Louisiana Guide to Piloting OpenSciEd: Chemistry

This document provides guidance regarding how OpenSciEd units correlate with the Louisiana Student Standards for Science (LSSS) to assist teachers with piloting the OpenSciEd chemistry curriculum. The OpenSciEd chemistry pilot provides ample instructional guidance for teachers. This Louisiana Guide for piloting OpenSciEd chemistry further points out where teachers may need to make strategic decisions considering student needs.

While the OpenSciEd chemistry pilot curriculum may include performance expectations featured in other courses, these units are intentionally designed to provide students with the opportunity to incrementally make sense of phenomena to build understanding and abilities over time through a coherent storyline. Modifying the sequence or content of lessons within these units could undermine the design, so it should be approached with caution and careful consideration.

This guidance document is considered a "living" document because we believe that teachers and other educators will find ways to improve it as they use it. Please send feedback to STEM@la.gov so we can use your input when updating this guide.

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Overview of OpenSciEd

OpenSciEd is an effort among science educators, curriculum developers, teachers, and philanthropic foundations to improve the supply of and demand for high-quality K-12 science instructional materials by producing open-sourced, freely available instructional materials designed for college and career-ready science standards. OpenSciEd works with classroom educators, experienced science curriculum developers, individual school districts, education non-profits, and the science education community to create and pilot robust, research-based, open-source science instructional materials.

Field Testing and Release of Units

Ten partner states volunteered to join this effort, including California, Iowa, Louisiana, Massachusetts, Michigan, New Mexico, New Jersey, Oklahoma, Rhode Island, and Washington. After the initial development of the OpenSciEd units, the unit prototypes or field test units undergo rigorous external review and robust field testing in participating classrooms across partner states. The field test units are then revised based on the feedback and data collected and submitted to the NextGenScience Peer Review Panel before being made freely and openly available to the public upon earning a quality rating. The entire high school curriculum (16 units in total) is now available to download for free online.

Unit Design and Sample Scope and Sequence

The units in the OpenSciEd Sample Scope and Sequence include bundles of performance expectations that are built around an anchoring phenomenon. These units are intentionally designed to allow students to incrementally make sense of phenomena to build understanding and abilities over time through a coherent storyline. Modifying the sequence or content of lessons within these units could undermine the design and, therefore, is not recommended and should be approached with caution and careful consideration.

Contact

Systems interested in piloting should reach out to STEM@la.gov for direct support. For questions or requests for additional information on the OpenSciEd initiative and/or materials, contact info@openscied.org.

2024-2025 Sample Scope and Sequence

	Unit 1 Thermodynamics in Earth's Systems	Unit 2 Structure and Properties of Matter	Unit 3 Molecular Processes in Earth's Systems	Unit 4 Chemical Reactions in Our World	Unit 5 Energy from Chemical & Nuclear Reactions
Number of Lessons *Lessons vary in length from 1-5 class periods*	13 lessons	14 lessons	15 lessons	15 lessons	15 lessons
Anchor Phenomenon Question	How can we slow the flow of energy on Earth to protect vulnerable coastal communities?	What causes lightning, and why are some places safer than others when it strikes?	How could we find, make, and recycle the substances we need to live on and beyond Earth?	Why are oysters dying, and how can we use chemistry to protect them?	How can chemistry help us evaluate fuels and transportation options to benefit the Earth and our communities?
Louisiana Students Standards for Science[1]	**HS-PS3-1*†** **HS-PS3-4** HS-ESS2-2 HS-ESS2-4 HS-ESS2-7† HS-ESS3-1 HS-ESS3-5 HS-ESS3-6	**HS-PS1-1*** **HS-PS1-3*** **HS-PS2-6*** *HS-PS3-2†* *HS-PS3-5†*	**HS-PS1-1*** **HS-PS1-2** **HS-PS1-3*** **HS-PS2-6*** HS-ESS1-2† HS-ESS2-1† HS-ESS2-5	**HS-PS1-5** **HS-PS1-6** **HS-PS1-7** HS-ESS2-6† HS-ESS3-4*	**HS-PS1-4** **HS-PS1-8†** **HS-PS3-1*†** *HS-PS3-2†* *HS-PS3-5†* HS-ESS3-2† HS-ESS3-4*
Unit Resources	Unit materials	Unit Materials	Unit Materials	Unit Materials	Unit Materials

*The performance expectation is addressed across multiple units.

†The performance expectation is addressed across the three-course sequence (Biology, Chemistry, Physics). Italicized performance expectations are found in the Physics and/or Physical Science Louisiana Student Standards for Science.

[1]HS-PS3-6 is a Louisiana-specific standard and is not addressed; HS-PS3-3 is addressed in the Physics course.

This table does not include performance expectations unique to the Next Generation Science Standards for Life Science.

Pacing and Unit Order Guidance

Modification of the lessons, even in the ways suggested here, should be approached with careful consideration. Additional attention should be given to navigation in lessons where adjustments are made in order to maintain coherence from the student's perspective.

Unit	Relevant OpenSciEd Guidance for Teaching Units in a Different Sequence †	Relevant OpenSciEd Guidance† for Condensing† *(Includes guidance directly from OpenSciEd)*

Unit 1
 	
C.1 Thermodynamics in Earth's System
	• This is the first unit in the OpenSciEd Scope and Sequence, intended for use at the beginning of chemistry. The following modifications would need to be made if teaching this unit later in the year.
	  ○ Classroom community agreements would need to be developed and supported.
	  ○ Supplemental modeling of energy flow within and between systems may be required.
	  ○ Explicit callbacks to middle school understanding of evolution as they consider the feedback loops that occur between the biosphere and other spheres over long periods of time.
		• **Lesson 3:** Planning the investigation is more closely connected to the Louisiana Student Standards for Science, while collecting the data is not a focal SEP for the unit performance expectations. To reduce time, students may be presented with sample data after planning the investigation. A simpler version of this investigation is also included in *Unit B.2* with a different emphasis; this activity may go more quickly if students have also experienced that unit.
		• **Lesson 4:** Planning the investigation supports student sensemaking and the focal SEPs in the unit performance expectations, so the actual investigation may be cut if needed. If ice melting needs to occur during class, prepare a "before and after" set of samples so that students can see the change without having to collect data themselves.
		• **Lesson 9:** Students should conduct the first investigation themselves so they have experience using scales. However, the

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Unit 1 **C.1 Thermodynamics in Earth's System** ***continued***		demonstration may be done with the provided videos instead. • **Lessons 10 and 11:** Students should plan the investigations and use the first simulation in Lesson 10, but may use provided data to develop conclusions in one of the lessons if necessary. • **Lesson 12:** Students' computations may be reduced or done partially as a class as long as students have the opportunity to show some calculations and make a claim based on this work.

Unit 2
 	
C.2 Structure and Properties of Matter
	• If taught before the OpenSciEd *biology* units, students who have not previously had these experiences at the high school level may require additional support in the practices and crosscutting concepts intentionally developed in this unit.
	• If taught before C.1, supplemental teaching of the following would be required:
	  ○ Support for helping students develop a culture of working together to progress in science sensemaking.
	  ○ Supports for development of high
		• **Lessons 2-3:** Students can watch the provided videos instead of using the physical water dropper. However, this will prevent them from planning their own investigations to test the reliability of their current models in Lesson 3.
		• **Lesson 4:** The peer feedback portion of this lesson could be removed.
		• **Lesson 7:** Each group could investigate only one of the four conditions as long as all four conditions are covered and information is shared with the whole class.
		• **Lesson 9:** The self-assessment portion of this

Unit	Relevant OpenSciEd Guidance for Teaching Units in a Different Sequence †	Relevant OpenSciEd Guidance† for Condensing† *(Includes guidance directly from OpenSciEd)*
Unit 2 **C.2 Structure and Properties of Matter** ***continued***	school-level investigative planning techniques. ○ Introduction to mathematics and computational thinking in a chemistry context. ○ Scaffolding support for thinking around matter and energy in chemistry- particle model of matter and energy transfer mechanisms. ○ Additional instruction in lab safety, conducting investigations, and using unit conversions and scientific notation.	lesson could be removed or assigned as home learning. ● **Lesson 11:** Students may complete more of the research for home learning, although this removes their access to peer and teacher support while they gather information. This should only be done in classrooms where students are skilled in gathering information. ● **Lessons 3-5 and 10-11:** If taught after OpenSciEd physics, students may require less support in sensemaking due to their familiarity with the M-E-F triangle and fields.
Unit 3 **C.3 Molecular Processes in Earth's Systems**	● If taught before C.2, supplemental teaching of the following would be required: ○ Review the nature of charges in an atom using common static electricity phenomena. ○ Ensure familiarity with "opposites attract" thinking, charges, and electricity, especially that electrons "jump" or move during ionization. ○ Ensure experience with protons, neutrons, electrons, and the characteristics of ionic bonding (e.g. positive and negative charges attracting, the formation of ionic	● **Lessons 13 and 14:** Remove if students do not bring up recycling. ● **Lesson 13:** Reduce the length of the lesson by removing the videos.

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	compounds/salts).	
Unit 4 **C.4 Chemical Reactions in Our World**	• If taught *before the biology curriculum*, supplemental teaching of carbon cycling due to photosynthesis, respiration, and decomposition will be required. • If taught earlier in the year, supplemental teaching of the kinetic theory of matter, ionic bonding, and balancing chemical equations may be required.	• There are no recommended opportunities for condensing C.4. Altering the intended lessons will severely impact student sensemaking.

Unit 5
 	
C.5 Energy from Chemical & Nuclear Reactions
	• Due to its placement as the last unit in the course, several modifications would need to be made if taught earlier in the year.
	  ○ Students would need additional support in understanding chemistry procedures and topics, such as stoichiometry, unit conversions, measurement, and models of matter, forces, and energy that pertain to matter from the subatomic scale on up.
	  ○ If taught out of sequence, students may experience incoherence and phenomenon fatigue due to the amount of
		• **Lesson 2:** BTB can be combined with alcohol in the watch glass, and the color changes to yellow when ethanol burns. This alternative saves time.
		• **Lesson 3:** This was added to meet the needs of many schools to address gas laws and to answer more detailed student questions about the differences between gasoline and diesel. The data portion that leads to the introduction of the Combined Gas Law may be omitted if these ideas were introduced elsewhere.
		• **Lesson 12**: Eliminate if students are not interested in nuclear-powered rockets or if

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	supplementation that may be required, and the unit may take double or triple the length of time to teach.	students have had enough practice with nuclear energy.

† Adapted from the OpenSciEd TeacherBackground Knowledge for “How will I need to modify the unit if taught out of sequence?” and “How do I shorten or condense the unit if needed? How can I extend the unit if needed?” for each unit.