Middle School, Standard 1. Physical Science

SC.MS.1.1

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties and interactions of matter.

Grade Level Expectation:

The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter and phase changes.

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.

Evidence Outcomes

a. Develop models to describe the atomic composition of simple molecules and extended structures. (MS-PS1-1)
[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.] [Boundary Statement: 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. 541, 543, 550, 553, 558-561, 563 (Step 11), 564 (Step15), 620
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)

b. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2)
[Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Boundary Statement: Limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

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), 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)
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)

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

Evidence Outcomes Cont'd

c. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. (MS-PS1-3)

[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.] [Boundary Statement: Limited to qualitative information.]

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), 541, 550, 586 (Step 7), 587 (Step 12), 588-589 (Steps 14-16), 613-614 (Step 6), 617 (Step 12), 618 (Step 16), 620
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)

d. 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. (MS-PS1-4)

[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. 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), 311, 315, 326, 343-346 (Steps 4-11), 364 (Step 3), 365-366 (Step 5), 367 (Step 10), 368-369 (Step 12), 370 467, 478, 488-489 (Step 11), 497, 533 (Step 6), 534 (Step 10), 537
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)

Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Develop a model to predict and/or describe phenomena.

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, 551, 558, 559, 560, 562, 563, 574, 587, 620
TR: pp. C14-C17, C44-C51

2. Analyzing and Interpreting Data

- Analyze and interpret data to determine similarities and differences in findings.

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

3. 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.

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

4. Connections to Nature of Science

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

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

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

Elaboration on the GLE

1. 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. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. 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. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. In liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced and may vibrate in position but do not change relative locations. The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.

FOSS Chemical Interactions

IG: pp. 107, 109,117, 137 (Step 6), 140-141(Step 15), 146,147 (Step 33), 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, 448 (Step 5), 487 (Step 10), 497 (Step 14), 533 (Step 6), 534 (Step 10), 537, 541, 543, 550, 553, 558-561, 563 (Step 11), 564 (Step15), 620

SRB: pp. 3-5, 24-27, 28-32, 33-39, 89-100, 98-99, 132, 165-173, 110-117, 180-181

SNM: Nos. 2-6

DOR: “Explore Dissolving” “Two-Substance Reactions” “Gas in a Syringe” “Energy Transfer by Collision” “Mixing Hot and Cold Water” *Hoar Frost* “Particles in Solids, Liquids, and Gases” “Thermometer”

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

Cross Cutting Concepts

1. 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.

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

2. Patterns

- Macroscopic patterns are related to the nature of microscopic and atomic-level structure.

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

3. 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.

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

4. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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

5. 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.

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

6. 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.

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

IG: Investigations Guide • **TR:** Teacher Resources • **SRB:** Student *Science Resources* Book • **DOR:** Digital-Only Resources
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Middle School, Standard 1. Physical Science

SC.MS.1.2

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding structure, properties and interactions of matter.

Grade Level Expectation:

Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb 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.

Evidence Outcomes

a. **Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2)**
[Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Boundary Statement: Limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]

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), 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)
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)

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

Evidence Outcomes Cont'd

b. 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. (MS-PS1-5)
[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. 541, 585-586 (Steps 5-7), 618-619 (Step 16), 620, 634, 637, 646-647 (Steps 11-12), 648
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)

c. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. (MS-PS1-6)
[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. 467, 474-475, 478, 521, 523 (Steps 12-13), 524 (Step 15)*
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)

Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Develop a model to describe unobservable mechanisms.

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

2. Constructing Explanations and Designing Solutions

- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.

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

3. Connections to Nature of Science

- Laws are regularities or mathematical descriptions of natural phenomena.

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

Disciplinary Core Ideas

1. 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. The total number of each type of atom is conserved, and thus the mass does not change. Some chemical reactions release energy, others store energy.

FOSS Chemical Interactions
IG: pp. *467, 474-475, 478, 521, 523 (Steps 12-13), 524 (Step 15),* 541, 585-586 (Steps 5-7), 618-619 (Step 16), 620, 634, 637, 646-647 (Steps 11-12), 648
SRB: pp.118-129, 131
SNM: Nos. 64, 69-71

Cross Cutting Concepts

1. Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes. The transfer of energy can be tracked as energy flows through a designed or natural system.

FOSS Chemical Interactions
IG: pp. 480, 527, 531, 532, 534, 535, 537, 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
DOR: "Energy Flow"

Middle School, Standard 1. Physical Science

SC.MS.1.3

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding interactions between objects and within systems of objects.

Grade Level Expectation:

Motion is described relative to a reference frame that must be shared with ithers and is determined by the sum of the forces action on it. The greater the mass of the object, the greater the force needed to achieve the same change in motion.

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.

Evidence Outcomes

a. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (MS-PS2-1)
[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.] [Boundary Statement: Limited to vertical or horizontal interactions in one dimension.]

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
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)

Evidence Outcomes Cont'd

b. 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. (MS-PS2-2)

[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.] [Boundary Statement: 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. 90, 93, 105 (Step 24), 112, 114, 122 (Step 4), 125 (Step 7), 127-131, 133, 185 (Step 15)
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. 149, 151, 158, 161, 164 (Step 2), 187 (Step 19), 179 (Step 2), 195, 290-291
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)

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

- Apply scientific ideas or principles to design an object, tool, process or system.

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

2. Planning and Carrying Out Investigations

- 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.

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

3. Connections to Nature of Science

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

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)

Elaboration on the GLE

1. 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). 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. 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.

FOSS Gravity and Kinetic Energy

IG: pp. 149, 151, 158, 161, 164 (Step 2), 187 (Step 19), 179 (Step 2), 195, 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. 26-30, 47-49, 57-62
SNM: No. 11 , No. 17
DOR: *Understanding Car Crashes-It's Basic Physics*

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

Cross Cutting Concepts

1. 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.

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

2. 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

3. Connections to Engineering, Technology, and Applications of Science

- 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.

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

Middle School, Standard 1. Physical Science

SC.MS.1.4

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding interactions between objects and within systems of objects.

Grade Level Expectation:

Forces that act at a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test.

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.

Evidence Outcomes

a. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3)
[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.] [Boundary Statement: Limited to questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]

FOSS Electromagnetic Force Model
IG: pp. 146, 149, 155, 156 164, 165, 167,168 (Step 17), 187, 251 (Step 15)
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)

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

Evidence Outcomes Cont'd

b. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (MS-PS2-4)

[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: 88, 91, 127 (Step 2), 128, 129, 145, 149, 161, 185, 188 (Step 24), 195, 290-291
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. 374, 377, 408, 409, 411 (Step 14), 415, 417 (I), 420, 542, 569
EA: *Performance Assessment,* IG p. 409 (Step 13)
EA: *Review Notebook Entries,* IG p. 420 (Step 22)

c. 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. (MS-PS2-5)

[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. 146, 149, 155, 164, 165, 187, 189
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)

Colorado Essential Skills and Science and Engineering Practices

1. Asking Questions and Defining Problems

- 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.

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

2. Engaging in Argument from Evidence

- 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.

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

3. Planning and Carrying Out Investigations

- 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.

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

4. Connections to the Nature of Science

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

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

Elaboration on the GLE

1. 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. 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. 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).

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"

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

Cross Cutting Concepts

1. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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

2. 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.

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

Middle School, Standard 1. Physical Science

SC.MS.1.5

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how energy is transferred and conserved.

Grade Level Expectation:

Kinetic energy can be distinguished from the various forms of potential 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.

Evidence Outcomes

a. 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. (MS-PS3-1)
[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. 206, 214-215, 216 (Step 7), 232 (Step 2), 234-237 (Steps 8-13), 254, 291*
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)

Evidence Outcomes Cont'd

b. 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. (MS-PS3-2)

[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.] [Boundary Statement: Limited to two objects and electric, magnetic, and gravitational interactions.]

FOSS Electromagnetic Force
IG: pp. 181 (Step 2), 186, 187 (Step 21), 215, 216, 217, 220, 221, 222
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. 206, 214, 215 (Step 5), 218, 209, 254
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)

c. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-PS3-3)

[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..*364, 365, 370, 373, 385 (Step 18), 398 (Step 16), 418*
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)

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

Evidence Outcomes Cont'd

d. 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. (MS-PS3-4)
[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.] [Boundary Statement: Does not include calculating the total amount of thermal energy transferred.]

FOSS Weather and Water
IG: p. *297, 299, 308, 311, 346-347 (Step 1), 357*
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)

e. 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. (MS-PS3-5)
[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.] [Boundary Statement: Does not include calculations of energy.]

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

Colorado Essential Skills and Science and Engineering Practices

1. Analyzing and Interpreting Data

- Construct and interpret graphical displays of data to identify linear and nonlinear relationships.

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

2. Planning and Carrying Out Investigations

- 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.

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

3. Constructing Explanations and Designing Solutions

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

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

4. Engaging in Argument from Evidence

- 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.

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

5. Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

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

Elaboration on the GLE

1. 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. A system of objects may also contain stored (potential) energy, depending on their relative positions. 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. 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.

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*

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 Weather and Water
IG: *pp. 297, 299, 308, 311, 346-347 (Step 1), 357, 364, 365, 370, 373, 385 (Step 18), 398 (Step 16), 418*
DOR: *"Thermometer", "Particles in Solids, Liquids, and Gases"*
SRB: *pp. 59-63*

Cross Cutting Concepts

1. 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.

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

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

2. Energy and Matter

- The transfer of energy can be tracked as energy flows through a designed or natural system. Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion)

FOSS Weather and Water
IG: pp. 310, 337, 350, 353, 357, 372, 382, 385, 392, 393, 405, 406
TR: pp. D17, D36-D37

Middle School, Standard 1. Physical Science

SC.MS.1.6

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how energy is transferred and conserved.

Grade Level Expectation:

Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states and amounts of matter.

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.

Evidence Outcomes

a. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-PS3-3)
[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..*364, 365, 370, 373, 385 (Step 18), 398 (Step 16), 418*
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)

b. 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. (MS-PS3-4)
[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.] [Boundary Statement: Does not include calculating the total amount of thermal energy transferred.]

FOSS Weather and Water
IG: p. *297, 299, 308, 311, 346-347 (Step 1), 357*
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)

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

Evidence Outcomes Cont'd

c. 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. (MS-PS3-5)
[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.] [Boundary Statement: Does not include calculations of energy.]

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

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

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

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

2. Planning and Carrying Out Investigations

- 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.

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

3. Engaging in Argument from Evidence

- 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.

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

Colorado Essential Skills and Science and Engineering Practices Cont'd

4. Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

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

Elaboration on the GLE

1. 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. 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. Energy is spontaneously transferred out of hotter regions or objects and into colder ones.

FOSS Weather and Water
***IG:** pp. 297, 299, 306-307, 308, 311, 335 (Step 17), 350,* 352-354 (Steps 13-15), *357, 361, 363, 370, 373,* 378-379 (Step 1), 381-383 (Steps 9-14)*, 408, 418*
***DOR:** "Energy Transfer: Conduction, Radiation, Convection"*

Cross Cutting Concepts

1. Energy and Matter

- The transfer of energy can be tracked as energy flows through a designed or natural system. Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion)

FOSS Weather and Water
IG: pp. 310, 337, 350, 353, 357, 372, 382, 385, 392, 393, 405, 406
TR: pp. D17, D36-D37

2. 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.

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

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

Middle School, Standard 1. Physical Science

SC.MS.1.7

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how energy is transferred and conserved.

Grade Level Expectation:

When two objects interact, each one exerts a force on the other that can cause energy to be transferred to and from the object.

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.

Evidence Outcomes

a. 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. (MS-PS3-2)
[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.] [Boundary Statement: Limited to two objects and electric, magnetic, and gravitational interactions.]

FOSS Electromagnetic Force
IG: pp. 181 (Step 2), 186, 187 (Step 21), 215, 216, 217, 220, 221, 222
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. 206, 214, 215 (Step 5), 218, 209, 254
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)

Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Construct and interpret graphical displays of data to identify linear and nonlinear relationships.

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

Elaboration on the GLE

1. 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.

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

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

Cross Cutting Concepts

1. 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.

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

Middle School, Standard 1. Physical Science

SC.MS.1.8

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how waves are used to transfer energy and information

Grade Level Expectation:

A simple wave model has a repeating pattern with specific wavelength, frequency, and amplitude and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena which include light and sound.

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.

Evidence Outcomes

a. 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. (MS-PS4-1)
[Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Boundary Statement: Does not include electromagnetic waves and is limited to standard repeating waves.]

FOSS Waves
IG: pp. 86, 89, 103 (Step 4), 105 (Step 10), 106-107, 122, 125, 130, 131,132, 138, 172 (Step 25), 173
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)

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

Evidence Outcomes Cont'd

b. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (MS-PS4-2)
[Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Boundary Statement: Limited to qualitative applications pertaining to light and mechanical waves.]

FOSS Waves
IG: pp. pp. 122, 129, 161,162, 168, 169, 173, 177, 186, 189, 193, 194, 196, 197, 198, 205, 206, 208, 211-213, 226, 227, 238, 239
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. 498, 501, 507, 508, 509, 510, 511, 512, 513 (Step 14), 528
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Using Mathematics and Computational Thinking

- Use mathematical representations to describe and/or support scientific conclusions and design solutions.

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

2. Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations.

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

Elaboration on the GLE

1. PS4.A: Wave Properties

A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. A sound wave needs a medium through which it is transmitted. Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet.

FOSS Waves
IG: pp. 86, 89, 103 (Step 4), 105 (Step 10), 106-107, 122, 125, 129, 130, 131,132, 138, 161,162, 168, 169, 172 (Step 25), 173
SRB: pp. 4-6, 8-9, 17-20
DOR: *Standing Wave*
Big Waves
"Oscilloscope"

Crosscutting Concepts

1. Patterns

- Graphs and charts can be used to identify patterns in data.

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

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

Middle School, Standard 1. Physical Science

SC.MS.1.9

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how waves are used to transfer energy and information

Grade Level Expectation:

A wave model of light is useful to explain how light interacts with objects through a variety of properties.

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.

Evidence Outcomes

a. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (MS-PS4-2)
[Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Boundary Statement: Limited to qualitative applications pertaining to light and mechanical waves.]

FOSS Waves
IG: pp. pp. 122, 129, 161,162, 168, 169, 173, 177, 186, 189, 193, 194, 196, 197, 198, 205, 206, 208, 211-213, 226, 227, 238, 239
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. 498, 501, 507, 508, 509, 510, 511, 512, 513 (Step 14), 528
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Develop and use a model to describe phenomena.

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

Elaboration on the GLE

1. 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. 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. A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or water waves.

FOSS Waves
IG: pp. 177, 186, 189, 193, 194, 196, 197, 198, 205, 206, 208, 211-213, 226, 227, 238, 239
SRB: pp. 32-41
SNM: Nos. 7, 18, 20
TM: Q
DOR: *"Refraction"*

FOSS Planetary Science
IG: pp. 498, 501, 507, 508, 509, 510, 511, 512, 513 (Step 14), 528
SRB: pp. 105-109
DOR: *"Properties of Light Slideshow" "Comparing Spectra" Hubble's Amazing Universe*

Cross Cutting Concepts

1. 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.

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

Middle School, Standard 1. Physical Science

SC.MS.1.10

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how waves are used to transfer energy and information.

Grade Level Expectation:

Designed technologies can transmit digital information as wave pulses.

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.

Evidence Outcomes

a. 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. (MS-PS4-3)
[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.] [Boundary Statement: Does not include binary counting or the specific mechanism of any given device.]

FOSS Waves
IG: pp. 256, 259, 265 (Step 10), 276, 280, 282, 284-289, 293
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)

Colorado Essential Skills and Science and Engineering Practices

1. Obtaining, Evaluating, and Communicating Information
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings.

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

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

Elaboration on the GLE

1. PS4.C: Information Technologies and Instrumentation

Appropriately designed technologies (e.g., radio, television, cellphones, wired and wireless computer networks) make it possible to detect and interpret many types of signals that cannot be sensed directly. Designers of such devices must understand both the signal and its interactions with matter. Many modern communication devices use digitized signals (sent as waves) as a more reliable way to encode and transmit information.

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"*

Cross Cutting Concepts

1. Structure and Function

- Structures can be designed to serve particular functions.

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

2. Influence of Science, Engineering, and Technology on Society and the Natural World

- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations.

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

3. Connections to the Nature of Science

- Advances in technology influence the progress of science and science has influenced advances in technology.

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

Middle School, Standard 2. Life Science

SC.MS.2.1

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

All living things are made up of cells, which is the smallest unit that can be said to be alive.

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.

Evidence Outcomes

a. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. (MS-LS1-1)
[Clarification Statement: Emphasis is on developing evidence that living things 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.

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)
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)

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

Evidence Outcomes Cont'd

b. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. (MS-LS1-2)

[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.] [Boundary Statement: 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. Does not include the biochemical function of cells or cell parts.]

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)
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)

c. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3)

[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.] [Boundary Statement: Does not include the mechanism of one body system independent of others. Limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

FOSS Human Systems Interactions

IG: pp. 80, 71, 73, 83, 89-92 (Steps 6-8), 123, 134 (Step 15), 166, 169, 173 (Step 1)
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)

Colorado Essential Skills and Science and Engineering Practices

1. Planning and Carrying Out Investigations

- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.

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

2. Developing and Using Models

- Develop and use a model to describe phenomena.

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

3. Engaging in Argument from Evidence

- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon.
- Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an exploration or a model for a phenomenon or a solution to a problem.

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

Elaboration on the GLE

1. 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).

FOSS Diversity of Life
IG: pp. 207, 209, 211, 212-215, 218, 219, 223, 228 (Step 6), 230 (Step 6), 231, ,232-233 (Steps 12-14), 234 (Step 16), 245 (Step 14), 247 (Step 18), 266 (Step 8), 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
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"

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"

Cross Cutting Concepts

1. Scale, Proportion, and Quantity

- Phenomena that can be observed at one scale may not be observable at another scale.

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

2. 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

3. Systems and System Models

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.

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

Middle School, Standard 2. Life Science

SC.MS.2.2

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.

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.

Evidence Outcomes

a. 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. (MS-LS1-4)

[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. 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)
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)

b. Construct a scientific based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LS1-5)

[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.] [Boundary Statement: Does not include genetic mechanisms, gene regulation, or biochemical processes.]

FOSS Diversity of Life
IG: pp. *435, 437, 441-442, 446-447, 451, 468-467 (Steps 2-3), 472-473 (Step 13)*
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)

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EA: Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

Colorado Essential Skills and Science and Engineering Practices

1. Engaging in Argument from Evidence

- 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.

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

2. Constructing Explanations and Designing Solutions

- 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.

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

Elaboration on the GLE

1. LS1.B: Growth and Development of Organisms

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. Genetic factors as well as local conditions affect the growth of the adult plant.

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. 58-61, 62-64, 65-72, 81-89, 122-125, 126-133
SNM: Nos. 47, 48, 51-53, 55-56, 62, 63
DOR: *Slide Show:*
Non-flowering Plants
"Database: Pollinator Collection"
"Pollinators Game"

Cross Cutting Concepts

1. 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. 448, 472, 473, 501, 565, 578-579, 580, 590
TR: pp. D11, D14-D15, D24-D29

Middle School, Standard 2. Life Science

SC.MS.2.3

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

Sustaining life requires substantial energy and matter inputs.

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.

Evidence Outcomes

a. 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. (MS-LS1-6)
[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. 350, 373 (Steps 6 and 7), 374, 378 (D), 381 (H), 385 (Step 1)
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)

b. 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. (MS-LS1-7)
[Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Boundary Statement: Does not include details of the chemical reactions for photosynthesis or respiration.]

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

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EA: Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

- 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.

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

2. Developing and using models

- Develop a model to describe unobservable mechanisms.

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

Elaboration on the GLE

1. 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. 337, 350, 353, 373 (Steps 6 and 7), 374, 378 (D), 381 (H), 385 (Step 1), 395 (Step 3), 396-397 (Step 10), 402 (Steps 27 and 28)
SNM: Nos.13, 19
SRB: pp. 51-55, 56-61

2. 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. 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.

FOSS Populations and Ecosystems Module
IG: pp. 337, 350, 353, 363 (Steps 12 and 13), 364 (Steps 15 and 16), 366 (Step 21), 372-374 (Steps 5-7), 381 (H), 397 (Step 10), 402 (Step 27 and 28), 425 (Step 2)
SRB: pp. 51-55, 56-61

Cross Cutting Concepts

1. Energy and Matter

- Within a natural system, the transfer of energy drives the motion and/or cycling of matter.

FOSS Populations and Ecosystems
IG: pp. 337, 352, 361, 373, 374, 395, 397, 398, 400, 404
TR: pp. D12-D13, D17, D38-D434

Middle School, Standard 2. Life Science

SC.MS.2.4

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how individual organisms are configured and how these structures function to support life, growth, behavior and reproduction.

Grade Level Expectation:

Each sense receptor responds to a different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain.

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.

Evidence Outcomes

a. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
[Boundary Statement: Does not include mechanisms for the transmission of this information.]

FOSS Human Systems Interactions
IG: 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
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)

Colorado Essential Skills and Science and Engineering Practices

1. Obtaining, Evaluating, and Communicating Information

- 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.

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

2. Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical connections between evidence and explanations.

FOSS Populations and Ecosystems
IG: pp. 360 (Steps 4-5), 364 (Step 14), 373 (Step 6)

Elaboration on the GLE

1. 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.

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"*

Cross Cutting Concepts

1. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems.

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

2. 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.

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*

3. 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.

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

Middle School, Standard 2. Life Science

SC.MS.2.5

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

Organisms and populations or organisms are dependent on their environmental interactions both with other living things and with nonliving.

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.

Evidence Outcomes

a. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1)
[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. 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)
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)

b. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (MS-LS2-2)
[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. 242, 262 (Step 2-6), 319, 416, 442 (Step 28) 443 (Step 29-30), 459 (Steps 19-20) 540, 541, 543, 589 (Step 10)*
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Analyzing and Interpreting Data

- Analyze and interpret data to provide evidence for phenomena.

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

2. Constructing Explanations and Designing Solutions

- Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.

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

Elaboration on the GLE

1. 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. 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. Growth of organisms and population increases are limited by access to resources.

FOSS Populations and Ecosystems
IG: pp. *242, 262 (Step 2-6), 319, 416, 442 (Step 28) 443 (Step 29-30), 459 (Steps 19-20),* 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), *589 (Step 10)*
SRB: pp. 87-96, 97-99
SNM: Nos. 9, 34-36, 40
DOR: "Milkweed Bugs: Limited*",* "Milkweed Bugs: Unlimited", "Ecoscenarios"**,** *The Mono Lake Story*

Cross Cutting Concepts

1. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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

2. Patterns

- Patterns can be used to identify cause and effect relationships.

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

3. **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.

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

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

Middle School, Standard 2. Life Science

SC.MS.2.6

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

Ecosystems are sustained by the continuous flow of energy, originating primarily from the sun, and the recycling of matter and nutrients within the 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.

Evidence Outcomes

a. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3)
[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.] [Boundary Statement: Does not include the use of chemical reactions to describe the processes.]

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*
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Developing and using models

- Develop a model to describe phenomena.

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

2. Scientific Knowledge is Based on Empirical Evidence

- Science disciplines share common rules of obtaining and evaluating empirical evidence.

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

Elaboration on the GLE

1. 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.

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”

Cross Cutting Concepts

1. Energy and Matter

- The transfer of energy can be tracked as energy flows through a natural system.

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

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

3. 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.

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

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EA: Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

Middle School, Standard 2. Life Science

SC.MS.2.7

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how living systems interact with the biotic and abiotic environment.

Grade Level Expectation:

Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem.

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.

Evidence Outcomes

a. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4)
[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: 481, 532-533, 540, 541, 543, 547, 557-558, 561, 586, 587 (Step 4), 594-596 (Steps 3-9), 607, 614, 644-646
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

b. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5)
[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: 547, 557, 570 (Step 14), 571-572 (Steps 16-17), 581(I), 582 (Steps 21-22)
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Engaging in Argument from Evidence

- 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. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

FOSS Populations and Ecosystems
IG: pp. 589, 604, 607, 615, 635, 636, 637, 642, 648
TR: pp. C33-C38, C72-C73

2. Scientific Knowledge is Based on Empirical Evidence

- Science disciplines share common rules of obtaining and evaluating empirical evidence.

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

Elaboration on the GLE

1. 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.

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*

Cross Cutting Concepts

1. 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, 560, 571, 586, 588, 589, 595, 598, 604, 616, 635, 636, 637, 642, 648
TR: pp. D19, D44-D45

2. 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.

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

Middle School, Standard 2. Life Science

SC.MS.2.8

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how genetic and environmental factors influence variation of organisms across generations.

Grade Level Expectation:

Heredity explains why offspring resemble, but are not identical to, their parents and is a unifying biological principle. Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes.

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.

Evidence Outcomes

a. 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. (MS-LS3-1)
[Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Boundary Statement: Does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

FOSS Heredity and Adaptation
IG: pp. 150, 153, 181, 186-189, 190, 196, 197, 229, 244, 247, 251, 252, 253, 254, 280, 281, 294, 295
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)

b. 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. (MS-LS3-2)
[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. 505, 507, 508-513, 514, 517, 521-522 (Steps 1-2), 525 (Steps 10-12), 526 (Step 14), 527 (Step 15), 535-536 (Step 5), 530 (Step 22), 549 (Steps 14-15), 550, 551 (Step 17)
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)

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EA: Embedded Assessment • **BM:** Benchmark Assessment • **IA:** Interim Assessment

Colorado Essential Skills and Science and Engineering Practices

1. 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

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

2. Obtaining, Evaluating, and Communicating Information

- 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.

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

Elaboration on the GLE

1. 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.

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"

2. 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.

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

Cross Cutting Concepts

1. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems.

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

2. 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.

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

3. 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.

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

4. 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.

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

Middle School, Standard 2. Life Science

SC.MS.2.9

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past.

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.

Evidence Outcomes

a. 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. (MS-LS4-1)
[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.] [Boundary Statement: Does not include the names of individual species or geological eras in the fossil record.]

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
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)

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

Evidence Outcomes Cont'd

b. 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. (MS-LS4-2)
[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. 84, 87, 119, 124 128, 129, 132, 167-169 (Steps 11-14), 175 (Step 27)
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)

c. 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. (MS-LS4-3)
[Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Boundary Statement: Comparisons are limited to gross appearance of anatomical structures in embryological development.]

FOSS Heredity and Adaptation
IG: pp. 150, 173 (Steps 21-22), 174 (Step 26)
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)

Colorado Essential Skills and Science and Engineering Practices

1. 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.

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

2. Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions to include constructing explanations and designing solutions supported by multiple sources.

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

Elaboration on the GLE

1. 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. I documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully formed anatomy.

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, 150, 173 (Steps 21-22), 174 (Step 26)
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 & "Cladogram*

Cross Cutting Concepts

1. Patterns

- Graphs, charts, and images can be used to identify patterns in data.

FOSS Heredity *and Adaptation*
IG: pp. 86, 98, 118, 132, 174 (Step 23), 175 (Step 28)
SRB: pp. 8-9, 17-21, 73-77
TR: pp. D9, D13, D22-D27

2. 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 Heredity and Adaptation
IG: pp. 86, 98 (Step 11), 152, 98 (Step 11), 169 (Step 14)
SRB: pp. 3-10, 12-14, 20-21, 62-64

Middle School, Standard 2. Life Science

SC.MS.2.10

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

Genetic variation among individuals in a population gives some individuals an advantage in surviving and reproducing in their environment.

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.

Evidence Outcomes

a. 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. (MS-LS4-4)
[Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]

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
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)

Evidence Outcomes Cont'd

b. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. (MS-LS4-5)
[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. 218 (Step 14), 244, 247, 302 (Step 2), 304
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)

c. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS4-6)
[Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Boundary Statement: Does not include Hardy Weinberg calculations.]

FOSS Heredity and Adaptation
IG: pp. 280 (Step 5), 287 (C), 289 (E), 294-29
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)

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.

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

2. Obtaining, Evaluating, and Communicating Information
- 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.

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

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

Elaboration on the GLE

1. LS4.B: Natural Selection

Natural selection leads to the predominance of certain traits in a population, and the suppression of others. 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.

FOSS Heredity and Adaptation
IG: pp. 150, 203, 213 (Step 3), 217 (Step 13), 218 (Step 14), 229, 233, 235, 244, 247, 251 (Step 2), 264 (G), 266 (I), 270 (M), 272 (Step 18), 278 (Step 1), 280 (Step 5), 292 (Step 13), 295, 302 (step 2), 304
SNM: No. 17
DOR: *"A Model for Predicting Genetic Variation" "Larkey Impossible Traits" "Larkey Punnett Squares" "Walking Sticks" "Genetic Technology Resources"*
SRB: pp. 28-32, 40, 49-51, 53-54, 84-88

Cross Cutting Concepts

1. Cause and Effect

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

FOSS Heredity and Adaptation
IG: pp. 152, 214, 217, 222 (C), 229, 246, 253, 255, 267 (J), 269 (L), 271, 272, 280, 292, 294-296, 303 (Step 3), 304
SRB: pp. 33-35, 58-59, 84-88
TR: pp. D10, D14, D22-D31

2. 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.

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

3. 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.

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

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

Middle School, Standard 2. Life Science

SC.MS.2.11

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions.

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.

Evidence Outcomes

a. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS4-6)

[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. 280 (Step 5), 287 (C), 289 (E), 294-296

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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Using Mathematics and Computational Thinking

- Use mathematical representations to support scientific conclusions and design solutions. 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.

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

Elaboration on the GLE

1. 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.

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

Cross Cutting Concepts

1. Cause and Effect

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

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

2. 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 Heredity and Adaptation
IG: pp. 86, 98 (Step 11), 152, 98 (Step 11), 169 (Step 14)
SRB: pp. 3-10, 12-14, 20-21, 62-64

Middle School, Standard 2. Life Science

SC.MS.2.12

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how natural selection drives biological evolution accounting for the unity and diversity of organisms.

Grade Level Expectation:

Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems.

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.

Evidence Outcomes

a. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS4-5)
[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: *557-558, 594-595, 596 (Step 9), 604, 607, 614, 623 (Step 2), 624, 642*
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)

Colorado Essential Skills and Science and Engineering Practices

1. Engaging in Argument from Evidence

- 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. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

FOSS Populations and Ecosystems
IG: pp. 589, 604, 607, 615, 635, 636, 637, 642, 648
TR: pp. C33-C38, C72-C73

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

Elaboration on the GLE

1. 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.

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*

Cross Cutting Concepts

1. Patterns

- Graphs, charts, and images can be used to identify patterns in data.

FOSS Heredity and Adaptation
IG: pp. 86, 98, 118, 132, 174 (Step 23), 175 (Step 28)
SRB: pp. 8-9, 17-21, 73-77
TR: pp. D9, D13, D22-D27

2. Energy and Matter

- The transfer of energy can be tracked as energy flows through a natural system.

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

3. 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.

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*

4. 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 Heredity and Adaptation
IG: pp. 86, 98 (Step 11), 152, 98 (Step 11), 169 (Step 14)
SRB: pp. 3-10, 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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.1

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how the universe and Earth's place in it.

Grade Level Expectation:

Motion is predictable in both solar systems and galaxies.

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.

Evidence Outcomes

a. 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. (MS-ESS1-1)
[Clarification Statement: Examples of models can be physical, graphical, or conceptual.]

FOSS Planetary Science
IG: pp. *146 (Step 6), 166, 175, 176, 274, 277, 281, 283, 289, 302 (Step 1)*
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)

b. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2)
[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).] [Boundary Statement: 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. 365, 374, 377, 386 (Step 13), 397-400, 404 (Step 1), 408,420
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Develop and use a model to describe phenomena.

FOSS Planetary Science
IG: pp. 167, 175, 188, 191, 204, 214 (D), 220, 275, 284, 285, 286, 287, 288, 295, 296, 400, 405, 414, 420, 437, 444, 445, 447, 448
SRB: pp. 11, 12, 23, 26, 82, 135
TR: pp. C14-C17, C46-C51

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

Elaboration on the GLE

1. 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. Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.

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"

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"

Cross Cutting Concepts

1. Patterns

- Patterns can be used to identify cause-and-effect relationships.

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

2. 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

3. 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, 384-385 (Steps 10-11), 408-409
SRB: pp. 10-12, 23-25, 40-41, 80-82

Middle School, Standard 3. Earth and Space Science

SC.MS.3.2

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how the universe and Earth's place in it.

Grade Level Expectation:

The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons.

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.

Evidence Outcomes

a. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2)
[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).] [Boundary Statement: 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. 365, 374, 377, 386 (Step 13), 397-400, 404 (Step 1), 408,420
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. 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
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)

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

Evidence Outcomes Cont'd

b. Analyze and interpret data to determine scale properties of objects in the solar system. (MS-ESS-1-3)

[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.] [Boundary Statement: Does not include recalling facts about properties of the planets and other solar system bodies.]

FOSS Planetary Science
IG: pp. 234, 237, 257, 260, 423, 425, 436, 439, 444, 445 (Step 3), 446, 448
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)

c. 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. (MS-ESS1-1)

[Clarification Statement: Examples of models can be physical, graphical, or conceptual.]

FOSS Planetary Science
IG: pp. *146 (Step 6), 166, 175, 176, 274, 277, 281, 283, 289, 302 (Step 1)*
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)

Colorado Essential Skills and +and Engineering Practices

1. Developing and Using Models

- Develop and use a model to describe phenomena.

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

2. Analyzing and Interpreting Data

- Analyze and interpret data to determine similarities and differences in findings.

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

Elaboration on the GLE

1. 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. 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. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.

FOSS Planetary Science
IG: pp. 153, 166, 169, 185-220, 189 (Step 9), 190, 191, 192, 193, 203, 210 (Step 26), 211, 220, 234, 237, 257, 260, 288, 306, 374, 377, 381, 389 (E), 400 (Step 16), 405, 408-409, 411 (Step 14), 415 (F), 417 (I), 418, 420, 423, 424, 436, 439, 445, 446-448
SRB: pp. 15-21, 45-48, 69-71, 82-85, 86-96, 134-135
SNM: Nos. 7-13, 45-46
DOR: *"Community Scale Model"*
"Tides" *"Seasons"*
"Day and Night"

FOSS Gravity and Kinetic Energy
IG: pp. 151, 158, 161, 179, 180, 188, 195
SRB: pp. 31-36

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

Cross Cutting Concepts

1. Patterns
- Patterns can be used to identify cause-and-effect relationships.

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

2. Scale
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

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

3. Modeling
- Models can be used to represent systems and their interactions.

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

4. 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.

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

5. 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. 384-385 (Steps 10-11), 408-409
SRB: pp. 80-82

Middle School, Standard 3. Earth and Space Science

SC.MS.3.3

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

Rock strata and the fossils record can be used as evidence to organize the relative occurrence of major historical events in Earth's history.

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.

Evidence Outcomes

a. 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. (MS-ESS1-4)
[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.] [Boundary Statement: Does not include recalling the names of specific periods or epochs and events within them.]

FOSS Heredity and Adaptation
IG: pp. pp. 84, 87, 95 (Steps 7, 8), 98, 99, 101, 104, 105
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)

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

- 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.

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

Elaboration on the GLE

1. 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.

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"*

Cross Cutting Concepts

1. 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.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.4

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these 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.

Evidence Outcomes

a. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1)
[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.] [Boundary Statement: Does not include the identification and naming of minerals.]

FOSS Earth History
IG: *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*
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)

b. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2)
[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. *179, 245, 299, 302,493 (Step 11), 521, 523, 534, 565 (Steps 30-31)*
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)

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

Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Develop and use a model to describe phenomena.

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

Elaboration on the GLE

1. 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. 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.

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, 36-39, 81-92*
***DOR:** Earth's Interior, Convection Tank, Animations: Sandstone Formation, Shale Formation, Limestone Formation, "Rock Column Movie Maker", Mountain Types Slideshow, Folding, Fault Type: Convergent Boundary, Divergent Boundary, Transform Boundary*

Cross Cutting Concepts

1. 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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.5

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history.

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.

Evidence Outcomes

a. 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).] [Boundary Statement: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

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)*
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)

Colorado Essential Skills and Science and Engineering Practices

1. Analyzing and Interpreting Data

- Analyze and interpret data to provide evidence for phenomena.

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

2. Connections to Nature of Science

- Science findings are frequently revised and/or reinterpreted based on new evidence.

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

Elaboration on the GLE

1. 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.

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

Cross Cutting Concepts

1. Patterns

- Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.6

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variation of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features.

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.

Evidence Outcomes

a. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2)
[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. *165, 183, 196 (Step 15), 201 (Step 25), 211, 215, 302, 657*
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)

b. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (MS-ESS2-4)
[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.] [Boundary Statement: Does not include a quantitative understanding of the latent heats of vaporization and fusion.]

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
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)

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

Evidence Outcomes Cont'd

c. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. (MS-ESS2-5)
[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).] [Boundary Statement: 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. 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
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)

d. 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. (MS-ESS2-6)
[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.] [Boundary Statement: Does not include the dynamics of the Coriolis effect.]

FOSS Weather and Water
IG: pp. 233, 237-238, 238-241, 242, 245, 261 (Step 25), 273 (Step 17), 291 (Step 9), 309
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)

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

- 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.

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

2. Developing and Using Models

- Develop a model to describe unobservable mechanisms.

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

3. Connections to Nature of Science

- Science findings are frequently revised and/or reinterpreted based on new evidence.

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

Elaboration on the GLE

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

- 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. Water's movements – both on the land and underground – cause weathering and erosion, which change the land's surface and creates underground formations. Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. Global movements of water and its changes in form are propelled by sunlight and gravity. 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. Water 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. Because these patterns are so complex, weather can only be predicted probabilistically. 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.

FOSS Weather and Water
IG: pp. 183, 185, 189-190, 193, 197, 206 (Step 11), 223-225 (Steps 4-7), 228, 233, 237-238, 238-241, 242, 245, 261 (Step 25), 273 (Step 17), 291 (Step 9), 309, 421, 423, 425-429, 430, 433, 453-454 (Steps 7-8), 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, 659, 661, 666, 669, 673 (Step 1), 676 (Step 8), 680

SNM: Nos. 7-10, 13, 20, 38, 39, 42, 44, 50
SRB: pp. 41-46, 47-50, 51-52, 76-84, 91-95, 122-123, 124-125
DOR: "Water Cycle" & "Weather Maps" & *Fluid Convection*

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

Cross Cutting Concepts

1. 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.

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

2. Energy and Matter

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.7

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how and why Earth is constantly changing.

Grade Level Expectation:

Complex interactions determine local weather patterns and influence climate, including the role of the ocean.

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.

Evidence Outcomes

a. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. (MS-ESS2-5)

[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).] [Boundary Statement: 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. 183, 185, 193, 197, 226-227 (Step 11), 228, 659, 661, 666, 669, 680 (Step 23), 681-682 (Steps 25-27

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)

b. 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. (MS-ESS2-6)

[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.] [Boundary Statement: Does not include the dynamics of the Coriolis effect.]

FOSS Weather and Water

IG: pp. 297, 299, 300-307, 308, 311, 320 (Step 13), 328 (Step 3), 352 (Step 13), 319, 357, 533, 535, 541-543, 569 (Step 1), 580 (Step 9), 589 (Step 10)

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)

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Colorado Essential Skills and Science and Engineering Practices

1. Developing and Using Models

- Develop and use a model to describe phenomena.

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

2. Planning and Carrying Out Investigations

- 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.

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

Elaboration on the GLE

1. ESS2.D: Weather and Climate

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. 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. Because these patterns are so complex, weather can only be predicted probabilistically. The ocean exerts a major influence on weather and climate by absorbing energy from the fun, releasing it over time, and globally redistributing it through oceans.

FOSS Weather and Water
IG: pp. 116-117, 120-121, 183, 185, 193, 197, 226-227 (Step 11), 228, 297, 299, 300-307, 308, 311, 320 (Step 13), 328 (Step 3), 352 (Step 13), 319, 357, 533, 535, 541-543, 569 (Step 1), 580 (Step 9), 589 (Step 10), 659, 661, 666, 669, 680 (Step 23), 681-682 (Steps 25-27)
SRB: pp. 96-102, 103-104
DOR: *Perpetual Ocean*

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

Cross Cutting Concepts

1. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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

2. 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.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.8
Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's processes interact.

Grade Level Expectation:

Humans depend on Earth's land, ocean, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic 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.

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

- 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.

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

Elaboration on the GLE

1. 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.

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

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

Cross Cutting Concepts

1. Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.9
Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's processes interact.

Grade Level Expectation:
Mapping the history of natural hazards in a region and understanding related geological forces.

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.

Evidence Outcomes

a. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2)
[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. 470, 479-482, 485, 486-487 (Step 26) 491- 494, 517, 550 (Step 12), 565
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)

Colorado Essential Skills and Science and Engineering Practices

1. 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

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

Elaboration on the GLW

1. 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.

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

Cross Cutting Concepts

1. 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

2. 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.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.10
Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's processes interact.

Grade Level Expectation:

Human activities have altered the biosphere, sometimes damaging it, although changes to environments can have different impacts for different living things.

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.

Evidence Outcomes

a. 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. *597, 604, 605-609, 610-611, 613, 629-630 (Step 7), 649, 656*
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)

Evidence Outcomes Cont'd

b. 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. 436, 439, 473-488, 473, 474, 475, 476 (Step 13), 477, 478, 480 (B), 481 (D), 485 (L), 486 (N), 487, 488
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. 259, 266, 285 (Step 2), 288, 289, 291 (Steps 16-17), 292 (Step 22)
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)

Colorado Essential Skills and Science and Engineering Practices

1. Constructing Explanations and Designing Solutions

- Apply scientific principles to design an object, tool, process or system.

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

2. Engaging in Argument from Evidence

- 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.

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

Elaboration on the GLE

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. 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.

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*

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

1. Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. Cause and effect relationships may be used to predict phenomena in natural or designed systems.

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

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

2. 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.

FOSS Planetary Science
IG: pp. 438, 473 (Steps 4-5), 474-475 (Steps 8-9), 476, (Step 12), 478 (Step 17)
SRB: pp. 97-104

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

3. 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.

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

Middle School, Standard 3. Earth and Space Science

SC.MS.3.11

Prepared Graduates:

Students can use the full range of science and engineering practices to make sense of natural phenomena and solve problems that require understanding how human activities and the Earth's processes interact.

Grade Level Expectation:

Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social 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.

Evidence Outcomes

a. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (MS-ESS3-5)
[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. *597, 599, 600-609, 610-611, 613, 619 (Step 11), 627 (Step 3), 652 (Step 12), 655, 656*
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)

Colorado Essential Skills and Science and Engineering Practices

1. Asking Questions and Defining Problems
- Ask questions to identify and clarify evidence of an argument.

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

Elaboration on the GLE

1. 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.

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"

Cross Cutting Concepts

1. Stability and Change

- Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

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

FOSS and Colorado Essential Skills:

Every child comes to school with unique experiences, cultural and linguistic backgrounds, and a range of cognitive and physical attributes. To access and leverage students' strengths, FOSS contains evidence-based, student talk supports that facilitate science learning for all. The talk structures and learning strategies embedded in FOSS ensure that students are effective communicators with their peers and adults. Additionally, the FOSS instructional design also supports students in explaining local and relevant phenomena as well as designing solutions to local problems. In this way, FOSS is empowering students to address the challenges of tomorrow in their communities. In addition to hitting all your standards for science, you can be sure that FOSS is also building the Colorado Essential Skills for all students.

Colorado Academic Skill	Evidence
Communicator	
Media Literacy	Opportunities for students to conduct research, validate sources, and report findings ethically can be found throughout FOSS modules. Students develop these skills through informal research opportunities during each investigation (hands-on activities, reading informational text, viewing videos, and writing evidence-based conclusions in notebooks). More formal research projects extend and apply content knowledge beyond classroom models. For example, see • ***Earth History* Investigation Guide**, Investigation 8. Geoscenarios, Part 2. Research and Writing, Student Resources Book Multimedia
Digital Literacy	Technology tools are used as an extension of first-hand experiences to support students in gathering information and evidence to justify solutions and to individualize instruction. Digital resources include interactive student eBooks, Streaming Videos, Multimedia Activities and Virtual Investigations. In the Investigation Guide, teachers are directed to the variety of technology tools at the point-of-use. Enter **FOSSWEB on ThinkLink** using the username and password for grade seven science http://thinklink.schoolspecialty.com/login View ***Gravity and Kinetic Energy.*** Scroll to *Interactive Student eBook* **Virtual Investigations** Virtual investigations recreate activities that students have had first-hand experience in class. A virtual investigation can be used to supplement instruction for students who have missed an in-class activity or in some cases, can be used to expand what has been experienced in class. Students are required to use their science notebooks to investigate specific focus questions similar to the first-hand experience. Enter **FOSSWEB on ThinkLink**

	http://thinklink.schoolspecialty.com/login View the ***Earth History*** module/course. Scroll to *Module Resources> Teaching Resources> Multimedia Activities and Videos* **Remote Learning** To see digital resources for virtual teaching/learning Enter **FOSSWEB on ThinkLink** http://thinklink.schoolspecialty.com/login View the ***Earth History*** module/course. Scroll to *Module Resources> Teaching Resources>Remote Learning Resources>Videos of Hands-On Experiences* At the same *Remote Learning Resources* site, see also *FOSS and Google Classroom*
Data Literacy	FOSS provides frequent opportunities for students to develop and apply data literacy. During and after an investigation, students record observations and organize data in grade-appropriate tables, graphs and charts in their notebooks. For other investigations, they create diagrams and models in their notebooks to record and make sense of their observations. The student-generated recorded visual information is then utilized in small and large group sense-making discussions to interpret and make meaning of the collected data. See ***Electromagnetic Force* Investigations Guide**, Investigation 1, Part 1 (students complete a data table) See ***Gravity and Kinetic Energy*** Investigation 1, Part 1 (students complete a data table then generate a graph) Students have opportunities to interpret visual information when active investigation is followed by reading in the student ***Science Resource*** Book. For example, students have multiple opportunities to engage with visual expressions of information in the ***Earth History*** student ***Science Resources*** book: • Diagrams -*Earth's Dynamic Systems* • 2-D Model- *Minerals, Crystals, and Rocks* • Bar Graph-*Geoscenario Introduction: Oil* • Data Table- *Getting to Know the Grand Canyon*
Interpersonal Communication	All investigations provide opportunities for student collaboration as a whole class, small group, or pairs to manage science equipment, plan and conduct investigations, organize and record observations and data, discuss science core ideas and practices, and reflect on learning. The FOSS equipment kits provide enough materials for 32 students working in pairs or groups of four students to conduct investigations. Collaboration roles are used to effectively and efficiently develop a community of science learners. ***Earth History* Investigation Guide**, Overview Tab-*Working in Collaborative Groups*

	Collaborative roles, such as Getter, Starter, and Recorder, are written into the investigation procedures to help teachers manage the class and to help students understand their role in the lesson. **Examples of Collaborative Investigation** • ***Earth History,* Investigation Guide**, Investigation 5. Igneous Rock, Part 2. Salol **Examples of Collaborative Reflection** *Wrap-up* procedures at the conclusion of every part of an investigation for 2nd Edition titles provide students with the opportunity to discuss the focus question, share their answers and ideas, and add new information about what they learned from reading and discussion. For example, see ***Earth History* Investigation Guide**, Investigation 1. Earth is Rock, Part 3. Correlating Grand Canyon Rocks
Problem Solver	
Critical Thinking and Analysis	All investigations provide opportunities for student collaboration as a whole class, small group, or pairs to manage science equipment, plan and conduct investigations, organize and record observations and data, discuss science core ideas and practices, and reflect on learning. The FOSS equipment kits provide enough materials for 32 students working in pairs or groups of four students to conduct investigations. Collaboration roles are used to effectively and efficiently develop a community of science learners. ***Earth History* Investigation Guide**, Overview Tab-*Working in Collaborative Groups* Collaborative roles, such as Getter, Starter, and Recorder, are written into the investigation procedures to help teachers manage the class and to help students understand their role in the lesson. **Examples of Collaborative Investigation** • ***Earth History,* Investigation Guide**, Investigation 5. Igneous Rock, Part 2. Salol **Examples of Collaborative Reflection** *Wrap-up* procedures at the conclusion of every part of an investigation for 2nd Edition titles provide students with the opportunity to discuss the focus question, share their answers and ideas, and add new information about what they learned from reading and discussion. For example, see ***Earth History* Investigation Guide**, Investigation 1. Earth is Rock, Part 3. Correlating Grand Canyon Rocks
Collaboration and Teamwork	Throughout all investigations, groups or pairs of students work cooperatively to plan and/or conduct investigations All investigations provide opportunities for student collaboration as a whole class, small group, or pairs to manage science equipment, plan and conduct investigations, organize and record observations and data, discuss science core ideas and practices, and reflect on learning. Primary students usually work together independently, but sometimes they will share materials and equipment and make observations together. Students are expected to work cooperatively to make observations and have discussions about the materials/hands-on activity.

	Program Resources Collaboration roles for group work are outlined in each FOSS **Investigation Guide**, Overview Tab, *Managing the Classroom.*
Creativity and Innovation	The FOSS instructional design aligns to the Universal Design for Learning Principles and is organized through a systematic learning cycle model that leverages students' creativity and divergent thinking. The instructional design provides opportunities to address a variety of learning modalities in each FOSS investigation. They include • Hands-on activities/investigations (concrete/kinesthetic experience) • Drawing illustrations in notebook and viewing virtual simulations, videos, and photographs (representational/visual experience) • Listening and speaking discourse routines/discussion (auditory/verbal experience) • Reading and writing about science (abstract experience) For more detail see ***Chemical Interactions* Investigations Guide**, Overview, Instructional Design; Differentiating Instruction.
Adaptability and Flexibility	Each part of an investigation is driven by a focus question in which students set out on an active learning inquiry in which they gather evidence to answer the focus question. Students gather evidence through hands-on activities, discourse, interactive multimedia simulations, videos, and text. Sometimes, the evidence results in a single solution, while other times, students and or groups of students may offer unique solutions to the focus question. The FOSS Focus Question for each part of an investigation is embedded into the procedures of the lesson and is highlighted for the teacher in red font. For example, see • ***Chemical Interactions* Investigations Guide**, Investigation 1 - Substances, Part 1. Mystery Mixture • ***Human Systems Interactions,* Investigations Guide**, Investigation 2 - Supporting Cells, Part 1. Food and Oxygen • ***Heredity and Adaptations,* Investigations Guide**, Investigation 2 - Heredity, Part 1. Lines of Descent
Community Member	
Civic Engagement	FOSS modules are designed to tell a story about something relevant in the student's life. This requires the connection of multiple scientific phenomena. In addition, each FOSS Middle School Investigation supports teachers with a section titled **"Why Do I Have to Learn This?"** This section focuses on the concerns and perceptions of middle school student: How is it relevant? What might they think? Insights from the field trials of each investigation are shared in this brief but revealing discussion that embeds a unique piece of professional development for teachers. Through the ***Chemical Interactions*** course storyline, students begin to understand that Chemistry is the scientific inquiry into properties, composition, and interaction of matter and the global issue that could occur as a result. **Investigation 1** touches on two cornerstone concepts, the concept of substance and the understanding of chemical reaction. They deepen their understanding of elements in **Investigation 2** in order to begin to understand the

	structure and behavior of matter as particles and in **Investigation 3** students deepen this understanding by advancing into the atomic theory of matter. Students then turn their attention to the concept of energy-related phenomena in **Investigation 4** where they grapple with the difficult ideas of matter transformation and energy and strengthen their conceptual understanding in **Investigation 5** as they apply their knowledge to meet an engineering challenge in **Investigation 6**. Pursuing melting and freezing in **Investigation 7** provides a foundation and opens the door to the kinetic theory of atoms in order to meet the engineering challenge in **Investigation 8**. They further their understanding in **Investigation 9** in order to grapple, in **Investigation 10** the larger implicit message**,** where they have to consider limiting reactants and their resulting products that are released into the environment, which can create global problems. Specific examples include: ***Chemical Interactions Investigations Guide*** Investigation 6 - Thermos Engineering, Part 1. Insulation, Part 2. Thermos Design ***Chemical Interactions*** Investigation 8 - Phase Change, Part 3. Freezing Water
Global and Cultural Awareness	The instructional materials provide students with an opportunity to connect science concepts to understand the impact of global issues and events through hands-on activities, excursions in the schoolyard, guided research, reading articles, and videos. For example, see ***Chemical Interactions* Investigations Guide,** Investigation 7. Solutions, Part 2. Solubility ***Heredity and Adaptation*** student **Science Resources** book: *The Frog Story* ***Heredity and Adaptation*** student **Science Resources** book: *Mapping the Human Genome*
Social Awareness	The instructional materials provide students an opportunity to discuss their observations, thinking, and solutions to problems. Questions, along with strategies for engaging in argumentation are two features that allow varying viewpoints to be exposed. For example, see • ***Chemical Interactions* Investigations Guide**, Investigation 1 - Substances, Part 1, Mixing Substances, • ***Heredity and Adaptations,* Investigations Guide**, Investigation 2 - Heredity, Part 2. Inheriting Traits
Empowered Individual	
Self-Awareness	A science notebook is a critical feature of every part of every investigation. The science notebook serves as a record of personal learning, exposing student thinking and understand of scientific practices and core ideas. At the

	end of each part of an investigation, students record their answer to the Focus Question with words and illustrations. For example, see ***Planetary Science* Investigation Guide**, Investigation 5. Moon Study, Part 3. Moon Phase Simulation FOSS supports implementation and differentiation of science notebooks with two chapters included in the course ***Teacher Resources***: • ***Science Notebooks in Middle School*** includes additional information on the purpose, set-up, and strategies for science notebooks. ***Science-Centered Language Development in Middle School*** includes information and strategies to provide students with opportunities to articulate thoughts and ideas through oral, written, and multimedia communications.
Self-Management	FOSS Middle School Collaborative Group roles model workplace teams. Teams often split to pairs to maximize access to investigation materials and data. The roles are defined as follows: A Starter manages the group as they proceed through an investigation. They monitor materials, help manage time and ensure group partners are completing appropriate duties. The Getter moves within the classroom to manage materials. A Recorder records and manages data in the active investigation phase. A Reporter is the group spokespersons. It is intended that the group roles are rotated so all students have the opportunity to manage people, projects, time, materials and data to meet a goal
Perseverance and Resilience	FOSS provides students with opportunities to solve problems, try different ideas, and persevere to complete a task. Within the procedures of lessons where students are exploring new concepts or confirming observations teachers challenge students to plan and carry out investigations designed by class consensus or in collaborative groups. For example, see • ***Planetary Science* Investigation Guide**, Investigation 6 Craters, Part 1, Moon Craters
Self-advocacy and Initiative	Throughout all investigations, groups or pairs of students work cooperatively to plan and/or conduct investigations. Collaborative group roles are outlined in each FOSS Middle School **Investigation Guide**, Overview Tab, *Working in Collaborative Groups*. The responsibilities of each role are described in the procedures for each investigation. • ***Planetary Science* Investigation Guide**, Investigation 8. The Solar System, Part 1. Where Are the Planets?
Career Awareness	Students are exposed to science careers through personal research, video and text. For example, see • ***Planetary Science* Investigation Guide**, Investigation 6. Craters, Part 2. Target Earth, Student Resources Book *Target Earth,* Extending the Investigation, Student Resources

	• ***Planetary Science* Investigation Guide**, Investigation 10. Orbits and New Worlds, Part 2. Looking for Planets, • ***Waves* student Science Resources**: *Electromagnetic Radiation and Human Health* • ***Populations and Ecosystems student Science Resources***: *Mono Lake in the Spotlight*