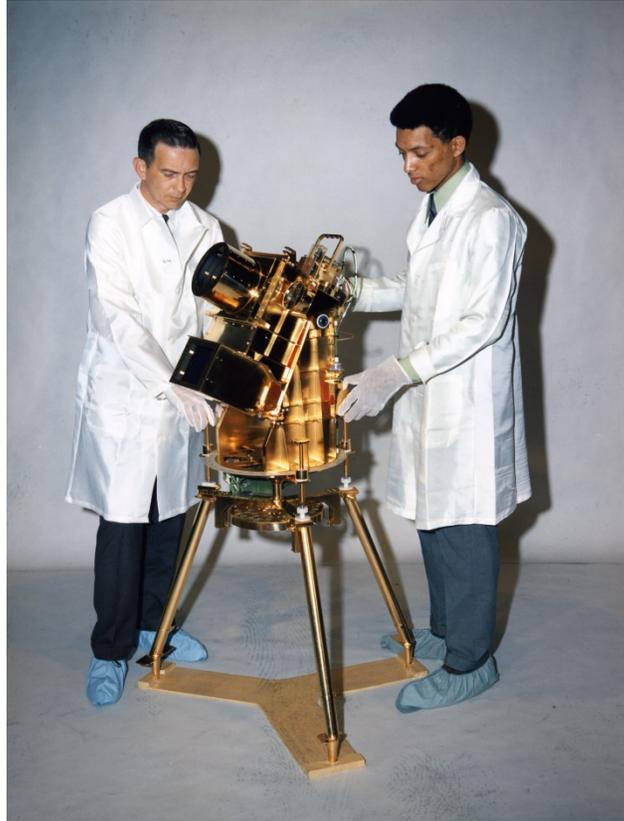


## Lesson Plan

### African Americans in Astronomy and Astrophysics



*Principal Investigator Dr. George Carruthers (right) and Project Engineer William Conway with the Apollo 16 far ultraviolet camera/spectrograph instrument. Naval Research Laboratory (NRL), courtesy AIP Emilio Segré Visual Archives, Ronald E. Mickens Collection.*

**Grade Level(s): 6-12**

**Subject(s): History, Physics, Astronomy**

**In-Class Time: (see below)**

**Prep Time: 10-15 min for each part**

Part One: The Life of Benjamin Banneker (45-60 min)

Part Two: Dr. George Carruthers, Space Scientist (45-60 min)

#### **Materials**

##### **Part One: The Life of Benjamin Banneker**

- Access to internet in order to provide groups of 3-4 copies of Benjamin Banneker's 1793 almanac, found at the Smithsonian Institution's Transcription page: [https://transcription.si.edu/view/8045/NMAAHC-2014\\_63\\_31\\_001](https://transcription.si.edu/view/8045/NMAAHC-2014_63_31_001)
- Copies of the Banneker's Almanac Worksheet (see supplemental material)

- Copies of Letter to Thomas Jefferson from Benjamin Banneker, 1791 (see supplemental material)

### **Part Two: Dr. George Carruthers, Space Scientist**

- George Carruthers Oral History Interview: Selected Excerpts (see supplemental material)
- Credible research resources (see Required/Recommended Resources) and/or access to internet

### **Optional Evaluation: African American Astronomers and Astrophysicists**

- Credible research resources (see Required/Recommended Resources) and/or access to internet

#### **Objective**

The purpose of this lesson is for students to explore the history of astronomy in the United States and the African-American scientists that are associated with this discipline. This lesson introduces students to African Americans involved in astronomy and astrophysics from the 1700s when astronomy was used as a practical tool to the twentieth century space race. In the first part, students will learn about Benjamin Banneker – the eighteenth century African American astronomer. They will use his 1793 almanac and read a letter Banneker wrote to Thomas Jefferson regarding racial equality. In the second part, students will learn about George Carruthers, a contemporary African American astrophysicist whose inventions contributed to the study of space. Optionally, students will choose to study other African American astronomers and astrophysicists from the twentieth century.

#### **Introduction**

Astronomy is a field of science that can trace its origins back to antiquity. People have based entire civilizations and technologies on the movement of the stars in the night sky. From the ancient Cushite empire in what is now Kenya to Benjamin Banneker to the African Americans who escaped slavery on the Underground Railroad by following the North Star to the African American astrophysicists and astronauts, people of African descent have long been connected to and contributed to the study of astronomy.

Benjamin Banneker was one of the earliest African American scientists. Banneker was born free in Baltimore County, Maryland in 1731, more than 40 years before the United States would become an independent nation. Benjamin was one of about 200 free blacks in the area living among about 4,000 slaves and 13,000 whites. Though he had little formal education, Banneker was a dedicated scholar interested in science, surveying, and farming. He published a successful series of farmer's almanacs – annual calendars that would include astronomical data, tide tables, and weather predictions to aid farmers. He also corresponded with Thomas Jefferson about race relations, chiding him and other writers of the Declaration of Independence for their hypocrisy in declaring all men created equal while maintaining a system of slavery which oppressed those of African descent.

More than 150 years after Banneker published his first almanac, African American astrophysicist George Carruthers invented the first moon-based observatory which was used in the Apollo 16 mission. Even though more than a century had passed since Banneker, Carruthers and other African Americans in the 1960s were still struggling for racial equality. During this time, schools and governmental agencies which were previously segregated began to open to African Americans. For example, the first black engineers to work at NASA joined in 1964. Carruthers was part of the first generation of African

Americans to have access to educational and employment opportunities in the sciences. Carruthers grew up in the South Side of Chicago. He received a bachelor’s degree in aeronautical engineering in 1961, a master’s degree in nuclear engineering in 1962, and a doctorate in aeronautical and astronautical (spacecraft) engineering in 1964 from the University of Illinois. In 1964, Carruthers was hired by the U.S. Naval Research Laboratory in Washington, D.C. where his research focused on far ultraviolet astronomy. He is internationally recognized for his inventions and research which have contributed to the study of space science.

Often, the history of African Americans is told as a story of linear progress. We are told that as time has progressed, so has race relations in the United States. As this lesson illustrates, history is much more complex than that. In this lesson we will take a brief look at astronomy and astrophysics, their uses, and the African American scientists associated with these fields from the 1700s to today. In particular, we will explore the practical uses of astronomy in almanacs, the shift from earth to space science during and beyond the space race of the 1960s, and consider where astronomy has progressed to today.

### Instructions/Activities

This is a two-part lesson that can be done over the course of two periods. Both parts have been broken down into their own separate 5E formats. There is also an optional third part to this lesson that is listed under the “evaluate” section of the second part.

#### Part 1: The Life of Benjamin Banneker

In this part, students will learn about the life of Benjamin Banneker. They will examine a letter he wrote to Thomas Jefferson regarding racial equality and study one of his almanacs produced from his knowledge and study of astronomy.

#### Engagement: 10 minutes

Students may not be familiar with Benjamin Banneker or the concept of an almanac. Start off the lesson with a quick introduction to these concepts by asking students what they know about the subject first and then filling in any missing information. Some teachers may choose to make a PowerPoint or show some pictures during this portion of the lesson.

#### What is the teacher doing?

Ask students if they know who Benjamin Banneker was. Also be sure to touch on the concept of an almanac and see if students are familiar with them.

#### What are students doing?

Students should be drawing on any historical knowledge that they have about the time period and should try to answer questions to the best of their knowledge about Benjamin Banneker and an almanac.

Based on student response, introduce students to Benjamin Banneker – where and when he was born and the historical context of the United States and the status of African Americans at the time. For resources on Benjamin Banneker, see the Required/Recommended Resources section.

Students should be paying attention to any new information and should be asking questions if they are unsure about a topic.

<p>Also introduce students to what an almanac is based on responses. If you can get a copy of a modern almanac, show them what it looks like and give them some time to look through it. Have them identify the astronomical data found in almanacs such as the rising and setting of the sun and moon, eclipses, hours of full tide, and other information.</p>	<p>Students should be looking through an almanac and trying to think about how it would be useful in the past. They should also be trying to identify the scientific information that is presented in an almanac.</p>
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**Exploration: approx. 20 minutes**

<p>In this portion of the lesson, students will have the opportunity to look at an almanac that Benjamin Banneker wrote in 1793.</p>	
<p><b>What is the teacher doing?</b> Divide the students into groups of 3-4. Either set each group up at a computer with internet access, or download a copy of Banneker's 1793 almanac from Temple University: <a href="http://digital.library.temple.edu/cdm/ref/collectio/p16002coll5/id/237">http://digital.library.temple.edu/cdm/ref/collectio/p16002coll5/id/237</a></p>	<p><b>What are the students doing?</b> Students should be forming groups and working on looking through Banneker's almanac.</p>
<p>Give each student a copy of the Banneker Almanac Worksheet and have them work in their groups to answer the questions while reviewing Banneker's almanac.</p>	<p>Students should be working in groups to answer the questions on the worksheet. All information should be found in the almanac but the students should ask questions if they do not understand anything.</p>
<p>Then, give students copies of Benjamin Banneker's letter to Thomas Jefferson in 1791 (see supplemental material). Have them read through the letter as a group and make notes on it.</p>	<p>Students should be working with their group to read through and understand the letter to Thomas Jefferson from Benjamin Banneker.</p>

**Explanation: 20 minutes**

<p>Now the students will share out what they have gathered from reading and working with their partners. This sharing of information will become a discussion based around the social and historical events that African Americans, and more specifically Benjamin Banneker, were faced with during this early period of our country's history. (Part two of this lesson plan focuses on a more recent African American physicist so that students can compare the work and social environment surrounding the two men).</p>	
<p><b>What is the teacher doing?</b> Using some of the discussion questions (listed below and in Supplementary Materials), help generate a discussion with the students about the science and social world of Benjamin Banneker.</p>	<p><b>What are the students doing?</b> Students should be paying careful attention and participating in the class discussion. Students should be taking notes on interesting ideas or topics that come up during the discussion. There should be opportunities for each student to participate if desired.</p>

**Elaboration: (in Explanation)**

For this lesson, the elaboration comes naturally during the explanation portion. While students are discussing ideas and answering discussion questions, the teacher can interject with more information, clarification, or historical context to help ideas become clearer.

**What is the teacher doing?**

Make sure to participate in discussion and to clarify any troubling spots that come up.

**What are the students doing?**

Students will be participating in the discussion that is described in the “explore” section. Students should ask for clarification on any ideas or concepts that they do not immediately understand.

**Evaluation (optional):**

During this lesson, evaluation of students’ work comes naturally through reviewing and grading the worksheets that students filled out while looking at the almanac and letter. This lesson can also be expanded by completing part two of this lesson plan the following day. Part two is outlined on the next page.

**Part Two: Dr. George Carruthers, Space Scientist**

In this part, students will learn about Dr. George Carruthers, an African American physicist and space scientist who lived and worked during the “Space Age.” Students will learn about his experiences through excerpts of an oral history interview with Dr. Carruthers.

**Engagement: 10 minutes**

During this lesson, the “Space Age” will be the historical context of all materials. In order to gain a sense of how familiar students are with this era and to grab attention, this lesson should be started off with a brief discussion about the Space Age.	
<b>What is the teacher doing?</b> Ask students to take three minutes and silently brainstorm about their knowledge of the Space Age. This can mean that students will recall certain events (such as the race to put a man in orbit) or certain people/countries involved.	<b>What are students doing?</b> Students should silently be thinking about the Space Age and writing down notes about anything that they can remember.
Ask for a few suggestions from students about key players in the Space Age. Be sure to ask about events, people, organizations, discoveries, or even countries involved.	Students should be sharing out some of the ideas that were brainstormed and should be asking questions about any ideas that they are unsure about.
Based on student responses, introduce students to the Space Age and the Civil Rights Movement. Give students historical context about the 1940s-1970s when Dr. Carruthers grew up, received his education, and worked at the U.S. Naval Research Laboratory. (See Required/Recommended Resources)	Students should be asking questions about any missing information.

**Exploration: 20 minutes**

Students will be exploring the differences that African Americans in physics experienced during different time periods. The first part of the lesson plan focused on Benjamin Banneker and his experience in the 1700s. However, this portion of the lesson plan will focus on George Carruthers’ experience during the 1900s and recent years.	
<b>What is the teacher doing?</b> Divide the students into four or five groups. Each group should be assigned one of the following readings (see Supplementary Materials): <ul style="list-style-type: none"> <li>• George Carruthers’ Oral History Interview: Selected Excerpt One</li> <li>• Carruthers Selected Excerpt Two</li> <li>• Carruthers Selected Excerpt Three</li> <li>• Carruthers’ general biography. A good place to start is the HistoryMakers website (requires a free account): <a href="http://www.thehistorymakers.com/biography/george-carruthers-41">http://www.thehistorymakers.com/biography/george-carruthers-41</a>.</li> </ul>	<b>What are the students doing?</b> Students should form groups to study their part of the assigned portion of the Carruthers lesson. They should take detailed notes and plan a presentation on their findings. They should try to draw comparisons or contrasting ideas between Carruthers and Banneker’s experiences.

<ul style="list-style-type: none"> <li>• If there are five groups, the last group should research general American history (1940s-1970s), particularly race relations and the “Space Age.”</li> </ul> <p>Students should work together to take notes on their topic/excerpt and note any differences that they see between the more recent account of an African American in astronomy as opposed to Benjamin Banneker’s experiences.</p>	
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**Explanation: 20 minutes**

<p>Groups will now give a short presentation of their research. Have each group elect a spokesperson or work together to give a short (~2-3 minutes) presentation of their research. If students were given the discussion questions worksheet, make sure they include the answers to relevant discussion sections in their presentation.</p>	
<p><b>What is the teacher doing?</b></p> <p>The teacher should be calling on groups to present their research. Ask groups to clarify any parts of their presentation that were unclear. Each presentation may be followed by a short question period so that other students have the opportunity to ask other groups about their research.</p>	<p><b>What are the students doing?</b></p> <p>Students should give short presentations on their research topic. When they are not presenting, students should be taking notes and (if used) completing the discussion questions worksheet. Students should have the opportunity to ask questions for clarification of the teacher and other groups.</p>

**Elaboration: 10-20 Minutes**

<p>Now that students have been able to explore both Benjamin Banneker and George Carruthers, they will focus on comparing the different experiences through presentations and a class discussion. While students are discussing ideas and answering discussion questions, the teacher can interject with more information, clarification, or historical context to help ideas become clearer.</p>	
<p><b>What is the teacher doing?</b></p> <p>Gather all the groups of students together and start a class discussion based on the information just learned about George Carruthers. Gradually introduce the idea of comparing George Carruthers’ life with that of Benjamin Banneker. One possibility is to use the provided discussion questions (listed below and in the Supplemental Materials).</p>	<p><b>What are the students doing?</b></p> <p>Students should be paying careful attention and participating in the class discussion. Students should be taking notes on interesting ideas or topics that come up during the discussion. All students should have the opportunity to participate.</p>

**Evaluation (optional):**

<p>The teacher can evaluate students through the class discussion following the exploration of Carruthers’ oral history. However, if there is a wish to extend the lesson further, an optional part three of the lesson has been included below and could be used as a means of evaluating student work.</p> <p><b>Part Three: African Americans in Astronomy and Astrophysics</b></p>
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In this part, students can choose to research and give a presentation on an African American astronomer or astrophysicist. Students must use at least three or four credible sources for their research (see Required/Recommended Resources). The following is a potential list of physicists that they should choose from:

Isaac Thomas Gillan, IV	Joseph Granville Logan, Jr.
Walter S. McAfee	Ronald E. McNair
Benjamin Peery, Jr.	John B. Slaughter
Neil deGrasse Tyson	George Carruthers
Carl Rouse	Reva Williams
Beth Brown	Arthur B.C. Walker

Additional African-American astrophysicists or astronomers can be added to the list. Have students compose a short presentation on the African American scientist that they researched.

The following discussion questions can also be used to prompt students' research:

1. Where was your scientist from and what was their family background?
2. What was life like for African Americans during this time?
3. Did your scientist attend a predominantly white institution or a Historically Black College and University?
4. What was your scientist's field of study?
5. Where did they work and what was their contribution to the development of astronomy and astrophysics?

### Required/Recommended Reading and Resources

#### Part One: The Life of Benjamin Banneker

Required Resources:

- PBS Africans in America, "Benjamin Banneker," <http://www.pbs.org/wgbh/aia/part2/2p84.html>.
- "Benjamin Banneker's Pennsylvania, Delaware, Maryland and Virginia Almanack and Ephemeris, for the year of our lord, 1793," Collection of the Smithsonian National Museum of African American History and Culture, <https://transcription.si.edu/project/8045>
- Banneker's Almanac Worksheet (see supplemental material)
- Letter to Thomas Jefferson from Benjamin Banneker, 1791 (see supplemental material)

Recommended Resources:

- Silvio A. Bedini, *The Life of Benjamin Banneker* (New York: Scribner, 1971).
- Charles A. Cerami, *Benjamin Banneker: Surveyor, Astronomer, Publisher, Patriot* (New York: John Wiley and Sons, Inc., 2002).

#### Part Two: Dr. George Carruthers, Space Scientist

- Selected passages from Interview of Dr. George R. Carruthers by David DeVorkin on August 18, 1992, Niels Bohr Library & Archives, American Institute of Physics, College Park, MD USA, <https://www.aip.org/history-programs/niels-bohr-library/oral-histories/32485>. (see supplemental material)

- HistoryMakers ScienceMakers Biography of George Carruthers, <http://www.thehistorymakers.com/biography/george-carruthers-41>.
- Carruthers talks about the impact of Sputnik on the American space program: <http://smdigital.thehistorymakers.com/iCoreClient.html#/&s=6&args=19108>
- Carruthers discusses his research: <http://smdigital.thehistorymakers.com/iCoreClient.html#/&s=6&args=19080>
- Carruthers discusses current African Americans in space science: <http://smdigital.thehistorymakers.com/iCoreClient.html#/&s=6&args=19094>
- Carruthers discusses the applications of his ultraviolet camera: <http://smdigital.thehistorymakers.com/iCoreClient.html#/&s=6&args=19111>

### Optional Evaluation: African American Astronomers and Astrophysicists

- Scott Williams, “Who are the Black Astronomers & Astrophysicists?,” 2007, <http://www.math.buffalo.edu/mad/physics/astronomy-peeps.html>.
- Gubert, Betty Kaplan, Miriam Sawyer, and Caroline Fannin. *Distinguished African Americans in Aviation and Space Science*. Westport, CT: Oryx Press, 2002.
- Kristine Krapp, ed. *Notable Black American Scientists* (Gale: Detroit, 1999).

### Discussion Questions

Discussion Questions can be found as a Handout with a corresponding Answer Key in the Supplemental Materials to this lesson plan.

#### Part One: The Life of Benjamin Banneker

1. How would a farmer use Banneker’s almanac? Why would it be important for them to know about eclipses, tides, and the other information provided in the almanac?
2. Benjamin Banneker was also a surveyor. What was surveying?
3. Why was Benjamin Banneker born free?
4. In his letter to Thomas Jefferson, what does Banneker think of the ideals of the American Revolution? What does he say about Jefferson and the other Founding Fathers?
5. Why does Banneker reference the American Revolution?

#### Part Two: Dr. George Carruthers, Space Scientist

1. How did Carruthers become interested in science? What was his family history?
2. How did George Carruthers learn about astronomy?
3. Why did Carruthers struggle when he went to the University of Illinois?
4. What event occurred in Carruthers freshman year that is relevant to his career path? Why was this a big deal at the time in which it happened?
5. Why do you think that astronomy and engineering were separated until around the time that Carruthers started becoming active in his career (Think back to the previous lesson)? If you think that the two disciplines weren’t truly separated as Carruthers said, explain your thought process.
6. How does Dr. Carruthers see himself as a role model?
7. What were some of Dr. Carruthers contributions to space science?
8. What does Dr. Carruthers think about the future of science education?
9. Compare the kind of work that Dr. Carruthers did as an astrophysicist to the kind of work that Benjamin Banneker did in the eighteenth century.

### Further Reading and Additional Resources

- Robert Fikes, Jr., "From Banneker to Best: Some Stellar Careers in Astronomy and Astrophysics," 2000, <http://www.math.buffalo.edu/mad/special/Black.Astronomers-Fikes.pdf>.
- Dick Russell, *Black Genius: Inspirational Portraits of America's Black Leaders* (New York: Skyhorse Pub, 2009).
- Stanley P. Jones and L. Octavia Tripp, *African-American Astronauts* (Mankato, MN: Capstone Press, 1998).
- Ivan Van Sertima, *Blacks in Science: Ancient and Modern* (New Brunswick, NJ: Transaction Books, 1983).
- Aaron E. Klein, *The Hidden Contributors: Black scientists and inventors in America* (Garden City, N.Y.: Doubleday, 1971).
- Lankford, John. *History of Astronomy: An Encyclopedia*. New York: Garland Pub, 1997.

### Extensions

Related AIP Teacher's Guides on Women and Minorities in the Physical Sciences:

- African Americans Physicists in the 1960s
- African American Inventors in History
- "Follow the Drinking Gourd:" Astronomy and the Underground Railroad
- "When Computers Wore Skirts:" Katherine Johnson, Christine Darden, and the "West Computers"
- The Night Sky by another Name: Orion, Osiris, and African Mythologies

### Common Core Standards

For more information on Common Core Standards, visit <http://www.corestandards.org/>.

Speaking & Listening	
<u>CCSS.ELA-LITERACY.SL.6.1</u>	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
<u>CCSS.ELA-LITERACY.SL.6.2</u>	Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
<u>CCSS.ELA-LITERACY.SL.6.3</u>	Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.
<u>CCSS.ELA-LITERACY.SL.6.4</u>	Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
<u>CCSS.ELA-LITERACY.SL.7.1</u>	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7

	topics, texts, and issues, building on others' ideas and expressing their own clearly.
<u>CCSS.ELA-LITERACY.SL.7.2</u>	Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
<u>CCSS.ELA-LITERACY.SL.7.3</u>	Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.
<u>CCSS.ELA-LITERACY.SL.7.4</u>	Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
<u>CCSS.ELA-LITERACY.SL.8.1</u>	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
<u>CCSS.ELA-LITERACY.SL.8.2</u>	Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
<u>CCSS.ELA-LITERACY.SL.8.3</u>	Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.
<u>CCSS.ELA-LITERACY.SL.8.4</u>	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
<u>CCSS.ELA-LITERACY.SL.9-10.1</u>	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
<u>CCSS.ELA-LITERACY.SL.9-10.2</u>	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
<u>CCSS.ELA-LITERACY.SL.9-10.3</u>	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
<u>CCSS.ELA-LITERACY.SL.9-10.4</u>	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
<u>CCSS.ELA-LITERACY.SL.11-12.1</u>	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
<u>CCSS.ELA-LITERACY.SL.11-12.2</u>	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to

	make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
<u>CCSS.ELA-LITERACY.SL.11-12.3</u>	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
<u>CCSS.ELA-LITERACY.SL.11-12.4</u>	Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
History/Social Studies	
<u>CCSS.ELA-LITERACY.RH.6-8.1</u>	Cite specific textual evidence to support analysis of primary and secondary sources.
<u>CCSS.ELA-LITERACY.RH.6-8.2</u>	Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.
<u>CCSS.ELA-LITERACY.RH.6-8.3</u>	Identify key steps in a text's description of a process related to history/social studies (e.g., how a bill becomes law, how interest rates are raised or lowered).
<u>CCSS.ELA-LITERACY.RH.6-8.4</u>	Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.
<u>CCSS.ELA-LITERACY.RH.6-8.6</u>	Identify aspects of a text that reveal an author's point of view or purpose (e.g., loaded language, inclusion or avoidance of particular facts).
<u>CCSS.ELA-LITERACY.RH.6-8.8</u>	Distinguish among fact, opinion, and reasoned judgment in a text.
<u>CCSS.ELA-LITERACY.RH.9-10.1</u>	Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.
<u>CCSS.ELA-LITERACY.RH.9-10.2</u>	Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.
<u>CCSS.ELA-LITERACY.RH.9-10.4</u>	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.
<u>CCSS.ELA-LITERACY.RH.9-10.5</u>	Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.
<u>CCSS.ELA-LITERACY.RH.9-10.8</u>	Assess the extent to which the reasoning and evidence in a text support the author's claims.
<u>CCSS.ELA-LITERACY.RH.11-12.1</u>	Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

<u>CCSS.ELA-LITERACY.RH.11-12.2</u>	Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.
<u>CCSS.ELA-LITERACY.RH.11-12.4</u>	Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines <i>faction</i> in <i>Federalist</i> No. 10).
<u>CCSS.ELA-LITERACY.RH.11-12.5</u>	Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.
<u>CCSS.ELA-LITERACY.RH.11-12.7</u>	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.
<b>Writing</b>	
<u>CCSS.ELA-LITERACY.WHST.6-8.7</u>	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
<u>CCSS.ELA-LITERACY.WHST.6-8.8</u>	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
<u>CCSS.ELA-LITERACY.WHST.6-8.9</u>	Draw evidence from informational texts to support analysis, reflection, and research.
<u>CCSS.ELA-LITERACY.WHST.9-10.7</u>	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.
<u>CCSS.ELA-LITERACY.WHST.9-10.8</u>	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
<u>CCSS.ELA-LITERACY.WHST.9-10.9</u>	Draw evidence from informational texts to support analysis, reflection, and research.
<u>CCSS.ELA-LITERACY.WHST.11-12.7</u>	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.
<u>CCSS.ELA-LITERACY.WHST.11-12.8</u>	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 specific

	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.
<u>CCSS.ELA-LITERACY.WHST.11-12.9</u>	Draw evidence from informational texts to support analysis, reflection, and research.

## Next Generation Science Standards

For more information on the Next Generation Science Standards, visit <http://www.nextgenscience.org/>.

N/A