ARKANSAS
K-12 SCIENCE STANDARDS

EDUCATION FOR A NEW GENERATION

Grade 5

2015

Re-aligned Fall 2016 to the Arkansas Mathematics Standards, Arkansas English Language Arts Standards, and Arkansas Disciplinary Literacy Standards

Table of Contents

How to Read
Arkansas K-12 Science Standards

Topic

GRADE TWO

An asterisk indicates an engineering connection to a practice or disciplinary core idea.

Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow. [Assessment Boundary: Assessment is limited to testing one variab...]

2-LS2-2. Develop a simple model that mimics the function o... ...eeds or pollinating plants. *

2-LS4-1. Make observations of plants and animals to compa... ...fferent habitats. [Clarification Statement: Emphasis is on the diversity of living thing... ...ssessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]

Student Performance Expectations (PEs)

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. ▪ Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. ▪ Plan and conduct an investig... collaboratively to produce da... as the basis for evidence to a... question. (2-LS2-1) ▪ Make observations (firsthand or from media) to collect data that can be used to make comparisons. (2-LS4-1) -- **Connections to Nature of Science** **Scientific Knowledge is Based on Empirical Evidence** ▪ Scientists look for patterns and order when making observations about the world. (2-LS4-1)	**LS2.A: Interdependent Relationships in Ecosystems** ▪ Plants depend on water and light to grow. (2-LS2-1) ▪ Plants depend on animals for pollination or to move their seeds around. (2-LS2-2) **LS4.D: Biodiversity and Humans** ▪ There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1) **ETS1.B: Developing Possible Solutions** ▪ Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (2-LS2-2) ▪	**Cause and Effect** ▪ Events have causes that generate observable patterns. (2-LS2-1) **Structure and Function** ▪ The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2)

Designates which PE uses this practice

Designates which PE incorporates this disciplinary core idea (DCI)

Designates which PE incorporates this crosscutting concept (CC)

Connections to the Nature of Science

DCI codes from *A Framework for K-12 Science Education* in boldface type.

Connections to other DCIs in second grade: N/A

Connections to other DCIs across grade levels: **K.LS1.C** (2-LS2-1); **K-ESS3.A** (2-LS2-1); **K-2.ETS1.A** (2-LS2-2); **3.LS4.C** (2-LS4-1); **3.LS4.D** (2-LS4-1); **5.LS1.C** (2-LS2-1); **5.LS2.A** (2-LS2-2, 2-LS4-1)

Connections to the Arkansas English Language Arts and Mathematics Standards are often found by scrolling to the next page

Arkansas K-12 Science Standards Overview

The Arkansas K-12 Science Standards are based on *A Framework for K-12 Science Education* (NRC 2012) and are meant to reflect a new vision for science education. The following conceptual shifts reflect what is new about these science standards. The Arkansas K-12 Science Standards

- reflect science as it is practiced and experienced in the real world,
- build logically from Kindergarten through Grade 12,
- focus on deeper understanding as well as application of content,
- integrate practices, crosscutting concepts, and core ideas, and
- make explicit connections to literacy and math.

As part of teaching the Arkansas K-12 Science Standards, it will be important to instruct and guide students in adopting appropriate safety precautions for their student-directed science investigations. Reducing risk and preventing accidents in science classrooms begin with planning. The following four steps are recommended in carrying out a hazard and risk assessment for any planned lab investigation:

1) Identify all hazards. Hazards may be physical, chemical, health, or environmental.
2) Evaluate the type of risk associated with each hazard.
3) Write the procedure and all necessary safety precautions in such a way as to eliminate or reduce the risk associated with each hazard.
4) Prepare for any emergency that might arise in spite of all of the required safety precautions.

According to Arkansas Code Annotated § 6-10-113 (2012) for eye protection, every student and teacher in public schools participating in any chemical or combined chemical-physical laboratories involving caustic or explosive chemicals or hot liquids or solids is required to wear industrial-quality eye protective devices (eye goggles) at all times while participating in science investigations.

The Arkansas K-12 Science Standards outline the knowledge and science and engineering practices that all students should learn by the end of high school. The standards are three-dimensional because each student performance expectation engages students at the nexus of the following three dimensions:

- Dimension 1 describes scientific and engineering practices.
- Dimension 2 describes crosscutting concepts, overarching science concepts that apply across science disciplines.
- Dimension 3 describes core ideas in the science disciplines.

Science and Engineering Practices

The eight practices describe what scientists use to investigate and build models and theories of the world around them or that engineers use as they build and design systems. The practices are essential for all students to learn and are as follows:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

The seven crosscutting concepts bridge disciplinary boundaries and unit core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas, and develop a coherent, and scientifically based view of the world. The seven crosscutting concepts are as follows:

1. *Patterns*- Observed patterns of forms and events guide organization and classification, and prompt questions about relationships and the factors that influence them.

2. *Cause and effect- Mechanism and explanation*. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, proportion, and quantity*- In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models*- Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. *Energy and matter: Flows, cycles, and conservation*- Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
6. *Structure and function*- The way in which an object or living thing is shaped and its substructure determines many of its properties and functions.
7. *Stability and change*- For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Disciplinary Core Ideas

The disciplinary core ideas describe the content that occurs at each grade or course. The Arkansas K-12 Science Standards focus on a limited number of core ideas in science and engineering both within and across the disciplines and are built on the notion of learning as a developmental progression. The Disciplinary Core Ideas are grouped into the following domains:

- Physical Science (PS)
- Life Science (LS)
- Earth and Space Science (ESS)
- Engineering, Technology and Applications of Science (ETS)

Connections to the Arkansas English Language Arts Standards

Evidence-based reasoning is the foundation of good scientific practice. The Arkansas K-12 Science Standards incorporate reasoning skills used in language arts to help students improve mastery and understanding in all three disciplines. The Arkansas K-8 Science Committee made every effort to align grade-by-grade with the English language arts (ELA) standards so concepts support what students are learning in their entire curriculum. Connections to specific ELA standards are listed for each student performance expectation, giving teachers a blueprint for building comprehensive cross-disciplinary lessons.
The intersections between Arkansas K-12 Science Standards and Arkansas ELA Standards teach students to analyze data, model concepts, and strategically use tools through productive talk and shared activity. Reading in science requires an appreciation of the norms and conventions of the discipline of science, including understanding the nature of evidence used, an attention to precision and detail, and the capacity to make and assess intricate arguments, synthesize complex information, and follow detailed procedures and accounts of events and concepts. These practice-based standards help teachers foster a classroom culture where students think and reason together, connecting around the subject matter and core ideas.

Connections to the Arkansas Disciplinary Literacy Standards

Reading is critical to building knowledge in science. College and career ready reading in science requires an appreciation of the norms and conventions of each discipline, such as the kinds of evidence used in science; an understanding of domain-specific words and phrases; an attention to precise details; and the capacity to evaluate intricate arguments, synthesize complex information, and follow detailed descriptions of events and concepts. When reading scientific and technical texts, students need to be able to gain knowledge from challenging texts that often make extensive use of elaborate diagrams and data to convey information and illustrate concepts. Students must be able to read complex informational texts in science with independence and confidence because the vast majority of reading in college and workforce training programs will be sophisticated nonfiction.

For students, writing is a key means of asserting and defending claims, showing what they know about science, and conveying what they have experienced, imagined, thought, and felt. To be college and career ready writers, students must take task, purpose, and audience into careful consideration, choosing words, information, structures, and formats deliberately. They need to be able to use technology strategically when creating, refining, and collaborating on writing. They have to become adept at gathering information, evaluating sources, and citing material accurately, reporting finds from their research and analysis of sources in a clear and cogent manner. They must have the flexibility, concentration, and fluency to produce high-quality first-draft text under a tight deadline and the capacity to revisit and make improvements to a piece of writing over multiple drafts when circumstances encourage or require it.

Connections to the Arkansas Mathematics Standards

Science is a quantitative discipline, so it is important for educators to ensure that students' science learning coheres well with their understanding of mathematics. To achieve this alignment, the Arkansas K-12 Science Committee made every effort to ensure that the mathematics standards do not outpace or misalign to the grade-by-grade science standards. Connections to specific math standards are listed for each student performance expectation, giving teachers a blueprint for building comprehensive cross-disciplinary lessons.

Table below lists key topics relevant to science and the grades at which topics are first expected in the Arkansas Mathematics Standards.

Number and Operations	**Grade First Expected**
The coordinate plane	5
Ratios, rates (e.g. speed), proportional relationships	6
Simple percent problems	6
Rational number system/signed numbers-concepts	6
Rational number system/signed numbers-arithmetic	7
Measurement	**Grade First Expected**
Convert units within a given measurement system	5
Volume	5
Convert units across measurement systems (e.g. inches to cm)	6
Statistics and Probability	**Grade First Expected**
Statistical distributions (including center, variation, clumping, outliers, mean, median, mode, range, quartiles), and statistical association or trends (including two-way tables, bivariate measurement data, scatter plots, trend line, line of best fit, correlation)	6-8
Probability, including chance, likely outcomes, probability models	7

Grades 5-8 Science Core Ideas and Topics Overview

Grade 5	PHYSICAL SCIENCES		LIFE SCIENCES		EARTH and SPACE SCIENCES		
	5. Structure and Properties of Matter		5. Matter and Energy in Organisms and Ecosystems		5. Earth's Systems	5. Space Systems	
ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE 5. Engineering Design							
Grade 6	PHYSICAL SCIENCES		LIFE SCIENCES		EARTH and SPACE SCIENCES		
	6. Energy		6. Structure, Function, and Information Processing	6. Growth, Development, and Reproduction of Organisms	6. Earth's Systems	6. Human Impacts	6. Weather and Climate
Grade 7	PHYSICAL SCIENCES		LIFE SCIENCES		EARTH and SPACES SCIENCES		
	7. Structure and Properties of Matter	7. Chemical Reactions	7. Interdependent Relationships in Ecosystems	7. Matter and Energy in Organisms and Ecosystems	7. Earth's Systems	7. History of Earth	7. Human Impacts
Grade 8	PHYSICAL SCIENCES		LIFE SCIENCES		EARTH and SPACES SCIENCES		
	8. Waves and Electromagnetic Radiation	8. Forces and Interactions	8. Growth, Development, and Reproduction of Organisms	8. Natural Selection and Adaptations	8. Energy	8. Space Systems	8. History of Earth
ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE 6-8. Engineering Design							

Science Grades 5-8 Overview

The Arkansas K-12 Science Standards for Grades 5-8 is a curriculum framework of grade level student performance expectations based on the core ideas of the physical sciences (PS), life sciences (LS), earth and space sciences (ESS), and engineering (ETS) from *A Framework for K-12 Science Education* (NRC 2012). The performance expectations build logically from Grades K-4 to Grades 5-8. The performance expectations clarify what students need to know and be able to do at the end of each grade. Student performance expectations consist of three dimensions: science and engineering practices, disciplinary core ideas, and crosscutting concepts. Engineering performance expectations are meant to be integrated into science instruction to support the learning of science phenomena at all levels from Kindergarten to Grade 12.

As part of teaching the Arkansas K-12 Science Standards, it will be important to instruct and guide students in adopting appropriate safety precautions for their student-directed science investigations. Reducing risk and preventing accidents in science classrooms begin with planning. There are four recommended steps in carrying out a hazard and risk assessment for any planned lab investigation.

1) Identify all hazards. Hazards may be physical, chemical, health, or environmental.
2) Evaluate the type of risk associated with each hazard.
3) Write the procedure and all necessary safety precautions in such a way as to eliminate or reduce the risk associated with each hazard.
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According to Arkansas Code Annotated § 6-10-113 (2012) for eye protection, every student and teacher in public schools participating in any chemical or combined chemical-physical laboratories involving caustic or explosive chemicals or hot liquids or solids is required to wear industrial-quality eye protective devices (eye goggles) at all times while participating in science investigations.

Notes:

1. Student Performance Expectations (PEs) may be taught in any sequence or grouping within a grade level.
2. An asterisk (*) indicates an engineering connection to a practice, core idea, or crosscutting concept.
3. The Clarification Statements are examples and additional guidance for the instructor. **AR** indicates Arkansas-specific Clarification Statements.
4. The Assessment Boundaries delineate content that may be taught but not assessed in large-scale assessments. **AR** indicates Arkansas-specific Assessment Boundaries.
5. The examples given (e.g.,) are suggestions for the instructor.
6. Throughout this document, connections are provided to the nature of science as defined by *A Framework for K-12 Science Education* (NRC 2012).
7. Throughout this document, connections are provided to Engineering, Technology, and Applications of Science as defined by *A Framework for K-12 Science Education* (NRC 2012).
8. Each set of PEs lists connections to other disciplinary core ideas (DCIs) within the Arkansas K-12 Science Standards and to the Arkansas Mathematics Standards, Arkansas English Language Arts Standards, and Arkansas Disciplinary Literacy Standards.

Grade 5 Learning Progression by Topic

Grade 5			
EARTH and SPACE SCIENCES		PHYSICAL SCIENCES	LIFE SCIENCES
Earth's Systems	Space Systems	Structure and Properties of Matter	Matter and Energy in Organisms and Ecosystems
5-ESS2-1	5-PS2-1	5-PS1-1	5-PS3-1
5-ESS2-2	5-ESS1-1	5-PS 1-2**AR**	5-LS1-1
5-ESS3-1	5-ESS1-2	5-PS1-3	5-LS2-1
		5-PS1-4**AR**	
ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE Engineering Design 5-ETS1-1, 5-ETS1-2, 5-ETS1-3			

Arkansas Clarification Statement/Assessment Boundary (**AR**)

Grade 5 Learning Progression by Disciplinary Core Idea

Grade 5							
EARTH and SPACE SCIENCES			PHYSICAL SCIENCES			LIFE SCIENCES	
Earth's Place in the Universe	Earth's Systems	Earth and Human Activity	Matter and its Interactions	Motion and Stability: Forces and Interactions	Energy	From Molecules to Organisms: Structures and Processes	Ecosystems: Interactions, Energy, and Dynamics
5-ESS1-1	5-ESS2-1	5-ESS3-1	5-PS1-1	5-PS2-1	5-PS3-1	5-LS1-1	5-LS2-1
5-ESS1-2	5-ESS2-2		5-PS1-2**AR**				
			5-PS1-3				
			5-PS1-4**AR**				
ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE Engineering Design 5-ETS1-1, 5-ETS1-2, 5-ETS1-3							

Arkansas Clarification Statement/Assessment Boundary (**AR**)

Grade Five Standards Overview

The Arkansas K-12 Science Standards are based on *A Framework for K-12 Science Education* (NRC 2012) and are meant to reflect a new vision for science education. The following conceptual shifts reflect what is new about these science standards. The Arkansas K-12 Science Standards

- reflect science as it is practiced and experienced in the real world,
- build logically from Kindergarten through Grade 12,
- focus on deeper understanding as well as application of content,
- integrate practices, crosscutting concepts, and core ideas, and
- make explicit connections to literacy and math.

Science and Engineering Practices

Students are expected to demonstrate grade-appropriate proficiency in

- developing and using models,
- planning and carrying out investigations,
- analyzing and interpreting data,
- using mathematics and computational thinking,
- engaging in argument from evidence, and
- obtaining, evaluating, and communicating information.

Students are expected to use these science and engineering practices to demonstrate understanding of the disciplinary core ideas.

Crosscutting Concepts

Students are expected to demonstrate grade-appropriate understanding of

- patterns,
- cause and effect,
- scale, proportion, and quantity,
- energy and matter,
- systems and systems models, and
- the influence of engineering, technology, and science on society and the natural world as organizing concepts for the disciplinary core ideas.

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Disciplinary Core Ideas

Students are expected to continually build on and revise their knowledge of

- PS1 - Matter and Its Interactions,
- PS2 - Motion and Stability: Forces and Interactions,
- PS3 - Energy,
- LS1 - Molecules to Organisms: Structures and Processes,
- LS2 - Ecosystems: Interactions, Energy, and Dynamics,
- ESS1 - Earth's Place in the Universe,
- ESS2 - Earth's Systems,
- ESS3 - Earth and Human Activity, and
- ETS1- Engineering Design in a 3-5 developmental learning progression.

Physical Sciences (PS)

The (PS) performance expectations in fifth grade help students formulate answers to the questions, “Can new substances be created by combining other substances?” and “When matter changes, does its weight change?” Fifth grade students are expected to be able to describe that matter is made of particles too small to be seen through the development of a model. Students determine whether the mixing of two or more substances results in new substances. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved.

Life Sciences (LS)

The (LS) performance expectations in fifth grade help students explore the questions, “Where does the energy in food come from?” and “What is it used for?” Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun.

Earth and Space Sciences (ESS)

The (ESS) performance expectations in fifth grade help students investigate the questions, “How much water can be found in different places on Earth?”, “How does matter cycle through ecosystems?”, and “How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?” Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. Through the development of a model, fifth grade students describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. Students describe and graph data to provide evidence about the distribution of water on Earth.

Engineering, Technology, and Applications of Science (ETS)

Engineering design performance expectations in the earliest grades introduce students to problems as situations that people want to change. With increased maturity students in third through fifth grade are able to develop these capabilities in various scientific contexts. The engineering design process involves three stages:

- **Defining and delimiting engineering problems** involves stating the problem to be solved as clearly as possible in terms of criteria for success, and constraints or limits. In this grade range the additional step of specifying criteria and constraints.
- **Designing solutions to engineering problems** begins with generating a number of different possible solutions, and then evaluating potential solutions to see which ones best meet the criteria and constraints of the problem. In this grade range students generate several alternative solutions and compare them systematically to see which best meet the criteria and constraints of the problem.
- **Optimizing the engineering design** involves a process in which solutions are systematically tested and refined and the final design is improved by trading off less important features for those that are more important. In this grade range students build and test models or prototypes using controlled experiments in which only one variable is changed from trial to trial while all other variables are kept the same.

By the end of fifth grade students should be able to achieve all three performance expectations (5-ETS1-1, 5-ETS1-2, 5-ETS1-3) related to a single problem in order to understand the interrelated processes of engineering design. Students can use tools and materials to solve simple problems, use visual or physical representations to convey solutions, and compare different solutions to a problem, test them, and determine which is best. These component ideas do not always follow in order. At any stage, a problem-solver can redefine the problem or generate new solutions to replace an idea that is not working.

GRADE FIVE

Earth's Systems

Students who demonstrate understanding can:

5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; or the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]

5-ESS2-2 Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. ▪ Develop a model using an example to describe a scientific principle. (5-ESS2-1) **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ▪ Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. ▪ Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)	**ESS2.A: Earth Materials and Systems** ▪ Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1) **ESS2.C: The Roles of Water in Earth's Surface Processes** ▪ Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2) **ESS3.C: Human Impacts on Earth Systems** ▪ Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	**Scale, Proportion, and Quantity** ▪ Standard units are used to measure and describe physical quantities such as weight, and volume. (5-ESS2-2) **Systems and System Models** ▪ A system can be described in terms of its components and their interactions. (5-ESS2-1, 5-ESS3-1) --- **Connections to Nature of Science** **Science Addresses Questions About the Natural and Material World** ▪ Science findings are limited to questions that can be answered with empirical evidence. (5-ESS3-1)

Connections to other Disciplinary Core Ideas (DCIs) in fifth grade: N/A

Connections to other DCIs across grade levels: **2.ESS2.A** (5-ESS2-1); **2.ESS2.C** (5-ESS2-2); **3.ESS2.D** (5-ESS2-1); **4.ESS2.A** (5-ESS2-1); **7.ESS2.A** (5-ESS2-1); **7.ESS2.C** (5-ESS2-1, 5-ESS2-2); **6.ESS2.D** (5-ESS2-1); **7.ESS3.A** (5-ESS2-2, 5-ESS3-1)**;** **6.ESS3.C** (5-ESS3-1); **6.ESS3.D** (5-ESS3-1)

Connections to the Arkansas English Language Arts Standards –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1, 5-ESS2-2, 5-ESS3-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources. Summarize or paraphrase information in notes and finished work. Provide a list of sources. (5-ESS2-2, 5-ESS3-1)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1)

SL.5.5 Include multimedia components and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-1, 5-ESS2-2)

Connections to the Arkansas Mathematics Standards–

MP.2 Reason abstractly and quantitatively. (5-ESS2-1, 5-ESS2-2, 5-ESS3-1)

MP.4 Model with mathematics. (5-ESS2-1, 5-ESS2-2, 5-ESS3-1)

5.G.2 Represent real world and mathematical problems by graphing points in the first quadrant and on the non-negative x- and y- axes of the coordinate plane**.** Interpret coordinate values of points in the context of the situation. (5-ESS2-1)

GRADE FIVE

Space Systems
Students who demonstrate understanding can: **5-PS2-1 Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.] **5-ESS1-1 Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.** [Assessment Boundary: Assessment is limited to relative distances rather than sizes of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, or stage).] **5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and select stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. ▪ Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). ▪ Support an argument with evidence, data, or a model. (5-PS2-1, 5-ESS1-1)	**PS2.B: Types of Interactions** ▪ The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1) **ESS1.A: The Universe and its Stars** ▪ The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth. (5-ESS1-1) **ESS1.B: Earth and the Solar System** ▪ The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (5-ESS1-2)	**Patterns** ▪ Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (5-ESS1-2) **Cause and Effect** ▪ Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1) **Scale, Proportion, and Quantity** ▪ Natural objects exist from the very small to the immensely large. (5-ESS1-1)

Connections to other DCIs in fifth grade: N/A

Connections to other DCIs across grade levels: **1.ESS1.A** (5-ESS1-2); **1.ESS1.B** (5-ESS1-2); **3.PS2.A** (5-PS2-1, 5-ESS1-2); **3.PS2.B** (5-PS2-1); **8.PS2.B** (5-PS2-1); **8.ESS1.A** (5-ESS1-1, 5-ESS1-2); **8.ESS1.B** (5-PS2-1, 5-ESS1-1, 5-ESS1-2); **7.ESS2.C** (5-PS2-1)

Connections to the Arkansas English Language Arts Standards –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1, 5-ESS1-1)

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1)

RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1, 5-ESS1-1)

W.5.1 Write opinion pieces on topics or texts, supporting the opinion with reasons and information. (5-PS2-1, 5-ESS1-1)

SL.5.5 Include multimedia components and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2)

Connections to the Arkansas Mathematics Standards –

MP.2 Reason abstractly and quantitatively. (5-ESS1-1, 5-ESS1-2)

MP.4 Model with mathematics. (5-ESS1-1, 5-ESS1-2)

5.NBT.A.2 Students understand why multiplying or dividing by a power of 10 shifts the value of the digits of a whole number or decimal.

AR.5.NBT.A.2.A
Explain patterns in the number of zeros of the product when multiplying a whole number by powers of 10.

AR.5.NBT.A.2.B
Explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.

AR.5.NBT.A.2.C
Use whole-number exponents to denote powers of 10.

5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant and on the non-negative x- and y-axes of the coordinate plane**.** Interpret coordinate values of points in the context of the situation. (5-ESS1-2)

GRADE FIVE

Structure and Properties of Matter
Students who demonstrate understanding can: **5-PS1-1** **Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.] **5-PS1-2** **Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.** [**AR** Clarification Statement: Examples could include chemical reactions that form new substances or physical changes including phase changes, dissolving, and mixing.] [**AR** Assessment Boundary: Assessment does not include distinguishing mass from weight or reactions that involve gases.] **5-PS1-3** **Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass from weight.] **5-PS1-4** **Conduct an investigation to determine whether the mixing of two or more substances results in new substances.** [**AR** Clarification Statement: Examples of qualitative evidence could include temperature change, color change, odor change, and the formation of a gas to determine if a new substance has formed.]
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. ▪ Develop a model to describe phenomena. (5-PS1-1) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ▪ Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4) ▪ Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)	**PS1.A: Structure and Properties of Matter** ▪ Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1) ▪ The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2) ▪ Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3) **PS1.B: Chemical Reactions** ▪ When two or more different substances are mixed, a new substance with different properties may be formed. (5-PS1-4) ▪ No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)	**Cause and Effect** ▪ Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4) **Scale, Proportion, and Quantity** ▪ Natural objects exist from the very small to the immensely large. (5-PS1-1) ▪ Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2, 5-PS1-3) --- **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Science assumes consistent patterns in natural systems. (5-PS1-2)

Using Mathematics and Computational Thinking Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. ▪ Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)		

Connections to other DCIs in fifth grade: N/A

Connections to other DCIs across grade levels: **2.PS1.A** (5-PS1-1, 5-PS1-2, 5-PS1-3); **2.PS1.B** (5-PS1-2, 5-PS1-4); **7.PS1.A** (5-PS1-1, 5-PS1-2, 5-PS1-3, 5-PS1-4); **7.PS1.B** (5-PS1-2, 5-PS1-4)

Connections to the Arkansas English Language Arts Standards –

RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-2, 5-PS1-3, 5-PS1-4)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources. Summarize or paraphrase information in notes and finished work. Provide a list of sources. (5-PS1-2, 5-PS1-3, 5-PS1-4)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-2, 5-PS1-3, 5-PS1-4)

Connections to the Arkansas Mathematics Standards –

MP.2 Reason abstractly and quantitatively. (5-PS1-1, 5-PS1-2, 5-PS1-3)

MP.4 Model with mathematics. (5-PS1-1, 5-PS1-2, 5-PS1-3)

MP.5 Use appropriate tools strategically. (5-PS1-2, 5-PS1-3)

5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. (5-PS1-1)

5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. Interpret division of a unit fraction by a natural number, and compute such quotients. Interpret division of a whole number by a unit fraction, and compute such quotients. Solve real world problems involving division of unit fractions by natural numbers and (5-PS1-1)

5.MD.A.1 Convert among different-sized standard measurement units within the metric system. Convert among different-sized standard measurement units within the customary system. Use these conversions in solving multi-step, real world problems. (5-PS1-2)

5.MD.C.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1) A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. A solid figure, which can be packed without gaps or overlaps using n unit cubes, is said to have a volume of n cubic units.

5.MD.C.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft., and improvised units. (5-PS1-1)

GRADE FIVE

Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

5-PS3-1 **Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.** [Clarification Statement: Examples of models could include diagrams and flow charts.]

5-LS1-1 **Support an argument that plants get the materials they need for growth chiefly from air and water.** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]

5-LS2-1 **Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. ▪ Use models to describe phenomena. (5-PS3-1) ▪ Develop a model to describe phenomena. (5-LS2-1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). ▪ Support an argument with evidence, data, or a model. (5-LS1-1) --- **Connections to Nature of Science** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ Science explanations describe the mechanisms for natural events. (5-LS2-1)	**PS3.D: Energy in Chemical Processes and Everyday Life** ▪ The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** ▪ Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1) ▪ Plants acquire their material for growth chiefly from air and water. (5-LS1-1) **LS2.A: Interdependent Relationships in Ecosystems** ▪ The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)	**Systems and System Models** ▪ A system can be described in terms of its components and their interactions. (5-LS2-1) **Energy and Matter** ▪ Matter is transported into, out of, and within systems. (5-LS1-1) ▪ Energy can be transferred in various ways and between objects. (5-PS3-1)

	LS2.B: Cycles of Matter and Energy Transfer in Ecosystems ▪ Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)	

Connections to other DCIs in fifth grade: **5.PS1.A** (5-LS1-1, 5-LS2-1); **5.ESS2.A** (5-LS2-1)

Connections to other DCIs across grade levels: **K.LS1.C** (5-PS3-1, 5-LS1-1); **2.PS1.A** (5-LS2-1); **2.LS2.A** (5-PS3-1, 5-LS1-1); **2.LS4.D** (5-LS2-1); **4.PS3.A** (5-PS3-1); **4.PS3.B** (5-PS3-1); **4.PS3.D** (5-PS3-1); **4.ESS2.E** (5-LS2-1); **6.PS3.D** (5-PS3-1, 5-LS2-1); **8.PS4.B** (5-PS3-1); **6.LS1.C** (5-PS3-1, 5-LS1-1, 5-LS2-1); **7.LS2.A** (5-LS2-1); **7.LS2.B** (5-PS3-1, 5-LS2-1)

Connections to the Arkansas English Language Arts Standards –

RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1)
RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS3-1, 5-LS2-1)
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)
W.5.1 Write opinion pieces on topics or texts, supporting the opinion with reasons and information. (5-LS1-1)
SL.5.5 Include multimedia components and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-PS3-1, 5-LS2-1)

Connections to the Arkansas Mathematics Standards –

MP.2 Reason abstractly and quantitatively. (5-LS1-1, 5-LS2-1)
MP.4 Model with mathematics. (5-LS1-1, 5-LS2-1)
MP.5 Use appropriate tools strategically. (5-LS1-1)
5.MD.A.1 Convert among different-sized standard measurement units within the metric system. Convert among different-sized standard measurements units within the customary system. Use these conversions in solving multi-step, real world problems. (5-LS1-1)

GRADE FIVE

Engineering, Technology, and Applications of Science

Students who demonstrate understanding can:

5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (5-ETS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-ETS1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (5-ETS1-2)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (5-ETS1-1)

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (5-ETS1-2)
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (5-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (5-ETS1-3)

ETS1.C: Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (5-ETS1-3)

Crosscutting Concepts

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

- People's needs and wants change over time, as do their demands for new and improved technologies. (5-ETS1-1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (5-ETS1-2)

Connections to 3-5.ETS1.A: Defining and Delimiting Engineering Problems include: **Fourth Grade:** (4-PS3-4) *Connections to 3-5.ETS1.B: Designing Solutions to Engineering Problems include:* **Fourth Grade:** (4-ESS3-2) *Connections to K-2.ETS1.C: Optimizing the Design Solution include:* **Fourth Grade: (**4-PS4-3)
Connections to other DCIs across grade levels: **K-2.ETS1.A** (5-ETS1-1, 5-ETS1-2, 5-ETS1-3); **K-2.ETS1.B** (5-ETS1-2); **K-2.ETS1.C** (5-ETS1-2, 5-ETS1-3); **6-8.ETS1.A** (5-ETS1-1); **6-8.ETS1.B** (5-ETS1-1, 5-ETS1-2, 5-ETS1-3); **6-8.ETS1.C** (5-ETS1-2, 5-ETS1-3)
Connections to the Arkansas English Language Arts Standards – **RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ETS1-2) **RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ETS1-2) **RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ETS1-2) **W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-ETS1-1, 5-ETS1-3) **W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources. Summarize or paraphrase information in notes and finished work. Provide a list of sources. (5-ETS1-1, 5-ETS1-3) **W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ETS1-1, 5-ETS1-3) *Connections to the Arkansas Mathematics Standards –* **3.0A** Operations and Algebraic Thinking (3-ETS1-1, 3-ETS1-2) **MP.2** Reason abstractly and quantitatively. (5-ETS1-1, 5-ETS1-2, 5-ETS1-3) **MP.4** Model with mathematics. (5-ETS1-1, 5-ETS1-2, 5-ETS1-3) **MP.5** Use appropriate tools strategically. (5-ETS1-1, 5-ETS1-2, 5-ETS1-3) **3-5.OA** Operations and Algebraic Thinking (5-ETS1-1, 5-ETS1-2)

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