Formative Assessments

Sample Item Sets

STEM • Middle School
Reading • Grade 6

COGNIA ASSESSMENTS

Formative Item Set

STEM · Middle School

Domain: Earth Science
Topic: History of Earth
Item Types: Multiple-choice, constructed-response, and extended-response items

Blueprint

Performance Expectation	Learning Target	DOK	Item Type	Item Position
Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. (MS-ESS1-4)	I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.	2	MC	1
		2	MC	2
		2	MC	3
	I can use evidence from rock layers to explain Earth's history based on the geologic time scale.	2	MC	4
	I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.	2	CR	5
		2	CR	6
		2	CR	7
		2	ER	8
		2	ER	9
		2	ER	10

MC = multiple-choice
CR = constructed-response
ER = extended-response

Scoring Guide

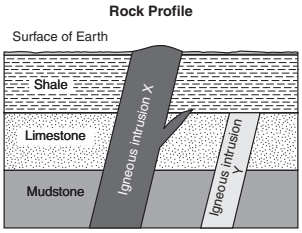
PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

LEARNING TARGET: I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.

SEP: SEP.6-8.6.c Constructing Explanations and Designing Solutions DCI: ESS1.C.6-8.a The History of Planet Earth
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

1. The diagram shows a rock profile containing layers of different types of rock and igneous intrusions.



Which sequence lists the correct order of events in the area represented in the diagram?

Ⓐ 1. Igneous intrusion Y formed.
2. The shale layer was deposited.
3. Igneous intrusion X formed.
4. The limestone layer was deposited.
5. The mudstone layer was deposited.

Ⓑ 1. The mudstone layer was deposited.
2. The limestone layer was deposited.
3. The shale layer was deposited.
4. Igneous intrusion Y was forced onto the mudstone, limestone, and shale.
5. Igneous intrusion X was forced onto the mudstone, limestone, and shale.

Ⓒ 1. Igneous intrusion X formed.
2. Igneous intrusion Y formed.
3. The shale layer was deposited.
4. The limestone layer was deposited.
5. The mudstone layer was deposited.

● 1. The layer of mudstone was deposited.
2. The layer of limestone was deposited.
3. Igneous intrusion Y was forced onto the mudstone and limestone.
4. The shale layer was deposited.
5. Igneous intrusion X was forced over the mudstone, limestone, and shale.

Distractor Rationales

A. According to the Law of Superposition, the oldest rock layers in a geologic profile are on the bottom and were deposited first. In addition, intrusions are younger than the rock layers that they cut through.

B. Igneous intrusion Y was placed after the deposition of the mudstone and limestone, because it cuts through those layers but then is cut off by the shale layer. Igneous intrusion X was then placed after the deposition of the shale layer.

C. According to the Law of Superposition, the oldest rock layers in a geologic profile are on the bottom and were deposited first. In addition, intrusions are younger than the rock layers that they cut through.

D. Key. According to the Law of Superposition, the oldest rock layers in a geologic profile are on the bottom and were deposited first. In addition, intrusions are younger than the rock layers that they cut through. Therefore, the mudstone layer was deposited first, followed by the limestone layer. Igneous intrusion Y then cut through those two layers. The shale layer was deposited after intrusion Y, because it cuts off the intrusion at the top. Igneous intrusion X then cut through all three rock layers.

Scoring Guide

PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

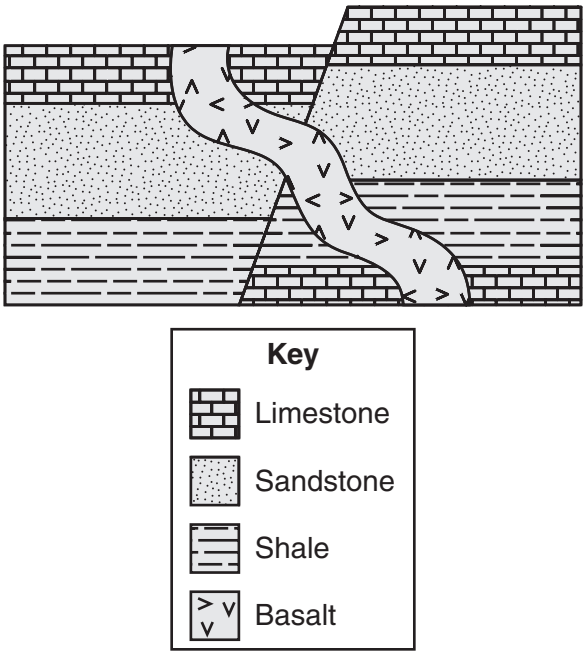
LEARNING TARGET: I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.

SEP: SEP.6-8.6.c Constructing Explanations and Designing Solutions DCI: ESS1.C.6-8.a The History of Planet Earth
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

2. A scientist studies this geologic profile.

Geologic Profile



What evidence from the profile would a scientist use to support that the basalt layer is younger than the other rock layers?

Ⓐ The basalt layer is thinner than the other rock layers, which means it is still forming.

● The basalt layer cuts across the rock layers, which means the other rock layers formed first.

Ⓒ The basalt layer is exposed at the surface, which means the basalt flowed downward after the other rock layers formed.

Ⓓ The basalt layer is near a fault, which means the basalt is continuing to flow out of the fault after the other rock layers formed.

Distractor Rationales

A. The thickness of an intrusion can indicate the volume of material erupted but does not indicate how old the intrusion is.

B. Key. The basalt layer is an intrusion that formed when melted rock flowed upward into existing rock and then cooled and solidified.

C. The basalt is exposed at the surface either because the intrusion reached all the way up to the surface or because any layers on top of it eroded. In addition, intrusions do not flow from the surface downward because the heat source is deeper.

D. Melted rock can flow out of faults, but not all faults are responsible for intrusions. In addition, since the intrusion is a solid rock layer, there is no longer any eruption of the melted rock.

Scoring Guide

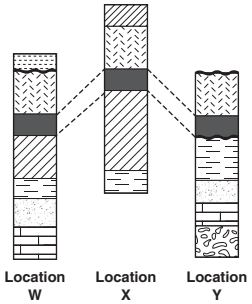
PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

LEARNING TARGET: I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.

SEP: SEP.6-8.6.c Constructing Explanations and Designing Solutions DCI: ESS1.C.6-8.a The History of Planet Earth
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

3. Scientists can use absolute dating techniques on a specific form of carbon called carbon-14. Volcanic ash contains large amounts of carbon-14. The diagram below shows partial rock columns from three different locations, with the same layer of volcanic ash identified by the dotted lines.



How can analyzing these layers of ash help scientists learn more about the rock columns in the three locations?

Ⓐ Scientists can determine the location of the volcano that erupted by comparing the thickness of the ash layer in each of the columns.

Ⓑ Scientists can determine that the ash layer was deposited at different times in each column because it is found at different depths in the columns.

● Scientists can determine the age of the ash layer in one location and use that information to estimate the age ranges of matching sequences of rocks in other locations.

Ⓓ Scientists can determine whether the volcanic eruption that produced the ash layer was responsible for the extinction of species found in the rock columns in the other locations.

Distractor Rationales

A. Scientists may be able to estimate whether the volcano was near or far based on the amount of ash; however, a precise location cannot be determined from the thickness of the layer. In addition, the thickness of the layer could also be indicative of the volume of the eruption.

B. The ash layer has been correlated between the rock columns because of the similarity of the rock sequence in each column. Therefore, it is reasonable to assume that the age of the ash layer is the same in all three columns. The depth of the ash layer can be different for each column depending on local events such as uplift or erosion.

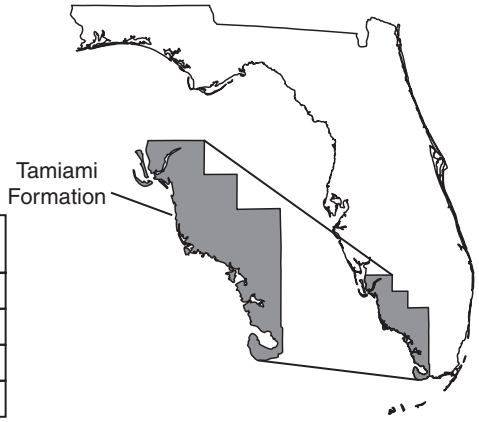
C. Key. During a volcanic eruption, ash may spread over long distances. The ash may later become buried in sediment. Scientists can use data about the time of the volcanic eruption to compare the ages of rocks above and below the ash.

D. Ash is a lightweight material and is not likely to trap organisms or produce fossils. In addition, though scientists might speculate that a volcanic eruption contributed to the extinction of organisms, the scientists cannot make a definitive determination to the cause simply by observing the presence of ash.

Scoring Guide

PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
LEARNING TARGET: I can use evidence from rock layers to explain Earth's history based on the geologic time scale.
SEP: SEP.6-8.6.c Constructing Explanations and Designing Solutions DCI: ESS1.C.6-8.a The History of Planet Earth
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity
DOK: 2

4. The diagram shows where a rock layer called the Tamiami Formation exists in Florida. The table lists the types of fossils found in this formation.



Fossils Found in Tamiami Formation
Barnacles
Mollusks
Corals
Plankton

Which conclusion about the Tamiami Formation is supported by evidence in the diagram and table?

Ⓐ The Tamiami Formation is shrinking in size as new fossils are created.

Ⓑ The Tamiami Formation is currently growing in size as new sediments are deposited.

● The part of Florida containing the Tamiami Formation was once underwater.

Ⓓ The part of Florida containing the Tamiami Formation is currently below sea level.

Distractor Rationales

A. The formation is already a solid rock layer so no new fossils can form in it. In addition, the formation of fossils does not cause a rock layer to shrink.

B. The formation is already a solid rock layer so the rock layer cannot grow in size. Any current deposition of sediments will eventually be part of a new rock layer.

C. Key. The fossils indicate that the area was once underwater.

D. This part of Florida may be below sea level, but fossils are not evidence of that since fossils formed millions of years ago.

Scoring Guide

PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

LEARNING TARGET: I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.

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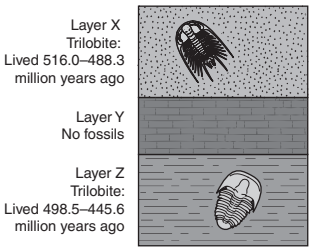
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

5. Juan studies the diagram representing three sedimentary layers in a rock sequence, as shown. The rock layers have not experienced any folding or faulting.



Juan claims that layer X formed between 498.5 million and 488.3 million years ago. Use evidence from the diagram to explain whether Juan's claim is supported.

Constructed-Response Rubric

Score	Level of Understanding	Evidence of Understanding
2	Demonstrating Expected Understanding	Student response provides **clear** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. Student is able to: • explain whether the data support or do not support the claim; **AND** • include evidence from the diagrams; **AND** • support their answer with the evidence.
1	Progressing toward Understanding	Student response provides **partial** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. The response lacks some critical information and details or contains some errors. Student is able to: • identify whether the data support or do not support the claim **BUT** evidence is not provided **OR** the evidence does not support their answer.
0	Not Showing Understanding	Student does not respond or student response is inaccurate, irrelevant, or contains insufficient evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.

**As outlined in the Performance Expectations (PE) of the NGSS, the three dimensions are the disciplinary core ideas (DCI), science and engineering practices (SEP), and crosscutting concepts (CCC). Note that due to the complexity of the PEs, individual assessment items may not address all three dimensions.*

Scoring Notes:

Possible answers include:

Yes, the evidence supports Juan's claim because layers are deposited in order of age [Law of Superposition], with the oldest layer on the bottom and the youngest layer on top. The oldest age the bottom layer, Z, could be is 498.5 mya. The youngest age the top layer, X, could be is 488.3 mya. Since the layers are undisturbed and layer Y is between those two layers, layer X is between 498.5 and 488.3 million years old.

Scoring Guide

PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

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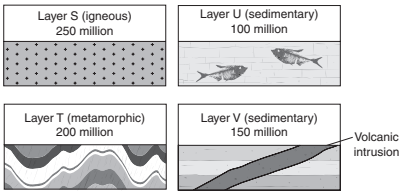
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

6. The diagrams represent four different rock layers. The age of each rock layer, in millions of years, is given.



A student claims that Layer S formed at the same time a volcanic intrusion cut across Layer V.

Based on the diagrams, identify whether the data support or do not support the student's claim. Include evidence from the diagrams to support your answer.

Constructed-Response Rubric

Score	Level of Understanding	Evidence of Understanding
2	Demonstrating Expected Understanding	Student response provides **clear** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. Student is able to: • identify whether the data support or do not support the student's claim; **AND** • include evidence from the diagrams; **AND** • the evidence supports their answer.
1	Progressing toward Understanding	Student response provides **partial** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. The response lacks some critical information and details or contains some errors. Student is able to: • identify whether the data support or do not support the student's claim **BUT** evidence is not provided **OR** the evidence does not support their answer.
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Scoring Notes:

Possible answers include:

No, the data do not support the student's claim. Layer V is 150 million years old and Layer S is 250 million years old. The intrusion cutting across Layer V couldn't have happened at the same time as Layer S formed because Layer V did not exist 250 million years ago when Layer S formed. Also, the intrusion would have happened after Layer V formed, so the intrusion is less than 150 million years old.

Note: Students may describe specific rock forming processes.

Scoring Guide

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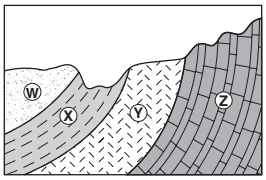
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

7. The diagram shows a section of rock layers W, X, Y, and Z.



Describe the sequence of events that likely occurred in this section of rock layers. Include evidence from the diagram in your answer.

Constructed-Response Rubric

Score	Level of Understanding	Evidence of Understanding
2	Demonstrating Expected Understanding	Student response provides **clear** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. Student is able to: • describe the sequence of events that likely occurred in this section of rock layers; **AND** • include evidence from the diagrams; **AND** • support their answer with the evidence.
1	Progressing toward Understanding	Student response provides **partial** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. The response lacks some critical information and details or contains some errors. Student is able to: • describe the sequence of events that likely occurred in this section of rock layers **BUT** evidence is not provided **OR** the evidence does not support their answer.
0	Not Showing Understanding	Student does not respond or student response is inaccurate, irrelevant, or contains insufficient evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.

**As outlined in the Performance Expectations (PE) of the NGSS, the three dimensions are the disciplinary core ideas (DCI), science and engineering practices (SEP), and crosscutting concepts (CCC). Note that due to the complexity of the PEs, individual assessment items may not address all three dimensions.*

Scoring Notes:

Possible answers include:

Layer Z was deposited first, because it's the layer on the bottom. Next, layer Y was deposited, because it is on top of layer Z. Layer X was deposited next, because it is on top of layer Y. Layer W was deposited after that, because it lies on top of layer X. After they were deposited, all of the layers were subjected to a force (uplift, compression) that pushed them up, because they appear slanted (and, according to the Principle of Original Horizontality, because rock layers are always deposited flat, or horizontal, originally). Finally, erosion occurred on the surface, because the tops of the layers that are exposed at the surface are jagged, not smooth.

Scoring Guide

PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

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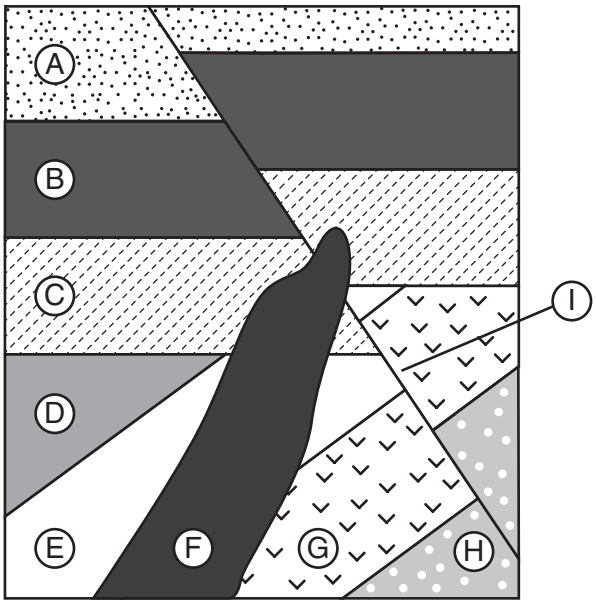
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

8. The diagram shows layers of rock (A, B, C, D, E, G, and H) and features (F and I) in a geologic profile.



a. List the sequence of events that occurred in the area represented by the profile.

b. Justify your conclusion in part (a) using evidence from the diagram.

Scoring Guide

Extended-Response Rubric		
Score	**Level of Understanding**	**Evidence of Understanding**
3	Demonstrating Expected Understanding	Student response provides **clear** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. Student is able to: • describe a sequence of events in the area represented by the profile; **AND** • correctly sequence the events; **AND** • justify the conclusion using evidence from the diagram.
2	Progressing toward Understanding	Student response provides **partial** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. The response lacks some critical information and details or contains some errors. Student is able to: • describe a sequence of events in the area represented by the profile **BUT** the sequence is incorrect; **OR** • describe a correct sequence of events in the area represented by the profile **BUT** evidence is not provided **OR** the evidence does not support the conclusion.
1	Beginning to Develop Understanding	Student response is incomplete or provides minimal evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.
0	Not Showing Understanding	Student does not respond or student response is inaccurate, irrelevant, or contains insufficient evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.

**As outlined in the Performance Expectations (PE) of the NGSS, the three dimensions are the disciplinary core ideas (DCI), science and engineering practices (SEP), and crosscutting concepts (CCC). Note that due to the complexity of the PEs, individual assessment items may not address all three dimensions.*

Scoring Notes:

Possible answers include:

a. H (oldest), G, E, D, C, B, A, I, F (youngest)

b. Sedimentary rock layers are deposited horizontally one on top of another. This means the oldest layers are on the bottom and the youngest layers are on the top. This also means that if the layers are tilted or folded, they must have been tilted or folded after they formed horizontally. This means that layer H was deposited first, then G, then E, and then D, and then the layers became tilted or folded because they are no longer horizontal. After those layers were tilted or folded, more sedimentary rock layers were deposited horizontally on top of that. Layer C is on the bottom, so it was deposited next, then B, and then A. The fault, I, cuts through all of the sedimentary rock layers, so it must have occurred after the layers were deposited. The igneous intrusion, F, cuts through the fault, so the fault must have already been there before the igneous intrusion formed. (Erosion has occurred at the surface of A.)

Scoring Guide

PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

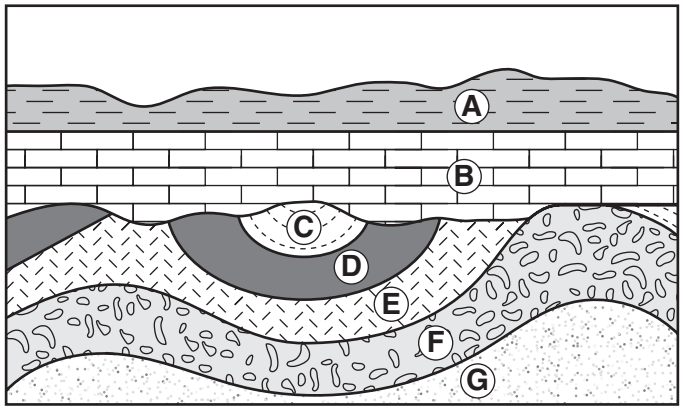
LEARNING TARGET: I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.

SEP: SEP.6-8.6.c Constructing Explanations and Designing Solutions DCI: ESS1.C.6-8.a The History of Planet Earth

CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

9. The diagram shows several layers of rock in an area.



Describe the geologic history of this area, using evidence from the diagram.

Scoring Guide

Extended-Response Rubric		
Score	**Level of Understanding**	**Evidence of Understanding**
3	Demonstrating Expected Understanding	Student response provides **clear** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. Student is able to: • describe a sequence of events in the area represented by the profile **AND** • sequence the events correctly; **AND** • use evidence from the diagram.
2	Progressing toward Understanding	Student response provides **partial** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. The response lacks some critical information and details or contains some errors. Student is able to: • describe a sequence of events in the area represented by the profile **BUT** the sequence is incorrect; **OR** • describe a correct sequence of events in the area represented by the profile **BUT** evidence is not provided **OR** the evidence does not support the conclusion.
1	Beginning to Develop Understanding	Student response is incomplete or provides minimal evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.
0	Not Showing Understanding	Student does not respond or student response is inaccurate, irrelevant, or contains insufficient evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.

**As outlined in the Performance Expectations (PE) of the NGSS, the three dimensions are the disciplinary core ideas (DCI), science and engineering practices (SEP), and crosscutting concepts (CCC). Note that due to the complexity of the PEs, individual assessment items may not address all three dimensions.*

Scoring Notes:

Possible answers include:

Based on the diagram, the geologic history of the area is:

- First, layer G was deposited, because it is the bottommost layer (based on the Law of Superposition, rocks on the bottom of a sequence are the oldest rocks).
- Next, layer F was deposited, because it is on top of layer G.
- Next, layer E was deposited, because it is on top of layer F.
- Next, layer D was deposited, because it is on top of layer E.
- Next, layer C was deposited, because it is on top of layer D.
- Layers G through C were subject to a pressure or force that compressed them to make them look folded [based on the Law of Original Horizontality, rock layers are deposited horizontally initially].
- After those layers were folded, erosion occurred on the surface because the tops of the layers on the surface look jagged and not smooth.
- Next, layer B was deposited, because it is on top of the erosional surface.
- Next, layer A was deposited, because it is on top of layer B.
- Finally, the top surface of layer A was eroded, because the surface looks jagged and not smooth.

Scoring Guide

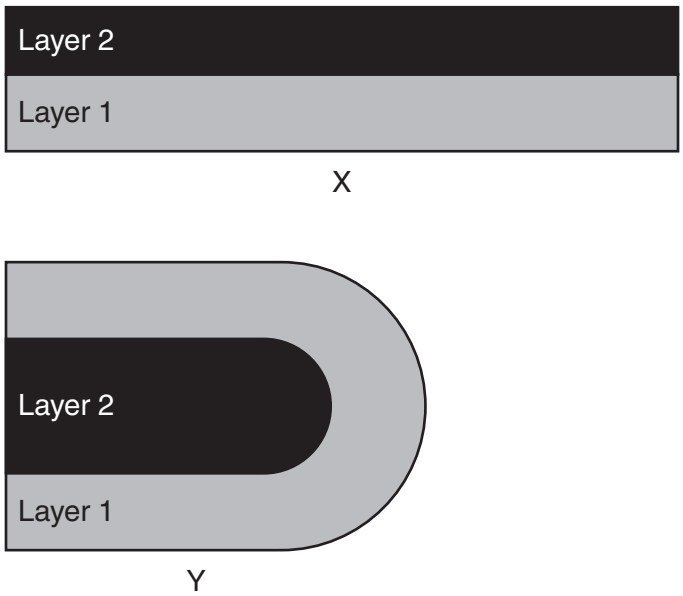
PERFORMANCE EXPECTATION: MS-ESS1-4: Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

LEARNING TARGET: I can use evidence from rock layers to explain the history of rock layers in an area based on the principles of relative dating.

SEP: SEP.6-8.6.c Constructing Explanations and Designing Solutions DCI: ESS1.C.6-8.a The History of Planet Earth
CCC: CCC.6-8.3.1 Scale, Proportion, and Quantity

DOK: 2

10. The diagram shows two rock layers at their time of deposition, X, and at a later time, Y.



a. What are the relative ages of the two rock layers? Identify the evidence you used.

b. Explain why it is important to know if rock layers have been folded when determining relative ages.

Scoring Guide

Extended-Response Rubric		
Score	**Level of Understanding**	**Evidence of Understanding**
3	Demonstrating Expected Understanding	Student response provides **clear** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. Student is able to: • identify the relative ages of the two rock layers; **AND** • identify the evidence used to determine the relative ages; **AND** • explain why it is important to know if rock layers have been folded when determining relative ages.
2	Progressing toward Understanding	Student response provides **partial** evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems. The response lacks some critical information and details or contains some errors. Student is able to: • identify the relative ages of the two rock layers **AND** explain why it is important to know if rock layers have been folded when determining relative ages **BUT** does not identify the evidence used to determine the relative ages **OR** the evidence does not support the identification; **OR** • identify the relative ages of the two rock layers **AND** identify the evidence used to determine the relative ages **BUT** does not explain why it is important to know if rock layers have been folded when determining relative ages.
1	Beginning to Develop Understanding	Student response is incomplete or provides minimal evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.
0	Not Showing Understanding	Student does not respond or student response is inaccurate, irrelevant, or contains insufficient evidence of using the dimensions* to make sense of scientific phenomena and/or to design solutions to problems.

**As outlined in the Performance Expectations (PE) of the NGSS, the three dimensions are the disciplinary core ideas (DCI), science and engineering practices (SEP), and crosscutting concepts (CCC). Note that due to the complexity of the PEs, individual assessment items may not address all three dimensions.*

Scoring Notes:

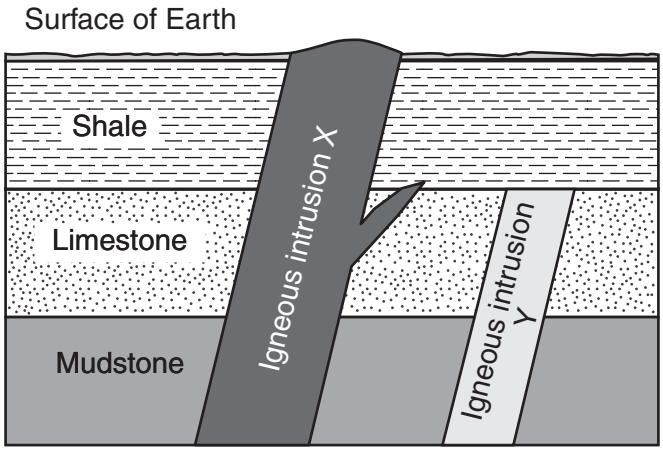
a. Layer 1 is older than Layer 2 because Layer 1 is on the bottom of the two layers.
OR
Layer 2 is younger than Layer 1 because Layer 2 is on the top of the two layers.

b. It is important to know if rock layers have been folded (or overturned) because the relative ages of the rock layers might be interpreted incorrectly. For example, in the given diagram, if it is not known that the layers were overturned and only a part of the rock section was visible, it might look like Layer 1 is on top of Layer 2 and thus younger.

Student Item Set

1. The diagram shows a rock profile containing layers of different types of rock and igneous intrusions.

Rock Profile



Which sequence lists the correct order of events in the area represented in the diagram?

Ⓐ 1. Igneous intrusion Y formed.
2. The shale layer was deposited.
3. Igneous intrusion X formed.
4. The limestone layer was deposited.
5. The mudstone layer was deposited.

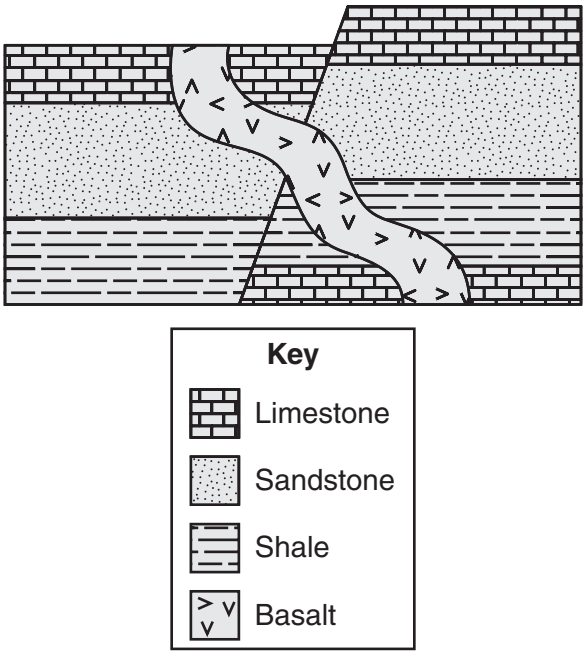
Ⓑ 1. The mudstone layer was deposited.
2. The limestone layer was deposited.
3. The shale layer was deposited.
4. Igneous intrusion Y was forced onto the mudstone, limestone, and shale.
5. Igneous intrusion X was forced onto the mudstone, limestone, and shale.

Ⓒ 1. Igneous intrusion X formed.
2. Igneous intrusion Y formed.
3. The shale layer was deposited.
4. The limestone layer was deposited.
5. The mudstone layer was deposited.

Ⓓ 1. The layer of mudstone was deposited.
2. The layer of limestone was deposited.
3. Igneous intrusion Y was forced onto the mudstone and limestone.
4. The shale layer was deposited.
5. Igneous intrusion X was forced over the mudstone, limestone, and shale.

2. A scientist studies this geologic profile.

Geologic Profile



What evidence from the profile would a scientist use to support that the basalt layer is younger than the other rock layers?

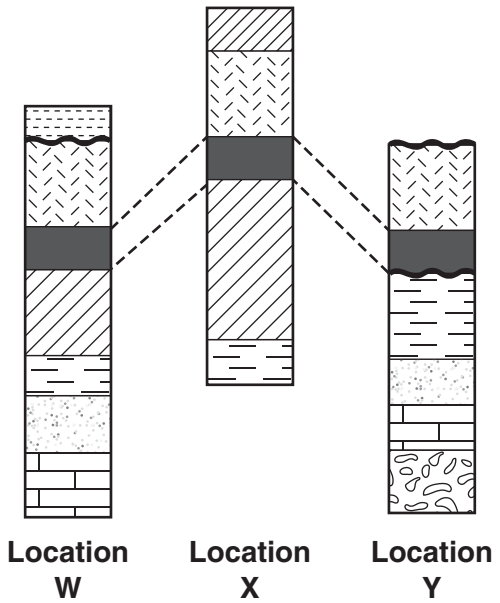
Ⓐ The basalt layer is thinner than the other rock layers, which means it is still forming.

Ⓑ The basalt layer cuts across the rock layers, which means the other rock layers formed first.

Ⓒ The basalt layer is exposed at the surface, which means the basalt flowed downward after the other rock layers formed.

Ⓓ The basalt layer is near a fault, which means the basalt is continuing to flow out of the fault after the other rock layers formed.

3. Scientists can use absolute dating techniques on a specific form of carbon called carbon-14. Volcanic ash contains large amounts of carbon-14. The diagram below shows partial rock columns from three different locations, with the same layer of volcanic ash identified by the dotted lines.



How can analyzing these layers of ash help scientists learn more about the rock columns in the three locations?

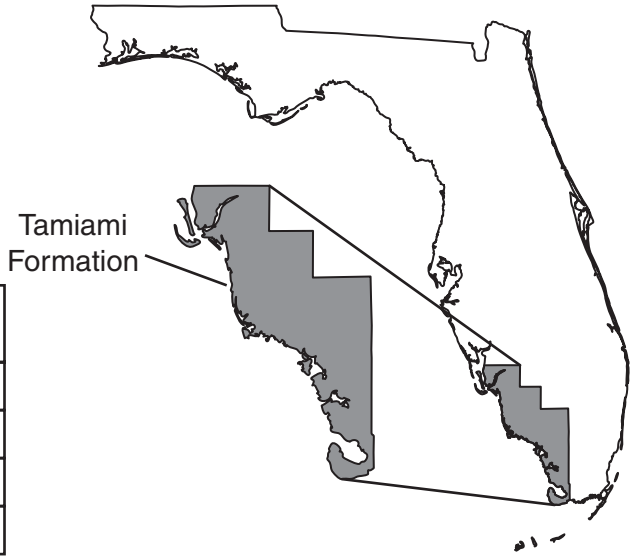
Ⓐ Scientists can determine the location of the volcano that erupted by comparing the thickness of the ash layer in each of the columns.

Ⓑ Scientists can determine that the ash layer was deposited at different times in each column because it is found at different depths in the columns.

Ⓒ Scientists can determine the age of the ash layer in one location and use that information to estimate the age ranges of matching sequences of rocks in other locations.

Ⓓ Scientists can determine whether the volcanic eruption that produced the ash layer was responsible for the extinction of species found in the rock columns in the other locations.

4. The diagram shows where a rock layer called the Tamiami Formation exists in Florida. The table lists the types of fossils found in this formation.



Fossils Found in Tamiami Formation
Barnacles
Mollusks
Corals
Plankton

Which conclusion about the Tamiami Formation is supported by evidence in the diagram and table?

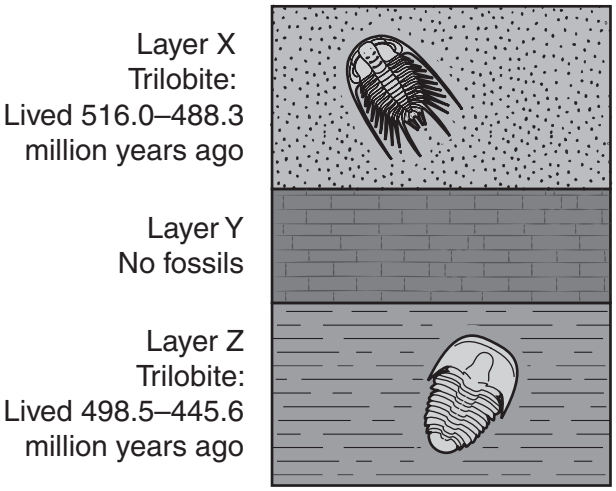
Ⓐ The Tamiami Formation is shrinking in size as new fossils are created.

Ⓑ The Tamiami Formation is currently growing in size as new sediments are deposited.

Ⓒ The part of Florida containing the Tamiami Formation was once underwater.

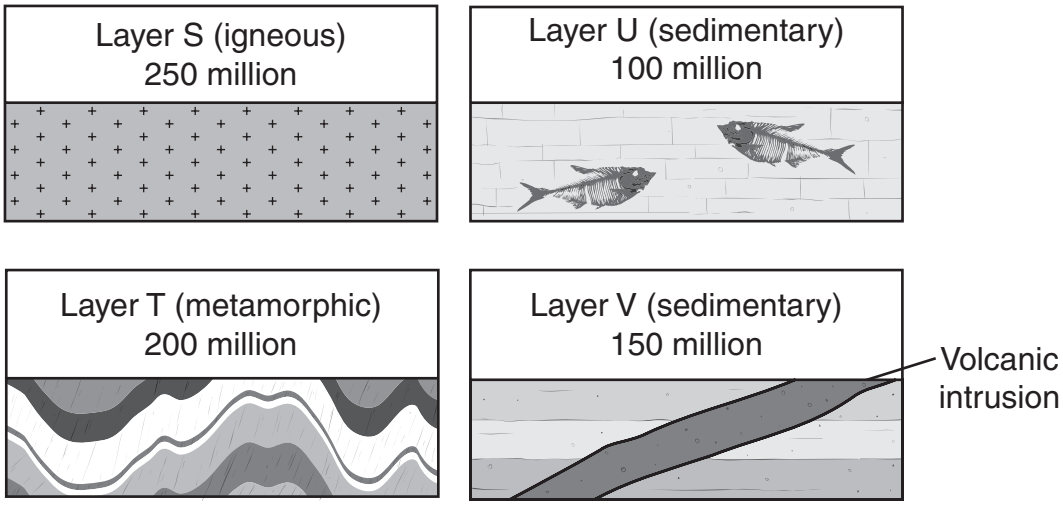
Ⓓ The part of Florida containing the Tamiami Formation is currently below sea level.

5. Juan studies the diagram representing three sedimentary layers in a rock sequence, as shown. The rock layers have not experienced any folding or faulting.



Juan claims that layer X formed between 498.5 million and 488.3 million years ago. Use evidence from the diagram to explain whether Juan's claim is supported.

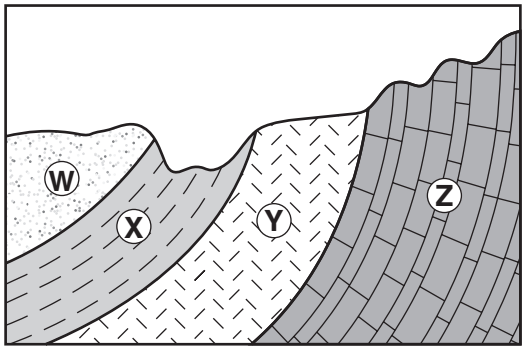
6. The diagrams represent four different rock layers. The age of each rock layer, in millions of years, is given.



A student claims that Layer S formed at the same time a volcanic intrusion cut across Layer V.

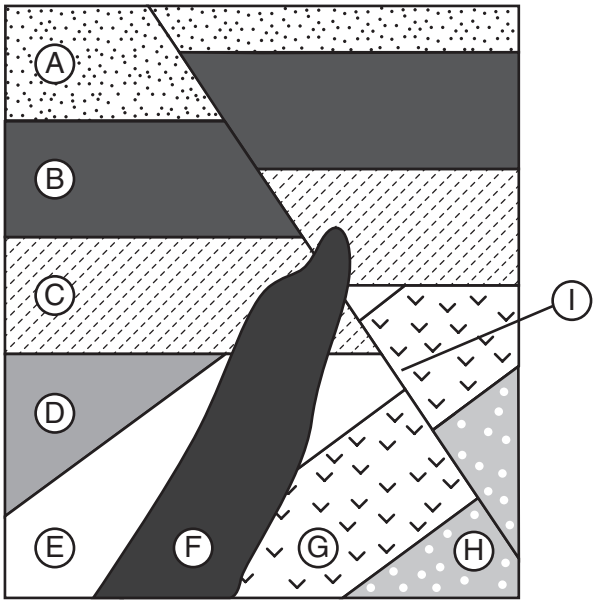
Based on the diagrams, identify whether the data support or do not support the student's claim. Include evidence from the diagrams to support your answer.

7. The diagram shows a section of rock layers W, X, Y, and Z.



Describe the sequence of events that likely occurred in this section of rock layers. Include evidence from the diagram in your answer.

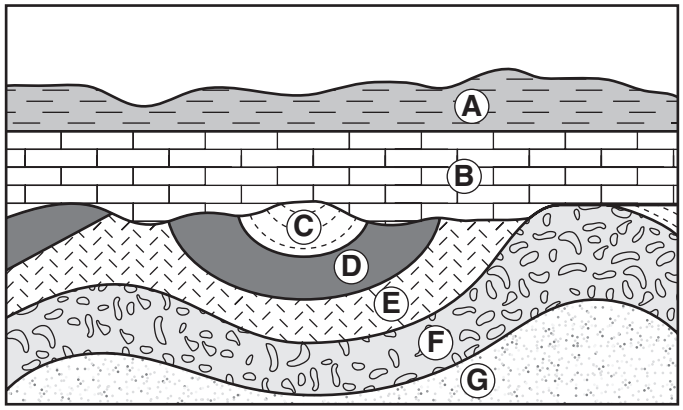
8. The diagram shows layers of rock (A, B, C, D, E, G, and H) and features (F and I) in a geologic profile.



a. List the sequence of events that occurred in the area represented by the profile.

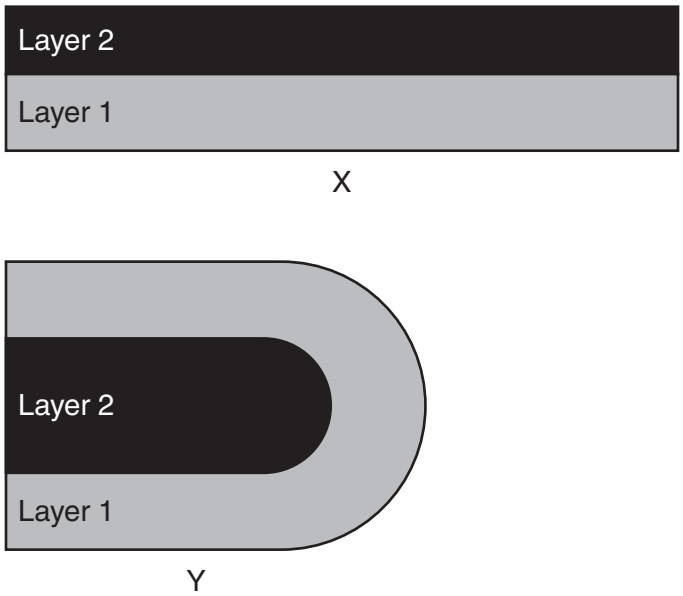
b. Justify your conclusion in part (a) using evidence from the diagram.

9. The diagram shows several layers of rock in an area.



Describe the geologic history of this area, using evidence from the diagram.

10. The diagram shows two rock layers at their time of deposition, X, and at a later time, Y.



a. What are the relative ages of the two rock layers? Identify the evidence you used.

b. Explain why it is important to know if rock layers have been folded when determining relative ages.

Formative Item Set

Reading · Grade 6

Domain: Reading Informational
Cluster: Integration of Knowledge and Ideas
Passage Name(s): The Maze Craze; Lost in a Corn Maze
Item Types: Multiple-choice and constructed-response items

Blueprint

Standard(s)	Learning Target	DOK	Item Type	Item Position
Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (RI.06.08)	I can determine how an author uses evidence to support arguments.	2	MC	A–1
	I can identify how evidence supports a claim.	2	MC	A–2
Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. (RI.06.07)	I can identify how a graphic supports a text.	2	MC	A–3
	I can determine how graphics relate to a text.	2	MC	A–4
Compare and contrast one author's presentation of events with that of another (e.g., a memoir written by and a biography on the same person). (RI.06.09)	I can identify how two authors present information differently.	3	MC	A–5
	I can compare how authors present information on the same topic.	3	MC	A–6
Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (RI.06.08)	I can analyze whether or not a claim is supported by evidence.	3	CR	B–1

MC = multiple-choice
CR = constructed-response

Scoring Guide–Part A

Multiple-Choice Items

STANDARD: Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (RI.06.08)

LEARNING TARGET: I can determine how an author uses evidence to support arguments.

DOK: 2

1. Which evidence from "The Maze Craze" supports the argument that corn mazes are a better use of land than corn crops?

● Mazes provide greater revenue per acre.

Ⓑ Mazes employ fewer people than farming.

Ⓒ Mazes are enjoyable for people to explore.

Ⓓ Mazes have been important throughout history.

Distractor Rationales

A. Key. This statement clarifies the comparison exactly.

B. The sentence stresses the labor involved in building corn mazes, not the land use.

C. The fact that corn mazes are enjoyable says nothing about their practicality.

D. The popularity of mazes in general says nothing about the practicality of corn mazes specifically.

STANDARD: Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (RI.06.08)

LEARNING TARGET: I can identify how evidence supports a claim.

DOK: 2

2. Which statement in "Lost in a Corn Maze" provides evidence to support the author's claim that corn mazes have become a popular attraction?

Ⓐ "A corn maze is a large, walk-through puzzle carved into a cornfield." (paragraph 2)

Ⓑ "A farmer may enlist the help of a maze designer to create these amazing images." (paragraph 3)

Ⓒ "People have been designing, building, and getting lost in mazes for thousands of years." (paragraph 4)

● "There are now approximately one thousand corn mazes across the United States, and corn mazes on every continent except for frosty Antarctica." (paragraph 5)

Distractor Rationales

A. The description simply defines what corn mazes are; it does not explain their popularity.

B. The claim that the designs are amazing does not indicate that the mazes are popular.

C. The statement points to the history of corn mazes, not to their popularity today.

D. Key. The large number of corn mazes shows that they are popular.

Scoring Guide–Part A

Multiple-Choice Items

STANDARD: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. (RI.06.07)

LEARNING TARGET: I can identify how a graphic supports a text.

DOK: 2

3. Which detail from "Lost in a Corn Maze" does the photograph **best** show?

Ⓐ "You walk along paths filled with turns, loops, and dead ends." (paragraph 1)

Ⓑ "A corn maze is a large, walk-through puzzle carved into a cornfield." (paragraph 2)

● "Seen from above, its winding paths may form a picture." (paragraph 2)

Ⓓ "The designer begins with a sketch, drawn either by hand or on a computer." (paragraph 3)

Distractor Rationales

A. Although the image shows turns and dead ends, it does not show it from the perspective of the reader as the quote does. The image does not clearly show the dead ends.

B. The image does look like a puzzle, but it is not clear from the image that the maze is carved out of corn crops.

C. Key. The image demonstrates how, from above, the corn maze looks like a picture.

D. While the image shows that someone must have designed the maze with a sketch, it does not show this connection directly.

STANDARD: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. (RI.06.07)

LEARNING TARGET: I can determine how graphics relate to a text.

DOK: 2

4. Which statement from "The Maze Craze" relates to the photograph in "Lost in a Corn Maze?"

Ⓐ "Stolworthy is one of a number of farmers . . . who have recently moved into the improbably popular business of corn-maze design." (paragraph 2)

Ⓑ "Corn farmers can certainly use a boost these days—prices in the past few years have been hovering at or near all-time lows." (paragraph 3)

● "You want your maze to be easy to get to, and you want it to look sharp and clean from the air." (paragraph 4)

Ⓓ "People need an objective to accomplish, beyond just making it through, so we try to create interactive games for them while they're inside." (paragraph 4)

Distractor Rationales

A. The photograph in "Lost in a Corn Maze" shows an aerial view of a maze, but it does not explain why designing mazes is popular.

B. The photograph shows what a corn maze looks like from the air, but it does not explain the profits that the mazes generate.

C. Key. The photograph in "Lost in a Corn Maze" is an aerial view of a corn maze.

D. The aerial photograph does not show interactive games.

Scoring Guide–Part A

Multiple-Choice Items

STANDARD: Compare and contrast one author's presentation of events with that of another (e.g., a memoir written by and a biography on the same person). (RI.06.09)

LEARNING TARGET: I can identify how two authors present information differently.

DOK: 3

5. How do the two authors' presentations on how to create a corn maze differ?

● In "The Maze Craze," the author describes the most time-efficient methods; in "Lost in a Corn Maze," the author highlights the artistic process involved.

Ⓑ In "The Maze Craze," the author points out the many steps and time involved; in "Lost in a Corn Maze," the author details techniques used in ancient times.

Ⓒ In "The Maze Craze," the author includes the high costs involved; in "Lost in a Corn Maze," the author stresses the importance of the finished product.

Ⓓ In "The Maze Craze," the author stresses the use of low-tech machinery to achieve the desired results; in "Lost in a Corn Maze," the author stresses the importance of the designer in the process.

Distractor Rationales

A. **Key: "The Maze Craze" focuses on popularity and profits; "Lost in a Corn Maze" on popularity and design.**

B. "The Maze Craze" focuses on the goals of designers; "Lost in a Corn Maze" on the techniques used today.

C. "The Maze Craze" emphasizes profits, not costs; "Lost in a Corn Maze" stresses the process of creation.

D. "The Maze Craze" alludes to the high level of technology involved in the design; "Lost in a Corn Maze" focuses on the design process.

STANDARD: Compare and contrast one author's presentation of events with that of another (e.g., a memoir written by and a biography on the same person). (RI.06.09)

LEARNING TARGET: I can compare how authors present information on the same topic.

DOK: 3

6. How does the author of each article present the information about Don Frantz's "Cornelius the Cobasaurus"?

Ⓐ Both compare smaller mazes to this large corn maze.

● Both credit this maze for making corn mazes popular.

Ⓒ Both acknowledge the hard work that goes into making corn mazes.

Ⓓ Both praise farmers for allowing designers to turn their land into entertainment.

Distractor Rationales

A. The articles make note of different sizes and shapes, but neither author compares mazes to Frantz's famous maze.

B. **KEY: The author of "The Maze Craze" states, "The maze was an immediate hit, and a new form of 'agritainment'—the use of farmland as a source of public entertainment, to supplement farmers' income—was born," and the author of "Lost in a Corn Maze" states, "'Cornelius, The Cobasaurus,' sparked a corn maze craze—there are now approximately one thousand corn mazes across the United States."**

C. The author of "The Maze Craze" thoroughly explains the work that goes into making corn mazes, but neither author uses Frantz's maze to make this point.

D. Both authors focus their article on corn mazes as "agritainment," but neither author uses Frantz's maze to make this point.

Scoring Guide–Part B

Constructed-Response Item

STANDARD: Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (RI.06.08)

LEARNING TARGET: I can analyze whether or not a claim is supported by evidence.

DOK: 3

1. In "The Maze Craze," Shawn Stolworthy claims that the corn maze business is "going well." Analyze whether Stolworthy's claim is well supported.

- Be sure to state the claim and support it with evidence.
- Be sure to include opposing ideas.
- Be sure that your writing is logical and thorough.

Constructed-Response Rubric

Score	Description
4	The response is thorough and focused; traces a specific claim in the text and determines whether that claim is well supported by reasons and evidence. The claim is clearly stated and maintained throughout. Opposing views are clearly addressed. The response is consistent, logical and has an effective introduction and conclusion. Relevant textual evidence demonstrates a strong understanding of the text. Effective use of facts, sources and/or details clearly supports the task. The writing demonstrates strong control of conventions; a few minor errors may be present.
3	The response is mostly focused; traces a specific claim in the text and determines whether that claim is supported by reasons and evidence. The claim is somewhat clear and maintained. The claim is somewhat developed. The response is somewhat complete and organized. It has a logical progression and contains a basic introduction and conclusion. Some relevant textual evidence demonstrates a general understanding of the text. Included facts, sources and/or details usually support the task. The writing demonstrates control of conventions; some minor errors may be present.
2	The response is partially maintained or inconsistent. It attempts to trace a specific claim in a text but doesn't determine whether that claim is supported by reasons and evidence. The response has lapses in focus or cohesion. It may establish the claim, but does so in a limited way. The response is sometimes confusing, disorganized, and there is little connection between ideas. The writing exhibits inconsistent evidence and support. The response makes limited use of facts, sources and/or details from the text. Text references provided to support the task may be general, used incorrectly, or used with limited success. The writing may exhibit issues with control of standard English grammar.
1	Response is incomplete, provides minimal understanding of the task or a minimal response to the task. Text references provided to support the task may be vague or lacking. The writing may exhibit major issues with focus, organization, support and/or control of standard English grammar.
0	Response is inaccurate, irrelevant, contains insufficient evidence to demonstrate understanding of the task, or the student has failed to respond to the task.
Blank	No Response.

Scoring Guide–Part B

Constructed-Response Item

Sample Response

Response may include, but is not limited to, the following:

- Writing should begin with an introduction that restates Stolworthy's claim: his new business of corn mazes is "going well." (central idea, effective introduction)
- Students should then trace the evidence the author provides: "Last year I was a full-time farmer and only did four of them, but I've quit farming now, and it looks like I'll be doing twenty to thirty this year." "An acre of field corn can profit a farmer two hundred dollars, at best. Revenue on our most successful sites, which average seven acres, has been over four hundred thousand dollars." "Signs indicate that the corn-maze business is still a growth industry." (evidence to support claim)
- Students should then write a conclusion, evaluating how well the author does in supporting the claim. (determine whether the claim is well supported, conclusion)

Student Item Set

Passages

Read the article about a farming business. Then answer the questions that follow.

The Maze Craze

by Toby Lester

1 "Well, grain prices in the past few years haven't been too kind, so we figured we wouldn't lose anything by trying this out," Shawn Stolworthy told me when I called him at home, in Firth, Idaho (pop. 429), to ask about the unusual line of work he's gotten into lately. "It's going well. Last year I was a full-time farmer and only did four of them, but I've quit farming now, and it looks like I'll be doing twenty to thirty this year."

2 Twenty to thirty giant corn mazes, that is. Stolworthy is one of a number of farmers and entrepreneurs[1] who have recently moved into the improbably popular business of corn-maze design. It's a business that didn't exist at all until 1993, when a former Disney producer named Don Frantz produced "Cornelius the Cobasaurus," a 3.3-acre dinosaur maze with almost two miles of pathways cut into a central Pennsylvania cornfield. The maze was an immediate hit, and a new form of "agritainment"—the use of farmland as a source of public entertainment, to supplement[2] farmers' income—was born. ("To the list of more than 3,500 products made from corn," *American Small Farm Magazine* wrote at the time, "add fun.") Frantz went on to create the remarkably successful American Maze Company, which has now produced scores of increasingly elaborate mazes around the country and has spawned several competitors, among them Shawn Stolworthy.

3 Corn farmers can certainly use a boost these days—prices in the past few years have been hovering at or near all-time lows. When I asked Frantz just how lucrative mazes could be, he said, "Figure it this way: An acre of field corn can profit a farmer two hundred dollars, at best. Revenue[3] on our most successful sites, which average seven acres, has been over four hundred thousand dollars. These farms spent quite a lot, however, in order to deliver an entertaining, engaging maze attraction."

4 Therein lies the catch. Actually cutting a maze is a relatively simple operation—one stakes off a cornfield according to a plan and then cuts through the corn once it has begun to grow—but choosing a site, designing a maze for it, and marketing it are the real challenges. "Design is critical," Shawn Stolworthy told me. "You want your maze to be easy to get to, and you want it to look sharp and clean from the air, for good pictures and publicity." (To that end, and because it's more time-efficient than lower-tech methods, Stolworthy uses Global Positioning Software[4] to design and cut his mazes.) "You've got to make people jump an emotional barrier, so that instead of being in a corn maze, they feel they're in, say, a moose maze. People need an objective to accomplish, beyond just

[1] entrepreneurs: business people

[2] supplement: add to

[3] revenue: income from the sale of goods or services

[4] Global Positioning Software: a system that allows for people on earth to set and find exact locations on the ground using data from satellites located in space

making it through, so we try to create interactive games for them while they're inside. We try to keep them entertained for about two hours, which is about as much time as they'd spend in a movie, and we charge them about what they'd pay for a movie." Other essentials: good crowd control; readily available restrooms and refreshments; and fruit and vegetable stands, to sell other farm products. Most important, though, is an integrated marketing plan, which the top maze designers now all sell as a part of their design packages.

5 Signs indicate that the corn-maze business is still a growth industry. Don Frantz's mazes have become elaborately constructed "shows" that, according to his Web site, are put together by "an extraordinary collection of theater artists and craftsmen who love a great game."

Read the article about corn mazes. Then answer the questions that follow.

Lost in a Corn Maze

by Laurie Wallmark

1 DARKNESS HAS FALLEN, and the full moon casts blue-gray shadows around you. You shine your flashlight at the ten-foot tall cornstalks towering above your head. With every step, dried cornhusks crunch beneath your feet. You walk along paths filled with turns, loops, and dead ends. You hear laughter and voices, but no one is in sight. You're lost in a corn maze.

2 A corn maze is a large, walk-through puzzle carved into a cornfield. Seen from above, its winding paths may form a picture—anything from Halloween monsters to fire-breathing dragons, flying saucers to pirate ships, or sports heroes to scary witches.

3 A farmer may enlist the help of a maze designer to create these amazing images. The designer begins with a sketch, drawn either by hand or on a computer. The design is then plowed into a cornfield using hoes, tractors, or lawn mowers. Many designers use a digital device called a Global Positioning System, or GPS, to guide their cutting.

4 Although today's corn mazes may get a boost from modern technology, people have been designing, building, and getting lost in mazes for thousands of years. Mazes first appeared in Greek mythology; the most famous was the labyrinth at Knossos, home of the Minotaur, a half-man, half-bull monster. In the Middle Ages, gardeners built "puzzle hedges" in European castle gardens to amuse the royal court. By the 19th century, mazes had become a popular form of entertainment all over the world.

5 In 1993, producer Don Frantz and designer Adrian Fisher built the world's first corn maze in Annville, Pennsylvania. Their dino-shaped creation, "Cornelius, The Cobasaurus," sparked a corn maze craze—there are now approximately one thousand corn mazes across the United States, and corn mazes on every continent except for frosty Antarctica.

Part A

For each question, choose the best answer. Then completely fill in the circle for the answer you chose.

1. Which evidence from "The Maze Craze" supports the argument that corn mazes are a better use of land than corn crops?

Ⓐ Mazes provide greater revenue per acre.

Ⓑ Mazes employ fewer people than farming.

Ⓒ Mazes are enjoyable for people to explore.

Ⓓ Mazes have been important throughout history.

2. Which statement in "Lost in a Corn Maze" provides evidence to support the author's claim that corn mazes have become a popular attraction?

Ⓐ "A corn maze is a large, walk-through puzzle carved into a cornfield." (paragraph 2)

Ⓑ "A farmer may enlist the help of a maze designer to create these amazing images." (paragraph 3)

Ⓒ "People have been designing, building, and getting lost in mazes for thousands of years." (paragraph 4)

Ⓓ "There are now approximately one thousand corn mazes across the United States, and corn mazes on every continent except for frosty Antarctica." (paragraph 5)

3. Which detail from "Lost in a Corn Maze" does the photograph **best** show?

Ⓐ "You walk along paths filled with turns, loops, and dead ends." (paragraph 1)

Ⓑ "A corn maze is a large, walk-through puzzle carved into a cornfield." (paragraph 2)

Ⓒ "Seen from above, its winding paths may form a picture." (paragraph 2)

Ⓓ "The designer begins with a sketch, drawn either by hand or on a computer." (paragraph 3)

4. Which statement from "The Maze Craze" relates to the photograph in "Lost in a Corn Maze?"

Ⓐ "Stolworthy is one of a number of farmers . . . who have recently moved into the improbably popular business of corn-maze design." (paragraph 2)

Ⓑ "Corn farmers can certainly use a boost these days—prices in the past few years have been hovering at or near all-time lows." (paragraph 3)

Ⓒ "You want your maze to be easy to get to, and you want it to look sharp and clean from the air." (paragraph 4)

Ⓓ "People need an objective to accomplish, beyond just making it through, so we try to create interactive games for them while they're inside." (paragraph 4)

5. How do the two authors' presentations on how to create a corn maze differ?

Ⓐ In "The Maze Craze," the author describes the most time-efficient methods; in "Lost in a Corn Maze," the author highlights the artistic process involved.

Ⓑ In "The Maze Craze," the author points out the many steps and time involved; in "Lost in a Corn Maze," the author details techniques used in ancient times.

Ⓒ In "The Maze Craze," the author includes the high costs involved; in "Lost in a Corn Maze," the author stresses the importance of the finished product.

Ⓓ In "The Maze Craze," the author stresses the use of low-tech machinery to achieve the desired results; in "Lost in a Corn Maze," the author stresses the importance of the designer in the process.

6. How does the author of each article present the information about Don Frantz's "Cornelius the Cobasaurus"?

Ⓐ Both compare smaller mazes to this large corn maze.

Ⓑ Both credit this maze for making corn mazes popular.

Ⓒ Both acknowledge the hard work that goes into making corn mazes.

Ⓓ Both praise farmers for allowing designers to turn their land into entertainment.

Part B

Write your answer in the box provided.

1. In "The Maze Craze," Shawn Stolworthy claims that the corn maze business is "going well." Analyze whether Stolworthy's claim is well supported.

- Be sure to state the claim and support it with evidence.
- Be sure to include opposing ideas.
- Be sure that your writing is logical and thorough.