

# Grade 11 Informational Mini-Assessment

## Stalagmite Trio

This grade 11 mini-assessment is based on two texts and an accompanying video about cave formations. The subject matter, as well as the stimuli, allow for the testing of the Common Core State Standards (CCSS) for Literacy in Science and Technical Subjects and the Reading Standards for Informational Texts. The texts are worthy of students’ time to read, and the video adds a multimedia component to make the task a more complete and authentic representation of research. The texts meet the expectations for text complexity at grade 11. Assessments aligned to the CCSS will employ quality, complex texts such as these, and some assessments will include multimedia stimuli as demonstrated by this mini-assessment.

Questions aligned to the CCSS should be worthy of students’ time to answer and therefore do not focus on minor points of the texts. Several standards may be addressed within the same question because complex texts tend to yield rich assessment questions that call for deep analysis. In this mini-assessment there are twelve questions that address the Reading Standards below. There is also one constructed response item that addresses Reading, Writing, and Language standards. We encourage educators to give students the time that they need to read closely and write to sources. Please note that this mini-assessment is likely to take at least two class periods.

**The thirteen questions align to the following standards:**

<b>RI.11-12.1</b>	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
<b>RI.11-12.2</b>	Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; provide an objective summary of the text.
<b>RI.11-12.3</b>	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
<b>RI.11-12.4</b>	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
<b>RI.11-12.5</b>	Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.
<b>RI.11-12.7</b>	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
<b>RST.11-12.1</b>	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

<b>RST.11-12.2</b>	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
<b>RST.11-12.4</b>	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to <i>grades 11-12 texts and topics</i> .
<b>RST.11-12.6</b>	Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
<b>RST.11-12.7</b>	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
<b>RST.11-12.9</b>	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
<b>W.11-12.2</b>	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
<b>W.11-12.4</b>	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
<b>W.11-12.7</b>	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
<b>W.11-12.8</b>	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
<b>W.11-12.9</b>	Draw evidence from literary or informational texts to support analysis, reflection, and research.
<b>L.11-12.1</b>	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
<b>L.11-12.2</b>	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
<b>L.11-12.3</b>	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

## Contents

Grade 11 Mini-Assessment – Stalagmite Trio ( <i>print for students</i> ).....	p. 4
Information for Teachers: Quantitative and Qualitative Analyses of the Texts .....	p. 14
Question Annotation: Correct Answer(s) and Distractor Rationales .....	p. 18
Additional Resources for Assessment and CCSS Implementation .....	p. 23

The assessment questions in this document align with the CCSS and reflect the instructional shifts implied by the standards. To learn more about these topics, please go to the following link:

[www.achievethecore.org](http://www.achievethecore.org)

## Grade 11 Mini-Assessment – Stalagmite Trio

Today you will read two passages about cave formations and watch a video of the researchers who are discussed in one of the passages. You will then answer several questions based on the passages and the video. I will be happy to answer questions about the directions, but I will not help you with the answers to any questions. You will notice as you answer the questions that some of the questions have two parts. You need to answer Part A of the question before you answer Part B, but you may go back to Part A if you want to.

Take as long as you need to read and answer the questions. It is likely that it will take you at least an hour and a half to finish the questions, not including the essay. If you do not finish, we will discuss ways to secure some extra time to complete.

Now read the passage and answer the questions. I encourage you to write notes in the margin as you read the passages.

### Passage 1: Nature’s Cave Sculptures

- 1 Speleothems, formations created by accumulating mineral deposits contained in water drips, provide natural decorations in caves all over the world. Although these fragile structures are often stunningly beautiful, the science behind how they form is just as intriguing.
- 2 The National Park Service explains the process of speleothem formation as follows: “Most speleothems are formed in similar ways. All formations are formed by water saturated with dissolved calcium. The water begins on the surface, where the water passes through the soil and absorbs carbon dioxide, transforming the water into a weak carbonic acid. This weak acid then dissolves a small amount calcium from the limestone rock as it travels through cracks and pores on its way to the cave system. As the water drips into the air-filled cave, the dissolved carbon dioxide released. Because the water has lost carbon dioxide, it cannot hold as much dissolved calcium. The excess calcium is then precipitated<sup>1</sup> on the cave walls and ceilings to make up speleothems. Most calcium deposited in the cave in the form of the mineral calcite (CaCO<sub>3</sub>). Slight differences to this process result in the creation of different cave decorations.”
- 3 The two main types of speleothems are stalagmites and stalactites. When mineralized water drips from the ceiling of a cave, the drops land in the same general area time and time again. As the water evaporates, the minerals remain and begin to amass on the

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<sup>1</sup> Precipitated: a chemical reaction that causes a substance to be deposited in solid form

cave floor, growing into stalagmites. Stalagmites, therefore, are upward-growing mounds of those mineral deposits. Stalactites are also formed from mineralized water, but the difference is that these particular formations hang from the cave ceilings. Because they form through such a similar process, stalagmites and stalactites are usually found in pairs, sometimes eventually joining in the middle to form columns. On the way down, the dripping water deposits some minerals at the top of the cave, forming icicle-like structures: stalactites. Once the drips land and the water evaporates from the cave floor, conical stalagmites emerge.

- 4 Scientists often cut open any type of speleothem to observe a cross-section of the layers of minerals deposited over hundreds or even thousands of years. Much can be learned about the prior geological conditions of a cave by studying these samples. For example, some cross-sections reveal subtle differences in the texture and color in the bands that make up a speleothem. These changes in texture and color reveal changes in the mineral content of the speleothem.



*Stalactites and Stalagmites in Lehman Caves*

NPS PHOTO

- 5 Despite their often strong appearance, cave formations are extremely fragile; human contact can impact the growth of the structures. Recreational viewers must be careful to avoid contact with these majestic cave formations. The extent of damage a human can cause to a speleothem depends on several factors, such as the diameter and age of the formation, or the current environmental conditions of the cave in which it grows. Oils from human skin can prevent a speleothem from growing, at least for a while, because the dripping water may simply slide away due to the oil. In fact, according to a 46-page document published by the National Speleological Society, many states have passed laws that protect these amazing natural sculptures for the enjoyment of future generations.

## Passage 2: Stalagmite Gives Further Evidence that Climate Change Contributed to Mayan Collapse

- 1 Archaeologists have long suspected that climate change may have caused droughts that brought the agriculture-based Maya civilization to its knees. A new study published in *Science* last week bolsters this theory with new physical evidence, showing that ancient droughts correspond with political upheaval as recorded in stone carvings.
- 2 Scientists generally figure out what long-ago climates looked like by measuring oxygen isotopes in sediment samples. These isotopes are variations on the oxygen atom that have eight, nine, or ten neutrons, depending on the amount of water present when the sediment was deposited. A sediment layer's ratio of heavy versus light oxygen isotopes can tell scientists when the layer was formed and what the climate was like at that time. Researchers in past studies have relied on sediment cores from lakes or oceans, but the researchers in this study used a stalagmite from a cave near the ancient Maya city of Uxbenká, in present-day Belize.
- 3 Protected by the cave, the stalagmite's layers were better preserved than those from the bottom of a lake or ocean. Plus, the data derived from these layers were much more detailed. The scientists were able to see what the climate was like in Mesoamerica over the past 2,000 years, and zoom in to intervals as short as 6 months.
- 4 The scientists compared their new and improved climate timeline with historical records the Maya carved into nearby stone monuments and found some interesting overlap. A period of unusually wet conditions in the mid-fifth century coincides with carvings that describe a major population boom and the expansion of political centers.
- 5 A drying trend in the later half of that century corresponds to records of political disintegration and warfare. For 80 years after the dry spell, climate records indicate extreme drought conditions, and the concurrent lack of stone monuments suggests that Mayan leaders were no longer commissioning them to be carved. With this new physical evidence of a climate change-related collapse, the researchers have reinforced theories that the once-great Mayan civilization dried up sometime between 1020 and 1100 A.D.

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**When the class is ready, we will watch the video together. To signal that you are ready to watch the video, please turn your mini-assessment face down on your desk.**

**We will watch the video twice, as some of the questions later in this mini-assessment will be asking you to remember specific information from it.**

<http://www.youtube.com/watch?v=DjjoHhLGgGc>

Video: UNM Research on Disintegration of Maya Political System and Climate Change. Shot and edited by Michael Mellas.  
University of New Mexico <http://www.youtube.com/watch?v=DjjoHhLGgGc>

**QUESTIONS:**

1. Understanding Passage 1 requires the reader to distinguish among several closely related scientific terms. Complete the chart by matching a term from the Word Bank to its corresponding definition. Not all terms from the Word Bank will be used.

**Word Bank**

carbonic acid	stalactites	mineralized
speleothem	Stalagmites	conical

<b>Term</b>	<b>Definition</b>
	Cave deposits located on ceilings
	General name for rock formations in caves
	Formations rising from cave floors
	Containing dissolved solids that serve as the building materials for rock formations

2. Based on paragraph 4 of Passage 1, what does the term cross-section mean?
- A. a core sample obtained by drilling into a substance
  - B. a representative slice taken from an object
  - C. a portion of a written account
  - D. a small group of individuals culled from a larger group
3. The following question has two parts. Answer Part A and then answer Part B.

**PART A: What is the author’s main purpose in Passage 1?**

- A. to explain the composition and formation of stalagmites and stalactites
- B. to explain the many difference between stalagmites and stalactites
- C. to advocate for more protection of stalagmites and stalactites
- D. to describe the natural beauty of stalagmites and stalactites

**PART B: In Passage 1, which paragraph best helps develop the author’s main purpose?**

- A. Paragraph 1
- B. Paragraph 2
- C. Paragraph 4
- D. Paragraph 5



4. Based on information in Passage 1, what are two benefits of speleothems?

- A. providing insight into past civilizations
- B. yielding valuable minerals
- C. preserving the delicate environment within a cave
- D. offering insights into the past
- E. suggesting a way to accurately date artifacts
- F. providing opportunities for recreational viewing

5. In Passage 2, the author develops several central ideas. In Column A, circle the two ideas that are central ideas rather than minor ideas in the passage. In Column B, copy a sentence from the passage that the author includes to provide evidence for each of the two central ideas you chose in Column A.

COLUMN A	COLUMN B
The study of the layers of a stalagmite has resulted in new data that provide insights about how climate change affected the Mayan civilization.	
Scientists typically study oxygen isotopes in sediment to reveal data about climate change.	
Archaeologists have long believed that climate change may have impact the Mayan civilization.	
Scientists have been studying climate change for many years to gain insight into the past.	
Climate change played a significant role in the disappearance of the Mayan civilization.	

6. Which two words below does the author of Passage 2 use in the last two paragraphs to emphasize that several factors, when considered together, all lead to the same conclusion?
- A. “records”
  - B. “compared”
  - C. “coincides”
  - D. “trend”
  - E. “corresponds”
  - F. “indicate”
  - G. “evidence”
7. Which sentence best describes how the author of Passage 2 uses the structure of the text to effectively convince the reader that climate change caused the Mayan civilization to die out?
- A. The author first states a conclusion about the Mayan civilization and then describes the scientific processes that led to that conclusion.
  - B. The author describes previous theories about the Mayan civilization and then compares those theories to current findings.
  - C. The author traces the chronological events caused by climate change, showing that this chronology led to the downfall of the Mayan civilization.
  - D. The author first explains droughts as a cause and then links that cause to an effect, which was the downfall of the Mayan civilization.
8. Based on information in Passage 1 and Passage 2, what are the two key scientific facts that make possible the research described in Passage 2?
- A. Stalagmites are found in many interesting shapes and sizes.
  - B. When water evaporates, it leaves mineral deposits behind.
  - C. Stalagmites often are found near the stalactites that grow on the ceiling of a cave.
  - D. The isotopes of oxygen found in layered deposits reveal the climate at the time.
  - E. Stone monuments are the best way to learn about ancient civilizations.
  - F. Periods of abundant rainfall guarantee a nation’s population growth.
9. What do the researchers in the video most likely mean when they use the term “modeling”?
- A. Making a miniature copy or representation of something
  - B. Being the subject for an artist, sculptor, or photographer
  - C. Structuring an organization so that it functions at greatest effectiveness
  - D. Analyzing past and current trends in an attempt to predict future ones

10. What are three ways that the video complements and enhances the information in Passage 2?

- A. It mentions that the project began in 2006.
- B. It reinforces the idea that climate change shapes human civilization.
- C. It shows the machine the researchers used to conduct their analysis.
- D. It defines the phrase “speleothem technique.”
- E. It describes how the researchers intend to use the technology in the future.
- F. It identifies the Belize cave that the stalagmite came from.
- G. It provides details about the decline of Mayan civilization.

11. The CLAIM column of the chart below contains claims made by researchers in the video. Choose one idea from the passages that provides the best support for each claim and write the idea in the correct place on the chart.

Claim	Support
Stalagmites contain “many, many, many archives.”	
New technology allows for “smaller samples, better precision.”	

**List of Ideas from Passage 1 and Passage 2**

Stalactites are often found near stalagmites.

Climate data can be measured in 6-month intervals.

Stalagmites grow in roughly conical shapes.

Stalagmites may contain colored bands.

Many stalagmites are made of calcium carbonate.

It takes a very long time for stalagmites to develop.

Underwater sediment cores offer less data than stalagmites do.

- 12. How does the video effectively develop the idea presented in Passage 2 that the UNM researchers have contributed to a breakthrough in archaeological climate research?**
- A.** It highlights the technique and technology used to solve a scientific mystery and describes what scientists hope to accomplish next.
  - B.** It interviews different researchers who were involved in designing a new technique and shows what each one contributed to the project.
  - C.** It features scientists explaining the workings of a machine that provides a definite understanding of what happened to Mayan civilization.
  - D.** It looks at current theories about climate change and its effect on humans and explains how scientists will soon be able to test those theories.
- 13. (Optional) Synthesize information from Passage 1, Passage 2, and the video to write an essay explaining how stalagmites are formed, why they have gained importance in archeological climate research, and what researchers have learned from stalagmites so far. Be sure to provide evidence from all three sources to support your response. Use the lines provided below and on the next page for your essay.**

Your response will be scored on how well you:

- **Demonstrate your understanding of the ideas of the text**
- **Use evidence from the text to help develop and support your ideas**
- **Organize your response in a logical manner**
- **Demonstrate an appropriate writing style through the use of precise word choice and varied sentences**
- **Use standard conventions for writing**

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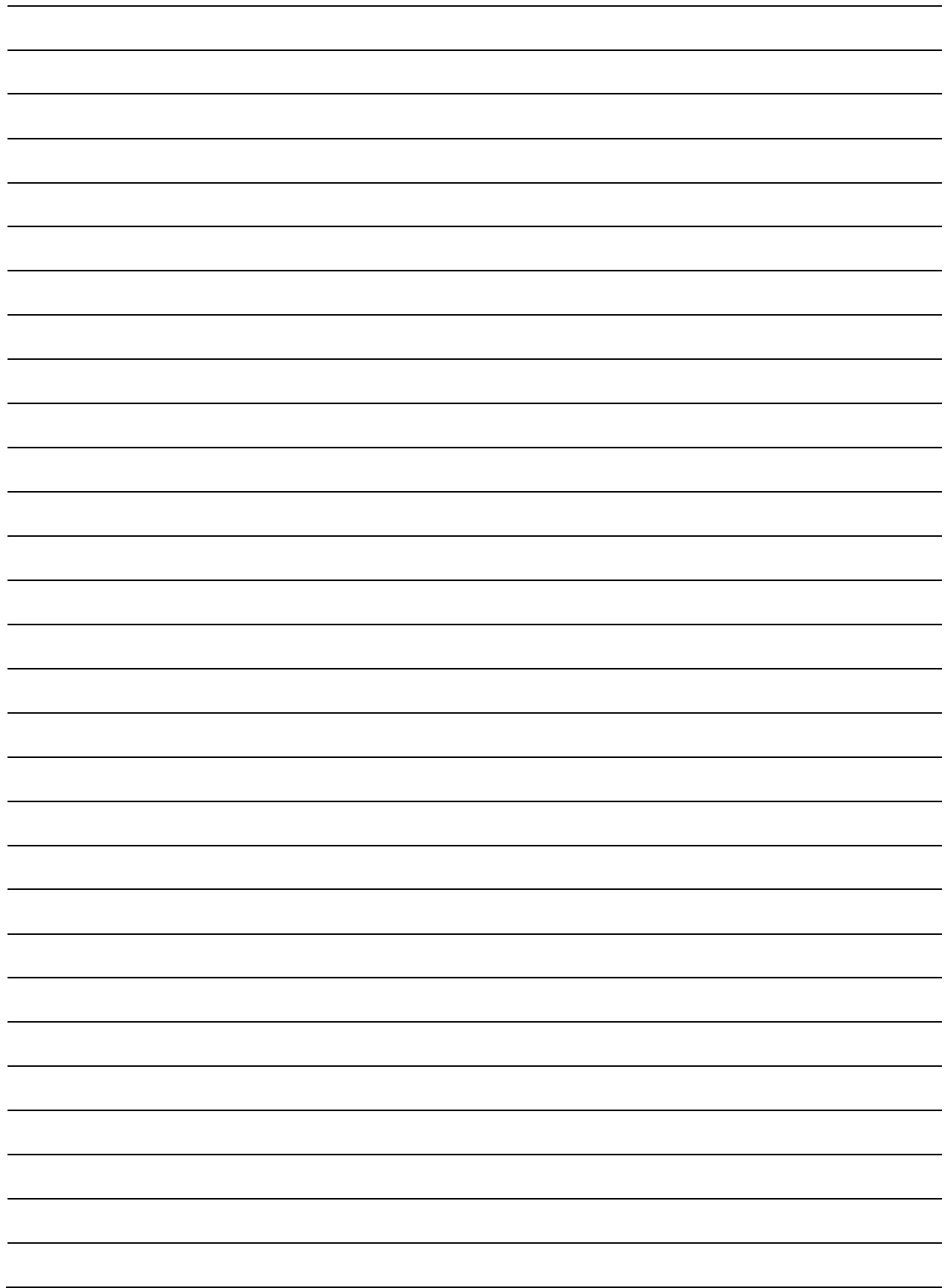
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## Information for Teachers: Quantitative and Qualitative Analyses of the Texts

Regular practice with complex texts is necessary to prepare students for college and career readiness. These texts have been placed at grade 11 for the purpose of this mini-assessment. This section of the document provides an explanation of the process that was used to place the texts at grade 11, illustrating why the texts meet the expectations for text complexity in Reading Standard 10. Appendix A of the Common Core State Standards and the Supplement to Appendix A: *New Research on Text Complexity* lay out a research-based process for selecting complex texts. According to Appendix A of the CCSS, the first step in selecting grade level appropriate texts is to place a text within a grade band according to a quantitative text complexity score.

The quantitative data for Text 1 and Text 2 are below:

	Quantitative Measure #1	Quantitative Measure #2
<b>Passage 1: “Nature’s Cave Sculptures”</b> (circled in orange on the chart below)	Flesch-Kincaid: 11.3	Lexile: 1380
<b>Passage 2: “Stalagmite Gives Further Evidence . . .”</b> (circled in blue on the chart below)	Flesch-Kincaid: 14.1	Lexile: 1280

After gathering the quantitative measures, the next step is to place the quantitative scores in the Conversion Table found in the Supplement to Appendix A ([www.corestandards.org/resources](http://www.corestandards.org/resources)) and determine the **grade band** of the text:

Figure 1 reproduces the conversion table from the Supplement to Appendix A, showing how the initial results from Flesch-Kincaid and the Lexile measure were converted to grade bands.

**Figure 1: Updated Text Complexity Grade Bands and Associated Ranges from Multiple Measures<sup>7</sup>**

Common Core Band	ATOS	Degrees of Reading Power®	Flesch-Kincaid <sup>§</sup>	The Lexile Framework®	Reading Maturity	SourceRater
2 <sup>nd</sup> – 3 <sup>rd</sup>	2.75 – 5.14	42 – 54	1.98 – 5.34	420 – 820	3.53 – 6.13	0.05 – 2.48
4 <sup>th</sup> – 5 <sup>th</sup>	4.97 – 7.03	52 – 60	4.51 – 7.73	740 – 1010	5.42 – 7.92	0.84 – 5.75
6 <sup>th</sup> – 8 <sup>th</sup>	7.00 – 9.98	57 – 67	6.51 – 10.34	925 – 1185	7.04 – 9.57	4.11 – 10.66
9 <sup>th</sup> – 10 <sup>th</sup>	9.67 – 12.01	62 – 72	8.32 – 12.12	1050 – 1335	8.41 – 10.81	9.02 – 13.93
11 <sup>th</sup> – CCR	11.20 – 14.10	67 – 74	10.34 – 14.2	1185 – 1385	10.57 – 12.00	12.30 – 14.50

To find the **grade level** of the text within the designated grade band, engage in a systematic analysis of the characteristics of the text. A sample of the characteristics that should be analyzed by doing a qualitative analysis can be found in Appendix A of the CCSS. ([www.corestandards.org](http://www.corestandards.org)).

### Qualitative Analysis for Text 1: “Nature’s Cave Sculptures”

Category	Notes and comments on text, support for placement in this band	Where to place within the band?					
		NOT suited to band	Early to mid-11	end 11-early 12	Mid-end 12 <sup>th</sup>	CCR	NOT suited to band
Structure (story structure or form of piece or sentence demands if notable)	The structure of the text is simple and accessible: the author uses main idea and supporting details. Paragraph 1 defines speleothems and introduces the main idea of the text, the formation of these natural structures. Paragraph 2 then provides the details about how they are formed, relating the process through scientific explanation. Paragraph 3 provides even more detail, discussing how the process creates stalagmites and stalactites, two of the different kinds of speleothems. Paragraph 4 discusses what can be learned from speleothems, and paragraph 5 explains how humans impact speleothems and explains the steps taken to preserve speleothems for future generations.						
Language Clarity and Conventions (including vocabulary load)	The text contains a few references to minerals and elements (calcium, carbon dioxide, calcite). However, the relationship among these terms is clear in regard to where they fall within the process of speleothem formation. Most vocabulary should be familiar to grade 11 students. Sentence structures vary, and punctuation, especially in regard to the use of colons, helps establish the relationship among them.						
Knowledge Demands (life, content, cultural/literary)	Because the text clearly outlines the process of speleothem formation and explains in depth how variations in the process result in the two main types of speleothems, there is no prior knowledge needed. Additionally, the photograph will help students establish a visual image of these natural phenomena.						
Levels of Meaning (chiefly literary) / Purpose (chiefly informational)	There is one main purpose: To explain how stalagmites and stalactites are formed.						
<b>Overall placement</b> Grade 11	<b>Justification: Because of the straightforward purpose, generally grade-level appropriate vocabulary, and lack of requirement for prior knowledge, this text rates as readily accessible for students.</b>						

## Qualitative Analysis for Text 2: “Stalagmite Gives Further Evidence that Climate Change Contributed to Mayan Collapse”

Category	Notes and comments on text, support for placement in this band	Where to place within the band?					
		NOT suited to band	Early to mid-11	end 11-early 12	Mid-end 12 <sup>th</sup>	CCR	NOT suited to band
Structure (story structure or form of piece or sentence demands if notable)	The purpose of the passage is provided in the first paragraph of the text: to explain the research done on the relationship between climate change and the downfall of the Mayan culture. The rest of the paragraphs provide details to support this claim by explaining the research process that took place as well as the findings.						
Language Clarity and Conventions (including vocabulary load)	The syntax and language used in this text are both more sophisticated than in Passage 1, but again there is context provided for most of the challenging words. The word “isotopes” is defined for the students, for example. Although there are some complex sentences, there are transitions that help tie the concepts together, again helping students navigate the text.						
Knowledge Demands (life, content, cultural/literary)	Although students with knowledge of the Mayan culture may be advantaged by knowledge of other theories of their demise, that knowledge is not required to understand the point of this text, that new evidence shows a strong correlation between the downfall of the Mayans and the climate at the time.						
Levels of Meaning (chiefly literary)/ Purpose (chiefly informational)	The text has a single purpose, to explain the process and results of a recent research study linking the disappearance of the Mayans and droughts.						
<b>Overall placement</b> Grade 11	<b>Justification: The language and syntax used in this text are rather sophisticated, but the structure is straightforward and no prior knowledge is needed. Although it is more difficult for 11<sup>th</sup> graders than Passage 1, Passage 2 is still in the moderately complex range.</b>						



### Qualitative Analysis for Text 3: UNM Research on Disintegration of Maya Political System and Climate Change.

Category	Notes and comments on text, support for placement in this band	Where to place within the band?					
		NOT suited to band	Early to mid-11	end 11-early 12	Mid-end 12 <sup>th</sup>	CCR	NOT suited to band
Structure (story structure or form of piece or sentence demands if notable)	The structure of the video is relatively simple for students to follow in that a central idea is introduced, and followed by supporting details and concrete examples. The first speaker states the central idea of the video: that technology is being used in new ways to understand the decline of Mayan political systems. The speakers use the example of the Yok Balume caves to show where the work occurs and the description of the new multi-collector ICP Mass Spectrometer to provide supporting details that explain their work.						
Language Clarity and Conventions (including vocabulary load)	The language of the video is quite complex. There are many Tier Two words (e.g. paradigm, archives, amenable) as well as complex, domain-specific words (Uranium series dating, calcite, Mass-spectrometer etc.). The Tier Three vocabulary is contextualized with the images, and the speakers provide some explanation of their meaning.						
Knowledge Demands (life, content, cultural/literary)	Students who have closely read the paired texts will have an easier time contextualizing the information provided in the video. Students who have a general grasp of the idea of scientific modeling will also have an easier time with the information, though there is some context provided to explain how scientists are using the models they develop.						
Levels of Meaning (chiefly literary)/ Purpose (chiefly informational)	The purpose of the text is straightforward: to explain a new body of research and introduce a tool that is being used to study climate change and the decline of the Mayan civilization.						
<b>Overall placement</b> Grade 11	<b>Although the purpose and structure are relatively straightforward, the complex language and knowledge demands add significant complexity to the film. As such, the text is most appropriate for 11th grade students.</b>						

## Question Annotations: Correct Answer(s) and Distractor Rationales

Question Number	Correct Answer(s)	Standards	Rationales for Answer Options
1	see Right	RST.11-12.4, RST.11-12.1, RI.11-12.4, RI.11-12.1	<p>Stalactites: Cave deposits located on ceilings <i>Rationale:</i> In paragraph 3, the author describes stalactites as formations that “hang from the cave ceilings” and “icicle-like structures.”</p> <p>Speleothem: Rock formations in caves <i>Rationale:</i> In paragraph 1, the author describes speleothems as “formations created by mineral deposits,” and “natural decorations in caves.”</p> <p>Stalagmites: Formations rising from cave floors <i>Rationale:</i> In paragraph 3, the author describes stalagmites as emerging on “the cave floor” “once the drips land and the water evaporates.”</p> <p>Mineralized: Containing dissolved solids <i>Rationale:</i> In paragraph 3, the author uses the word “mineralized” to describe the water that has gone through the process described in paragraph 2, where the water contains “dissolved calcium.”</p>
2	B	RST.11-12.4, RST.11-12.1, RI.11-12.4, RI.11-12.1	<p>A. “A core sample obtained by drilling into a substance” focuses on a small area at the center, rather than the many layers of the stalagmite.</p> <p>B. This is the correct answer. “A representative slice taken from an object” is the definition of cross-section. The passage states that the stalagmite must be “cut open” to observe the varied bands.</p> <p>C. Although “section” may mean a portion, the passage focuses on observations of the layers of stalagmites rather than written accounts.</p> <p>D. “A small group of individuals culled from a larger group” focuses on another meaning of the term cross-section rather than the physical piece of a stalagmite, which is the meaning of the word as used in the passage.</p>
3, Part A	A	RST.11-12.6, RST.11-12.1, RI.11-12.1	<p>A. This is the correct answer. To explain stalagmites and stalactites to the audience, the author explains what speleothems are composed of and how they are formed.</p> <p>B. Although the author mentions the basic differences between stalagmites and stalactites, she does so to explain how the formation process is very similar.</p> <p>C. Although the author mentions that laws exist to protect speleothems, she does not necessarily advocate for more protection.</p> <p>D. Although the beauty of speleothems is referenced, that characteristic is not a major focus of the text.</p>
3, Part B	B		<p>A. Paragraph 1 defines the term speleothems, but does not speak to the author’s purpose of explaining their formation.</p> <p>B. This is the correct answer. Paragraph 2 explains the complicated chemical process that creates speleothems.</p> <p>C. Paragraph 4 discusses what can be learned from speleothems, but not what they are actually composed of.</p> <p>D. Paragraph 5 discusses how humans impact stalagmites and stalactites, and explains how these formations are protected, not what they are made of or how they are formed</p>

Question Number	Correct Answer(s)	Standards	Rationales for Answer Options
4	D, F	RST.11-12.2, RST.11-12.1, RI.11-12.1	<p>A. Although Passage 1 mentions that insights can be gleaned from studying speleothems, those insights are not about past civilizations.</p> <p>B. Speleothems do not yield valuable minerals; instead, the passage describes how speleothems are formed from deposits of minerals.</p> <p>C. Although the passage notes that speleothems are delicate, it does not mention any benefit provided to the surrounding cave by the formations.</p> <p>D. This is a correct answer. Paragraph 4 explains geological insights that can be gleaned from analyzing a stalagmite cross-section.</p> <p>E. Although the passage mentions that speleothems form over time slowly, it does not relate that fact to dating any artifacts.</p> <p>F. This is a correct answer. Paragraphs 1 and 5, and even the title of the passage, speak to the natural beauty of speleothems and preserving them for future generations to enjoy.</p>
5	See right column	RST.11-12.2, RST.11-12.1, RI.11-12.2, RI.11-12.1	<p><b>Central idea 1:</b> The study of the layers of a stalagmite has resulted in the most reliable data to date that shows climate change was responsible for the collapse of the Mayan civilization.</p> <p><b>Possible supporting sentences for Central idea 1:</b></p> <ul style="list-style-type: none"> <li>• Protected by the cave, the stalagmite’s layers were better preserved than those from the bottom of a lake or ocean.</li> <li>• Plus, the data derived from these layers were much more detailed.</li> <li>• The scientists were able to see what the climate was like in Mesoamerica over the past 2,000 years, and zoom in to intervals as short as 6 months.</li> <li>• The scientists compared their new and improved climate timeline with historical records the Maya carved into nearby stone monuments and found some interesting overlap.</li> </ul> <p><i>Rationale:</i> The knowledge gained from studying stalagmites provides insight about climate change during the time the Mayan civilization. This is a key idea in the article.</p> <p><b>Central idea 2:</b> Climate change played a significant role in the disappearance of the Mayan civilization.</p> <p><b>Possible supporting sentences for central idea 2:</b></p> <ul style="list-style-type: none"> <li>• A drying trend in the later half of that century corresponds to records of political disintegration and warfare.</li> <li>• For 80 years after the dry spell, climate records indicate extreme drought conditions, and the concurrent lack of stone monuments suggests that Mayan leaders were no longer commissioning them to be carved.</li> <li>• With this new physical evidence of a climate change-related collapse, the researchers have reinforced theories that the once-great Mayan civilization dried up sometime between 1020 and 1100 A.D.</li> </ul> <p><i>Rationale:</i> The idea that climate change played a significant role in the decline of the Mayan civilization is another central idea of the text.</p> <p>Any of the bullets above would serve as support for the central ideas identified. The other ideas presented in the “Central Idea” column are all minor ideas presented in the text.</p>

Question Number	Correct Answer(s)	Standards	Rationales for Answer Options
6	C, E	RST.11-12.4, RST.11-12.1, RI.11-12.4, RI.11-12.1	<p>A. "Records" refers to the data on the drought conditions, not how multiple factors support the same conclusion.</p> <p>B. "Compared" describes scientists viewing their new timeline against historical records to look for similarities and differences but not how several pieces of information led to the same conclusion.</p> <p>C. This is a correct answer. "Coincides" refers to how scientists' various findings on climate conditions overlap with the social and political growth of Mayan civilization and how the change in climate aligned to Mayan decline.</p> <p>D. "Trend" refers to one of the climate changes, not how several trends led to a collective understanding.</p> <p>E. This is a correct answer. "Corresponds" refers to how a trend and records align, connecting multiple factors.</p> <p>F. "Indicate" refers to a signal of climate conditions, not how many factors together led to a conclusion.</p> <p>G. "Evidence" refers to one of the factors, not the several factors that are used to draw a conclusion.</p>
7	A	RI.11-12.5, RI.11-12.1	<p>A. This is the correct answer. The article begins by stating that "Archaeologists have long suspected that climate change may have caused droughts that brought the agriculture-based Maya civilization to its knees." The rest of the article then describes a specific study of stalagmites that helped prove the suspicions were correct.</p> <p>B. The text does not compare previous theories about the collapse of the Mayan civilization to current findings.</p> <p>C. The text is not structured in a way that shows a series of chronological events led to the downfall of the Mayans. Instead, he proves that climate change was the main factor as shown by evidence collected from stalagmites.</p> <p>D. Droughts are a later consequence of climate change, and the author does not mention them until later in the text when we connect climate change to the downfall of the Mayans.</p>
8	B, D	RI.11-12.3, RI.11-12.1	<p>A. Although stalagmites come in many different shapes and sizes, this fact does not help aid research. It is the materials within a stalagmite that reveal information.</p> <p>B. This is a correct answer. The mineral deposits left behind after water evaporates can reveal much about the climates during the time the stalagmites formed.</p> <p>C. Although stalagmites are found near stalactites, this fact does not aid research.</p> <p>D. This is a correct answer. The isotopes of oxygen found in layered deposits of stalagmites reveal what the climate was like during the extended time of formation.</p> <p>E. Although stone monuments are one relict of some ancient civilizations, they cannot provide exact information for research as stalagmites can.</p> <p>F. Although abundant rainfall helps crops grow, which can feed populations, there is no "guarantee" of growth, as many other factors must come into play.</p>
9	D	RST.11-12.1, RI.11-12.4, RI.11-12.1	<p>A. "Making a miniature copy or representation of something" is one meaning of "modeling," but the scientists in the video do not use this meaning of the word "modeling."</p> <p>B. "Being the subject for an artist, sculptor, or photographer" is one meaning of "modeling," but the scientists in the video do not use this meaning of the word "modeling."</p> <p>C. "Structuring an organization so that it functions at greatest effectiveness" is one definition of "modeling" but is not the meaning used in the context of the video.</p> <p>D. This is the correct answer. The scientist explains how establishing chronologies of past events ("modeling") can be developed into theories and applied to new civilizations.</p>

Question Number	Correct Answer(s)	Standards	Rationales for Answer Options
10	B, C, F	RST.11-12.9, RST.11-12.7, RI.11-12.7, RST.11-12.1, RI.11-12.1	<p>A. The dates from the project in the video and Passage 2 that are most important relate to the timeline of the Mayan civilization and the development of the stalagmites, rather than the date of the project.</p> <p>B. This is a correct answer. Both sources offer evidence to support their claims that climate change had an impact on the Mayan civilization.</p> <p>C. This is a correct answer. The video features the machine described in paragraph 2 of the article.</p> <p>D. The “speleothem technique” in the video focuses on uranium dating rather using the oxygen isotopes mentioned in the article.</p> <p>E. Although the video includes information on how scientists hope to use the technology in the future, Passage 2 focuses only on the results of the study.</p> <p>F. This is a correct answer. The video includes images from the cave mentioned in paragraph 2 of Passage 2.</p> <p>G. Although Passage 2 provides details about the decline of Mayan civilization, the video does not mention this topic.</p>
11	See right column	RST.11-12.9, RST.11-12.7, RI.11-12.7, RST.11-12.1, RI.11-12.1	<p><b>Claim:</b> Stalagmites contain “many, many, many archives”  <b>Support:</b> It takes hundreds of years for stalagmites to develop.  <i>Rationale:</i> This evidence supports the claim because the lengthy development process of stalagmites leads to the inclusion of many data points within the formations.</p> <p><b>Claim:</b> New technology allows for “smaller samples, better precision”  <b>Support:</b> Climate data can be measured in 6-month intervals.  <i>Rationale:</i> This evidence supports the claim because determining the origin of a sample down to a six-month interval within a stalagmite formed over hundreds of years illustrates a more precise data source that is yielded through new technology.</p>
12	A	RI.11-12.3, RI.11-12.7, RST.11-12.6, RST.11-12.1, RI.11-12.1	<p>A. This is the correct answer. The video explains the speleothem technique, features technology like the mass spectrometer, and explains how scientists hope to incorporate their findings with those of scientists focused on modeling climate change.</p> <p>B. Although the video shows interviews of multiple scientists involved in the study, the focus of each interview is the information gleaned from various aspects of the research, rather than the role of each participant.</p> <p>C. Although the video mentions technological advancements, these advancements are not the focus of the video, nor do the scientists suggest that they know definitively what happened to the Mayans.</p> <p>D. The video does not review current theories about climate change, but rather focuses on a study of past climate change.</p>

Question Number	Correct Answer(s)	Standards	Rationales for Answer Options
<p align="center"><b>13</b> <b>Optional writing prompt</b></p>	<p align="center">See right column</p>	<p>W.11-12.9, W.11-12.8, W.11-12.7, W.11-12.4, W.11-12.2, RST.11-12.9, RST.11-12.7, RST.11-12.1, RI.11-12.7, RI.11-12.1, L.11-12.3, L.11-12.2, L.11-12.1</p>	<p>A top score response will include most or all of the following :</p> <ul style="list-style-type: none"> <li>• stalagmites grow on cave floors</li> <li>• stalagmites take hundreds or even thousands of years to grow</li> <li>• stalagmites are made of deposits left behind after mineralized water drips down and then evaporates</li> <li>• over time, the deposits in stalagmites form layers</li> <li>• climate researchers have generally looked at the layers in sediment cores from the bottom of a lake or ocean</li> <li>• around 2006, researchers instead looked at a cross section of a stalagmite from a cave in Belize</li> <li>• the stalagmite’s layers were better preserved and provided more detailed climate data than did sediment cores</li> <li>• the UNM researchers who did the study are excited about the new “speleothem technique” which can date material and reveal the climate at any point in a sample</li> <li>• these researchers used a machine (an ICP mass spectrometer) for fast, precise analysis of the stalagmite</li> <li>• the analyzed stalagmite clearly showed which periods of Mayan history were wet and which were dry</li> <li>• wet and dry periods indicated by the stalagmite corresponded to records indicated by carved Mayan stones</li> <li>• dry periods appeared to cause upheaval, which supports the theory that climate change caused the Mayans’ demise</li> </ul>

## Additional Resources for Assessment and CCSS Implementation

**Shift 1 – Complexity:** *Regular practice with complex text and its academic language*

- See Appendix B for examples of informational and literary complex texts:  
[http://www.corestandards.org/assets/Appendix\\_B.pdf](http://www.corestandards.org/assets/Appendix_B.pdf)
- See the Text Complexity Collection on [www.achievethecore.org](http://www.achievethecore.org)

**Shift 2 – Evidence:** *Reading, writing, and speaking grounded in evidence from text, both literary and informational*

- See Close Reading Exemplars for ways to engage students in close reading on  
<http://www.achievethecore.org/steal-these-tools/close-reading-exemplars>
- See the Basal Alignment Project for examples of text-dependent questions:  
<http://www.achievethecore.org/basal-alignment-project>

**Shift 3 – Knowledge:** *Building knowledge through content-rich nonfiction*

- See Appendix B for examples of informational and literary complex texts:  
[http://www.corestandards.org/assets/Appendix\\_B.pdf](http://www.corestandards.org/assets/Appendix_B.pdf)

**Sample Scoring Rubric for Text-Based Writing Prompts:**

[http://achievethecore.org/content/upload/Scoring\\_Rubric\\_for\\_Text-Based\\_Writing\\_Prompts.pdf](http://achievethecore.org/content/upload/Scoring_Rubric_for_Text-Based_Writing_Prompts.pdf)