.1

F. bright, cool
G. bright, hot
H. dim, cool
I. dim, hot

The table below shows the apparent magnitudes of some objects visible from Earth. Sirius is actually the brightest star in the sky. Why is its apparent magnitude less than that of the Moon? SC.E.2.3.1

<table>
<thead>
<tr>
<th>Object</th>
<th>Apparent Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>−26.8</td>
</tr>
<tr>
<td>Moon</td>
<td>−12.5</td>
</tr>
<tr>
<td>Venus</td>
<td>−4.6</td>
</tr>
<tr>
<td>Jupiter</td>
<td>−2.7</td>
</tr>
<tr>
<td>Sirius</td>
<td>−1.46</td>
</tr>
<tr>
<td>Saturn</td>
<td>+0.7</td>
</tr>
</tbody>
</table>

A. Sirius is very small.
B. The Moon is not a star.
C. Sirius is very far from Earth.
D. The Moon shines all the time.
Which of the following lists the main function of the endocrine system?

**SC.F.1.3.1**

F. body coordination  
G. exchange of gases  
H. reacting to a stimulus  
I. defense against diseases

In the past, scientists believed that since flies flew over a piece of rotten meat, they were formed from that meat, a non-living substance. What is this idea called? **SC.F.1.3.1**

A. spontaneous growth  
B. spontaneous generation  
C. a controlled experiment  
D. a stimulus and response

Billy is running in a marathon for the first time. While he is running, he notices that he is losing his breath. After his body adjusts to the running, his rhythm is normal again. Explain how the respiratory system regulates breathing for runners. **SC.F.1.3.1**
Benchmark Practice

Strand F: Processes of Life

Which of the following is an organism that makes its own food? SC.F.1.3.1

F. black bear  
G. clam  
H. deer  
I. pine tree

A living thing must be able to keep its internal conditions stable despite changes in its environment. What is this process called? SC.F.1.3.1

A. development  
B. homeostasis  
C. response  
D. spontaneous generation

How do consumers, such as rabbits or eagles, get their energy? SC.F.1.3.1

__________________________  ____________________________  ____________________________
Name: Date: Class:

Go on
A lily and a protist are two different examples of living organisms. Which of the following statements is true? **SC.F.1.3.2**  
F. The lily and the protist can both be unicellular.  
G. A lily is unicellular, while the protist is multicellular.  
H. Only the lily can be a unicellular and multicellular organism.  
I. Only the protist can be a unicellular and multicellular organism.

Which of the following statements is part of the cell theory? **SC.F.1.3.2**  
A. All cells are produced from other cells.  
B. When organisms die they lose their cells.  
C. Organisms must have more than one cell to survive.  
D. An organism’s first cell comes from spontaneous generation.

Which of the following is NOT accomplished by cellular division? **SC.F.1.3.3**  
F. growth  
G. repair  
H. reproduction  
I. respiration
62 The following diagram shows the internal organization of an organism. Which of the following would be in the organ category? SC.F.1.3.4

A. blood cell  
B. boy’s hand  
C. heart  
D. muscle tissue

63 Which organelle is responsible for catching energy from the Sun and using it to produce food in the cell? SC.F.1.3.5

F. cell wall  
G. chloroplasts  
H. endoplasmic reticulum  
I. vacuole
Red blood cells quickly carry oxygen to all parts of the body. What characteristics of red blood cells help them perform their function?

**SC.F.1.3.6**
A. color and feel  
B. shape and size  
C. texture and tint  
D. population and size

An experiment was performed by timing rats running through a maze. One set of rats was given a piece of cheese when they finished the maze. The other set received no cheese. After repeating the experiment several times, the set of rats that received the cheese went through the maze faster than the other set. What type of learning did the rats with cheese exhibit?

**SC.F.1.3.7**
F. conditioning  
G. imprinting  
H. insight  
I. instinct

Bacteria reproduce by asexual reproduction. The table below shows the rate at which a bacterial population would increase if each cell reproduced every 20 minutes. How many cells can be expected after five hours of reproduction?

**SC.F.2.3.1**

<table>
<thead>
<tr>
<th>Time</th>
<th>Number of bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1 hour</td>
<td>8</td>
</tr>
<tr>
<td>2 hours</td>
<td>64</td>
</tr>
<tr>
<td>3 hours</td>
<td>512</td>
</tr>
<tr>
<td>4 hours</td>
<td>4096</td>
</tr>
</tbody>
</table>

A. 20,480  
B. 32,768  
C. 36,864  
D. 40,960
Which is the correct term for an organism’s behavior and physical appearance? **SC.F.2.3.2**

- F. adaptation
- G. dominance
- H. genotype
- I. phenotype

Genes are located on chromosomes. Some of the chromosomes in a pair have the same alleles for certain genes and some have different alleles. Based on the diagram, which of the following is a list of heterozygous genes? **SC.F.2.3.2**

- A. A, B, and E
- B. C, B, and E
- C. E, F, and G
- D. A, B, and G

Which of the following defines a change in a person’s DNA? **SC.F.2.3.2**

- F. an allele
- G. a mutation
- H. a chromosome
- I. Punnett square
In gerbils, the gene for a spotted coat is dominant over the gene for a brown coat. A spotted gerbil is crossed with a brown gerbil. What are the genotypes of the parents if some of their offspring are spotted? Explain.

SC.F.2.3.2

---

In pea plants, a round seed (S) is dominant over a wrinkled seed (s). The table below shows the phenotypes of offspring produced from a cross between two plants with round seeds. What are the genotypes of the parents? Explain your answer. SC.F.2.3.2

<table>
<thead>
<tr>
<th>Phenotype</th>
<th>Number of offspring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth seeds</td>
<td>12</td>
</tr>
<tr>
<td>Wrinkled seeds</td>
<td>4</td>
</tr>
</tbody>
</table>

---
In a lizard population, there are a few individuals with gray skin, while others can change colors. Why is it more likely that the color-changing lizards will produce offspring? SC.F.2.3.3
A. They can hide from predators more successfully.
B. They will be faster and stronger than the gray lizards.
C. The color-changing skin is a dominant gene over the gray.
D. Theircolor-changing skin will make their offspring more attractive.

Natural selection is the process by which animals with characteristics suited for their environment survive and reproduce. Over time this results in organisms that have adaptations that enable the species to survive. What is needed for natural selection to occur? SC.F.2.3.3
F. continental drift
G. genetic disorder
H. geographic isolation
I. variation

Many ancient organisms are preserved as a copy of only the shape of the organism. What type of fossil is this? SC.F.2.3.4
A. amber
B. cast
C. mold
D. petrified fossil
Viruses are not considered living organisms. Which of the following choices explains that? **SC.G.1.3.2**

- F. Viruses only contain molecules.
- G. Viruses contain genetic material.
- H. Viruses are active only in their host.
- I. Viruses have an outer and inner core.

What is an entire group of similar organisms that can mate and produce fertile offspring called? **SC.G.1.3.3**

- A. a community
- B. a family
- C. a genus
- D. a species

The chart below shows the classification of a housefly. Which of the following is the least specific classification for this insect? **SC.G.1.3.3**

<table>
<thead>
<tr>
<th>Classification of a Housefly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
</tr>
<tr>
<td>Phylum</td>
</tr>
<tr>
<td>Class</td>
</tr>
<tr>
<td>Order</td>
</tr>
<tr>
<td>Family</td>
</tr>
<tr>
<td>Genus</td>
</tr>
<tr>
<td>Species</td>
</tr>
</tbody>
</table>

- F. Animalia
- G. Arthropoda
- H. Insecta
- I. Musca
Benchmark Practice

Strand G: How Living Things Interact with Their Environment

In the simplified food chain below, which is the first-level consumer? SC.G.1.3.4

- A. the grass
- B. the hawk
- C. the mouse
- D. the Sun

The table below shows the energy available at each level of a food web. How many times more energy is available at the producer level than at the second-level consumer level? SC.G.1.3.4

<table>
<thead>
<tr>
<th>Energy Level</th>
<th>Energy Available (kilocalories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producers</td>
<td>1000</td>
</tr>
<tr>
<td>First-level consumers</td>
<td>100</td>
</tr>
<tr>
<td>Second-level consumers</td>
<td>10</td>
</tr>
<tr>
<td>Third-level consumers</td>
<td>1</td>
</tr>
</tbody>
</table>

- F. 10 times
- G. 100 times
- H. 500 times
- I. 1000 times

In some Florida food webs, black bears consume berries, acorns, and other plant material. They also eat small animals such as armadillos. Based on this information, what kind of consumer is the Florida black bear? SC.G.1.3.4

- A. carnivore
- B. herbivore
- C. omnivore
- D. vegetarian
81. The diagram below shows a simplified nitrogen cycle. Explain why decomposers are a vital part of the whole nitrogen cycle. **SC.G.1.3.4**

![Nitrogen Cycle Diagram]

- **Nitrogen in atmosphere**
- **Animal waste**
- **Plant matter**
- **Bacteria**
- **Decomposers bacteria/fungi**
  - **Ammonia ammonium**
  - **Nitrites**

---

82. Every few years a farmer plants alfalfa in his corn fields. Explain the farmer’s reason for doing this. **SC.G.1.3.4**

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Name: ____________________________ Date: ____________ Class: ______________
Benchmark Practice

Strand G: How Living Things Interact with Their Environment

83 Which of the following is a **renewable** source of energy? **SC.G.2.3.1**

- F. coal
- G. hydroelectric
- H. natural gas
- I. petroleum

84 Abiotic factors are necessary parts of an ecosystem. Which of the following is an abiotic factor that **all** organisms use to carry out their life processes? **SC.G.2.3.2**

- A. chlorophyll
- B. soil
- C. sunlight
- D. water

85 Nitrogen, oxygen, and argon account for virtually all of the air we breathe. Nitrogen makes up approximately 78 percent of our air, while argon accounts for almost 1 percent. What is the approximate percentage of oxygen in the air that land organisms breathe? **SC.G.2.3.2**

Name: ____________________________ Date: ____________ Class: ______________
The table below shows the rate of bird extinction over the past 400 years. What would be a cause of this rate?  SC.G.2.3.3

<table>
<thead>
<tr>
<th>Year</th>
<th>New Number of Species Becoming Extinct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
<td>3</td>
</tr>
<tr>
<td>1700</td>
<td>6</td>
</tr>
<tr>
<td>1800</td>
<td>12</td>
</tr>
<tr>
<td>1900</td>
<td>32</td>
</tr>
<tr>
<td>2000</td>
<td>45</td>
</tr>
</tbody>
</table>

F. an increase in habitat loss  
G. a decrease in human population  
H. a decrease in welfare spending  
I. an increase of animal protective services

What is a species that might become endangered in the future called?  SC.G.2.3.3

A. a thriving species  
B. an extinct species  
C. an enraged species  
D. a threatened species

The circle graph below shows the reasons that birds have become endangered or threatened. What percentage of the birds have become endangered or threatened by habitat loss and poaching?  SC.G.2.3.3

Habitat loss 60%  
Poaching 20%  
Exotic species 12%  
Other causes 8%
Benchmark Practice

Strand G: How Living Things Interact with Their Environment

89 What is the practice of illegally killing wildlife species called? SC.G.2.3.4
   F. captive breeding
   G. habitat fragmentation
   H. poaching
   I. trapping

90 Which of the following is a reason why an increase in the human population can harm the environment? SC.G.2.3.4
   A. The competition for water and land will decrease.
   B. The amount of resources being used will decrease.
   C. The number of scientists trying to save the environment will increase.
   D. The destruction of natural habitats will occur from an increase in housing.

91 Which of the following is NOT a natural event that causes changes in Earth’s environment? SC.G.2.3.4
   F. the nitrogen cycle
   G. ozone layer depletion
   H. the rise and fall of ocean tides
   I. weather disruptions due to El Niño
Some regions of Earth have a much higher diversity of organisms than others. Name one of these diverse ecosystems and how it is being threatened. **SC.G.2.3.4**

The Endangered Species Act creates a list of threatened or endangered species and allows government agencies to create rules to protect the species on the endangered list. Explain how the Endangered Species Act has helped fragile ecosystems. **SC.G.2.3.4**
Benchmark Practice

Strand H: The Nature of Science

94 Multiple Choice

In the past, scientists classified all organisms as either plants or animals, but never both. This classification proved wrong when unicellular organisms were observed switching back and forth between the two categories. Then a new classification system was invented. What can be concluded from this? SC.H.1.3.1

A. Theories are more important than observations.
B. Observations that do not agree with current theories are wrong.
C. Scientists must always be prepared to re-evaluate theories with new data.
D. If recorded data does not support the current theory, the theory must be wrong.

95 Multiple Choice

Fossils of trilobites, like the one shown in the picture below, have been found in ancient rock layers, but no living trilobite has ever been found. Which of the following offers a scientific explanation for why trilobites do not exist anymore? SC.H.1.3.1

F. extinction  H. uncertainty principle
G. relativity theory  I. variation

96 In addition to optical telescopes, scientists use infrared, microwave, radio, X-ray, and gamma ray telescopes to explore the vast distances of the universe. What do all of these tools have in common and why is each one necessary? SC.H.1.3.1
Astronomers discovered Uranus and Neptune at the end of the 19th century. When calculating the orbits, data pointed toward the idea of another new planet. It was not until 1921 that Pluto was discovered. Why did it take so long to find Pluto?  

A. Pluto could only be discovered after the radio telescope was invented.  
B. Astronomers couldn’t see with old telescopes because of the strong sunlight.  
C. Astronomers were looking in the wrong place because Neptune was in the way.  
D. Pluto is very small and far away, making it hard to see even with the best telescopes.

Duane is collecting rocks around town. Near some hills, he finds many samples of igneous rocks. What does Duane theorize might have happened in the past?  

F. The area was once part of an inland sea.  
G. One or more volcanoes were active in the area.  
H. Lightning struck the hills and melted rocks in the area.  
I. Dinosaurs once lived in the area since igneous rock came from them.

Bobby’s favorite science subject is astronomy, while Sue loves physics. They have a study group once a week and can understand each other’s science work. Why are they able to understand the other’s science subject?  

A. Astronomy and physics are identical in scientific terms.  
B. Astronomy and physics are interrelated and use similar principles.  
C. Once you have studied one science, you can understand most scientific discussions.  
D. Astronomy and physics use the same lab reports, so it is easier for each student to read the other’s report.
LeAnn is working on her science project that is due tomorrow. She takes notes, uses clean equipment, and follows directions. Her results are unexpected. She discovers that the triple-beam balance used to weigh ingredients was off by 5 percent. Since she does not have time to retest her experiment, what should she do? **SC.H.1.3.4**

**F.** She should change her results to match the expected results.

**G.** She shouldn’t change anything and pretend that nothing was wrong.

**H.** She should record the error so her teacher will understand her results.

**I.** She should retest until she gets it right, even if she misses the due date.

Bernice and Toby are studying daily ozone levels near a school of asthmatic children. In order to have unbiased results, they made a questionnaire for the students, teachers, and students’ parents to fill out without mentioning asthma or ozone. What else can Bernice and Toby do to make their study as objective as possible? **SC.H.1.3.4**

**A.** Repeat the study at all the schools in the city.

**B.** Tell everyone that they are actually studying a different problem.

**C.** Find articles about ozone levels and asthma to use in their results.

**D.** Create another questionnaire for everyone participating in the study.

While digging in Florida, Luka found stone chips and flakes. The stone chips were near a layer of carbon soot that may have been a fireplace. The layer of soot was dated much earlier than when scientists thought humans came to this part of Florida. Luka is eager to publish his findings, but what should he do first? **SC.H.1.3.4**

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Jean filled three identical pots with equal portions of soil. She planted five flower seeds in Pot A, 10 seeds in Pot B, and 15 seeds in Pot C. After the flowers grew, she noticed that Pot A had bigger, healthier flowers. Which variable may have caused this result? SC.H.1.3.5

F. The amount of space within each seed had to grow.
G. Where the seeds were placed affected their nutrient intake.
H. The amount of soil could have suffocated the roots of the flowers.
I. The pot size could have affected how much water the plants received.

Mike experiments with airplane designs. He wants to figure out what airspeed is needed to have enough lift for a small airplane. The total weight of the plane is 5000 newtons. If the total wing surface area is 50 square meters, at what speed will the plane have to be going to take off? Give your answer in kilometers per hour (km/h). SC.H.1.3.5

<table>
<thead>
<tr>
<th>Airspeed (kilometers per hour)</th>
<th>Lift (newtons per meter of wing surface)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>45</td>
</tr>
<tr>
<td>200</td>
<td>75</td>
</tr>
<tr>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>400</td>
<td>120</td>
</tr>
<tr>
<td>500</td>
<td>135</td>
</tr>
</tbody>
</table>

Paolo wants to see if tomatoes grow in artificial light like they do in real sunlight. He puts the plants in a room with no light and places them under lightbulbs that emit light similar to sunlight. He also plants the same number of tomato plants in sunlight as a control group. What other factors about light should Paolo consider? SC.H.1.3.5
As shown in the table below, lift is not directly proportional to airspeed; meaning if speed is doubled, the lift is not doubled. Another factor, drag, affects how lift and airspeed are related. SC.H.1.3.5

<table>
<thead>
<tr>
<th>Airspeed (kilometers per hour)</th>
<th>Lift (newtons per meter of wing surface)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>45</td>
</tr>
<tr>
<td>200</td>
<td>75</td>
</tr>
<tr>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>400</td>
<td>120</td>
</tr>
<tr>
<td>500</td>
<td>135</td>
</tr>
</tbody>
</table>

**Part A** When investigating the relationship between airspeed and lift, what other variables should be held constant?

**Part B** In order to have meaningful results, why must the variables discussed in Part A be held constant?
Benchmark Practice

Strand H: The Nature of Science

107 Multiple Choice

The oceans absorb a large amount of thermal energy from solar radiation. One way this heat energy travels back into the atmosphere is through hurricanes. Although they cause damage, what would result if there were no hurricanes? SC.H.2.3.1

A. Tourism in coastal states would decrease.
B. Erosion along coastlines would increase.
C. The value of oceanfront property would decrease.
D. Ocean temperatures could rise to a level harmful for fish and other aquatic life.

108 Multiple Choice

Sayid has a white-haired, blue-eyed cat who was born deaf. He reads information on the subject and discovers that genetics are the cause of his cat’s deafness. However, the exact gene combination is not known. Sayid decides NOT to breed cats of various coat and eye colors to see if their kittens will be deaf. Which of the following ethically supports Sayid’s decision? SC.H.3.3.1

F. The experiment would be too much trouble.
G. The experiment would be a waste of time and money.
H. The experiment could produce cats with a disability that can affect their survival.
I. Sayid’s mom, a doctor, told him that other scientists already proved this theory wrong.

109 Multiple Choice

An earthquake under the Indian Ocean produced a huge tsunami that hit many countries. Scientists who monitor earthquakes could predict the tsunami, but had no way to warn people in the short amount of time between the earthquake and the tsunami reaching land. Given current technology, which of the following would be an efficient way to warn people in the event of a tsunami? SC.H.3.3.4

A. Hire local citizens in each area to alert everyone of the danger; notify the messengers by telephone.
B. Keeps ships offshore at all times. When the ships see the tsunami, they can signal people on shore by blinking powerful lights.
C. If an earthquake is detected, fly helicopters over the area that may be affected and drop leaflets warning the citizens of danger.
D. Build radio towers along the coasts and on top of the towers, place sirens that can be turned on by the scientists in the earthquake-monitoring center.
Susan wants to know what affects the motion of a pendulum. She conducts an experiment to test if the angle of release changes the period of back and forth motion. Which of the following must she make sure is a constant in the experiment?

A. The angle of release stays the same each time she tests.
B. The length of the string remains the same each time she tests.
C. The friction at the pivot point of the pendulum stays the same each time she tests.
D. Both the friction at the pivot point of the pendulum and the length of the string remain the same each time she tests.

The Sun has a whitish-yellow color. Astronomers have found stars similar to the Sun in our galaxy and beyond. If they also have the same color as the Sun, what can scientists conclude about these other stars?

F. They will have equal densities and temperatures.
G. They probably are all identical in size and temperature.
H. Color is not useful in studying similar traits between stars.
I. They probably have the same surface temperature as the Sun.

Samuel is preparing dinner for his family and is using the food items shown below.

Which has the least amount of kinetic energy?
A. boiling spaghetti
B. ice cream
C. loaf of bread
D. head of lettuce
Chris uses a machine to help him do work. He notices that he has to put in 1000 joules of work to get out 900 joules of work from the machine. What is the machine’s percent efficiency?

The table lists the magnitude and direction of forces on a wagon sitting on flat ground.

<table>
<thead>
<tr>
<th>Force</th>
<th>Direction</th>
<th>Magnitude (newtons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Right</td>
<td>500</td>
</tr>
<tr>
<td>F2</td>
<td>Left</td>
<td>25</td>
</tr>
<tr>
<td>F3</td>
<td>Up</td>
<td>100</td>
</tr>
<tr>
<td>F4</td>
<td>Down</td>
<td>100</td>
</tr>
</tbody>
</table>

What will the motion of the wagon be?
F. no motion
G. accelerate to the left
H. accelerate to the right
I. move at a constant speed

The density of water is 1.0 gram per milliliter at 4 degrees Celsius. Shelby drops a spoonful of sugar into water at this temperature and it sinks to the bottom of the container. Compare the densities of the sugar and water and explain how this affects the position of the sugar in the liquid water.
Near Shandra’s house is a rock quarry. In the area that has been dug out, she notices layers of rock and sediment as shown in the diagram below.

Which of the following would explain the formation of layers with different thicknesses and colors?

A. earthquake  
B. volcanic eruption  
C. folding and uplifting  
D. erosion and deposition

Only 10 percent of the available energy is transferred from one trophic level to the next. The diagram below shows an energy pyramid within an ecosystem.

Based on the energy pyramid, if the Sun provides 100 000 joules of energy to the sunflower, how much energy is available for the wolf?

F. 10 joules  
G. 100 joules  
H. 1000 joules  
I. 10 000 joules
Adult salmon return to where they hatch to reproduce by swimming upstream. In a river where salmon return to reproduce, the nearby city wants to build a reservoir to provide water to the community by damming the river. Explain how this dam could affect the population of the salmon.

Abby has learned that as the pressure on a substance increases, the temperature of that substance will also increase. Abby conducted an experiment to test this theory. She increased the pressure on an object and then measured its temperature. Her data are listed below.

Do Abby’s data support the theory? If not, where should Abby go from here with her data and her experiments?

<table>
<thead>
<tr>
<th>Pressure (in atmospheric pressure units)</th>
<th>Temperature (in degrees Celsius)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
</tr>
</tbody>
</table>
When Thomas Edison was developing the light bulb, he went through about 600 different filaments until he found the one that worked the best. By 1880, he had found a filament that would burn at 16 watts for 1500 hours. Why was it critical that Edison take careful notes during his experiments?

A. so no one would use the same methods he used  
B. so no one else would steal his thoughts and ideas  
C. so his efforts could be correctly replicated when it worked  
D. so he would be recognized for his lengthy experimental process

Light travels at 300,000 kilometers per second (km/s), but sound travels much slower at a rate of 0.341 km/s. Karen notices a delay of about 30 seconds between the time she sees an airplane and hears its engine. How far (in km) is the plane from her when she first sees it?

Which of the following correctly describes a difference between a white dwarf star and a red giant star?

F. White dwarfs are brighter than red giants.  
G. White dwarfs are smaller in magnitude than red giants.  
H. White dwarfs have a greater gravitational pull than red giants.  
I. White dwarfs have cooler surface temperatures than red giants.
Posttest

14 Which of the following is the correct structural hierarchy for living things?

A. cells, tissues, systems, organs  
B. organs, tissues, cells, systems  
C. cells, organs, tissues, systems  
D. cells, tissues, organs, systems

15 Tony recorded the outside temperature at regular intervals during a period of several days. The table below shows the temperature changes.

<table>
<thead>
<tr>
<th>Temperature Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
</tr>
<tr>
<td>Day 1</td>
</tr>
<tr>
<td>Day 1</td>
</tr>
<tr>
<td>Day 2</td>
</tr>
<tr>
<td>Day 2</td>
</tr>
<tr>
<td>Day 3</td>
</tr>
<tr>
<td>Day 3</td>
</tr>
</tbody>
</table>

Which of the following is likely occurring based on the temperature data?

F. cold front  
G. warm front  
H. calm winds  
I. snow storm

16 Which of the following behaviors of light allows you to see your image in a mirror?

A. diffraction  
B. rarefaction  
C. reflection  
D. refraction
Two parents with brown eyes have a child with blue eyes. Brown eyes are a dominant trait \((B)\) and blue eyes are recessive \((b)\). Which of the following must be the genotypes of the child’s mother and father?

- F. \(bb\) and \(bb\)
- G. \(BB\) and \(BB\)
- H. \(Bb\) and \(BB\)
- I. \(Bb\) and \(Bb\)

A freezer works by removing the thermal energy from inside the freezer. How much energy would the freezer always need to put in so it can work properly?

- A. equal to the amount of thermal energy
- B. less than the amount of thermal energy
- C. more than the amount of thermal energy
- D. it varies depending on the amount of thermal energy

The diagram below shows an electrical circuit.

Which of the following is the initial form of energy in the circuit?

- F. kinetic energy
- G. thermal energy
- H. chemical energy
- I. electromagnetic energy
The diagram below shows Alfred Wegener’s theory of how the landmass Pangaea looked 225 million years ago.

Which of the following processes explains how Pangaea broke apart and how the continents reached their current locations on Earth?

A. erosion  
B. deposition  
C. natural selection  
D. plate tectonics

Kim’s father presses the gas pedal in his car and speeds up from 10 meters per second (m/s) to 35 m/s in 5 seconds. What is the car’s change in velocity?

For a party, Germaine places warm cans of soda in a bowl of ice. In which direction is the thermal energy flowing?

A. from the ice to the air  
B. from the ice to the soda  
C. from the soda to the ice  
D. from the soda to the bowl
Elena wants to test the effect of the addition of salt to a pot of boiling water. She adds 30 grams of salt to one kilogram of water and then reads the temperature of the water as it heats. She then repeats the experiment several more times, increasing the amount of salt by 30 grams each time. The following table represents her results.

<table>
<thead>
<tr>
<th>Amount Salt Added (grams)</th>
<th>Boiling Point of Water (degrees Celsius)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100.0</td>
</tr>
<tr>
<td>30</td>
<td>100.5</td>
</tr>
<tr>
<td>60</td>
<td>101.0</td>
</tr>
<tr>
<td>90</td>
<td>101.5</td>
</tr>
<tr>
<td>120</td>
<td>102.0</td>
</tr>
</tbody>
</table>

What conclusion can Elena make about adding salt to water?
A. The boiling point of water increases by 5 degrees as 30 grams of salt is added.
B. The boiling point of water decreases by 5 degrees as 30 grams of salt is added.
C. The boiling point of water decreases by 0.5 degrees as 30 grams of salt is added.
D. The boiling point of water increases by 0.5 degrees as 30 grams of salt is added.

Which of the following resources are nonrenewable?
F. hydroelectricity
G. natural gas
H. solar energy
I. wind energy

In physics experiments, the variables are controlled, hypotheses are tested, and conclusions are drawn from the results. In meteorology, the process is much more observation-based because many of the variables cannot be controlled, but hypotheses are still tested and conclusions are still drawn. What do both of these fields of science have in common during experimentation?
A. They both use scientific methods.
B. They both are able to define theories based on one experiment.
C. They both draw unchangeable conclusions based on reliable data.
D. They both repeat experiments to increase certainty in their results.
On the first day of school, Edwin’s teacher presented the class with a challenge. She told the class to come up with a viable scientific experiment to test a paper airplane design. Each group in the class had to come up with one variable to test in their experiment. Edwin’s group decided to test how wingspan might affect the distance traveled by the plane. They created a table, as shown below, to record their data.

<table>
<thead>
<tr>
<th>Wingspan length</th>
<th>Distance flown</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 centimeters</td>
<td>?</td>
</tr>
<tr>
<td>15 centimeters</td>
<td>?</td>
</tr>
<tr>
<td>20 centimeters</td>
<td>?</td>
</tr>
</tbody>
</table>

**Part A** What other information should be included in their table to ensure they test only one variable?

**Part B** Why do these variables need to be constant?
A cleft chin is a dominant trait in humans. Two parents who each have a cleft chin carry the dominant trait. If a father has the heterozygous genotype (Cc) and the mother has the homozygous genotype (CC), what are the chances that the children of these two parents will NOT have a cleft chin?

F. zero percent  
G. 25 percent  
H. 50 percent  
I. 100 percent

A lumber company cut down or destroyed most of the plant life in a land area that supported a population of about 700 deer. The area was then split into a neighborhood development and a wildlife sanctuary. Over time, the wildlife sanctuary increased in native vegetation. Other vegetation was returned to the neighborhood after homes were built and people created lawns and gardens. The change in deer population during this time is shown in the graph below.

Deer Population Change

Explain the changes in deer population over time.