This document contains the answer keys, rubrics, and Scoring Notes for items on the Science Grade 8 Practice Test. Additional Practice Test resources are available in the LDOE Practice Test Library.

<table>
<thead>
<tr>
<th>Session</th>
<th>Set</th>
<th>Sequence</th>
<th>Item Type</th>
<th>Key</th>
<th>Point Value</th>
<th>Alignment</th>
</tr>
</thead>
</table>
| 1       | Opal              | 1        | TEI       | See Rubric   | 1           | PE: 8-MS-ESS3-1  
DCI: MS.ESS3A.a  
CCC: Cause and Effect |
| 1       |                   | 2        | TEI       | See Rubric   | 1           | PE: 8-MS-ESS3-3  
DCI: MS.ESS3C.a  
CCC: Cause and Effect |
| 1       |                   | 3        | TPD: MS/MC| A, C/C       | 2           | PE: 8-MS-ESS3-1  
SEP: 6. Constructing explanations (for science)  
and designing solutions (for engineering)  
DCI: MS.ESS3A.a  
CCC: Cause and Effect |
| 1       |                   | 4        | CR        | See Rubric   | 2           | PE: 8-MS-ESS3-3  
SEP: 6. Constructing explanations (for science)  
and designing solutions (for engineering)  
DCI: MS.ESS3C.a  
CCC: Cause and Effect |
| 1       |                   | 5        | MC        | C            | 1           | PE: 8-MS-LS3-1  
DCI: MS.LS4C.a  
CCC: Cause and Effect |
| 1       | Glowing Jellyfish | 6        | TEI       | See Rubric   | 2           | PE: 8-MS-LS3-1  
SEP: 2. Developing and using models  
DCI: MS.LS3A.a  
CCC: Cause and Effect |
| 1       |                   | 7        | MC        | A            | 1           | PE: 8-MS-LS4-6  
DCI: MS.LS4C.a  
CCC: Cause and Effect |
| 1       |                   | 8        | CR        | See Rubric   | 2           | PE: 8-MS-LS4-6  
SEP: 5. Using mathematics and computational thinking  
DCI: MS.LS4C.a  
CCC: Structure and Function |
| 1       | Solar Cooker      | 9        | MS        | B, D         | 1           | PE: 8-MS-PS3-3  
DCI: MS.PS3B.c  
CCC: Energy and Matter |
| 1       |                   | 10       | MC        | D            | 1           | PE: 8-MS-PS3-3  
SEP: 6. Constructing explanations (for science)  
and designing solutions (for engineering)  
DCI: ETS.MS.1B.a  
CCC: Energy and Matter |
| 1       |                   | 11       | TEI       | See Rubric   | 2           | PE: 8-MS-PS3-5  
SEP: 7. Engaging in argument from evidence  
DCI: MS.PS3B.a  
CCC: Energy and Matter |
<table>
<thead>
<tr>
<th>Session</th>
<th>Set</th>
<th>Sequence</th>
<th>Item Type</th>
<th>Key</th>
<th>Point Value</th>
<th>Alignment</th>
</tr>
</thead>
</table>
| 1       | Solar Cooker | 12 | CR | See Rubric | 2 | PE: 8-MS-PS3-3  
SEP: 6. Constructing explanations (for science) and designing solutions (for engineering)  
DCI: MS.ETS1A.a  
CCC: Energy and Matter |
| 1       | Standalone Items | 13 | MS | A, E | 1 | PE: 8-MS-ESS2-3  
SEP: 4. Analyzing and interpreting data  
DCI: MS.ESS2B.a |
| 1       | Tsunamis and the Louisiana Coast | 14 | TPD: MS/ MC | A, D/ B | 2 | PE: 8-MS-ESS1-4  
SEP: 6. Constructing explanations (for science) and designing solutions (for engineering)  
DCI: MS.ESS1C.a  
CCC: Scale, Proportion and Quantity |
| 2       | Standalone Items | 16 | MS | B, C, E | 1 | PE: 8-MS-ESS3-2  
SEP: 4. Analyzing and interpreting data  
DCI: MS.ESS3B.a |
| 2       | Tsunamis and the Louisiana Coast | 17 | TPD: MC/ MS | D/ B, D | 2 | PE: 8-MS-ESS3-2  
DCI: MS.ESS3B.a  
CCC: Patterns |
| 2       | Tsunamis and the Louisiana Coast | 18 | MC | B | 1 | PE: 8-MS-ESS2-1  
DCI: MS.ESS2A.a  
CCC: Stability and Change |
| 2       | Tsunamis and the Louisiana Coast | 19 | TPD: MC/ MS | C/ B, C, E | 2 | PE: 8-MS-ESS2-1  
SEP: 2. Developing and using models  
DCI: MS.ESS2A.a |
| 2       | Standalone Items | 20 | ER | See Rubric | 9 | PE: 8-MS-ESS3-2  
SEP: 4. Analyzing and interpreting data  
DCI: MS.ESS3B.a  
CCC: Patterns |
| 2       | Nitinol | 21 | MC | B | 1 | PE: 8-MS-LS1-4  
SEP: 6. Constructing explanations (for science) and designing solutions (for engineering)  
DCI: MS.LS1B.c  
CCC: Cause and Effect |
| 2       | Nitinol | 22 | TPD: MC/ TEI | See Rubric | 2 | PE: 8-MS-PS1-6  
SEP: 6. Constructing explanations (for science) and designing solutions (for engineering)  
DCI: MS.PS1B.c |
| 2       | Nitinol | 23 | TPD: TEI/ MC | See Rubric | 2 | PE: 8-MS-LS4-3  
DCI: MS.LS4A.c  
CCC: Patterns |
| 3       | Nitinol | 24 | MC | D | 1 | PE: 8-MS-PS1-3  
DCI: MS.PS1A.b  
CCC: Structure and Function |
<table>
<thead>
<tr>
<th>Session</th>
<th>Set</th>
<th>Sequence</th>
<th>Item Type</th>
<th>Key</th>
<th>Point Value</th>
<th>Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Nitinol</td>
<td>25</td>
<td>TEI</td>
<td>See Rubric</td>
<td>2</td>
<td>PE: 8-MS-PS1-1&lt;br&gt;SEP: 2. Developing and using models&lt;br&gt;DCI: MS.PS1A.e&lt;br&gt;CCC: Scale, Proportion and Quantity</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>26</td>
<td>MS</td>
<td>B, E</td>
<td>1</td>
<td>PE: 8-MS-PS1-3&lt;br&gt;DCI: MS.PS1A.b&lt;br&gt;CCC: Structure and Function</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>27</td>
<td>CR</td>
<td>See Rubric</td>
<td>2</td>
<td>PE: 8-MS-PS1-1&lt;br&gt;SEP: 2. Developing and using models&lt;br&gt;DCI: MS.PS1A.e&lt;br&gt;CCC: Scale, Proportion and Quantity</td>
</tr>
<tr>
<td>3</td>
<td>Surviving in Desert Landscapes</td>
<td>28</td>
<td>MC</td>
<td>D</td>
<td>1</td>
<td>PE: 8-MS-LS1-5&lt;br&gt;DCI: MS.LS1B.e&lt;br&gt;CCC: Cause and Effect</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>29</td>
<td>MC</td>
<td>B</td>
<td>1</td>
<td>PE: 8-MS-LS1-4&lt;br&gt;DCI: MS.LS1B.d&lt;br&gt;CCC: Cause and Effect</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>30</td>
<td>TEI</td>
<td>See Rubric</td>
<td>2</td>
<td>PE: 8-MS-LS1-5&lt;br&gt;DCI: MS.LS1B.e&lt;br&gt;CCC: Cause and Effect</td>
</tr>
<tr>
<td>3</td>
<td>Standalone Items</td>
<td>31</td>
<td>TPD: TEI/MS</td>
<td>See Rubric</td>
<td>2</td>
<td>PE: 8-MS-LS1-5&lt;br&gt;SEP: 6. Constructing explanations (for science) and designing solutions (for engineering)&lt;br&gt;DCI: MS.LS1B.e&lt;br&gt;CCC: Cause and Effect</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>32</td>
<td>MC</td>
<td>D</td>
<td>1</td>
<td>PE: 8-MS-LS4-1&lt;br&gt;SEP: 4. Analyzing and interpreting data&lt;br&gt;DCI: MS.LS4A.a&lt;br&gt;CCC: Patterns</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>33</td>
<td>MC</td>
<td>D</td>
<td>1</td>
<td>PE: 8-MS-ESS1-4&lt;br&gt;SEP: 6. Constructing explanations (for science) and designing solutions (for engineering)&lt;br&gt;DCI: MS.ESS1C.c&lt;br&gt;CCC: Scale, Proportion and Quantity</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>34</td>
<td>TEI</td>
<td>See Rubric</td>
<td>1</td>
<td>PE: 8-MS-PS1-6&lt;br&gt;DCI: MS.PS1B.c&lt;br&gt;CCC: Energy and Matter</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>35</td>
<td>TPI: TEI/TEI</td>
<td>See Rubric</td>
<td>2</td>
<td>PE: 8-MS-ESS2-3&lt;br&gt;SEP: 4. Analyzing and interpreting data&lt;br&gt;DCI: MS.ESS1C.c&lt;br&gt;CCC: Patterns</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>36</td>
<td>MS</td>
<td>B, D, E</td>
<td>1</td>
<td>PE: 8-MS-ESS2-2&lt;br&gt;DCI: MS.ESS2A.b&lt;br&gt;CCC: Scale, Proportion and Quantity</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>37</td>
<td>MS</td>
<td>C, D, F</td>
<td>1</td>
<td>PE: 8-MS-ESS3-2&lt;br&gt;SEP: 4. Analyzing and interpreting data&lt;br&gt;DCI: MS.ESS3B.a&lt;br&gt;CCC: Patterns</td>
</tr>
<tr>
<td>Session</td>
<td>Set</td>
<td>Sequence</td>
<td>Item Type</td>
<td>Key</td>
<td>Point Value</td>
<td>Alignment</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>----------</td>
<td>-----------</td>
<td>-----------</td>
<td>-------------</td>
<td>-----------</td>
</tr>
</tbody>
</table>
| 3       |         | 38       | TEI       | See Rubric| 1           | PE: 8-MS-PS3-3  
SEP: 6. Constructing explanations (for science)  
and designing solutions (for engineering)  
DCI: MS.PS3B.c |
| 3       | Standalone Items | 39       | TPD: MC/ MC  | C/C       | 2           | PE: 8-MS-LS4-1  
SEP: 4. Analyzing and interpreting data  
DCI: MS.LS4A.a  
CCC: Patterns |
| 3       |         | 40       | TEI       | See Rubric| 1           | PE: 8-MS-ESS3-1  
SEP: 6. Constructing explanations (for science)  
and designing solutions (for engineering)  
DCI: MS.ESS3A.a  
CCC: Cause and Effect |
| 3       |         | 41       | MS        | A, E, F   | 1           | PE: 8-MS-LS1-5  
SEP: 6. Constructing explanations (for science)  
and designing solutions (for engineering)  
DCI: MS.LS1B.e  
CCC: Cause and Effect |
Item Types and Scoring:

- Multiple-choice (MC) questions with four answer options and only one correct answer. All MC items are worth one point each.

  Multiple-select (MS) questions with five to seven answer options and more than one correct answer. For MS items, the question identifies the number of correct answers, unless it is part of a Two-part Dependent (TPD). In a TPD, the question in Part B will then be worded to “select all that apply.” All MS items are worth one point each.

- Technology Enhanced Items (TEI): uses technology to capture student comprehension in authentic ways. TE items are worth up to two points and may include item types such as, but not limited to, drag and drop, dropdown menus, and hot spots.

- Two-part Items: require students to answer two related questions, worth a total of two points. Two-part items may combine MC, MS, and/or TE item types.
  - Two-part Dependent (TPD): the first part must be correct in order to earn credit for the second part. TPDs are scored as follows:
    - If both parts are correct, score is 2.
    - If Part A is correct and Part B is incorrect or partially correct, score is 1.
    - If Part A is incorrect, score is 0 regardless of Part B.
  - Two-part Independent (TPI): each part is scored independently, with each part worth one point.

- Constructed Response (CR): requires a brief response provided by the student and will be scored using a 2-point rubric. These items may require a brief paragraph, a few sentences, and/or completion of a chart.

- Extended Response (ER): asks students to write an in-depth response that expresses the students’ ability to apply all three dimensions of the LSS for Science and will be scored using a 9-point rubric.
Session 1 Item 1 (TEI)

The locations of mineral and gem formation depend on different Earth processes. Some gems need heat, extreme pressure, or even a certain type of rock layer to form.

Which location in the figure shows where opal is most likely to form?

Select the correct location.
Session 1 Item 1 (TEI) - Rubric

Note: On Accommodated form, this TEI item has been adapted to a multiple choice item, with answer choice D as the correct answer.
Session 1 Item 2 (TEI)

Certain steps in the mineral extraction process can often have a lasting impact on Earth.

Drag the correct labels into the table to show a primary environmental impact and a secondary environmental impact of a step in the opal extraction process.

Not all labels will be used.

| Risk of flooding in the area decreases. | Local vegetation is damaged or removed. | Concentration of minerals in the ground is small. |
| Animals move to new locations in search of food sources. |  |  |

<table>
<thead>
<tr>
<th>Step in Mining Process</th>
<th>Primary Environmental Impact</th>
<th>Secondary Environmental Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land is cleared for mining and drilling of minerals.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Session 1 Item 2 (TEI) - Rubric

Risk of flooding in the area decreases.  
Concentration of minerals in the ground is small.

<table>
<thead>
<tr>
<th>Step in Mining Process</th>
<th>Primary Environmental Impact</th>
<th>Secondary Environmental Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land is cleared for mining and drilling of minerals.</td>
<td>Local vegetation is damaged or removed.</td>
<td>Animals move to new locations in search of food sources.</td>
</tr>
</tbody>
</table>
Session 1 Item 4 (CR)

Identify two potential improvements to the opal extraction process and explain how these improvements could minimize harm to the environment.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Student’s response correctly identifies two potential improvements to the opal extraction process and explains how both improvements could minimize harm to the environment.</td>
</tr>
<tr>
<td>1</td>
<td>Student’s response correctly identifies one potential improvement to the opal extraction process and explains how this improvement could minimize harm to the environment, but does not identify or explain a second improvement.</td>
</tr>
<tr>
<td>0</td>
<td>Student’s response does not correctly identify or explain an improvement to the opal extraction process. OR Student’s response is blank, irrelevant, or too brief to evaluate.</td>
</tr>
</tbody>
</table>

**SCORE POINTS**

**Scoring Notes:**

- Identifies one improvement to the opal extraction process and explains how the improvement minimizes harm to the environment (1 point)
- Identifies a second improvement to the opal extraction process and explains how the second improvement minimizes harm to the environment (1 point)

**Examples include:**

- Miners could use hand tools instead of heavy machinery to reduce the emission of greenhouse gases and limit the clearing of land for mining, which would help maintain the local ecosystem for plants and animals.
- Once mining in an area is complete, trees and plants can be planted and added back to the area to help with removing CO₂ from the atmosphere. Compacted soil and land can also be dug back up and loosened to improve water flow and drainage.

Accept other reasonable answers.
Session 1 Item 6 (TEI)

A large population of comb jellies was found living in an area with a large food source. After a long period of overfishing, the food source in the area significantly decreased. Scientists want to build a model to describe how the change in the availability of food may affect different types of comb jellies in the population.

Drag the statements into the correct order to complete the outline for the scientists' model.

Each statement will be used once.

1. The slow-glow genes will get passed on to future generations of comb jellies.
2. Some comb jellies in the population carry genes for producing a slow glow of light.
3. Comb jellies that slow glow will attract more prey than comb jellies that do not slow glow.
4. Slow-glowing comb jellies will be more likely to survive and reproduce.
**Session 1 Item 6 (TEI) - Rubric**

<table>
<thead>
<tr>
<th>Some comb jellies in the population carry genes for producing a slow glow of light.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combs jellies that slow glow will attract more prey than comb jellies that do not slow glow.</td>
</tr>
<tr>
<td>Slow-glowing comb jellies will be more likely to survive and reproduce.</td>
</tr>
<tr>
<td>The slow-glow genes will get passed on to future generations of comb jellies.</td>
</tr>
</tbody>
</table>

**Scoring Notes:**

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 4 correct responses; therefore 1 point will be awarded if the student selects 2 or more correct responses.
Session 1 Item 8 (CR)

The slow-glow gene for bioluminescence is inherited as a dominant trait. One of two rabbits that is born with the bioluminescence gene is a male. This male rabbit is mated with a female rabbit that does not have the bioluminescence gene. The offspring resulting from this mating experiment are shown in the pedigree chart.

Unlike some jellyfish and comb jellies, which are often helped by their ability to glow, rabbits with bioluminescence genes can be more easily spotted by predators.
Session 1 Item 8 (CR), continued

Use the pedigree chart to describe how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild. Explain how natural selection would affect this probability.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Student’s response correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild and correctly explains how natural selection would affect this probability.</td>
</tr>
<tr>
<td>1</td>
<td>Student’s response correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild OR correctly explains how natural selection would affect this probability.</td>
</tr>
<tr>
<td>0</td>
<td>Student’s response does not correctly describe how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild or correctly explain how natural selection would affect this probability. OR Student’s response is blank, irrelevant, or too brief to evaluate.</td>
</tr>
</tbody>
</table>

SCORE POINTS

Scoring Notes:

- Description of how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild (1 point)
- Explanation of how natural selection would affect the probability of rabbit offspring inheriting bioluminescence (1 point)

Examples include:

- The probability of rabbit offspring inheriting bioluminescence would decrease over time because the slow-glow gene would increase the likelihood that glowing rabbits are preyed on by predators. This means there would be fewer surviving parents who can pass on the slow-glow trait to offspring.

Accept other reasonable answers.
Session 1 Item 11 (TEI)

Drag the different parts of the solar cooker design into the correct order from least to greatest based on the average kinetic energy of the particles in each part.

Each part will be used once.

[Diagram showing different parts of the solar cooker design and their Kinetic Energy levels]
Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 4 correct responses; therefore 1 point will be awarded if the student selects 2 or more correct responses.
Session 1 Item 12 (CR)

The students have decided to test how removing the reflective lid will affect the efficiency of the solar cooker. Explain how this change will impact the transfer of thermal energy in the solar cooker design and describe one possible design improvement the students can make to compensate for this change.

### Scoring Information

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Student’s response correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design and describes a possible design improvement to the solar cooker to compensate for the change.</td>
</tr>
<tr>
<td>1</td>
<td>Student’s response correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design OR describes a possible design improvement to the solar cooker to compensate for the change.</td>
</tr>
<tr>
<td>0</td>
<td>Student’s response does not correctly explain how removing the lid will affect the transfer of thermal energy or describe a possible design improvement to the solar cooker. OR Student’s response is blank, irrelevant, or too brief to evaluate.</td>
</tr>
</tbody>
</table>

**SCORE POINTS**

**Scoring Notes:**

- Explanation of how removing the lid will reduce the transfer of thermal energy into the solar cooker (1 point)
- Description of a possible design improvement to the solar cooker (1 point)

**Examples include:**

- Removing the lid will decrease the amount of sunlight getting into the solar cooker, which means less heat will be emitted by the black-colored interior. Students can tilt the solar cooker device at an angle toward the Sun so that more sunlight can directly enter through the glass.
- Taking the lid off will reduce the efficiency of the solar cooker because less light is trapped by the interior of the cooker. Students can replace the glass cover with another material that better transmits sunlight at greater angles.

Accept other reasonable answers.
Session 2 Item 20 (ER)

In the past, tsunami predictions depended on readings from individual seismometers and coastal tide gauges. The seismometer data only described the force of the earthquake, but not the resulting tsunami waves. Coastal tide gauges provided data on changes in wave height at different locations. These gauges were often placed near shorelines and were more easily affected by changes in water depth, wave movement, and shape of the harbor.

As you respond to Part A and Part B, follow the directions below.

- Address all of the instructions in each prompt.
- Use evidence from the information provided and your own knowledge of science to support your responses.

Part A
Use evidence from Graph 1 to describe the effectiveness of the forecast models used to predict tsunamis, and explain two ways in which the forecast models were less accurate in modeling the actual tsunami data.

Part B
Identify three advantages to using the newer DART system and sensors in Figure 2 compared to the seismometers and coastal tide gauges previously used to measure tsunami-related events. Explain how each of these advantages can improve predictions in accuracy and timing for future tsunami-related events.

Score Points
- The student’s score is the sum total of all the points earned across all parts (up to an item-maximum of 9 points) of the item.
- The student’s score is 0 if the response is blank, incorrect, or does not address the prompt.

PART A (0–3 points maximum)
- 1 point for describing effectiveness of forecast models
- 1 point each for explaining how the models were less accurate in modeling the data (for a total of TWO explanations)

PART B (0–6 points maximum)
- 1 point each for identifying an advantage to using the new DART system and sensors (for a total of THREE advantages)
- 1 point each for explaining how each identified advantage improves accuracy or timing (for a total of THREE explanations)
Session 2 Item 20 (ER), continued

Score Information

Part A: Student describes how the forecast models were very effective in modeling the tsunami data because the models and data lines are very similar (1 point) and explains two ways in which the models were less accurate (1 point each).

- The forecast models were very effective in modeling the tsunami data because the model and data lines are very similar.
- The models were less accurate for the amplitudes as the tsunami wave approached the shoreline and during the hours closer to when the tsunami waves were generated (less than 5 hours).

Part B: Student identifies three advantages to using the DART system and sensors (1 point each) and explains how each advantage can improve the accuracy and timing of tsunami predictions (1 point each).

- DART sensors are placed nearer to the underwater events causing tsunamis, compared to surface-level gauges placed around the shorelines. This can help reduce the time needed between a tsunami-related even and an alert.
- DART uses underwater pressure sensors in place of surface-level gauges. This can reduce the time between an underwater event and initial data collection.
- DART transmits data using acoustics and satellites instead of gauges or meters. This can increase notification speed.
- DART collects more data at a faster rate. These data can be made available to forecasting models more quickly.

NOTE: Accept any other plausible explanation.
Session 2 Item 22 (TPD) - Rubric

Use the information and your knowledge of science to answer the questions.

A class of students is designing a carrier to help keep foods warmer during long-distance trips. The students plan to use a chemical reaction to help keep the carrier and the food warm. The students have collected temperature data over time using four different chemical reactions, as shown in the table.

<table>
<thead>
<tr>
<th>Temperature Measurement</th>
<th>Reaction 1</th>
<th>Reaction 2</th>
<th>Reaction 3</th>
<th>Reaction 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>start of reaction</td>
<td>23°C</td>
<td>23°C</td>
<td>23°C</td>
<td>23°C</td>
</tr>
<tr>
<td>2 minutes</td>
<td>26°C</td>
<td>90°C</td>
<td>20°C</td>
<td>8°C</td>
</tr>
<tr>
<td>10 minutes</td>
<td>36°C</td>
<td>84°C</td>
<td>18°C</td>
<td>17°C</td>
</tr>
<tr>
<td>60 minutes</td>
<td>68°C</td>
<td>62°C</td>
<td>14°C</td>
<td>19°C</td>
</tr>
<tr>
<td>180 minutes</td>
<td>75°C</td>
<td>29°C</td>
<td>11°C</td>
<td>22°C</td>
</tr>
</tbody>
</table>

Part A

Based on the temperature data in the table, which chemical reaction should the students use for their food carrier design?

- Reaction 1
- Reaction 2
- Reaction 3
- Reaction 4

Part B

Select the correct answer from the drop-down menus to complete the paragraph and explain the answer to Part A.

The chemical reaction that is best suited for the food carrier will release energy as the reaction occurs over time. This chemical reaction should also have the highest temperature over time.
Session 2 Item 23 (TPD)

Part A

Drag the images of embryological development into the correct boxes to complete the diagram of a developing organism.

Not all images will be used.

---

Part B

Based on the embryological development of four different species of organisms, which organism **most likely** shares the closest evolutionary relationship to the organism in Part A?
Part B

Based on the embryological development of four different species of organisms, which organism most likely shares the closest evolutionary relationship to the organism in Part A?
Session 3 Item 25 (TEI) - Rubric

Using Figure 1, select the correct answers from the drop-down menus to complete the paragraph.

All forms of nitinol have ▼ the same ▼ types of atoms, but the different forms of nitinol have different properties because the ▼ positions of atoms ▼ change. The atoms in the martensite molecules can ▼ move more easily ▼ than the atoms in the austenite molecules.

Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.
Session 3 Item 27 (CR)

Using Table 1 and Figure 1, describe two differences in the atomic structure of nitinol and the atomic structure of either nickel or titanium that result in different physical properties of the elements used to make nitinol.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Student’s response correctly describes two differences in the atomic structure of nitinol and the atomic structure of either nickel or titanium that result in different physical properties of the elements used to make nitinol.</td>
</tr>
<tr>
<td>1</td>
<td>Student’s response correctly describes one difference in the atomic structure of nitinol and the atomic structure of either nickel or titanium that results in different physical properties of the elements used to make nitinol, but does not correctly describe a second difference.</td>
</tr>
<tr>
<td>0</td>
<td>Student’s response does not correctly describe a difference in the atomic structure between nitinol and either nickel or titanium that results in different physical properties. OR Student’s response is blank, irrelevant, or too brief to evaluate.</td>
</tr>
</tbody>
</table>

SCORE POINTS

Scoring Notes:

- First description of a difference in the atomic structure of nitinol and the atomic structure of either nickel or titanium that result in different physical properties of the elements used to make nitinol (1 point)
- Second description of a difference in the atomic structure of nitinol and the atomic structure of either nickel or titanium that results in different physical properties of the elements used to make nitinol (1 point)
Session 3 Item 27 (CR), continued

Examples include:

- The atomic structure of nickel or titanium would have fewer types of atoms, which would make it more difficult to adjust the physical properties of the nickel or titanium metals.
- Nickel has a higher density than nitinol, so the atomic structure of nickel should have more atoms in the same space than the atomic structure of nitinol does.
- Titanium is harder than nitinol, so titanium atoms should not be able to move as much as nitinol atoms do.

Accept other reasonable answers.
Session 3 Item 30 (TEI) - Rubric

Select the correct answers from each drop-down menu to complete the description of desert plant adaptations.

Desert plants become dormant or stop growing temporarily during the dry season. These plants begin their growth cycles again during the wet season. By absorbing and storing carbon dioxide at night, many desert plants can minimize evaporation during growth periods.

Scoring Notes:

This item is worth 2 points. Partial credit (1 point) will be awarded if half or more of the student responses are correct. For this item, the key contains 3 correct responses; therefore 1 point will be awarded if the student selects 2 correct responses.
Session 3 Item 31 (TPD)

Part A

Select the correct region in each graph to show the most likely root length for each plant.

![Diagram showing Cactus and Oak Tree graphs with regions 1, 2, and 3 labeled.]

Part B

Which information can best be used as evidence to support the answer to Part A?

Select all that apply.

- Desert areas have less precipitation than non-desert areas.  
- Both desert and non-desert plants absorb light from the Sun.  
- Plants in both desert and non-desert areas can grow leaves.  
- Lower temperatures in non-desert areas reduce the rate of evaporation.  
- Desert areas are most often found at low latitudes.
Session 3 Item 31 (TPD) - Rubric

Part A

Which information can be used as evidence to support the answer to Part A?

Select all that apply.

- Desert areas have less precipitation than non-desert areas.
- Both desert and non-desert plants absorb light from the Sun.
- Plants in both desert and non-desert areas can grow leaves.
- Lower temperatures in non-desert areas reduce the rate of evaporation.
- Desert areas are most often found at low latitudes.
Session 3 Item 34 (TEI)

Use the information and your knowledge of science to answer the question.

Engines help vehicles move by burning different types of fuels. Gasoline is a common fuel that is made of molecules containing hydrogen and carbon atoms. A spark plug is used to burn a mixture of fuel and air in the engine. This process causes the fuel-air mixture to expand and move a piston up and down, eventually resulting in the motion of different parts of the car.

Drag the descriptions into the correct boxes to complete the diagram showing the flow of energy in an engine.

Not all descriptions will be used.
Session 3 Item 34 (TEI) – Rubric

Thermal energy is transformed into chemical energy.

Chemical energy is released and then transformed into thermal energy.

Spark plug ignites fuel-air mixture

Fuel added to engine

Exhaust gases exit engine

Chemical energy is absorbed and then transformed into thermal energy.

Thermal energy is transformed into mechanical energy.

Energy used for motion of car parts

OK
Session 3 Item 35 (TPI)

Use the information and your knowledge of science to answer the questions.

Part A

The map shows how tectonic plate movement can affect the age of the ocean floor over time.

Drag the arrows into the correct boxes to complete the map to show the most likely directions of plate movement.

Not all arrows will be used.
**Session 3 Item 35 (TPI), continued**

**Part B**

Which location on the map is a ridge *most likely* to be found at?

Select the correct location.
Session 3 Item 35 (TPI) – Rubric

Part A

[Image of a map with arrows and color key indicating million years ago.]
Session 3 Item 35 (TPI) – Rubric, continued

Part B

Note: On Accommodate form, the TEI in Part B has been adapted to a multiple choice item with answer choice C being the correct answer.
Session 3 Item 38 (TEI)

Use the information and your knowledge of science to answer the question.

Select the sentence from the information that best supports which insulation material should be used to minimize the loss of thermal energy from a home.

**Open-Cell Spray Foam**
The cheapest spray foam option is known as open-cell, so-called because the bubbles inside of the foam never completely close. As the foam expands, air gets trapped in between the broken bubbles. These bubbles allow water to pass through them, which can be good or bad depending on the application. Although open-cell spray foam works well for filling in and around wires, pipes, and other obstacles, its insulating power is not very high.

Source: “What is the Best Insulation?” by Corey Binford.

**Closed-Cell Spray Foam**
The bubbles or cells in closed-cell spray foam are closed and tightly packed together. This makes closed-cell spray foam much denser and stronger than open-cell spray foam. It will not absorb water or allow air to pass through it. This is because the bubbles in closed-cell foam are filled with a gas, making them much smaller and a better insulator.

Source: “What is the Best Insulation?” by Corey Binford.

**Vegetable Spray Foams**
A new, greener generation of vegetable-based spray foams uses small amounts of oils from soy, sugarcane, corn fructose, and other botanical sources, plus a minimum of 5 percent recycled content. Vegetable-based foams are blown with water, carbon dioxide, or hydrofluorocarbons (HFCs), which do not damage the ozone layer. The more environmentally sound versions are low density, meaning they also have a lower insulating power than the denser, more toxic varieties.

Source: “The Best Insulation Types for Your Home” from Mother Earth Living by Susan Lahey.
Open-Cell Spray Foam
The cheapest spray foam option is known as open-cell, so-called because the bubbles inside of the foam never completely close. As the foam expands, air gets trapped in between the broken bubbles. These bubbles allow water to pass through them, which can be good or bad depending on the application. Although open-cell spray foam works well for filling in and around wires, pipes, and other obstacles, its insulating power is not very high.

Source: “What is the Best Insulation?” by Corey Binford.

Closed-Cell Spray Foam
The bubbles or cells in closed-cell spray foam are closed and tightly packed together. This makes closed-cell spray foam much denser and stronger than open-cell spray foam. It will not absorb water or allow air to pass through it. This is because the bubbles in closed-cell foam are filled with a gas, making them much smaller and a better insulator.

Source: “What is the Best Insulation?” by Corey Binford.

Vegetable Spray Foams
A new, greener generation of vegetable-based spray foams uses small amounts of oils from soy, sugarcane, corn fructose, and other botanical sources, plus a minimum of 5 percent recycled content. Vegetable-based foams are blown with water, carbon dioxide, or hydrofluorocarbons (HFCs), which do not damage the ozone layer. The more environmentally sound versions are low density, meaning they also have a lower insulating power than the denser, more toxic varieties.

Source: “The Best Insulation Types for Your Home” from Mother Earth Living by Susan Lahey.
Session 3 Item 40 (TEI)

Use the information and your knowledge of science to answer the question.

Thousands of minerals can be found on Earth’s surface. Some minerals are very common and can be found at locations all around the world. Other minerals are extremely rare and can only be found in one or two locations on Earth.

Select the mineral that is most likely to be found in many locations around the world, and select the text that best supports the mineral selection.

Mineral A forms where vanadium and copper exist together at fumaroles, or openings, on the sides of volcanic mountains. As gases pass through the openings, the mineral forms along the surface of the fumaroles and then washes away when it rains.

Mineral B forms under high temperature and pressure around 100 miles below Earth’s surface. After forming, it is then brought to the surface through violent volcanic eruptions and is one of the hardest minerals on the Mohs hardness scale.

Mineral C is found where silica and oxygen naturally occur and is formed when the silica and oxygen combine. The mineral does not require a specific temperature or pressure to form and is resistant to weathering.
Session 3 Item 40 (TEI) - Rubric

Mineral A forms where vanadium and copper exist together at fumaroles, or openings, on the sides of volcanic mountains. As gases pass through the openings, the mineral forms along the surface of the fumaroles and then washes away when it rains.

Mineral B forms under high temperature and pressure around 100 miles below Earth's surface. After forming, it is then brought to the surface through violent volcanic eruptions and is one of the hardest minerals on the Mohs hardness scale.

Mineral C is found where silica and oxygen naturally occur and is formed when the silica and oxygen combine. The mineral does not require a specific temperature or pressure to form and is resistant to weathering.