

OpenSciEd Massachusetts Standards Guidance 7th Grade: Thermal Energy

This document is to provide guidance to Massachusetts 7th grade teachers who are implementing [OpenSciEd](#). This guidance assumes the OpenSciEd curriculum is being implemented across grades 6-8, following the [MA coherent sequence by grade level](#) ([download](#)). The following guidance identifies the MA standards addressed in the [Thermal Energy](#) unit, and the most effective use of the OpenSciEd materials for 7th grade teachers.

Scope and Sequence Recommendation

Implement the *Thermal Energy* unit in 7th grade after *Contact Forces* and before *Matter Cycling & Photosynthesis* units. *Thermal Energy* addresses grade 7 physical science and technology/engineering standards, and 8th grade physical science standards, and builds on the foundation set in the *Contact Forces* unit. Refer to the [MA coherent sequence by grade level](#) ([download](#)) for the complete scope and sequence recommendation.

7th Grade Standards in *Thermal Energy*

Standards in unit	Lessons building towards standards
7.MS-ETS1-4 . Generate and analyze data from iterative testing and modification of a proposed object, tool, or process to optimize the object, tool, or process for its intended purpose.*	Foundational Concepts for Design: Lessons 1-14 Design: Lessons 15-17 (analysis), 16-17 (design, test, iterate), 18 (argue)
7.MS-ETS1-7(MA) . Construct a prototype of a solution to a given design problem.*	Lessons 16-17
7.MS-PS3-3 . Apply scientific principles of energy and heat transfer to design, construct, and test a device to minimize or maximize thermal energy transfer.*	Lessons 1-18
7.MS-PS3-4 . Conduct an investigation to determine the relationships among the energy transferred, how well the type of matter retains or radiates heat, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.	Lessons 10-15
7.MS-PS3-5 . Present evidence to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	Lessons 10-15
7.MS-PS3-6(MA) . [Partial] Use a model to explain how thermal energy is transferred out of hotter regions or objects and into colder ones by convection, conduction, and radiation. <ul style="list-style-type: none"> Why partial? Conduction and radiation are emphasized throughout the sensemaking process. Convection is addressed in <i>Weather, Climate, & Water Cycling</i> (8th grade in MA) 	Convection: Addressed in <i>Weather, Climate, & Water Cycling</i> (8 th grade in MA) Conduction: Lessons 1, 3, 4, 7, 9, 10 Radiation: Lesson 8

Additional Standards in *Thermal Energy*

Standards in unit	Lessons building towards standards
6.MS-ETS1-6(MA). Communicate a design solution to an intended user, including design features and limitations of the solution.	Lessons 15-18
6.MS-PS4-2. [Partial] Use diagrams and other models to show that both light rays and mechanical waves are reflected, absorbed, or transmitted through various materials. <ul style="list-style-type: none"> Why partial? Reflection and transmission of light rays are explored in lesson 8 and integrated into the revised student models in lessons 15 and beyond Reflection, absorption and transmission of mechanical waves, as well as more exploration of the behavior of light rays, is addressed in <i>Light & Matter</i>, <i>Sound Waves</i>, <i>Forces at a Distance</i>, and <i>Weather, Climate & Water Cycling</i> 	Lessons 8, 15-18
8.MS-PS1-4. Develop a model that describes and predicts changes in particle motion, relative spatial arrangement, temperature, and state of a pure substance when thermal energy is added or removed.	Lessons 1-18

See recommendations below for addressing these 6th and 8th grade standards.

Recommendations for Addressing Standards in *Thermal Energy*

Include, and teach 8.MS-PS1-4 with *Thermal Energy* as planned in the unit. This standard is included as a foundational standard for communicating explanations of the phenomena related to **7.MS-PS3-3** and **7.MS-PS3-6(MA)**, especially through the practice of modeling. **Excluding this standard would require substantial redesign of the unit, which is not recommended.**

Include, and teach 6.MS-ETS1-6(MA) with *Thermal Energy* as planned in the unit. This standard's engineering focus is the method through which students are assessed for their understanding of concepts across the unit. Communicating their design solution is contained within a single lesson and builds upon lessons that address 7th grade standards. Therefore, **it is not recommended to change the summative assessment for this unit.**

Include, and teach 6.MS-PS4-2 with *Thermal Energy* as planned in the unit. Exploring the function of light rays is integral to developing deep understanding of how heat is transferred into the cup and results in changes in kinetic energy. Therefore, **it is not recommended to change the summative assessment for this unit.**

Opportunities to Address Additional Standards in *Thermal Energy*

Standards in unit
6.MS-ETS1-5(MA). [Opportunity to address] Create visual representations of solutions to a design problem. Accurately interpret and apply scale and proportion to visual representations.

Recommendations for Extensions in *Thermal Energy*

Teachers have the option to extend the ***Thermal Energy*** Unit to include the grade 6 standard on scale drawings. To best address **6.MS-ETS1-5(MA)**, teachers can direct students to create scale drawings of their cup design plans. Note that students should be introduced to the concept of scale in 5th grade math ([5.NF.B.05](#)), however, a resource such as this reading on [Scale and Proportion](#) may be used to reinforce the concept for students.