GRADE 6-MS-LS1-1

# Structure, Function and Information Processing

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-1

*Students who demonstrate understanding can:*
**Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.** *[Clarification Statement: Emphasis is on developing evidence that living things **(**including Bacteria, Archaea, and Eukarya)** are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells. ****Viruses, while not cells, have features that are both common with, and distinct from, cellular life.]***

***FOSS Diversity of Life***
**IG:** pp. 53, 57, 59, 61, 65
**EA:** *Performance Assessment,* IG p. 181 (Step 13), IG p. 231 (Step 8), IG p. 256 (Step 10)
**EA:** *Notebook Entry***,** IG pp. 638-639 (Step 11)
**EA:** *Response Sheet,* IG pp. 249-250 (Step 23)**,** Student Notebook Masters No. 15
**EA:** *Review Notebook Entries***,** IG pp. 277-278 (Step 16)**,** IG pp. 371-372 (Step 13)
**BM:** *Assessment Coding Guide*, pp. 2-3 (Item 2ab), pp. 10-11 (Item 2), pp. 14-15 (Item 6)

## Science and Engineering Practices

**Planning and Carrying Out Investigations**
Planning and carrying out investigations in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

***FOSS Diversity of Life***
**IG:** pp. 208, 210, 230, 231, 241, 242, 255, 256, 264, 277-278, 309, 310, 326, 329, 353
**TR:** pp. C18-C21, C50-C53

## Disciplinary Core Ideas

**LS1.A: Structure and Function**

- All living things are made up of cells. A cell is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)

***FOSS Diversity of Life***
**IG:** pp. 207, 209, 211, 215, 218, 219, 223, 230 (Step 6), 231, 245 (Step 14), 276 (Step 12), 283, 285, 287, 289-293, 295, 299, 312, (Step 14), 344 (Step 24), 359 (Step 15),
371-372 (Step 13)
**SRB:** pp.14-19, 20-27, 29-30, 106-109, 110-113
**SNM:** Nos. 11, 15
**DOR:** Levels of Complexity

## Crosscutting Concepts

**Scale, Proportion, and Quantity**

- Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

***FOSS Diversity of Life***
**IG:** pp. 220, 231, 242, 256, 276, 277-278, 296, 314, 315, 341, 372
**SRB:** pp. 106-109, 110-113
**SNM:** Nos. 7-9
**TR:** pp. D15-D16, D30-D31

## 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-LS1-1)

***FOSS Diversity of Life***
**IG:** pp. 159 (Guiding question for phenomenon), 162, 176, 265 (Step 7, Teaching Note), 288, 354 (Step 6 Teaching Note), 368-369 (Step 7)
**SRB:** pp. 10-13, 23, 28-35
**SNM:** No. 33
**DOR:** Slide Show: *Classification History*

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment


School Specialty. Delta Education

GRADE 6-MS-LS1-2

# Structure, Function and Information Processing

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-2

*Students who demonstrate understanding can:*
**Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.**
*[Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]*

***FOSS Diversity of Life***
**IG:** pp. 53, 55, 57, 59, 61
**EA:** *Performance Assessment,* IG p. 201 (Step 7), IG p. 231 (Step 8)
**EA:** *Response Sheet,* IG pp. 317-318, Student Notebook Masters No. 29
**EA:** *Review Notebook Entries***,** IG pp. 277-278 (Step 16)**,** IG pp. 371-372 (Step 13)
**BM:** *Assessment Coding Guide,* pp. 14-15 (Item 7), pp. 16-17 (Item 9), pp.18-19 (Item 1), pp. 52-53 (Item 4), pp. 60-61 (Item 16), pp. 62-63 (Item 17)

## 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 and use a model to describe phenomena. (MS-LS1-2)

***FOSS Diversity of Life***
**IG:** pp. 208, 210, 220, 234, 247, 266, 277, 284, 286, 296, 315, 367, 371
**TR:** pp. C14-C17, C44-C49

## Disciplinary Core Ideas

**LS1.A: Structure and Function**

- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)

***FOSS Diversity of Life***
**IG:** pp. 207, 209, 211, 212-214, 219, 223, 228 (Step 6), 232-233 (Steps 12-14), 234 (Step 16), 247 (Step 18), 266 (Step 8), 283, 277, 285, 295, 299, 328-329 (Step 6), 356 (Step 10 and 11), 366 (Step 3), 367 (Step 5), 371-372 (Step 13)
**SRB:** pp. 24-27, 30, 114-118
**STUDENT NOTEBOOK MASTERS:** Nos. 11-14, 17,18, 30, 31
**DOR:** *Levels of Complexity:*
“Plant Cell”
“Animal Cells”
“Bacterial Cell”
“Fungal Cell”
“Archaean Cell”
“Levels of Complexity Card Sort”

## Crosscutting Concepts

**Structure and Function**

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural and designed structures/systems can be analyzed to determine how they function. (MS-LS1-2)

***FOSS Diversity of Life***
**IG:** pp. 220, 231-232, 247, 248, 266, 296, 277, 328, 366
**SRB:** pp. 24-27, 30, 110-113
**DOR:** *Levels of Complexity*
**TR:** pp. D13, D18, D38-D39

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-LS1-3

# Structure, Function and Information Processing

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-3

*Students who demonstrate understanding can:*
**Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.**
*[Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]*

***FOSS Human Systems Interactions***
**IG:** pp. 43, 45, 47, 49
**EA:** *Performance Assessment,* IG p. 108 (Step 21), IG p. 146 (Step 13)
**EA:** *Response Sheet,* IG p. 135, Student Notebook Masters No. 5, IG p. 206, Student Notebook Masters No. 9
**EA:** *Review Notebook Entries***,** IG p. 110 (Step 25)**,** IG p. 154-155 (Step 20)**,** IG p. 247 (Step 21)
**BM:** Assessment Coding Guide, pp. 6-7 (Items 1-3), pp. 8-9 (Item 9), pp.10-11 (Item 7ab), pp.12-13 (Item 9), pp. 22-23 (Item 1ab), pp. 26-27 (Items 7 and 8), pp. 28-29 (Item 10)

## 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).

- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)

***FOSS Human Systems Interactions***
**IG:** pp. 71, 72. 81, 91, 107 (Step 20), 158, 167, 186, 206
**SNM:** No. 9
**TR:** pp. C33-C38, C66-C69

## Disciplinary Core Ideas

**LS1.A: Structure and Function**

- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

***FOSS Human Systems Interactions***
**IG:** pp. 80, 71, 73, 83, 89-92 (Steps 6-8), 123, 134 (Step 15), 166, 169, 173 (Step 1)
**SRB:** pp. 3, 4-7, 8-13, 14-19, 20-25, 26-31, 32-37, 38-44, 45-49
**SNM:** Nos. 1-3
**DOR:** "Human Systems Structural Levels"
"Levels of Complexity"
**"**Human Cardiovascular System"

## Crosscutting Concepts

**Systems and System Models**

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)

***FOSS Human Systems Interactions***
**IG:** pp. 82, 102, 105, 127, 133, 145, 168, 199, 203, 204, 206, 228
**TR:** pp. D12, D16, D32-D35

## Connections to Nature of Science

**Science is a Human Endeavor**

- Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

***FOSS Human Systems Interactions***
**IG:** pp. 88 (Step 4), 103 (Step 13), 107 (Step 19), 109 (Step 24), 111 (Step 27), 245 (Step 17)

GRADE 6-MS-LS1-4

# Structure, Function and Information Processing

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-4

*Students who demonstrate understanding can:*
**Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.**
*[Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds; and, creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]*

***FOSS Diversity of Life***
**IG:** pp. 53, 63, 65
**EA:** *Performance Assessment,* IG p. 472 (Step 12)
**EA:** *Response Sheet,* IG p. 487, Student Notebook Masters No. 54
**EA:** *Review Notebook Entries*, IG p. 501 (Step 13), IG p. 590 (Step 11)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 6), pp. 34-35 (Item 2ab) pp. 36-37 (Item 4), pp. 51-52 (Item 3), pp. 56-57 (Item 9)

## 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).

- Use 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-LS1-4)

***FOSS Diversity of Life***
**IG:** pp. 438, 447, 473 (Step 15), 498, 501, 587, 590
**TR:** pp. C33-C38, C66-C69

## Disciplinary Core Ideas

**LS1.B: Growth and Development of Organisms**

- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)

***FOSS Diversity of Life***
**IG:** pp. 435, 437, 439, 440, 442-445, 446-447, 451, 456-457 (Step 1), 479-480 (Step 1), 483-484 (Steps 12-13), 486-487 (Step 16), 495 (Step 1), 497 (Step 7), 499 (Step 10), 501-502 (Steps 13 and 14)
**SRB:** pp. 62-64, 65-72, 81-89, 122-125, 126-133
**SNM:** Nos. 47, 51-53, 55-56, 62, 63
**DOR:** *Slide Show:*
*Non-flowering Plants*
*"Database: Pollinator Collection"*
*"Pollinators Game"*

## Crosscutting Concepts

**Cause and Effect**

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4)

***FOSS Diversity of Life***
**IG:** pp.565, 578-579, 580, 590
**TR:** pp. D11, D14-D15, D24-D29

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-LS1-5

# Structure, Function and Information Processing

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-5

*Students who demonstrate understanding can:*
**Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.**
*[Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]*

***FOSS Diversity of Life***
**IG:** pp. 53, 63
**EA:** *Performance Assessment,* p. 472 (Step 12)
**EA:** *Review Notebook Entries*, IG p. 501 (Step 13)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 5), pp. 36-37 (Item 5), pp. 38-39 (Item 7), pp. 40-41 (Item 8), pp. 62-63 (Item 19)

## 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-LS1-5)

***FOSS Diversity of Life***
**IG:** pp. 435, 436, 438, 447, 460, 472, 474, 497, 501
**SNM:** No. 49
**TR:** pp. C28-C32, C66-C67

## Disciplinary Core Ideas

**LS1.B: Growth and Development of Organisms**

- Genetic factors as well as local conditions affect the growth of the adult plant.

***FOSS Diversity of Life***
***IG:** pp. 435, 437, 441-442, 446-447, 451, 468-467 (Steps 2-3), 472-473 (Step 13)*
***SRB:** pp. 58-61*
***SNM:** No. 48*

## Crosscutting Concepts

**Cause and Effect**

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-5)

***FOSS Diversity of Life***
**IG:** pp. 448, 472, 473, 501
**TR:** pp. D11, D14-D15, D24-D29

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-LS1-8

# Structure, Function and Information Processing

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-8

*Students who demonstrate understanding can:*
**Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.**
*[Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]*

***FOSS Human Systems Interactions***
**IG:** pp. 43, 49
**EA:** *Notebook Entry,* IG p. 246 (Step 20)
**EA:** *Review Notebook Entries***,** IG p. 247 (Step 21)
**BM:** *Assessment Coding Guide*, pp. 4-5 (Items 5 and 6), pp. 14-15 (Items 2 and 3), pp. 18-19 (Items 6 and 7), pp. 20-21 (Item 9), pp. 24-25 (Item 4abc)

## Science and Engineering Practices

**Obtaining, Evaluating, and Communicating Information**
Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences 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-LS1-8)

***FOSS Human Systems Interactions***
**IG:** pp. 158, 167, 176, 179, 196, 207, 218, 227, 239, 247
**TR:** pp. C39-C41, C70-C73

## Disciplinary Core Ideas

**LS1.D: Information Processing**

- Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8)

***FOSS Human Systems Interactions***
**IG:** pp. 157, 159, 160-165, 166, 169, 175 (Step 6), 195 (Step 4), 206 (Step 16), 221 (Step 9), 227 (Step 21 and 22), 245 (Step 17), 247
**SRB:** pp. 55-59, 60-63, 64- 68, 69-73, 74-78, 79-83, 84-87, 88-92, 104
**SNM:** Nos. 8, 9, 13
**DOR:** *"Touch Menu"*
*"Brain: Synapse Function"*
*"Smell Menu"*
*"Vision Menu"*

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)

***FOSS Human Systems Interactions***
**IG:** pp. 168, 194, 247
**TR:** pp. D11, D14-D15, D24-D29

GRADE 6-MS-LS3-2

# Heredity: Inheritance and Variation of Traits

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS3-2

*Students who demonstrate understanding can:*
**Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.**
*[Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]*

***FOSS Diversity of Life***
**IG:** pp. 53, 63, 537 (Step 7), 548 (Step 12)
**EA:** *Notebook Entry*, IG p. 530 (Step 23), IG p. 547 (Step 10)
**EA:** *Review Notebook Entries,* IG p. 550 (Step 16)
**BM:** *Assessment Coding Guide*, pp. 8-9 (Item 7), pp. 36-37 (Item 5), pp. 42-43 (Items 1 and 2), pp. 44-45 (Items 3 and 4), pp. 46-47 (Item 6), pp. 56-57 (Item 9)

## 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 and use a model to describe phenomena. (MS-LS3-2)

***FOSS Diversity of Life***
**IG:** pp. 506, 515, 535, 550
**SNM:** Nos. 59, 60
**TR:** pp. C14-C17, C44-C49

## Disciplinary Core Ideas

**LS1.B: Growth and Development of Organisms**
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)

***FOSS Diversity of Life***
**IG:** pp. 505, 507, 508-510, 514, 517, 521-522 (Steps 1-2), 525 (Steps 10-12), 526 (Step 14), 530 (Step 22), 549 (Steps 14-15), 550, 551 (Step 17)
**SRB:** pp. 73-80
**DOR:** *Genes and Heredity*

**LS3.A: Inheritance of Traits**
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

***FOSS Diversity of Life***
**IG:** pp. 505, 507, 508-513, 514, 517, 527 (Step 15), 535-536 (Step 5), 549 (Steps 14-15), 550
**SRB:** pp. 73-80
**DOR:** *Genes and Heredity*

**LS3.B: Variation of Traits**
- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)

***FOSS Diversity of Life***
**IG:** pp. 505, 507, 510-513, 514, 517, 527 (Steps 15-16), 547-548 (Step 11), 549 (Steps 14-15), 550
**SRB:** pp. 73-80

## Crosscutting Concepts

**Cause and Effect**
- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)

***FOSS Diversity of Life***
**IG:** pp. 516, 528, 529, 536, 550
**TR:** pp. D11, D14-D15, D24-D29

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | **SNM:** Nos. 59, 60<br>**DOR:** *Genes and Heredity* | |

GRADE 6-MS-ESS2-4

# Earth's Systems

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS2-4

*Students who demonstrate understanding can:*
**Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** *[Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]*

***FOSS Weather and Water***
**IG:** pp. 61, 75, 77, 556-557 (Step 12-14)
**EA:** *Notebook Entry*, IG p. 527 (Step 20), IG p. 565 (Step 22)
**EA:** *Review Notebook Entries*, IG p. 530 (Step 26), IG p. 594 (Step 15)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 4), pp. 50-51 (Item 1), pp. 54-55 (Item 4acde), pp. 56-57 (Items 5 and 6), pp. 76-77 (Items 8 and 9), pp. 78-79 (Item 10ab), pp. 80-81 (Item 11)

## 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-ESS2-4)

***FOSS Weather and Water***
**IG:** pp. 484, 495, 509, 521, 526, 530, 533, 534, 545, 553, 556, 565, 594
**TR:** pp. C14-C17, C44-C49

## Disciplinary Core Ideas

**ESS2.C: The Roles of Water in Earth's Surface Processes**

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

***FOSS Weather and Water***
**IG:** pp. 483, 485, 486-493, 494, 497, 505 (Step 15), 509 (Step 2), 511-512 (Steps 6-9), 528 (Step 21), 529 (Step 24), 530, 533, 535, 536-538, 544, 547, 554-555 (Step 7), 564-565 (Steps 20-22), 566 (Step 24), 594
**SNM:** Nos. 42, 44
**SRB:** pp. 91-95, 123, 124-125
**DOR:** "Water Cycle"

## Crosscutting Concepts

**Energy and Matter**

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

***FOSS Weather and Water***
**IG:** pp. 496, 510, 515, 530, 546, 556, 595
**TR:** pp. D17, D36-D37

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-ESS2-5

# Earth's Systems

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS2-5

*Students who demonstrate understanding can:*

**Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** *[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]*

***FOSS Weather and Water***
**IG:** pp. 61, 65, 73, 77, 81
**EA:** *Notebook Entry,* IG p. 455 (Step 12), IG p. 467 (Step 17), IG p. 480 (Step 24b)
**EA:** *Performance Assessment,* IG p. 226 (Step 9)**,** IG pp. 679-680 (Step 20)**,** *Review Notebook Entries***,** IG p. 228 (Step 15)**,** IG p. 480 (Step 24a)
**BM:** *Assessment Coding Guide,* pp. 8-9 (Item 5), pp. 72-73 (Item 5ab), pp. 74-75 (Item 7), pp. 84-85 (Item 16ab)

## Science and Engineering Practices

**Planning and Carrying Out Investigations**
Planning and carrying out investigations in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)

***FOSS Weather and Water***
**IG:** pp. 184, 103, 228, 659, 662-665, 679 (Step 19)
**TR:** pp. C18-C21, C50-C53

## Disciplinary Core Ideas

**ESS2.C: The Roles of Water in Earth's Surface Processes**

- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)

***FOSS Weather and Water***
**IG:** pp. 183, 185, 189-190, 193, 197, 206 (Step 11), 223-225 (Steps 4-7), 228, 421, 423, 425-429, 430, 433, 453-454 (Steps 7-8), 659, 661, 666, 669, 673 (Step 1), 676 (Step 8), 680
**SNM:** Nos. 7, 20, 38, 39, 50
**SRB:** pp. 76-84, 122
**DOR:** "Weather Maps"

**ESS2.D: Weather and Climate**

- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)

***FOSS Weather and Water***
**IG:** pp. 183, 185, 193, 197, 226-227 (Step 11), 228, 659, 661, 666, 669, 680 (Step 23), 681-682 (Steps 25-27)

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

***FOSS Weather and Water***
**IG:** pp. 195, 225, 227, 228, 432, 436, 448, 454, 463, 465, 466, 467, 668, 674, 680
**TR:** pp. D11, D14-D15, D24-D29

IG: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-ESS2-6

# Earth's Systems

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS2-6

*Students who demonstrate understanding can:*
**Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.**
*[Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]*

***FOSS Weather and Water***
**IG:** pp. 67, 69, 77
**EA:** *Review Notebook Entries***,** IG p. 294 (Step 16)**,** IG p. 357 (Step 21)**,** IG p. 594 (Step 15)
**BM:** *Assessment Coding Guide,* pp. 4-5 (Item 3ab)**,** pp. 8-9 (Item 6), pp. 28-29 (Item 3abc), pp. 30-31 (Item 4ab), pp. 32-33 (Item 7), pp. 34-35 (Item 1abc), pp. 44-45 (Item 4abcd), pp. 54-55 (Item 4abcde), pp. 44-45 (Item 4abcd), pp. 58-59 (Item 7a), pp. 74-75 (Item 6 and 7), pp. 82-83 (Item 14)

## 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 and use a model to describe phenomena. (MS-ESS2-6)

***FOSS Weather and Water***
**IG:** pp. 232, 243, 256, 261, 272, 273, 289, 291, 297, 298, 328, 329, 335, 337, 338, 353, 357, 587
**TR:** pp. C14-C17, C44-C49

## Disciplinary Core Ideas

**ESS2.C: The Roles of Water in Earth's Surface Processes**

- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

***FOSS Weather and Water***
**IG:** pp. 233, 237-238, 238-241, 242, 245, 261 (Step 25), 273 (Step 17), 291 (Step 9), 309
**SNM:** Nos. 8-10, 13
**SRB:** pp. 41-46, 47-50, 51-52
**DOR:** *Fluid Convection*

**ESS2.D: Weather and Climate**

- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

***FOSS Weather and Water***
**IG:** pp. 297, 299, 300-307, 308, 311, 320 (Step 13), 328 (Step 3), 352 (Step 13), 319, 357
**SRB:** pp.116-117, 120-121

***FOSS Weather and Water***
**IG:** pp. 533, 535, 541-543, 569 (Step 1), 580 (Step 9), 589 (Step 10)

## Crosscutting Concepts

**Systems and System Models**

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

***FOSS Weather and Water***
**IG:** pp. 244, 290, 310, 329, 352, 594
**TR:** pp. D12, D16, C32-C35

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | **SRB:** pp. 96-102, 103-104<br>**DOR:** *Perpetual Ocean* | |

GRADE 6-MS-ESS3-3

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS3-3

*Students who demonstrate understanding can:*
**Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.***
*[Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]*

***FOSS Weather and Water***
**IG:** p. 79
**EA:** *Performance Assessment*, IG p. 649 (Step 6)
**EA:** *Review Notebook Entries,* IG p. 655 (Step 18)
**BM:** *Assessment Coding Guide,* pp. 60-61 (Item 2), pp. 86-86 (Item 18)

## 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.

- Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

***FOSS Weather and Water***
**IG:** pp. 597, 598, 611, 630, 652, 655
**TR:** pp. C28-C32, C66-C67

## Disciplinary Core Ideas

**ESS3.C: Human Impacts on Earth Systems**

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)

***FOSS Human Systems Interactions***
***IG:** p. 111 (Step 27)*

***FOSS Weather and Water***
***IG:** pp. 597, 604, 605-609, 610-611, 613, 629-630 (Step 7), 649, 656*
***DOR:** "Human-Caused Sources of Carbon Dioxide*

## Crosscutting Concepts

**Cause and Effect**

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)

***FOSS Human Systems Interactions***
**IG:** p. 111 (Step 27)

***FOSS Weather and Water***
**IG:** pp. 612, 629, 649, 651, 655
**TR:** pp. D11, D14-D15, D24-D29

## Connections to Engineering, Technology, and Applications of Science

**Influence of Science, 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-ESS3-3)

***FOSS Weather and Water***
**IG:** pp. 564 (Step 18), 627-30 (Steps 3-9), 632 (Steps 13-14)
**SRB:** pp. 93-95, 109-110
**DOR:** "Greenhouse-Gas Simulator", **"**Human-Caused Sources of Carbon Dioxide"

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-ESS3-5

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS3–5

*Students who demonstrate understanding can:*
**Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.**
*[Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]*

***FOSS Weather and Water***
**IG:** p. 79
**EA:** *Review Notebook Entries***,** IG p. 655 (Step 18)
**BM:** *Assessment Coding Guide,* pp. 8-9 (Item 7), pp. 66-67 (Item 5ab), pp. 80-81 (Item 13)

## 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.
- Ask questions to identify and clarify evidence of an argument. (MS-ESS3–5)

***FOSS Weather and Water***
**IG:** pp. 598, 611, 647
**TR:** pp. C9-C13, C42-C43

## Disciplinary Core Ideas

**ESS3.D: Global Climate Change**
- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3–5)

***FOSS Weather and Water***
***IG:*** *pp. 597, 599, 600-609, 610-611, 613, 619 (Step 11), 627 (Step 3), 652 (Step 12), 655, 656*
***SRB:*** *pp. 72-75, 105-110, 130-131*
***DOR:*** *Earth's Climate over Time*
*"Greenhouse-Gas Simulator"*

## Crosscutting Concepts

**Stability and Change**
- Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

***FOSS Weather and Water***
**IG:** pp. 612, 630, 632, 655
**TR:** pp. D19, D40-D41

GRADE 6-MS-PS3-3

# Energy

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS3-3

*Students who demonstrate understanding can:*
**Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.***
*[Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]*

***FOSS Weather and Water***
**IG:** p. 79
**EA:** *Performance Assessment*, IG p. 408 (Step 17)
**EA:** *Review Notebook Entries*, IG p. 418 (Step 32)
**EA:** *Response Sheet,* IG p. 398, Student Notebook Masters No. 28
**BM:** *Assessment Coding Guide,* pp. 42-43 (Items 1 and 2), pp. 48-49 (Item 6abcde), pp. 70-71 (Item 4)

## 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.

- Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)

***FOSS Weather and Water***
**IG:** pp. 361, 362, 371, 380, 383, 385, 398, 408, 418
**TR:** pp. C28-C32, C66-C67

## Disciplinary Core Ideas

**PS3.A: Definitions of Energy**

- Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-PS3-4)

***FOSS Weather and Water***
***IG:** pp. 364, 365, 370, 373, 385 (Step 18), 398 (Step 16), 418*
***DOR:** "Thermometer", "Particles in Solids, Liquids, and Gases"*

**PS3.B: Conservation of Energy and Energy Transfer**

- Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

***FOSS Weather and Water***
***IG:** pp. 361, 363, 370, 373, 381 (Step 9), 408, 418*

**ETS1.A: Defining and Delimiting an 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 is likely to limit possible solutions. (secondary to MS-PS3-3)

***FOSS Weather and Water***
***IG:** pp. 361, 367-369, 370, 373, 394-395 (Step 6), 404 (Step 3), 418*
***TM:** X, Y*

**ETS1.B: Developing Possible Solutions**

## Crosscutting Concepts

**Energy and Matter**

- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)

***FOSS Weather and Water***
**IG:** pp. 372, 382, 385, 392, 393, 405, 406
**TR:** pp. D17, D36-D37

| | | |
|---|---|---|
| | • A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (secondary to MS-PS3-3)<br><br>***FOSS Weather and Water***<br>***IG:*** *pp. 361, 367-369, 370, 373, 397 (Step 15), 418*<br>***TM:*** *Z* | |

GRADE 6-MS-PS3-4

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS3-4

*Students who demonstrate understanding can:*
**Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.**
*[Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]*

***FOSS Weather and Water***
**IG:** p. 69
**EA:** *Performance Assessment,* IG p. 350 (Step 9)
**EA:** *Review Notebook Entries***,** IG p. 357 (Step 21)
**BM:** Assessment Coding Guide, pp. 32-33 (Item 5 and 7)**,** pp. 34-35 (Item 1), pp. 74-75 (Item 7)

## Science and Engineering Practices

**Planning and Carrying Out Investigations**
Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS3-4)

***FOSS Weather and Water***
**IG:** pp. 298, 309, 348, 350, 357
**TR:** pp. C18-C21, C50-C53

## Disciplinary Core Ideas

**PS3.A: Definitions of Energy**

- Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-4)

***FOSS Weather and Water***
***IG:** pp. 297, 299, 308, 311, 346-347 (Step 1), 357*
***SRB:** pp. 59-63*
***DOR:** "Thermometer"*
*"Particles in Solids, Liquids, and Gases"*

**PS3.B: Conservation of Energy and Energy Transfer**

- The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)

***FOSS Weather and Water***
***IG:** pp. 299, 306-307, 308, 311, 335 (Step 17), 350, 357*
***DOR:** "Energy Transfer: Conduction, Radiation, Convection"*

## Crosscutting Concepts

**Scale, Proportion, and Quantity**

- Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-4)

***FOSS Weather and Water***
**IG:** pp. 310, 329, 330, 336, 352
**TR:** pp. D15-D16, C30-C31

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-PS3-5

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS3–5

*Students who demonstrate understanding can:*
**Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.**
*[Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]*

***FOSS Weather and Water***
**IG:** p. 69
**EA:** *Performance Assessment*, IG p. 350 (Step 9)
**EA:** *Review Notebook Entries*, IG p. 357 (Step 21)
**BM:** *Assessment Coding Guide,* pp. 34-35 (Item 1), pp. 70-71 (Item 4), pp. 74-75 (Item 6), pp. 76-77 (Items 8 and 9)

## 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 worlds.
- Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3–5)

***FOSS Weather and Water***
**IG:** pp. 322 (Step 17), 338 (Step 23), 353 (Step 14), 357 (Step 22)
**TR:** pp. C33-C38, C66-C69

## Disciplinary Core Ideas

**PS3.B: Conservation of Energy and Energy Transfer**
- When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3–5)

***FOSS Weather and Water***
**IG:** pp. 297, 350, 352-354 (Steps 13-15), 357, 361, 370, 378-379 (Step 1), 381-383 (Steps 9-14)

## Crosscutting Concepts

**Energy and Matter**
- Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). (MS-PS3–5)

***FOSS Weather and Water***
**IG:** pp. 310, 337, 350, 353, 357
**TR:** pp. D17, D36-D37

## Connections to Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**
- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS3–5)

***FOSS Weather and Water***
**IG:** 330-331 (Step 9), 353 (Step 14), 383 (Steps 12-13), 436-437 (Steps 1-2)

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-ETS1-1

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-1

*Students who demonstrate understanding can:*
**Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

***FOSS Weather and Water***
**IG:** p. 71
**EA:** IG p. 407 (Step 14)
**BM:** *Assessment Coding Guide*, pp. 48-49 (Item 6abcde)**,** pp. 85-86 (Item 17)

## 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)

***FOSS Weather and Water***
**IG:** pp. 362, 371, 395 (Step 7), 406
**TR:** pp. C9-C13, C42-C43

## Disciplinary Core Ideas

**ETS1.A: Defining and Delimiting Engineering Problems**

- 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)

***FOSS Weather and Water***
**IG:** pp. 361, 367-369, 370, 373, 394-395 (Step 6), 404 (Step 3), 418
**TM:** X, Y, BB

## Crosscutting Concepts

**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)
- 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)

***FOSS Weather and Water***
**IG:** pp. 407 (Steps 14-15), 409-410 (Steps 24-24), 417 (Step 30)
**TM:** EE
**SRB:** pp. 64-68

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 6-MS-ETS1-2

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-2

*Students who demonstrate understanding can:*
**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

***FOSS Weather and Water***
**IG:** p.71
**EA:** *Response Sheet*, IG pp. 398-399 (Step 19), Student Notebook Masters No. 28
**EA:** *Performance Assessment*, IG p. 408 (Step 17)
**EA:** *Review Notebook Entries*, IG p. 418 (Step 32)
**BM:** Assessment Coding Guide, pp. 48-49 (Item 6abcde), pp. 84-85 (Item 16ab)

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|
| **Engaging in Argument from Evidence**<br>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.<br>• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)<br><br>***FOSS Weather and Water***<br>**IG:** pp. 397 (Step 15), 406 (Step 10), 408 (Step 20)<br>**TR:** pp. C33-C38, C66-C69 | **ETS1.B: Developing Possible Solutions**<br>• There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2)<br><br>***FOSS Weather and Water***<br>**IG:** pp. 404 (Step 3), 406 (Step 10), 408 (Step 20), 418<br>**TM:** DD | |

GRADE 6-MS-ETS1-3

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-3

*Students who demonstrate understanding can:*
**Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

***FOSS Weather and Water***
**IG:** p. 71
**EA:** *Review Notebook Entries***,** IG p. 418 (Step 32)
**BM:** *Assessment Coding Guide***,** pp. 48-49 (Item 6abcde)**,** pp. 84-85 (Item 16ab)

## 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)

***FOSS Weather and Water***
**IG:** pp. 362, 371, 380, 383, 397, 406, 408
**TR:** pp. C22-C24, C54-C59

## 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)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)

***FOSS Weather and Water***
**IG:** pp. 404 (Step 3), 405 (Step 4), 406 (Steps 10-11), 408 (Step 20), 418
**TM:** DD

**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)

***FOSS Weather and Water***
**IG:** pp. 397 (Step 15), 398 (Step 17), 406 (Steps 10-11), 407 (14-16), 408 (Step 20), 418
**TM:** DD

## Crosscutting Concepts

GRADE 6-MS-ETS1-4

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-4

*Students who demonstrate understanding can:*
**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

***FOSS Weather and Water***
**IG:** p. 71
**EA:** *Review Notebook Entries*, IG p. 418 (Step 32)
**BM:** *Assessment Coding Guide*, pp. 48-49 (Item 6abcde)

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|
| **Developing and Using Models**<br>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.<br>• Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)<br><br>***FOSS Weather and Water***<br>**IG:** pp. 362, 371, 381, 383, 385, 394, 397, 405, 408, 418<br>**TR:** pp. C14-C17, C44-C49 | **ETS1.B: Developing Possible Solutions**<br>• A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)<br>• Models of all kinds are important for testing solutions. (MS-ETS1-4)<br><br>***FOSS Weather and Water***<br>**IG:** pp. 397-398 (Steps 13-17), 405 (Steps 4 and 7), 406 (Steps 10-11), 407 (Steps 15-16), 408 (Steps 18-20), 418<br><br>**ETS1.C: Optimizing the Design Solution**<br>• 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)<br><br>***FOSS Weather and Water***<br>**IG:** pp. 398 (Step 17), 403-404 (Step 1), 405 (Step 4), 406 (Step 11), 407 (Steps 14-16), 408 (Step 20), 418 | |

GRADE 7-MS-LS1-6

# From Molecules to Organisms: Structures and Processes

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-6

*Students who demonstrate understanding can:*
**Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into 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.]*

***FOSS Populations and Ecosystems***
**IG:** pp. 55, 65
**EA:** *Notebook Entry,* IG p. 402 (Step 28)
**EA:** *Performance Assessment,* IG pp. 360-361 (Step 5)
**EA:** *Response Sheet,* IG p. 375**,** Student Notebook Master No. 19
**EA:** *Review Notebook Entries***,** IG p. 504 (Step 30)
**BM:** *Assessment Coding Guide,* pp. 4-5 (Item 2a), pp. 6-7 (Item 3ab), pp.24-25 (Item 1ab), pp. 26-27 (Items 4 and 5), pp. 30-31 (Item 7abc), pp. 68-69 (Item 9), pp.72-73 (Item 14ab), pp. 74-75 (Item 15)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 351, 365, 375, 404
**TR:** pp. C28-C32, C64-C73

## 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.

***FOSS Populations and Ecosystems***
**IG:** pp. 350, 373 (Steps 6 and 7), 374, 378 (D), 381 (H), 385 (Step 1)
**SNM:** Nos.13, 19
**SRB:** pp. 51-55, 56-61

**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)

***FOSS Populations and Ecosystems Module***
**IG:** pp. 350, 363 (Steps 12 and 13), 364 (Steps 15 and 16), 366 (Step 21), 372-374 (Steps 5-7), 381 (H) 425 (Step 2)
**SRB:** pp. 51-55, 56-61

## Crosscutting Concepts

**Energy and Matter**

- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)

***FOSS Populations and Ecosystems***
**IG:** pp. 337, 352, 361, 373, 374, 395, 397, 398, 400, 404
**TR:** pp. D12-D13, D17, D38-D43

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

## Connections to the Nature and Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)

***FOSS Populations and Ecosystems***

**IG:** pp. 360 (Steps 4-5), 364 (Step 14), 373 (Step 6)

GRADE 7-MS-LS1-7

# From Molecules to Organisms: Structures and Processes

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS1-7

*Students who demonstrate understanding can:*
**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.]*

***FOSS Populations and Ecosystems***
**IG:** pp. 55, 65
**EA:** *Notebook Entry*, IG p. 402 (Step 28), IG p. 404 (Steps 30-31)
**EA:** *Response Sheet*, IG p. 375, Student Notebook Master No. 19
**EA:** *Review Notebook Entries*, IG p. 504 (Step 30)
**BM:** *Assessment Coding Guide, pp*. 4-5 (Item 2a), pp. 6-7 (Item 3ab), pp. 24-25 (Items 1ab, 2), pp. 28-29, (Item 6abc), pp. 70-71(12), pp. 72-73 (Item 14ab), pp. 74-75 (Item 15)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 337, 351, 397, 398, 400, 401, 404
**TR:** pp. C14-C17, C44-C51

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 337, 350, 353, 374 (Steps 8 and 9) 395 (Step 3), 396-397 (Step 10), 402 (Steps 27 and 28)
**SRB:** pp. 54-55

**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)

***FOSS Populations and Ecosystems***
**IG:** pp. 337, 350, 353, 374 (Step 8), 397 (Step 10), 402 (Step 27 and 28)
**SRB:** pp. 54-55

## Crosscutting Concepts

**Energy and Matter**
- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

***FOSS Populations and Ecosystems***
**IG:** pp. 337, 352, 361, 373, 374, 378 (C), 395, 397, 398, 400, 404
**TR:** pp. D12-D13, D17, D38-D43

GRADE 7-MS-LS2-1

# Ecosystems: Interactions, Energy, and Dynamics

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS2-1

*Students who demonstrate understanding can:*
**Analyze and interpret data to provide evidence for the effects of 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.]*

***FOSS Populations and Ecosystems***
**IG:** pp. 55, 69
**EA:** *Notebook Entry,* IG p. 507 (Step 30)*,* IG p. 541 (Step 16)
**EA:** *Performance Assessment***,** IG p. 515 (Step 7)
**EA:** *Review Notebook Entries***,** IG p. 543 (Step 20)
**BM:** *Assessment Coding Guide,* pp. 2-3 (Item 1abc)**,** pp. 40-41 (Item 1)**,** pp. 42-43 (Item 2)**,** pp. 44-45 (Items 2c and 3), pp. 48-49 (Item 6), pp. 58-59 (Item 1)**,** pp. 64-65 (Items 4 and 6)**,** pp. 66-67 (Item 7)**,** pp. 68-69 (Item 10), pp. 70-71 (Item 12)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 481, 491, 504, 505, 506, 514, 515, 531, 532, 540, 543
**TR:** pp. C22-C24, C56-C61

## 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)
- 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)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

***FOSS Populations and Ecosystems***
**IG:** pp. 481, 490, 502 (Step 15), 504 (Step 22), 506 (Step 26), 507 (Step 29-30), 514-515 (Step 5), 533-535 (Steps 5-9), 540 (Steps 12-14), 543 (Steps 20-21)
**SRB:** pp. 87-96, 97-99
**SNM:** Nos. 9, 34-36, 40
**DOR: "**Milkweed Bugs: Limited*",* "Milkweed Bugs: Unlimited", "Ecoscenarios"**,** *The Mono Lake Story*

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

***FOSS Populations and Ecosystems***
**IG:** 492, 498, 504, 505, 506, 507, 508, 514, 515, 516, 518, 523, 531, 532, 533, 534, 535, 540, 543
**TR:** pp. D10, D14-D15, D26-D31

GRADE 7-MS-LS2-2

# Ecosystems: Interactions, Energy, and Dynamics

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS2-2

*Students who demonstrate understanding can:*
**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.]*

***FOSS Populations and Ecosystems***
**IG:** pp. 55, 61, 67
**EA:** *Notebook Entry*, IG p. 257 (Step 12), IG p. 541 (Step 16)
**EA:** *Performance Assessment*, IG p. 278 (Step 6), IG pp. 441-442 (Step 24)
**EA:** *Response Sheet*, IG p. 459, Student Notebook Master No. 23
**EA:** *Review Notebook Entries*, IG p. 280 (Step 12), IG p. 477 (Step 12)
**BM:** *Assessment Coding Guide,* pp. 18-19 (Item 1), pp. 20-21 (Items 2-4), pp. 22-23 (Item 5), pp. 32-33 (Item 1), pp. 36-37 (Item 3), pp. 38-39 (Item 6), pp. 40-41 (Item 1), pp. 42-43 (Item 2), pp. 46-47 (Item 5), pp. 48-49 (Item 6), pp. 54-55 (Item 5), pp. 60-61 (Item 2), pp. 62-63 (Item 3), pp. 66-67 (Item 8), pp. 70-71 (Item 13), pp. 74-75 (Item 15)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 407, 417, 443, 458, 459, 534, 535, 540, 541,542, 543, 589
**TR:** pp. C28-C32, C64-C73

## 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)

***FOSS Populations and Ecosystems***
***IG:*** *pp. 242, 262 (Step 2-6), 319, 416, 442 (Step 28) 443 (Step 29-30), 459 (Steps 19-20) 540, 541, 543, 589 (Step 10)*
***SRB:*** *pp.76, 97-99*
***DOR:*** *The Mono Lake Story, "Mono Lake Food Web", Hawaii: Strangers in Paradise*

## Crosscutting Concepts

**Patterns**

- Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

***FOSS Populations and Ecosystems***
**IG:** pp.244, 265, 266, 277, 280, 418, 440, 443, 452, 469, 532, 533, 560
**TR:** pp. D14, D26-27

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-LS2-3

# Ecosystems: Interactions, Energy, and Dynamics

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS2-3

*Students who demonstrate understanding can:*
**Develop a model to describe the cycling of matter and flow of 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.]*

***FOSS Populations and Ecosystems***
**IG:** pp. 55, 61, 67
**EA:** *Notebook Entry*, IG p. 257 (Step 12), IG p. 318 (Step 11), IG p. 474 (Steps 7-8*)*
**EA:** *Performance Assessment***,** IG p. 278 (Step 6)**,** IG pp. 441-442 (Step 24)
**EA:** *Response Sheet*, IG p. 270, Student Notebook Master No. 8, IG p. 459, Student Notebook Master No. 23
**EA:** *Review Notebook Entries***,** IG p. 280 (Step 12)**,** IG p. 477 (Step 12)
**BM:** *Assessment Coding Guide*, pp. 18-19 (Item 1), pp. 20-21 (Item 2), pp. 24-25 (Item 1), pp. 26-27 (Item 4), pp. 30-31 (Item 7), pp. 32-33 (Item 1), pp. 34-35 (Item 2), pp. 36-37 (Items 3-5), pp. 38-39 (Item 6), pp. 60-61 (Item 2), pp. 62-63 (Item 3), pp. 68-69 (Item 9), pp. 72-73 (Item 14), pp. 74-75 (Item 15)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 265, 266, 269, 270, 278, 280, 318, 321, 334, 397, 398, 400, 401, 404, 438, 439, 442, 443, 453, 455, 456, 458, 459, 469, 477
**TR:** pp. C14-C17, C44-C51

## 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)

***FOSS Populations and Ecosystems***
***IG:** pp.229, 266-267 (Steps 8-12), 280, 318 (Step 12), 321 (Step 22), 407, 416, 442 (Step 28), 443-444 (Steps 30-31), 451-454 (Steps 1-7), 474 (Step 6), 475 (Steps 8-9), 477 (Steps 12-13*
***SRB:** pp. 35-40, 70-74, 75-82, 83-86*
***SNM:** No. 8*
***DOR:** The Mono Lake Story*
*"Mono Lake Food Web"*

## Crosscutting Concepts

**Energy and Matter**

- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

***FOSS Populations and Ecosystems***
**IG:** pp. 265, 267, 269, 278, 424, 427, 429, 435, 442, 451, 452, 453,458, 460, 469, 473, 474, 475, 477
**TR:** pp. D12-D13, D17, D38-D43

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

## Connections to Nature of Science

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

***FOSS Populations and Ecosystems***

**IG:** pp.244, 269, 281, 418, 443-444 (Steps 30-31), 469 (Step 25)

GRADE 7-MS-LS2-4

# Ecosystems: Interactions, Energy, and Dynamics

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS2-4

*Students who demonstrate understanding can:*
**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.]*

***FOSS Populations and Ecosystems***
**IG:** pp. 55, 63, 67, 69, 71, 73
**EA:** *Notebook Entry*, IG p. 596 (Step 9)
**EA:** *Performance Assessment*, IG p. 589 (Step 10)
**EA:** *Review Notebook Entries*, IG p. 334 (Step 17), IG p. 477 (Step 12), IG p. 543 (Step 20), IG p. 604 (Step 14)
**BM:** *Assessment Coding Guide,* pp. 32-33 (Item 1bc), pp. 46-47 (Item 5ab), pp. 48-49 (Item 6), pp. 52-53 (Items 2-4), pp. 54-55 (Items 5 and 6), pp. 56-57 (Item 7), pp. 62-63 (Item 3c), pp. 66-67 (Item 8), pp. 68-69 (Item 11)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 589, 604, 635, 636, 637, 642, 648
**TR:** pp. C33-C38, C72-C73

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 481, 532-533, 540, 541, 543, 547, 557-558, 561, 586, 587 (Step 4), 594-596 (Steps 3-9), 607, 614, 644-646
**SRB:** pp. 100-107, 118-119
**SNM:** No. 44
**DOR:** *The Mono Lake Story, Hawaii: Strangers in Paradise*

## Crosscutting Concepts

**Stability and Change**

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4)

***FOSS Populations and Ecosystems***
**IG:** pp. 534, 535, 540, 541, 542, 543, 571, 586, 588, 589, 598, 635, 636, 637
**TR:** pp. D19, D44-D45

## Connections to Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)

***FOSS Populations and Ecosystems***
**IG:** pp. 566-571 (Steps 2-17)

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-LS2-5

# Ecosystems: Interactions, Energy, and Dynamics

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS2-5

*Students who demonstrate understanding can:*
**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.]*

***FOSS Populations and Ecosystems***
**IG:** 55, 71, 73
**EA:** *Notebook Entry*, IG p. 582 (Step 22), IG p. 596 (Step 9)
**EA:** *Performance Assessment*, IG p. 627 (Step 10), IG p. 642 (Step 4)
**EA:** *Review Notebook Entries*, IG p. 604 (Step 14)
**BM:** *Assessment Coding Guide,* pp. 50-51(Item 1ab), pp. 52- 53 (Item 3), pp. 54-55 (Item 6), pp. 64-65 (Items 4 and 5), pp. 66-67 (Item 8)

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 607, 615, 635, 636, 637, 642, 648
**TR:** pp. C33-C38, C72-C73

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 547, 557, 570 (Step 14), 571-572 (Steps 16-17), 581(I), 582 (Steps 21-22),
**SRB:** pp. 100-101
**SNM:** Nos. 42, 43
**DOR:** *Hawaii: Strangers in Paradise*

**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)

***FOSS Populations and Ecosystems***
***IG:** pp. 557-558, 594-595, 596 (Step 9), 604, 607, 614, 623 (Step 2), 624, 642*
***SRB:** pp.102-105, 118-122*
***SNM:** Nos. 6, 20*

**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)

***FOSS Populations and Ecosystems***

## Crosscutting Concepts

**Stability and Change**

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-5)

***FOSS Populations and Ecosystems***
**IG:** pp. 560, 571, 588, 589, 595, 598, 604, 616, 635, 636, 637, 642, 648
**TR:** pp. D19, D44-D45

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | **IG**: pp. 614, 633, 642, 644-646<br>**SRB:** pp.106-107, 115-117, 119-122<br>**SNM:** Nos. 45, 46, 48<br>**DOR:** *The Mono Lake Story* | |

## Connections to Engineering, Technology, and Applications of Science

**Influence of Science, 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 644-646
**SRB:** pp.106-107, 118, 120-122

## 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)

***FOSS Populations and Ecosystems***
**IG:** pp. 616, 644-646
**SRB:** pp. 106-107, 108-117, 118, 120-122

GRADE 7-MS-ESS2-1

# Earth's Systems

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS2-1

*Students who demonstrate understanding can:*
**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.]*

***FOSS Earth History***
**IG:** 55, 59, 61, 65, 67, 69
**EA:** *Notebook Entry*, IG p. 226 (Step 26), IG p. 266 (Step 13), IG p. 451 (Step 9), IG p. 492 (Step 38)
**EA:** *Response Sheet***,** IG p. 238, Student Notebook Master No. 20
**EA:** *Performance Assessment***,** IG p. 279 (Step 9)**,** IG p. 416 (Step 3)**,** IG p. 431 (Step 11)**,** IG p. 579 (Step 19)
**EA:** *Review Notebook Entries***,** IG p. 239 (Step 21)**,** IG p. 302 (Step 20)**,** IG p. 453 (Step 15)**,** IG p. 517 (Step 21)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 3), pp. 30-31 (Items 1 and 3), pp. 34-35 (Item 6), pp. 36-37 (Item 9), pp. 44-45 (Item 5), pp. 48-49 (Item 3ab)

## 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 and use a model to describe phenomena. (MS-ESS2-1)

***FOSS Earth History***
**IG:** pp. 191, 192, 196, 197, 198, 209, 239, 263, 276, 295, 298, 302, 429, 435, 453, 547, 548, 551, 554, 653
**TR:** pp. C14-C17, C44-C51

## 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)

***FOSS Earth History***
***IG:*** *pp. 179, 194 (Steps 10-11), 201 (Step 25), 209 (Step 4), 215 (Steps 16-17), 237 (Step 17), 239, 245, 254, 266-267 (Steps 13-16), 269, 281, 302, 395, 407, 420, 428, 431, 433 (Step 18), 453, 504, 578, 582-584, 592*
***SRB:*** *pp. 20-26, 36, 88-92*
***DOR:*** *Earth's Interior, Convection Tank, Animations: Sandstone Formation, Shale Formation, Limestone Formation*

## 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)

***FOSS Earth History***
**IG:** pp.472, 492, 504, 517, 536, 550, 552, 553, 555, 566, 567, 592
**TR:** pp. D19, D44-D45

GRADE 7-MS-ESS2-2

# Earth's Systems

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS2-2

*Students who demonstrate understanding can:*
**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.]*

***FOSS Earth History***
**IG:** pp. 55, 57, 59, 61, 65, 67, 69
**DOR:** "Geoscenarios"
**EA:** *Notebook Entry,* IG pp. 195-196 (Step 14), IG p. 226 (Step 26), IG p. 266 (Step 13), IG p. 297 (Step 10), IG p. 494 (Step 15),IG p. 554 (Step 22), IG p. 564 (Step 27), IG pp. 656-657 (Step 15)
**EA:** *Performance Assessment*, IG p. 279 (Step 9)
**EA:** *Review Notebook Entries*, IG p. 162 (Step 18), IG p. 239 (Step 21), IG p. 302 (Step 20), IG p. 453 (Step 15), IG p. 517 (Step 21), IG p. 592 (Step 38)
**BM:** *Assessment Coding Guide,* pp. 12-13 (Items 1 and 2), pp. 18-19 (Item 7ab), pp. 22-23 (Item 2ab), pp. 28-29 (Item 8ab), pp. 30-31 (Item 2), pp. 38-39 (Item 1ab), pp. 46-47 (Item 1ab), pp. 50-51 (Item 4abc), pp. 56-57 (Item 8), pp. 58-59 (Item 10ab)

## 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)

***FOSS Earth History***
**IG:** pp. 196, 199, 225, 237, 239, 266, 277, 280, 298, 430, 434, 471, 492, 494, 505, 517, 548, 552, 554, 577, 578, 582, 584, 652, 653, 654, 661
**TR:** pp. C28-C32, C64-C73

## 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)

***FOSS Earth History***
***IG:*** *pp. 179, 245, 299, 302,493 (Step 11), 521, 523, 534, 565 (Steps 30-31)*
***SRB:*** *pp. 36-39, 81-87*
***DOR:*** *"Rock Column Movie Maker", Mountain Types Slideshow, Folding, Fault Type: Convergent Boundary, Divergent Boundary, Transform Boundary*

**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)

***FOSS Earth History***
***IG:*** *pp.165, 183, 196 (Step 15), 201 (Step 25), 211, 215, 302, 657*
***SRB:*** *pp. 20-26*
***SNM:*** *Nos. 1, 10, 11, 12*
***DOR:*** *Glen Canyon Dam High Flow Experiment*
*Grand Canyon Flyover*

## 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)

***FOSS Earth History***
**IG:** pp. 182,191,209, 239, 256, 264, 296, 302, 409, 428, 472, 480, 645, 657
**TR:** pp. D15-D16, D32-D35

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-ESS2-3

# Earth's Systems

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS2-3

*Students who demonstrate understanding can:*
**Analyze and interpret data on the distribution of FOSSils and rocks, continental shapes, and seafloor structures to provide evidence 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.]*

***FOSS Earth History***
**IG:** pp. 55, 65, 67, 69
**EA:** *Notebook Entry,* IG p. 493 (Step 10) Student Notebook Master No. 32**,** IG p. 516 (Step 20)**,** IG p. 554 (Step 22)**,** IG p. 656 (Step 15)
**EA:** *Review Notebook Entries***,** IG p. 517 (Step 21)**,** IG p. 592 (Step 38)
**BM:** *Assessment Coding Guide,* pp. 34-35 (Items 5 and 7), pp. 36-37 (Item 8), pp. 38-39 (Item 1ab), pp. 42-43 (Item 3abc), pp. 44-45 (Item 4ab), pp. 46-47 (Item 2), pp. 54-55 (Item 7), pp. 56-57 (Item 9)

## 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)

***FOSS Earth History***
**IG:** 471, 480, 481, 482, 486, 491, 517, 535, 574, 579, 580, 592
**TR:** pp. C22-C24, C56-C61

## 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)

***FOSS Earth History***
***IG:*** *pp. 505-507, 517, 526, 550 (Step 13), 551, 552 (Step 16),*
***SRB:*** *pp. 77-78, 84*
***SNM:*** *No. 40*

**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)

***FOSS Earth History***
***IG:*** *pp. 305, 455, 470, 491, 492, 493, 507, 517 (Step 21 and 22), 547 (Step 5 w/SNM No. 41), 554 (Step 21), 566, 592 (Step 39)*
***SRB:*** *pp.46-49, 74-79, 83, 85-86*
***SNM:*** *No. 32*
***DOR:*** *NOAA Plate Tectonics***,** *Folding*
*Fault Type:*
*Convergent Boundary*
*Divergent Boundary*
*Transform Boundary*

## Crosscutting Concepts

**Patterns**

- Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. (MS-ESS2-3)

***FOSS Earth History***
**IG:** pp. 472, 481, 482, 483, 486, 487, 491, 494, 517, 536, 578, 580, 592, 645, 652
**TR:** pp. D14, D26-D27

## Connections to Nature of Science

**Scientific Knowledge is Open to Revision in Light of New Evidence**

- Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)

***FOSS Earth History***
**IG:** pp. 491, 493, 495 (Step 17), 501 (Step 2), 502 (Step 4)
**SRB:** p. 80

GRADE 7-MS-ESS3-1

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS3-1

*Students who demonstrate understanding can:*
**Construct a scientific explanation based on evidence for 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).]*

***FOSS Earth History***
**IG:** pp. 55, 65, 69
**EA:** *Notebook Entry*, IG p. 623 (Step 10), IG p. 625 (Step 16)
**EA:** *Performance Assessment*, IG: p. 630 (Steps 4 and 5)
**EA:** *Review Notebook Entries*, IG p. 517 (Step 21), IG p. 633 (Steps 10-11)
**BM:** *Assessment Coding Guide*, pp. 8-9 (Item 5)

## 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)

***FOSS Earth History***
**IG:** pp. 471, 492, 494, 505, 517, 605, 623, 625, 633
**TR:** pp. C28-C32, C64-C73

## 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)

***FOSS Earth History***
**IG:** pp. 494 (TM), 597, 601, 603, 604, 607, 631, 633
**SRB:** pp. 99-114
**DOR:** *"Geoscenarios", "Timeliner"*

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)

***FOSS Earth History***
**IG:** pp.472, 486, 517, 606, 623, 625, 630, 633
**TR:** pp. D10, D14-D15, D26-D31

## Connections to Engineering, Technology, and Applications of Science

**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-ESS3-1)

***FOSS Earth History***
**IG:** pp. 494, 606, 631
**SRB:** pp. 119-124

GRADE 7-MS-ESS3-2

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS3-2

*Students who demonstrate understanding can:*
**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).]*

***FOSS Earth History***
**IG:** pp. 55, 65, 69
**EA:** *Notebook Entry*, IG p. 494 (Step 15), IG p. 516 (Step 20)
**EA:** *Performance Assessment*, IG p. 481 (Step 8)
**EA:** *Review Notebook Entries*, IG p. 517 (Step 21), IG p. 633 (Steps 10-11)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 4), pp. 30-31 (Item 2), pp. 46-47 (Item 1ab)

## 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)

***FOSS Earth History***
**IG:** pp. 471, 480, 481, 482, 486, 485, 517
**TR:** pp. C22-C24, C56-C61

## 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)

***FOSS Earth History***
**IG:** pp. 470, 479-482, 485, 486-487 (Step 26) 491-494, 517, 550 (Step 12), 565
**SRB:** p. 74
**DOR:** *"Volcano-Plotting Activity"*
*"Volcanoes Around the World"*
*"Earthquake-Plotting Activity"*
*"Earthquakes around the World"*
*Mount St. Helens: The Eruption Impact*
*ShakeAlert*

## Crosscutting Concepts

**Patterns**
- Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

***FOSS Earth History***
**IG:** pp. 472, 481, 482, 483, 485 (Step 24); 486 (Step 25), 487 (Step 30), 491, 494, 517
**TR:** pp. D14, D26-D27

## Connections to Engineering, Technology, and Applications of Science

**Influence of Science, 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)

***FOSS Earth History***
**IG:** p. 486 (Step 26)
**SRB:** pp.119-124
**DOR:** *Shake Alert*

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-PS1-1

# Matter and its Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS1-1

*Students who demonstrate understanding can:*
**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.]*

***FOSS Chemical Interactions***
**IG:** pp. 59, 77
**EA:** *Notebook Entry,* IG p. 574 (Step 20)**,** Student Notebook Masters Nos. 67-68
**EA:** *Performance Assessment***,** IG p. 588 (Step 13)
**EA:** *Review Notebook Entries***,** IG p. 620 (Step 20)
**BM:** *Assessment Coding Guide,* pp. 52-53 (Item 4)**,** pp. 54-55 (Items 6 and 7)**,** pp. 64-65 (Item 6)**,** pp. 66-67 (Items 8a and 9)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 551, 558, 559, 560, 562, 563, 574, 587, 620
**TR:** pp. C14-C17, C44-C51

## 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)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)

***FOSS Chemical Interactions***
**IG:** pp. 541, 543, 550, 553, 558-561, 563 (Step 11), 564 (Step15), 620
**SRB:** pp. 24-27, 110-117, 180-181

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 552, 589, 614, 617, 620
**TR:** pp. D15-D16, D32-D35

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-PS1-2

# Matter and its Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS1-2

*Students who demonstrate understanding can:*
**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.]*

***FOSS Chemical Interactions***
**IG:** pp. 59, 61, 63, 65, 73, 77, 79
**EA:** *Notebook Entry*, IG p. 147 (Step 33), IG p. 439 (Step 17), IG p. 464 (Step 19)
**EA:** *Performance Assessment***,** IG pp. 139-140 (Step 13)**,** IG p. 588 (Step 13)**,** IG p. 447 (Step 4)
**EA:** *Response Sheet***,** IG p. 619, Student Notebook Master No. 17
**EA:** *Review Notebook Entries***,** IG p. 147 (Step 33)**,** IG p. 198 (Step 16), IG p. 255 (Step 10)**,** IG p. 464 (Steps 19)**,** IG p. 620 (Steps 20)
**BM:** *Assessment Coding Guide,* pp. 12-13 (Item 4), pp. 16-17 (Item 7), pp. 22-23 (Items 4 and 5), pp. 44-45 (Item 3), pp. 48-49 (Item 7), pp. 50-51 (Item 1), pp. 56-57 (Item 8), pp. 58-59 (Item 1), pp. 60-61 (Item 3), pp. 68-69 (Item 10)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 107, 115, 126 140, 147, 447, 451, 464, 487, 551, 584, 586, 616, 618
**TR:** pp. C22-C24, C56-C61

## 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)

***FOSS Chemical Interactions***
**IG:** pp.107, 109,117, 137 (Step 6), 140-141(Step 15), 146,147 (Step 33), 467, 448 (Step 5), 487 (Step 10), 497 (Step 14)
**SRB:** pp. 98-99, 132, 165-173
**SNM:** Nos. 2-6
**DOR:** "Explore Dissolving"
"Two-Substance Reactions"

**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)

***FOSS Chemical Interactions***
**IG:** pp. 541, 550
586 (Step 7), 587 (Step 12), 588-589 (Steps 14-16), 613-614 (Step 6), 617 (Step 12), 618 (Step 16), 620
**SRB:** pp. 118-129, 146
**SNM:** Nos. 69-71
**DOR:** "Two-Substance Reactions"

## Crosscutting Concepts

**Patterns**

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

***FOSS Chemical Interactions***
**IG:** pp. 107, 116,137, 140, 141, 142, 147, 164, 171, 172, 428, 447 (Step 4), 480
**TR:** pp. D14, D26-D27

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

## Connections to Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)

***FOSS Chemical Interactions***

**IG:** pp. 137 (Step 9) 140-142 (Steps 15-18), 145 (Step 28), 586-587 (Steps 7-9), 618 (Step 16)
**SRB:** pp. 134-140, 148-154, 155-160

GRADE 7-MS-PS1-3

# Matter and its Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS1-3

*Students who demonstrate understanding can:*
**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.]*

***FOSS Chemical Interactions***
**IG:** pp. 59, 61, 63, 65, 73, 77, 79
**EA:** *Think Question*, IG p. 573 (K)
**EA:** *Review Notebook Entries***,** IG p. 147 (Step 33)**,** IG p. 198 (Step 16)**,** IG p. 255 (Step 10)**,** IG p. 464 (Step 19)**,** IG p. 620 (Step 20)
**BM:** *Assessment Coding Guide,* pp. 14-15 (Item 6), pp. 52-52 (Item 5)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 163, 170, 172, 174, 183, 193,194, 605
**TR:** pp. C39-C41, C74-C77

## 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)

***FOSS Chemical Interactions***
**IG:** pp.107, 109,117, 137 (Step 6), 140-141(Step 15), 146,147 (Step 33), 467, 448 (Step 5), 487 (Step 10), 497 (Step 14)
**SRB:** pp. 3-5, 98-99, 132, 165-173
**DOR:** "Explore Dissolving"
"Two-Substance Reactions"

**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)

***FOSS Chemical Interactions***
**IG:** pp. 541, 550
586 (Step 7), 587 (Step 12), 588-589 (Steps 14-16), 613-614 (Step 6), 617 (Step 12), 618 (Step 16), 620
**SRB:** pp. 118-129, 146
**DOR:** "Two-Substance Reactions"

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 164, 194, 552, 561, 565
**TR:** pp. D18, D44-D45

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

## 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)

***FOSS Chemical Interactions***
**IG:** p. 597 (H)
**SRB:** pp. 110-117, 134-140, 148-154

**Influence of Science, 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)

***FOSS Chemical Interactions***
**IG:** pp. 193, 552
**SRB:** pp. 110-115, 148-154, 155-160

GRADE 7-MS-PS1-4

# Matter and its Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS1-4

*Students who demonstrate understanding can:*
**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.]*

***FOSS Chemical Interactions***
**IG:** pp. 59, 65, 67, 69, 73, 75
**EA:** *Notebook Entry*, IG p. 254 (Step 9), IG p. 312 (Step 11), IG p. 338 (Step 13), IG p. 536 (Step 14)
**EA:** *Performance Assessment*, IG p. 276 (Step 7), IG p. 367 (Step 8), IG p. 487 (Step 8)
**EA:** *Response Sheet*, IG p. 302, Student Notebook Master No. 26, IG p. 358, Student Notebook Master No. 38, IG p. 511, Student Notebook Master No. 63
**EA:** *Review Notebook Entries*, IG p. 255 (Step 10), IG p. 311 (Step 9), IG p. 370 (Step 15), IG. 464 (Step 19), IG. 537 (Step 15)
**BM:** *Assessment Coding Guide*, pp. 24-25 (Item 6), pp. 26-27 (Item 1), pp. 28-29 (Items 2 and 3), pp. 30-31 (Items 4 and 5), pp. 32-33 (Item 6), pp. 36-37 (Item 4), pp. 38-39 (Item 6), pp. 40-41 (Item 8), pp. 42-43 (Item 1), pp. 44-45 (Items 2 and 4), pp. 46-47 (Items 5 and 6), pp. 48-49 (Item 8), pp. 58-59 (Item 2), pp. 60-61 (Item 3), pp. 62-63 (Item 4), pp. 64-65 (Items 6 and 7), pp. 68-69 (Item 11)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 232, 233, 235, 241 (D), 246, 247, 255, 276, 279, 292, 302, 309, 311, 337, 339 (Step 15), 343, 344, 346, 368, 370, 488, 489, 497, 532, 533, 535
**TR:** pp. C14-C17, C44-C51

## 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)
- 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)
- 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)

***FOSS Chemical Interactions***
**IG:** pp. 201, 210, 233 (Step 12), 236 (Step 17), 245-247 (Steps 1-4), 255, 259, 266, 274 (Step 1), 279-280 (Step 12), 289-290 (Step 9), 291 (Step 11), 467, 478, 488-489 (Step 11), 497, 533 (Step 6), 534 (Step 10), 537
**SRB:** pp. 28-32, 33-39, 89-100
**SNM:** Nos. 17, 18, 50, 63
**DOR:** "Gas in a Syringe"
"Energy Transfer by Collision"
"Mixing Hot and Cold Water"
*Hoar Frost*
"Particles in Solids, Liquids, and Gases"
"Thermometer"

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

***FOSS Chemical Interactions***
**IG:** pp. 276, 279, 289, 290, 291, 302, 308, 311, 437, 447, 487, 497,498, 511, 525, 527, 535, 537
**TR:** pp. D10, D14-D15, D26-D31

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | **PS3.A: Definitions of Energy**<br>• 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)<br>• 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)<br><br>***FOSS Chemical Interactions***<br>**IG:** pp. 266, 279, (Step 12), 289 (Step 9), 311, 315, 326, 343-346 (Steps 4-11), 364 (Step 3), 365-366 (Step 5), 367 (Step 10), 368-369 (Step 12), 370<br>**SRB:** pp. 35-39, 46-55<br>**DOR:** "Energy Transfer by Collision"<br>"Gas in a Syringe"<br>"Energy Flow"<br>"Mixing Hot and Cold Water"<br>*Hoar Frost*<br>"Particles in Solids, Liquids, and Gases"<br>"Thermometer" | |

GRADE 7-MS-PS1-5

# Matter and its Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS1-5

*Students who demonstrate understanding can:*
**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.]*

***FOSS Chemical Interactions***
**IG:** pp. 59, 61, 65, 79
**EA:** *Notebook Entry*, IG p. 574 (Step 20), IG p. 648 (Step 15), Student Notebook Master No. 72
**EA:** *Performance Assessment*, **IG:** p. 588 (Step 13)
**EA:** *Response Sheet*, IG p. 619, Student Notebook Master No. 71
**EA:** *Review Notebook Entries*, IG p. 147 (Step 33), IG p. 255 (Step 10)
**BM:** *Assessment Coding Guide,* pp. 50-51 (Items 1- 3), pp. 56-57 (Item 9), pp. 63-63 (Item 5), pp. 66-67 (Item 8)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 551, 559, 587, 588, 589, 590, 613, 620, 635, 645, 646, 653
**TR:** pp. C14-C17, C44-C51

## 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)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)

***FOSS Chemical Interactions***
**IG:** pp. 541, 585-586 (Steps 5-7), 618-619 (Step 16), 620, 634, 637, 646-647 (Steps 11-12), 648
**SRB:** pp.118-129
**SNM:** Nos. 69-71

## Crosscutting Concepts

**Energy and Matter**
- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

***FOSS Chemical Interactions***
**IG:** pp. 552, 583, 584, 585, 586, 587, 588, 589, 590, 613, 616, 617, 618, 620, 636, 647, 648, 654
**TR:** pp. D12-D13, D17, D38-D43

## Connections to Science

**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena**
- Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)

***FOSS Chemical Interactions***
**IG:** pp. 552, 553, 603 (Q), 619 (Step 16), 620, 655
**SRB:** p. 138

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-PS1-6

# Matter and its Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS1-6

*Students who demonstrate understanding can:*
**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.]*

***FOSS Chemical Interactions***
**IG**: pp. 59, 75
**EA:** *Performance Assessment***,** IG p. 525 (Step 18)
**EA:** *Review Notebook Entries***,** IG p. 537 (Step 15)
**BM:** *Assessment Coding Guide*, pp. 48-49 (Item 7)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 467, 478, 479, 523 (Step 13), 524, 525, 527
**SRB:** pp.183-184
**TR:** pp. C28-C32, C64-C73

## Disciplinary Core Ideas

**PS1.B: Chemical Reactions**

- Some chemical reactions release energy, others store energy. (MS-PS1-6)

***FOSS Chemical Interactions Module***
***IG:** pp. 467, 474-475, 478, 521, 523 (Steps 12-13), 524 (Step 15)*
***SRB:** p. 131*
***SNM:** No. 64*

**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)

***FOSS Chemical Interactions***
***IG:** pp. 478, 524-527 (Steps 15-26)*
***SRB:** pp.183-184*
***SNM:** no. 65*

**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)
- 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)

***FOSS Chemical Interactions Module***
***IG:** pp. 478, 524-527 (Steps 15-26)*
***SRB:** pp.183-184*
***SNM:** No. 65*

## Crosscutting Concepts

**Energy and Matter**

- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

***FOSS Chemical Interactions***
**IG:** pp. 480, 527, 531, 532, 534, 535, 537
**DOR:** “Energy Flow”
**TR:** pp. D12-D13, D17, D38-D43

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-ETS1-1

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-1

*Students who demonstrate understanding can:*
**Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

***FOSS Chemical Interactions***
**IG:** p. 71
**EA:** *Performance Assessment*, IG p. 400 (Step 6)

***FOSS Populations and Ecosystems***
**IG:** p. 73
**EA:** *Performance Assessment***,** IG p. 642 (Step 4)
**EA:** *Review Notebook Entries***,** IG p. 413 (Step 17)

## 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, clarify 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)

***FOSS Chemical Interactions***
**IG:** pp. 378, 381,389, 401, 413
**SRB:** pp.183-184

***FOSS Populations and Ecosystems***
**IG:** pp. 615, 627, 642, 644-646, 648
**TR:** pp. C9-C13, C42-C43

## Disciplinary Core Ideas

**ETS1.A: Defining and Delimiting Engineering Problems**

- 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)

***FOSS Chemical Interactions***
**IG:** pp.373, 375, 378, 380, 383, 390 (Step 7 and 9), 398, 399 (Step 3), 400 (Step 5), 401 (Step 9), 524 (Step 15),
**SRB:** pp. 56-58
**SNM:** Nos. 45-46

***FOSS Populations and Ecosystems***
**IG:** 627 (Step 9), 633

## Crosscutting Concepts

**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)
- 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)

***FOSS Chemical Interactions***
**IG:** pp. 401 (Step 9-10), 411 (K)
**SRB:** pp. 60-63

***FOSS Populations and Ecosystems***
**IG:** pp. 607, 610-613, 616, 623, 624, 642 (Step 4)
**DOR:** **"**Ecoscenarios and Ecoscenario Research Center"

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-ETS1-2

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-2

*Students who demonstrate understanding can:*
***Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.***

***FOSS Chemical Interactions***
**IG:** pp. 71, 75
**EA:** *Notebook Entry*, IG p. 393 (Step 19)
**EA:** *Performance Assessment*, IG p. 400 (Step 6), IG p. 525 (Step 18)
**EA:** *Review Notebook Entries*, IG p. 537 (Steps 15)

***FOSS Populations and Ecosystems***
**IG**: p. 73
**EA:** *Notebook Entry*, IG 643 (Step 5)
**EA:** *Performance Assessment*, IG p. 627 (Step 10), IG p. 636 (Step 11), IG pp. 642-643 (Step 4)
**EA:** *Review Notebook Entries*, IG p. 604 (Step 14)

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|
| **Engaging in Argument from Evidence**<br>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.<br>• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)<br><br>***FOSS Chemical Interactions***<br>**IG:** pp. 381, 392, 479, 525, 527 (Step 30)<br>**SRB:** pp. 182-184<br><br>***FOSS Populations and Ecosystems***<br>**IG:** pp. 607, 615, 635, 636, 637, 642, 648<br>**TR:** pp. C33-C38, C72-C73 | **ETS1.B: Developing Possible Solutions**<br>• There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2)<br><br>***FOSS Chemical Interactions***<br>**IG:** pp. 377-379, 380, 390-392 (Steps 9-15), 401 (Steps 8-9), 412 (Step 16), 525 (Step 18), 526 (Step 23),<br>**SRB:** pp. 58, 61<br>**SNM:** Nos. 45-46<br><br>***FOSS Populations and Ecosystems***<br>**IG:** pp. 625, (Step 5), 636, 642-643 (Step 4), 646, 649 | |

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-ETS1-3

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-3

*Students who demonstrate understanding can:*
***Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.***

***FOSS Chemical Interactions***
**IG:** pp. 71, 75
**EA:** *Performance Assessment*, IG p. 400 (Step 6), IG p. 525 (Step 18)
**EA:** *Review Notebook Entries*, IG p. 413 (Step 17), IG p. 537 (Step 15)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 373, 381, 392, 400, 401, 413, 479, 523, 524, 525, 527
**SRB:** p. 183
**TR:** pp. C22-C24, C56-C61

## 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)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)

***FOSS Chemical Interactions***
**IG:** pp. 375, 379, 380, 401-402 (Steps 8-12), 411 (K), 412 (Step 16), 524 (Step 16), 525-526 (Steps 20, 23-24), 527 (Steps 25-26, 30)
**SRB:** p. 184
**SNM:** Nos. 45-46, 65

**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)

***FOSS Chemical Interactions***
**IG:** pp. 375, 379, 380, 401-402 (Steps 8-12), 411 (K), 412 (Step 16), 524 (Step 16), 525-526 (Steps 20, 23-24), 527 (Steps 25-26, 30)
**SRB:** p. 184
**SNM:** Nos. 45-46, 65

## Crosscutting Concepts

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 7-MS-ETS1-4

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-4

*Students who demonstrate understanding can:*
***Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.***

***FOSS Chemical Interactions***
**IG:** pp. 71, 75
**EA:** *Performance Assessment*, IG p. 400 (Step 6), IG p. 525 (Step 18)
**EA:** *Review Notebook Entries***,** IG p. 413 (Step 17)

## 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)

***FOSS Chemical Interactions***
**IG:** pp. 381, 383, 400, 413
**SRB:** p. 183
**TR:** pp. C14-C17, C44-C51

## 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)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

***FOSS Chemical Interactions***
**IG:** pp. 375, 379, 380, 401-402 (Steps 8-12), 411 (K), 412 (Step 16), 524 (Step 16), 525-526 (Steps 20, 23-24), 527 (Steps 25-26, 30)
**SRB:** p. 184
**SNM:** Nos. 45-46, 65

**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)

***FOSS Chemical Interactions***
**IG:** pp. 375, 379, 380, 401-402 (Steps 8-12), 411 (K), 412 (Step 16), 524 (Step 16), 525-526 (Steps 20, 23-24), 527 (Steps 25-26, 30)
**SRB:** p. 184
**SNM:** Nos. 45-46, 65

## Crosscutting Concepts

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-LS3-1

# Heredity: Inheritance and Variation of Traits

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS3-1

*Students who demonstrate understanding can:*
**Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.**
*[Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.]*
*[Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 51, 53
**EA:** *Notebook Entry,* IG p. 272 (Step 17), IG p. 293 (Step 13)
**EA:** *Response Sheet,* IG p. 293, Student Notebook Master No. 19**,** IG p. 207, Student Notebook Master No. 9
**EA:** *Review Notebook Entries***,** IG pp. 229 (Step 19)
**BM:** *Assessment Coding Guide*, pp. 4-5 (Item 3), pp.16-17 (Item 1), pp. 24-25 (Item 1), pp. 26-27 (Item 3), pp. 28-29 (Item 6), pp. 36-37 (Item 5), pp. 42-43 (Item 9)

## 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 and use a model to describe phenomena. (MS-LS3-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 203, 245, 254
**SRB:** pp. 26-27
**TR:** pp. C14-C17, C46-C51

## Disciplinary Core Ideas

**LS3.A: Inheritance of Traits**

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 150, 153, 181, 186-189, 190, 196, 197, 229, 280, 281, 294, 295
**SRB:** pp. 22-27
**DOR: "**Heredity Slideshow"

**LS3.B: Variation of Traits**

- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 244, 247, 251, 252, 253, 254
**SRB:** pp. 39, 49, 50, 51, 52
**SNM:** No. 12

## Crosscutting Concepts

**Structure and Function**

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function. (MS-LS3-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 196 (G), 265 (H), 269 (L)
**SRB:** pp. 26-27, 47, 49, 51
**TR:** pp. D18, D44-D47

GRADE 8-MS-LS4-1

# Biological Evolution: Unity and Diversity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS4-1

*Students who demonstrate understanding can:*
**Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.**
*[Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 49
**EA:** *Notebook Entry,* IG p. 107 (Step 19)
**EA:** *Performance Assessment,* IG p. 95 (Step 6)**,** IG p. 99 (Step 13)
**EA:** *Response Sheet,* IG p. 130**,** Student Notebook Master No.4
**EA:** *Review Notebook Entries***,** IG pp. 132-133 (Step 24)

## 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-LS4-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 73, 85, 94, 98, 103 (B), 116, 118, 123, 132
**SRB:** pp. 8-11, 73-77
**TR:** pp. C22-C24, C54-C59

## Disciplinary Core Ideas

**LS4.A: Evidence of Common Ancestry and Diversity**

- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 73, 75, 87, 93 (Step 3), 94 (Step 4), 95 (Steps 6-7), 96 (Step 10), 115 (Step 2), 132
**SRB:** pp. 2-10, 73-77
**SNM:** Nos. 1-2
**DOR:** *"Biodiveristy Slideshow"*
*"Fossil Slideshow"*
*Fish with Fingers*
*Great Transitions: The Origin of the Tetrapods*

## Crosscutting Concepts

**Patterns**

- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 86, 98, 118, 132
**SRB:** pp. 8-9, 73-77
**TR:** pp. D9, D13, D22-D27

## Connections to the Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 74, 85, 87, 128 (H)
**SRB:** pp. 14-16

## Connections to the Nature of Science

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1)

***FOSS Heredity and Adaptation***
**IG:** pp. 86, 98 (Step 11)
**SRB:** pp. 3-10

GRADE 8-MS-LS4-2

# Biological Evolution: Unity and Diversity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS4-2

*Students who demonstrate understanding can:*
**Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.**
*[Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 49, 51
**EA:** *Notebook Entry,* IG p. 175 (Step 28) Student Notebook Master No. 7
**EA:** *Performance Assessment,* IG p. 119 (Step 11)
**EA:** *Response Sheet,* IG p. 130**,** Student Notebook Master No. 4
**EA:** *Review Notebook Entries***,** IG pp. 132-133 (Step 24)**,** IG pp. 229 (Step 19)
**BM:** *Assessment Coding Guide*, pp. 8-9 (Item 7), pp. 12-13 (Item 4ab), pp. 14-15 (Item 7), pp. 20-21 (Item 4abc), pp. 30-31 (Item 9), pp. 34-35 (Item 2)

## 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.

- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)

***FOSS Heredity and Adaptation***
**IG:** pp. 85, 87, 117 (Step 8), 118, 119, 120, 131, 132
**SRB:** p. 15
**TR:** pp. C28-C31, C66-C71

## Disciplinary Core Ideas

**LS4.A: Evidence of Common Ancestry and Diversity**

- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)

***FOSS Heredity and Adaptation***
**IG:** pp. 84, 87, 119, 124 128, 129, 132, 167-169 (Steps 11-14), 175 (Step 27)
**SRB:** pp. 11-16, 78-81
**SNM:** Nos. 3-4
**DOR:** *Fish with Fingers*
*Great Transitions: The Origin of the Tetrapods*

## Crosscutting Concepts

**Patterns**

- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)

***FOSS Heredity and Adaptation***
**IG:** pp. 86, 98, 118, 120, 122, 123, 132, 152, 169, 175
**SRB:** pp. 17-21
**TR:** pp. D9, D13, D22-D27

## Connections to Nature of Science

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-2)

***FOSS Heredity and Adaptation***
**IG:** pp. 86, 152, 98 (Step 11), 169 (Step 14)
**SRB:** pp. 12-14, 20-21, 62-64

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-LS4-3

# Biological Evolution: Unity and Diversity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS4-3

*Students who demonstrate understanding can:*
**Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.**
*[Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 51
**EA:** *Notebook Entry,* IG p. 174 (Step 26)**,** IG p. 175 (Step 28)
**EA:** *Performance Assessment,* IG p. 173 (Step 22)
**EA:** *Review Notebook Entries***,** IG pp. 229 (Step 19)
**BM:** *Assessment Coding Guide,* pp. 22-23 (Item 5)**,** pp. 32-33 (Item 1)

## 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 displays of data to identify linear and nonlinear relationships. (MS-LS4-3)

***FOSS Heredity and Adaptation***
**IG:** pp. 151, 174 (Step 23), 175 (Step 28)
**SRB:** pp. 17-21
**TR:** pp. C22-C24, C54-C59

## Disciplinary Core Ideas

**LS4.A: Evidence of Common Ancestry and Diversity**

- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully formed anatomy. (MS-LS4-3)

***FOSS Heredity and Adaptation***
**IG:** pp. 150, 173 (Steps 21-22), 174 (Step 26)
**DOR:** *"Cladogram"*
**TM:** T

## Crosscutting Concepts

**Patterns**

- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-3)

***FOSS Heredity and Adaptation***
**IG:** pp. 174 (Step 23), 175 (Step 28)
**SRB:** pp. 17-21
**TR:** pp. D9, D13, D22-D27

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-LS4-4

# Biological Evolution: Unity and Diversity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS4-4

*Students who demonstrate understanding can:*
**Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.**
*[Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 53
**EA:** *Notebook Entry,* IG p. 217 (Step 12) Student Notebook Masters Nos. 10-11**,** IG p. 272 (Step 17)
**EA:** *Performance Assessment,* IG p. 207 (Step 9)
**EA:** *Response Sheet,* IG p. 207**,** Student Notebook Master No. 9, IG p. 293, Student Notebook Master No. 19
**BM:** *Assessment Coding Guide,* pp. 4-5 (Item 3), pp. 24-25 (Item 1), pp. 26-27 (Item 4), pp. 28-29 (Item 5), pp. 30-31 (Items 7-9)**,** pp. 36-37 (Item 6), pp. 38-39 (Item 7)

## 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 describe phenomena. (MS-LS4-4)

***FOSS Heredity and Adaptation***
**IG:** pp. 151, 207 (Step 9), 226 (H), 229, 233, 234, 286 (B), 294-296
**SRB:** pp. 28-31, 47-50, 60-68
**TR:** pp. C28-C31, C66-C71

## Disciplinary Core Ideas

**LS4.B: Natural Selection**

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

***FOSS Heredity and Adaptation***
**IG:** pp. 150, 203, 213 (Step 3), 217 (Step 13), 229, 233, 235, 251 (Step 2), 264 (G), 266 (I), 270 (M), 272 (Step 18), 278 (Step 1), 280 (Step 5), 292 (Step 13), 295
**SNM:** No. 17
**DOR:** ***"****A Model for Predicting Genetic Variation"*
*"Larkey Impossible Traits"*
*"Larkey Punnett Squares"*
*"Walking Sticks****"***
**SRB:** pp. 28-32, 49-51, 53-54

## Crosscutting Concepts

**Cause and Effect**

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4)

***FOSS Heredity and Adaptation***
**IG:** pp. 152, 214, 217, 222 (C), 229, 253, 255, 267 (J), 269 (L), 271, 272, 280, 292, 295
**SRB:** pp. 33-35
**TR:** pp. D10, D14, D22-D31

GRADE 8-MS-LS4-5

# Biological Evolution: Unity and Diversity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS4-5

*Students who demonstrate understanding can:*
**Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.** *[Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 53
**EA:** *Notebook Entry,* IG p. 306 (Step 9)
**EA:** *Performance Assessment,* IG p. 304 (Step 5)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 6), pp. 42-43 (Item 10ab), pp. 24-25 (Item 11abc)

## Science and Engineering Practices

**Obtaining, Evaluating, and Communicating Information**
Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences 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-LS4-5)

***FOSS Heredity and Adaptation***
**IG:** pp. 245, 304, 305
**SRB:** pp. 84-88
**TR:** pp. C39-C41, C74-C79

## Disciplinary Core Ideas

**LS4.B: Natural Selection**

- In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (MS-LS4-5)

***FOSS Heredity and Adaptation***
**IG:** pp. 218 (Step 14), 244, 247, 302 (Step 2), 304
**SRB:** pp. 40, 84-88
**DOR:** *"Genetic Technology Resources"*

## Crosscutting Concepts

**Cause and Effect**

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-5)

***FOSS Heredity and Adaptation***
**IG:** pp. 246, 303 (Step 3), 304
**SRB:** pp. 84-88
**TR:** pp. D10, D14, D22-D31

## 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-LS4-5)

***FOSS Heredity and Adaptation***
**IG:** pp. 172 (Step 20), 218 (Step 14), 246, 303 (Step 3)
**SRB:** pp. 36-40, 84-88

## Connections to Nature of Science

**Science Addresses Questions About the Natural and Material World**

- Science knowledge can describe consequences of actions but does not make the decisions that society takes. (MS-LS4-5)

***FOSS Heredity and Adaptation***
**IG:** pp. 218 (Step 14), 246, 303 (Step 3)
**SRB:** pp. 36-40, 84-88

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-LS4-6

# Biological Evolution: Unity and Diversity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-LS4-6

*Students who demonstrate understanding can:*
**Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.**
*[Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 53
**EA:** *Notebook Entry,* IG pp. 294-295 (Step 17)
**EA:** *Performance Assessment,* IG pp. 282-283 (Steps 7-8)**,** IG p. 279 (Step 3)
**EA:** *Response Sheet,* IG p. 293, Student Notebook Master No. 19
**BM:** *Assessment Coding Guide***,** pp. 4-5 (Item 4)**,** pp. 6-7 (Item 5), pp. 24-25 (Item 2b), pp. 26-27 (Item 4), pp. 30-31 (Item 9)**,** pp. 36-37 (Items 4 and 5)**,** pp. 38-39 (Item 7b)

## Science and Engineering Practices

**Using Mathematics and Computational Thinking**
Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

***FOSS Heredity and Adaptation***
**IG:** pp. 245, 278, 283, 287 (C), 294-295
**TR:** pp. C25-C27, C60-C65

## Disciplinary Core Ideas

**LS4.C: Adaptation**

- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)

***FOSS Heredity and Adaptation***
**IG:** pp. 280 (Step 5), 287 (C), 289 (E), 294-296
**DOR:** *"Walking Sticks"*
*"Larkey Natural Selection"*
*The Making of the Fittest: Natural Selection and Adaptation*
*The Origin of Species: The Beak of the Finch*
**SRB:** pp. 53-57
**SNM:** Nos. 13-15

## Crosscutting Concepts

**Cause and Effect**

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-6)

***FOSS Heredity and Adaptation***
**IG:** pp. 280, 292, 294-296
**SRB:** pp. 58-59
**TR:** pp. D10, D14, D22-D31

GRADE 8-MS-ESS1-1

# Earth's Place in the Universe

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS1-1

*Students who demonstrate understanding can:*
**Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.**
*[Clarification Statement: Examples of models can be physical, graphical, or conceptual.]*

***FOSS Planetary Science***
**IG:** pp. 55, 57, 59, 61, 63, 65, 73
**EA:** *Notebook Entry,* IG pp. 209-210 (Step 25), IG pp. 304-305 (Steps 7-8)
**EA:** *Performance Assessment,* IG p. 148 (Step 11) IG p. 177 (Step 13), IG p. 288 (Steps 21- 22)**,** IG p. 289 (Step 26), IG p. 296 (Step 6)
**EA:** *Response Sheet,* IG p. 194**,** Student Notebook Master No. 8**,** IG p. 297, Student Notebook Master No. 29
**EA:** *Review Notebook Entries***,** IG (Step 14)**,** IG p. 220 (Step 29)**,** IG p. 260 (Step 19)**,** IG p. 304 (Step 6)**,** IG p. 358 (Step 23)
**BM:** *Assessment Coding Guide,* pp. 2-3 (Item 3), pp. 6-7 (Item 4), pp. 10-15 (Items 1-3), pp. 16-20 (Items 4-7), pp. 22-23 (Item 1), pp. 24-29 (Items 3-6), pp. 58-59 (Item 1), pp. 60-67 (Items 3-7)

## 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 and use a model to describe phenomena. (MS-ESS1-1)

***FOSS Planetary Science***
**IG:** pp. 167, 175, 188, 191, 204, 214 (D), 220, 275, 284, 285, 286, 287, 288, 295, 296
**SRB:** pp. 11, 12, 23, 26
**TR:** pp. C14-C17, C46-C51

## Disciplinary Core Ideas

**ESS1.A: The Universe and Its Stars**

- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1)

***FOSS Planetary Science***
***IG:** pp. 146 (Step 6), 166, 175, 176, 274, 277, 281, 283, 289, 302 (Step 1)*
***SRB:** pp. 43-45*
***DOR:** "Day and Night"*
*"Phases of the Moon"*
*"Moon Puzzle"*

**ESS1.B: Earth and the Solar System**

- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)

***FOSS Planetary Science***
**IG:** pp. 153, 166, 169, 185-220, 189 (Step 9), 190, 191, 192, 193, 203, 210 (Step 26), 211, 220, 288, 306
**SRB:** pp. 15-21, 45-48
**DOR:** *"Seasons"*
*"Day and Night"*

## Crosscutting Concepts

**Patterns**

- Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1)

***FOSS Planetary Science***
**IG:** pp. 168,177, 178, 183, 203, 208, 220, 276, 281, 282, 284, 287, 289, 295, 297
**SRB:** pp. 34-37
**TR:** pp. D9, D13, D22-D27

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

## Connections to Nature of Science

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

***FOSS Planetary Science***
**IG:** pp. 289 (Step 26), 298
**SRB:** pp. 10-12, 23-25, 40-41

GRADE 8-MS-ESS1-2

# Earth's Place in the Universe

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS1-2

*Students who demonstrate understanding can:*
**Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.**
*[Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as their school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]*

***FOSS Planetary Science***
**IG:** pp. 55, 67, 69
**EA:** *Notebook Entry,* IG p. 418 (Step 16), IG p. 419 (Step 21)
**EA:** *Performance Assessment,* IG pp. 409-410 (Step 13)
**EA:** *Review Notebook Entries***,** IG p. 420 (Step 22)**,** IG p. 488 (Step 22)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 5)**,** pp. 38-39 (Items 7 and 8)**,** pp. 70-71 (Item 11)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 53
**EA:** *Notebook Entry,* IG p. 187 (Step 20)
**EA:** *Review Notebook Entries***,** IG p. 195 (Step 26)
**BM:** *Assessment Coding Guide***,** pp. 2-3 (Item 2)**,** pp. 18-19 (Item 3), pp. 20-21 (Item 5), pp. 22-23 (Item 7)**,** pp. 38-39 (Item 10)**,** pp. 42-43 (Item 13)

## 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 and use a model to describe phenomena. (MS-ESS1-2)

***FOSS Planetary Science***
**IG:** pp. 400, 405, 414, 420, 437, 444, 445, 447, 448
**SRB:** pp. 82, 135

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 159, 179, 183, 188, 195
**SRB:** pp. 31-36
**TR:** pp. C14-C17, C46-C51

## Disciplinary Core Ideas

**ESS1.A: The Universe and Its Stars**

- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2)

***FOSS Planetary Science***
**IG:** pp. 365, 374, 377, 386 (Step 13), 397-400, 404 (Step 1), 408,420
**SRB:** pp. 76-79
**SNM:** Nos. 4-6
**DOR:** *"Solar System Origin Card Sort"*
*"Cosmos Card Sort"*

**ESS1.B: Earth and the Solar System**

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2)

***FOSS Planetary Science***
**IG:** pp. 374, 377, 381, 389 (E), 400 (Step 16), 405, 408-409, 411 (Step 14), 415 (F), 417 (I), 418, 420, 423, 424, 436, 439, 446-448,
**SRB:** pp. 69-71, 82-85, 86-96, 135
**SNM:** Nos. 7-13
**DOR:** *"Community Scale Model"*

## Crosscutting Concepts

**Systems and System Models**

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS1-2)

***FOSS Planetary Science***
**IG:** pp. 376, 381, 384, 400, 405, 409-410, 418 (Step 18), 438, 444

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 160, 179, 188, 195
**SRB:** pp. 31-36
**TR:** pp. D16, D38-D43

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | *"Tides"*<br><br>***FOSS Gravity and Kinetic Energy***<br>**IG:** pp. 151, 158, 161, 179, 180, 188, 195<br>**SRB:** pp. 31-36 | |

## Connections to Nature of Science

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-2)

***FOSS Planetary Science***
**IG:** pp. 384-385 (Steps 10-11), 408-409
**SRB:** pp. 80-82

GRADE 8-MS-ESS1-3

# Earth's Place in the Universe

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS1-3

*Students who demonstrate understanding can:*
**Analyze and interpret data to determine scale properties of objects in the solar system.**
*[Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]*

***FOSS Planetary Science***
**IG:** pp. 55, 61, 63, 65, 67, 69, 73
**EA:** *Notebook Entry,* IG p. 260 (Item 17), IG p. 447 (Step 10), IG p. 448 (Step 14)
**EA:** *Performance Assessment,* IG p. 258 (Step 11)**,** IG p. 445 (Step 5)
**EA:** *Review Notebook Entries***,** IG p. 260 (Step 19)**,** IG p. 304 (Step 6)**,** IG p. 358 (Step 23)**,** IG p. 420 (Step 22)**,** IG p. 488 (Step 22)
**BM:** *Assessment Coding Guide,* pp. 22-23 (Items 1bc and 2), pp. 36-37 (Items 5 and 6), pp. 42-43 (Item 1), pp. 66-67 (Item 8), pp. 72-73 (Item 12)

## 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-ESS1-3)

***FOSS Planetary Science***
**IG:** pp. 444 (Step 1), 445 (Step 4),446 (Step 7), 448 (Step 13)
**SRB:** p. 135
**TR:** pp. C22-C24, C54-C59

## Disciplinary Core Ideas

**ESS1.B: Earth and the Solar System**

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-3)

***FOSS Planetary Science***
**IG:** pp. 234, 237, 257, 260, 423, 425, 436, 439, 444, 445 (Step 3), 446, 448
**SRB:** p. 134
**SNM:** Nos. 45-46

## 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-ESS1-3)

***FOSS Planetary Science***
**IG:** pp. 236, 254, 255, 260, 438, 444, 445, 447, 448
**TR:** pp. D11, D15, D32-D37

## 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-ESS1-3)

***FOSS Planetary Science***
**IG:** pp. 500, 526 (Step 9), 527
**SRB:** pp. 25-26, 110- 117, 161- 171

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-ESS1-4

# Earth's Place in the Universe

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS1-4

*Students who demonstrate understanding can:*
**Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.**
*[Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]*

***FOSS Heredity and Adaptation***
**IG:** pp. 47, 49
**EA:** *Notebook Entry,* IG pp. 107-108 (Step 19)
**EA:** *Performance Assessment,* IG p. 100 (Step 15)
**EA:** *Review Notebook Entries***,** IG pp. 132-133 (Step 24)
**BM:** *Assessment Coding Guide,* pp. 14-15 (Item 6), pp. 34-35 (Item 3)

## 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-ESS1-4)

***FOSS Heredity and Adaptation***
**IG:** pp. 88 (Step 13), 100 (Steps 14, 15), 118, 119, 120, 132
**SRB:** pp. 4-7, 73-77
**TR:** pp. C28-C31, C66-C71

## Disciplinary Core Ideas

**ESS1.C: The History of Planet Earth**

- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)

***FOSS Heredity and Adaptation***
**IG:** pp. 84, 87, 95 (Steps 7, 8), 98, 99, 101, 104, 105
**SRB:** pp. 2-10, 73-77
**DOR:** *"Fossil Slideshow"*

## 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-ESS1-4)

***FOSS Heredity and Adaptation***
**IG:** pp. 99, 100 (Step 15)
**SRB:** pp. 5, 6, 7, 8, 9, 78-81
**TR:** pp. D11, D15, D32-D37

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-ESS3-4

# Earth and Human Activity

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ESS3-4

*Students who demonstrate understanding can:*
**Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.**
*[Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]*

***FOSS Planetary Science***
**IG:** pp. 55, 57, 69
**EA:** *Performance Assessment,* IG p. 475 (Step 10) SNM No. 51
**EA:** *Review Notebook Entries***,** IG p. 488 (Step 22)
**BM:** *Assessment Coding Guide,* pp. 2-3 (Item 2b), pp. 48-49 (Item 6)**,** pp. 56-57 (Item 8)

***FOSS Electromagnetic Force***
**IG:** pp. 51, 59
**EA:** *Notebook Entry,* IG p. 301 (Step 27), *Performance Assessment,* IG pp. 292-293 (Step 19)
**BM:** *Assessment Coding Guide,* pp. 34-35 (Item 4), pp. 48-49 (Item 14)

## 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-ESS3-4)

***FOSS Planetary Science***
**IG:** pp. 437, 473 (Step 6), 474 (Step 8), 475 (Step 10), 476 (Step 12)
**SRB:** p. 104
**DOR:** "Earth Images Comparison Database"

***FOSS Electromagnetic Force***
**IG:** pp. 292, 300 (M)
**TR:** pp. C33-C38, C72-C73

## Disciplinary Core Ideas

**ESS3.C: Human Impacts on Earth Systems**

- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-4)

***FOSS Planetary Science Module***
**IG:** pp. 436, 439, 473-488, 473, 474, 475, 476 (Step 13), 477, 478, 480 (B), 481 (D), 485 (L), 486 (N), 487, 488
**SRB**: p. 166
**SNM:** No. 51
**DOR:** *"World Population"*
*"Earth Images Comparison Database"*

***FOSS Electromagnetic Force***
**IG:** pp. 259, 266, 285 (Step 2), 288, 289, 291 (Steps 16-17), 292 (Step 22)
**SRB:** pp. 54-55, 62

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-4)

***FOSS Planetary Science***
**IG:** pp. 438, 475, 477, 482, 483 (H), 486 (N), 488
**SRB:** pp. 97-104

***FOSS Electromagnetic Force***
**IG:** pp. 292
**TR:** pp. D10, D14, D22-D31

## Connections to Engineering, Technology, and Applications of Science

**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-ESS3-4)

***FOSS Planetary Science***
**IG:** pp. 438, 473 (Steps 4-5), 474-475 (Steps 8-9), 476, (Step 12), 478 (Step 17)

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment


School Specialty. Delta Education

**SRB:** pp. 97-104

***FOSS Electromagnetic Force***
**IG:** pp. 268, 300 (M)
**SRB:** pp. 59-62

## 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-ESS3-4)

***FOSS Planetary Science***
**IG:** pp. 438, 473 (Step 5), 474-475 (Steps 8, 9), 476 (Step 12), 482 (Notes E, F), 484 (J), 487 (Steps 19, 21), 488
**SRB:** pp. 97-104

***FOSS Electromagnetic Force***
**IG:** pp. 287 (Step 10), 288, 289
**SRB:** pp. 49-51

GRADE 8-MS-PS2-1

# Motion and Stability: Forces and Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS2-1

*Students who demonstrate understanding can:*
**Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.***
*[Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]*

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 55, 57
**EA:** *Notebook Entry,* IG p. 253 (Step 16)
**EA:** *Performance Assessment,* IG p. 277 (Step 20)
**EA:** *Review Notebook Entries***,** IG p. 254 (Step 18)
**BM:** *Assessment Coding Guide,* pp. 6-7 (Item 5), pp. 26-27 (Item 5), pp. 36-37 (Item 7ab), pp. 40-41 (11ab)

## 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.

- Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 265, 274, 275, 276, 279, 287 (Step 29)
**SRB:** pp. 56,62, 71
**TR:** pp. C28-C31, C66-C71

## Disciplinary Core Ideas

**PS2.A: Forces and Motion**

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's Third Law). (MS-PS2-1)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 199, 206, 209, 242 (Step 2), 244, 245, 249, 264, 267, 271, 272 (Step 3), 279 (Step 23), 280 (Step 25), 287 (Step 28), 290-293
**SRB:** pp. 47-49, 57-62
**SNM:** No. 17
**DOR:** *Understanding Car Crashes-It's Basic Physics*

## Crosscutting Concepts

**Systems and System Models**

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 208, 254, 266, 277, 278 (Step 22), 279, 290-291
**SRB:** pp. 52-55, 60
**TR:** pp. D16, D38-D43

## Connections to Engineering, Technology, and Applications of Science

**Influence of Science, 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. (MS-PS2-1)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 266, 278 (Step 22), 283 (E), 286 (J)
**SRB:** pp. 50-56, 57-62

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-PS2-2

# Motion and Stability: Forces and Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS2-2

*Students who demonstrate understanding can:*
**Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.**
*[Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]*

***FOSS Electromagnetic Force***
**IG:** pp. 51, 53, 55
**EA:** *Notebook Entry,* IG p. 100 (Step 10), IG p. 102 (Step 15), IG p. 105 (Step 25)
**EA:** *Performance Assessment,* IG p. 114 (Step 7)
**EA:** *Response Sheet,* IG p. 126**,** Student Notebook Master No. 7
**EA:** *Review Notebook Entries***,** IG p. 133 (Step 29)**,** IG pp. 189-190 (Step 26)
**BM:** *Assessment Coding Guide,* pp. 2-3 (Items 1 and 2)**,** pp. 8-9 (Items 1 and 2)**,** pp. 14-15 (Items 7 and 8)**,** pp. 38-39 (Items 3 and 4)**,** pp. 42-43 (Item 8)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 51, 53, 55, 57
**EA:** *Notebook Entry,* IG p. 187 (Step 20)
**EA:** *Performance Assessment,* IG p. 166 (Step 7)
**EA:** *Review Notebook Entries***,** IG p. 145 (Step 29)**,** IG p. 195 (Step 26)**,** IG p. 254 (Step 18)
**BM:** *Assessment Coding Guide,* pp. 2-3 (Item 1), pp. 4-5 (Item 3ab), pp. 8-9 (Items 1abcd and 2), pp. 12-13 (Items 4-6), pp. 20-21 (Item 6), pp. 24-25 (Item 1ab), pp. 26-27 (Item 4), pp. 28-29 (Item 6abc), pp. 32-33 (Items 1 and 3), pp. 34-35 (Item 4), pp. 44-45 (Item 14)

## Science and Engineering Practices

**Planning and Carrying Out Investigations**
Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)

***FOSS Electromagnetic Force***
**IG:** pp. 91, 99, 102, 113, 114, 133,

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 150, 159, 161, 167, 183, 195, 290-291
**TR:** pp. C18-C21, C52-C55

## Disciplinary Core Ideas

**PS2.A: Forces and Motion**

- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)
- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)

***FOSS Electromagnetic Force***
**IG:** pp. 90, 93, 105 (Step 24), 112, 114, 122 (Step 4), 125 (Step 7), 127-131, 133, 185 (Step 15)
**SRB:** pp. 3-7, 12-13, 15-18
**SNM:** Nos. 5-6
**DOR:** Forces

## 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 forces at different scales. (MS-PS2-2)

***FOSS Electromagnetic Force***
**IG:** pp. 92, 130 (C), 131 (D), 133
**SRB:** pp. 15-18
**TR:** pp. D12, D19, D46-D49

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | ***FOSS Gravity and Kinetic Energy***<br>**IG:** pp. 149, 151, 158, 161, 164 (Step 2), 187 (Step 19), 179 (Step 2), 195, 290-291<br>**SRB:** pp. 26-30<br>**SNM:** No. 11 | |

## Connections to Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2)

***FOSS Electromagnetic Force***
**IG:** pp. 116
**SRB:** pp. 9-14

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 160, 186 (Step 17), 187 (Steps 22-23)

GRADE 8-MS-PS2-3

# Motion and Stability: Forces and Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS2-3

*Students who demonstrate understanding can:*
**Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.**
*[Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]*

***FOSS Electromagnetic Force Model***
**IG:** pp. 51, 55, 57
**EA:** *Notebook Entry,* IG p. 158 (Step 18)*,* IG p. 188 (Step 25), IG p. 240 (Step 18)
**EA:** *Performance Assessment,* IG p. 185 (Step 14), IG p. 249 (Step 10)
**EA:** *Response Sheet,* IG p. 168, SNM No. 8
**EA:** *Review Notebook Entries*, IG p. 189 (Step 26), IG p. 252 (Step 16)
**BM:** *Assessment Coding Guide,* pp.4-5 (Item 3), pp. 18-19 (Item 6), pp. 20-21 (Item 7), pp. 22-23 (Items 8 and 9), pp. 26-27 (Item 4), pp.42-43 (Item 7)

## Science and Engineering Practices

**Asking Questions and Defining Problems**
Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)

***FOSS Electromagnetic Force***
**IG:** pp. 203, 230, 236, 251
**TR:** pp. C9-C14, C42-C45

## Disciplinary Core Ideas

**PS2.B: Types of Interactions**

- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)

***FOSS Electromagnetic Force***
**IG:** pp. 146, 149, 155, 156 164, 165, 167,168 (Step 17), 187, 251 (Step 15)
**SRB:** pp. 19-24, 38-41
**DOR:** *Magnetism*
*"Adding Magnetic Fields"*
*"Virtual Electromagnet"*

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3)

***FOSS Electromagnetic Force***
**IG:** pp. 148, 155, 157, 166, 189, 249, 250, 252
**SRB:** pp. 24, 41
**TR:** pp. D10, D14, D22-D31

GRADE 8-MS-PS2-4

# Motion and Stability: Forces and Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS2-4

*Students who demonstrate understanding can:*
**Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.**
*[Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]*

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 51
**EA:** *Notebook Entry,* IG p. 144 (Step 27), IG p. 187 (Step 20)
**EA:** *Performance Assessment,* IG p. 184 (Step 11)
**EA:** *Review Notebook Entries*, IG p. 145 (Step 29)
**BM:** *Assessment Coding Guide,* pp. 10-11 (Item 3ab), pp. 18-19 (Items 1-3), pp. 22-23 (Item 7), pp. 32-33 (Item 2), pp. 42-43 (Item 13)

***FOSS Planetary Science***
**IG:** pp. 55, 67
**EA:** *Performance Assessment,* IG p. 409 (Step 13)
**EA:** *Review Notebook Entries,* IG p. 420 (Step 22)

## Science and Engineering Practices

**Engaging in Argument from Evidence**
Engaging in argument from evidence in 6–8 builds from 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.

- Construct and present oral and written arguments 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-PS2-4)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 59, 161, 180 (Step 6), 181 (Step 8), 183 (Step 13), 184, 187 (Step 20)

***FOSS Planetary Science***
**IG:** pp. 375, 409-410, 420, 543, 569, 574
**SRB:** pp. 80-85
**TR:** pp. C33-C38, C72-C73

## Disciplinary Core Ideas

**PS2.B: Types of Interactions**

- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)

***Gravity and Kinetic Energy***
**IG:** pp. 88, 91, 127 (Step 2), 128, 129, 145, 149, 161, 185, 188 (Step 24), 195, 290-291
**SRB:** pp. 18-25, 31-36
**DOR:** *Falling Ball Analysis Slideshow*
*Falling Ball Videos*
*Hammer and Feather in Space*

***FOSS Planetary Science***
**IG:** pp. 374, 377, 408, 409, 411 (Step 14), 415, 417 (I), 420, 542, 569
**SRB:** pp. 80-85, 110-120
**DOR:** *"Origin of the Moon"*
*Tides*

## Crosscutting Concepts

**Systems and System Models**

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-4)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 90, 132, 137, 145, 160, 179, 188, 195, 291
**SRB:** pp. 18-25

***FOSS Planetary Science***
**IG:** pp. 376, 405, 410
**SRB:** pp. 80-85
**TR:** pp. D16, D38-D43

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

## Connections to Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-4)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 138, 160
**SRB:** pp. 20-21

***FOSS Planetary Science***
**IG:** p. 411 (Step 14)
**SRB:** pp. 80-85

GRADE 8-MS-PS2-5

# Motion and Stability: Forces and Interactions

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS2-5

*Students who demonstrate understanding can:*
**Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**
*[Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically charged strips of tape, and electrically charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and is limited to qualitative evidence for the existence of fields.]*

***FOSS Electromagnetic Force***
**IG:** pp. 51, 55, 57
**EA:** *Notebook Entry,* IG p. 158 (Step 18), IG p. 240 (Item 18)
**EA:** *Performance Assessment,* IG p. 185 (Step 14)**,** IG p. 249 (Step 10)
**EA:** *Response Sheet,* IG p. 168 (Step 19), Student Notebook Master No. 8
**EA:** *Review Notebook Entries***,** IG p. 189 (Step 26)**,** IG p. 252 (Step 16)
**BM:** *Assessment Coding Guide,* pp. 4-5 (Item 3), pp. 16-17 (Items 2 and 3), pp. 18-19 (Items 4 and 6), pp. 20-21 (Item 7ab), pp. 22-23 (Item 9), pp. 26-27 (Item 4), pp. 28-29 (Item 6), pp. 30-31 (Item 7), pp. 40-41 (Item 6), pp. 42-43 (Items 7 and 8)

## Science and Engineering Practices

**Planning and Carrying Out Investigations**
Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

- Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS-PS2-5)

***FOSS Electromagnetic Force***
**IG:** pp. 147, 183, 184, 185, 189, 203, 247
**TR:** pp. C18-C21, C52-C55

## Disciplinary Core Ideas

**PS2.B: Types of Interactions**

- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5)

***FOSS Electromagnetic Force***
**IG:** pp. 146, 149, 155, 164, 165, 187, 189
**SRB:** pp. 19-24, 40
**DOR:** *"Adding Magnetic Fields"*

## Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-5)

***FOSS Electromagnetic Force***
**IG:** pp. 148, 155, 157, 166, 189, 204, 249, 250
**TR:** pp. D10, D14, D22-D31

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-PS3-1

# Energy

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS3-1

*Students who demonstrate understanding can:*
**Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**
*[Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]*

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 55
**EA:** *Notebook Entry,* IG p. 237 (Step 16), IG p. 253 (Step 16)
**EA:** *Performance Assessment,* IG pp. 217-218 (Step 12)
**EA:** *Review Notebook Entries***,** IG p. 254 (Step 18)
**BM:** *Assessment Coding Guide,* pp. 4-5 (Item 3ab), pp. 24-25 (Item 2), pp. 28-29 (Items 6ab and 7), pp. 30-31 (Item 8ab), pp. 36-37 (Item 7ab), pp. 38-39 (Item 9), pp. 42-43 (Item 12)

## 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.

- Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 207, 218, 219, 226 (F), 235, 236, 254, 291
**SRB:** p. 40
**TR:** pp. C22-C24, C54-C59

## Disciplinary Core Ideas

**PS3.A: Definitions of Energy**

- Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1)

***FOSS Gravity and Kinetic Energy***
***IG:*** *pp. 206, 214-215, 216 (Step 7), 232 (Step 2), 234-237 (Steps 8-13), 254, 291*
***SRB:*** *pp. 37-40*
***SNM:*** *Nos. 15-16*

## Crosscutting Concepts

**Scale, Proportion, and Quantity**

- Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-1)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 208, 222, 235, 236, 238, 254, 291
**SRB:** pp. 41-42, 49
**TR:** pp. D11, D15, D32-D37

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-PS3-2

# Energy

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS3-2

*Students who demonstrate understanding can:*
**Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.**
*[Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]*

***FOSS Electromagnetic Force***
**IG:** pp. 51, 55, 57, 59
**EA:** *Performance Assessment,* IG p. 185 (Step 14)*, Response Sheet,* IG p. 222 (Step 16), Student Notebook Master No. 11
**EA:** *Review Notebook Entries*, IG p. 189 (Step 26), IG p. 252 (Step 16)
**BM:** *Assessment Coding Guide,* pp. 4-5 (Item 4), pp. 16-17 (Item 3), pp. 26-27 (Item 3ab)*,* pp. 40-41 (Item 5), pp. 42-43 (Item 8)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 55, 57
**EA:** *Notebook Entry,* IG p. 237 (Step 16)
**EA:** *Performance Assessment,* IG p. 217 (Step 12)
**EA:** *Review Notebook Entries,* IG p. 254 (Step 18)
**BM:** *Assessment Coding Guide*, pp. 2-3 (Item 1), pp. 24-25 (Item 3), pp. 28-29 (Item 6abc), pp. 30-31 (Item 8b), pp. 34-35 (Item 6), pp. 42-43 (Items 12 and 13)

## 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-PS3-2)

***FOSS Electromagnetic Force***
**IG:** pp. 147, 164, 167, 168, 171, 174, 185, 188, 189
**SRB:** pp. 20, 21, 23, 32

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 209, 219, 221, 226 (F), 236, 254, 291
**SRB:** pp. 39-40
**TR:** pp. C14-C17, C46-C51

## Disciplinary Core Ideas

**PS3.A: Definitions of Energy**

- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)

***FOSS Electromagnetic Force***
**IG:** pp. 181 (Step 2), 186, 187 (Step 21), 215, 216, 217, 220, 221, 222
**SRB:** pp. 20, 21 32, 33, 61
**DOR:** *"Adding Magnetic Fields"*

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 206, 214, 215 (Step 5), 218, 209, 254
**SRB:** pp. 37-40

**PS3.C: Relationship Between Energy and Forces**

- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

***FOSS Electromagnetic Force***
**IG:** pp. 184 (Step 12), 186 (Steps 18, 19), 233-234
**SRB:** pp. 17-18, 37, 40-41, 45-49
**SNM:** No. 9

## Crosscutting Concepts

**Systems and System Models**

- Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy and matter flows within systems. (MS-PS3-2)

***FOSS Electromagnetic Force***
**IG:** pp. 148, 167, 185, 188, 189, 223, 239, 249

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 208, 218, 219, 221
**SRB:** pp. 39-40
**TR:** pp. D16, D38-D43

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | ***FOSS Gravity and Kinetic Energy***<br>**IG:** pp. 206, 209, 220 (Step 17), 221, 222, 232 (Step 2), 242 (Step 2), 254, 291<br>**SRB:** pp. 37-40 | |

GRADE 8-MS-PS4-1

# Waves and Their Applications in Technologies for Information Transfer

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS4-1

*Students who demonstrate understanding can:*
**Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.**
*[Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]*

***FOSS Waves***
**IG:** pp. 49, 51, 53,
**EA:** *Notebook Entry,* IG pp. 95 (Step 8), IG 97 (Step 13), IG 107-108 (Step 16), IG 138 (Step 21)
**EA:** *Performance Assessment,* IG pp. 107-108 (Step 16)
**EA:** *Response Sheet,* IG p. 110**,** Student Notebook Master No. 3
**EA:** *Review Notebook Entries***,** IG p. 111 (Step 24)**,** IG p. 173 (Step 29)
**BM:** *Assessment Coding Guide,* pp. 2-3 (Items 1 and 2ab)**,** pp. 4-5 (Items 3ab)**,** pp. 8-9 (Items 1, 2, and 4)**,** pp. 12-13 (Item 7)**,** pp. 14-15 (Item 8)**,** pp. 28-29 (Items 1-3)**,** pp. 32-33 (Item 5)

## Science and Engineering Practices

**Using Mathematics and Computational Thinking**
Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)

***FOSS Waves***
**IG:** pp. 87, 95, 96, 108, 114, 123, 137
**SRB:** p. 6
**TR:** pp. C25-C27, C60-C65

## Disciplinary Core Ideas

**PS4.A: Wave Properties**

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)

***FOSS Waves***
**IG:** pp. 86, 89, 103 (Step 4), 105 (Step 10), 106-107, 122, 125, 130, 131,132, 138, 172 (Step 25), 173
**SRB:** pp. 4-6, 8-9
**DOR:** *Standing Wave*
*Big Waves*
*"Oscilloscope"*

## Crosscutting Concepts

**Patterns**

- Graphs and charts can be used to identify patterns in data. (MS-PS4-1)

***FOSS Waves***
**IG:** pp. 88, 96, 98, 104, 105, 108, 111, 124, 135, 136, 137, 173
**SRB:** pp. 4-6, 8-9
**TR:** pp. D9, D13, D22-D27

## Connections to Nature of Science

**Scientific Knowledge is Based on Empirical Evidence**

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS4-1)

***FOSS Waves***
**IG**: pp. 107-108 (Steps 14-16), 134-137 (Steps 10-18)

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-PS4-2

# Waves and Their Applications in Technologies for Information Transfer

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS4-2

*Students who demonstrate understanding can:*
**Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.**
*[Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]*

***FOSS Waves***
**IG:** pp. 49, 53, 55
**EA:** *Notebook Entry,* IG p. 173 (Step 30), IG p. 220 (Step 16), IG p. 239 (Step 12)
**EA:** *Performance Assessment,* IG p. 167 (Step 15) IG p. 237 (Steps 6-7), Student Notebook Master No. 20
**EA:** *Response Sheet,* IG p. 229, Student Notebook Master No. 19
**EA:** *Review Notebook Entries*, IG p. 173 (Step 29), IG p. 240 (Step 13)
**BM:** *Assessment Coding Guide*, pp. 4-5 (Items 3 and 4), pp. 16-17 (Items 1-3), pp. 22-23 (Item 10), pp. 24-25 (Items 1 and 2), pp. 30-31 (Item 4abc), pp. 34-35 (Items 7 and 8), pp. 36-37 (Items 9 and 10)

***FOSS Planetary Science***
**IG:** pp. 55, 71
**EA:** *Notebook Entry,* IG p. 519 (Step 18)
**EA:** *Review Notebook Entries*, IG p. 528 (Step 15)
**BM:** *Assessment Coding Guide*, pp. 50-51 (Items 1-3), pp. 52-53 (Item 4), pp. 54-55 (Items 6 and 7), pp. 68-69 (Item 9), pp. 74-75 (Item 14)

## 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 and use a model to describe phenomena. (MS-PS4-2)

***FOSS Waves***
**IG:** pp. 123, 125, 135, 136, 177, 178, 187, 208, 266
**SRB:** pp. 33-41
**DOR:** "Refraction"
"Oscilloscope"

***FOSS Planetary Science***
**IG:** pp. 499, 507, 543, 551, 563, 564
**SRB:** pp. 105-109, 110-111
**DOR:** "Exoplanet Transit Hunt"
**TR:** pp. C14-C17, C46-C51

## Disciplinary Core Ideas

**PS4.A: Wave Properties**

- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

***FOSS Waves***
**IG:** pp. 122, 129, 161,162, 168, 169, 173
**SRB:** pp. 17-20
**DOR:** *"Oscilloscope"*

**PS4.B: Electromagnetic Radiation**

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)

## 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-PS4-2)

***FOSS Waves***
**IG:** pp. 124, 168, 173, 198 (Step 17), 263
**SRB:** pp. 18-19, 30-31. 60-62
**DOR:** *Fiber Optics*

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

| | | |
|---|---|---|
| | • However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)<br><br>***FOSS Waves***<br>**IG:** pp. 177, 186, 189, 193, 194, 196, 197, 198, 205, 206, 208, 211-213, 226, 227, 238, 239<br>**SRB:** pp. 32-41<br>**SNM:** Nos. 7, 18, 20<br>**TM:** Q<br>**DOR:** *"Refraction"*<br><br>***FOSS Planetary Science***<br>**IG:** pp. 498, 501, 507, 508, 509, 510, 511, 512, 513 (Step 14), 528<br>**SRB:** pp. 105-109<br>**DOR:** *"Properties of Light Slideshow"*<br>*"Comparing Spectra"*<br>*Hubble's Amazing Universe* | |

GRADE 8-MS-PS4-3

# Waves and Their Applications in Technologies for Information Transfer

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-PS4-3

*Students who demonstrate understanding can:*
**Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.**
*[Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]*

***FOSS Waves***
**IG:** pp. 49, 57
**EA:** *Notebook Entry,* IG p. 265 (Step 13), IG p. 276 (Step 16), IG p. 290 (Step 10), IG p. 292 (Step 12)
**BM:** *Assessment Coding Guide*, pp. 6-7 (Item 6), pp. 24-25 (Item 3), pp. 26-27 (Items 4 and 5), pp. 38-39 (Items 12-14)

## 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.
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)

***FOSS Waves***
**IG:** pp. 257, 282, 283, 284- 290
**SRB:** pp. 63-68, 69-78, 84, 85, 86
**DOR:** *Fiber Optics*
*"Digitized Images"*
**TR:** pp. C39-C41, C74-C79

## Disciplinary Core Ideas

**PS4.C: Information Technologies and Instrumentation**
- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

***FOSS Waves***
**IG:** pp. 256, 259, 265 (Step 10), 276, 280, 282, 284-289, 293
**SRB:** pp. 63-68, 69- 78
**SNM:** No. 25
**DOR:** *"Digitized Images"*

## Crosscutting Concepts

**Structure and Function**
- Structures can be designed to serve particular functions. (MS-PS4-3)

***FOSS Waves***
**IG:** pp. 263, 273-275
**SRB:** pp. 64-65, 86
**TR:** pp. D18, D44-D47

## Connections to Engineering, Technology, and Applications of Science

**Influence of Science, Engineering, and Technology on Society and the Natural World**
- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)

***FOSS Waves***
**IG:** pp. 205 (Step 3), 206 (Step 5), 273 (Step 9), 274, 275, 293
**SRB:** pp. 34-35, 69-78

## Connections to Nature of Science

**Science is a Human Endeavor**
- Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)

***FOSS Waves***
**IG:** pp. 258, 263 (Step 4), 264 (Step 5, 8), 266 (Step 14), 273, 275 **SRB:** pp. 69-78

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-ETS1-1

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-1

*Students who demonstrate understanding can:*
**Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**

***FOSS Waves***
**IG:** pp. 49, 53
**EA:** *Notebook Entry,* IG p. 155 (Step 13), IG p. 164 (Step 9)
**EA:** *Performance Assessment,* IG pp. 167-168 (Steps 15-16)
**EA:** *Review Notebook Entries,* IG p. 173 (Step 29)
**BM:** *Assessment Coding Guide*, pp. 10-11 (Item 6)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 57
**EA:** *Performance Assessment,* IG p. 277 (Step 20)
**BM:** *Assessment Coding Guide*, pp. 38-39 (Item 8)

## 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, and 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)

***FOSS Waves***
**IG:** pp. 114,123, 125, 144 (Step 1), 164 (Step 9), 168
**DOR:** *Tacoma Narrows Bridge Collapse 1*
*Tacoma Narrows Bridge Collapse 2*
*Soundproof Engineering*
**TR:** pp. C9-C14, C42-C45

## Disciplinary Core Ideas

**ETS1.A: Defining and Delimiting Engineering Problems**
- 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)

***FOSS Waves***
**IG:** pp. 122, 125, 148 (Step 8), 151 (B), 164 (Step 9), 173
**SRB:** pp. 13, 16, 25, 26

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 46, 264, 273 (Step 7), 277, 287 (Step 29)
**SRB:** pp. 51, 61
**DOR:** *Understanding Car Crashes-It's Basic Physics*

## Crosscutting Concepts

**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)
- 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)

***FOSS Waves***
**IG:** pp. 124, 145, 146, 147, 148, 154 (F)
**SRB:** pp. 12-16

***FOSS Gravity and Kinetic Energy***
**IG:** p. 286
**SRB:** pp. 52, 53, 55, 62

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

GRADE 8-MS-ETS1-2

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-2

*Students who demonstrate understanding can:*
**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 51, 57
**EA:** *Notebook Entry,* IG p. 275 (Step 12), IG p. 276 (Step 14)
**EA:** *Performance Assessment,* IG p. 277 (Step 20)
**EA:** *Review Notebook Entries*, IG p. 189 (Step 26)
**BM:** *Assessment Coding Guide*, pp. 38-39 (Item 8)

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|
| **Engaging in Argument from Evidence**<br>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.<br>• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)<br><br>***FOSS Gravity and Kinetic Energy***<br>**IG:** pp. 276 (Step 18), 277<br>**TR:** pp. C33-C38, C72-C73 | **ETS1.B: Developing Possible Solutions**<br>• A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)<br>• There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2),<br><br>***FOSS Electromagnetic Force***<br>***IG:** pp. 248 (Steps 4-5)*<br><br>***FOSS Gravity and Kinetic Energy***<br>***IG:** pp. 46, 264, 275, 287 (Step 29)*<br>***SRB:** pp. 52,53, 55*<br>***DOR:** Understanding Car Crashes-It's Basic Physics* | |

GRADE 8-MS-ETS1-3

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-3

*Students who demonstrate understanding can:*
**Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**

***FOSS Waves***
**IG:** pp. 49, 53
**EA:** *Notebook Entry,* IG p. 155 (Step 13), IG p. 167 (Step 14) SNM No. 6
**EA:** *Performance Assessment,* IG pp. 167-168 (Steps 15-16)
**EA:** *Review Notebook Entries***,** IG p. 173 (Step 29)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 57
**EA:** *Performance Assessment,* IG p. 277 (Step 20)
**BM:** *Assessment Coding Guide*, pp. 38-39 (Item 8)

## 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)

***FOSS Waves***
**IG:** pp. 114, 123, 168, 172, 173
**SRB:** pp. 12-16
**TR:** pp. C22-C24, C54-C59

## 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)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)

***FOSS Electromagnetic Force***
**IG:** pp. 250-251 (Step 12), 255

***FOSS Waves***
**IG:** pp. 122, 153, 155, 164, 168 (Step 16), 172 (Steps 26-27), 173
**SRB:** pp. 15, 24, 83

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 47, 264, 275-277 (Steps 13-18), 287 (Step 29)
**SRB:** pp. 50, 51
**DOR:** *Understanding Car Crashes-It's Basic Physics*

**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)

***FOSS Waves***

## Crosscutting Concepts

| | | |
|---|---|---|
| | **IG:** pp. 122, 151 (Step 13), 172 (Steps 26-27), 173<br>**SRB:** pp. 16, 23, 24, 83<br><br>***FOSS Gravity and Kinetic Energy***<br>**IG:** pp. 47, 264, 275-277 (Steps 13-18), 287 (Step 29) | |

GRADE 8-MS-ETS1-4

# Engineering Design

*The following FOSS program elements address the performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts indicated below. References are selected and do not reflect every possible alignment to a standard.*

## Performance Expectation MS-ETS1-4

*Students who demonstrate understanding can:*
**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 49, 57
**EA:** *Notebook Entry,* IG p. 277 (Step 19)*,* IG p. 279 (Step 24)
**EA:** *Performance Assessment,* IG p. 277 (Step 20)
**BM:** *Assessment Coding Guide*, pp. 38-39 (Item 8)

***FOSS Waves***
**IG:** pp. 49, 53
**EA:** *Notebook Entry,* IG p. 155 (Step 13), IG p. 167 (Step 14)
**EA:** *Performance Assessment,* IG pp. 167-168 (Steps 15-16)

## 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)

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 257, 265, 277, 279 (Step 24)
**SRB:** pp. 50-56, 71

***FOSS Waves Module***
**IG:** pp. 123, 161, 164, 167
**TR:** pp. C14-C17, C46-C51

## 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)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

***Electromagnetic Force***
**IG:** pp. 248-251

***FOSS Gravity and Kinetic Energy***
**IG:** pp. 257, 259, 264, 267, 275-276 (Step 13), 277, 287 (Step 29)
**SRB:** pp. 50-56
**DOR:** *Understanding Car Crashes-It's Basic Physics*

***FOSS Waves***
**IG:** pp. 121, 151 (C), 147,172 (Step 26-27), 173
**SRB:** pp. 15, 23, 83

**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)

***FOSS Electromagnetic Force***
**IG:** pp. 250-251 (Step 12), 255
**SRB:** p. 74

## Crosscutting Concepts

**IG**: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
**EA:** Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment