Performance Expectations at a Glance

In this unit, students will discover and practice the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts needed to perform the following Performance Expectations.

Performance Expectations	Module: **Classification and tates of Matter**	Module: **Matter: Properties and Changes**
MS-PS1-1	●	
MS-PS1-2		●
MS-PS1-4	●	
MS-PS1-5		●
MS-PS1-6		●
MS-ETS1-1		●
MS-ETS1-2		●
MS-ETS1-3		●
MS-ETS1-4		●

Correlations by Module to the NGSS

MODULE: Classification and States of Matter

MS-PS1	**Matter and its Interactions**	
MS-PS1-1.	**MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.** [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [*Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.*]	97–104

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Developing and Using Models* Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to predict and/or describe phenomena. (MS–PS1–1) *Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.	*12–13, 22–23,* 25, 26, 37, 40, *41–42,* 43, *44–45,* 47, 49, 54, *67, 78–79, 84–85,* 92, 97–104, PhET Interactive Simulation *States of Matter: Basics* (online)
DCI Disciplinary Core Ideas	
PS1.A: Structure and Properties of Matter • Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)	19–21, *22–23,* 23, 26–27, 78–79, 79, 82–83, *84–85,* 86–87, 88, *88–89,* 89, *89–90,* 90, 92, 94, 97–104
• Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)	83, 85–86, 88, *88–89,* 91–92
CCC Crosscutting Concepts	
Scale, Proportion, and Quantity • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)	*15,* 16–18, 37, 40, *44–45,* 47, 49, 54, *67, 78–79,* 82–83, *84–85,* 97–104, PhET Interactive Simulation *States of Matter: Basics* (online)
CCSS ELA/Literacy Connections	
ELA RST.6–8.7	19, 25, 37, 43, 47, 52, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	16–17, *22–23*, Math Skill Handbook (online)
Math MP.4	*22–23, 60–61, 63–65*, Math Skill Handbook (online)
Math 6.RP.A.3	*22–23,* Math Skill Handbook (online)

MS-PS1	Matter and its Interactions	
MS-PS1-4.	**Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.** [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]	97–104

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Developing and Using Models* Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to predict and/or describe phenomena. (MS-PS1-4) *Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.	*12–13, 22–23,* 25, 26, 37, 40, *41–42,* 43, *44–45,* 47, 49, 54, 97–104, PhET Interactive Simulation *States of Matter: Basics* (online)
DCI Disciplinary Core Ideas	
PS1.A: Structure and Properties of Matter • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)	*10–11, 12–13,* 14, 19, 21, 24, 36, 42–43, 45–49, 80, 97–104
• In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)	*10–11, 12–13,* 14, 26, 27, 42–43, 45–49, 96, 97–104
• The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)	46–49, 53, 97–104, PhET Interactive Simulation *States of Matter: Basics* (online), Video *Melting* (online)
PS3.A: Definitions of Energ • The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS-PS1-4)	*15,* 18, 40
• The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4)	*15,* 16–18, 26, 28, 46–49, 97–104, PhET Interactive Simulation *States of Matter: Basics* (online), Video *Melting* (online)
CCC Crosscutting Concepts	
Cause and Effec • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)	37, 45, 49, 66, 71–72, 97–104
CCSS ELA/Literacy Connections	
ELA RST.6-8.7	19, 25, 37, 43, 47, , 52, Literacy Skill Handbook (online)
CCSS Math Connections	
Math 6.NS.C.5	Math Skill Handbook (online)

Labs and investigations are in italics.

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ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	7, 105
SEP Developing and Using Models	*15,* 19, *21–22,* 27, 37, 43, 47, 95
SEP Planning and Carrying Out Investigations	*10–11, 38–39,* 105
SEP Analyzing and Interpreting Data	26, *60–61, 63–65, 80–82, 86–87*
SEP Using Mathematics and Computational Thinking	*34–35,* 66, 72
SEP Constructing Explanations and Designing Solutions	8–9, *10–11,* 14, 28, 32–33, 37, 43, 49–50, 54, 58–59, 68, 71, 76–77, *80–82, 86–87,* 97–104
SEP Engaging in Argument from Evidence	54, 83, 92
SEP Obtaining, Evaluating, and Communicating Information	23A–23B, 93
Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena	62
DCI ESS2.C: The Role of Water on Earth's Surface Processes	50
DCI PS3.A: Definitions of Energy	*15,* 16, 18, 31, *34–35,* 36–37, 47–51, 97–104, 105
CCC Patterns	*10–11,* 11, *12–13,* 14, *15,* 16–18, *24, 60–61, 63–65, 80–82, 86–87*
CCC Systems and System Models	*12–13, 15,* 40, 49, 53, 83, 92
CCC Energy and Matter	*15,* 16–18, 28, 37, 40, 47, 49–50, 68, 97–104
CCC Structure and Function	*12–13,* 14, *80–82, 86–87,* 91–93, 95
CCSS ELA 6.SL.7.4	93
CCSS ELA 6.SL.7.5	51, 93, 97–104
CCSS ELA 6.SL.7.6	93
CCSS ELA RST.6–8.1	8–9, 32–33, 58–59, 76–77, 91
CCSS ELA RST.6–8.3	*10–11, 34–35, 38–39, 41–42, 44–45, 60–61, 63–65, 80–82, 86–87*
CCSS ELA RST.6–8.10	23A–23B, 51, 69, 91, 93
CCSS ELA WHST.6–8.2	69
CCSS ELA WHST.6–8.4	23A–23B, 69
CCSS ELA WHST.6–8.6	20, 23A–23B, 51, 69

Labs and investigations are in italics.

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CCSS ELA WHST.6–8.7	23A–23B, 51, 69
CCSS ELA WHST.6–8.9	93
CCSS Math 6.RP.A.1	*22–23*
CCSS Math 6.RP.A.2	*22–23*
CCSS Math 6.RP.A.3	*22–23*
CCSS Math 7.RP.A.2	*34–35*, 36, 43, *60–61*, *63–65*, 65–66
CCSS Math 8.EE.A.3	20

MODULE: Matter: Properties and Changes

MS-PS1	Matter and its Interactions	
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.** [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [*Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.*]	*142–143*, 177–182
SEP Science and Engineering Practices		
Analyzing and Interpreting Data* Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*114–115*, *119–121*, *126–127*, 135, *145–146*, *164–165*, *168–171*, 177–182
Connections to Nature of Science **Scientific Knowledge is Based on Empirical Evidenc** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)		147, 171
DCI Disciplinary Core Ideas		
PS1.A: Structure and Properties of Matter • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2)		114, *114–115*, 116–117, *119–121*, 122–123, *124*, 125, *126–127*, 128, *129–131*, 131–132, 134–136

Labs and investigations are in italics.

MS-ETS1	Engineering Design	
MS-ETS1-2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	*168–171*, 177–182
SEP Science and Engineering Practices		
Engaging in Argument from Evidence* Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*168–171*, 177–182
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2) possible solutions. (MS-ETS1-1)		*168–171*, 177–182, , Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		112–113, 140–141, 160–161, 167, Literacy Skill Handbook (online)
ELA RST.6–8.9		118, 122, *145–146*, *168–171*, 177–182, Literacy Skill Handbook (online)
ELA WHST.6–8.7		153, 173, Literacy Skill Handbook (online)
ELA WHST.6–8.9		167, 173, 177–182, Literacy Skill Handbook (online)
CCSS Math Connections		
Math MP.2		118, *119–121*, 122–123, *124*, 155, Math Skill Handbook (online)
Math 7.EE.A.3		*73–78, Math Skill Handbook (online)*

Labs and investigations are in italics.

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PS1.B: Chemical Reactions • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2)	*142–143*, 144, *147*, 148, *148–149*, 150, 154–156, 177–182
CCC Crosscutting Concepts	
Patterns • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)	116–118, 122–123, 144, *145–146*, *147*, 148, *148–149*, 150, 177–182
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	112–113, 140–141, 160–161, 167
ELA RST.6–8.7	134, *151*, 154, 163, 174–176, 177–182
CCSS Math Connections	
Math MP.2	118, *119–121*, 122–123, *124*, 155
Math 6.RP.A.3	*124*
Math 6.SP.B.4	Math Skill Handbook (online)
Math 6.SP.B.5	*119–121*

MS-PS1	Matter and its Interactions	
MS-PS1-5.	**Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.** [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [*Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces*.]	*145–146, 151*, 177–182
SEP Science and Engineering Practices		
Developing and Using Models* Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms. (MS-PS1-5) *Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		118, *145–146*, *151*, 163, 174, 176, 177–182
Connections to Nature of Science **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)		147, 171

Labs and investigations are in italics.

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DCI **Disciplinary Core Ideas**	
PS1.B: Chemical Reactions • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-5)	*142–143*, 144, *147*, 148, *148–149*, 150, 154–156, 177–182
• The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)	*145–146*, *147*, 147–148, *148–149*, 150, *151*, 153–156, 177–182
CCC **Crosscutting Concepts**	
Energy and Matter • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)	*145–146*, *147*, 147–148, *148–149*, 150, 153–156, 177–182
CCSS ELA/Literacy Connections	
ELA RST.6–8.7	134, *151*, 154, 163, 174–176, 177–182, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	118, *119–121*, 122–123, *124*, 155, Math Skill Handbook (online)
Math MP.4	*119–121*, 122–123, *151*, 152, 155, Math Skill Handbook (online)
Math 6.RP.A.3	*124,* Math Skill Handbook (online)

MS-PS1	Matter and its Interactions	
MS-PS1-6.	**Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.** [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [*Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.*]	*168–171*, 177–182

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Constructing Explanations and Designing Solutions* Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories. • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.	*168–171*, 177–182
DCI Disciplinary Core Ideas	
PS1.B: Chemical Reactions • Some chemical reactions release energy, others store energy. (MS-PS1-6)	144, *162*, 163, *164–165*, 166–167, *168–171*, 171–176
ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6)	*168–171*, 177–182, Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6)	*168–171*, 177–182, Science and Engineering Practices Handbook (online)
• The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS-PS1-6)	*168–171*, 177–182, Science and Engineering Practices Handbook (online)
CCC Crosscutting Concepts	
Energy and Matter • The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)	163, 166–167, *168–171*, 171–172, 177–182
CCSS ELA/Literacy Connections	
ELA RST.6–8.3	*114–115*, *126–127*, *129–131*, *142–143*, *164–165*, Literacy Skill Handbook (online)
ELA WHST.6–7	153, 173, Literacy Skill Handbook (online)

Labs and investigations are in italics.

MS-ETS1	Engineering Design	
MS-ETS1.	**Define the criteria and constraints of a design problem wit sufficient precision to ensure a successful solution, taking in account relevant scientific principles and potential impacts o people and the natural environment that may limit possible solutions.**	*64–67*, 73–87
SEP Science and Engineering Practices		
Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*168–171*, 177–182
DCI Disciplinary Core Ideas		
ETS1.A: Defining and Delimiting Engineering Problem • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)		*168–171*, 177–182, Science and Engineering Practices Handbook (online)
CCC Crosscutting Concepts		
Connections to Science, Technology, Society and the Environment **Influence of Science, Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)		153A–153B
• The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)		153A–153B
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		112–113, 140–141, 160–161, 167, Literacy Skill Handbook (online)
ELA WHST.6–8.8		133, 173, Literacy Skill Handbook (online)
CCSS Math Connections		
Math MP.2		118, *119–121*, 122–123, *124*, 155, Math Skill Handbook (online)
Math 7.EE.A.3		73–78, Math Skill Handbook (online)

Labs and investigations are in italics.

MS-ETS1	Engineering Design	
MS-ETS1-3.	**Analyze data from tests to determine similarities and differences among several design solutions to identify the bes characteristics of each that can be combined into a new solution to better meet the criteria for success.**	*168–171*, 177–182
SEP Science and Engineering Practices		
Analyzing and Interpreting Data* Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*114–115*, *119–121*, *126–127*, 135, *145–146*, *164–165*, *168–171*, 177–182
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-3)		*168–171*, 177–182, Science and Engineering Practices Handbook (online)
• Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)		*168–171*, 177–182, Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)		*145–146*, *168–171*, 177–182, Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		112–113, 140–141, 160–161, 167, Literacy Skill Handbook (online)
ELA RST.6–8.7		134, *151*, 155, 163, 174–176 177–182, Literacy Skill Handbook (online)
ELA RST.6–8.9		118, 122, *145–146*, *168–171*, 177–182, Literacy Skill Handbook (online)
CCSS Math Connections		
Math MP.2		118, *119–121*, 122–123, *124*, 155
Math 7.EE.A.3		73–78, Math Skill Handbook (online)

Labs and investigations are in italics.

MS-ETS1	Engineering Design	
MS-ETS1-4.	**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that a optimal design can be achieved.**	177–182
SEP Science and Engineering Practices		
Developing and Using Models* Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*145–146*, 177–182
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)		*168–171*, 177–182, Science and Engineering Practices Handbook (online)
• Models of all kinds are important for testing solutions. (MS-ETS1-4)		*168–171*, 177–182, Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)		*168–171*, 177–182, Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections		
ELA SL.8.5		69, 73-78, Literacy Skill Handbook (online)
CCSS Math Connections		
Math MP.2		118, *119–121*, 122–123, *124*, 155
Math 7.SP.C.7		Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	183
SEP Developing and Using Models	177–182
SEP Planning and Carrying Out Investigations	*114–115*, *119–121*, *126–127*, *129–131*, 132, *145–146*, *168–171*, 177–182

Labs and investigations are in italics.

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SEP Analyzing and Interpreting Data	*119–121*, *124*, *168–171*, 177–182
SEP Using Mathematics and Computational Thinking	*119–121*, *124*, 152, 155, Lab *Density Column* (online), Lab *Do heavy objects always sink and light objects always float?* (online)
SEP Constructing Explanations and Designing Solutions	112–113, 123, 136, 140–141, *148–149*, 156, 160–161, 172, 176, 177–182
SEP Engaging in Argument from Evidence	166, *168–171*, 177–182
SEP Obtaining, Evaluating, and Communicating Information	167, 177–182
DCI PS3.D: Energy in Chemical Processes and Everyday Life	167, 172, 175
DCI LS1.C: Organization for Matter and Energy Flow in Organisms	167, 172, 175
DCI LS2.B: Cycle of Matter and Energy Transfer in Ecosystems	172
DCI ESS2.A: Earth's Materials and Systems	150
CCC Cause and Effect	*142–143*
CCC Scale Proportion, and Quantity	*151*, 152, 155
CCC Systems and System Models	*151*, 152, 155, *162*, 163, 177–182
CCC Structure and Function	*151*, 177–182
CCC Stability and Change	*142–143*
CCSS ELA RST.6-8.10	29, 49, 49A-49-B, 63, 69
CCSS ELA WHST.6–8.1	118
CCSS ELA WHST.6–8.2	153
CCSS ELA WHST.6–8.4	153
CCSS ELA WHST.6–8.6	133
CCSS ELA WHST.6–8.10	118, 133
CCSS ELA SL.7.4	173
CCSS ELA SL.7.5	173, 177–182
CCSS MATH 7.EE.A.4	*124,* 135
CCSS MATH 7.RP.A.2	*119–121*, *124*

Labs and investigations are in italics.

Performance Expectations at a Glance

In this unit, students will discover and practice the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts needed to perform the following Performance Expectations.

Performance Expectations	Module: **Dynamic Earth**	Module: **Natural Hazards**
MS-ESS2-1	●	
MS-ESS2-2	●	
MS-ESS2-3	●	
MS-ESS3-2		●
MS-ETS1-1		●
MS-ETS1-2		●
MS-ETS1-4		●

Correlations by Module to the NGSS

MODULE: Dynamic Earth

MS-ESS2	Earth's Systems	
MS-ESS2-1.	**Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] *[Assessment Boundary: Assessment does not include the identification and naming of minerals.]*	*118–119,* 122, 125–130, 131
SEP Science and Engineering Practices		
Developing and Using Models Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Develop and use a model to describe phenomena. (MS-ESS2-1)		*12–13, 15–16, 28–29, 46–49,* 49, *50–51, 53–54, 60–61, 72–73, 74–75, 77–80, 82–83, 86, 102–103, 107–109,* 110, *111–112, 116, 118–119,* 122, 125–130, 131
DCI Disciplinary Core Ideas		
ESS2.A: Earth's Materials and Systems • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)		*34,* 73, 76, *102–103,* 104, 106, 109–110, 112–114, 117–118, *118–119,* 122–124, 125–130, 131

Labs and investigations are in italics.

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CCC Crosscutting Concepts	
Stability and Change • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)	*12–13, 15–16,* 18, 20–22, 36, *50–51,* *55,* 55, *56,* 57, 62–66, 69, 72, *72–73,* 73, *74–75, 76, 77, 77–80,* 82, *82–83,* 86–87, 89–94, 104, 106, 110, 113, 117, *118–119,* 120, 122, 124, 125–130, 131
CCSS ELA/Literacy Connections	
ELA SL.8.5	89, 125–130, Lab *What tectonic processes are most responsible for shaping North America?* (online), Literacy Skill Handbook (online)

MS-ESS2	Earth's Systems	
MS-ESS2-2.	**Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]	125–130, 131
SEP Science and Engineering Practices		
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)		8–9, *12–13, 15–16,* 20, 22, 26–27, 36, 44–45, 49, *50–51, 53–54,* 66, 70–71, *72–73*, *74–75*, *77–80*, 81, 85, 88–92, 98–99, *102–103*, *107–109*, 110, 113, 120–122, 124, 125–130, 131
DCI Disciplinary Core Ideas		
ESS2.A: Earth's Materials and Systems • The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)		*11*, 12, 18, 36, 46, *46–49,* 49, *50–51,* 52, *53–54,* 54, *55,* 55–56, *56*, 57–59, 62–66, 75, *76*, 76, *77–80, 82–83,* 84–86, *86, 87*, 87–94, 125–130, 131

Labs and investigations are in italics.

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ESS2.C: The Roles of Water in Earth's Surface Processes • Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)	57, 62–63, 69, *74–75*, 75–76, *76*, 77, *77–80*, 80–81, 86, *86*, 87, *87*, 88–94, 125–130, 131
CCC Crosscutting Concepts	
Scale, Proportion, and Quantity • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS2-2)	*12–13*, *15–16*, *32–33*, *46–49*, 49, *50–51*, *53–54*, *60–61*, *72–73*, *74–75*, 77, *77–80*, *82–83*, 85, *86*, 90, *102–103*, *107–109*, *111–112*, *116*, *118–119*, 122, 125–130, 131
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	8–9, 26–27, 31, 38, 44–45, 57, 70–71, 89, 98–99, 115, Literacy Skill Handbook (online)
ELA WHST.6–8.2	40, 49, 66, 89, 91, 125–130, 131, Literacy Skill Handbook (online)
ELA SL.8.5	89, 125–130, Lab *What tectonic processes are most responsible for shaping North America?* (online), Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	35, 39, 65, *77–80*, Math Skill Handbook (online)
Math 6.EE.B.6	35, 39, Math Skill Handbook (online)
Math 7.EE.B.4	35, 39, 65, *77–80*, Math Skill Handbook (online)

MS-ESS2	Earth's Systems	
MS-ESS2-3.	**Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidenc of the past plate motions.** [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [*Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.*]	*12–13*, 14, *15–16*, 36, 125–130

Labs and investigations are in italics.

Continued from previous page.

CCC Crosscutting Concepts	
Connections to Science, Technology, Society and the Environment **Influence of Scienc , Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)	217A–217B
• The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)	*160*, *161*, 161A–161B, 185, *186*, 208, *220*, 225–230
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	138–139, 149, 168–169, 172, 194–195, 225–230, Scientific Text *The Benefits of Hurricanes* (online), Literacy Skill Handbook (online)
ELA WHST.6-8.8	161B, *186*, 187, 217B, 221, 225–230, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*142–143, 173, 178–181, 197–199,* Math Skill Handbook (online)
Math 7.EE.3	Math Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	225–230
SEP Science and Engineering Practices		
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)		161, 225–230
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2) possible solutions. (MS-ETS1-1)		225–230, Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)	*10, 12–13,* 14, *15–16,* 21, *30, 32–33,* 35–37, *46–49, 50–51, 53–54, 60–61, 72–73, 74–75, 77–80, 82–83, 100–101, 102–103, 107–109, 111–112, 116,* 125–130
Connections to Nature of Science **Scientific Knowledge is Open to evision in Light of New Evidence** • Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)	31, 34, 36, 39–40
DCI Disciplinary Core Ideas	
ESS1.C: The History of Planet Earth • Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)	*30,* 31, *32–33,* 34, *34,* 35–36, 38–39
ESS2.B: Plate Tectonics and Large-Scale System Interactions • Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)	10, *10, 11,* 12, *12–13,* 13–15, *15–16,* 17–18, 20–21
CCC Crosscutting Concepts	
Patterns* • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. (MS-ESS2-3) * = Other aspects of this CCC are integrated throughout this module and are listed in the *Also Integrates* section.	*32–33,* 35–37, *77–80,* Lab *Can you guess the age of the glue?* (online), Lab *How old is the Atlantic Ocean?* (online)
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	8–9, 26–27, 31, 38, 44–45, 57, 70–71, 89, 98–99, 115, Literacy Skill Handbook (online)
ELA RST.6–8.7	*28–29,* 35, 38, 64, 92, *118–119,* 125–130, Literacy Skill Handbook (online)
ELA RST.6–8.9	*15–16,* Lab *Can you guess the age of the glue?* (online), Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	35, 39, 65, *77–80,* Math Skill Handbook (online)
Math 6.EE.B.6	35, 39, Math Skill Handbook (online)
Math 7.EE.B.4	35, 39, 65, *77–80,* Math Skill Handbook (online)

Labs and investigations are in italics.

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ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	131
SEP Planning and Carrying Out Investigations	*28–29,* 131
SEP Using Mathematics and Computational Thinking	35, 39, 65, *77–80*
SEP Engaging in Argument from Evidence	22, 124
SEP Obtaining, Evaluating, and Communicating Information	31, 38, 57, 89, 115, 125–130, 131
Connections to Nature of Science Scientific Investigations Use a Variety of Methods	37, 121
DCI ESS3.C: Human Impacts on Earth Systems	115
DCI LS2.A: Interdependent Relationships in Ecosystems	73
DCI LS4.A: Evidence of Common Ancestry and Diversity	15, 18
DCI PS1.A: Structure and Properties of Matter	101, 104–105
DCI PS1.B: Chemical Reactions	75, 104–106, 109, 117
DCI PS3.B: Conservation of Energy and Energy Transfer	104, 106, 117
DCI PS4.A: Wave Properties	28
CCC Patterns	7, *12–13,* 14, *15–16,* 66
CCC Cause and Effect	*55, 72–73, 74–75, 76, 77–80, 82–83,* 92–94, 105, *107–109, 118–119*
CCC Systems and System Models	*46–49,* 49, *50–51, 53–54, 60–61, 72–73, 74–75, 77–80, 82–83, 86, 102–103, 107–109,* 110, *111–112, 116, 118–119,* 125–130
CCC Energy and Matter	*77–80,* 80–81, 104, 106, 109, 115, 117–122, 125–130
Connections to Nature of Science Science is a Way of Knowing	11–14, 17, 31
Connections to Nature of Science Science is a Human Endeavor	11–14, 17, 18, 31
CCSS ELA RST.6–8.2	38
CCSS ELA RST.6–8.3	*12–13, 15–16, 46–49, 50–51, 53–54, 60–61, 72–73, 74–75, 77–80, 82–83, 107–109, 100–101, 116*
CCSS ELA WHST.6–8.7	18, 31, 59, 89, 91, 121
CCSS ELA WHST.6–8.8	89
CCSS ELA RST.6–8.10	18, 31, 37, 57, 59, 89, 91, 115, 121
CCSS ELA SL.7.1	3, 7, 25, 31, 43, 57, 69, 89, 115

Labs and investigations are in italics.

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MODULE: Natural Hazards

MS-ESS3	Earth and Human Activity	
MS-ESS3-2.	**Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects** [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]	225–230, 231
SEP Science and Engineering Practices		
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)		*142–143, 155–157,* 164, *170–171, 178–181,* 190, *202–205, 213, 218–219,* 225–230
DCI Disciplinary Core Ideas		
ESS3.B: Natural Hazards Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)		*140–141,* 141–142, *142–143,* 152–153, *155–157,* 157, *158–159, 159,* 160, *160, 161,* 161A–161B, 162–163, *170–171,* 171–173, *176–177,* 178, *178–181,* 181, *182,* 183, *183–184,* 185, *186,* 189, *196, 197–199,* 199, 202, 205, 209, *210–211, 213,* 214–215, 217, 217A–217B, *218, 220,* 223, 225–230
CCC Crosscutting Concepts		
Patterns • Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)		*140–141, 145–148, 158–159*, 163, *170–171*, *176–177*, *178–181*, *182*, *183–184*, *196*, *197–199*, *202–205*, *213*, 225–230
Connections to Engineering, Technology, and Applications of Science **Influence of Scienc , Engineering, and Technology on Society and the Natural World** • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-2)		*160*, *161*, 161A–161B, 185, *186*, 208, 219, *220*, 225–230

Labs and investigations are in italics.

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CCSS ELA/Literacy Connections	
ELA RST.6–8.1	138–139, 149, 168–169, 172, 194–195, 225–230, Scientific Text *The Benefits of Hurricanes* (online), Literacy Skill Handbook (online)
ELA RST.6–8.7	154, 188, 218, 222, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*142–143, 173, 178–181, 197–199,* Math Skill Handbook (online)
Math 6.EE.B.6	*173, 178–181, 197–199,* Math Skill Handbook (online)
Math 7.EE.B.4	*173, 178–181, 197–199,* Math Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-1.	**Define the criteria and constraints of a design problem wit sufficient precision to ensure a successful solution, taking in account relevant scientific principles and potential impacts o people and the natural environment that may limit possible solutions.**	225–230
SEP Science and Engineering Practices		
Asking Questions and Defining Problem Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)		*161*, 185, 225–230
DCI Disciplinary Core Ideas		
ETS1.A: Defining and Delimiting Engineering Problem • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)		Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

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CCSS ELA/Literacy Connections	
ELA RST.6–8.1	138–139, 149, 168–169, 172, 194–195, 225–230, Scientific Text *The Benefits of Hurricanes* (online), Literacy Skill Handbook (online)
ELA RST.6-8.9	225–230, Literacy Skill Handbook (online)
ELA WHST.6-8.9	161B, 187, 217B, 221, 225–230, Scientific Text *The Benefits of Hurricanes* (online), Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	225–230, Math Skill Handbook (online)
Math 7.EE.3	Math Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-4.	**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that a optimal design can be achieved.**	225–230
SEP Science and Engineering Practices		
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)		*151–152*, 225–230
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)		225–230, STEM Activity *Earthquake Design Challenge* (online), Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

Continued from previous page.

• Models of all kinds are important for testing solutions. (MS-ETS1-4)	225–230, Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)	Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections	
ELA SL.8.5	187, 217A–217B, 225–230, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	142–143, 173, 178–181, 197–199, Math Skill Handbook (online)
Math 7.SP	Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	*186*, 231
SEP Developing and Using Models	154, *178–181*
SEP Planning and Carrying Out Investigations	*151–152*
SEP Analyzing and Interpreting Data	*145–148, 158–159,* 163, *183–184*
SEP Using Mathematics and Computational Thinking	*142–143, 173, 178–181, 198–199*
SEP Constructing Explanations and Designing Solutions	138–139, 141, *151–152*, 152, *159*, *160*, *161*, 168–169, 176, *178–181*, *182, 183–184, 186,* 194–195, 201, *202–205*, *213*, 215, *220*
SEP Engaging in Argument from Evidence	*178–181*
SEP Obtaining, Evaluating, and Communicating Information	149, *161,* 172, *214–215*, 216, *220,* 223
CCC Cause and Effect	133, *151–152,* 176, 209, 215, 217A–217B
CCC Scale Proportion and Quantity	171
CCC Systems and System Models	175, 209, 211, 214
CCC Energy and Matter	*142–143*, 143–144, 149, 154, *183–184*, 199

Labs and investigations are in italics.

Continued from previous page.

CCC Structure and Function	*159*, STEM *Activity Earthquake Design Challenge* (online)
CCC Stability and Change	*183–184, 210–211, 213,* 216
Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems	218
Connections to Nature of Science Science is a Human Endeavor	154
CCSS ELA SL.7.1	133, 137, 149, 172, 216
CCSS ELA RST. 6–8.3	*151–152*
CCSS ELA WHST.6–8.7	*155–157, 161, 176–177,* 185, *186,* 187, *197–199, 210–211, 214–215,* 217A–217B, *220,* STEM *Activity Earthquake Design Challenge* (online), Lab *Hurricane and Their Effects* (online)
CCSS ELA WHST.6–8.10	149, 154, 161A–161B, 172, 187, 208, 217A–217B, 221, Scientific Text *The Benefits of Hurricanes* (online)

Labs and investigations are in italics.

Performance Expectations at a Glance

In this unit, students will discover and practice the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts needed to perform the following Performance Expectations.

Performance Expectations	Module: **Distribution of Earth's Resources**	Module: **Materials Science**
MS-ESS3-1	●	
MS-PS1-3		●
MS-ETS1-1		●
MS-ETS1-2		●
MS-ETS1-4		●

Correlations by Module to the NGSS

MODULE: Distribution of Earth's Resources

MS-ESS3	Earth's Place in the Universe	
MS-ESS3-1.	**Construct a scientific explanation based on evidence fo how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.** [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]	73–78, 79
SEP Science and Engineering Practices		
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)		8–9, 21, 23B, 26, 30–31, 34, 39, 44, 52, 56–57, 58–59, 73–78, 79

Labs and investigations are in italics.

Continued from previous page.

DCI Disciplinary Core Ideas	
ESS3.A: Natural Resources • Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)	7, 10, *10–11,* 11, *12–13,* 13, *14–16,* 16, *17–19,* 19–21, *21–23,* 23, 23A–23B, 24–26, 32, *32–33,* 33–36, *37,* 38–40, *41,* 42, *42–43,* 43–44, *45–46,* *47–48,* 48–52, 58, 60, 64–66, 72, 73–78, 79
CCC Crosscutting Concepts	
Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1) * = Other aspects of this CCC are integrated throughout this module and are listed in the *Also Integrates* section.	44, *62–63,* 65, *66–67,* 69, 73–78
Connections to Engineering, Technology, and Applications of Science **Influence of Scienc , Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1)	7, 10–11, 13, 16, 19–21, 23A–23B, 49, *62–63,* 64, *66–67,* 69, 69A–69B, 73–78
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	8–9, 30–31, 40, 56–57, 69, Literacy Skill Handbook (online)
ELA WHST.6–8.2	52, 72, 73–78, Literacy Skill Handbook (online)
ELA WHST.6–8.9	8–9, 30–31, 40, 56–57, 69, 73–78, Literacy Skill Handbook (online)
CCSS Math Connections	
Math 6.EE.B.6	Math Skill Handbook (online)
Math 7.EE.B.4	Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	79
SEP Developing and Using Models	*62–63*
SEP Planning and Carrying Out Investigations	79
SEP Analyzing and Interpreting Data	*12–13, 17–19,* 25, *58–59, 60–61, 64, 66–67*

Labs and investigations are in italics.

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SEP Using Mathematics and Computational Thinking	*17–19, 45–46*
SEP Obtaining, Evaluating, and Communicating Information	69–70, 73–78
Connections to Nature of Science Scientific Investigations Use a Variety of Methods	68
DCI LS1.A: Structure and Function	19
DCI PS1.B: Chemical Reactions	14
DCI PS2.B: Types of Interactions	68
DCI PS3.B: Conservation of Energy and Energy Transfer	14
CCC Patterns	*32, 66–67,* 73–78
CCC Cause and Effect	23A–23B, 69A–69B
CCC Scale, Proportion, and Quantity	23, 34, 44
CCC Systems and System Models	21
CCC Energy and Matter	14
CCC Stability and Change	23A–23B, 69A–69B
Connections to Nature of Science Science is a Human Endeavor	35
CCSS ELA RST.6–8.2	70
CCSS ELA RST.6–8.3	*58–59, 62–63*
CCSS ELA RST.6–8.7	*58–59*
CCSS ELA RST.6–8.10	20, 35, 40, 49, 68–69
CCSS ELA WHST.6–8.7	40, 68–69, 73–78
CCSS ELA SL.7.1	3, 29, 40, 49, 55, 69
CCSS ELA SL.8.5	23A–23B, 73–78
Math MP.4	*17–18*
Math 6.SP.4	*58–59*

Labs and investigations are in italics.

MODULE: Materials Science

MS-PS1	Matter and its Interactions	
MS-PS1-3.	**Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.** [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [*Assessment Boundary: Assessment is limited to qualitative information.*]	*118*, 125–130
SEP Science and Engineering Practices		
Obtaining, Evaluating, and Communicating Information* Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods. • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3) * = Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		*91–92,* 97, *116, 117, 118, 121*, 125–130
DCI Disciplinary Core Ideas		
PS1.A: Structure and Properties of Matter • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)		*88–90,* 90, *93–94,* 97, 131
PS1.B: Chemical Reactions • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-3)		*93–94*, *95*, 95, 96, *113–114*, 115, 125–130
CCC Crosscutting Concepts		
Structure and Function • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)		85, *88–90,* 90, *91–92,* 93, 96–97, 99–100, 119, 125–130, 131
Connections to Engineering, Technology, and Applications of Science **Interdependence of Science, Engineering, and Technology*** • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3) *Other aspects of this Connections to Engineering, Technology, and Applications of Science are integrated throughout this module and are listed in the *Also Integrates* section.		*95*, 96–97, 119–120, 125–130

Labs and investigations are in italics.

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Influence of Scienc , Engineering and Technology on Society and the Natural World • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-PS1-3)	*106–107*, 108–109, *109*, 110, *110–111*, 117A-117B, 120, 125–130
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	86–87, 104–105, 117, 119, Literacy Skills Handbook (online)
ELA WHST.6–8.8	*91–92*, 97, *116*, *118*, 121, Literacy Skills Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-1.	**Define the criteria and constraints of a design problem wit sufficient precision to ensure a successful solution, taking in account relevant scientific principles and potential impacts o people and the natural environment that may limit possible solutions.**	125–130
SEP Science and Engineering Practices		
Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) * = Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		125–130
DCI Disciplinary Core Ideas		
ETS1.A: Defining and Delimiting Engineering Problem • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)		125–130, Science and Engineering Practices Handbook (online)
CCC Crosscutting Concepts		
Connections to Science, Technology, Society and the Environment **Influence of Scienc , Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)		91, *91–92*, 103, 108, *109*, 110, *110–111*, 112, 115, 117A-117B, *118*, 122–124, 125–130, 131

Labs and investigations are in italics.

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• The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)	*106–107*, 108–109, *109*, 110, *110–111*, 117A–117B, 120, 125–130
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	86–87, 104–105, 117, 119, Literacy Skills Handbook (online)
ELA WHST.6–8.8	*91–92* , 97, *116* , *118*, 121, Literacy Skills Handbook (online)
CCSS Math Connections	
Math MP.2	99, Math Skill Handbook (online)
Math 7.EE.A.3	Math Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	*106–107*, 125–130
SEP Science and Engineering Practices		
Engaging in Argument from Evidence* Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) * = Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		*106–107*, 125–130
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2) possible solutions. (MS-ETS1-1)		125–130, Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections		
ELA RST.6–8.1		96–97, 104–105, 117, 119, Literacy Skills Handbook (online)
ELA RST.6–8.9		108, Literacy Skills Handbook (online)

Labs and investigations are in italics.

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ELA WHST.6–8.7	*91–92,* Literacy Skills Handbook (online)
ELA WHST.6–8.9	*91–92,* 97, *116, 118,* Literacy Skills Handbook (online)
CCSS Math Connections	
Math MP.2	99

MS-ETS1	Engineering Design	
MS-ETS1-4.	**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that a optimal design can be achieved.**	*106–107,* 125–130
SEP **Science and Engineering Practices**		
Developing and Using Models* Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4) * = Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		*106–107,* 125–130
DCI **Disciplinary Core Ideas**		
ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)		Science and Engineering Practices Handbook (online)
• Models of all kinds are important for testing solutions. (MS-ETS1-4)		*106–107,* 125–130, Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)		Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections		
ELA SL.8.5		125–130, Literacy Skills Handbook (online)
CCSS Math Connections		
Math MP.2		99, Math Skill Handbook (online)
Math 7.SP		Math Skill Handbook (online)

Labs and investigations are in italics.

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ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	131
SEP Developing and Using Models	96, 115
SEP Planning and Carrying Out Investigations	*88–90, 93–94, 106–107, 113–114,* 131
SEP Analyzing and Interpreting Data	*88–90,* 99, *106–107*
SEP Constructing Explanations and Designing Solutions	86–*87*, 100, 104–105, 108, *113–114,* 115, 124, 125–130, 131
SEP Engaging in Argument from Evidence	112
SEP Obtaining, Evaluating, and Communicating Information	123, 125–130
DCI ESS3.A: Natural Resources	108, 110
DCI ESS3.C: Human Impacts on Earth Systems	112
DCI LS2.A: Interdependent Relationships in Ecosystems	112
DCI LS4.D: Interdependent Relationships in Ecosystems	112
CCC Patterns	*88–90*
CCC Systems and System Models	115
CCC Energy and Matter	96
CCC Stability and Change	112
Connections to Nature of Science Science is a Human Endeavor	97
Connections to Nature of Science Science Addresses Questions About the Natural and Material World	120
Connections to Science, Technology, Society, and the Environment Interdependence of Science, Engineering, and Technology	120
CCSS ELA RST.6–8.3	*88–90, 93–94, 113–114*
CCSS ELA RST.6–8.6	117
CCSS ELA RST.6–8.7	*91–92,* 97–98, 122
CCSS ELA RST.6–8.8	117
CCSS ELA RST.6–8.10	97, 117, 117A–117B, 119, 121
CCSS ELA WHST.6–8.1	112

Labs and investigations are in italics.

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CCSS ELA WHST.6–8.2	*118*
CCSS ELA WHST.6–8.5	*118*
CCSS ELA WHST.6–8.6	*116, 118*
CCSS ELA SL.7.1	117, 119
CCSS ELA SL.7.4	125–130
CCSS ELA SL.7.5	125–130

Labs and investigations are in italics.

Performance Expectations at a Glance

In this unit, students will discover and practice the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts needed to perform the following Performance Expectations.

Performance Expectations	Module: **Matter and Energy in Ecosystems**	Module: **Dynamic Ecosystems**	Module: **Biodiversity in Ecosystems**
MS-LS1-6	●		
MS-LS1-7	●		
MS-LS2-1		●	
MS-LS2-2		●	
MS-LS2-3	●		
MS-LS2-4		●	
MS-LS2-5			●
MS-ETS1-1			●
MS-ETS1-2			●
MS-ETS1-3			●

Correlations by Module to the NGSS

MODULE: Matter and Energy in Ecosystems

MS-LS1	From Molecules to Organisms: Structures and Processes	
MS-LS1-6.	**Construct a scientific explanation based on evidence for the rol of photosynthesis in the cycling of matter and flow of energy int and out of organisms.** [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [*Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis*.]	59–64, 65

SEP Science and Engineering Practices

Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories. • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-6)	8–9, *12–14*, 16, 24, 28–29, 46–47, 49, 58, 59–64, 65

Labs and investigations are in italics.

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Connections to Nature of Science **Scientific Knowledge is Based on Empirical Evidenc** • Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)	*12–14*
DCI Disciplinary Core Ideas	
LS1.C: Organization for Matter and Energy Flow in Organisms • Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use.	10–11, *12–14*, 15, 20–24, *30*, 59–64, 65
PS3.D: Energy in Chemical Processes and Everyday Life • The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon–based organic molecules and release oxygen. (secondary to MS-LS1-6)	11, *12, 14*, 15–16, 19–23, 59–64, 65
CCC Crosscutting Concepts	
Energy and Matter • Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)	11, 15–16, 19–20, 59–64
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	16, Literacy Skill Handbook (online)
ELA RST.6–8.2	16, Literacy Skill Handbook (online)
ELA WHST.6–8.2	24, 35, 59–64, Literacy Skill Handbook (online)
ELA WHST.6–8.9	16, 21, 24, 33, Literacy Skill Handbook (online)
CCSS Math Connections	
Math 6.EE.C.9	Math Handbook (online)

MS-LS1	From Molecules to Organisms: Structures and Processes	
MS-LS1-7.	**Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.** [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [*Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration*.]	59–64

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Developing and Using Models Modeling in 6–8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms. (MS-LS1-7)	22, *34–35*, 35, 37B, 40, Lab *How is energy transferred in a food chain?* (online)
DCI Disciplinary Core Ideas	
LS1.C: Organization for Matter and Energy Flow in Organisms • Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)	19–22, 24, 30–31, *32*, 38, 40–41, 59–64, 65
PS3.D: Energy in Chemical Processes and Everyday Life • Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)	*17–18*, 19–20, 24, 59–64, 65
CCC Crosscutting Concepts	
Energy and Matter • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)	15, 19–20, 22
CCSS ELA/Literacy Connections	
ELA SL.8.5	21, 33, 37B, 55, Literacy Skill Handbook (online)

MS-LS2	Interactions, Energy, and Dynamics	
MS-LS2-3.	**Develop a model to describe the cycling of matter and flow o energy among living and nonliving parts of an ecosystem.** [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [*Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.*]	*34–35*, *36–37*, 59–64
SEP Science and Engineering Practices		
Developing and Using Models Modeling in 6–8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe phenomena. (MS-LS2-3)		*34–35*, 35, *36–37*, 37B, 40, 45, *51–52*, 56, 59–64

Labs and investigations are in italics.

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CCC Crosscutting Concepts	
Stability and Change* • Small changes in one part of a system might cause large changes in another part. (MS-LS2-4) *Other aspects of this CCC are integrated throughout this module and are listed in the *Also Integrates* section.	112, *113–114,* 114–115, 117, *118,* 119–120, 122, 123–130
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	72–73, 88–89, 106–107, Literacy Skill Handbook (online)
ELA RI.8.8	115, Literacy Skill Handbook (online)
ELA WHST.6–8.1	118, 123–130, Literacy Skill Handbook (online)
ELA WHST.6–8.9	Literacy Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	131
SEP Planning and Carrying Out Investigations	131
SEP Using Mathematics and Computational Thinking	*76–77,* 79
SEP Obtaining, Evaluating, and Communicating Information	115, 119
DCI LS2.B: Cycles of Matter and Energy Transfer in Ecosystems	115
CCC Stability and Change	82–84, 116, *116,* 121–122, 123–130
CCSS ELA RST.6-8.3	*76–77, 92–94*
CCSS ELA RST.6–8.10	81, 96, 99, 115, 119
CCSS ELA WHST.6-8.6	115A–115B
CCSS ELA WHST.6-8.7	81, *92–94,* 119
CCSS ELA WHST.6-8.8	81, *92–94,* 119
CCSS ELA SL.7.5	*92–94,* 96, 123–130

Labs and investigations are in italics.

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DCI Disciplinary Core Ideas	
LS2.B: Cycle of Matter and Energy Transfer in Ecosystems • Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)	31–33, *34–35*, 35, *36–37*, 37, 37B, 38, 40–41, 49–51, 52–54, 56–58, 59–64
CCC Crosscutting Concepts	
Energy and Matter • The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)	30, 32, *34–35*, 35, *36–37*, 37–38, 37B, 38, 40–41, 50, 59–64, 65, Lab *How is energy transferred in a food chain?* (online)
Connections to Nature of Science **Scientific Knowledge Assumes an Order and Consistency in Natural ystems** • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)	39
CCSS ELA/Literacy Connections	
ELA SL.8.5	21, 33, 37B, 55, Literacy Skill Handbook (online)
CCSS Math Connections	
Math 6.EE.C.9	Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	65
SEP Planning and Carrying Out Investigations	65
SEP Analyzing and Interpreting Data	*12–14*, *48–49*
SEP Using Mathematics and Computational Thinking	*12–14*
SEP Obtaining, Evaluating, and Communicating Information	16
DCI LS1.B: Growth and Development of Organisms	37A–37B
CCC Patterns	*12–14*
CCC Cause and Effect	16, 37B, 42, *48–49*

Labs and investigations are in italics.

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CCC Systems and System Models	20
CCC Structure and Function	11
CCC Stability and Change	*34–35*, *36–37*, 37A–37B
CCSS ELA RST.6–8.2	16
CCSS ELA RST.6–8.3	*12–14*, *17–18*, *34–35*, *36–37*, *48–49*, *51–52*
CCSS ELA RST.6–8.7	22, 40, 56, 59–64
CCSS ELA RST.6–8.10	16, 21, 33, 37A-37B, 39, 55
CCSS ELA WHST.6–8.8	21, 33
CCSS ELA SL.7.1	3, 16, 39
CCSS ELA SL.7.4	33, 59–64

MODULE: Dynamic Ecosystems

MS-LS2	Ecosystems: Interactions, Energy, and Dynamics	
MS-LS2-1.	**Analyze and interpret data to provide evidence for the effects o resource availability on organisms and populations of organisms in an ecosystem.** [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]	*76–77,* 79, 123–130
SEP Science and Engineering Practices		
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)		*76–77,* 79, 83, 123–130
DCI Disciplinary Core Ideas		
LS2.A: Interdependent Relationships in Ecosystems • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)		75, *75,* 76, 78, *78,* 80–81, 82, 84, 115A–115B, 131
• In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)		*76–77,* *78,* 98, 100

Labs and investigations are in italics.

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• Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)	*76–77,* 77–78, *78,* 79–80, 82, 84
CCC Crosscutting Concepts	
Cause and Effec • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)	*76–77,* 79–81, 82, 102, 112, *118,* 120, 123–130, 131
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	72–73, 88–89, 106–107, Literacy Skill Handbook (online)
ELA RST.6–8.7	82, *92–94,* 100, Literacy Skill Handbook (online)

MS-LS2	Ecosystems: Interactions, Energy, and Dynamics	
MS-LS2-2.	**Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]	*91,* 123–130
SEP Science and Engineering Practices		
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. • Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)		72–73, *78,* 84, 88–89, *91,* 98, 102, 106–107, 120, 123–130, 131
DCI Disciplinary Core Ideas		
LS2.A: Interdependent Relationships in Ecosystems • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)		*78,* 79, *90,* 91, *91,* 92, *92–94,* 94–97, *97,* 98, 100–102, 123–130
CCC Crosscutting Concepts		
Patterns • Patterns can be used to identify cause and effect relationships. (MS-LS2-2)		95, 97, 123–130, 131

Labs and investigations are in italics.

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CCSS ELA/Literacy Connections	
ELA RST.6–8.1	72–73, 88–89, 106–107, Literacy Skill Handbook (online)
ELA WHST.6–8.2	81–82, 120, Literacy Skill Handbook (online)
ELA WHST.6–8.9	Literacy Skill Handbook (online)
ELA SL.8.1	67, 95, Literacy Skill Handbook (online)
ELA SL.8.4	*92–94,* 99, Literacy Skill Handbook (online)
CCSS Math Connections	
Math 6.SP.B.5	123–130, Math Skill Handbook (online)

MS-LS2	Ecosystems: Interactions, Energy, and Dynamics	
MS-LS2-4.	**Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations** [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]	112, 118, 123–130
SEP Science and Engineering Practices		
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)		96, *118,* 123–130
Connections to Nature of Science **Scientific Knowledge is Based on Empirical Evidenc** • Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)		119
DCI Disciplinary Core Ideas		
LS2.C: Ecosystem Dynamics, Functioning, and Resilience • Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)		82, 108, *108,* 109–110, *111,* 112, *113–114,* 114–116, *116,* 116–118, *118,* 120–122, 123–130, 131, Animation *Aquatic Succession* (online)

Labs and investigations are in italics.

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MODULE: Biodiversity in Ecosystems

MS-LS2	Ecosystems: Interactions, Energy, and Dynamics	
MS-LS2-5.	**Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*** [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]	*177–178*, 180, 185–192
SEP Science and Engineering Practices		
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Evaluate competing design solutions based on jointly developed and agreed–upon design criteria. (MS-LS2-5) *Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		*177–178*, 180, 185–192
DCI Disciplinary Core Ideas		
LS2.C: Ecosystem Dynamics, Functioning, and Resilience • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)		137, *140*, 141, *142*, 142–144, *144–145*, 145, *146–147*, *148*, *149*, 150–158, 163A–163B, 164–166, 175, 181–182, 185–192
LS4.D: Biodiversity and Humans • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS-LS2-5)		137, *148*, 150, *159*, 159–160, *160–162*, 162, 163A–163B, 164–166, 173–175, 180, 182, 184, 185–192
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)		*177–178*, 185–192
CCC Crosscutting Concepts		
Stability and Change • Small changes in one part of a system might cause large changes in another part. (MS-LS2-5)		*149*, 150–151, 165–166, 169, 175, 175A–175B, 180, 184, 185–192
Connections to Engineering, Technology, and Applications of Science **Influence of Scienc , Engineering, and Technology on Society and the Natural World** • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)		*142*, 142–144, 166, *177–178*, 179, 183

Labs and investigations are in italics.

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Connections to Nature of Science **Science Addresses Questions About the Natural and Material World** • Science knowledge can describe consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)	169, 173–175, 177, *177–178,* 178–182, 184
CCSS ELA/Literacy Connections	
ELA RST.6-8.8	174, Literacy Skill Handbook (online)
ELA RI.8.8	174, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.4	*146–147*, Math Skill Handbook (online)
Math 6.RP.A.3	*144–145*, *146–147, 172, Math Skill Handbook (online)*

MS-ETS1	Engineering Design	
MS-ETS1-1.	**Define the criteria and constraints of a design problem wit sufficient precision to ensure a successful solution, taking in account relevant scientific principles and potential impacts o people and the natural environment that may limit possible solutions.**	*177–178*, 185–192
SEP Science and Engineering Practices		
Asking Questions and Defining Problem Asking questions and defining problems in grades 6–8 builds on grades K-5 experiences and progresses to specifying relationships between variables, clarifying arguments and models. • Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		185–192
DCI Disciplinary Core Ideas		
ETS1.A: Defining and Delimiting Engineering Problem • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)		Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

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CCC Crosscutting Concepts	
Connections to Engineering, Technology, and Applications of Science **Influence of Scienc , Engineering, and Technology on Society and the Natural World** • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)	173–175, *176–177*, 177, *177–178*, 179–181, 185–192
• The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions	*142*, 142–144, 166, *177–178*, 179, 183
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	138–139, 170–171, 174, Literacy Skill Handbook (online)
ELA WHST.6–8.8	*160–162*, 163, 163B, 175, 175B, *177–178*, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*144–145*, *146–147,* Math Skill Handbook (online)
Math 7.EE.3	*144–145*, *146–147*, *172,* Math Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	*177–178*, 180, 185–192
SEP Science and Engineering Practices		
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed–upon design criteria. (MS-ETS1-2) *Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		*177–178*, 180, 185–192
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2)		*177–178*, 185–192, Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

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CCSS ELA/Literacy Connections	
ELA RST.6–8.1	138–139, 170–171, 174, Literacy Skill Handbook (online)
ELA RST.6–8.9	*149*, Literacy Skill Handbook (online)
ELA WHST.6–8.7	*160–162*, 163, 163B, 175, 175B, *177–178*, Literacy Skill Handbook (online)
ELA WHST.6–8.9	163, *177–178*, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*144–145*, *146–147*, Math Skill Handbook (online)
Math 7.EE.3	*144–145, 146–147, 172*, Math Skill Handbook (online)

MS-ETS1	**Engineering Design**	
MS-ETS1-3.	**Analyze data from tests to determine similarities and differences among several design solutions to identify the bes characteristics of each that can be combined into a new solution to better meet the criteria for success.**	185–192
SEP Science and Engineering Practices		
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) *Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*148*, *149*, *172*, 185–192
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-3)		*177–178*, 185–192, Science and Engineering Practices Handbook (online)
• Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)		*177–178*, 185–192, Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)		185–192, Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

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CCSS ELA/Literacy Connections	
ELA RST.6–8.1	138–139, 170–171, 174, Literacy Skill Handbook (online)
ELA RST.6–8.7	*160–162*, 164, Literacy Skill Handbook (online)
ELA RST.6–8.9	*149*, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*144–145*, *146–147*, Math Skill Handbook (online)
Math 7.EE.3	*144–145*, *146–147*, *172*, Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	163, 193
SEP Developing and Using Models	*146–147*
SEP Planning and Carrying Out Investigations	193
SEP Analyzing and Interpreting Data	*144–145, 146–147,* 165
SEP Using Mathematics and Computational Thinking	*144–145, 146–147, 149,* 150, *172*
SEP Constructing Explanations and Designing Solutions	138–139, 141, 170–171, 184, 185–192
SEP Engaging in Argument from Evidence	*166*
SEP Obtaining, Evaluating, and Communicating Information	*160–162,* 163–164, 174–175, 177–178, 182, 185–192
CCC Patterns	*148, 149,* 150, 165
CCC Structure and Function	155
CCSS ELA RST.6-8.3	*144–145, 146–147,* 172, 176
CCSS ELA RST.6–8.10	163, 174–175, 175A–175B, 181
CCSS ELA WHST.6-8.1	166, 180
CCSS ELA WHST.6-8.2	181
CCSS ELA SL.7.4	160–162, 175

Labs and investigations are in italics.