

OpenSciEd Massachusetts Standards Guidance 8th Grade: Chemical Reactions and Energy

The purpose of this document is to provide guidance to Massachusetts 8th 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 [Chemical Reactions & Energy](#) unit, and the most effective use of the OpenSciEd materials for 8th grade teachers.

Scope and Sequence Recommendation

Implement the *Chemical Reactions & Energy* unit in 8th grade after the *Chemical Reactions & Matter* unit, and before the *Metabolic Reactions* unit. *Chemical Reactions & Energy* has significant coherence when building on experiences from the *Chemical Reactions & Matter* unit. *Chemical Reactions & Energy* addresses one 8th grade physical science standard, one 6th grade physical science standard, and four 7th grade engineering and technology standards. Refer to the [MA coherent sequence by grade level](#) ([download](#)) for the complete scope and sequence recommendation.

8th Grade Standards in Chemical Reactions and Energy

Standards in unit	Lessons building towards standards
<p>8.MS-PS1-5. [Partial] Use a model to explain that atoms are rearranged during a chemical reaction to form new substances with new properties. Explain that the atoms present in the reactants are all present in the products and thus the total number of atoms is conserved. Clarification Statement: Examples of models can include physical models or drawings, including digital forms, that represent atoms.</p> <ul style="list-style-type: none"> Why partial? <i>Chemical Reactions & Energy</i> uses the idea that atoms are conserved in order to support students in a new understanding (e.g., that energy must be present in the reason) <i>Chemical Reactions & Matter</i> (8th grade in MA) foundationally addresses this standard 	Lessons 2-3

Recommendations for Addressing Standards in Chemical Reactions & Matter

Include, and teach 6.MS-PS1-6, 7.MS-ETS1-2, 7.MS-ETS1-4, and 7.MS-ETS1-7(MA) with *Chemical Reactions & Energy* as planned in the unit. This unit builds significantly on the foundational understanding of matter developed in the *Chemical Reactions & Matter* unit, and students are best prepared for *Chemical Reactions & Energy* shortly following *Chemical Reactions & Matter*. The work on exothermic and endothermic reactions is integrated with the work on modeling chemical reactions and provides important framing for the unit. The 7th grade technology & engineering standards are also an important component of supporting students' understanding of chemical reactions in the context of this unit. **Excluding these standards would require substantial redesign of the unit, which is not recommended.**

Additional Standards in Chemical Reactions & Energy

Standards in unit	Lessons building towards standards
6.MS-PS1-6. Plan and conduct an experiment involving exothermic and endothermic chemical reactions to measure and describe the release or absorption of thermal energy. Clarification Statements: Emphasis is on describing transfer of energy to and from the environment. Examples of chemical reactions could include dissolving ammonium chloride or calcium chloride.	Lessons 2-4, 6
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.	Lessons 5-9
7.MS-ETS1-7 (MA). Construct a prototype of a solution to a given design problem.	Lessons 6-9
7.MS-ETS1-2. Evaluate competing solutions to a given design problem using a decision matrix to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solution.	Lessons 8-10

Opportunities to Address Additional Standards in Chemical Reactions & Energy

Standards in unit
7.MS-PS3-7(MA). [Opportunity to address] Use informational text to describe the relationship between kinetic and potential energy and illustrate conversions from one form to another.
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 in Chemical Reactions & Matter

Teachers have the option to extend the **Chemical Reactions & Energy** Unit to include the grade 7 standard on conversions between kinetic and potential energy. To best address **7.MS-PS3-7(MA)**, teachers should explicitly ask students to identify transitions from potential to kinetic energy and vice versa as they come up throughout the unit, although the teacher materials may not directly call for this. Teachers may also add criteria to gotta-have-it checklists and models throughout the unit that indicate that students should identify energy conversions. Similar recommendations have been developed for the 7th grade **Contact Forces** and **Thermal Energy** units. Teachers may choose to make all or some of these extensions. **The following table highlights some possible areas to integrate this standard, though there may be other opportunities that can be used at teachers' discretion.**

Unit Extension	Support for coherently extending the unit
<p>Lesson 2</p> <p>Do all objects change shape or bend when they are pushed in a collision?</p>	<p>Add to the Learning Plan in the Teacher Guide:</p> <p>Between Parts 4 (investigation) and 5 (building understandings discussion)</p> <ul style="list-style-type: none"> Support students in understanding that there is stored or potential energy in the substances before they are combined. You might draw from the following resources to provide a reading for the students: <ul style="list-style-type: none"> Forms of energy - U.S. Energy Information Administration (EIA) Chemical Potential Energy (Read) Chemistry CK-12 Foundation (ck12.org) <p>During Parts 5 and 6 (Building Understandings Discussion)</p> <ul style="list-style-type: none"> Include stored chemical potential energy in the models developed. Support students in understanding that the energy in the chemical reaction must exist in the substances before they are combined. Emphasize that the kinetic energy in the reaction is the transformed chemical potential energy from the reactants
<p>Lessons 3-6</p>	<p>Throughout the lessons, emphasize the presence of chemical potential energy in the reactants of the chemical reactions. Assess student models and designs for mentions of chemical potential energy.</p>

Teachers also have the option to extend the ***Chemical Reactions and 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 flameless heater 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.