Louisiana Guide to Implementing Carolina OpenSciEd Physics

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Purpose

To assist teachers with implementing the Carolina OpenSciEd physics curriculum, this document provides guidance on how Carolina OpenSciEd chemistry units correlate with the Louisiana Student Standards for Science (LSSS). The Carolina OpenSciEd physics curriculum provides ample instructional guidance for teachers. This Louisiana Guide to Implementing Carolina OpenSciEd physics takes it a step further by highlighting areas where teachers may need to make strategic decisions that consider student needs.

The Carolina OpenSciEd physics 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, building understanding and abilities over time through a coherent storyline. Modifications to the sequence or content of lessons within these units could undermine the design and should therefore be approached with caution and careful consideration.

This guidance document is considered a 'living' document, reflecting the expectation that teachers and other educators will continue to identify opportunities for improvement as it is applied in practice. Please send feedback to STEM@la.gov so that the Louisiana Department of Education (LDOE) may incorporate your suggestions when updating this guide.

Sample Scope and Sequence

	Unit 1 Energy Flow from Earth's Systems	Unit 2 Energy, Forces, and Earth's Crust	Unit 3 Collisions & Momentum	Unit 4 Meteors, Orbits, & Gravity	Unit 5 Electromagnetic Radiation	Unit 6 Stars & the Big Bang
Number of Lessons **lessons vary in length from 1-5 class periods*	11 lessons	13 lessons	15 lessons	15 lessons	13 lessons	7 lessons
Anchor Phenomenon Question	How can we design more reliable systems to meet our communities' energy needs?	How do forces in Earth's interior determine what will happen to the surface we see?	What can we do to make driving safer for everyone?	How have collisions with objects from space changed Earth in the past, and how could they affect our future?	How do we use radiation in our lives, and is it safe for humans?	Why do stars shine, and will they shine forever?
Louisiana Student Standards for Science[1]	HS-PS2-5* HS-PS3-1*† HS-PS3-2*† HS-PS3-3 HS-PS3-5†	HS-PS2-1* *HS-PS1-8*†*	HS-PS2-1* HS-PS2-2 HS-PS2-3	HS-PS2-4 HS-PS3-1*† HS-PS3-2*†	HS-PS2-5* HS-PS4-1 HS-PS4-3	*HS-PS1-8*†*

*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 Physical Science Louisiana Student Standards for Science.*
[1] HS-PS3-4 is addressed in the Chemistry course.
This table does not include performance expectations unique to the Next Generation Science Standards for Life Science or Earth and Space Science.

Pacing and Unit Order Guidance

Approach modification of the lessons, even in the ways suggested here, with careful consideration. Give additional attention to navigation in lessons where adjustments are made to maintain coherence from the students' perspective.

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

Unit 1
 	
P.1 Energy Flow from Earth's Systems
	• This is the first unit in the OpenSciEd Scope and Sequence, intended for use at the beginning of physics and after completion of the chemistry course. If taught in a different order, the following modifications would need to be made.
	  ○ Before chemistry: supplemental teaching of the particle model of matter, including a conceptual understanding of the nature of electrons, nuclei, and atoms, will be required.
	  ○ Not as the first unit: additional supplementary materials related to forces should be incorporated into class discussions to help students integrate a "forces and energy" perspective.
		• **Lessons 2, 5, 6, and 7:** Demonstrations may be utilized in some of the lessons listed; however, students need to have opportunities to carry out investigations for at least two of the lessons listed.

Unit 2 **P.2 Energy, Forces, and Earth's Crust**	• If taught before the *chemistry curriculum,* supplemental teaching of the particle model of matter will be required. This will include a conceptual understanding of the nature of electrons, nuclei, and atoms. A review of the nature of thermal energy and thermal energy transfer would also be needed.	• **Lesson 8:** Decrease the investigation time within the lesson. • **Lessons 9, 11, and 12:** Reduce the time necessary for the investigations by providing students with sample data (provided in the linked videos for lessons 9 and 11, and in the Teacher Guide for lesson 12). Students

Unit	Relevant OpenSciEd Guidance for Teaching Units in a Different Sequence †	Relevant OpenSciEd Guidance for Condensing † (*Includes guidance directly from OpenSciEd)*
Unit 2 ***continued***	• Supplemental teaching on the nature of energy transfer through systems and how to represent it may be required if taught earlier in the school year.	who have experienced the *chemistry curriculum* will have had practice with this performance expectation.
Unit 3 **P.3 Collisions & Momentum**	• If taught earlier in the school year, supplemental teaching of the following may be required: ○ Support around the nature of energy transfer through systems and how to represent it. ○ Support around the basics of forces.	• **Lesson 4:** Reduce the time for the investigation by conducting a demonstration and providing students with sample data to analyze • **Lesson 11:** The Scientists Circle about M-E-F perspectives wraps up the crumple zone discussion, but could be integrated into the Lesson 12 Gotta-Have-It Checklist discussion.
Unit 4 **P.4 Meteors, Orbits, & Gravity**	• If taught earlier in the school year, supplemental teaching of the following may be required: ○ Support around the nature of energy transfer through systems and how to represent it. ○ Support around the nature of forces, how to represent them, and Newton's second and third laws.	• **Lesson 3:** Use the Circular Motion Investigation to collect qualitative data instead of taking actual measurements of the period of revolution using the physical model. • **Lessons 8 and 9:** Condense these lessons into a single lesson and use it as a re-anchor to motivate the lessons in the second lesson set.
Unit 5 **P.5 Electromagnetic Radiation**	• If taught before the *chemistry curriculum*, supplemental teaching of the following will be required: ○ Review the particle model of matter, including a conceptual understanding of the nature of	• **Lesson 5:** Develop an investigation plan together as a class.

Unit	Relevant OpenSciEd Guidance for Teaching Units in a Different Sequence †	Relevant OpenSciEd Guidance for Condensing † (*Includes guidance directly from OpenSciEd)*
Unit 5 ***continued***	electrons, nuclei, atoms, molecules, and polarity. ○ Review the nature of thermal energy and thermal energy transfer. ● If taught earlier in the school year, supplemental teaching of the relationship between energy and forces, the nature of forces at a distance, the basic properties of mechanical waves, and the fundamentals of electricity will be required.	
Unit 6 **P.6 Stars & the Big Bang**	● Due to its placement as the last unit in the course, several modifications would need to be made if it were taught earlier in the year. ○ Additional materials related to energy, forces, and matter, including developing the M-E-F triangle conceptual framework, should be incorporated into class discussions to help students integrate forces and energy perspectives. Lesson 1 includes a visual of this conceptual framework. Lesson 3 of P.2 includes instructions for co-developing the M-E-F triangle as a conceptual tool. ○ Supplemental teaching about the nature of electromagnetic radiation may also be required. ● If taught before P.2, supplemental materials related to scale, stability, and change will be required. This unit uses the Scale Chart conceptual tool developed in P.2 to help students think about the significance of	● There are no recommended opportunities for condensing P.6.

Unit	Relevant OpenSciEd Guidance for Teaching Units in a Different Sequence †	Relevant OpenSciEd Guidance for Condensing † (*Includes guidance directly from OpenSciEd)*
Unit 6 ***continued***	scale and how systems can seem stable at one scale but not at another. • If taught before *chemistry*, supplemental teaching of the particle model of matter will be required, including a conceptual understanding of spectral analysis and the nature of electrons, nuclei, and atoms.	

† Adapted from the OpenSciEd Teacher Background 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.