

California Education and the Environment Initiative

Increasing Environmental Literacy for K–12 Students...

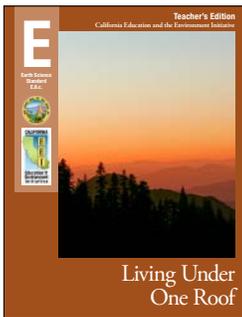
Because the Future is in Their Hands



TEACH COMMON CORE STANDARDS WITH THE EEI CURRICULUM

Created with your needs in mind, this document shows the correlation between the EEI Curriculum and the California Common Core State Standards. By teaching the EEI unit lessons in your classroom, you will be simultaneously addressing the Common Core standards depicted in this guide.

E.8.c.—Living Under One Roof



In this unit, students explore the location of the ozone layer, how it is both produced and destroyed, and how humans both benefit from and influence its very nature. They also examine the scientific, economic, and social complexities associated with international efforts related to the ozone layer. The unit starts with students examining the role of the ozone layer in their personal lives as it acts as “Earth’s sunscreen.” Next, students examine the chemical nature of ozone and the natural processes and events that result in both its production and destruction. Students then explore both natural and human-related causes of ozone depletion, looking at real data to determine the events involved in the creation of the ozone hole over Antarctica. Finally, students look at how scientific knowledge has been used by global policymakers to make decisions about human activities. They also examine the limits of our knowledge of the atmosphere, learning that because atmospheric science is so complex, scientists are not always certain how environmental changes will play out.

		RST.9–10.1	RST.9–10.2	RST.9–10.3	RST.9–10.4	RST.9–10.5	RST.9–10.6	RST.9–10.7	RST.9–10.8	RST.9–10.9	RST.9–10.10	WHST.9–10.1	WHST.9–10.2	WHST.9–10.4	WHST.9–10.5	WHST.9–10.6	WHST.9–10.7	WHST.9–10.8	WHST.9–10.9	SL.9–10.1	SL.9–10.2	SL.9–10.3	SL.9–10.4	SL.9–10.5	SL.9–10.6	
LESSONS	California Connections	✓			✓	✓			✓		✓		✓													
	1		✓		✓			✓					✓	✓					✓		✓		✓			
	2		✓	✓	✓			✓	✓	✓		✓	✓	✓				✓	✓	✓			✓			
	3		✓		✓															✓		✓	✓			✓
	4	✓	✓	✓	✓		✓	✓	✓	✓	✓							✓	✓	✓	✓		✓	✓	✓	✓
	5	✓	✓		✓		✓	✓	✓	✓			✓	✓	✓					✓	✓		✓	✓	✓	✓
	6	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Traditional Assessment	✓	✓		✓				✓	✓	✓	✓	✓	✓					✓							
	Alternative Assessment	✓	✓		✓			✓	✓	✓					✓	✓	✓		✓	✓	✓			✓		

COMMON CORE STANDARDS

Note: For your reference, the list of California Common Core State Standards abbreviations is on the following page.

Using the EEI-Common Core Correlation Matrix

The matrix on the front page identifies a number of Common Core standards that are supported by this EEI unit. However, the check marks in the matrix do not necessarily signify that the Common Core standards checked will be taught to mastery by using this EEI unit alone. Teachers are encouraged to select which Common Core standards they wish to emphasize, rather than teaching to every indicated standard. By spending more time on selected standards, students will move toward greater Common Core proficiency in comprehension, critical thinking and making reasoned arguments from evidence. Teaching this EEI unit will provide opportunities for teachers to implement the shift in instructional practice necessary for full Common Core implementation.

California Common Core State Standards Abbreviations

- **CCSS:** California Common Core State Standards
- **RST:** Reading Standards for Literacy in Science and Technical Subjects
- **SL:** Speaking and Listening Standards
- **WHST:** Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects

Note: Since each Common Core standard includes a breadth of skills, in this correlation, the portion of the standard description that is featured in the Common Core standards applications is cited, using “...” to indicate omitted phrases. For a list of the complete standard descriptions, please see the Common Core Reference Pages located on pages 33–34 of this document.

A Note about Common Core Speaking and Listening Standards

Throughout this unit, students participate in various learning structures and groups to analyze, discuss, and synthesize data, which supports the skill in Speaking and Listening Standard 1 “Participate effectively in a range of collaborative discussions (one-on-one, groups...) with diverse partners.” With prior instruction on collaborative discussions, these various groupings and the materials students examine lend themselves to prime discussion material for collaborative discussions. Learning structures with tasks for pairs and groups are in the following lessons:

- **Lesson 1:** Pairs, individual, whole class
- **Lesson 2:** Pairs, whole class, individual
- **Lesson 3:** Whole class, large and small group
- **Lesson 4:** Pairs, whole class
- **Lesson 5:** Whole class, 12 groups
- **Lesson 6:** Groups of 4, whole class

National Geographic Resources

No maps or posters are used with this unit.

Unit Assessment Options

Assessments	Common Core Standards Applications
Traditional Assessment	
<p>The traditional unit assessment is comprised of multiple-choice and short-answer questions.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts...</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p> <p>RST.9–10.10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.</p> <p>WHST.9–10.1: Write arguments focused on <i>discipline-specific content</i>.</p> <p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <p>WHST.9–10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Assessments	Common Core Standards Applications
Alternative Assessment	
<p>Students create a public service announcement, poster, or brochure summarizing their learning from the unit.</p> <p>Suggestion: Provide students the option of using a multimedia presentation in addition to incorporating information from other researched resources. Provide students the opportunity to discuss the scoring tool prior to beginning the assignment. Have students self-evaluate their work.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts...</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grades 9–10 topics, texts, and issues</i>, building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.</p> <p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p> <p>WHST.9–10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</p> <p>WHST.9–10.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.</p> <p>WHST.9–10.7: 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.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Lesson 1: The Ozone Layer: Earth's Natural Sunscreen

Students read about sunscreens, sunburns, UV radiation, and ozone, and summarize their prior knowledge about the ozone layer. They identify the location of the ozone layer in Earth's atmosphere and learn how to read a UV index.



Use this correlation in conjunction with the **Procedures** located on pages 38–39 of the Teacher's Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: 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...</p>
<p>Steps 2 and 3: Students discuss the photographs and illustrations in the story California Connections: Don't Forget Your Sunscreen! (Student Edition, pages 2–5) to make predictions. Students read the story in pairs and develop questions.</p> <p>Suggestion: Refer to the Reading California Connections Using a Common Core Reading and Writing Focus on pages 28–32 to view specific suggestions for integrating Common Core standards while reading the selection not only for content, but for text structure as well.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p>
<p>Steps 4 and 5: Students observe Where in Earth's Atmosphere Is the Ozone Layer? (Visual Aid #2) and Model of the Ozone Layer (Visual Aid #3). Using slightly cracked and highly cracked colored eggs as a model of the Earth, they demonstrate the protective nature of the ozone layer.</p>	<p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.</p>
<p>Step 6: Students will read aloud the first two pages of The UV Index and You (Student Edition, pages 6–7) and discuss what a UV index is and how to interpret the scale, and identify UV index ratings from different locations on the map.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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...</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p>

Student Tasks	Common Core Standards Applications
<p>Steps 7 and 8: Students read the section “How Much Sun Is Too Much for You?” in The UV Index and You. Students review the “Minutes to Skin Damage” by identifying how long they can stay in the Sun if the UV Index is 2, 5, and 8. Several students explain how they found their own “Minutes to Skin Damage.”</p> <p>Refer to the “Protective Actions” chart at the bottom of The UV Index and You. Display the day’s UV index for the students’ location. Ask students what protective actions they would need to take if they go outside today. Ask students to review questions learned about the ‘ozone’.</p> <p>Suggestion: Provide students the questions prior to reading the selection. As students find text to support their answers, have students write the page number in addition to the answers.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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...</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p>
<p>Step 9: Students turn to Hiking Mount Whitney (Student Workbook, pages 4–8), read the instructions, and refer to The UV Index and You to complete the essay.</p> <p>Suggestion: Have students review the <i>Scoring Tool</i> to guide their writing.</p> <p>Tip: If Student Workbooks need to be reused from year to year, students should not write in them. Some strategies teachers use to preserve the workbooks are:</p> <ul style="list-style-type: none"> ■ Have students use binder paper or other lined or unlined paper. ■ Have students use a sheet protector over the page and write with a whiteboard marker. ■ Do together as a class on a projector or chart paper. ■ Project the digital fill-in version and do together as a class. ■ Students use digital devices to fill in the digital version found on the website. ■ Make student copies when necessary. 	<p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <p>WHST.9–10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Lesson 2: How Ozone Forms and What It Does

Students review prior knowledge about atmospheric layers and compare ground-level ozone to stratospheric ozone. Students model how UV radiation influences the the oxygen-ozone cycle that occurs in the stratosphere.



Use this correlation in conjunction with the **Procedures** located on pages 58–60 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: 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...</p>
<p>Step 1: Students create an ozone layer chart, reflect on the previous lesson, and compare and contrast ozone that is found in the lower atmosphere with the ozone layer.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p> <p>WHST.9–10.8: Gather relevant information from multiple authoritative print and digital sources...</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Steps 2 and 3: Students observe the projected images Los Angeles Smog (Visual Aid #4) and Ozone in the Atmosphere (Visual Aid #5) and note the smog rankings of various cities, and the relationship between smog and ozone. Have students complete What’s Up with the Ozone Layer? (Student Workbook, pages 9–12).</p>	<p>RST.9–10.4: 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...</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 2 and 3 (Continued):</p>	<p>WHST.9–10.8: Gather relevant information from multiple authoritative print and digital sources...</p>
<p>Steps 4–6: Students observe Natural Oxygen-Ozone Cycle (Visual Aid #6) and, in pairs, build three molecules of oxygen from modeling clay. Students listen to and read What’s Up with the Ozone Layer? Students model the effects of UV radiation on oxygen and ozone molecules.</p> <p>Suggestion: Have students repeat this several times. After students are familiar with the process, have individuals create a scientific drawing of each of the steps of the process, making sure to label each step. Have students identify the text that supports each step of their drawing.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p>
<p>Step 7: Referring to the Ozone Layer Chart, each student volunteer one item of information they learned during the lesson to record in the table created in Step 1.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p>

Student Tasks	Common Core Standards Applications
<p>Step 8: Students answer the questions on pages 3 and 4 of What’s Up with the Ozone Layer?</p>	<p>WHST.9–10.1: Write arguments focused on <i>discipline-specific content</i>.</p> <ul style="list-style-type: none"> a) Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b) Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns. <p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <ul style="list-style-type: none"> d) Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. <p>WHST.9–10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>

Lesson 3: UV Radiation and the Web of Life

Students investigate the effects of increased levels of UV-B radiation on crops, oceanic food webs, and human health (skin cancer, cataracts, and weakened immune systems). They infer the ramifications of such outcomes on Earth’s natural systems and human social systems.



Use this correlation in conjunction with the **Procedures** located on pages 74–75 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: 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 9–10 texts and topics</i>.</p>
<p>Step 1: Refocus students’ attention by asking:</p> <ul style="list-style-type: none"> ■ What tool is used to measure ozone? ■ Is the measurement a direct measurement of ozone? ■ What happens to skin when there is not enough ozone in the stratosphere to protect us? ■ How many think that plants and animals are affected the same ways as humans by too much UV radiation? <p>Suggestion: Provide students time to discuss in small groups prior to having students share their responses with the entire group.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p>
<p>Step 2: In three groups, students read one of the case studies: Effects of UV Radiation on Human Health (Student Edition, pages 8–9), Effects of UV Radiation on the Oceanic Food Web (Student Edition, pages 10–11), or Effects of UV Radiation on Crop Production (Student Edition, pages 12–13).</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p>
<p>Steps 3 and 4: In smaller groups of three or four, students turn to Notes on the Effects of UV Radiation (Student Workbook, page 13), review the instructions, and prepare to report on their assigned case study to the rest of the class.</p> <p>After 20 minutes, one representative from each group present their assigned case study to the class. Students in other groups will listen and ask clarifying questions in order to complete all sections of Notes on the Effects of UV Radiation.</p> <p>Suggestion: Have students submit clarifying questions in written format to encourage thoughtful questions.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 3 and 4 (Continued):</p>	<p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: 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 (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>a) Plan and deliver an informative/explanatory presentation that presents evidence in support of a thesis, conveys information from primary and secondary sources coherently, uses domain specific vocabulary, and provides a conclusion that summarizes the main points. (9th or 10th grade) CA</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Step 5: Lead the students in a discussion summarizing the effects resulting from increased UV radiation on humans and other living organisms and the role of the ozone layer in protecting life on Earth from too much UV-B radiation. Project Ozone Layer Connection (Visual Aid #7) and ask students the following questions:</p> <ul style="list-style-type: none"> ■ How does increasing UV radiation exposure affect human health? ■ How do marine ecosystems respond to changes in UV radiation? How might these changes affect people? ■ How do certain crops respond to changes in UV radiation? ■ How might these changes affect people? (<i>Reduced crop yields</i>) ■ As a result of increasing UV radiation, what costs or consequences do human communities face? ■ What did we learn in the last lesson about a function the ozone layer serves for life on Earth? ■ Because we are seeing more cases of skin cancer, more weakened immune systems, changes to populations of phytoplankton and krill, and reduced crop production, what do you think might be happening to the ozone layer? ■ What do you think would happen to life on Earth if the ozone layer were to become thinner than it is under normal conditions? <p>Suggestion: Have students create a graphic organizer with the answers from the questions that were posed. Ask students to compare the graphic organizer Ozone Layer Connection (Visual Aid #7) to what they created.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grades 9–10 topics, texts, and issues</i>, building on others’ ideas and expressing their own clearly and persuasively.</p> <p>a) Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.</p> <p>b) Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</p>

Student Tasks	Common Core Standards Applications
<p>Step 5 (Continued):</p>	<p>c) Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p> <p>d) Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: 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 (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>

Lesson 4: Ozone Depletion: A Natural Process

Students model catalytic reactions that destroy ozone, then examine news reports of natural sources that can lead to ozone layer thinning. Through examination of real-world data, students determine how natural systems contribute to ozone depletion.



Use this correlation in conjunction with the **Procedures** located on pages 90–92 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: 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...</p>
<p>Steps 1–3: In pairs, have students model how ozone is created from oxygen as a result of UV radiation, and how chlorine atoms interact with gases in the atmosphere using the modeling clay.</p> <p>Project Ozone Destruction Process (Visual Aid #8). Students use blue modeling clay to create one molecule of ozone, one molecule of oxygen, and one free oxygen atom.</p> <p>Students listen as Step 1 of the Ozone Destruction Process is read aloud, and they use yellow modeling clay to create two chlorine atoms.</p> <p>Students listen as Steps 2 and 3 of the Ozone Destruction Process is read aloud, and they demonstrate each reaction using their modeling clay.</p> <p>Have students discuss the reactions using the following questions:</p> <ul style="list-style-type: none"> ■ What happens to the ozone in this reaction? ■ What happens to the free chlorine atoms in this reaction? 	<p>RST.9–10.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: 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 (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 1–3 (Continued):</p>	<p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Steps 4 and 5: Project Antarctic Ozone Hole Timeline (Visual Aid #9). Have students identify the spectrometer legend at the bottom, which shows ozone levels in Dobson Units (DU). Have students interpret the timeline by answering, “What has happened to the ozone layer over the Antarctic in the past 25 years?”</p> <p>Explain that “hole” is somewhat of a misnomer; it really is an area of thinning of the ozone layer.</p> <p>In pairs or as a whole class, students read aloud What Could Be Causing the Antarctic Ozone Hole? (Student Edition, page 14) and answer the following questions:</p> <ul style="list-style-type: none"> ■ Why would people be concerned about this growing “hole”? ■ What do you think is causing this ozone depletion? 	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.3: Follow precisely a complex multistep procedure when...taking measurements...</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p> <p>WHST.9–10.8: Gather relevant information from multiple authoritative print...sources...</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 6 and 7: Project Headlines About the Ozone Layer (Visual Aid #10). Have students note that each headline appeared within the last decade. In pairs, have students read one of the three articles (Report 1 [solar flares], Report 2 [volcanic eruption], or Report 3 [polar clouds]) from News Reports (Student Edition, pages 15–16). Tell students to turn to Ozone Destruction (Student Workbook, pages 14–15). As students read their assigned news report, have them complete the first two rows about their topic in the chart on Ozone Destruction with their partner.</p> <p>Lead a class discussion with students about the three natural phenomena.</p> <ul style="list-style-type: none"> ■ Project Solar Flares (Visual Aid #11). Students who read about solar flares explain what solar flares are and how they affect the ozone layer. ■ Project Volcanic Eruptions (Visual Aid #12). Students who read about volcanic eruptions explain what they are and how they affect the ozone layer. ■ Project Stratospheric Polar Clouds and the Ozone Layer (Visual Aid #13). Students who read about stratospheric polar clouds explain what they are and how they affect the ozone layer. <p>Students will record information about each phenomenon on Ozone Destruction.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Steps 8–11: Project Comparing Solar Flares to Ozone Levels (Visual Aid #14) and have students compare the pattern of solar flares occurring in cycles.</p> <p>Project Comparing Volcanic Eruptions to Ozone Levels (Visual Aid #15) and have students discuss if volcanic eruptions are an important cause of ozone thinning. Explain to students that while some volcanic emissions can reach the stratosphere, in the past century they have not been large enough or lasted long enough to cause long-term changes to the ozone layer.</p> <p>Project Comparing Stratospheric Clouds to Ozone Levels (Visual Aid #16). Help students interpret the graph that shows that the amount of water vapor in the stratosphere has steadily increased.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.6: Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 8–11 (Continued):</p>	<p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p> <p>RST.9–10.10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners..., building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: 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 (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grades 9–10 Language standards 1 and 3 for specific expectations.)</p>

Student Tasks	Common Core Standards Applications
<p>Step 12: Students complete Part 2 of Ozone Destruction for homework.</p>	<p>WHST.9–10.7: Conduct short...research projects to answer a question (including a self-generated question) or solve a problem; ...synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>WHST.9–10.8: Gather relevant information from multiple authoritative print and digital sources...</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Lesson 5: Miracle Products of the 1930s to 1970s

Students use information cards to identify everyday products, such as refrigerators, solvents, inhalers, and fire extinguishers, that use CFCs or halon-containing compounds. Students learn that these are “ozone-depleting substances” that affect the ozone layer.



Use this correlation in conjunction with the **Procedures** located on pages 112–114 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: 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...</p>
<p>Step 1: Project Which Can You Live Without? (Visual Aid #17). Ask students:</p> <ul style="list-style-type: none"> ■ Which item or items contain ozone-destroying chemicals? ■ Which product would you be willing to do without to save the ozone layer? 	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts...</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p>
<p>Steps 3–5: Divide the class into twelve groups. Have each of the twelve groups read one of the Miracle Products (Information Cards #1–12) and determine what component of the product is likely to have a connection with the ozone layer and what element from the product will catalyze the destruction of ozone.</p> <p>Project Sources of Chlorine and Bromine Gas Emissions (Visual Aid #18). Ask a student in each group to hold up their assigned Miracle Products information card while another group member shares some information about the product with the class. As each group shares information, a third student from the group will write the “chemicals involved” on the projected Sources of Chlorine and Bromine Emissions.</p> <p>When all groups have shared their Miracle Products, have students compare the products they have with the Sources of Chlorine and Bromine Gas Emissions.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.6: Analyze the author’s purpose in providing an explanation..., defining the question the author seeks to address.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 3–5 (Continued):</p>	<p>RST.9–10.7: ...translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: 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 (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>

Student Tasks	Common Core Standards Applications
<p>Steps 6–8: Project Periodic Table of Elements (Visual Aid #19) and point out that CFCs and halon-containing compounds are all from the halogen family of elements. Explain that halogens have seven electrons in their outer shell—making them one short of a full shell, which makes them easily combine with many different elements. Tell students that CFCs and HCFCs are man-made compounds that all contain either chlorine or bromine (halogen elements). Remind students that these gases are nonreactive in the troposphere, but when they get to the stratosphere and the amount of UV radiation increases, they become very reactive and can break apart ozone molecules. UV radiation breaks these molecules to release free chlorine or bromine atoms, which act as catalysts in the destruction of ozone molecules.</p> <p>Suggestion: Provide students the opportunity to discuss note-taking strategies they use. Have students use one of the strategies discussed and share with each other at the end of this mini-lecture.</p> <p>Project Sources of Chlorine and Bromine Gas Emissions and have students complete the “Natural Conditions” together. Have students identify any of the “miracle products” discussed that they use in their daily lives. Have volunteers read aloud Sources That Destroy Ozone (Student Workbook, pages 16–19) to the class while others follow along.</p> <p>Suggestion: Have students read Sources That Destroy Ozone individually before breaking into pairs to re-read the selection.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Steps 9 and 10: Project Miracle Products’ ODP (Visual Aid #20).</p> <p>Have students answer:</p> <ul style="list-style-type: none"> ■ Which products are the most destructive to the ozone? ■ Why are they more destructive? <p>Project Stratospheric Gas Sources (Visual Aid #21). Have students compare where gases that catalyze ozone destruction come from. Students should note that in this data set the total chlorine is 160 times more abundant in the stratosphere than bromine. Emphasize that while natural events and processes do contribute to ozone thinning, human activities are the most significant factor in ozone depletion.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>

Student Tasks	Common Core Standards Applications
<p>Step 11: Students complete Parts 1 and 2 of Sources That Destroy Ozone for homework.</p>	<p>WHST.9–10.1: Write arguments focused on <i>discipline-specific content</i>.</p> <ul style="list-style-type: none"> a) Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence. b) Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns. <p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <ul style="list-style-type: none"> d) Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. <p>WHST.9–10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>WHST.9–10.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Lesson 6: Saving the Ozone Layer

Students discuss how science influences policymaking. They review the Montreal Protocol that is aimed at monitoring and improving the health of the ozone layer. Students discuss the factors that contribute to uncertainty in predicting the future of the ozone layer.



Use this correlation in conjunction with the **Procedures** located on pages 142–144 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: 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...</p>
<p>Steps 1 and 2: In groups of 4, have students create a two-column chart, “Problems Associated with Ozone Layer” and “Possible Solutions,” answering questions regarding solutions humans might consider regarding the ozone layer, UV radiation, and human sources of halogen gases.</p> <p>After 10 minutes, have volunteers from each group share problems & solutions, recording these on the Problems and Possible Solutions Chart.</p> <p>Have students discuss the following points:</p> <ul style="list-style-type: none"> ■ What are the problems? ■ What can people do to help the ozone layer recover? ■ What do you think people can do to reduce the amount of ozone-depleting substances in the atmosphere? ■ Who should be responsible for seeing that these types of solutions happen? <p>Suggestion: Provide each group one of the questions to answer. In addition to providing the solution, challenge each group to provide the reason why they think the solution they provide is the best solution. Have students discuss how their solutions will affect other systems.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely,... such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p> <p>WHST.9–10.7: Conduct...research projects to answer a question...</p>

Student Tasks	Common Core Standards Applications
<p>Steps 1 and 2 (Continued):</p>	<p>WHST.9–10.8: Gather relevant information from multiple authoritative print and digital sources...; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas...</p>
<p>Step 4: Discuss with student what kinds of information they need to make a decision.</p> <p>Suggestion: <i>If students have trouble answering this question, review the entries on the Problems and Possible Solutions Chart and discuss what helped them identify the main problems listed.</i></p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: 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 (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p> <p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Steps 5–7: Have students read aloud the first paragraph of The History of the Montreal Protocol (Student Edition, pages 17–19).</p> <p>Have students read the next section of The History of the Montreal Protocol and discuss: What led to their decision to reduce the use of certain ODSs?</p> <p>Have student read “Who Is in Charge of the Montreal Protocol?” and list the jobs of the United Nations Environmental Programme.</p> <p>Have students read and discuss “The Effects of the Montreal Protocol on the Ozone Layer.”</p> <p>Ask students to identify what solutions policy makers found for reducing ODSs.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts...</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p>

Student Tasks	Common Core Standards Applications
<p>Steps 5–7 (Continued):</p>	<p>RST.9–10.4: 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 9–10 texts and topics</i>.</p> <p>RST.9–10.5: Analyze the structure of the relationships among concepts in a text...</p> <p>RST.9–10.6: Analyze the author’s purpose in providing an explanation...</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely,... such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose (e.g., argument, narrative, informative, response to literature presentations), audience, and task. CA</p>

Student Tasks	Common Core Standards Applications
<p>Steps 5–7 (Continued):</p>	<p>SL.9–10.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Step 8: Have a students read aloud from the section “How Do We Know if the Montreal Protocol Is Working?” and discuss what scientists are looking for that will tell them that the Montreal Protocol is working.</p> <p>Students should be reminded that treaties are often used to help define “boundaries” between nations.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts...</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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...</p> <p>RST.9–10.5: Analyze the structure of the relationships among concepts in a text...</p> <p>RST.9–10.6: Analyze the author’s purpose in providing an explanation...</p> <p>RST.9–10.7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments)...</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats...</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric...</p>

Student Tasks	Common Core Standards Applications
<p>Step 8 (Continued):</p>	<p>SL.9–10.4: 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...</p>
<p>Steps 9–11: Project Changes to the Ozone Layer (Visual Aid #22). Student should note the general trends in the graphs and discuss the causes and effects of the ozone levels.</p> <p>Project Projected Recovery Stages of Global Ozone (Visual Aid #23) and have students note the “range of uncertainty” as indicated by the orange band.</p> <p>Students brainstorm what kinds of limitations scientists may face in creating models and making predictions about the ozone layer, and record their answers on the back of their two-column chart.</p> <p>Conduct class discussion in which the following points are discussed:</p> <ul style="list-style-type: none"> ■ Insufficient data: Scientists may not have enough data from the past, or they may not have collected data for some important variables. Scientists may not have enough funding to gather all the data they need for their models. ■ Faulty data: Models are only as good as the data fed into them. ■ Unknown variables that are left out of predictive models: Scientists may not know that certain variables will affect the ozone layer, and thus will not include them in their models. ■ Poor understanding of the complex interactions between variables: Scientists may not know how many variables will interact together. For example, scientists are unsure about how climate change will alter ozone layer recovery, partly because so many variables (temperatures, wind, humidity, atmospheric chemistry) are involved. ■ Government policies may lead to unknown changes: Scientists cannot predict how governments will enact and enforce policies regarding pollutants that may influence the ozone layer or other related variables. 	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts...</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...</p> <p>RST.9–10.4: 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...</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>
<p>Step 12: Students complete Scientific Knowledge and Policymaking (Student Workbook, pages 20–21) for homework.</p>	<p>WHST.9–10.1: Write arguments focused on <i>discipline-specific content</i>.</p> <p>a) Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</p> <p>b) Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</p>

Student Tasks	Common Core Standards Applications
<p>Step 12 (Continued):</p>	<p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <p>WHST.9–10.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>WHST.9–10.8: Gather relevant information from multiple authoritative print and digital sources...</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Unit Assessment

Refer to the introduction pages at the front of this document for information regarding the Traditional and Alternative Assessments for this unit and their Common Core correlations.

Reading *California Connections* using a Common Core Reading and Writing Focus

Reading

Science teachers can further enhance the teaching of Common Core Reading Literacy Standards by noting the suggestions below and in the following pages while reading the *California Connections* selection for content. Explicitly teach students to pay attention to the structure of the text by noting the following:

- Note how the author cites evidence to support main points; note any gaps or inconsistencies. **(RST.9–10.1 and RST.11–12.1)**
- Note how the author sets up the central ideas or conclusions; trace the text’s explanation or depiction of a process or concept; summarize concepts, processes, and information by paraphrasing the text. **(RST.9–10.2 and RST.11–12.2)**
- Note how the author explains multi-step procedures. **(RST.9–10.3 and RST.11–12.3)**
- Note how the author explains the meaning of key terms, symbols, domain-specific words, and phrases. **(RST.9–10.4 and RST.11–12.4)**
- Analyze the structure of the relationships among concepts in a text, and the relationships among key terms, including categories or hierarchies. **(RST.9–10.5 and RST.11–12.5)**
- Analyze the author’s purpose in providing an explanation, or describing a procedure, and how this defines the question the author seeks to address; identify important unresolved issues. **(RST.9–10.6 and RST.11–12.6)**
- Note how the information in the *California Connections* text integrates with information provided throughout the unit in diverse formats, including tables, charts, maps, and quantitative data. **(RST.9–10.7 and RST.11–12.7)**
- Assess the extent to which the reasoning and evidence in a text support the author’s claim; evaluate the analysis and conclusions in the text. **(RST.9–10.8 and RST.11–12.8)**
- When other documents are included, compare and contrast findings presented in this text to those in other sources, noting when the findings support or contradict previous explanations. **(RST.9–10.9 and RST.11–12.9)**
- Note comprehension strategies for understanding science text. **(RST.9–10.10 and RST.11–12.10)**

Note: Standard descriptions are paraphrased, using terminology that applies to reading a *California Connections* selection.

Writing

Many *California Connections* selections can be used as a model for future student writing tasks applying the Writing Literacy Standards by noting how the author structures the text, organizes the ideas, and provides well-chosen relevant and sufficient facts, extended definitions, concrete details, quotations, or other information and examples.

Using the *California Connections* Selection

The following pages note specific places where the *California Connections* selection provides examples for specific Writing Literacy Standards for Science and Technical Subjects, using this selection as a writing model. They also provide suggestions for teaching students to analyze text structure using the Reading Literacy Standards for Science and Technical Subjects. Teachers can incorporate more suggestions from the list above.

WHST.9–10.2a: Introduce a topic and organize ideas...

Suggestion: Discuss with students how the introduction sentences are used to capture the reader's attention.

RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...

- UV (ultraviolet)
- SPF

California Connections: Don't Forget Your Sunscreen!
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Don't Forget Your Sunscreen!



You live in California, near the ocean, the bays, or rivers; in the mountains, in the desert, in the pine or woodland forests; near farmlands or wine country; or in a city where you spend time in the parks or skateboarding. Wherever you live, you are sure of two things—California sunshine and many outdoor adventure possibilities.

But today you and your friends are at the beach. You have everything together: towel, bathing suit, hat, your music, and a snack. The dogs are barking, telling you that your friend has arrived. You race for the door. "Bye, Mom!" you yell, as you push the dogs back. "Did you remember the sunscreen?" shouts your mom. "I checked the weather forecast for today and the UV (ultraviolet) forecast is 10 and that is high, you can easily get a sunburn." You stop in your tracks, turn, and climb the stairs two at a time. There it is, on the bathroom counter—SPF 30. You grab the bottle. Your mom waits for you as you slide down the stairs. "Have fun," she says. "Remember to put it on again, after you go swimming!"



People at the beach

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RST.9–10.10: ...read and comprehend science/technical texts...independently and proficiently.

Suggestion: Provide students opportunities to reread the text with a partner, looking for academic vocabulary. If time allows, have students reread a third time, looking at how the author develops the claim through the text.

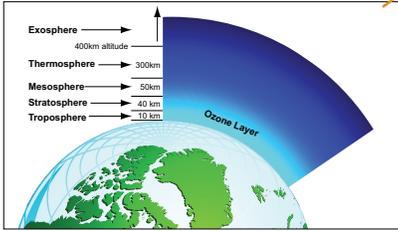
RST.9–10.5: Analyze the structure of the relationships among concepts in a text...

Suggestion: This sentence sets up the structure of this text. Have students trace its development while reading.

California Connections: Don't Forget Your Sunscreen
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Why Worship the Sun?
Throughout history, human beings have had a special relationship with the Sun. In the past, ancient cultures worshipped the golden star as a god, praising it as the source of all living things. The Sun helped crops grow; it brought warmth and light to the people. They lived freely in the Sun, soaking up its generous rays. The ancient Greeks used olive oil as a primitive type of sunscreen, and no one seemed to notice when their skin turned red after a hot day in the Sun.

Sunscreen: A Solution to a Problem
In 1938, a Swiss chemistry student named Franz Greiter developed a simple sunblock after he was severely sunburned while climbing the mountain peak, Piz Buin. He called it "Glacier Cream." A few years later, it was considered healthy and attractive to go on vacation and come back with a tan. People flocked to beaches, lakes, and mountains to surf, swim, and ski. By the 1970s, a whole generation had baked their bodies in the Sun, not



Earth's atmosphere

aware that harmful rays could cause serious damage.

Sun and Ultraviolet Radiation
To understand how the Sun can sustain life and cause trouble at the same time, we need to look a little more closely at the bright star at the center of our solar system. Although the Sun broadcasts many different kinds of radiation, UV radiation is the main cause of tissue damage to human beings, animals, and plant life. UV radiation is associated with sunburn, skin cancer, and premature aging. UV radiation is subdivided into three different wavelengths: UV-A, UV-B, and UV-C radiation. UV-C radiation has

the highest energy and is possibly the most dangerous of all UV radiation. Luckily, most UV-C radiation is filtered out by Earth's atmosphere. Too much UV-A and UV-B radiation exposure from the Sun damages the skin, eyes, and immune systems of human beings. UV-A radiation penetrates more deeply into the skin than UV-B radiation. It does not cause sunburn, but scientists think it may be the primary cause of wrinkles and even cancer. UV-B radiation is the type of solar radiation that we usually associate with sunburn and skin cancer.

Ozone in the Atmosphere
Earth's atmosphere is made up of many layers that protect

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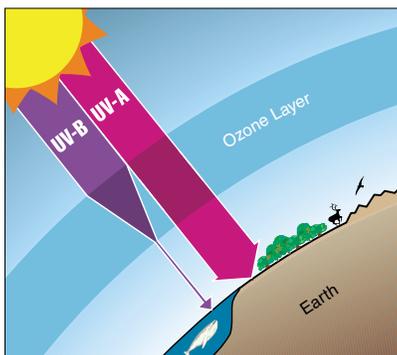
WHST.9–10.2a: ...include...graphics... and multimedia when useful to aiding comprehension.

Suggestion: Have students write a short summary of what the graph is depicting. Explain to students that oftentimes in technical and scientific text, graphs and charts are included as additional pieces of information.

RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...

- Radiation
- Tissue
- Premature aging
- UV-A
- UV-B
- UV-C
- Cancer

California Connections: Don't Forget Your Sunscreen
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UV radiation and the ozone layer

the surface from dangerous levels of solar radiation. The layer of Earth's atmosphere closest to the surface is called the troposphere. The layer above it is the stratosphere. Ozone, a strong-smelling, pale blue, reactive gas consisting of three oxygen atoms, is found in both layers. Ozone in the troposphere (or ground-level ozone; a major component of smog) forms when air pollutants are directly emitted from motor vehicles, refineries, industrial plants, and other sources react in the

presence of sunlight. It is also formed naturally by lightning. Ozone causes acute and chronic respiratory difficulties and other health problems in human beings. However, most ozone is found in the stratosphere, 10 to 30 miles above Earth, where it absorbs ultraviolet radiation from the Sun. Scientists call this the ozone layer and recognize it as Earth's natural "sunscreen." Scientific evidence shows that certain man-made chemicals, especially chlorofluorocarbons (CFCs),

are causing the slow destruction of our protective ozone layer. Other factors, such as global climate change, also play a part. This dangerous depletion of the ozone layer allows more harmful UV radiation to enter the troposphere.

So far, most of the damage to the ozone layer has occurred over the North and South Poles during the winter months. However, there is now evidence of thinning over more densely populated areas in the Northern Hemisphere. Scientists are afraid that a continued thinning of the ozone layer will cause a huge increase in skin cancer, infectious diseases, and problems with human and animal eyesight. It may also cause a decrease in food production on Earth due to crop yield losses.

Rating and Using Sunscreen

In 1979, the Food and Drug Administration (FDA) developed a rating for Sun Protection Factors (SPFs) in sunscreen or sunblock. Sunscreen contains chemicals that absorb UV-B

WHST.9–10.2b: Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details,...or other information and examples...

Suggestion: Have students identify how these three paragraphs provide supporting details, examples, and evidence.

RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...

- Troposphere
- Ozone
- Atoms
- Stratosphere
- CFCs
- Sunscreen vs. sunblock

RST.9–10.1: Cite specific textual evidence to support analysis of science...texts, attending to the precise details of explanations or descriptions.

Suggestion: While reading, have students summarize sections of the material, citing evidence from the text.

California Connections: Don't Forget Your Sunscreen!
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radiation (chemical blocks), and sunblock generally contains an opaque material that reflects UV-B radiation (physical blocks). Some products contain both. The number rating after "SPF" on the bottle indicates the amount of time you can be exposed to sunlight without getting a sunburn, provided you use the recommended dosage. Unfortunately, many sunscreens do not protect the skin from UV-A radiation, which can also be dangerous.

Does wearing sunscreen or sunblock prevent sunburn from harmful UV-B radiation? The answer is "yes." However,

there are a few things to consider. In small amounts, UV-B radiation has a positive effect, creating vitamin D in the skin. Ironically, studies show that vitamin D may prevent certain cancers. The vitamin is also necessary for healthy bones and teeth. Luckily, you can take vitamin D in pill form, which is one way to make up for the loss of UV-B radiation.

Sunscreen has come a long way since Franz Greiter went climbing on Piz Buin. Currently, the FDA recommended dosage is approximately one ounce of sunscreen or sunblock

to cover exposed skin on the body. Studies show that sunscreen is most effective if applied 15 to 30 minutes before you go out in the Sun, followed by one reapplication 15 to 30 minutes later. After swimming, remember to apply more.

By the time you get to the beach, the sand is already so hot that you and your friend have to wear flip-flops to keep your feet from burning. You can feel the radiant heat off the bright sand burning your legs. You shout, "Run!" and race each other to the cool dampness of the shore, where you shed your cover-ups and throw down your towels and bags. Suddenly, your mother's voice rings in your head. "Hey," you say to your friend, "Let's put on sunscreen." "Why?" she asks. "Don't you want to get a tan?" "The ozone layer is thinning," you tell her. "A tan is not what it used to be." "Ozone?" She looks at you as if you have just told her to stand on her head. "I'll tell you later," you say, as you cover yourselves with a generous amount of SPF 30, wait until it dries, and run straight into the waves.



Sunscreen products

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RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author's claim...

Suggestion: Pose the following questions to students:

- Does the reasoning and evidence in the text support the author's claims?
- Cite the specific supporting reasoning and evidence.
- Cite any gaps in reasoning or evidence.

California Common Core State Standards Descriptions

Reading Standards for Literacy in Science and Technical Subjects

- **RST.9–10.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **RST.9–10.2:** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- **RST.9–10.3:** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- **RST.9–10.4:** 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 *grades 9–10 texts and topics*.
- **RST.9–10.5:** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).
- **RST.9–10.6:** Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
- **RST.9–10.7:** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **RST.9–10.8:** Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.
- **RST.9–10.9:** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
- **RST.9–10.10:** By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Speaking and Listening Standards

- **SL.9–10.1:** 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.
 - a) Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
 - b) Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
 - c) Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
 - d) Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
- **SL.9–10.2:** Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.
- **SL.9–10.3:** Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

- **SL.9–10.4:** Present information, findings, and supporting evidence clearly, concisely, and logically (**using appropriate eye contact, adequate volume, and clear pronunciation**) such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose (**e.g., argument, narrative, informative, response to literature presentations**), audience, and task. **CA**
 - a) **Plan and deliver an informative/explanatory presentation that: presents evidence in support of a thesis, conveys information from primary and secondary sources coherently, uses domain-specific vocabulary, and provides a conclusion that summarizes the main points. (9th or 10th grade) CA**
- **SL.9–10.5:** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- **SL.9–10.6:** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grades 9–10 Language standards 1 and 3 for specific expectations.)

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects

- **WHST.9–10.1:** Write arguments focused on *discipline-specific content*.
 - a) Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.
 - b) Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.
- **WHST.9–10.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
 - a) Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
 - b) Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
 - d) Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
- **WHST.9–10.4:** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- **WHST.9–10.5:** Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- **WHST.9–10.6:** Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.
- **WHST.9–10.7:** 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.
- **WHST.9–10.8:** Gather relevant information from multiple authoritative print and digital sources (**primary and secondary**), 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. **CA**
- **WHST.9–10.9:** Draw evidence from informational texts to support analysis, reflection, and research.