
# ARKANSAS

## K-12 SCIENCE STANDARDS

EDUCATION FOR A NEW GENERATION

# Grade 3

# 2015

**Realigned Fall 2016 to the Arkansas Mathematics Standards and Arkansas English Language Arts Standards**

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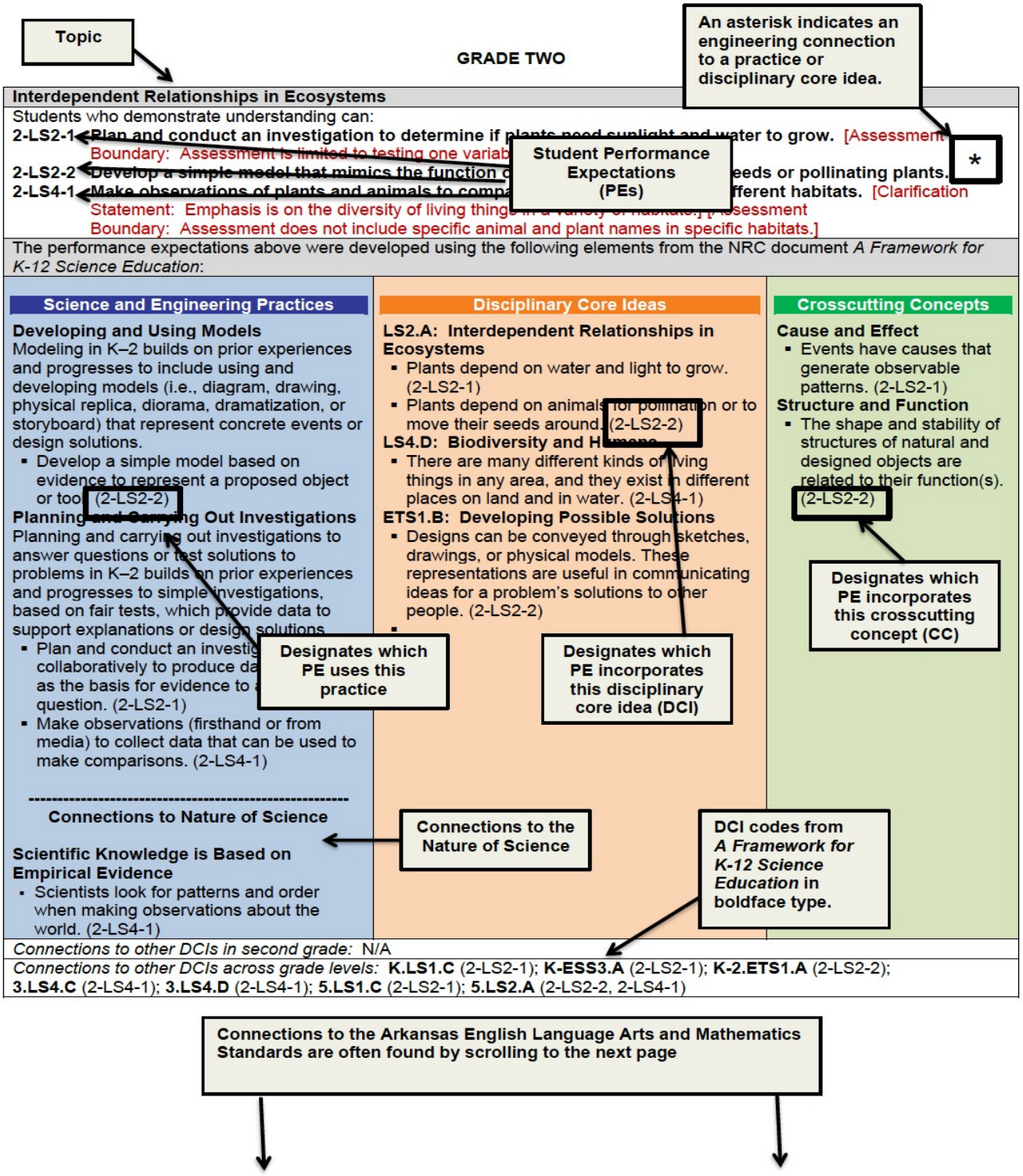
# How to Read
# Arkansas K-12 Science Standards



## 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 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 |
|---|---|
| Multiplication and division of whole numbers | 3 |
| Concept of a fraction a/b | 3 |
| Beginning fraction arithmetic | 4 |
| **Measurement** | **Grade First Expected** |
| Standard length units (inch, centimeter, etc.) | 2 |
| Area | 3 |
| Convert from a larger unit to a smaller in the same system | 4 |

## Grades K-4 Science Core Ideas and Topics

| | | | |
|---|---|---|---|
| **Kindergarten** | PHYSICAL SCIENCES | LIFE SCIENCES | EARTH and SPACE SCIENCES |
| | K. Forces and Interactions: Pushes and Pulls | K. Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment | K. Weather and Climate |
| | | | |
| **Grade 1** | PHYSICAL SCIENCES | LIFE SCIENCES | EARTH and SPACE SCIENCES |
| | 1. Waves: Light and Sound | 1.Structure, Function, and Information Processing | 1.Space Systems: Patterns and Cycles |
| | | | |
| **Grade 2** | PHYSICAL SCIENCES | LIFE SCIENCES | EARTH and SPACE SCIENCES |
| | 2.Structure and Properties of Matter | 2.Interdependent Relationships in Ecosystems | 2.Earth's Systems: Processes that Shape the Earth |
| ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE<br>K-2. Engineering Design | | | |

| | | | | |
|---|---|---|---|---|
| **Grade 3** | PHYSICAL SCIENCES | LIFE SCIENCES | | EARTH and SPACE SCIENCES |
| | 3.Forces and Interactions | 3.Interdependent Relationships in Ecosystems | 3.Inheritance and Variation of Traits | 3.Weather and Climate |
| | | | | |
| **Grade 4** | PHYSICAL SCIENCES | LIFE SCIENCES | | EARTH and SPACE SCIENCES |
| | 4.Waves | 4.Structure, Function, and Information Processing | | 4.Energy / 4.Earth's Systems: Processes that Shape the Earth |
| ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE<br>3-4. Engineering Design | | | | |

## Science K-4

The Arkansas K-12 Science Standards for Grades K-4 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.
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.

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 and the Arkansas English Language Arts Standards.

## Grade 3 Learning Progression by Topic

| Grade 3 | | | |
|---|---|---|---|
| PHYSICAL SCIENCES | LIFE SCIENCES | | EARTH and SPACE SCIENCES |
| Forces and Interactions | Interdependent Relationships in Ecosystems | Inheritance and Variation of Traits | Weather and Climate |
| 3-PS2-1**AR** | 3-LS2-1**AR** | 3-LS1-1 | 3-ESS2-1 |
| 3-PS2-2 | 3-LS4-1 | 3-LS3-1 | 3-ESS2-2 |
| 3-PS2-3 | 3-LS4-3**AR** | 3-LS3-2 | 3-ESS3-1 |
| 3-PS2-4 | 3-LS4-4 | 3-LS4-2**AR** | |
| ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE<br>Engineering Design<br>3-ETS1-1, 3-ETS1-2, 3-ETS1-3 | | | |

Arkansas Clarification Statement (**AR**)

## Grade 3 Learning Progression by Disciplinary Core Idea

| Grade 3 | | | | | | |
|---|---|---|---|---|---|---|
| PHYSICAL SCIENCES | LIFE SCIENCES | | | | EARTH and SPACE SCIENCES | |
| Motion and Stability: Forces and Interactions | From Molecules to Organisms: Structures and Processes | Ecosystems: Interactions, Energy, and Dynamics | Heredity: Inheritance and Variation of Traits | Biological Evolution: Unity and Diversity | Earth's Systems | Earth and Human Activity |
| 3-PS2-1**AR** | 3-LS1-1 | 3-LS2-1**AR** | 3-LS3-1 | 3-LS4-1 | 3-ESS2-1 | 3-ESS3-1 |
| 3-PS2-2 | | | 3-LS3-2 | 3-LS4-2**AR** | 3-ESS2-2 | |
| 3-PS2-3 | | | | 3-LS4-3**AR** | | |
| 3-PS2-4 | | | | 3-LS4-4 | | |
| ENGINEERING, TECHNOLOGY, and APPLICATIONS of SCIENCE<br>Engineering Design<br>3-ETS1-1, 3-ETS1-2, 3-ETS1-3 | | | | | | |

Arkansas Clarification Statement (**AR**)

## Third Grade 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

- asking questions and defining problems,
- developing and using models,
- planning and carrying out investigations,
- analyzing and interpreting data,
- constructing explanations and designing solutions,
- 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,
- systems and system models,
- interdependence of science, engineering, and technology, and
- influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for the disciplinary core ideas.

### Disciplinary Core Ideas

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

- PS2- Motion and Stability: Forces and Interactions,
- LS1- Molecules to Organisms: Structures and Processes,
- LS2- Ecosystem: Interactions, Energy, and Dynamics,
- LS3- Heredity: Inheritance and Variation of Traits,
- LS4- Biological Evolution: Unity and Diversity,
- 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 third grade help students formulate answers to the questions, “How do equal and unequal forces on an object affect the object?” and “How can magnets be used?” Students determine the effects of balanced and unbalanced forces on the motion of an object and the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. Students are then able to apply their understanding of magnetic interactions to define a simple design problem that can be solved with magnets.

## Life Sciences (LS)

The LS performance expectations in third grade help students explore the questions, “How do organisms vary in their traits?”, “How are plants, animals, and environments of the past similar or different from current plants, animals, and environments?”, and “What happens to organisms when their environment changes?” Third graders are expected to develop an understanding of the idea that when the environment changes some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. Students develop an understanding of the similarities and differences of organisms’ life cycles. Students at this level acquire an understanding that organisms have different inherited traits, and that the environment can also affect the traits that an organism develops. In addition, students construct an explanation using evidence for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Students are expected to develop an understanding of types of organisms that lived long ago and also about the nature of their environments.

## Earth and Space Sciences (ESS)

The ESS performance expectations in third grade help students investigate the questions, “What is typical weather in different parts of the world and during different times of the year?” and “How can the impact of weather-related hazards be reduced?” Students organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students make a claim about the merit of a design solution that reduces the impacts of such hazards.

## 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.

In the third grade students are beginning to develop the ability to achieve all three performance expectations (3-ETS1-1, 3-ETS1-2, 3-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 THREE

### Forces and Interactions

Students who demonstrate understanding can:

**3-PS2-1** **Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [**AR** Clarification Statement: Examples could include an unbalanced force on one side of a box can make it start moving or balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

**3-PS2-2** **Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]

**3-PS2-3** **Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon or the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force or how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]

**3-PS2-4** **Define a simple design problem that can be solved by applying scientific ideas about magnets.*** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

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 grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)

**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. (3-PS2-1)
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

#### Disciplinary Core Ideas

**PS2.A: Forces and Motion**

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

#### Crosscutting Concepts

**Patterns**

- Patterns of change can be used to make predictions. (3-PS2-2)

**Cause and Effect**

- Cause and effect relationships are routinely identified. (3-PS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

| | | |
|---|---|---|
| (3-PS2-2)<br><br>**Connections to Nature of Science**<br><br>**Science Knowledge is Based on Empirical Evidence**<br>▪ Science findings are based on recognizing patterns. (3-PS2-2)<br>**Scientific Investigations Use a Variety of Methods**<br>▪ Science investigations use a variety of methods, tools, and techniques. (3-PS2-1) | **PS2.B: Types of Interactions**<br>▪ Objects in contact exert forces on each other. (3-PS2-1)<br>▪ Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3, 3-PS2-4) | **Connections to Engineering, Technology, and Applications of Science**<br><br>**Interdependence of Science, Engineering, and Technology**<br>▪ Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4) |
| *Connections to other DCIs in third grade:* N/A | | |
| *Connections to other DCIs across grade levels:* **K.PS2.A** (3-PS2-1); **K.PS2.B** (3-PS2-1); **K.PS3.C** (3-PS2-1); **K-2.ETS1.A** (3-PS2-4); **1.ESS1.A** (3-PS2-2); **4.PS4.A** (3-PS2-2); **3-5.ETS1.A** (3-PS2-4); **5.PS2.B** (3-PS2-1); **7.ESS2.C** (3-PS2-1); **8.PS2.A** (3-PS2-1, 3-PS2-2); **8.PS2.B** (3-PS2-3, 3-PS2-4); **8.ESS1.B** (3-PS2-1, 3-PS2-2) | | |
| *Connections to the Arkansas English Language Arts Standards –*<br>**RI.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-1, 3-PS2-3)<br>**RI.3.3** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)<br>**RI.3.8** Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-3)<br>**W.3.7** Conduct short research projects that build knowledge about a topic. (3-PS2-1, 3-PS2-2)<br>**W.3.8** Recall information from experiences or gather information from print and digital sources. Take brief notes on sources. Sort evidence into provided categories. (3-PS2-1, 3-PS2-2)<br>**SL.3.3** Ask and answer questions about information from a speaker in order to clarify comprehension, offering appropriate elaboration and detail. (3-PS2-3)<br><br>*Connections to the Arkansas Mathematics Standards –*<br>**MP.2** Reason abstractly and quantitatively. (3-PS2-1)<br>**MP.5** Use appropriate tools strategically. (3-PS2-1)<br>**3.MD.A.2** Measure and estimate liquid volumes and masses of objects using standard units such as: grams (g), kilograms (kg), and liters (l); gallons (gal), quarts (qt), pints (pt), and cups (c). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units (e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-PS2-1) | | |

## GRADE THREE

### Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

**3-LS2-1** **Construct an argument that some animals form groups that help members survive.** [**AR** Clarification Statement: Examples could include ant colonies, herds of bison, or hives of bees.]

**3-LS4-1** **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossilized organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or living plants and animals. Assessment is limited to major fossil types and relative ages.]

**3-LS4-3** **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [**AR** Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other for survival.]

**3-LS4-4** **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

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

**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.

- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS4-1)

**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 worlds.

- Construct an argument with evidence, data, and/or a model. (3-LS2-1)
- Construct an argument with evidence. (3-LS4-3)
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4)

#### Disciplinary Core Ideas

**LS2.C: Ecosystem Dynamics, Functioning, and Resilience**

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (3-LS4-4)

**LS2.D: Social Interactions and Group Behavior**

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (3-LS2-1)

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

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (3-LS4-1)
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

**LS4.C: Adaptation**

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

#### Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1, 3-LS4-3)

**Scale, Proportion, and Quantity**

- Observable phenomena exist from very short to very long time periods. (3-LS4-1)

**Systems and System Models**

- A system can be described in terms of its components and their interactions. (3-LS4-4)

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

**Interdependence of Science, Engineering, and Technology**

- Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-4)

| | | |
|---|---|---|
| | **LS4.D: Biodiversity and Humans**<br>▪ Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4) | **Connections to Nature of Science**<br><br>**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**<br>▪ Science assumes consistent patterns in natural systems. (3-LS4-1) |

*Connections to other DCIs in third grade:* **3.ESS2.D** (3-LS4-3); **3.ESS3.B** (3-LS4-4)

*Connections to other DCIs across grade levels:* **K.ESS3.A** (3-LS4-3, 3-LS4-4); **K-2.ETS1.A** (3-LS4-4); **1.LS1.B** (3-LS2-1); **2.LS2.A** (3-LS4-3, 3-LS4-4); **2.LS4.D** (3-LS4-3, 3-LS4-4); **4.ESS1.C** (3-LS4-1); **4.ESS3.B** (3-LS4-4); **3-5.ETS1.A** (3-LS4-4); **6.ESS3.C** (3-LS4-4); **7.LS2.A** (3-LS2-1, 3-LS4-1, 3-LS4-3, 3-LS4-4); **7.LS2.C** (3-LS4-4); **7.ESS2.B** (3-LS4-1); **8.LS4.A** (3-LS4-1); **8.LS4.B** (3-LS4-3); **8.LS4.C** (3-LS4-3, 3-LS4-4); **8.ESS1.C** (3-LS4-1, 3-LS4-3, 3-LS4-4)

*Connections to the Arkansas English Language Arts Standards –*

**RI.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS2-1, 3-LS4-1, 3-LS4-3, 3-LS4-4)

**RI.3.2** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-1, 3-LS4-3, 3-LS4-4)

**RI.3.3** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS2-1, 3-LS4-1, 3-LS4-3, 3-LS4-4)

**W.3.1** Write opinion pieces on topics or texts, supporting the opinion with reasons. (3-LS2-1, 3-LS4-1, 3-LS4-3, 3-LS4-4)

**W.3.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-1, 3-LS4-3, 3-LS4-4)

**W.3.8** Recall information from experiences or gather information from print and digital sources. Take brief notes on sources. Sort evidence into provided categories. (3-LS4-1)

**SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4-3, 3-LS4-4)

*Connections to the Arkansas Mathematics Standards –*

**MP.2** Reason abstractly and quantitatively. (3-LS4-1, 3-LS4-3, 3-LS4-4)

**MP.4** Model with mathematics. (3-LS2-1, 3-LS4-1, 3-LS4-3, 3-LS4-4)

**MP.5** Use appropriate tools strategically. (3-LS4-1)

**3.NBT** Number and Operations in Base Ten (3-LS2-1)

**3.MD.B.3** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled picture graphs and scaled bar graphs. (3-LS4-3)

**3.MD.B.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS4-1)

## Inheritance and Variation of Traits: Life Cycles and Traits

Students who demonstrate understanding can:

**3-LS1-1** **Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.** [Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]

**3-LS3-1** **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]

**3-LS3-2** **Use evidence to support the explanation that traits can be influenced by the environment.** [Clarification Statement: Examples of the environment affecting a trait could include insufficient water stunting normally tall plants ; and, a pet dog becoming overweight that is given too much food and too little exercise.]

**3-LS4-2** **Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.** [**AR** Clarification Statement: Examples of cause and effect relationships could be plants of the same species with larger thorns may be less likely to be eaten; and, animals of the same species with more effective camouflage or coloration may be more likely to survive and produce offspring.]

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

**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 models to describe phenomena. (3-LS1-1)

**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.

- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)

**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.

- Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2)
- Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)

### Disciplinary Core Ideas

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

- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

**LS3.A: Inheritance of Traits**

- Many characteristics of organisms are inherited from their parents. (3-LS3-1)
- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2)

**LS3.B: Variation of Traits**

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

**LS4.B: Natural Selection**

- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

### Crosscutting Concepts

**Patterns**

- Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1)
- Patterns of change can be used to make predictions. (3-LS1-1)

**Cause and Effect**

- Cause and effect relationships are routinely identified and used to explain change. (3-LS3-2, 3-LS4-2)

| | | |
|---|---|---|
| **----------**<br>**Connections to Nature of Science**<br><br>**Scientific Knowledge is Based on Empirical Evidence**<br>▪ Science findings are based on recognizing patterns. (3-LS1-1) | | |

*Connections to other DCIs in third grade:* **3.LS4.C** (3-LS4-2)

*Connections to other DCIs across grade levels:* **1.LS3.A** (3-LS3-1, 3-LS4-2); **1.LS3.B** (3-LS3-1); **6.LS1.B** (3-LS1-1, 3-LS3-2); **6.LS3.B** (3-LS3-1, 3-LS4-2); **7.LS2.A** (3-LS4-2); **8.LS3.A** (3-LS3-1); **8.LS4.B** (3-LS4-2)

*Connections to the Arkansas English Language Arts Standards –*

**RI.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1, 3-LS3-2, 3-LS4-2)

RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1, 3-LS3-2, 3-LS4-2)

RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1, 3-LS3-2, 3-LS4-2)

RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-LS1-1)

W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1, 3-LS3-2, 3-LS4-2)

**SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1, 3-LS3-2, 3-LS4-2)

**SL.3.5** Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enhance certain facts or details. (3-LS1-1)

*Connections to the Arkansas Mathematics Standards –*

**MP.2** Reason abstractly and quantitatively. (3-LS3-1, 3-LS3-2, 3-LS4-2)

**MP.4** Model with mathematics. (3-LS1-1, 3-LS3-1, 3-LS3-2, 3-LS4-2)

**3.NBT** Number and Operations in Base Ten (3-LS1-1)

**3.NF** Number and Operations—Fractions (3-LS1-1)

**3.MD.B.3** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled picture graphs and scaled bar graphs. (3-LS4-2)

**3.MD.B.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1, 3-LS3-2)

## Weather and Climate

Students who demonstrate understanding can:

**3-ESS2-1** **Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]

**3-ESS2-2** **Obtain and combine information to describe climates in different regions of the world.**

**3-ESS3-1** **Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.*** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]

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

**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 tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)

**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).

- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1)

**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 other reliable media to explain phenomena. (3-ESS2-2)

### Disciplinary Core Ideas

**ESS2.D: Weather and Climate**

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)
- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)

**ESS3.B: Natural Hazards**

- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1)

### Crosscutting Concepts

**Patterns**

- Patterns of change can be used to make predictions. (3-ESS2-1, 3-ESS2-2)

**Cause and Effect**

- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

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

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

- Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1)

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**Connections to Nature of Science**

**Science is a Human Endeavor**

- Science affects everyday life. (3-ESS3-1)

*Connections to other DCIs in third grade:* N/A

*Connections to other DCIs across grade levels:* **K.ESS2.D** (3-ESS2-1); **K.ESS3.B** (3-ESS3-1); **K-2.ETS1.A** (3-ESS3-1); **4.ESS2.A** (3-ESS2-1); **4.ESS3.B** (3-ESS3-1); **3-5.ETS1.A** (3-ESS3-1); **5.ESS2.A** (3-ESS2-1); **6.ESS2.D** (3-ESS2-1, 3-ESS2-2); **7.ESS2.C** (3-ESS2-1, 3-ESS2-2); **7.ESS3.B** (3-ESS3-1)

*Connections to the Arkansas English Language Arts Standards –*

**RI.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2)

RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2)

W.3.1 Write opinion pieces on topics or texts, supporting the opinion with reasons. (3-ESS3-1)

W.3.7 Conduct short research projects that build knowledge about a topic. (3-ESS3-1)

W.3.8 Recall information from experiences or gather information from print and digital sources. Take brief notes on sources. Sort evidence into provided categories. (3-ESS2-2)

*Connections to the Arkansas Mathematics Standards –*

**MP.2** Reason abstractly and quantitatively. (3-ESS2-1, 3-ESS2-2, 3-ESS3-1)

**MP.4** Model with mathematics. (3-ESS2-1, 3-ESS2-2, 3-ESS3-1)

**MP.5** Use appropriate tools strategically. (3-ESS2-1)

**3.MD.A.2** Measure and estimate liquid volumes and masses of objects using standard units such as: grams (g), kilograms (kg), and liters (l); gallons (gal), quarts (qt), pints (pt), and cups (c). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units (e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-ESS2-1)

**3.MD.B.3** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled picture graphs and scaled bar graphs. (3-ESS2-1)

## Engineering, Technology, and Applications of Science

Students who demonstrate understanding can:

**3-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.**

**3-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.**

**3-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. (3-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. (3-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. (3-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. (3-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. (3-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. (3-ETS1-2)
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-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. (3-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. (3-ETS1-1)
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-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 3-5-ETS1.C: Optimizing the Design Solution include:* **Fourth Grade:** (4-PS4-3)

*Connections to other DCIs across grade levels:* **K-2.ETS1.A** (3-ETS1-1, 3-ETS1-2, 3-ETS1-3); **K-2.ETS1.B** (3-ETS1-2); **K-2.ETS1.C** (3-ETS1-2, 3-ETS1-3); **6-8.ETS1.A** (3-ETS1-1); **6-8.ETS1.B** (3-ETS1-1, 3-ETS1-2, 3-ETS1-3); **6-8.ETS1.C** (3-ETS1-2, 3-ETS1-3)

*Connections to the Arkansas English Language Arts Standards –*

**RI.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ETS1-2)
RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-ETS1-2)
RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ETS1-2)
W.3.7 Conduct short research projects that build knowledge about a topic. (3-ETS1-1, 3-ETS1-3)
**W.3.8** Recall information from experiences or gather information from print and digital sources. Take brief notes on sources. Sort evidence into provided categories. (3-ETS1-1, 3-ETS1-3)

*Connections to the Arkansas Mathematics Standards –*

**MP.2** Reason abstractly and quantitatively. (3-ETS1-1, 3-ETS1-2, 3-ETS1-3)
**MP.4** Model with mathematics. (3-ETS1-1, 3-ETS1-2, 3-ETS1-3)
**MP.5** Use appropriate tools strategically. (3-ETS1-1, 3-ETS1-2, 3-ETS1-3)
**3-5.OA** Operations and Algebraic Thinking (3-ETS1-1, 3-ETS1-2)

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