OpenSciEd Massachusetts Standards Guidance
8th Grade: Metabolic Reactions

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 *Metabolic Reactions* unit, and the most effective use of the OpenSciEd materials for 8th grade teachers.

Scope and Sequence Recommendation

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

8th Grade Standards in *Metabolic Reactions*

Standards in unit	Lessons building towards standards
8.MS-LS1-5. **[Partial]** Construct an argument based on evidence for how environmental and genetic factors influence the growth of organisms. • **Why partial?** This unit does not address genetic factors affecting growth. • The *Genetics* unit will address how genetics influences the growth of organisms and is coherently sequenced to follow *Metabolic Reactions* in the MA scope and sequence.	Environmental: Lessons 7, 8, 9, 13, 14, 15 Genetic: Addressed in *Genetics*
8.MS-LS1-7. Use informational text to describe that food molecules, including carbohydrates, proteins, and fats, are broken down and rearranged through chemical reactions forming new molecules that support cell growth and/or release of energy.	Lessons 1-3, 5-7, 9-14, 15
8.MS-PS1-1. **[Partial]** Develop a model to describe that (a) atoms combine in a multitude of ways to produce pure substances which make up all of the living and nonliving things that we encounter, (b) atoms form molecules and compounds that range in size from two to thousands of atoms, and (c) mixtures are composed of different proportions of pure substances. • **Why partial?** This unit does not address mixtures. • **See recommendation below** for how to address mixtures as an extension of this unit.	(a): Lessons 4, 6, 7, 11, 12, 14, 15 (b): Lessons 3, 4, 11, 14 (c): **See recommendation below**
8.MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	Lessons 1-3, 5-7, 10-12, 15

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Additional Standards in *Metabolic Reactions*

Standards in unit	Lessons building towards standards
6.MS-LS1-3. Construct an argument supported by evidence that the body systems interact to carry out essential functions of life.	Lessons 1-9, 12-15

See recommendations below for addressing this 6th grade standard.

Recommendations for Addressing Standards in *Metabolic Reactions*

Include, and teach 6.MS-LS1-3 with *Metabolic Reactions* as planned in the unit. This standard is integral to the understanding of other standards in the unit and is used as an opportunity for application in most lessons. Depending on your students' prior knowledge of this standard, support for students should be adjusted to increase the rigor of explanations or data analysis, or increase the support for students in interpreting data or explanations concerning the body systems' interactions. **Excluding this standard would require substantial redesign of the unit, which is not recommended.**

Explicitly address mixtures in Lessons 5, 6 and 7 to fully address standard **8.MS-PS1-1.** To best address standard **8.MS-PS1-1 (c)** students should learn the word **mixture** to describe how these nutrients appear in the digestive system in Lesson 5 and use "mixtures" in the discussion in Lesson 6. Teachers can assess for student understanding of mixtures in Lesson 7 by looking at how mixtures are represented in student models.

Lesson	Support for maintaining content coherence
Lesson 5: Why do large food molecules, like some complex carbohydrates, seem to disappear in the digestive system?	Add to the Learning Plan in the Teacher Guide: **Part 2 - Following the Food (p69)** • During the introduction, say "the food in the digestive system is a mixture, and you have pulled together graphs of how that mixture changes (how each nutrient goes up or down) in each organ." • Define **mixture** on the board and give the food in the digestive system as an example. • **Mixture**: A substance made up of different molecules (pure components). For example, in the beginning of M'Kenna's small intestine, we have a mixture of _____) • Ask students use their evidence from lesson 4 to fill in the blank above. Expected responses include water, fiber, amino acids, proteins, fatty acids, fat, glucose, and carbohydrates (p58). They will likely add stomach acid to the list as well! Samples of student observations from data: • The mixture of food molecules in M'Kenna's small intestine

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Lesson	Support for maintaining content coherence
Lesson 6: What happens to the different substances in food as it travels through the digestive system?	Use the vocabulary word **mixture** in discussion and questioning during the Scientists Circle (p85). Examples of teacher questions: • What are the components of the mixture before the reaction? After the reaction? • What component(s) of the mixture increases? Decreases? • How does the mixture change from the beginning to the end? • Why does the mixture change? How do you know?
Lesson 7: What is the function of the digestive system, and how is M'Kenna's digestive system different?	Students should use "**mixture**" in their models/explanations to describe the food mixture at different parts of the digestive system and when comparing M'Kenna to a healthy person. Possible student responses: • The mixture of food molecules in M'Kenna's small intestine and large intestine is different from a healthy person. • The mixture in M'Kenna's small intestine has more complex carbohydrates than a healthy person. • The food mixture in a healthy person changes in different ways than M'Kenna's.