Science Grade 8 Practice Test
Answer Key

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.

UPDATES INCLUDED - AUGUST 2021

- **Student Responses with Annotations -**
  Session 1 Item 4 (CR)
  Session 1 Item 8 (CR)
  Session 1 Item 12 (CR)

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
1	Opal	1	TEI	See Rubric	1	PE: 8-MS-ESS3-1 DCI: MS.ESS3A.a CCC: Cause and Effect
1	Opal	2	TEI	See Rubric	1	PE: 8-MS-ESS3-3 DCI: MS.ESS3C.a CCC: Cause and Effect
1	Opal	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	Opal	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	Glowing Jellyfish	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	Glowing Jellyfish	7	MC	A	1	PE: 8-MS-LS4-6 DCI: MS.LS4C.a CCC: Cause and Effect
1	Glowing Jellyfish	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	Solar Cooker	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

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
1	Solar Cooker	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
1		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		14	TPD: MS/ MC	A, D/ B	2	PE: 8-MS-LS4-2 DCI: MS.LS4A.b CCC: Patterns
1		15	TPD: MC/ MC	B/C	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	Tsunamis and the Louisiana Coast	16	MS	B, C, E	1	PE: 8-MS-ESS3-2 SEP: 4. Analyzing and interpreting data DCI: MS.ESS3B.a
2		17	TPD: MC/ MS	D/ B, D	2	PE: 8-MS-ESS3-2 DCI: MS.ESS3B.a CCC: Patterns
2		18	MC	B	1	PE: 8-MS-ESS2-1 DCI: MS.ESS2A.a CCC: Stability and Change
2		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		20	ER	See Rubric	9	PE: 8-MS-ESS3-2 SEP: 4. Analyzing and interpreting data DCI: MS.ESS3B.a CCC: Patterns
2	Standalone Items	21	MC	B	1	PE: 8-MS-LS1-4 SEP: 7. Engaging in argument from evidence DCI: MS.LS1B.c CCC: Cause and Effect
2		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		23	TPD: TEI/ MC	See Rubric	2	PE: 8-MS-LS4-3 DCI: MS.LS4A.c CCC: Patterns

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
3	Nitinol	24	MC	D	1	PE: 8-MS-PS1-3 DCI: MS.PS1A.b CCC: Structure and Function
3		25	TEI	See Rubric	2	PE: 8-MS-PS1-1 SEP: 2. Developing and using models DCI: MS.PS1A.e CCC: Scale, Proportion and Quantity
3		26	MS	B, E	1	PE: 8-MS-PS1-3 DCI: MS.PS1A.b CCC: Structure and Function
3		27	CR	See Rubric	2	PE: 8-MS-PS1-1 SEP: 2. Developing and using models DCI: MS.PS1A.e CCC: Scale, Proportion and Quantity
3	Surviving in Desert Landscapes	28	MC	D	1	PE: 8-MS-LS1-5 DCI: MS.LS1B.e CCC: Cause and Effect
3		29	MC	B	1	PE: 8-MS-LS1-4 DCI: MS.LS1B.d CCC: Cause and Effect
3		30	TEI	See Rubric	2	PE: 8-MS-LS1-5 DCI: MS.LS1B.e CCC: Cause and Effect
3		31	TPD: TEI/ MS	See Rubric	2	PE: 8-MS-LS1-5 SEP: 6. Constructing explanations (for science) and designing solutions (for engineering) DCI: MS.LS1B.e CCC: Cause and Effect
3	Standalone Items	32	MC	D	1	PE: 8-MS-LS4-1 SEP: 4. Analyzing and interpreting data DCI: MS.LS4A.a CCC: Patterns
3		33	MC	D	1	PE: 8-MS-ESS1-4 SEP: 6. Constructing explanations (for science) and designing solutions (for engineering) DCI: MS.ESS1C.c CCC: Scale, Proportion and Quantity
3		34	TEI	See Rubric	1	PE: 8-MS-PS1-6 DCI: MS.PS1B.c CCC: Energy and Matter
3		35	TPI: TEI/ TEI	See Rubric	2	PE: 8-MS-ESS2-3 SEP: 4. Analyzing and interpreting data DCI: MS.ESS1C.c CCC: Patterns
3		36	MS	B, D, E	1	PE: 8-MS-ESS2-2 DCI: MS.ESS2A.b CCC: Scale, Proportion and Quantity

Session	Set	Sequence	Item Type	Key	Point Value	Alignment
3	Standalone Items	37	MS	C, D, F	1	PE: 8-MS-ESS3-2 SEP: 4. Analyzing and interpreting data DCI: MS.ESS3B.a CCC: Patterns
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		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.

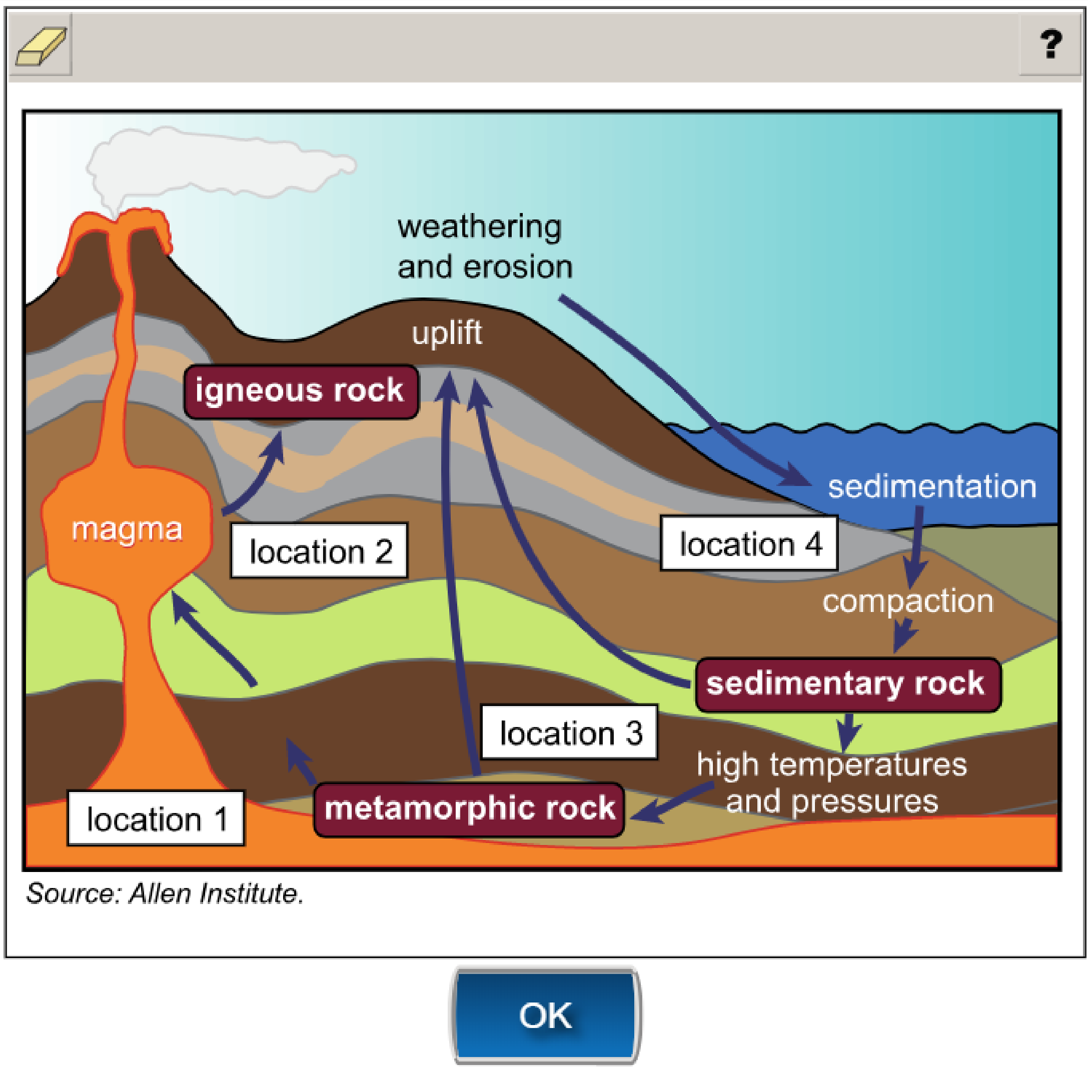
- Extended Response (ER): asks students to write an in-depth response that expresses the students' ability to apply all three dimensions of the LSS for Science and will be scored using a 9-point rubric.

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.

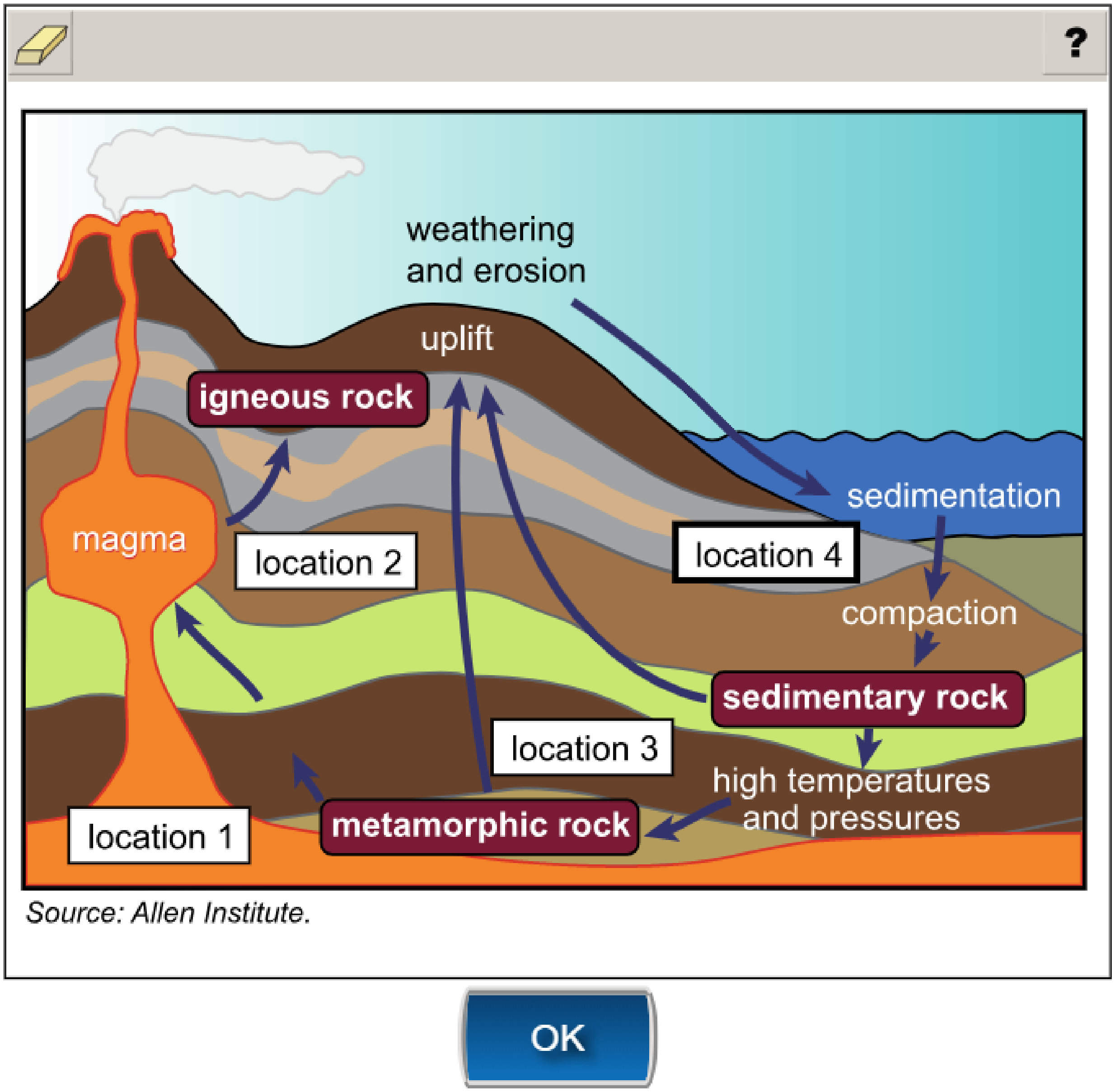
Which location in the figure shows where opal is **most likely** to form?

Select the correct location.



Source: Allen Institute.

Session 1 Item 1 (TEI) - Rubric



Source: Allen Institute.

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.

Step in Mining Process	Primary Environmental Impact	Secondary Environmental Impact
Land is cleared for mining and drilling of minerals.		

OK

Session 1 Item 2 (TEI) - Rubric

?

Risk of flooding in the area decreases.

Concentration of minerals in the ground is small.

Step in Mining Process	Primary Environmental Impact	Secondary Environmental Impact
Land is cleared for mining and drilling of minerals.	Local vegetation is damaged or removed.	Animals move to new locations in search of food sources.

OK

Session 1 Item 4 (CR)

Identify **one** improvement that could be made to the opal extraction process and explain how the improvement could minimize harm to the environment.

Scoring Information	
Score	**Description**
2	Student's response correctly identifies one improvement that could be made to the opal extraction process and correctly explains how the improvement could minimize harm to the environment.
1	Student's response correctly identifies one improvement that could be made to the opal extraction process, but does **not** correctly explain how the improvement could minimize harm to the environment.
0	Student's response does **not** correctly identify one improvement that could be made to the opal extraction process or how the improvement could minimize harm to the environment. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

SCORE POINTS

Scoring Notes:

- Identifies one improvement that could be made to the opal extraction process (1 point)
- Explains how the improvement could minimize harm to the environment (1 point)

Examples include:

- Replace trucks that use fossil fuels with trucks that use electric or hybrid motors.
- Using electric or hybrid trucks will reduce the amount of carbon dioxide and other gases released into the air by the machines operating at the opal mine.
- Rock that does not contain opal can be returned to the hole after the opal has been removed and plants that were dug up when the hole was made could be planted. This would begin to repair damage to the landscape.

Accept other reasonable answers.

Student Responses for Session 1 Item 4 (CR)

Identify **one** improvement that could be made to the opal extraction process and explain how the improvement could minimize harm to the environment.

Response 1

Using machines that doesn't need any type of fossil fuel to function is a clean alternative that wouldn't harm the environment. This means that the usage of certain machines can make polluntants that affects the atmosphere and other factors of earth needed for life.

Score: 2

This response earns a 2. It correctly identifies one potential improvement to the opal extraction process and explains how the improvement could minimize harm to the environment. One potential improvement to the opal extraction process identified is "using machinery that doesn't require fossil fuels." The explanation to how this improvement could minimize harm to the environment is "Using machines that doesn't need any type of fossil fuel to function is a clean alternative that wouldn't harm the environment."

Response 2

After a mine shuts down the people running the mine can replant trees and other things in the enviroment destroyed, so that animals and other organisms around wont have to leave.

Score: 2

This response earns a 2. It correctly identifies one potential improvement to the opal extraction process and explains how the improvement could minimize harm to the environment. The potential improvement to the opal extraction process identified is "replant trees and other things in the enviroment destroyed." The explanation to how this improvement could minimize harm to the environment is "so that animals and other organisms around wont have to leave."

Response 3

One improvement is to replace and take care of the soil once the mine has shut down.

Score: 1
This response earns a 1. It correctly identifies one potential improvement to the opal extraction process but does not explain how the improvement could minimize harm to the environment. One potential improvement to the opal extraction process identified is "to replace and take care of the soil once the mine has shut down." There is no explanation to how this improvement could minimize harm to the environment.

Response 4

One improvement to the opal extraction process is move to a more sandy location. This is because so the volcanoes that sometimes erupt forms opal, it wouldn't affect the environment. Another improvement that would extract more opals without impacting the environment is to get a volcano near water. This is because the water will cool the volcano, so minerals can form.

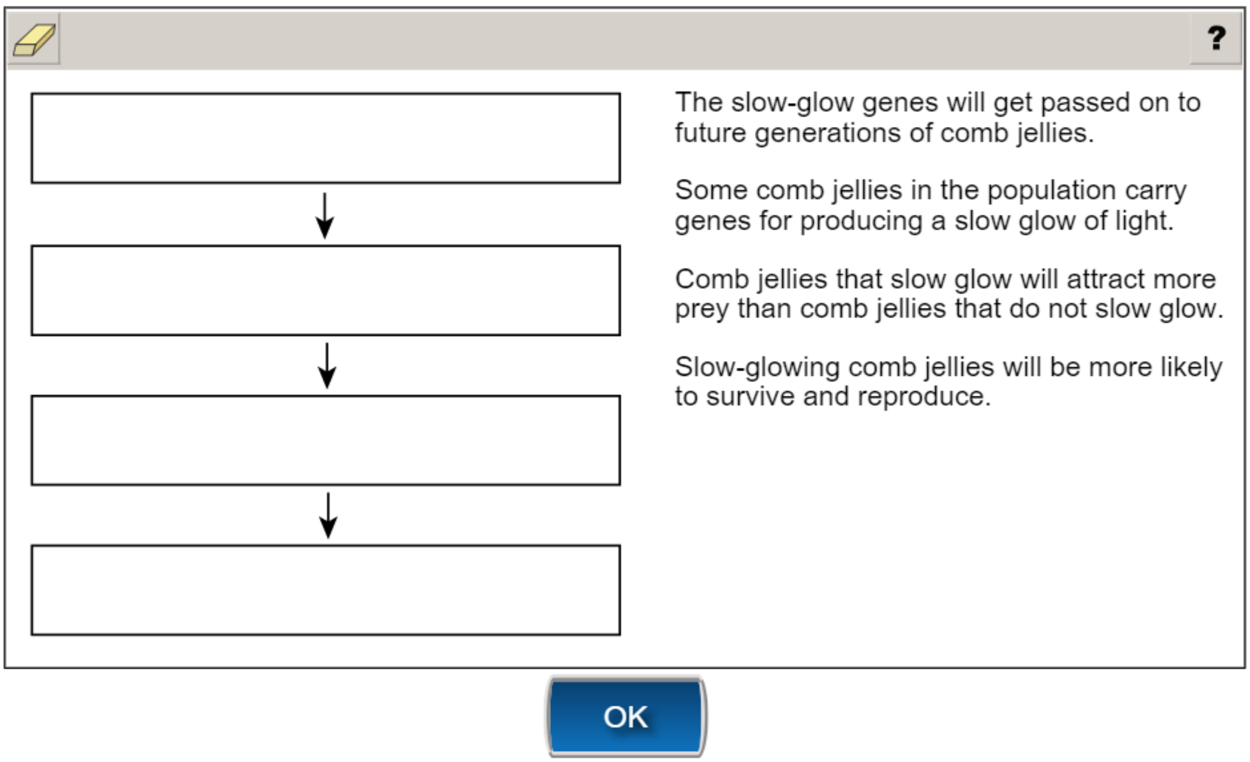
Score: 0
This response earns a 0. It incorrectly identifies one potential improvement to the opal extraction process. One potential improvement to the opal extraction process identified is "move to a more sandy location." The response does not correctly provide an improvement to the actual extraction process, and therefore, does not receive credit for explaining how this improvement could minimize harm to the environment.

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.



Session 1 Item 6 (TEI) - Rubric

Some comb jellies in the population carry genes for producing a slow glow of light.

↓

Comb jellies that slow glow will attract more prey than comb jellies that do not slow glow.

↓

Slow-glowing comb jellies will be more likely to survive and reproduce.

↓

The slow-glow genes will get passed on to future generations of comb jellies.

OK

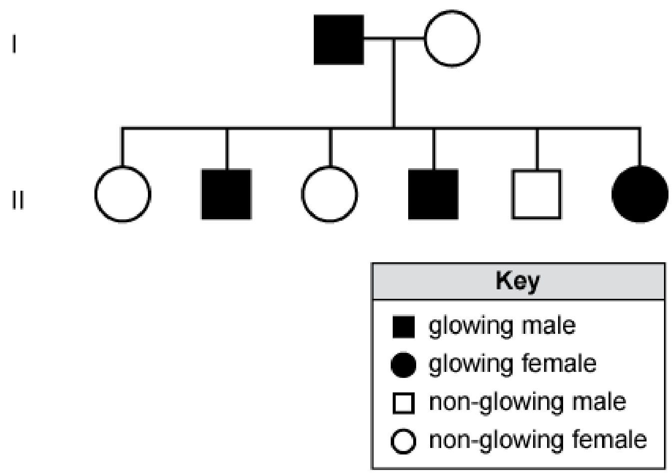
Scoring Notes:

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.

Rabbit 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.

Scoring Information	
Score	**Description**
2	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.
1	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.
0	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.

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.

Student Responses for Session 1 Item 8 (CR)

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.

Response 1

The probability of rabbit offspring inheriting bioluminescence would decrease. This is because rabbits with this trait would not survive to reproduce more glowing rabbits. Natural selection helps with this because glowing rabbits are more likely to be seen by predators than non-glowing rabbits. Therefore, natural selection comes in and glowing rabbits die while non-glowing rabbits survive.

Score: 2

This response earns a 2. It correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild, "The probability of rabbit offspring inheriting bioluminescence would decrease." The response also accurately explains how natural selection would affect this probability, "This is because rabbits with this trait would not survive to reproduce more glowing rabbits. Natural selection helps with this because glowing rabbits are more likely to be seen by predators than non-glowing rabbits."

Response 2

The rabbit with bioluminescence would change after several generations in the wild because, the rabbits are easier to spot. With them being easier to spot the preditors can find them easier and eat them. If that keeps happening the population of the rabbits will decrease.

Score: 2

This response earns a 2. It correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild, "the population of the rabbits will decrease." The response also accurately explains how natural selection would affect this probability, "the rabbits are easier to spot. With them being easier to spot the preditors can find them easier and eat them."

Response 3

The probability of rabbit offspring inheriting bioluminescence would decrease because the slow glow gene would increase.

Score: 1

This response earns a 1. It correctly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild, "The probability of rabbit offspring inheriting bioluminescence would decrease." The response does not explain how natural selection would affect this probability.

Response 4

Rabbit offspring inheriting bioluminescence would change after serval generations in the wild because rabbits would become an easy target for other animals that prey on them, because of their emit light.

Score: 1

This response earns a 1. The response states that the probability of “Rabbit offspring inheriting bioluminescence would change after serval generations in the wild” but does not describe how it will change (e.g., decrease). The response accurately explains how natural selection would affect this probability, “rabbits would become an easy target for other animals that prey on them.”

Response 5

The way the probability of rabbit offspring inheriting bioluminescence would change after sevreal generations in the wild is that it would increase. Natural selection would affect this probability because some of them would probably not be picked or selected.

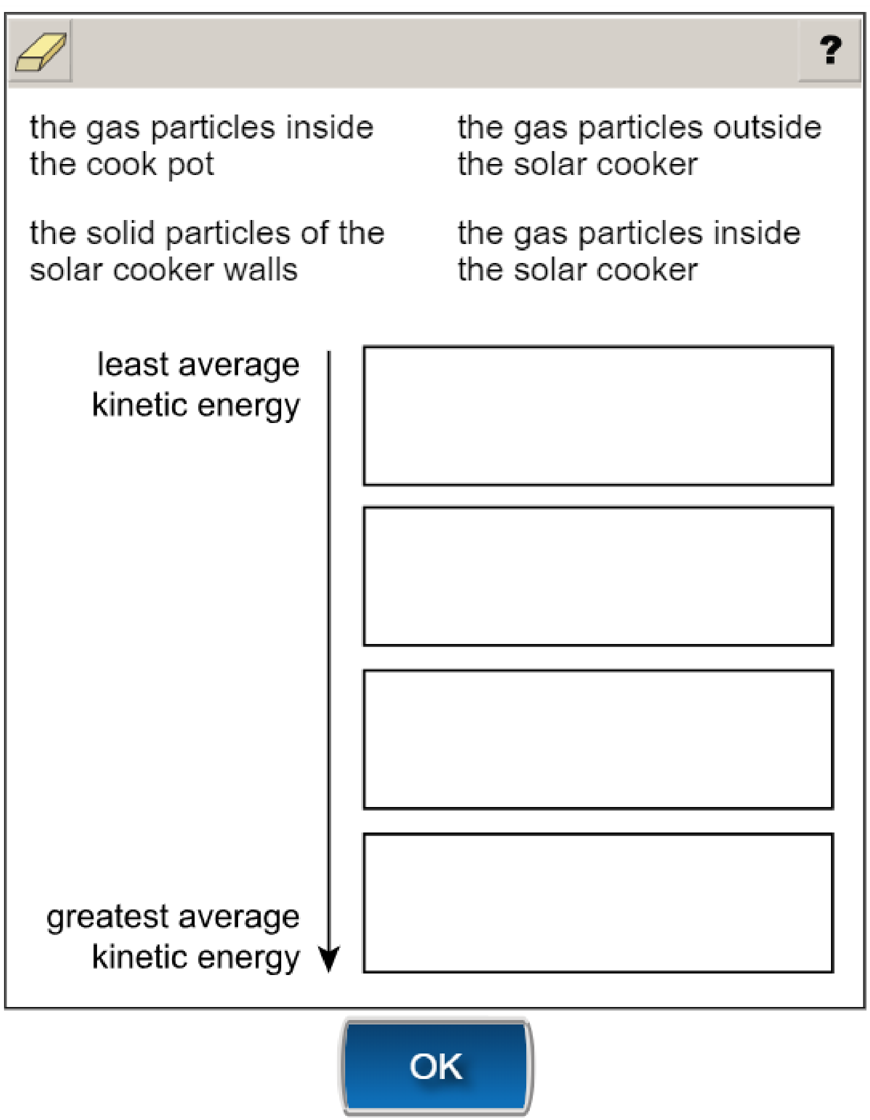
Score: 0

This response earns a 0. It incorrectly describes how the probability of rabbit offspring inheriting bioluminescence would change after several generations in the wild, “it would increase.” The response inaccurately explains how natural selection would affect this probability, “some of them would probably not be picked or selected.” Bioluminescent rabbits would be preyed upon more than non-bioluminescent rabbits.

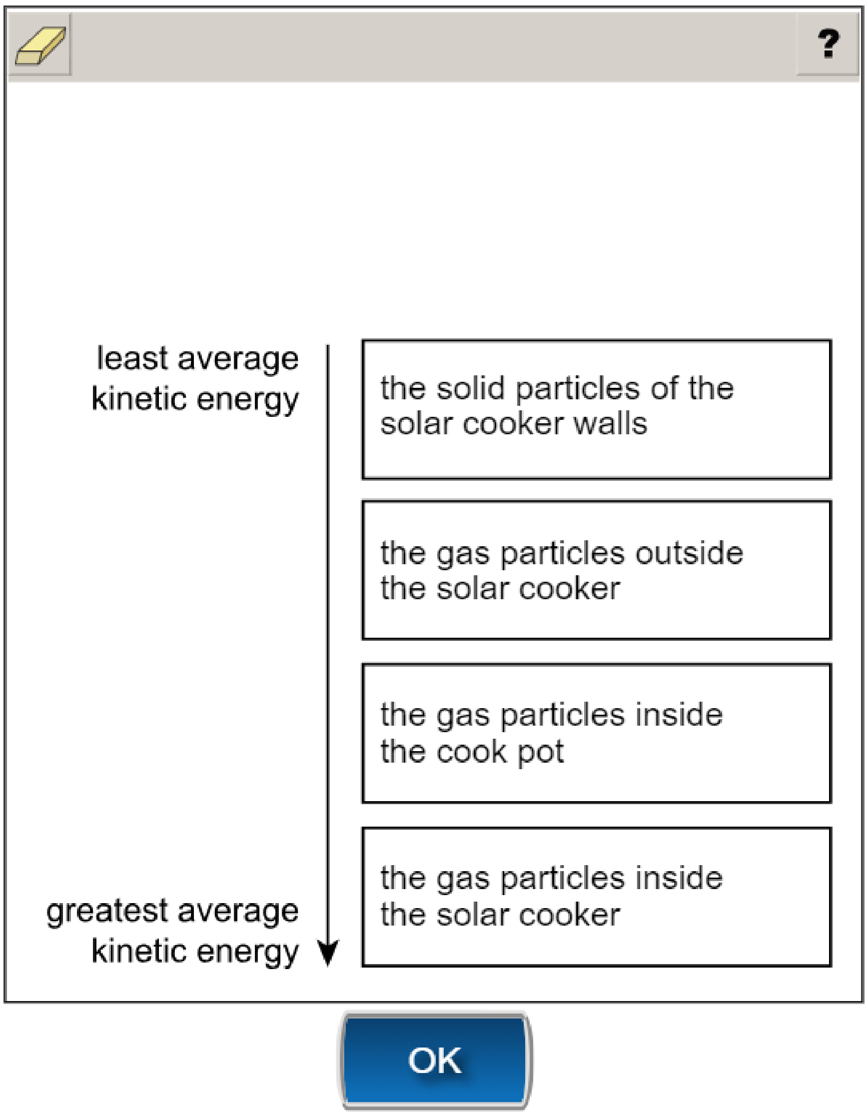
Session 1 Item 11 (TEI)

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.



Session 1 Item 11 (TEI) - Rubric



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	
Score	**Description**
2	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 compensate for the change.
1	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 compensate for the change.
0	Student's response does **not** correctly explain how removing the lid will affect the transfer of thermal energy **or** describe a possible design improvement. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

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 (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 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.

Response 1

If the students remove the reflective lid it will cause the suns rays to not direlitcly hit the box, causing less thermal energy in the box, causing it to take longer to coomk the food. A desingn improvement would be to move the box with the sun so that it could stay getting direct sunlight.

Score: 2
This response earns a 2. It correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design, "it will cause the suns rays to not direlitcly hit the box, causing less thermal energy in the box, causing it to take longer to coomk the food." The response also accurately describes a possible design improvement to compensate for the change, "A desingn improvement would be to move the box with the sun so that it could stay getting direct sunlight."

Response 2

Yes by removing the reflective lid will affect the efficiency of the solar cokker because the reflective lids reflective the sun in the direction you wants the sun to go so less sun will go in the cooker without the lid. One thing that I would change is make the make the glasscover black becasuse blacks absorbs heat. So it can make the cooking process faster.

Score: 2
This response earns a 2. It correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design, "the reflective lids reflective the sun in the direction you wants the sun to go so less sun will go in the cooker without the lid." The response also accurately describes a possible design improvement to compensate for the change, "make the glasscover black becasuse blacks absorbs heat. So it can make the cooking process faster."

Response 3

This will change the impact of the transfer of thermal energy in the solar cooker design because without the reflective lid no sun will come in so the water want get to were it will boil so the food want cook.

Score: 1

This response earns a 1. It correctly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design, “without the reflective lid no sun will come in so the water want get to were it will boil so the food want cook.” The response does not describe a possible design improvement to compensate for the change.

Response 4

Removing the reflective lid will affect the efficiency of the solar cooker, by removing the reflective lid this allows sun to past right through the cook pot and it causes the food to heat quicker. One possible design improvement the students can make is by making the glass cover black because this will allow the sun to past right through it and heat up.

Score: 1

This response earns a 1. It incorrectly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design, “by removing the reflective lid this allows sun to past right through the cook pot and it causes the food to heat quicker.” Removing the reflective lid would cause the food to heat more slowly. The response accurately describes a possible design improvement to compensate for the change, “making the glass cover black because this will allow the sun to past right through it and heat up.”

Response 5

Removing the lid from the cooker would affect it because the energy would be transfering into the pot and this would cause the cooker to become more hot then what it is. The design the students could improve that they could get rid of the sides to get extra energy in the pot and this would rise the temperature.

Score: 0

This response earns a 0. It incorrectly explains how removing the reflective lid will impact the transfer of thermal energy in the solar cooker design, “the energy would be transfering into the pot and this would cause the cooker to become more hot then what it is.” Removing the lid would cause the cooker to become less hot than what it is. The response also inaccurately describes a possible design improvement to compensate for the change, “they could get rid of the sides to get extra energy in the pot and this would rise the temperature.” Removing the sides would decrease the thermal energy in the solar cooker.

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 20 (ER)

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.

Response 1

The effectiveness of the forecast models used to predict tsunamis is very accurate. If you look at the graph the prediction model is almost as same as the actual data itself. The two ways that the predictions made by the model is incorrect is because from 4 hours to 5 hours the prediction made was that the amplitude of the tsunami would stay at 0. The correct data is that the amplitude changed during the hours by an increase and decrease. The other way why is the predictions are incorrect is that in the end of graph one the predictions made arent as similar anymore.

Score: 3
This response earns a 3. It accurately describes the effectiveness of the forecast models, “If you look at the graph the prediction model is almost as same as the actual data itself.” The response also correctly gives two explanations of how the models were less accurate in modeling the data. Explanation 1 states, “because from 4 hours to 5 hours the prediction made was that the amplitude of the tsunami would stay at 0. The correct data is that the amplitude changed during the hours by an increase and decrease.” Explanation 2 states, “The other way why is the predictions are incorrect is that in the end of graph one the predictions made arent as similar anymore.”

Response 2

The effectiveness in the forecast is Almost even going close neck to neck The tide-gauge or as you can see on the map the blue one started of with a lot of movement and not a straight line like the second one that is the prediction model and that started off as a straight line. This earthquake was not the best it cause a lot of damage.

Score: 2
This response earns a 2. It accurately describes the effectiveness of the forecast models, “The effectiveness in the forecast is Almost even going close neck to neck.” The response also correctly gives one of two explanations of how the models were less accurate in modeling the data, “The tide-gauge or as you can see on the map the blue one started of with a lot of movement and not a straight line like the second one that is the prediction model and that started off as a straight line.”

Response 3

Two ways in which the forecast models were less accurate in modeling in actual tsunami data that tide-gauge data closely matches up with the prediction model so it is close to what they were predicting. The second way is that the prediction is really close so they are getting closer every time they do this and this helps find the best way to avoid a tsunami.

Score: 1
This response earns a 1. It accurately describes the effectiveness of the forecast models, "tide-gauge data closely matches up with the prediction model so it is close to what they were predicting." The response incorrectly gives one of two explanations of how the models were less accurate in modeling the data, "the prediction is really close so they are getting closer every time they do this and this helps find the best way to avoid a tsunami."

Response 4

The two ways that the forecast models were less accurate in modeling the actual tsunami data are how the lines are looking in the icture and how there are two different lines to represent the red and the blue lines that start from 0.0 to 8.0.

Score: 0
This response earns a 0. It does not describe the effectiveness of the forecast models. The response also incorrectly gives two explanations of how the models were less accurate in modeling the data, "how the lines are looking in the icture" and "how there are two different lines to represent the red and the blue lines that start from 0.0 to 8.0."

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.

Response 1

One advantage of using the DART system is that the pressure sensors can detect any underwater movement. This can improve predictions by instead of waiting for a big part of the tsunami to hit they would get it from the beginning it starts. Another advantage would be is how they can transmit the data from the buoy to the satellites in outer space. This can improve predictions by getting the information to the people quicker. The third advantage would be the broadcast alert to the people. This would improve predictions because once they get the information they will immediately alert all the people and the predictions they get. These are the three advantages to using the DART system.

Score: 6

This response earns a 6. It fully and accurately identifies three advantages to using the DART system and sensors (3 points). The response also correctly explains how each advantage can improve the accuracy and timing of tsunami predictions (3 points). The first advantage identified is, “the pressure sensors can detect any underwater movement.” The explanation provided states, “instead of waiting for a big part of the tsunami to hit they would get it from the beginning it starts.” The second advantage identified is, “how they can transmit the data from the buoy to the satellites in outer space.” The explanation provided states, “This can improve predictions by getting the information to the people quicker.” The third advantage identified is, “the broadcast alert to the people.” The explanation provided states, “once they get the information they will immediately alert all the people and the predictions they get.”

Response 2

One advantage to using the newer DART system and sensors is that the there's a sensor underwater at the bottom of the surface to predict a tsunami. The second advantage is the sensors sends a signal to the acoustic transmission, and that sends it to the data processed at surface buoy.The third advantage is the broadcast alert to population.The sensor at the bottom of the surface to predict tsunamis can improve predictions of tsunamis because it can pick up activity and sends the message through the technology in the water. The sensor that sends a signal to the acoustic transmission, and then send it to the data processe at surface buoy can improve predictions about tsunamis because the signal that tsunami is about to happen is sending the alert quicker so the people can know about it. The broadcast alert to population can improve predictions about tsunamis because it can send a signal to population in that area where the tsunami is going to or not go to.

Score: 5

This response earns a 5. It fully and accurately identifies three advantages to using the DART system and sensors (3 points). The response also correctly explains how two advantages can improve the accuracy and timing of tsunami predictions (2 points). The first advantage identified is, "there's a sensor underwater at the bottom of the surface to predict a tsunami." The first explanation does not correctly state that the underwater sensors reduce the timing between an underwater event and data collection, "it can pick up activity and sends the message through the technology in the water." The second advantage identified is, "the sensors sends a signal to the acoustic transmission, and that sends it to the data processed at surface buoy." The explanation provided states, "the signal that tsunami is about to happen is sending the alert quicker so the people can know about it." The third advantage identified is, "the broadcast alert to population." The explanation provided states, "it can send a signal to population in that area where the tsunami is going to or not go to."

Response 3

Three advantages of the newer DART system is that there is a broadcast alert section of this system, the second advantage is that data can be generates within minutes and lastly the DART system isn't always accurate compared to actual data but it's close enough so that someone gets the gist. These are all advantages because the broadcast section can inform people of how dangerous the tsunami can be so that those people can retreat to safety, the second is an advantage because the information can be generated in minutes which gives people more time to prepare for the tsunami rather than waiting until the last minute and the last reasoning as to why this part of the DART system is an advantage because this system isn't always accurate but close enough to understand how severe the tsunami is or isn't.

Score: 4

This response earns a 4. It fully and accurately identifies two advantages to using the DART system and sensors (2 points). The response also correctly explains how two advantages can improve the accuracy and timing of tsunami predictions (2 points). The first advantage identified is, "there is a broadcast alert section of this system." The explanation provided states, "the broadcast section can inform people of how dangerous the tsunami can be so that those people can retreat to safety." The second advantage identified is, "data can be generates within minutes." The explanation provided states, "the information can be generated in minutes which gives people more time to prepare for the tsunami rather than waiting until the last minute." The third advantage inaccurately identifies the DART system as being less accurate than the tide-gauge system, "the DART system isn't always accurate compared to actual data but it's close enough so that someone gets the gist." The explanation provided incorrectly states, "this system isn't always accurate but close enough to understand how severe the tsunami is or isn't."

Response 4

It helps sends broadcast alerts when there are tsunamis, it sends data to the satellite, and detects them underwater. Each of the adv advantages can improve predictions because data from these events is used to make predictions about tsunamis and provide warnings in coastal areas.

Score: 3

This response earns a 3. It accurately identifies three advantages to using the DART system and sensors (3 points). The response does not explain how each advantage can improve the accuracy and timing of tsunami predictions (0 points). The first advantage identified is, "It helps sends broadcast alerts when there are tsunamis" The second advantage identified is, "it sends data to the satellite." The third advantage identified is, "detects them underwater."

Response 5

Three advantages to using the newer DART system and sensors compared to the seismometers and costal tide gauges previously used to measure tsunami-related events are having the panels on the seafloor, having the waves to measure the tsunami, and the transmission sending data to the satellites.

Score: 2

This response earns a 2. It accurately identifies two advantages to using the DART system and sensors (2 points). The response does not explain how each advantage can improve the accuracy and timing of tsunami predictions (0 points). The first advantage identified is, “having the panels on the seafloor.” The second advantage is inaccurately identified as, “having the waves to measure the tsunami.” The DART system does not measure waves. The third advantage identified is, “the transmission sending data to the satellites.”

Response 6

the three advantages to using the newer DART system and senors in figure 2 compared to the seismometers and coastal tide gauges previously used to measure tsunami related events are one the DART can detected underwater event by pressure sensors which is helpful because the ground shakes when a tsunami are about to come.

Score: 1

This response earns a 2. It accurately identifies one advantage to using the DART system and sensors (1 point). The response does not correctly explain how the advantage can improve the accuracy and timing of tsunami predictions (0 points). The first advantage identified is, “the DART can detected underwater event by pressure sensors.” The explanation does not correctly state that the underwater sensors reduce the timing between an underwater event and data collection, “the ground shakes when a tsunami are about to come.”

Response 7

The newer Dart system gives reports on the wave lengths being created this is extremely helpful because scientists can watch this and know when the next tsunami or earthquake is about to happen.

Score: 0

This response earns a 0. It does not accurately identify an advantage to using the DART system and sensors (0 points). The response cannot receive credit for explaining how this advantage can improve the accuracy and timing of tsunami predictions (0 points). The advantage identified is, “The newer Dart system gives reports on the wave lengths being created.” Both the DART system and tide-gauge system give reports, therefore this is not an advantage.

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.

Temperature Measurement	Reaction 1	Reaction 2	Reaction 3	Reaction 4
start of reaction	23°C	23°C	23°C	23°C
2 minutes	26°C	90°C	20°C	8°C
10 minutes	36°C	84°C	18°C	17°C
60 minutes	68°C	62°C	14°C	19°C
180 minutes	75°C	29°C	11°C	22°C

Part A

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

(a) Reaction 1
(c) Reaction 3
(b) Reaction 2
(d) Reaction 4

Part B

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

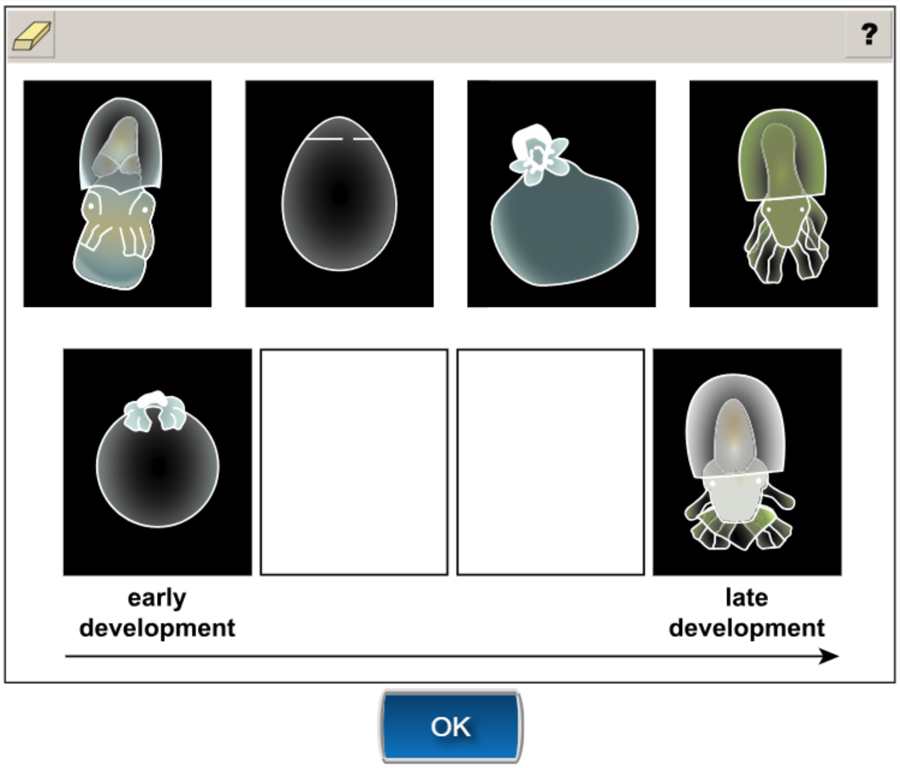
The chemical reaction that is best suited for the food carrier will [release ▾] energy as the reaction occurs over time. This chemical reaction should also have the [highest ▾] temperature over time.

Session 2 Item 23 (TPD)

Part A

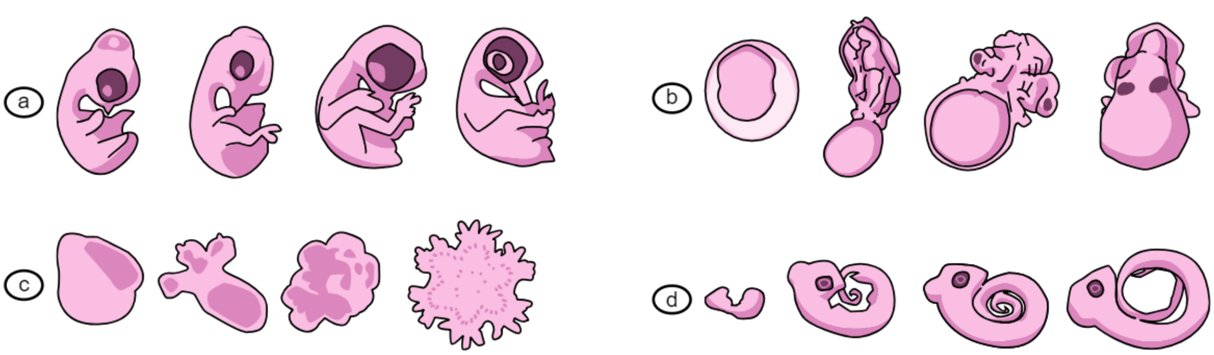
Drag the images of embryological development into the correct boxes to complete the diagram of a developing organism.

Not all images will be used.

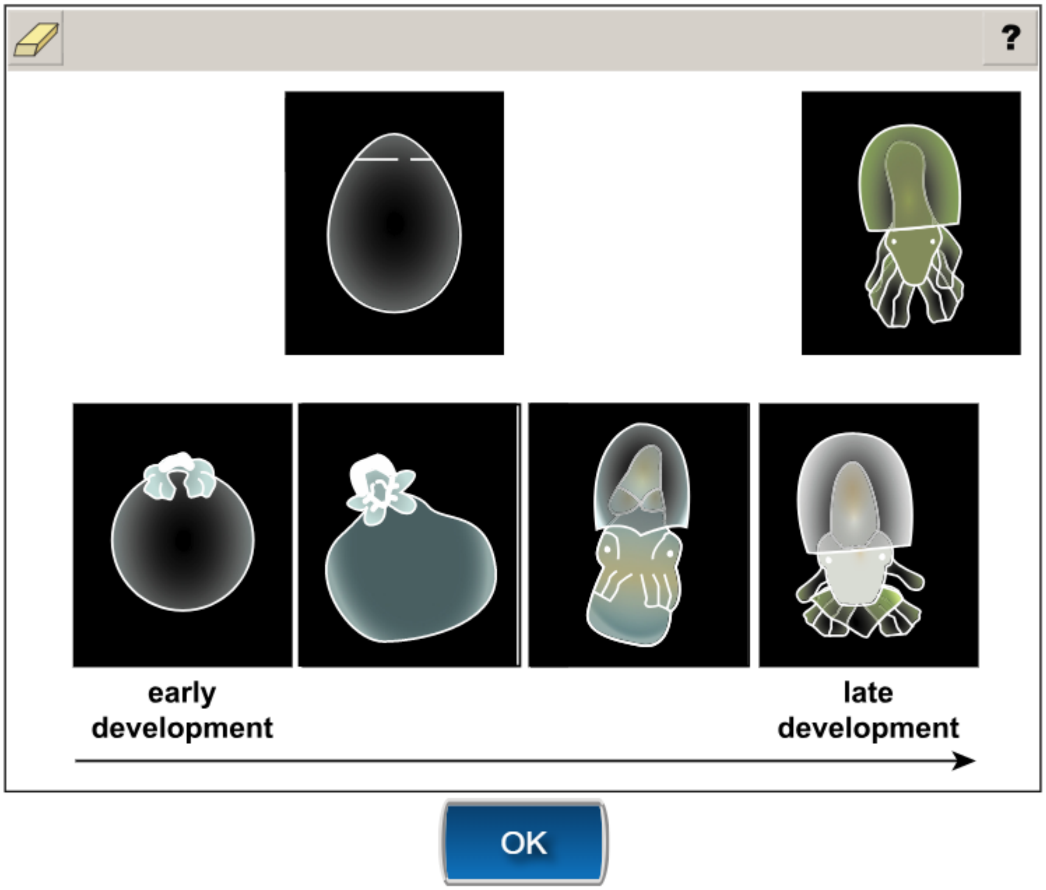


Part B

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?

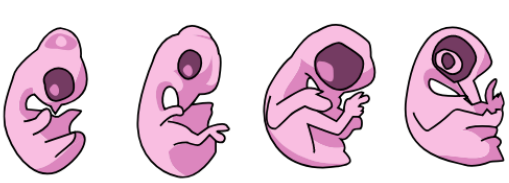


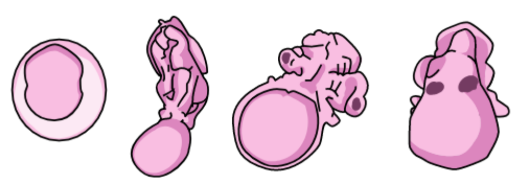
Session 2 Item 23 (TPD) - Rubric



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?

a 

b 

c 

d 

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, explain how the particle arrangements of titanium and nitinol are different when the densities of each substance are different. Explain how the particle arrangement of titanium is different than the particle arrangement of nitinol when the compositions of each substance are different.

Scoring Information	
Score	**Description**
2	Student's response correctly explains how the particle arrangements of titanium and nitinol are different when the densities of each substance are different and correctly explains how the particle arrangement of titanium is different than the particle arrangement of nitinol when the compositions of each substance are different.
1	Student's response correctly explains how the particle arrangements of titanium and nitinol are different when the densities of each substance are different, but does **not** correctly explain how the particle arrangement of titanium is different than the particle arrangement of nitinol when the compositions of each substance are different. **OR** Student's response correctly explains how the particle arrangement of titanium is different than the particle arrangement of nitinol when the compositions of each substance are different, but does **not** correctly explain how the particle arrangements of titanium and nitinol are different when the densities of each substance are different.
0	Student's response does **not** correctly explain how the particle arrangements of titanium and nitinol are different when the densities of each substance are different **or** correctly explain how the particle arrangement of titanium is different than the particle arrangement of nitinol when the compositions of each substance are different. **OR** Student's response is blank, irrelevant, or too brief to evaluate.

Session 3 Item 27 (CR), continued

SCORE POINTS

Scoring Notes:

- Explanation of how the particle arrangements are different when the densities are different (1 point)
- Explanation of how the particle arrangements are different when the compositions are different (1 point)

Examples include:

- The atoms (particles) in nitinol are closer together than the atoms (particles) in titanium.
- The atoms (particles) in nitinol are arranged in an alternating pattern between the titanium atoms (particles) and the nickel atoms (particles), but the titanium is only made up of titanium atoms.

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.

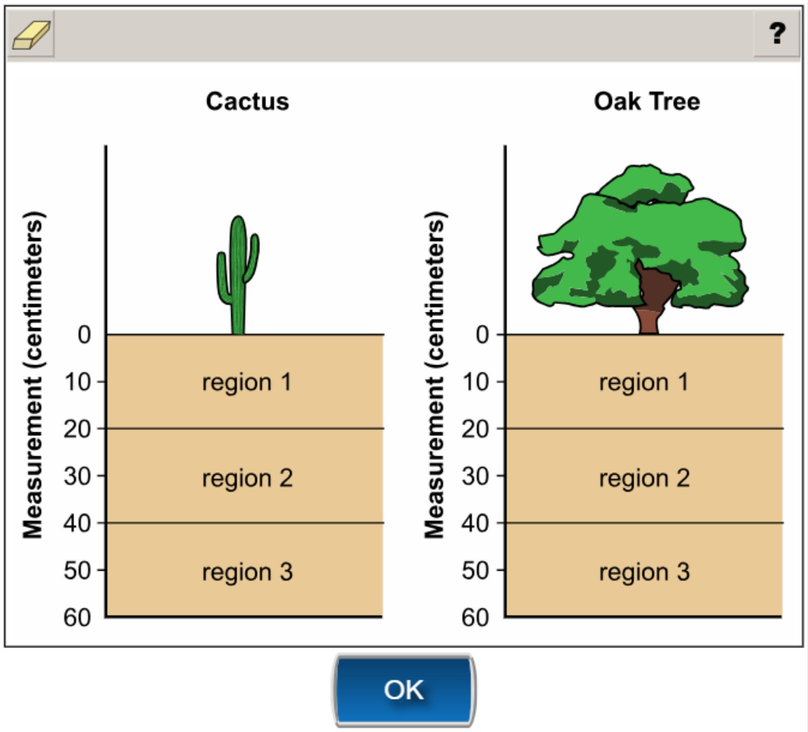
Scoring Notes:

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.



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.

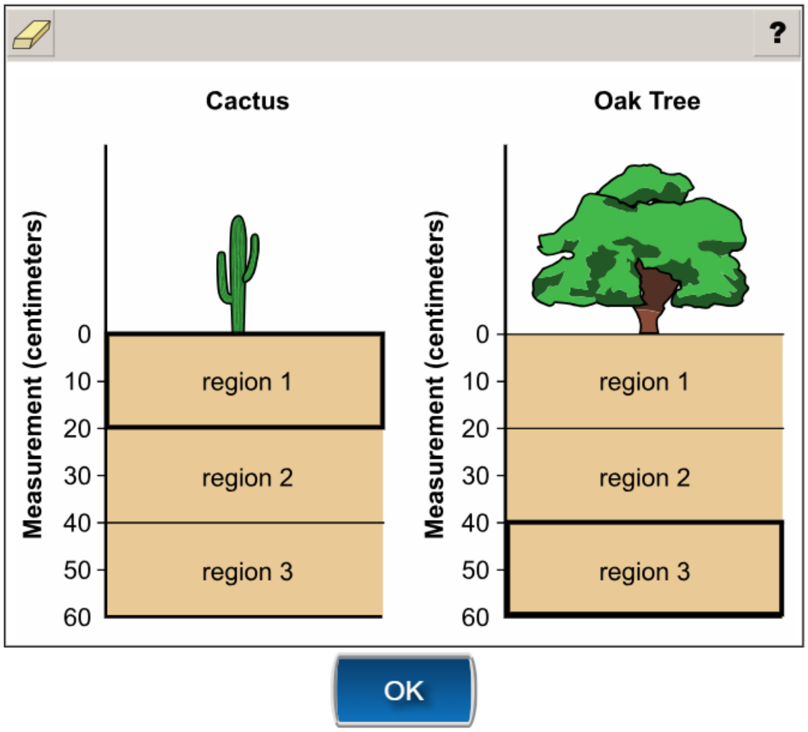
ⓒ Plants in both desert and non-desert areas can grow leaves.

ⓓ 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



Part B

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

Select **all** that apply.

(a) Desert areas have less precipitation than non-desert areas.

(b) Both desert and non-desert plants absorb light from the Sun.

(c) Plants in both desert and non-desert areas can grow leaves.

(d) Lower temperatures in non-desert areas reduce the rate of evaporation.

(e) Desert areas are most often found at low latitudes.

Session 3 Item 34 (TEI)

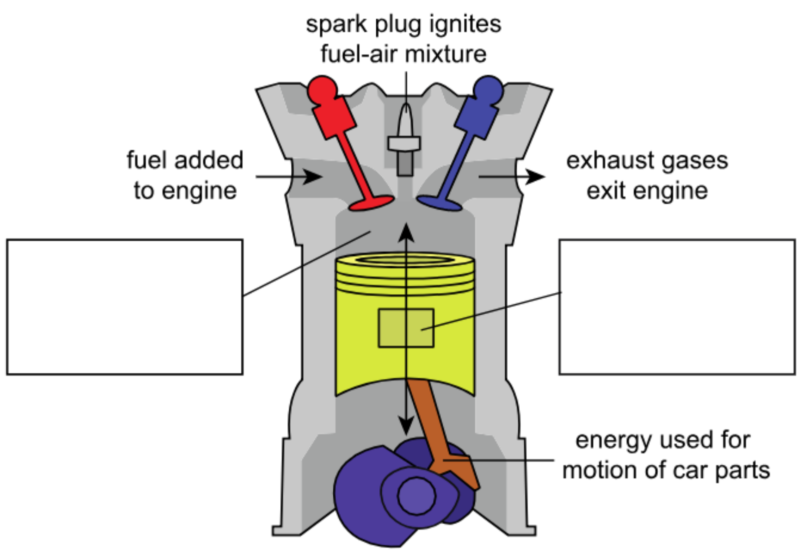
Use the information and your knowledge of science to answer the question.

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.

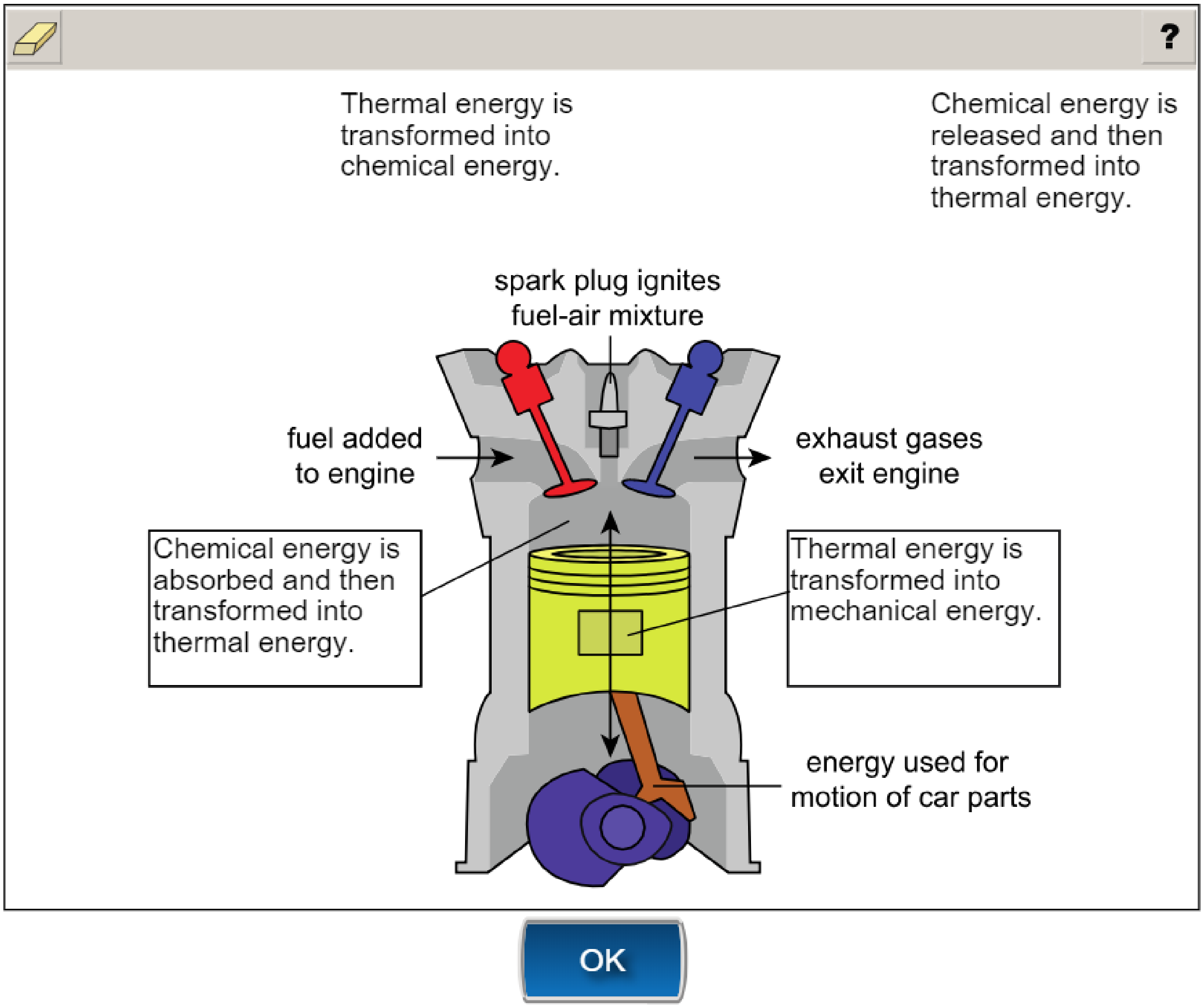
Not all descriptions will be used.

Thermal energy is transformed into mechanical energy.	Thermal energy is transformed into chemical energy.	Chemical energy is absorbed and then transformed into thermal energy.	Chemical energy is released and then transformed into thermal energy.



OK

Session 3 Item 34 (TEI) – Rubric



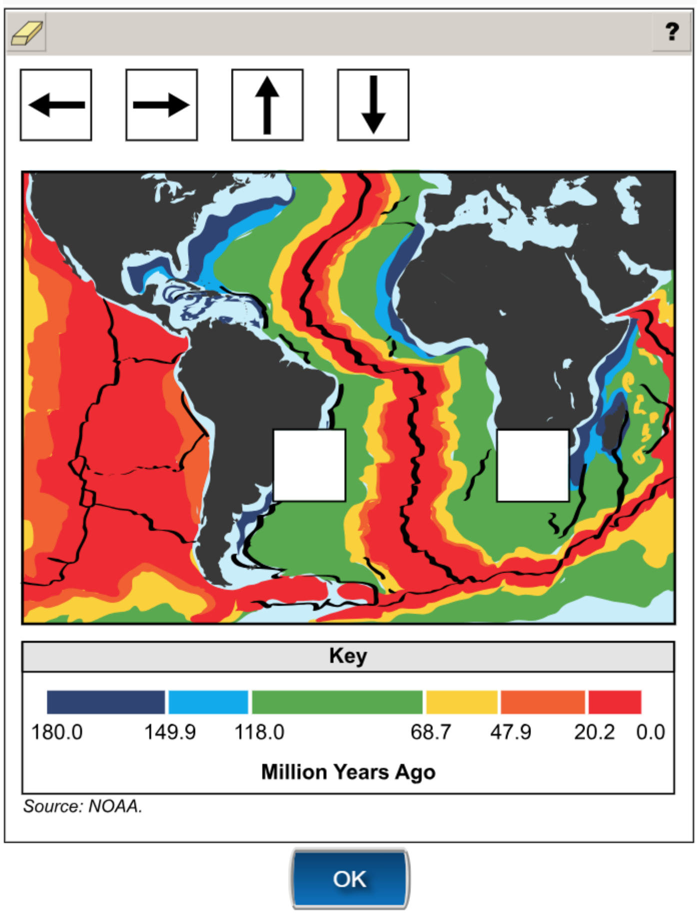
Session 3 Item 35 (TPI)

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.

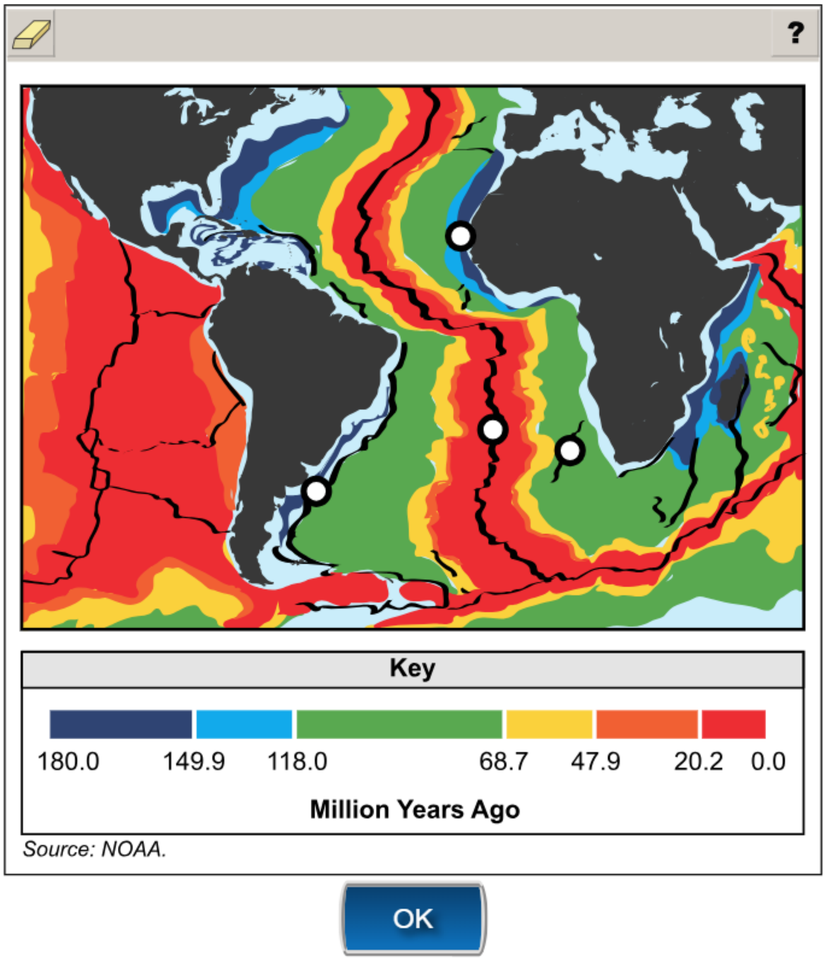


Session 3 Item 35 (TPI), continued

Part B

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

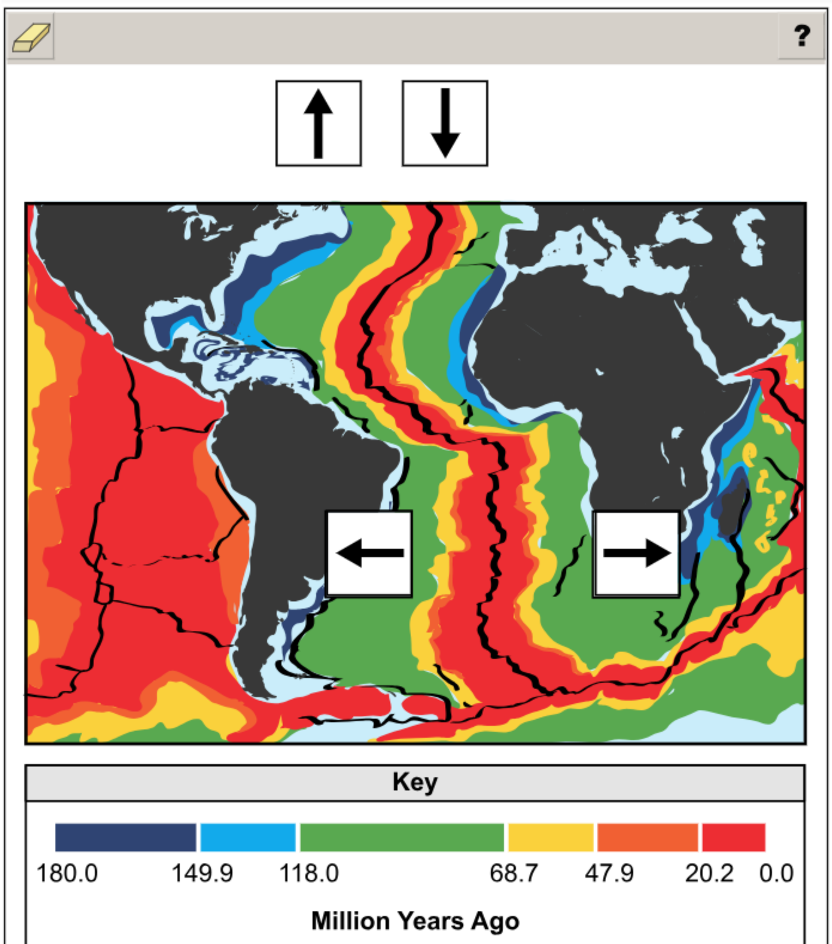
Select the correct location.



Source: NOAA.

Session 3 Item 35 (TPI) – Rubric

Part A

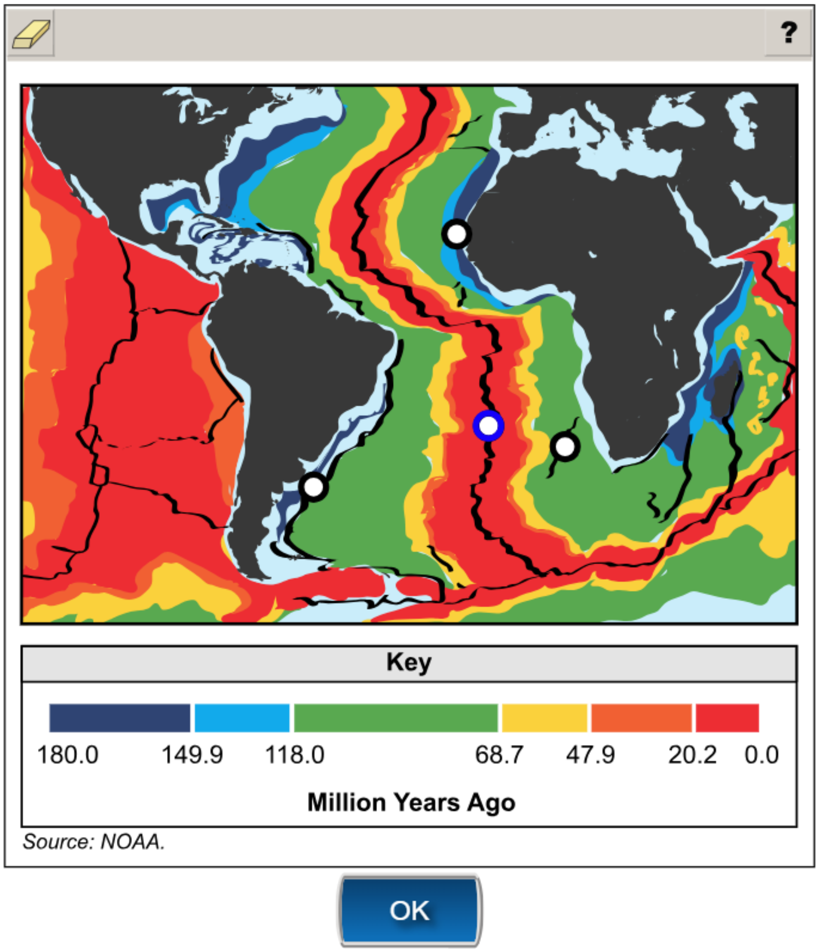


Source: NOAA.

OK

Session 3 Item 35 (TPI) – Rubric, continued

Part B



Source: NOAA.

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.*

Session 3 Item 38 (TEI) – Rubric

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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.