

APPENDIX 2.2.2 CURRICULUM RESOURCES

2.2.2a: Grade 6 Achievement First Science Resources

Vision of the AF Science Program

For students to thrive in the world they will face after college, they must approach science as an inquiry-based discipline founded on determining scientific claims through patterns in repeated evidence and data, and revising those claims upon discovery of new evidence. Scholars access their current conceptions of the world and contextualize their learning through relevant and anchoring learning experiences. Scholars learn science through the application of scientific practices through meaningful content and scaffold their understanding in a logical, spiraled and sequential process, from kindergarten through twelfth grade. Our scholars view science as a lens through which to understand and question the world. They develop a sense of curiosity about our world through a desire for the deeper understanding of key scientific principles, their relevance to their daily lives and their broader connection to one another. Our scholars see and experience the natural, clear connections between science and other key disciplines including reading, writing, math, technology and social studies. Successful completion of the AF science program aims to increase the number of our scholars pursuing STEM careers beyond college, to increase their career opportunities, and to ultimately increase the competitiveness and future economic prosperity of the United States. At Achievement First all scholars, including special education and ELL students, should have complete access to our science program.

Tenets of Achievement First's Science Program

The four tenets of the AF science program are derived from and connected to the conceptual shifts in the Next Generation Science Standards (NGSS), the principles of *A Framework for K-12 Science Education* (the foundational document from the National Research Council that is the foundation of the NGSS), and our internal core beliefs at Achievement First.

1. **Curiosity through Inquiry:** Children are natural scientists; their curiosity and wonder for how the world works drive their formative years. Therefore, it is our responsibility to ensure that students continue to cultivate a love and appreciation for the beauty and wonder of science, engineering, and the natural world. Students at all grade levels in AF will display deep intellectual engagement in the study of science, driving them to design their own investigations, to talk about what they are learning, and to explain why their work is important to them and to the world. Our program accomplishes this by using meaty questions to drive individual investigations and units of study, this builds on the inherent curiosity and joy students experience in learning to bring purpose to the study of science and thus is prerequisite to a rigorous educational experience. Engaging in this work is the heart of science and is the true embodiment of inquiry. This tenet aligns in part to the NGSS conceptual shift that K-12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world and the principles from *A Framework for K-12 Science Education* that children are born investigators and connecting to students' interests and experiences.

2. **Depth and Coherence:** *A Framework for K-12 Science Education* states, “To develop a thorough understanding of scientific explanations of the world, students need sustained opportunities to work with and develop the underlying ideas and to appreciate those ideas’ interconnections over a period of years rather than weeks or months”. To accomplish this goal, students at AF build background knowledge and an understanding of science by deeply engaging with a focused set of core ideas and practices throughout their educational experience. Through this intensive approach, they will build expertise and use their expertise to make sense of new information or tackle problems. For example, the core science idea of matter and its interactions is first introduced in second grade as students observe, describe and classify matter by its properties and observe changes to matter. In fifth grade students develop a particle model of matter, use properties to identify matter, develop the idea that matter is conserved, and use properties of matter to determine if new substances are made during changes to matter. In later fifth grade units, students come back to the idea of matter conservation by connecting it to the recycling of matter in ecosystems and the water cycle. Students continue to use these ideas in sixth grade as they test matter for chemical properties and apply the ideas of properties and conservation to the cycling of matter Earth materials in the rock cycle, weather, and tectonic plate movements. This core idea continues to be developed and applied in this manner throughout middle school and into high school, not just in Chemistry, but as it applies to Physics and Biology as well. This tenet directly aligns to the NGSS conceptual shifts that the science concepts in the NGSS build coherently from K-12 and that the NGSS focus on deeper understanding of content as well as application of content. In addition, it also directly aligns to the principles from *A Framework for K-12 Science Education* of focusing on core ideas and practices and that understanding develops over time.

3. **Rigor:** According to a recent report put out by Change the Equation, STEM employment is expected to rise 17 percent by 2018 and is one of the fastest growing areas of employment. STEM careers, on average, pay nearly double the salary of non-STEM careers. And yet, only 30 percent of U.S. high school graduates in 2011 were ready for college work in science. Therefore, it is incumbent upon us to ensure that students develop the skills and understandings necessary to be prepared for introductory college level science courses and ultimately the careers of their choice, including (but not limited to) careers in science, engineering, and technology. Our program goes beyond the floor set by current external assessments to ensure that all performance expectations set forth in the Next Generation Science Standards are met and that college readiness expectations are met as outlined by the College Board Standards for College Success. The rigor of content, concepts, and practices gradually increases in complexity from grade band to grade band, to ensure that all AF scholars have the knowledge and skills to choose careers in STEM. For example, in grades K-2 we expect students to make observations and use those to construct an evidence-based account of a natural phenomenon such as describing patterns of what plants and animals need to survive. In grades 3-5 we now expect students to build on this by constructing an explanation of an observed relationship that includes reasoning such as constructing and explanation relating the speed of an object to the energy of that object. In grades 6-8 students should now develop explanations that include both qualitative and quantitative relationships between variables and should use these explanations to make predictions of phenomena. For example, students would explain that as the speed of

an object doubles, its kinetic energy quadruples by conducting various investigations and describing the patterns in the data. In high school students build on middle school by making quantitative and qualitative claims regarding the relationship between independent and dependent variables. For example, students would derive Coulomb's Law from data and evidence they collect in their own experiments. This tenet directly aligns to the NGSS conceptual shift that the NGSS are designed to prepare students for college, careers, and citizenship.

4. **STEM Literacy:** Science, engineering, mathematics, and the technologies they influence permeate every aspect of modern life. The understanding of and interest in STEM topics that informed citizens bring to their personal and civic decision-making is critical to our nation's future. Therefore, AF's science program incorporates all aspects of STEM, as well as literacy in the language arts, to develop proficiency with the science-related issues that are intrinsically relevant to students. It is especially important to note that the inclusion of engineering as a core component of our science program represents a significant and essential shift. Engineering is the application of science to design solutions to problems in an effort to make our lives better. Applied sciences such as engineering are one of the fastest growing careers in the world today. Therefore, developing literacy in engineering is an extremely important aspect of our program. This tenet directly aligns to three of the NGSS conceptual shifts: K-12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world, science and engineering are integrated in the NGSS from kindergarten through twelfth grade, and the NGSS and Common Core State Standards (English Language Arts and Mathematics) are aligned.

6th Grade Science Scope & Sequence, Unit Plan, and Lesson Plan

Gr 6 Science NY				Gr 6 Science CT			
Week	Dates	Important Dates	Units	Week	Dates	Important Dates	Units
1	8/19-8/23		Unit 1: Expansion and Contraction (12 days)	1	8/19-8/23		Unit 1: Expansion and Contraction (12 days)
2	8/26-8/30			2	8/26-8/30		
3	9/2-9/6	9/2 - Labor Day Holiday		3	9/2-9/6	9/2 - Labor Day Holiday	
4	9/9-9/13			4	9/9-9/13		
5	9/16-9/20			5	9/16-9/20		
6	9/23-9/27		Unit 2: Phase Changes (16 days)	6	9/23-9/27		Unit 2: Phase Changes (16 days)
7	9/30-10/4			7	9/30-10/4		
8	10/7-10/11			8	10/7-10/11		
9	10/14-10/18	10/14 - Indigenous People Day/Columbus Day Holiday		9	10/14-10/18	10/14 - Indigenous People Day/Columbus Day Holiday	
10	10/21-10/25			10	10/21-10/25		
11	10/28-11/1			11	10/28-11/1	10/28 - CT DOP	
12	11/4-11/8	11/5 - NY DOP (Election Day); 11/8 IA 1 Window Opens		12	11/4-11/8		
13	11/11-11/15	11/11 - Veterans' Day Holiday; IA 1 Window		13	11/11-11/15	11/11 - Veterans' Day Holiday; IA 1 Window	
14	11/18-11/22	IA 1 Window Closes 11/21		14	11/18-11/22	IA 1 Window Closes 11/21	
15	11/25-11/29	11/27 - early dismissal; 11/28-11/29 Thanksgiving Holiday	Unit 3: Chemical Properties and Processes (22 days)	15	11/25-11/29	11/27 - early dismissal; 11/28-11/29 Thanksgiving Holiday	Unit 3: Chemical Properties and Processes (22 days)

16	12/2-12/6	12/2 - Data Day		16	12/2-12/6	12/2 - Data Day	
17	12/9-12/13			17	12/9-12/13		
18	12/16-12/20			18	12/16-12/20		
	12/23-12/27	Holiday Break			12/23-12/27	Holiday Break	
	12/30-1/3	Holiday Break	Holiday Break		12/30-1/3	Holiday Break	Holiday Break
19	1/6-1/10			19	1/6-1/10		
20	1/13-1/17			20	1/13-1/17		
21	1/20-1/24	1/20 - MLK Holiday		21	1/20-1/24	1/21 - MLK Holiday	
22	1/27-1/31	IA 2 Window		22	1/27-1/31	IA 2 Window	
23	2/3-2/7	IA 2 Window Closes 2/6	Unit 4: Growth and Development of Organisms)	23	2/3-2/7	IA 2 Window Closes 2/6	
24	2/10-2/14	2/10 - Data Day		24	2/10-2/14	2/10 - Data Day	Unit 4: Growth and Development of Organisms
	2/17-2/21	Feb Break	Feb Break		2/17-2/21	2/17-2/18 - Feb Break	
25	2/24-2/28			25	2/24-2/28		
26	3/2-3/6	NY Math Mock 2		26	3/2-3/6		
27	3/9-3/13	3/13 - AF Day Off		27	3/9-3/13	3/13 - AF Day Off	
28	3/16-3/20			28	3/16-3/20		
29	3/23-3/27	3/25-3/26 NY ELA Test	Unit 5: Interdependent Relationships in Ecosystems (21 days)	29	3/23-3/27	CT ELA Mock 2	
30	3/30-4/3			30	3/30-4/3	CT Math Mock 2	Unit 5: Interdependent Relationships in Ecosystems (21 days)
	4/6-4/10	NY Spring Break	NY Spring Break		4/6-4/10	4/10 - Good Friday	
31	4/13-4/17			31	4/13-4/17	Spring Break	CT Spring Break
32	4/20-4/24	4/22-4/23 NY Math Test	Unit 6: Earth's History -	32	4/20-4/24		Unit 6: Earth's History -

33	4/27-5/1		Reconstructing the Past (16 days)	33	4/27-5/1		Reconstructing the Past (15 days)
34	5/4-5/8	NY Math Test		34	5/4-5/8	SBAC ELA	
35	5/11-5/15			35	5/11-5/15	SBAC Math	
36	5/18-5/22			36	5/18-5/22		
37	5/25-5/29	5/25 - Memorial Day Holiday; 5/26 EOY Testing Window Opens		37	5/25-5/29	5/25 - Memorial Day Holiday; 5/26 EOY Testing Window Opens	
38	6/1-6/5	EOY Testing Window; 6/5 - Norming Day		38	6/1-6/5	EOY Testing Window; 6/5 - Norming Day	
39	6/8-6/12	6/12 Last Day of School		39	6/8-6/12	6/12 Last Day of School	

Grade 6: Science Unit 1

Expansion and Contraction:

How does temperature affect matter?

August 19 – September 18

Instructional Days: 12

Overview

Essential Question:

How does temperature affect matter?

Unit Overview

In service of answering the unit essential question, scholars gather evidence through investigation, observation, and text to develop a model to explain the expansion and contraction of matter when temperature changes. This unit builds on what scholars have learned in 5th grade where they initially developed the particle model of matter. In 7th grade, scholars will continue to build on their particle model of matter to describe the atomic and molecular structure of matter and use it to model the conservation of matter. In high school, scholars will continue to build and apply their model of matter. Initially scholars are presented with an intriguing question about the expansion of an iron bar. After initial discussion, scholars then observe various phenomena involving the expansion and contraction of matter during temperature changes and are asked to develop initial models to explain what is happening. In the following lessons, scholars then conduct a series of investigations where they explore the expansion of gases, liquids, and solids as they are heated. They use all of this evidence to develop a model that explains the phenomena presented in the Unit Engage. Their model should include the following:

- Matter is made of particles
- The particles of matter are in constant motion
- The particles of matter gain kinetic energy as energy is transferred
- The particles of a gas are not in contact (except during collisions) with one another and move about relative to one another
- The particles of a liquid are constantly in contact with one another as they move relative to one another
- The particles of a solid are closely spaced and vibrate, but do not change relative positions

Next, scholars apply their modeling to the rock falls of Yosemite. They read an article about how thermal expansion may be a contributing factor to rock falls in Yosemite and elsewhere. They then develop a model to explain how this might occur. Finally, scholars are evaluated with an engineering question about bridges and use their understanding of thermal expansion to develop an argument for the best design for the bridge. This is followed up by a series of separate NGSS written tasks.

Scholars will also have practiced and strengthened their understanding of how to use scientific models. They will review what scientific models are and how they are used to explain phenomena. They will review that scientific models should show the components of the model, the relationships between components, and the connections between the model and the phenomenon. Scholars will see that models must be consistent with the available evidence and that as new evidence is obtained, the models change to accommodate the new evidence.

In addition scholars have opportunities to use text as a resource to obtain information in order to help them deepen their understanding of concepts and explain phenomena. In the unit assessment, scholars are expected to be able to research from text.

Unit Goals

By the end of this unit, you as the teacher will:

- Develop a culture of scientific inquiry by guiding scholars as they safely conduct investigations and make their own observations and measurements in service of collecting evidence to answer scientific questions.
- Develop a culture of collaboration where scholars share their ideas, respond to and respectfully challenge the ideas of others as they engage in scientific argumentation and modeling.
- Demand the use of genuine and sufficient evidence in students' written and oral explanations.
- Develop a culture for the use of the science notebook as a tool to record information, reflect on thinking, and retrieve information.
- Assist scholars in seeing the nature of science as a process where understanding changes over time as more evidence is obtained.
- Develop a culture by which students can safely conduct laboratory investigation through planned systems and procedures.
- Develop a culture where models and explanations are developed by students through evidence rather than being told to students by the teacher.

Enduring Understandings

By the end of this unit your scholars will:

- Develop and use models of matter to:
 - explain how particle motion changes when thermal energy is transferred to or from a substance without changing state.

- explain the expansion and contraction of solids, liquids, and gases as thermal energy is absorbed or released.
- predict how the average kinetic energy and the temperature of a substance change when thermal energy is transferred from or to a sample.
- make predictions about phenomena using their understanding of thermal expansion and contraction (Cause and Effect).
- make engineering recommendations about the design of objects subject to temperature changes.
- Use evidence to construct a scientific explanation about how the average kinetic energy and the temperature of a substance change when thermal energy is transferred from or to a sample.

Content Acquisition

By the end of this unit your scholars will:

- Differentiate between kinetic energy, thermal energy transfer, and temperature.
- Describe what is meant by the absorption and release of thermal energy from a system or the transfer of thermal energy to or from a substance.
- Define thermal expansion and contraction.

College Ready Skills

By the end of this unit your scholars will:

- Use and maintain a science notebook. By the end of unit 1 scholars should be able to efficiently complete their table of contents, tape or glue pages into their notebook as required, and follow teacher directions for what to write on specific pages of their notebook building off what they did in 5th grade.
- Use text to deepen understanding of scientific ideas. By the end of unit 1 scholars should be able to make teacher directed annotations and set up a page of Cornell Notes to use when reading a text as directed by the teacher.

Practices and Laboratory Skills

By the end of this unit your scholars will:

- Safely follow basic laboratory procedures.
- Safely conduct lab in pairs and in groups of four.
- Measure (with the use of standard metric units) mass using an electronic scale
 - Measurements should be within 5% of the accurate value.
 - All measurements should be given with the correct unit.
 - All calculations should be made by showing work via a valid method of finding the answer.

- Develop models that are consistent with the available evidence.
- Develop a scientific explanation from evidence.
- Revise scientific models and explanations based on new evidence and connect this to the nature of science and their own iterative development of the particle model of matter.
- Explain that models should be consistent with the available evidence and can successfully predict new observations; and that in order to be considered science, a model must have the characteristic of testability.

Intellectual Preparation

Expansion and Contraction, Heat, Thermal Energy, Kinetic Energy, and Temperature:

Use the following resources to help you better understand the science ideas in this unit:

- [Expansion and Contraction](#) Reading
- [Particles in Motion](#) Reading
- [Heat, Temperature, and Thermal Energy Transfer](#) Reading

Scientific Modeling

Use the following resources to help you better understand how to teach the science and engineering practice of modeling:

- [Developing and Using Models](#) by Paul Anderson

The Standard from the NGSS

Review the following resources to better understand the standard from the NGSS this unit is based on:

- The full standard of [MS-PS1-4](#) with connections to the Common Core
- The evidence statements for [MS-PS1-4](#) that indicate what mastery of this standard looks like

Review the Unit

- Read and annotate this unit overview.
- Perform the unit assessment and annotate:
 - Unit 1 Assessment - [Thermal Energy and Particle Motion](#)
- At least 1 month prior to instruction, make sure you have all the necessary materials listed under the Unit Materials section of this unit overview. If you are missing some, coordinate with your DSO and/or dean to obtain them.
- Map your instructional sequence to your school's calendar to ensure you teach the full unit with any needed flex time prior to 9/15.

Connections to Prior Learning

Scholars should enter this unit with a foundation in matter from 5th grade. In 5th grade scholars developed a particle model of matter. They learned that all matter is made of particles too small to be seen with our own eyes and that these particles are in constant motion and explain the behavior of matter (with a focus on gases in 5th grade). They developed an initial understanding of how to apply the particle model of matter to explain the particle structure of solids, liquids, and gases. They learned that matter can change and that the particles of matter are somehow involved in these changes. They also learned that matter is conserved during these changes.

NGSS Alignment

Students who demonstrate understanding can:

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models</p> <p>Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <p>Develop a model to predict and/or describe phenomena.</p>	<p>PS1.A: Structure and Properties of Matter</p> <p>Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.</p> <p>In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.</p> <p>The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.</p>	<p>Cause and Effect</p> <p>Cause and effect relationships may be used to predict phenomena in natural or designed systems.</p>

	<p>PS3.A: Definitions of Energy</p> <p>The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary)</p> <p>The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system’s total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary)</p>	
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Unit Progression

5E Instructional Cycle: Expansion and Contraction: How does temperature affect matter?

Engage

The Engage to this 5E cycle engages scholars in thinking about why matter expands and contracts when the temperature changes.

Scholars begin the Engage by discussing a Keely Probe question about the expansion of an iron bar and thinking about how what they learned about matter in 5th grade could help them answer the question. Scholars next observe a balloon shrink when placed in cold water and food coloring in both cold and hot water. They develop initial models to explain these phenomena and circle back to the Keely probe question.

It is important to treat this investigation as an Engage. All scholars' answers should be accepted since the purpose is to make student thinking visible, raise scholar questions, and engage scholars in the unit. This is an excellent opportunity to formatively assess their understanding of the particle model of matter from 5th grade and see if this is a model they genuinely believe or if it is merely something they were told.

During the Engage scholars get initial practice in how to conduct safe laboratory investigation and how to record their data in tables appropriately.

Investigation	Type of Investigation	Learning Goals	Instructional Time
1. Thinking about Expansion	Discussion, laboratory investigation, and Demonstration	<ol style="list-style-type: none">1. Construct a tentative model and explanation for the expansion and contraction of matter during temperature changes.2. Accurately measure mass using an electronic scale	2 Days: Lessons 1-2

		<ol style="list-style-type: none"> 3. Set up a basic data table with appropriate labels for columns/rows 4. Safely follow a procedure to conduct a laboratory investigation 		
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Explore			
<p>In the explore to this 5E cycle scholars investigate various phenomena involving the expansion and contraction of solids, liquids, and gases. After reviewing the properties and composition of gas, students work with “empty” ½-liter plastic water bottles to find out what happens to air when it is heated and cooled. Scholars observe that air expands when heated and contract when cooled. Next Scholars make a water thermometer with a glass bottle, plastic tube, and rubber stopper. They place the water-filled system in cold water, then hot water. They observe the contraction and expansion of liquid water in response to cooling and heating. In the final part of the investigation, scholars observe the brass sphere-and ring demonstration. At room temperature, the sphere passes easily through the ring, When the ring is cooled in ice water, and the sphere is heated on a burner, the sphere will not pass easily through the ring. Throughout, scholars are developing initial models to explain what is happening. During the Explore scholars are continuing to practice conducting safe laboratory investigation.</p>			
Investigation	Type of Investigation	Learning Goals	Instructional Time
2. Kinetic Energy	Laboratory Investigation	<ol style="list-style-type: none"> 1. Observe the expansion and contraction of solids, liquids, and gases and develop tentative models to explain these phenomena 2. Explain that models should be consistent with the available evidence and can successfully predict new observations; and that in order to be considered science, a model must have 	3 Days: Lessons 3-5

		<p>the characteristic of testability.</p> <p>3. Safely follow a procedure to conduct a laboratory investigation.</p>		
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Explain

In the Explain for this 5E Cycle, scholars develop and present a model that explains all of the phenomena they have observed thus far. After engaging in discussion and scientific argumentation, scholars then deepen their understanding of what is happening to energy and particles during thermal expansion and contraction. They use what they have learned from text to revise and refine their models of thermal expansion and contraction in terms of kinetic theory. Finally scholars will apply their learning to explaining what is happening in new situations through guided practice. During the Explain Scholars also practice using text as a resource and their ability to take Cornell Notes.

Investigation	Type of Investigation	Learning Goals	Instructional Time
3. Modeling Expansion and Contraction	Text-based and Modeling	<ol style="list-style-type: none"> 1. Differentiate between thermal energy, temperature, and kinetic energy. 2. Develop and use a model to predict how particle motion changes when thermal energy is transferred to or from a substance without changing state. 3. Use evidence to construct a scientific explanation about how the average kinetic energy and the temperature of a substance change when thermal energy is transferred from or to a sample. 4. Develop and use a model that includes a particle view of matter to predict how the average kinetic energy and the temperature of a 	3 Days: Lessons 6-8

		<p>substance change when thermal energy is transferred from or to a sample.</p> <ol style="list-style-type: none"> Use particle models to explain the phenomena of expansion and contraction. Use text as a resource to deepen understanding of scientific ideas through the completion of Cornell Notes. 		
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Elaborate			
<p>During the Elaborate, scholars extend their understanding of thermal expansion to Earth science. They will read an article about the rock falls of Yosemite where scientists have hypothesized that thermal expansion may be a contributing factor to some of the rock falls. Scholars find evidence for this hypothesis in the text and then use their model for thermal expansion to model what may be happening. Although this is just one example, a point can be made that thermal expansion is relevant to understanding how our planet works. Scholars can then discuss how liquid expansion may be relevant to the Earth.</p>			
Investigation	Type of Investigation	Learning Goals	Instructional Time
4. Yosemite's Rock falls	Text-based and Modeling	<ol style="list-style-type: none"> Use the particle model to hypothesize and model how thermal expansion affects rock falls and other Earth features. 	1 Day: Lesson 9

Evaluate			
<p>During the Evaluate for this 5E cycle, scholars will address an engineering question about the use of joints on bridges. Scholars will make an argument for how (or how not) joints should be used in the design of a new bridge by applying what they have learned about the expansion and contraction of matter.</p>			
Investigation	Type of Investigation	Learning Goals	Instructional Time

5. Thermal Energy and Particle Motion	Performance Task and Unit Assessment	<ol style="list-style-type: none"> 1. Apply the particle model of matter to explain phenomena 2. Apply an understanding of thermal energy, temperature, and kinetic to explain phenomena. 	2 Days – Lesson 10-11	
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Unit Calendar

Note: This is based on a generic calendar. Since each region (CT and NY) school has its own calendar variations with roll-offs, DOPs, and other events, you should plan on mapping out the unit based on your school’s calendar. Generally, network numbered lessons from the unit should be taught Mon-Thurs. On Fri, you may:

- Make up a lesson if a day was lost to something not already on this calendar.
- Account for having a school content area roll-off day.
- Provide a day of guided practice or a quiz.
- Implement a response to data lesson.

If you provided guided practice or a response to data lesson on day other than Friday, you must account for how you will stay on pace. That could mean making up a numbered lesson on the Friday of that week.

Plan on completing the Evaluate (Unit Assessment), no later than Friday September 14.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Aug 12	Aug 13	Aug 14	Aug 15	Aug 16	Aug 17	Aug 18
	<i>PD</i>	<i>PD</i>	<i>1st Day of School/Early Dismissal</i>	<i>Early Dismissal</i>	<i>Early Dismissal</i>	
Aug 19	Aug 20	Aug 21	Aug 22	Aug 23	Aug 24	Aug 25
	<i>Intro Lesson 1</i>	<i>Intro Lesson 2</i>	<i>Lesson 1</i>	<i>Lesson 2</i>	<i>Flex for MAP (date set by school)</i>	
Aug 26	Aug 27	Aug 28	Aug 29	Aug 30	Aug 31	Sept 1
	<i>Lesson 3</i>	<i>Lesson 4</i>	<i>Lesson 5</i>	<i>Lesson 6</i>	<i>Flex</i>	

Sept 2	Sept 3	Sept 4	Sept 5	Sept 6	Sept 7	Sept 8
	<i>Labor Day</i>	<i>Lesson 7</i>	<i>Lesson 8</i>	<i>Lesson 9</i>	<i>Flex</i>	
Sept 9	Sept 10	Sept 11	Sept 12	Sept 13	Sept 14	Sept 15
	<i>Lesson 10</i>	<i>Lesson 11 (Unit 1 Assessment)</i>	<i>Flex</i>	<i>Flex</i>	<i>Flex</i>	

Investigation Overviews

Note: During the development/revision of daily lesson resources, there may be light revisions to the exact details within each investigation. Therefore, use the overviews that follow as a guide.

Investigation #1 (Lessons 1-2)
Investigation Driving Question
What causes matter to expand and contract with temperature changes?
Investigation Summary and Connection to the Unit Storyline
<p>In this investigation, scholars are introduced to the phenomena of thermal expansion and contraction which will be the focus of this 5E cycle. The investigation begins with a Keeley probe about the expansion of an iron bar that has been left in the Sun. Scholars are given various potential explanations and discuss which of these they think is correct. After discussion, students are introduced to the engineering task they will be asked to complete by the end of this unit, given an opportunity to ask questions about the task, and given the opportunity to brainstorm what they think they will need to know and learn to complete the task. The teacher will then connect what they need to learn to being able to explain why the iron bar expanded. Next scholars will make observations of matter related to thermal expansion and contraction. Scholars will observe the contraction of a balloon and the difference in how food coloring spreads when in hot and cold water. The purpose of this is to gather student ideas about the particle model of matter and gather additional ideas about why they think matter contracts and expands. This also allows the teacher to begin to assess scholar’s ability to develop a model. As scholars conduct the investigations, they will make observations, discuss those observations, and develop a model based on the particle model of matter to explain them. We want to find out what scholars think, not bait them with correct answers. If scholar understanding of the particle model of matter is low consider using flex time to give scholars experiences that establish the key ideas of the particle model of matter and/or use investigation 2 as a purposeful place to help scholars understand that the particle model of matter is what helps us explain the phenomena. During modeling, look for the use of labeling/key and a caption. Point out why these are strong practices when using a diagram to model that should be always used. This investigation also serves as the first opportunity to develop lab investigation culture. At the end of the investigation, allow scholars to go back to their response to the Keeley probe and make any revisions based on their new observations and class discussion.</p>
Investigation Aim

SWBAT: <ul style="list-style-type: none"> • construct an initial model and explanation for the expansion and contraction of matter during temperature changes. • accurately measure mass using an electronic scale • set up a basic data table with appropriate labels for columns/rows 	
5 E Phase	Aligned External Resource(s)
Engage	Iron Bar Keeley Probe BSCS Science and Technology – Investigating Physical Systems: Chapter 10 Elaborate
Investigation Description	Investigation Questions
<ul style="list-style-type: none"> • Scholars answer and discuss Iron Bar Keeley Probe. • Scholars are presented with Engineering a Bridge Task and discuss what they may need to know to answer the task. • Scholars predict and make observations of a balloon before and after being cooled. • Scholars predict and make observations of food coloring in cold and hot water. • Scholars discuss the questions they have about the expansion and contraction of matter and relate these questions back to the Kelly probe and the Engineering a Bridge Task. 	<ul style="list-style-type: none"> • What happens to an iron bar left out in the hot sun? • What do you think you will need to know and learn to perform this task? • What happened to the balloon? • How can we explain why the balloon behaved this way using the particle model of matter? • What happened to the food coloring? How can we explain why the food coloring behaved this way using the particle model of matter? • What questions do we have about why matter behaves this way?

New Lesson Vocabulary	Cumulative Review Lesson Vocabulary
N/A	Particle Model Particles Phenomena Evidence Observation Expansion Contraction
Daily Assessment and Exemplar Response	Criteria for Success for Response
<p>Prompt: Use a model to explain why the balloon and the food coloring behaved the way they did.</p> <p>Exemplar Response:</p> <p>As an Engage lesson, the purpose of prompt is to:</p> <ol style="list-style-type: none"> 1.) Elicit student ideas about expansion and contraction 2.) Assess their understanding of the particle model of matter 3.) Assess their ability to develop a model <p>Therefore responses will vary.</p>	<p>Models should:</p> <ul style="list-style-type: none"> ● Show that matter is made of particles too small to be seen. ● Identify the necessary components using labeling and/or a key. ● Use a diagram to show the relationships between the components. ● Show the connection between the model and the phenomena using a caption.

Key Point(s)

Note: These are all considered cumulative review.

- When developing and using a model to explain a phenomena, we should:
 - Include and identify the necessary components.
 - Use the model to show the relationships between the components.
 - Make a connection between the model and the phenomena to explain the phenomena.
- The particle model of matter states:
 - All matter is made of tiny particles too small to be see with our eyes (they may use terms such as atoms and molecules, but these have not yet been formally defined)
 - There is empty space between the particles.

Investigation #2 (Lessons 3-5)

Investigation Driving Question

What happens to solids, liquids, and gases during temperature changes?

Investigation Summary and Connection to the Unit Storyline

In the previous investigation, scholars were introduced to phenomena where matter either expanded or contracted during temperature changes and they provided their initial explanations for what might be happening. In this investigation, scholars will more formally test gases, liquids, and solids to find out how they behave as they are heated and cooled and to develop an explanation for this behavior. This is an Explore, so the purpose of the investigation is for scholars to collect genuine and sufficient evidence to explain thermal expansion and contraction, but not to necessarily develop the complete scientifically accurate response with all the vocabulary by the end with that evidence. They will be able to develop the complete scientifically accurate explanation in the Explain during the next investigation.

In part one of this investigation, scholars investigate gases. First, scholars will share their ideas about gases. This serves as a review from 5th grade. Scholars will then have leeway in how they choose to investigate the behavior of hot and cold air when given a set of equipment. It may be tempting to simply tell scholars what to do, but rigor is increased when scholars connect what they are doing to what they are trying to figure out. If properly framed, scholars should be able to make reasonable decisions with guidance about how they could test the heating and cooling of air. After making observations, scholars will develop models based on the particle model of matter to explain what they observed, discuss these models, and revise them based on discussion. Formal criteria for models (introduced in investigation 1) should be reinforced. Models should include and identify the necessary components, show the relationships between those components, and connect the model to the phenomena. The vocabulary terms of expansion and compression will be introduced here.

In part two of the investigation, scholars first attempt to compress water. Water cannot be compressed and scholar are asked to use the particle model of matter to explain why this is true. Next scholars test the heating

and cooling of water following a set procedure. After making observations scholars will develop models based on the particle model of matter, discuss these models, and revise them based on discussion.

In part three of the investigation, scholars will observe a teacher demonstration with a brass sphere and ring that has been heated. Similar to the previous two parts of the investigation scholars will develop models based on the particle model of matter, discuss these models, and revise them based on discussion. Scholars will then look across all three parts of the investigation, to develop a final model that explains what happens when matter is heated and cooled. By the end of this investigation, scholars should have models that are based on the particle model including:

- Representing matter as being made of particles at the micro level.
- Showing empty space between particles.
- Showing that particles of matter are in constant motion.
- Showing that the space between particles differs between states of matter.
- Showing that as a substance is heated, the space between particles increases and vice-versa.

Scholars should also be consistently using models that include the identified necessary components, the relationships between components, and the connections between the models and the phenomena. Furthermore, scholars should be able to conduct laboratory investigations and participate in discourse about their observations and models.

Investigation Aim	
SWBAT: <ul style="list-style-type: none"> ● construct a tentative model and explanation for the expansion and contraction of gases, liquids, and solids during temperature changes. 	
5 E Phase	Aligned External Resource(s)
Explore	FOSS Chemical Interactions Investigation 4: Kinetic Energy
Investigation Description	Investigation Questions
<p>Part 1:</p> <ul style="list-style-type: none"> ● Scholars discuss their ideas about gases. ● Scholars are presented with the task of testing what happens to air when it is heated and cooled and are given a set of equipment to test this. ● Scholars develop a plan and vary it out to observe the heating and cooling of air. ● Scholars develop and discuss models to explain what they observed. <p>Part 2:</p> <ul style="list-style-type: none"> ● The teacher clarifies the difference between compression and contraction. ● Scholars predict and test if water can be compressed. 	<p>Part 1:</p> <ul style="list-style-type: none"> ● What are the characteristics of gases? ● How could you use these materials to see what happens to air when it is heated and cooled? ● What do you observe? What happens to air that is heated? What happens to air that is cooled? ● How can we explain the behavior of air that has been heated and cooled with a model? <p>Part 2:</p> <ul style="list-style-type: none"> ● Can water be compressed? ● How can we use the particle model of matter to explain why water cannot be compressed? ● What do you observe? What happens to

<ul style="list-style-type: none"> • Scholars use the particle model to explain why water cannot be compressed. • Scholars follow a procedure to test the heating and cooling of water. • Scholars develop and discuss models to explain what they observed. <p>Part 3:</p> <ul style="list-style-type: none"> • Scholars observe a teacher demonstration where a brass sphere and ring is heated. • Scholars develop and discuss models to explain what they observed. • Scholars put together all of their models and observations to create a model that explains what happens when matter is heated and cooled. 	<p>water that is heated? What happens to water that is cooled?</p> <ul style="list-style-type: none"> • How can we explain the behavior of water that has been heated and cooled with a model? <p>Part 3:</p> <ul style="list-style-type: none"> • What do you observe? What happens to brass that is heated? What happens to brass that is cooled? • How can we explain the behavior of brass that has been heated and cooled with a model? • How can we explain the general behavior of matter that has been heated and cooled with a model?
New Lesson Vocabulary	Cumulative Review Lesson Vocabulary
<p>Contraction</p> <p>Component (of model)</p> <p>Relationship (between components of a model)</p> <p>Connections (between a model and the phenomena)</p>	<p>Particle Model</p> <p>Particles</p> <p>Phenomena</p> <p>Evidence</p> <p>Observation</p> <p>Expansion</p> <p>Compression</p>
Daily Assessment and Exemplar Response	Criteria for Success for Response
<p>Prompt: Use a model to explain the behavior of solids, liquids, and gases when heated and cooled.</p> <p>Exemplar Response:</p> <p>See criteria for success.</p>	<p>Model should:</p> <ul style="list-style-type: none"> • Show that matter is made of particles too small to be seen. • Show that there is more space between particles of a gas than particles of a liquid or solid. • Show that particles are in constant motion and that that particles of a gas have more motion than those of a liquid which in turn have more motion than those of a solid. • Show that the amount of space between particles increases as the temperature of a substance increases and vice-versa. • Identify the necessary components using labeling and/or a key. • Use a diagram to show the relationships between the components. • Show the connection between the model and the phenomena using a caption.

Key Point(s)

- Models are used to explain phenomena and change over time as we collect more evidence. Models should include:
 - The identified components (often shown with labeling and a key)
 - The relationships between components
 - The connections between the model and the phenomena (often shown with a caption)
- When a substance is heated, its particles move faster and the space between them increases. This is why the substance expands at the macro level.
- When a substance is cooled, its particles move slower and the space between them increases. This is why the substance contracts at the macro level.

Investigation #3 (Lessons 6-8)

Investigation Driving Question

How do we explain the expansion and contraction of matter during temperature changes?

Investigation Summary and Connection to the Unit Storyline

In the previous investigation, scholars tested and observed the heating and cooling of gases liquids, and solids. They saw a consistent theme at the macro level, substances expand when heated and contract then cooled. They also developed tentative models to explain at the micro level what is happening at the macro level to cause this expansion and contraction with temperature changes. In this investigation, scholars will deepen their understanding of what is happening through readings, teacher questions, and class discussion to develop the complete scientifically accurate explanation for thermal expansion and contraction.

In part one, scholars are given a text called “Particles in Motion.” They read and discuss the text close reading style to develop the general rules about kinetic energy and the movement of particles. In part two, the class reads and discusses the article “Expansion and Contraction” and engages in a discussion to directly apply the learnings from both articles to the models previous developed so that the use of terms such as kinetic energy, energy transfer, thermal energy and temperature are properly used in the models and in the explanations of the phenomena. It is important to use this investigation to establish a foundation of using text as a source of evidence for developing explanations and to ensure that part of the culture includes placing the lift on the scholars for pulling out evidence, analyzing it, and using it to build explanations. Simply giving scholars the information may feel ‘efficient’ in the short run, but does not support scholars long term with accessing rigorous text, a skill necessary for success in science and life and something that is in itself one of the NGSS science and engineering practices, practice 8: Obtaining, evaluating, and communicating information. Scholars will conduct a close read of the passage in order to answer the lesson driving questions as they learn to record information in the form of Cornell Notes. At first scholars should focus their reading on defining terms and answering questions that are ‘right there’ in the text. This should then shift to answering questions that require more analysis.

Investigation Aim

SWBAT:

- construct a model and explanation for the expansion and contraction of gases, liquids, and solids during temperature changes.

5 E Phase	Aligned External Resource(s)
Explain	FOSS Chemical Interactions Investigation 4: Kinetic Energy
Investigation Description	Investigation Questions
<p>Part 1:</p> <ul style="list-style-type: none"> Teacher introduces the article “Particles in Motion.” Scholars conduct a close read of the text and take Cornell Notes during reading and discussion. The class discusses questions from the text. <p>Part 2:</p> <ul style="list-style-type: none"> Teacher introduces the article “Expansion and Contraction” Scholars conduct a close read of the text and take Cornell Notes during reading and discussion. The class discusses questions from the text. Scholars apply their learnings from the text to the models they developed in the previous investigation to improve them. <p>Part 3:</p> <ul style="list-style-type: none"> Scholars apply their new learnings to new situations in NGSS style written tasks. Scholars discuss and evaluate the thinking and solutions. 	<p>Part 1:</p> <ul style="list-style-type: none"> What is kinetic energy? What is the relationship between kinetic energy and the movement of particles? <p>Part 2:</p> <ul style="list-style-type: none"> How can we explain the expansion and contraction of gases, liquids, and solids? <p>Part 3:</p> <ul style="list-style-type: none"> How can we model and explain new situations using what we have learned?
New Lesson Vocabulary	Cumulative Review Lesson Vocabulary
Kinetic Energy Temperature Thermal Energy Transfer Thermal Expansion Thermal Contraction	Particle Model Particles Phenomena Evidence Observation Expansion Compression Contraction
Daily Assessment and Exemplar Response	Criteria for Success for Response

<p>Prompt: Use a model to explain the behavior of solids, liquids, and gases when heated and cooled.</p> <p>Exemplar Response:</p> <p>See criteria for success.</p>	<p>Model should:</p> <ul style="list-style-type: none"> ● Show that matter is made of particles too small to be seen. ● Show that there is more space between particles of a gas than particles of a liquid or solid. ● Show that particles are in constant motion and that that particles of a gas have more motion than those of a liquid which in turn have more motion than those of a solid. ● Show that the amount of space between particles increases as the temperature of a substance increases and vice-versa. ● Identify faster moving particles as having more kinetic energy and vice versa. ● Identify thermal energy being transferred from an area of warmer temperature to an area of lower temperature. ● Correctly distinguish between kinetic energy, thermal energy transfer, and temperature. ● Identify the necessary components using labeling and/or a key. ● Use a diagram to show the relationships between the components. ● Show the connection between the model and the phenomena using a caption.
Key Point(s)	
<ul style="list-style-type: none"> ● Kinetic energy is energy of motion. ● Thermal energy transfers from an area of greater temperature to an area of lesser temperature. ● The particles in substances gain kinetic energy as the substance warms and absorbs thermal energy, and lose kinetic energy as the substance cools and loses thermal energy. ● Matter expands when the kinetic energy of its particles increases; matter contracts when the kinetic energy of its particles decreases. 	

Investigation #4 (Lesson 9)
Investigation Driving Question
What is causing the unexplained rock falls in Yosemite National Park?
Investigation Summary and Connection to the Unit Storyline
<p>In the previous investigation, scholars developed a scientifically accurate model that explains the thermal expansion and contraction of matter. In this investigation, scholars will apply this model to a new situation, rock falls in Yosemite National Park. Most rock falls can be easily explained, the freeze/thaw cycles of water and ice are a major cause of erosion and rock falls. However, there are many rock falls that occur in Yosemite during the heat of the day that cannot be explained by the freezing and thawing of ice and water. (Note: the expansion of ice is an exception to the rule established in the previous investigation because ice results in an expansion of the substance even though water is being cooled. Rather than going down a rabbit hole, simply note that this is</p>

a phase change and you will be investigating interesting questions regarding phase changes in the next 5E cycle.) Scholars will conduct a close read and Cornell note taking of an article to figure out how they can explain the rock falls using information from the text and what they have previously learned about thermal expansion and contraction.

Investigation Aim	
SWBAT: <ul style="list-style-type: none"> construct a model and explanation for the unexplained rock falls in Yosemite that take place during the hottest part of the day. 	
5 E Phase	Aligned External Resource(s)
Elaborate	NEWSELA "Yosemite Park's rock cliffs "breathe" and heat can make them fall" Article
Investigation Description	Investigation Questions
Part 1: <ul style="list-style-type: none"> Teacher introduces the article Scholars conduct a close read of the text and take Cornell Notes during reading and discussion. The class discusses questions from the text. Scholars apply their learnings from the text and what they have previously learned to model what may be causing many of the unexplained rock falls. 	Part 1: <ul style="list-style-type: none"> What causes most rock falls in Yosemite? When are many of the unexplained rock falls happening? How can we apply what we have learned in this unit to explain these rock falls? How can we model what may be causing many of these unexplained rock falls?
New Lesson Vocabulary	Cumulative Review Lesson Vocabulary
N/A	Kinetic Energy Thermal Energy Transfer Thermal Expansion Thermal Contraction
Daily Assessment and Exemplar Response	Criteria for Success for Response
Prompt: Use a model to explain what may be causing many of the unexplained rock falls of Yosemite. Exemplar Response: See criteria for success.	Model should: <ul style="list-style-type: none"> Show that matter is made of particles too small to be seen. Show that there is more space between particles of a gas than particles of a liquid or solid. Show that particles are in constant motion and that that particles of a gas have more motion than those of a liquid which in turn have more motion than those of a solid. Show that the amount of space between particles increases as the temperature of a

	<p>substance increases and vice-versa.</p> <ul style="list-style-type: none"> ● Identify faster moving particles as having more kinetic energy and vice versa. ● Identify energy being transferred from an area of warmer temperature to an area of lower temperature. ● Correctly distinguish between kinetic energy, energy transfer, and temperature. ● Identify the necessary components using labeling and/or a key. ● Use a diagram to show the relationships between the components. ● Show the connection between the model and the phenomena using a caption.
Key Point(s)	
<ul style="list-style-type: none"> ● Thermal energy from the Sun is transferred to the rock walls of Yosemite. ● Thermal expansion creates stress on the rock walls and the rocks move. ● The stress and movement eventually causes rock falls. 	

Investigation #5 (Lessons 10-11)	
Investigation Driving Question	
What is the argument for the use of expansion joints in bridges?	
Investigation Summary and Connection to the Unit Storyline	
Scholars come back to the task they were introduced to in investigation one. They will determine why expansion joints are used in bridges by reading text and applying their learnings from the unit. They will also engage in the process of scientific argumentation while they do so as they will listen to the ideas of others and share their ideas after developing a tentative argument. Since this is an Evaluate, the role of the teacher is as facilitator. The teacher should not be providing direct instruction.	
Investigation Aim	
SWBAT:	
<ul style="list-style-type: none"> ● construct and present a scientific argument in favor of the use of expansion joints in bridges. 	
5 E Phase	Aligned External Resource(s)
Evaluate	See Unit Assessment - Thermal Energy and Particle Motion
Investigation Description	Investigation Questions

<p>Part 1:</p> <ul style="list-style-type: none"> • Teacher re-introduces the task. • Scholars conduct reading and research in small groups. <p>Part 2:</p> <ul style="list-style-type: none"> • Scholars develop a tentative argument. • Scholars engage in an argumentation session. • Scholars develop their own individual arguments. <p>Part 3:</p> <ul style="list-style-type: none"> • Scholars complete three NGSS written tasks 	<p>Part 1:</p> <ul style="list-style-type: none"> • See Unit Assessment
New Lesson Vocabulary	Cumulative Review Lesson Vocabulary
N/A	N/A
Daily Assessment and Exemplar Response	Criteria for Success for Response
See Unit Assessment	See Unit Assessment
Key Point(s)	
N/A	

Unit Materials

Materials List By Investigation			
Investigation	For The Classroom:	For Each Group:	For Each Scholar:
<p>Note: This unit is very similar to Unit 1 in 2016-17 so although this unit does not align with a commercial kit, many of these materials may already exist at the school. Please check before ordering.</p> <p>An ordering friendly version of this list can be found in this separate spreadsheet.</p>			
1	<ul style="list-style-type: none"> • (1) pair of safety goggles • (1) tie a balloon 	<ul style="list-style-type: none"> • (1) large bowl – large enough to fit 4 balloons with ice water • Ice water • (1) Electronic scale (capable of measuring the difference in mass between an empty and inflated ball) - <i>on network spring purchase list</i> 	<ul style="list-style-type: none"> • Science notebook • Modified Keely probe • (1) pair of safety goggles

		<ul style="list-style-type: none"> • (2) cups • Hot water • (1) vial of red food coloring • (1) vial of blue food coloring • (1) 10 inch round balloon • 1 metric measuring tape 	
2	<ul style="list-style-type: none"> • (2) thermometers, metal backed • Dishwashing detergent, liquid • (2) syringes, 35 ml • (2) pieces of plastic tubing, flexible, 10-cm • (2) binder clips, small • (1) vial blue food coloring • Paper towels • (1) container, ½ liter • (1) sphere-and-ring set, metal • (1) hot plate • Table salt • (1) pair of safety goggles 	<ul style="list-style-type: none"> • (2) water bottles, disposable, clear with cap, ½ liter • (2) cups, insulated foam, 177 ml • (4) cups, plastic, clear, 500 ml • (1) tray, plastic, tote • (1) stopper, rubber, #4, 1-hole • (1) plastic tubing, flexible, 45-cm (18") • (1) balloon, round, blue • (1) bubble solution in a plastic cup (teacher makes solution with dishwashing soap) • Hot water • Cold water • Room temperature water • (2) bottles, glass, 8-dr. • (2) stoppers, rubber, #1, 1-hole • (2) pipes, rigid plastic, clear, 10-cm • (4) cups, plastic, 500-ml • (2) index card pieces • (2) thermometers, glass, -10° to 100°C, 8" (or wireless Pasco thermometers paired with Chromebook) • (2) syringes, 35-mL • Tape, transparent 	<ul style="list-style-type: none"> • Science notebook • (1) pair of safety goggles
3	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • (1) chart paper • (1) set of markers 	<ul style="list-style-type: none"> • N/A
4	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • (1) Yosemite rock fall reading

5	• N/A	• N/A	• N/A
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Grade 6 | Expansion and Contraction | Unit 1, Lesson 01

Lesson Driving Question	
What causes matter to expand and contract with temperature changes?	
Lesson Summary and Connection to the Unit Storyline	
<p>In this investigation, which takes place over two lessons, scholars are introduced to the phenomena of thermal expansion and contraction which will be the focus of this 5E cycle.</p> <p>The first day, Lesson 01, begins with a Keeley probe about the expansion of an iron bar that has been left in the Sun. Scholars are given various potential explanations and discuss which of these they think is correct. After discussion, students are introduced to the engineering task they will be asked to complete by the end of this unit, given an opportunity to ask questions about the task, and given the opportunity to brainstorm what they think they will need to know and learn to complete the task. The teacher will then connect what they need to learn being able to explain why the iron bar expanded. Next scholars will make observations of matter related to thermal expansion and contraction. Scholars will observe the contraction of a balloon and the difference in how food coloring spreads when in hot and cold water. As scholars conduct these investigations, they will collect observations to help them address the lesson driving question. By the end of the day, scholars should believe that heating causes matter to expand and that matter will expand more quickly in hot temperatures. This will prepare scholars to build models of expansion and contraction during Lesson 02.</p>	
Lesson Aim	
<p>SWBAT: Construct an initial explanation for the expansion and contraction of matter during temperature changes.</p>	
5 E Phase	Aligned External Resource(s)
Engage	<p style="text-align: center;">Iron Bar Keeley Probe (NSTA) BSCS Science and Technology – Investigating Physical Systems: Chapter 10 Elaborate</p> <p style="font-size: small;">Achievement First does not own the copyright in BSCS or NSTA and claims no copyright in this material. The material is being used exclusively for non-profit educational purposes under fair use principles in U.S. Copyright law. The user should make the judgment about whether this material may be used under fair use / fair dealing permissions in the user’s country.</p>
Intellectual Preparation	
<p>To be successful in this lesson, in addition to reviewing the lesson plan, conducting the investigation yourself, developing exemplar responses to questions, and developing additional potential responses to data, you should study the materials below and keep in mind the thinking jobs below.</p> <p>Study Ahead: Read Teachers Notes on p. 18 of “Iron Bar”</p> <p>Thinking Jobs:</p> <ul style="list-style-type: none"> • How will you invest and ensure that scholars effectively set-up their interactive notebooks? 	

- What are the values you want living in your classroom during a laboratory investigation? How will you look for and emphasize these values?
- What will you do to ensure that scholars are using precision and specificity when making observations and collecting data?
- How does this lesson challenge scholars to examine the crosscutting concept (CCC) of cause and effect? How can you use the investigation to make this CCC live?
- Since this is a two-part lesson, what data will you collect today to help you best modify lesson 2 for where your scholars are at?

Materials Preparation

For Each Group (make kits that can be used from class to class):

- 2 large bowls
- 1 balloon per student
- 1 metric measuring tape
- 1 felt tipped sharpie
- Paper towels
- Red food coloring
- 3 cups
- 1 spoon

Each scholar will also need 1 sticky note. This will be used to capture data for the Keeley probe, so the sticky notes can be small.

Handouts:

- Print the Keeley Probe, the procedure, and the Investigation observations worksheet. Make one per scholar. These should be **three separate** handouts.
- The procedure handout should be taped into scholars' notebooks. Therefore, it is helpful to trim it to the size of the notebook. The margins of the procedure page have already been modified so you can do this.

Advanced Prep:

- Determine a way that you can have both ice water and hot water ready for use with scholars. You will need 4-5 liters of each per class.
- Create ice water baths and hot water baths. You will need one of each bath per group
- Practice tying balloons.
- Create a poster paper to collect data on the iron bar probe for each class at three moments. A suggested template is [here](#).

New Lesson Vocabulary	Cumulative Review Lesson Vocabulary
N/A	Particle model, particles, phenomena, evidence, observation, expansion, contraction
Daily Assessment and Exemplar Response	Criteria for Success for Response
Prompt:	

<p>Explain how temperature changes affect matter, using the particle model of matter. Make sure to use evidence from both investigations.</p> <p>Exemplar Response:</p> <p>As an Engage lesson, the purpose of prompt is to:</p> <ol style="list-style-type: none"> 1.) Elicit student ideas about expansion and contraction 2.) Assess their understanding of the particle model of matter <p>Therefore, responses will vary</p>	<p>Response:</p> <ul style="list-style-type: none"> • Incorporates data and observations (such as circumference and rate the food coloring moved through the water) • States that heat causes matter to expand while cold causes matter to contract. (It's okay if scholars don't use the vocabulary expansion and contraction).
Potential Misconceptions	Methods to Address Misconceptions
<p><i>This is an engage lesson, so there are numerous misconceptions that might be uncovered. That is okay. Over the course of the remainder of the unit, we will gradually address these misconceptions. However, if you notice that scholar understanding of the particle model of matter is low, use flex time (provided on the calendar) to give scholars experiences that help establish this idea.</i></p> <p><i>The Keeley probe will help you elicit misconceptions. All answer choices (save for choice C which is the correct choice) are researched misconceptions. The teacher guide gives more details on how to deepen scholar understanding.</i></p>	
<ul style="list-style-type: none"> • The particle model is not a good model 	<ul style="list-style-type: none"> • Challenge scholars to determine what we can do to change or fix this model. Future lessons will give scholars more at bats to revise their models.
<ul style="list-style-type: none"> • When a substance expands, its particles expand 	<ul style="list-style-type: none"> • Scholars may think this because they are unable to separate the substance as a whole from its parts.
<ul style="list-style-type: none"> • When a substance expands, it's because there are new particles added. 	<ul style="list-style-type: none"> • Emphasize the closed system. Ask scholars to analyze whether air was added or removed from the closed balloon.
Key Point(s)	
<p>Note: These are all considered cumulative review.</p> <ul style="list-style-type: none"> • The particle model of matter states: <ul style="list-style-type: none"> ○ All matter is made of tiny particles too small to be see with our eyes (they may use terms such as atoms and molecules, but these have not yet been formally defined) ○ There is empty space between the particles. <p><i>Since these key points are a review, we are not explicitly teaching these points today—rather we are assessing scholars' ability to use and apply these in their explanation.</i></p>	

Lesson Part	Lesson Details
<p>Framing (about 11 min)</p>	<p>Do Now (5 min)</p> <ul style="list-style-type: none"> • Have students spend 4 minutes answering the “<u>Iron Bar</u>” probe from Page Keeley. • Spend 1-minute collecting data—use your <u>pre-made</u> chart paper to capture the number of students who selected each answer. Do this without disclosing any input on which is right/more popular. Instead, state that we are collecting data to see our initial ideas and name that over the course of a science unit, we recognize ideas will change, and that we will track this. • Once scholars vote, collect the scholar Iron Bar papers. Save these for use during Lesson 2. <p>Scholars are Invested in the Unit (4 min)</p> <ul style="list-style-type: none"> • Show scholars pictures of the <u>I-35W Bridge Collapse</u> and a <u>Yosemite Rock Fall</u> • There were 7 deaths and 145 injuries due to the bridge collapse and over 1000 rock falls in the past 150 years in Yosemite. Pique scholar interest to connecting it to the expansion of matter and the Keeley Probe. • Tell scholars that by the end of this unit, they will model how matter expands and contracts and explain why this happens, in order to explain why rocks come crashing down on beautiful summer days and to argue for the addition of something called expansion joints to make bridges safer and more durable. Show scholars a picture of an expansion joint. • For Brooklyn schools, you might include that the iconic Verrazano Bridge is <u>currently undergoing repairs</u> to add in expansion joints. • Ask scholars to brainstorm what they might need to learn about matter in order to explain why expansion joints are beneficial. Have scholars think of a few reasons independently and then have them share out. Chart ideas on a chart paper. Tell scholars that we hope to learn this and much more throughout the unit. <p>Framing Example:</p> <ul style="list-style-type: none"> • Look at these catastrophes <Pretend you are showing pictures of a collapsed bridge and a rock fall> • Due to this bridge collapse <point to the bridge>, there were 7 deaths and 145 injuries! Over the past 150 years in Yosemite there were over 1000 rock falls. • What’s causing these catastrophes? Well, we saw that an iron bar expanded when it was heated, just a few minutes ago. Expansion and contraction, due to temperature changes cause destruction like this. • By the end of this unit, you will be able to use a model to explain how matter expands and contracts, in order to explain why tons of rocks come

	<p>crashing down on a beautiful summer day and to argue for the addition of something called expansion joints to make bridges safer and more durable <show picture of expansion joint> In fact, if you’ve driven over the Verrazano bridge, that connects Brooklyn to Staten Island, you might’ve noticed construction—this bridge is actually getting expansion joints!</p> <ul style="list-style-type: none"> • Before we kick off this unit, let’s brainstorm what we will need to learn in order to persuade cities to add expansion joints to bridges. When I say go, silently jot down your ideas and questions in your notebooks. Pen’s at the ready--you have 90 seconds. Go! <p><90 seconds silent brainstorming, for the sake of the drill, only give 10 seconds></p> <p><Cold call 3 “scholars.” Pretend to write on chart paper what scholars say.></p> <p>Scholars are Invested in the Lesson (1 min)</p> <ul style="list-style-type: none"> • Connect to scholars’ experiences in 5th grade where they used models to explain changes in matter, patterns in the sky, and how matter and energy cycled through ecosystems. • Say: We saw that an iron bar- which is matter- expanded after being left in the sun. We need to figure out what happened to the particles to cause that to happen. Today we will observe the effect of temperature changes on matter through two investigations. Tomorrow, we will use those observations to model what is happening to the particles to cause matter to expand and contract. <p>Scholars Internalize the Framing (1 min)</p> <ul style="list-style-type: none"> • Turn and talk. Explain what we are investigating today, what we will do to do that, and how we will show our answer by the end of class. (30 sec) • T quickly circulates to listen • Call on 1 scholar (one you heard) to restate the framing in their own words. Call on others to build on what they said is missing something. (30 sec)
<p>Building a Body of Evidence (34 min)</p>	<p>Set-up for the balloon inquiry will be more guided than future inquiries. This is due to the fact that you are focusing on clear directions and 100%. There will be more freedom for scholars in later lessons in this unit.</p> <p>Contextualize the Inquiry (Conduct this investigation as demo)</p> <p>Say: Our first investigation looks at how hot and cold temperatures affect a common object- a balloon. We will examine closely the behavior of the balloon and then model this behavior. While we are waiting for our balloons to heat up and cool down, we will also see how a drop of food coloring moves through hot and cold water. While today, our focus is on observing why matter contracts and expands, tomorrow we will use these experiences to determine whether or not the particle model can describe what we observe.</p>

Clear Expectations for Inquiry (7 min)

- Distribute kits of equipment to all scholars.
- Walk scholars through steps 1-5 of the procedure. Pay attention to how scholars use the measuring tape. It might be helpful to have scholars use a felt tipped sharpie to place a few marks where they measure the balloon, to ensure consistency across all measurements.
- Direct scholars to examine figure 10.7 on the procedure. Model the three ways to measure the balloon and ask scholars to explain to their neighbor which method is correct. Give scholars 1 minute to measure their own balloons.
- Emphasize the importance of taking detailed observations and precise measurements. State the importance of units. Clarify that observations are descriptions of what scholars can see with their eyes. Name that you will be collecting their inquiry observation worksheets.
- Give scholars clear expectations for the duration of the inquiry. It might be helpful to have these posted throughout the investigation. These expectations should include (but are not limited to)
 - Volume level
 - Where scholars can find the bowls of crushed ice water and the heat source and how they should transport small volumes of this liquid to complete the second portion of the investigation.
 - How scholars should keep time
 - What scholars should do while they wait for their balloons to cool and to heat. In order to maximize time, it is recommended to have scholars set up their interactive notebooks while their balloon cools and then execute the procedure for Part B while their balloon warms.
 - Clean up expectations

Clear Focus for Inquiry (1 min)

- Have scholars complete a turn and talk- reminding their peers of what they will be looking for in each investigation. Listen that they are not only describing the investigation—and how it will help them answer the lesson driving question, but also stating that these investigations will help us verify whether the particle model is accurate
- Remind scholars that as they complete their investigations, you will be circulating to look for what they observe with their eyes as well as their ideas of what is happening on the particle level.

<It is extremely important that the data collection outlined below is completed within the class period>

Active Engagement in the Inquiry with Teacher Circulation/Conferencing/Rapid Feedback (25 min)

- Teacher sets timer for Streamers investigation. Teacher names clear expectations or roles for all members of the group. (4 scholars per group) (3 mins)

	<ul style="list-style-type: none"> • Teacher provides scholars with directions (since this is the first lab activity, teachers should walk scholars through each step). Have scholars engage in procedures, then conduct a CFU check. (5 mins) • Set clear expectation for observations for the demo and lab. (3 mins) • Scholars create observation chart for both labs (2 mins) • Scholars conduct inquiry responsibly and effectively. Teacher monitors to ensure scholars are on task, efficient, and safe. (7 mins) • Teacher circulates to collect ideas and solicit scholars thinking on how their observations confirm the particle model of matter. (5 mins) <p>Responding to Data:</p> <ul style="list-style-type: none"> ➤ Show-call exemplar execution of the procedure. Specifically, watch the measuring of the balloons and the set-up of the food coloring investigation. ➤ To emphasize culture, narrate with concrete examples of scholars demonstrating the values you pre-determined ➤ Watch that scholars’ observations are purely what they see. If you notice that scholars have observations like “the red dye particles must be able to push past the water particles more in hot water,” ask scholars if they can see the particles. Help scholars differentiate between observations and inferences. <p>Science Notebook Set-Up</p> <ul style="list-style-type: none"> • While the balloons are in cold water, lead scholars through set-up of interactive notebook. Watch for scholars to set-up: <ul style="list-style-type: none"> ○ Table of Contents ○ Number all pages ○ Glossary • Model how you want scholars to create a heading for their notes each day.
<p>Explanation (4 min)</p>	<p><i>Since this investigation takes place over two days, the majority of the explanation phase will take place during Lesson 02.</i></p> <p>Initial Explanation (3 min)</p> <ul style="list-style-type: none"> • Distribute half pages of lined paper to scholars. Scholars will respond to the following prompt on it: <p>Explain how temperature changes affect matter, using the particle model of matter. Make sure to use evidence from both investigations.</p> <ul style="list-style-type: none"> • During this time, circulate and look for 2-3 interesting ideas. <p>Synthesis of Evidence (1 min)</p> <p>Consolidate the thinking in the room by selecting 2-3 reflective thinkers to share out their reasoning for why temperature changes cause matter to expand and contract.</p> <p>Daily Assessment (0 min)</p>

	Collect scholars' initial explanations
Closing (2 min)	<p>Consolidation and Anchoring of the Learning (1.5 min)</p> <ul style="list-style-type: none"> • Call on a scholar to remind class of the goals of the investigation. • Congratulate scholars on successfully completing their first laboratory investigation. Name 2 glows and 1 grow of the section on their lab investigation. <p>Connection to Future Learning (30 sec)</p> <ul style="list-style-type: none"> • Say: Today, we observed how temperature causes matter to expand and contract. We compared this phenomenon for gases and liquids. You had many thoughtful ideas about why heat causes matter to expand. Tomorrow, we will use the particle model to formally explain the connection between temperature and expansion/contraction.

Template to Collect Data on “Iron Bar” Probe

Use a “Sticky Bar” Chart to track how scholars’ thinking has changed over the course of the unit. Using a large piece of poster paper, create axes for a bar chart, using the template below. Scholars will track their thinking using three different colored sticky notes. You should make one poster per class and hang it prominently throughout the lesson. This bar chart will be used again in Lesson 02 and Lesson 08.

Which sentence best describes what happened to the iron particles after the bar was left in the hot sun?					
A) The number of particles increased	B) The size of the particles increased	C) The space between each particle increased	D) The air in the spaces between the iron particles increased	E) Some of the particles began to melt and spread out further in the bar	F) The heat caused the particles to flow around the bar and push it outward.

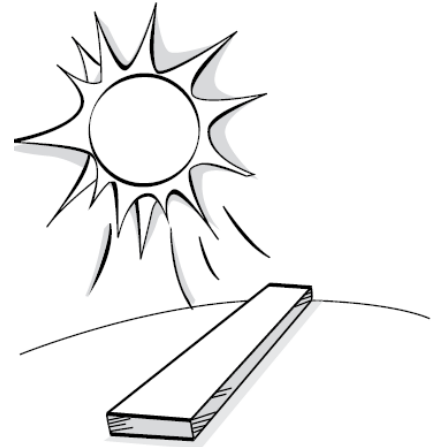
Name: _____

Class: _____

Iron Bar

Nate measured an iron bar. He put the iron bar in the hot sun. When he measured the bar after it had been in the sun, it was slightly longer. Which sentence best describes what happened to the iron particles after the bar was left in the hot sun?

- A. The number of particles increased.
- B. The size of the particles increased.
- C. The space between each particle increased.
- D. The air in the spaces between the iron particles expanded.
- E. Some of the particles began to melt and spread out further in the bar.
- F. The heat caused the atoms to flow around the bar and pushed it outward.



Explain your thinking about what happens to atoms when a metal is heated. You may draw pictures to support your explanation.

Probe modified from Uncovering Student Ideas in Science by Page Keeley

Procedure- For Teacher Demo

Part A: The Balloon

1. Obtain all of the materials for this part.
2. Blow up a balloon as much as you can without popping it. Then, let out all of the air.
3. Repeat Step 2.
4. Blow up the balloon a little more than halfway.
 - Do not fill the balloon completely with air.
5. Tie a knot in the end of the balloon to seal it tightly.
6. Measure the balloon with the metric measuring tape around the fattest part of the balloon.
 - This measurement is called the *circumference* of the balloon. Figure 10.7 shows you the right way and the wrong way to measure a circumference.
 - Notebook entry: Record this measurement in Table A.
7. Place the balloon in the bowl of crushed ice and water for 10 minutes. Write down in Table A the time you put the balloon in the ice water and the time you will need to take it out.
 - Periodically submerge the balloon into the ice water for 1 minute or so. Do this a total of 4 times during a 10-minute period. While you are waiting, listen to your teacher's instructions of what to do.
8. After 10 minutes, remove the balloon and immediately measure its circumference.
 - Notebook entry: Record this measurement in Table A.
9. Place the balloon beside, but not touching, a heat source for 10 minutes. Write down in Table A the time you put the balloon by the heat source and the time you will need to remove it. While the balloon is at the heat source, you will complete Part B.
 - You will have to ask your teacher what heat source you should use. While you are waiting, listen to your teacher's instructions of what to do.
10. After 10 minutes, take the balloon away from the heat source and immediately measure its circumference.
 - Notebook entry: Record this measurement in Table A.
11. Compare the circumference of the balloon when it was at room temperature, when it was cold, and when it was hot.
 - Notebook entry: Record your observation in Table A.

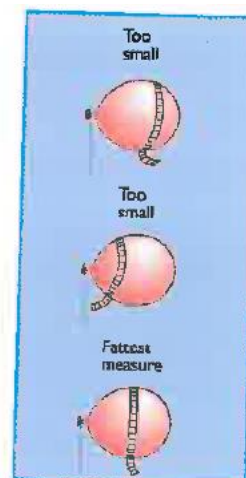


Figure 10.7 The fattest part of the balloon is not necessarily the middle part of the balloon as shown here. Where the fattest part of the balloon is depends on its shape. You can determine the fattest part by looking or taking several measurements of different areas of the balloon.

Procedures for Read Streamers Lab

Part B: Red Streamers

1. Obtain all materials for this part.
2. Fill 1 of the cups with ice and water so the cup is three-quarters full.
3. Fill the second cup full of hot water.
 - Your teacher will provide this hot water when you are ready.
CAUTION: Always use hot pads to handle the hot water!
4. Remove all of the ice from the ice water in the 1st beaker.
 - Use a spoon to remove the ice and dispose of it as your teacher directs.
5. Carefully drop 1 drop of red food coloring onto the surface of the water in the middle of each beaker.
6. Observe the action of each drop of food coloring in each beaker.
 - Notebook entry: Record your observations in Table B.

Table B: Observations of Red Streamers

	Cold Water	Hot Water
Diagram of what I see		
Written Observations		

2.2.2b: 7th Grade ELA Scope & Sequence, Unit Plan, and Lesson Plan

Overview

The purpose of this document is to clarify the core programmatic tenets of the Achievement First ELA Program and explain how each of these tenets lives within curriculum and instruction on multiple levels. This detailed version of the Program Overview is structured for all instructional leaders.

Alignment to our Mission:

Our mission at Achievement First is a lofty one: to provide all of our students with the academic and character skills they need to graduate from top colleges, to succeed in a competitive world and to serve as the next generation of leaders in our communities. Our mission is intricately tied to our literacy program; in order to ensure this threefold mission of preparedness for college, career and community leadership, our students must be critical, compelling and thoughtful readers, writers, speakers and listeners. Indeed, our literacy program must serve not just to promote foundational skills to ensure that scholars are well-prepared for a rigorous college experience, but stretch their knowledge, perspective and character to deeply understand themselves and the world around them. It is important to note that the critical work of our literacy program does

not simply happen within the confines of composition and literature class. Rather, it is important to ask the question, “How does scholar experience at Achievement First ensure that students become literate throughout the day?” As our program aims to ensure command of reading, writing, speaking and listening of complex text and ideas, a nuanced program design demands that different parts of the day serve different purposes in enhancing scholar proficiency. At the same time, it is perhaps most critical that these various parts of the day thoughtfully speak to each other, both in design and implementation. Literature class, composition class, book clubs, independent reading, interventions and other core classes are all designed to meaningfully promote a cohesive literacy approach and to meet the following core tenets of the Achievement First ELA Program.

Program Tenets:

Great instruction is driven by the interplay between daily lesson resources (DLRs), intellectual preparation (IPP), clear Fundamentals of Instruction (FOI), and frequent Looking at Student Work (LASW):

We believe that the best instruction is driven by the interplay of four key parts of our program:

- High quality DLRs that our T&L team produces and delivers to schools: these plans are rigorous and clear.
- Daily IPP: teachers intellectually prep the DLRs, focusing their efforts on internalizing the end-of-lesson bar (In literature, exit ticket; in composition, the quantitative and qualitative daily output backwards-mapped from weekly checkpoints), the lesson tasks, and DNPG moments.
- A Clear FOI: this document and its corresponding resources (videos, etc.) sets the vision for a rigorous, engaging, and urgent ELA block. Used in concert with the DLR, teachers should have a very clear roadmap for how to achieve daily lesson outcomes.
- Daily LASW: teachers look at student work each day – and at frequent assessment touchpoints – to inform instructional changes or “keep doing’s” based on student data. This data may inform DLR IPP (e.g., adding a specific CFU – check for understanding – to the lesson plan based on gaps in student understanding; giving batch feedback the next day; pulling students for conferences or small-group instruction) and/or SGI (small group intervention).

We believe that a shared curriculum – build on our best internal and external research and practices – enables us to row together and drive student engagement most effectively. In middle school, our curriculum includes both unit plans and daily lesson resources for grades 5-8 in both Literature and Composition. These units and lessons are undergoing constant revision based on teacher and leader feedback. In high school, our curriculum includes unit plans and will aim to include daily lessons resources in some grades in 2017-2018. Ultimately, these lessons are meant to serve as the starting point for teachers and should never be used in a “plug and play” manner. We believe that leveraging a shared curriculum – in concert with thoughtful unit unpacking, intellectual

prep, and looking at student work – will result in stronger instruction within schools and across our network. We are proudly open-source with our curricular resources.

Develop Critical Consumers of Complex Text –

All students must be voracious & critical readers of varied, complex literature and informational text; the ability to deeply comprehend and analyze complex texts is a critical component not only to college and career readiness, but to leadership in our communities. Scholars must be able to deeply understand the perspective and purpose of an author, the circumstances in which the author is writing, to whom the author is writing, etc.; scholars must analyze authorial choices so as to more deeply understand the author's purpose for his/her intended audience. At Achievement First, we believe that all students must have experiences closely reading rich text from diverse genres and perspectives to develop both their analytical skill and critical thinking. Texts must be selected for their complexity and for their worthiness, ensuring equity of access to examining revolutionary ideas, well-crafted arguments and great literature. In order to lead, in order to affect change, one needs economic, political and social power. This includes a strong, inclusive canonical foundation, which will provide our students with the needed social capital to be successful. Furthermore, a love of great books can and will spark a deep love of reading essential to our program.

Encourage Rigorous, Evidence-Based Thinking and Argumentation to Ensure Students Communicate Persuasively –

If the hallmark of college and career readiness is the ability to make a coherent and thoughtful argument using sound and sufficient evidence, all students must write and talk both independently and collaboratively in a manner that is insightful, persuasive and critical. To that end, students must be able to find credible information, both digitally and through printed texts, synthesize that information, reconciling disparities and addressing counterarguments, and critically evaluate that information to effectively convince their audience. Students must thoughtfully plan their writing, and occasionally their speaking, such that they substantiate claims with sound evidence and reasoning, cultivating logical arguments. As students make intentional choices as authors, they simultaneously deepen their understanding of the choices published authors make. Students must also become adept at incorporating feedback – from teachers and peers – and consequently revising their work to demonstrate stronger thinking, writing, and speaking.

Build Knowledge of Words and the World Grounded in Critical Topics and Transferable Themes -

In many ways, the achievement gap is both fueled and reinforced by a knowledge and vocabulary gap. At Achievement First, we believe that building deep knowledge across a range of essential topics will ensure that students are stronger readers and can access complex, content-rich text. Topical and thematic immersion increases domain familiarity and the complexity of ideas that a student can access, which in turn quickens the rate of word and content acquisition. Therefore, ELA texts and writing assignments are selected intentionally to reinforce both world and word knowledge and align to our history, science, music and art programs when appropriate.

Cultivate Critical Curiosity about Our Ever-Changing World to Build Academic Independence –

We do not build knowledge for the sake of building knowledge; fundamentally, our program must aim to ensure that all students are curious, critical citizens, intent on expanding their own knowledge of the world through asking questions, seeking and evaluating information, and collaborating and debating with others. We aim to spark students' inquisitiveness to ultimately drive academic research, independence and develop a sense of passion for building and sharing their knowledge. Students will seek new understandings and question their previous assumptions on a variety of topics, including those central to the human experience and current world landscape.

Foster Voracious, Lifelong Readers and Writers-

As a network, we remain deeply rooted in our commitment to ensuring that scholars find true joy in the study of literacy and leave our program with a deep appreciation for great books, new information and diverse perspectives. Simply put, we want our students to love literacy. Reading is both a means to college and career readiness as well as a worthy endeavor in itself. It is true that students who love reading will benefit from a virtuous cycle: when they choose to read on their own, they will invariably develop larger vocabularies, learn more content, receive positive feedback and want to read even more. At the same time, we also believe that reading is an end in itself. Great works of literature function as both windows and mirrors – they affirm readers' experiences and also open a window into new worlds worth discovering. Our schools should inspire life-long readers. Teachers have a significant role to play in this effort; to paraphrase master teacher Rafe Esquith, our reading program should be like orchestras, and – as the conductors – our job is to make the instruments sing and help students lose themselves in books. Our writing program should not only cultivate the ability to express oneself clearly and concisely, but also ignite a passion for writing. We should also be cultivating school-wide literacy cultures, where teachers are modeling their own passion for the discipline.

Program Outcomes:

Secondary ELA Program Outcomes

Critical Consumers of Complex Text:

Academic Independence and Thinking Skills

- o Build **critical thinking skills** by asking and answering oral and written **text dependent questions** that allow access to the big ideas of the text, core comprehension and engagement with critical text demands, including author's purpose and craft;
- o Build ability for students to **navigate and create texts of different purposes, genres and styles.**
- o Foster strong academic habits to ensure that scholars tackle complex texts and tasks with **increasing independence and awareness.**

- o Where applicable, use thoughtful accommodations and modifications to further foster critical consumption of text.

Encourage Rigorous, Evidence-Based Thinking to Ensure Students Communicate Persuasively:

- o Use direct instruction and feedback to support students in planning and communicating sound **argumentation** that is substantiated by compelling, accurate evidence in both process and on-demand settings.
- o Empower students to write **clearly** and **fluently** through attention to the **rhetorical situation, word choice**, and **sentence composition** (grammar, syntax, and punctuation) and through use of technological aids
- o Build thinking, listening and speaking skills through rich **discussion of text** and application of the **habits of discussion**; adapt conversation to the demands of the situation; Express and synthesize ideas in both **presentation** and **conversation**.
- o Use **technology** to facilitate efficient **feedback**, enable student-to-student collaboration, and widen access to information

Build Knowledge of Words and the World Grounded in Critical Topics and Transferable Themes:

- o Build **world knowledge** intentionally and systematically in every class to deepen scholar understanding of essential and relevant topics across the day.
- o Develop a robust academic vocabulary by building **word knowledge** through direct acquisition of roots and words and through indirect acquisition by volume of reading in all classes;
- o Where applicable, intervention texts selected should reinforce critical topics and themes being discussed in ELA, history, science, etc.

Foster Voracious, Lifelong Readers and Writers:

- o Build a **love of reading** through exposure to rich, relevant high-interest text and genuine enthusiasm for the discipline;
- o Enhance scholar capacity and motivation to **sustain a volume of engaged reading**;
- o **Creatively engage** with self-discovery as well as new worlds and ideas while exploring text and their own writing.

Support all scholars in their endeavors to become stronger readers, writers, and speakers-

- o **Thoughtfully bridge connections** between reading intervention and core humanities classes, both via programmatic clarity and teacher-to-teacher discourse about student needs (e.g., the Guided Reading teacher and the Literature teacher know how to support their shared scholars and communicate frequently about reinforcing strong literacy habits).

2019-2020 | 7th Grade Literature & Composition Scope & Sequence: CT

Week #	Dates	Important Dates	Literature Scope & Sequence ¹	Composition Scope & Sequence
	8/19-8/23		Unit 1: <i>Fahrenheit 451</i> (28 Lessons)	Unit 1: <i>Fahrenheit 451</i> (26 Lessons)
	8/26-8/30			
	9/2-9/6	Labor Day (9/2)		
	9/9-9/13			
	9/16-9/20			
	9/23-9/27			
	9/30-10/4			
	10/7-10/11		Unit 2: <i>Night</i> (22 Lessons)	Unit 2: <i>Night</i> (21 Lessons)
	10/14-10/18	Indigenous Peoples' Day (10/14)		
	10/21-10/25			
	10/28-11/1	DOP (10/28)		
	11/4-11/8	IA 1 Window Opens (11/8)	Unit 3: <i>Call of the Wild</i> OR <i>Hamilton: The Revolution</i> (20-22 Lessons)	Unit 3: Paul Revere OR Evaluating History & Lin-Manuel Miranda's <i>Hamilton</i> (20 Lessons)
	11/11-11/15	IA 1 Window		
	11/18-11/22	IA 1 Window Closes (11/21)		
	11/25-11/29	Thanksgiving Break (11/28-11/29)		
	12/2-12/6	IA 1 Data Day (12/2)		
	12/9-12/18			
	12/16-12/20		Winter Break (12/23-1/3)	
	1/6—1/10		Unit 4: <i>Raisin in the Sun</i> (22 Lessons)	Unit 4: Harlem Renaissance (22 Lessons)
	1/13-1/17			
	1/20-1/24	MLK Day (1/20)		
	1/27-1/31	IA 2 Window		
	2/3-2/7	IA 2 Window		
	2/10-2/14	IA 2 Data Day (2/10)	Unit 5: <i>Love Poetry</i> (16 Lessons)	Unit 5: Interdisciplinary Research (18 Lessons) (This unit is SBAC-Research-Aligned)
	2/17-2/21	February Break		
	2/24-2/28			
	3/2-3/6			
	3/9-3/13	No School (3/13)	Crescendo (SBAC Prep) (16 Lessons, 4 Quiz Reteach Days,	Crescendo (SBAC Prep) (16 Lessons, 4 Quiz Reteach Days,
	3/16-3/20			
	3/23-3/27	ELA Mock 2 (3/24-3/27)		
	3/30-4/3	CT Math M2		

¹ The start and end days indicated below by color-coding are not exact; refer to # of lessons & dates rather the color-coding (which is approximate)

4/6-4/10	NH Spring Break	& Flex Days)	& Flex Days)
4/13-4/17	Hartford Spring Break BP Spring Break		
4/20-4/24			
4/27-5/1			
5/4-5/8	ELA SBAC (5/5-5/6)		
5/11-5/16	Math SBAC (5/12-5/13)	Unit 6: <i>The Narrative of the Life of Frederick Douglass</i> (18 Lessons)	Unit 6: Argumentation (19 Lessons)
5/18-5/22			
5/25-5/29	5/25 – Memorial Day		
6/1-6/5	EOY Testing Window		
6/8-6/12			

2019-20

7th Grade Literature: Unit 1

Fahrenheit 451 by Ray Bradbury

Table of Contents

What the Unit will Achieve..... Page 2

What Makes This a Great Teaching Unit? Page 2

Alignment..... Page 3

Essential Questions & Enduring Understandings Page 3

The Unit’s Core Skills Page 4

Ensuring Mastery of the Unit’s Core Skills Page 5

The Performance Task Page 7

Key Definitions Page 8

Planning Guidance Page 9

Daily Unit Calendar Page 10

Unit Supplements: S&L and Informational Lessons Page 13

WHAT THIS UNIT WILL ACHIEVE

In the opening unit of the year, 7th grade scholars will engage with the genre of speculative fiction and will study Ray Bradbury's novel *Fahrenheit 451* as the anchor text. *Fahrenheit 451* tells the tale of Montag, a firefighter in a futuristic dystopia. His role as a firefighter is unfamiliar to the contemporary reader; instead of putting out fires, Montag and others in his trade are charged with setting fires to books and to the homes of those in this society who own them. Books and other forms of art are considered dangerous and are outlawed entirely in this hyper-controlling community. Through a chance encounter with a young woman named Clarisse, Montag begins to question the systems and values of his society, which are embodied by his supervisor, Beatty. Slowly, Montag begins to bear witness to the ways in which he and his fellow citizens are forced to live meaningless lives ruled by fear, and he must decide whether to remain complicit or fight back.

Over the course of Unit 1, students will engage in several introductory lessons to build thematic, genre and topical understandings necessary to evaluate *Fahrenheit 451*. The unit opens with an exploration of the genre through a series of short stories to acquaint scholars with the characteristics of speculative fiction. Then, as scholars read the novel, they will begin to form schema and analyze symbols. In later lessons, they will explore how Bradbury develops the themes of his novel. A focus throughout the whole unit is Montag's character, his interactions with ideas and other characters, and his eventual change.

This unit has several key goals: (1) that students begin to understand and engage with the genre of speculative fiction and how the genre often features characteristics of an unfamiliar society to offer comment on contemporary life; and (2) that students continue to build an understanding of how an author's commentary is developed, especially through the use of symbols and character development.

This unit overview should be used along with the anthology and daily lesson plans on the Curriculum Hub.

WHAT MAKES THIS A GREAT TEACHING LITERATURE UNIT?

In Literature, the Great Teaching initiative means that we will be intentional about building scholars' critical reading & thinking skills so that they will be better able to read complex texts and understand, both on a personal and intellectual level, how books help us come to a deeper insights and understandings of the world and of human experience.

In this unit, the following lessons have been revised to meet the standards of Great Teaching: 2, 3, 5, 6, 10, 11, 14, 15, 18, 22 and 25. These lessons are designed so that scholars engage with texts in way that fosters deep thinking and will encourage key shifts in our approach to reading instruction, including:

- **More Disciplinary and Conceptual Thinking:** We believe that scholars must leave middle school as more independent learners; thus, we must begin to shift away from lessons that teach scholars *what* to think and instead focus on teaching scholars *how* to think in disciplinary ways. To do this, we will ask broader questions that target the *thinking* scholars must do rather than simply the answers they should give.
- **More Divergent Thinking:** At a high level, we are trying to shift our instruction from convergence (getting to one "right answer" or one "stamp") towards divergence (multiple valid responses and fostering the type of thinking / reasoning that an exemplar might illustrate).
- **More Time Surfacing Complexity:** In the old paradigm, many of the lessons we designed focused too much on "removing obstacles to mastery." For example, we would include lists of back pocket questions and other supports that encouraged quick intervention and high degrees of scaffolding. In this new paradigm, we are instead focused on what disciplinary thinking should look like and we aim to design lessons that foster great reading skills in and beyond the lesson. And, we are intentional about designing each lesson with an arc of activities that ensure that scholars grapple with meaning, especially with the most complex and worthy sections of text.

To this end, Great Teaching lessons are designed with multiple reads of a text that foster inquiry and close reading. The way one interacts with a text in order to create knowledge or develop claims is via multiple rounds of closely reading text, starting with an entry point at the imaginative and effective level of the text, then analyzing the specific choices of the author, and then drawing conclusions about what the text says and means at an abstract level. Thus, many lessons include these multiple reads: reading to experience; reading to recognize & notice & question; reading to analyze; and, reading to evaluate.

For more on disciplinary thinking in Literature, please refer to pages 4-23 of [this document](#).

ALIGNMENT TO COMPOSITION

This unit aligns closely with Unit 1 in Composition, which is also focused on *Fahrenheit 451*. Literature teachers should keep the following in mind while planning and executing the unit:

- **Ensuring pacing alignment and cohesion between literature and composition:** Because these units work in conjunction with one another, **it's a best practice to fully read the companion composition unit (composition teachers should do the same for literature),** OR check in carefully with your composition teacher about what you should know about the focus of their unit prior to instruction. **This will ensure both teachers see the full picture of instruction.**
- Literature and composition teams **should meet early and often, at least on a weekly basis.** These meetings should be check-ins to review student work, review calendars for planning and pacing, and review the skills each teacher will instruct on so that both classes support each other.
- **Working with Composition to craft strong paragraph responses:** Because it's so important to set students up with a firm foundation for articulating their understandings of the text in written form, scholars will revisit and revise Literature class TDQs during Composition. **Literature teachers should grade and provide feedback on scholar responses for Days 2, 3, 5, 8, 10, 11, and the Mid-Unit Performance Task and, before handing them back to scholars, make copies and give these to Composition teachers within 24 hours of the end of the lesson.** Scholars will generally revisit TDQs 1-3 days after they are written in Literature class, so this will give literature and composition teachers time to review the writing. Because of this, it's very important for literature and composition teachers to communicate and collaborate in order to ensure that student writing has a strong start in the unit and so that both teachers have a shared understanding of both the strengths and gaps in their students' writing. The recommendation is that Literature and Comp teachers engage in LASW with these exit tickets for as many of the lessons as possible.

ALIGNMENT: VERTICAL & HORIZONTAL

Alignment to Writing	Alignment to History	Alignment to Science	Vertical Alignment
Scholars will examine <i>Fahrenheit 451</i> simultaneously in their Composition classes. They will explore similar themes and authorial moves in both classes.	There may not be a direct connection with 7 th grade history.	There may not be a direct connection with 7 th grade science.	This unit builds upon scholar's initial introduction to speculative fiction in 6 th grade in their reading of <i>The Giver</i> . Scholars will be asked to call upon specific characteristics of <i>The Giver</i> as they are introduced to other examples of the genre. Scholars will also read other examples of speculative fiction in 8 th grade when they read Octavia Butler's short story "Speech Sounds" and later in high school when they read <i>The Handmaid's Tale</i> .

HOW WILL YOU KNOW THIS UNIT IS SUCCESSFUL?

You'll know this unit was successful if students can (1) identify the characteristics of speculative fiction, (2) identify how a symbol helps an author convey meaning in texts and (3) articulate the major themes of *Fahrenheit 451* and how they are developed. In addition, students should begin internalizing the following disciplinary reasoning skills and strategies: being attentive to the details and craft in a text & positing claims on why author's make certain choices and the impact those choices have on a text's meaning and purpose.

THE UNIT'S ESSENTIAL QUESTIONS		THE UNIT'S ENDURING UNDERSTANDINGS
1. What forces shape the human experience?	Human behavior does not happen in a vacuum; our choices and actions are almost always impacted by the systems and structures around us. Ultimately, however, humans have the capacity to work against these systems and structures and make choices for themselves.	
2. What makes life meaningful?	Life is made meaningful through authentic relationships, experiences that are transformative, and the exposure to ideas that force people to question what makes them comfortable. A happy life is one that is content and simple, while a meaningful life is one full of questioning and attempts at understanding.	
3. How should readers approach the genre of speculative fiction?	Speculative fiction is, at its heart, cautionary, and it invites the reader to consider big questions about our world: <i>What if...? If only... If this goes on....</i> It shines a light on a troubling or dangerous part of our society and invites us to examine it from a different angle – e.g. an unfamiliar society, futuristic elements, hypothetical situations, etc. When reading a work of speculative fiction, readers should always be looking for the author's social commentary.	
4. How & why does the act of interpreting a symbol enhance a reader's experience?	In literary texts, symbols can and do have a range of possible meanings and interpretations. The way in which a reader interprets a symbol is influenced by their background knowledge, their depth of understanding of the text, their experiences, and their personal demographics. Interpreting symbols is a worthy intellectual exercise because (1) it encourages formative thinking (e.g. What <i>might</i> the hound symbolize?); (2) it offers a rich opportunity for divergent thinking; and (3) it helps the reader navigate the intricate web of meanings in a text	
KEY SKILLS IN THE UNIT		
Core Skill	Description	Embedded, Discrete Skills
Genre-Based Thinking	Students will develop their understanding of reading fiction by annotating & discussing elements of the genre (i.e., CMPSLL)	<ul style="list-style-type: none"> Identifying the thinking job for a work of fiction Explaining the meaning of each part of the thinking job Articulating at least one theme statement and support it with examples from the text.
Analyzing characteristics and purpose of speculative fiction	Students will generate the characteristics of speculative fiction and will determine how those characteristics support the text's purpose.	<ul style="list-style-type: none"> Using examples of speculative fiction short texts to determine the common traits and characteristics across the genre Determining how those characteristics help the author achieve their purpose in writing the examples of speculative fiction Identifying those common traits and characteristics in <i>Fahrenheit 451</i> & how they contribute to the meaning and purpose of the novel
Determining how symbols to reveal theme	Students will analyze how an author uses a symbol in a text, or as a recurring element of the story, to help reveal their theme.	<ul style="list-style-type: none"> Distinguishing a symbol from other objects, people, actions or events in a story Determining the literal and figurative use of the symbol Tracking the development of a symbol over the course of the text Determining how the symbol contributes to the author's larger commentary or message
Determining how a theme is developed throughout the novel	Students will work to determine several themes of <i>Fahrenheit 451</i> and analyze how these themes are developed	<ul style="list-style-type: none"> Explaining what a theme is (i.e., a universal message or understanding about life; what the author intends for the reader to learn or consider about life after reading the text; a deep understanding about a big idea) Determining the theme(s) based on how characters respond to challenges or reflect on events

		<ul style="list-style-type: none">• Supporting a theme statement with relevant textual evidence from the text
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THE PERFORMANCE TASKS

Summary:

This unit includes two performance tasks. The first performance task takes place halfway through the unit to assess scholars' ability to determine how a symbol is used to reveal an author's meaning. The second performance task is spread over two days. The first day is a traditional Reading Workout B lesson where scholars read select parts of *Fahrenheit 451* to discuss its nature as a work of speculative fiction. Then, on the second day, they write an on-demand essay response explaining how *Fahrenheit 451* is a work of speculative fiction. (NOTE: Scholars will no longer write a comparative essay in Composition; the PBA essay for Composition now focuses on "Harrison Bergeron" only. This revised task is more realistic given the unit calendaring and is now more aligned to the first Composition IA.)

For each performance task, scholars will (1) attack the prompt, (2) plan, and (3) write a response. For the mid-unit task, student responses should follow the format of an open response and will be scored with the OR rubric. The end-of-unit performance task should be scored using the on-demand PBA rubric, according to the PBA thresholds for BOY 7th grade.

Prompt and Resources:

	Mid-Unit Performance Task	End of Unit Performance Task
The Prompt	In "The Pedestrian," what does the police car represent? Use two details from the text to support your response.	Choose one of the excerpts provided from the novel. How does this excerpt support the claim that <i>Fahrenheit 451</i> is a work of speculative fiction? While your response should largely focus on details from the excerpt, you may refer to other parts of the novel to support your response.
Student Materials	Click Here	Click Here
Sample Responses & Grading Guidance	Click Here	Click Here

KEY DEFINITIONS

- **Analogy:** Comparison made between two things to show how they are alike
- **Anecdote:** Brief story, told to illustrate a point or serve as an example of something, often shows character of an individual
- **Connotation:** the associations and emotional overtones that have become attached to a word or phrase, in addition to its strict dictionary definition.
- **GBTJ (Genre-Based Thinking Jobs):** Genre-based thinking is part of strategic reading. It is based on the belief that if a student can identify the genre of a specific text, he or she can likely apply a set of transferrable questions and strategies in order to aid in his/her comprehension and understanding of the text.
- **Central Idea:** The central idea of a text means that the reader is able to state both the literal and the deepest meaning of the text and contextualize this meaning with details from the text. In fiction, a central idea statement often includes the theme of the text.
- **Character:** a person portrayed in a work of fiction. Characters can be animals or objects (which are often personified, or given human-like characteristics.)
- **Character Inference:** a conclusion about a character based on textual evidence

- **Character Development:** most often this refers to the change a character experiences during the course of a story.
- **Character Trait:** enduring aspects of a character's behavior and attitudes that makes up that character's personality. Character traits may be positive or negative. [Click here](#) for a list of some character traits. Traits often describe a consistent, enduring quality of a character; this makes them different from singular emotions and feelings. A character's traits may develop over the course of a novel.
- **Character Motivation:** a reason that explains, or partially explains, a character's thoughts, feelings, actions, or speech.
- **Problem/Conflict:** this is usually an event or situation in the text that makes it difficult for the character(s) to achieve goals (e.g., a happy ending)
- **Solution:** This is how the character ultimately "deals with" the problem. Not every novel has solution and not every solution means a happy ending.
- **Lesson Learned:** This is what the character(s) learn in the novel (usually after dealing with the problem.) Not every "lesson learned" is positive.
- **Theme:** The theme is the message about life that the author wants you to realize after reading. Sometimes the theme is a lesson; other times it is a universal message about a big idea. In *Wonder*, there are themes about friendship, growing up, identity, acceptance, etc. Theme is never a one-word answer; instead, it is always framed as a statement.
- **Conflict:** the struggle between opposing forces or characters in a story.
 - **External Conflict:** conflicts can exist between two people, between a person and nature or a machine, or between a person and a whole society.
 - **Internal Conflict:** a conflict can be internal, involving opposing forces within a person's mind.
- **Diction:** a speaker or writer's choice of words.
- **Figurative Language:** Words which are inaccurate if interpreted literally, but are used to describe; typically figurative language illustrates comparisons or describes qualities.
 - **Metaphor:** figurative language that makes a comparison between two unlike things without the use of such specific words of comparison as like, as, than, or resembles.
 - **Simile:** figurative language that makes an explicitly comparison between two unlike things, using words such as like, as, than, or resembles.
 - **Personification:** figurative language in which an object or animal is given human feelings, thoughts, or attitudes.
- **Flashback:** a scene that interrupts the normal chronological sequence of events in a story to depict something that happened at an earlier time (or an entire story/novel can be told in flashback)
- **Foreshadowing:** the use of hints and clues to suggest what will happen later in a plot.
- **Motif:** a recurring image, word, phrase, action, idea, object, or situation used throughout a work (or in several works by one author), unifying the work by tying the current situation to previous ones, or new ideas to the theme.
- **Point of view:** the vantage point from which the writer tells the story.
- **Speculative Fiction:** A genre of literature that uses unfamiliar or futuristic elements to make a commentary on contemporary life.
- **Stream of Consciousness:** a style of writing that portrays the inner (often chaotic) workings of a character's mind.
- **Symbol:** a person, place, thing, or event that has meaning in itself and that also stands for something more than itself.
- **Juxtaposition:** poetic and rhetorical device in which normally unassociated ideas, words, or phrases are placed next to one another, creating an effect of surprise and wit. For example, Ezra Pound wrote "The apparition of these faces in the crowd;/Petals on a wet, black bough" where he juxtaposed the faces with petals. Juxtaposition is also a form of contrast by which writers call attention to dissimilar ideas or images or metaphors.

PLANNING GUIDANCE


- **Tracking the Central Idea and & Themes of the Book:** *Fahrenheit 451* is a relatively long book with many events and characters. It's highly recommended that teachers set up a system to help scholars track "what happens" in the book as well as developing themes & big ideas.
- **Structure of the Unit:** This unit was planned with an intentional arc. The unit moves from an analysis of Bradbury's use of symbolism into his development of theme. A focus throughout the whole unit is Montag's character, his interactions with ideas and other characters, and his eventual change.
- **Homework:** Unit 1 is critical for building students' homework habits as the reading that students do at home will really set them up to succeed in both the next day's lesson and for the duration of the unit. It's recommended that homework assignments are primarily focused on literal understanding (i.e., what happened in the text.) A good rule of thumb to follow is that all homework assignments should expect that students: annotate for literal understanding (using genre-based thinking jobs to the extent possible), answer important comprehension questions, and summarize what they read. One best practice we've seen is that at the end of a HW assignment the teacher includes a text box that says "By the end of this reading and assignment, you should be able to explain the following:" and then lists key ideas (e.g., "what happened between Clarisse and Montag").
- **DIRT Quizzes:** DIRT quizzes (Did-I-Read-Thoroughly quizzes) should be a consistent practice in all lessons and should be administered and graded in such a way that they impact a student's grade, at least minimally. Questions should always be fair and assess basic comprehension; teachers should avoid "gotcha" questions that focus on minor details that even an experienced, fluent reader would likely miss. While it's recommended that DIRT quizzes assess the most crucial literal understanding, teachers may at time choose to ask more analytical/interpretative questions.
- **Performance Task Introductions:** Performance Tasks should not come as a "surprise" to students. This is noted in the AIMS calendar, but teachers should introduce the Mid Unit Performance Task on Day 4 of the unit.



DAILY UNIT CALENDAR					
Lesson #	Lesson Type	Text	Focus of Lesson ²	Draft of the TDQ ³	Homework Assignment
1	Reading Workout A	Gaiman's Introduction (pp. xi-xiv; stop at "About books.")	RI 7.2: Students will read to develop a working understanding of speculative fiction and its purpose.	Scholars will answer multiple choice questions to show their learning re: speculative fiction as a genre.	"The Fun They Had" by Isaac Asimov
2	Reading Workout B	"The Fun They Had" by Isaac Asimov	RL7.2: Students will work to determine Asimov's purpose in writing "The Fun They Had" & what features make the story an example of speculative fiction.	How is the story "The Fun They Had" an example of speculative fiction?	"The Pedestrian" by Ray Bradbury ⁴
3	Reading Workout B	"The Pedestrian" by Ray Bradbury	RL7.2: Students will work to determine Bradbury's purpose in writing "The Pedestrian" & what features make the story an example of speculative fiction.	How is the story "The Pedestrian" an example of speculative fiction?	Finish Gaiman's introduction (pp. xiv-xvi)
4	Close Reading	<i>Fahrenheit</i> 451 p. 1-2	RL 7.3: Students will analyze how Montag is characterized in the opening pages of the novel to establish a foundational understanding of his character at the beginning of the book and the setting of the text.	How does Bradbury characterize Montag in pages 1-2 of <i>Fahrenheit</i> 451?	<i>Fahrenheit</i> 451 p. 2-7
5	Reading Workout B	<i>Fahrenheit</i> 451 p. 2-7	RL 7.3 & RL 7.6: Students will determine what Montag's run-in with Clarisse and their subsequent	Why did Bradbury include Clarisse's character?	<i>Fahrenheit</i> 451 p. 8-15

² It should be assumed that genre-based thinking lies at the foundation of most lessons; however, there will be some lessons where it is the focus of the lesson.

³ This TDQ is in **draft form**. The final AIM TDQ for each lesson will be published in the daily lesson plans resource and may not be the same as the question listed here. The drafted question is provided here only to illustrate one *possible* way of assessing the lesson.

⁴ Scholars have read "The Pedestrian" and "The Fun They Had" as part of the Literature and Composition units for *The Giver* in 6th grade, so these will be familiar texts. The rationale for the re-read is that both are accessible examples of the genre, and scholars will be able to dive more deeply into the text and access it beyond the literal understanding they developed in prior reads.

			conversation reveals about Montag's character.		
6 	Reading Workout B	<i>Fahrenheit</i> 451 p. 10-15	RL 7.3: Students will analyze how the events of the novel reveal the setting and society in the novel	Why is this scene important?	<i>Fahrenheit</i> 451 p. 15-21
7	Reading Workout A	<i>Fahrenheit</i> 451 p. 21-25	RL 7.2: Students will determine what the mechanical hound is and its function in this society.	How is the mechanical hound described? (assessed via MC questions)	"Why Your Local Police Force..."
8	Reading Workout B	<i>Fahrenheit</i> 451 p. 21-25	RL 7.2: Students will analyze what the hound represents or symbolizes, and how this symbol contributes to the emerging themes in the text.	The Mechanical Hound is dangerous to humans. Agree or disagree.	<i>Fahrenheit</i> 451 p. 25-29 ("... to his plan.")
9	Reading Workout B	<i>Fahrenheit</i> 451 p. 25-29	RL 7.2 Students will evaluate Clarisse's argument against life in the community of <i>Fahrenheit 451</i> , and determine her chief frustration with life as it is.	Why does Clarisse have such a powerful impact on Montag?	<i>Fahrenheit</i> 451 p. 29-39
10 	Reading Workout B	<i>Fahrenheit</i> 451 p. 32-37	RL 7.2: Students will analyze an older woman's actions to evaluate what her defiance says about the community.	Why does the woman kill herself?	<i>Fahrenheit</i> 451 p. 39-45
11 	Reading Workout B	<i>Fahrenheit</i> 451 p. 1-3, 30, 34	RL 7.2: Students will analyze Bradbury's use of color throughout the text, and how his use of color contributes to the emerging themes of the novel.	What do colors represent in <i>Fahrenheit 451</i> ?	<i>Fahrenheit</i> 451 p. 45-50
12	Mid-Unit Performance Task	What does the police car in "The Pedestrian" represent?			
13	Reading Workout B	<i>Fahrenheit</i> 451 p. 39-50	RL 7.2 & RL 7.3: Students will analyze Montag's interaction with his wife Mildred to determine what is revealed about life in this society through their conversation.	What does Montag's interaction with Mildred reveal about this society?	<i>Fahrenheit</i> 451 p. 50-61
14 & 15 	Reading Workout B	<i>Fahrenheit</i> 451 p. 50-60	RI 7.8: Students will work through various excerpts of the text to	Trace Beatty's argument.	<i>Optional Creative Writing</i> and

			determine Bradbury's commentary on human communication throughout the novel.		<i>Fahrenheit</i> 451 p. 61-71
16 (FLEX)	Reading Workout B	<i>Fahrenheit</i> 451 p. 67-71 and Allegory of the Cave " (0:00-3:00)	RL 7.2: Students will compare the shared commentaries presented by both Bradbury and Plato in their respective texts.	How does Plato's cave allegory relate to <i>Fahrenheit</i> 451?	<i>Fahrenheit</i> 451 p. 71-76
17	Reading Workout B	<i>Fahrenheit</i> 451 p. 67-69, 12, 23-24 27-28 & 16-18	RL 7.2: Students will work through various excerpts of the text to determine Bradbury's commentary on technology throughout the novel.	What is Bradbury's commentary on technology?	<i>Fahrenheit</i> 451 p. 76-83
18 	Reading Workout B	<i>Fahrenheit</i> 451 78-81	RL 7.2: Students will analyze Faber's beliefs about books in this society and how he explains his position to Montag.	What is Faber's argument about books?	<i>Fahrenheit</i> 451 p. 81-89
19	Reading Workout A	<i>Fahrenheit</i> 451 pp. 89-98	RL 7.6: Students will read for literal meaning. This lesson will help them to engage more deeply in the following lesson.	Scholars will answer literal questions and will make a prediction about the events to come.	Reread <i>Fahrenheit</i> 451 p. 96-97 & "Dover Beach"
20 & 21	Reading Workout B	(1) <i>Fahrenheit</i> 451 p. 89-98; (2) "Dover Beach" by Matthew Arnold	RL 7.2: Student will determine the relationship between "Dover Beach" and <i>Fahrenheit</i> 451, and infer why Bradbury would choose to include this reference in the novel.	How does Matthew Arnold's poem "Dover Beach" relate to the world of <i>Fahrenheit</i> 451?	<i>Fahrenheit</i> 451 p. 99-111
22 	Reading Workout B	<i>Fahrenheit</i> 451 p. 109-111	RL 7.2: Students will analyze what fire represents or symbolizes, and how this symbol contributes to the emerging themes in the text.	What does this scene reveal about Montag?	<i>Fahrenheit</i> 451 p. 111-119
23	Reading Workout B	<i>Fahrenheit</i> 451 p. 111-119	RL 7.2 & 7.3: Students will analyze how the death of Beatty contributes to Bradbury's larger commentary.	How does Beatty's death develop a theme of the novel?	"The Fall of Icarus" & <i>Fahrenheit</i> 451 p. 119-130
24	Reading Workout B	"The Fall of Icarus"	RL 7.2: Student will determine the relationship between "The Fall of Icarus"	How does the myth of Icarus relate to the characters and	<i>Fahrenheit</i> 451 p. 130-148

			and <i>Fahrenheit 451</i> , especially the similarities between Icarus and Montag.	events in <i>Fahrenheit 451</i> ?	
25	Reading Workout B	<i>Fahrenheit 451</i> p. 138-148	RL 7.2: Students will analyze how the actions of Granger and his community are examples of “writing the other way.”	In what ways do the actions of Granger and his community exemplify the meaning of the quotation “If they give you ruled paper, write the other way”?	<i>Fahrenheit 451</i> p. 148-158
26	Reading Workout B	<i>Fahrenheit 451</i> p. 148-158	RL 7.2: Students will analyze how Granger’s anecdote about his grandfather contributes to an already established theme of <i>F451</i> .	How does Granger’s anecdote about his grandfather contribute a theme to the novel <i>F451</i> ?	Legacy Narrative Assignment or unit reflection
27	Reading Workout B (FLEX-CT teachers may replace with a supplemental lesson)	<i>Fahrenheit 451</i> p. 156-158 & excerpt from Ecclesiastes (from the Bible)	RL 7.2: Students will analyze how Granger’s speech contributes to an already established theme of <i>F451</i>	Select one line from the poem that you feel connects most to Montag’s journey in <i>Fahrenheit 451</i> and explain the connection.	Legacy Narrative Assignment, unit reflection or preparation for unit 2
28	Performance Task Reading Day (optional)				Unit Reflection
29	Performance Task				Flexible

UNIT SUPPLEMENTS: SPEAKING AND LISTENING AND INFORMATIONAL TEXT LESSONS

NOTE: There are four Flex Lessons indicated in the AIMS calendar. Teachers can replace those lessons with the following supplemental lessons. (Please note that these swaps, particularly the speaking and listening lessons, are recommended for CT classrooms only.)

Type	Text	Lesson & Text	Brief Explanation
Informational Text Lesson	“Ray Bradbury”	Text & Lesson	<p>Summary of Text: This biographical article focuses on the life of author Ray Bradbury, and the events of his life that inspired his interest in speculative fiction and the writing of <i>Fahrenheit 451</i>.</p> <p>Summary of Lesson: Scholars will read the article for its central idea and will need to articulate the CI. Additionally, they will use the article to answer a variety of question types, including multiple choice, multiple select, and 2-part questions.</p> <p>Culminating TDQ: How do paragraphs 8-11 contribute to the central idea of the article?</p> <p>Stretch-It Question: How does this article help the reader understand Bradbury’s purpose for writing <i>Fahrenheit 451</i>?</p>

Informational Text Lesson	“A History of Book Burning”	Text & Lesson	<p>Summary of Text: This article outlines the ways in which ritualistic book burning has been used for generations to ensure conformity and wipe out dissident thought. The text is from the United States Holocaust Memorial Museum, and focuses on the use of book burning to control Jewish populations.</p> <p>Summary of Lesson: Scholars will read the article for its central idea and will need to articulate the CI. Additionally, they will use the article to answer a variety of question types, including multiple choice, multiple select, and 2-part questions.</p> <p>Culminating TDQ: Summarize the author’s message about the Nazi book burning of 1933.</p> <p>Stretch-It Question: How does this article connect to events in the novel <i>Fahrenheit 451</i>?</p>
Speaking and Listening Lesson	“The 1950’s: Booms and Busts”	Clip and Lesson	<p>Summary of Passage: This passage describes the different experiences Americans had living during the 1950’s. The article suggests that while the decade offered prosperity for some, many were left behind, and had to resist in order to gain equality.</p> <p>Summary of Lesson: Scholars will listen to the speaking and listening passage multiple times in order to answer a variety of question-types, including multiple choice, multiple select, and an open response question.</p> <p>Culminating TDQ: What is the speaker’s purpose in this clip?</p>
Speaking and Listening Lesson	“Does TV Rot Your Brain?”	Clip and Lesson	<p>Summary of Passage: This informational passage provides evidence of the harmful effects watching too much television can have on the human brain.</p> <p>Summary of Lesson: Scholars will listen to the speaking and listening passage multiple times in order to answer a variety of question-types, including multiple choice, multiple select, and an open response question.</p> <p>Culminating TDQ: According to this passage, how would Mildred be impacted by her watching of television?</p>

Grade 7 | Unit 1 | Lesson 1 | *Fahrenheit 451* Introduction (RWa)

READING TASK

Reading: *Fahrenheit 451* Introduction, beginning

Guiding TDQ: For this lesson, there is not one guiding TDQ that will be assessed via an open response prompt. Instead, scholars will answer three multiple choice questions that test their comprehension and understanding. See below for those questions.

CCSS Aligned Standards: RI 7.2, RI 7.6

WHAT THIS LESSON WILL ACHIEVE

In the introduction of *Fahrenheit 451*, contemporary author Neil Gaiman offers a definition of the genre of speculative fiction. He argues that while speculative fiction usually contains worlds of the “not-yet” or future, the genre is not predictive, but rather cautionary. Gaiman suggests that books, like *Fahrenheit 451*, use futuristic or seemingly unbelievable worlds to offer commentary and caution on the current state of things.

Over the course of this lesson, students will read, annotate, and discuss the introduction in order to determine how Gaiman defines speculative fiction and its purpose. By the end of this lesson, scholars will correctly answer

three multiple choice questions to demonstrate understanding of the definition and characteristics of speculative fiction.

WHAT DOES EXCELLENCE LOOK LIKE?

Exit Ticket |

Exemplar Response

Example Short Response

- 1) Which statement below best defines and describes *speculative fiction*?
 - a) Speculative fiction is fiction that tries to accurately predict exactly what the future will be like.
 - b) Speculative fiction is fiction that warns readers about conditions of the present using worlds in the future.
 - c) Speculative fiction documents what life is like in the present.
 - d) Speculative fiction asks what the present would be like if some event had taken place in the past.

- 2) Below, circle the three answer choices that identify characteristics of *speculative fiction*.
 - a) Speculative fiction often is about future worlds that are yet to exist.
 - b) Speculative fiction is usually violent.
 - c) Speculative fiction often asks “What if...” some huge change or event took place.
 - d) Speculative fiction is always about disastrous events.
 - e) Speculative fiction is usually about societies far different from our own.
 - f) Speculative fiction often examines problems that are occurring in present day society.

3) Read the excerpt below from Ray Bradbury’s short story *The Pedestrian*

“Just walking, Mr. Mead?” the police car’s metallic voice asked.

“Yes,” Mead replied.

“But you haven’t explain for what purpose.”

“I explained; for air, and to see, and just to walk.”

“Have you done this often?”

“Every night for eight years.

The police car sat in the center of the street with its radio throat faintly humming... There was a sigh, a pop. The back door of the police car sprang wide. “Get in.”

- What speculative question is Bradbury asking in this story?
- a) What if police began arresting every random person they found?
 - b) If only people would stop walking at night, how much better might the world be?
 - c) What if walking alone became so rare and strange that you could be arrested for it?
 - d) What if the people were replaced by robots?

KEY THEMATIC CONCEPTS

- Speculative fiction
- The power of books


KEY VOCABULARY

- Enticing (xi)
- Extrapolating (xii)
- Predictive (xi)
- Polemic (xii)
- Pervasive (xii)
- Speculative

INTELLECTUAL PREPARATION

- Follow the steps for [IPP with a Literature Network Plan](#)

- Ensure that your scholars have copies of the novel prior to the start of today’s class (or that you have a system for doing this efficiently at the start of class), other unit resources (e.g., the text-companion) and a system for taking notes (if they are not annotating in the book)
- Accommodate the homework as necessary for your scholars who need those accommodations.

PART OF THE LESSON		READING MODALITY, READING TASK, AND KEY QUESTIONS		
Launch (5-8 minutes)	<p>DIRT Quiz N/A</p> <p>Build the Narrative: Teachers may choose to build the narrative by asking the following questions:</p> <ul style="list-style-type: none"> • Why is it important to know a book’s genre? <p>Build Investment/Background Knowledge: Explain to students that today, we will begin our first unit, tackling one of the most famous novels in American history titled <i>Fahrenheit 451</i>. Before we start reading the book, we’re going to learn more about its genre, which is called speculative fiction. We will do this by reading the introduction of the novel, written by contemporary writer Neil Gaiman. Teachers might consider using the Launch to make sense of the word “speculative” with scholars. Teachers might consider having scholar fill out the below organizer to determine their own definition for the word:</p>			
	Picture:			How Else is This Word Used?
	In a Sentence:	<p>She could only speculate as to why her friends no longer wanted to go on the trip.</p>		My Definition:
Heavy-Lifting Loop #1	Read & Annotate (28-30 mins)	<p>Paragraph-by-Paragraph Teacher Read-Aloud: <i>Fahrenheit 451</i> introduction, stopping at “...harder to see.”</p> <p>Context: We are going to begin our analysis of the introduction today by determining how Gaiman defines speculative fiction and its purpose.</p> <p>Note: We recommend that the teacher read each section aloud before giving scholars time to write their responses. This will build investment in the reading and promote a “shared reading” in the classroom.</p> <p>Time:</p> <ol style="list-style-type: none"> 1. Teacher reads section aloud. 2. Teacher gives scholars 2-3 minutes to write response or annotate. 3. Teacher debriefs section, using BPQs as needed. 4. Repeat steps 1-3 for remaining sections. 		
		Stopping Point	Format/Question (Exemplar Response)	BPQs
		End of Paragraph 1	EVERYBODY WRITES: According to Gaiman, why do people write about the future?	<ul style="list-style-type: none"> • Why does Gaiman include the section in parentheses?

	(“Sometimes writers...people writing.”)	(Gaiman claims that there are many reasons why authors write fiction about the future.)	<ul style="list-style-type: none"> Which sentence best captures Gaiman’s claim about writers?
	End of Paragraph 2 (“This is...for granted.”)	<p>EVERYBODY WRITES: What does Gaiman claim about <i>Fahrenheit 451</i> in this section?</p> <p>(Gaiman claims that the reason Bradbury wrote <i>F451</i> was to warn readers to appreciate what they have before it is gone.)</p>	<ul style="list-style-type: none"> Gaiman writes “This is a book” – to what book is Gaiman referring? According to Gaiman, why did Bradbury write this book?
	End of Paragraph 3 (“There are... <i>goes on</i> ...”)	<p>EVERYBODY WRITES: What does Gaiman claim about speculative fiction in this section?</p> <p>(Gaiman claims that there are three phrases authors use to guide their writing of speculative fiction.)</p>	<ul style="list-style-type: none"> What makes writing speculative fiction “possible” according to Gaiman?
	End of Paragraph 5 (“What if... <i>were invisible</i> .”)	<p>EVERYBODY WRITES: According to Gaiman, what is the difference between the two phrases listed in this section?</p> <p>(Gaiman claims that “What if” allows authors to depart from present everyday life, and “If only” allows authors to reflect on the future.)</p>	<ul style="list-style-type: none"> What “worlds” does the “What if” phrase allow authors to examine? What “worlds” does the phrase “If only” allow authors to examine?
	End of Paragraph 7 (“If this goes...cautionary worlds.”)	<p>EVERYBODY WRITES: According to Gaiman, what is the purpose of the “If this goes on” phrase for authors?</p> <p>(The “If this goes on” framing phrase let’s authors warn readers about contemporary issues by imagining if these issues became “bigger”.)</p>	<ul style="list-style-type: none"> What examples does Gaiman provide in this part of his essay? What do the examples have in common?
<p>If scholars gloss over the sentence “It’s a cautionary question, and it lets us explore cautionary world” or skip it altogether, the teacher can facilitate the following close reading burst:</p>			
Close Reading Burst – Sensitivity Analysis			
	Original Evidence	Revised Evidence	Question Sequence
	“It’s a cautionary question, and it lets us explore a cautionary world.”	“It’s a question, and it lets us explore a different kind of world.”	<p>FIRST, show <i>just</i> the original:</p> <ol style="list-style-type: none"> Cold Call: Read Gaiman’s sentence aloud. What “world” is Gaiman discussing? (the world in a speculative fiction novel) <p>THEN, juxtapose the original with the revised version:</p> <ol style="list-style-type: none"> What is different about the two versions? Gaiman intentionally repeats the word “cautionary.” How does this word choice help us understand the purpose of speculative fiction?
	End of Paragraph 8 (“People think...quite different.”)	<p>EVERYBODY WRITES: What does Gaiman claim about speculative fiction in this section?</p> <p>(Gaiman claims that speculative fiction does not predict the future, because the future is too large and complicated to ever accurately predict.)</p>	<ul style="list-style-type: none"> What does Gaiman claim people “get wrong” about speculative fiction? Why can’t speculative fiction predict the future?

		<p>End of Paragraph 9 ("What speculative...It's cautionary.")</p>	<p>EVERYBODY WRITES: What does Gaiman claim about speculative fiction in this section?</p> <p>(Gaiman claims that instead of predicting the future, speculative fiction offers readers warning about the present, and asks them to imagine what life would be like if certain elements of the present persisted.)</p>	<ul style="list-style-type: none"> • What is speculative fiction actually good at, according to Gaiman? • Again, Gaiman uses the word "cautionary". Why? How does this word help support his claim about speculative fiction in this section? 							
		<p>End of Paragraph 10 ("Fahrenheit 451...harder to see.")</p>	<p>EVERYBODY WRITES: What does Gaiman claim about <i>Fahrenheit 451</i> in this section?</p> <p>(Gaiman claims that <i>Fahrenheit 451</i> is an example of speculative fiction because it offers a warning to modern readers.)</p>	<ul style="list-style-type: none"> • How does the first sentence of this section help the reader understand Gaiman's claim about <i>F451</i>? • What "warning" does the novel provide? 							
<p>Attack the Prompts (OPTIONAL) (4-5 mins)</p>	<p>Introduce the lesson's two multiple choice questions. Guide scholars through the use of the <i>attack the prompt</i> strategy so that they have annotated each question and drafted a plan. Use the following questions to help you plan:</p>										
	<p>1.</p> <table border="1"> <thead> <tr> <th data-bbox="430 842 716 873">Prompt</th> <th data-bbox="716 842 1604 873">"Exemplar response" – <i>Teacher script</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="430 873 716 936">Let's read the question aloud.</td> <td data-bbox="716 873 1604 936">Which statement below best defines and describes <i>speculative fiction</i>?</td> </tr> <tr> <td data-bbox="430 936 716 1073">What are the key words in this prompt?</td> <td data-bbox="716 936 1604 1073"> "defines and describes" – <i>gives overview of</i> "speculative fiction" – <i>The genre</i> </td> </tr> <tr> <td data-bbox="430 1073 716 1209">So, what do we have to do to answer this question correctly?</td> <td data-bbox="716 1073 1604 1209"> <u>Plan:</u> 1) Read every answer choice 2) Identify the overview of speculative fiction 3) Select most accurate answer </td> </tr> </tbody> </table>	Prompt	"Exemplar response" – <i>Teacher script</i>	Let's read the question aloud.	Which statement below best defines and describes <i>speculative fiction</i> ?	What are the key words in this prompt?	"defines and describes" – <i>gives overview of</i> "speculative fiction" – <i>The genre</i>	So, what do we have to do to answer this question correctly?	<u>Plan:</u> 1) Read every answer choice 2) Identify the overview of speculative fiction 3) Select most accurate answer		
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So, what do we have to do to answer this question correctly?	<u>Plan:</u> 1) Read every answer choice 2) Select most accurate three answers										
<p>Answer Exit Ticket (8-10 mins)</p>	<p>Exit Ticket: Scholars should answer the multiple choice questions listed on the first page of this plan. See first page for correct answers.</p>										

HOMEWORK

Scholars should read “The Fun They Had” and annotate using your genre-based thinking job (i.e., CMPSLL = Character, Motivation, Problem, Solution, and Lesson Learned). Then write a central idea jot at the end of the story.⁵ Teachers should also provide scholars with a vocabulary word bank and comprehension questions.

⁵ Provide students with the CFS for the genre-based thinking job and the central idea jot on the homework assignment.