

# 2016 WYOMING SCIENCE

## CONTENT AND PERFORMANCE STANDARDS

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## Effective September 23, 2016

**TO BE FULLY IMPLEMENTED IN DISTRICTS BY THE BEGINNING OF SCHOOL YEAR 2020-2021**

## **ACKNOWLEDGEMENT**

The Wyoming State Board of Education would like to thank the Wyoming Department of Education, as well as educators, parents and community members, business and industry representatives, community college representatives, and the University of Wyoming representatives for their help with the development of these science standards.

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# 2016 WYOMING SCIENCE CONTENT AND PERFORMANCE STANDARDS

## INTRODUCTION

The Wyoming Science Content and Performance Standards (WyCPS) were last reviewed and approved in 2008 in accordance with Wyoming state statute W.S. 21-2-304(c). The 2016 Wyoming Content and Performance Standards were developed collaboratively through the contributions of Science Standard Review Committee (SSRC) members from across the state. The committee's work was informed and guided by initial public input through community forums, as well as input solicited from specific stakeholder groups.

## INTRODUCTION TO STANDARDS

**Content Standards:** Content standards define what students are expected to know and be able to do by the time they graduate. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

**Benchmarks:** Benchmarks (also called performance expectations in this document) specify what students are expected to know and be able to do at the end of each of the benchmark grade levels. These benchmarks specify the skills and content students must master along the way in order to demonstrate proficiency of the content standard by the time they graduate. In this standards document, you will find these are broken out into individual grades for Kindergarten through 5th grade and then banded by grade bands for middle school/junior high school and high school grade levels (6-8 and 9-12).

## RATIONALE

Today, quality science education enables students to learn science by being actively involved with scientific and engineering practices as they progress from kindergarten through 12th grade. They are encouraged to be inquisitive, to actively explore their environment, and become productive, scientifically literate citizens. The standards we present here provide the necessary foundation for local school district decisions about curriculum, assessments, and instruction. Implementation of the new standards will better prepare Wyoming high school graduates for the rigors of college and/or careers. In turn, Wyoming employers will be able to hire workers with a strong science and engineering base — both in specific content areas and in critical thinking and inquiry-based problem solving.

The Wyoming Science Content and Performance Standards support that:

- all students can engage in sophisticated science and engineering practices.
- students must have the opportunity to conduct investigations, solve problems, and engage in discussions.
- students learn through relevant context and use modeling to explain observed phenomena.
- students move beyond facts and terminology to develop explanations and design solutions supported by evidence-based arguments and reasoning.
- students discuss open-ended questions that focus on the strength of the evidence used to generate claims.
- students develop summaries of information through multiple sources, including science-related magazine and journal articles and web-based resources.
- students develop questions that drive multiple investigations with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas.
- students write reports, create posters, and design media presentations that explain and add credibility to their argument.
- students develop a better understanding of the science they are researching by accessing professional scientists and engineers through various means.
- students communicate and defend their research to an authentic audience such as at colloquiums with secondary students.

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## ORGANIZATION OF STANDARDS

These standards were informed by *A Framework for K-12 Science Education* (National Research Council, 2012), the Next Generation Science Standards (National Academies Press, 2013), and the unique needs of Wyoming. They are distinct from prior science standards in that they integrate three dimensions of learning within each standard and have intentional connections across standards, grade bands, and subjects. The three dimensions are crosscutting concepts, disciplinary core ideas, and science and engineering practices.

### Dimension 1: Crosscutting Concepts (CCC)

The seven crosscutting concepts have application across all domains of science. As such, they provide one way of linking across the domains of the Disciplinary Core Ideas.

### Dimension 2: Disciplinary Core Ideas (DCI)

The continuing expansion of scientific knowledge makes it impossible to teach all of the ideas related to a given discipline in exhaustive detail during the K-12 years. But given the cornucopia of information available today, virtually at a touch, an important role of science education is not to teach “all the facts” but rather to prepare students in the four domains of science with sufficient core knowledge so that they can later acquire additional information on their own. The four domains referenced are: 1) physical science, 2) life science, 3) earth and space science, and 4) engineering, technology and applications of science.

### Dimension 3: Science and Engineering Practices (SEP)

The SEPs describe (a) the major practices that scientists employ as they investigate and build models and theories about the world, and (b) a key

set of engineering practices that engineers use as they design and build systems. We use the term “practices” instead of skills to emphasize that engaging in a scientific investigation requires not only skill but also knowledge that is specific to each practice.

Cross-curricular connections to Wyoming Content and Performance Standards in English Language Arts (ELA), Mathematics, Social Studies (S.S.), Physical Education (P.E.), Health, Fine and Performing Arts (FPA), and Career and Vocational Education (CVE) are identified and referenced within the science standards. These are intended as suggestions for areas where other content standards can be integrated in the teacher’s instruction and lessons. The connection would be dependent on the curricula.

## 2016 Wyoming Science Standards

Physical Science	PS1 - Matter and Its Interactions							
	K	1	2	3	4	5	6-8	9-12
	PS2 - Motion and Stability: Forces and Interactions							
	K	1	2	3	4	5	6-8	9-12
	PS3 - Energy							
Life Science	PS4 - Waves and Their Applications in Technologies for Information Transfer							
	K	1	2	3	4	5	6-8	9-12
	LS1 - From Molecules to Organisms: Structure and Processes							
	K	1	2	3	4	5	6-8	9-12
	LS2 - Ecology: Interactions, Energy, and Dynamics							
Earth & Space	LS3 - Heredity: Inheritance and Variation of Traits							
	K	1	2	3	4	5	6-8	9-12
	LS4 - Biological Evolution: Unity and Diversity							
	K	1	2	3	4	5	6-8	9-12
	ESS1 - Earth's Place in the Universe							
ETS	ESS2 - Earth's Systems							
	K	1	2	3	4	5	6-8	9-12
	ESS3 - Earth and Human Activity							
ETS	ETS - Engineering, Technology, and Applications of Science							
	K	1	2	3	4	5	6-8	9-12

# 2016 WYOMING SCIENCE CONTENT AND PERFORMANCE STANDARDS

On the next page you will find how to read this document and understand its many components.

## WYOMING CROSS-CURRICULAR CONNECTIONS

At the bottom of each standards page, you will find where these science standards tie in with other content areas, such as the following:

- ELA
- Mathematics
- Social Studies
- Health
- Physical Education
- Career & Vocational Education
- Fine & Performing Arts

These standards can be found on the WDE website at  
<http://edu.wyoming.gov/educators/standards>

## INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION (ISTE) CONNECTIONS

The Committee suggests educators use the following ISTE standards in their science curriculum, instruction, and activities, where appropriate. Standard 3 has been identified throughout the document, however others may apply depending on the curriculum used.

### [2007 ISTE Standards for Students](#)

1. Creativity and innovation
2. Communication and collaboration
3. Research and information fluency
4. Critical thinking, problem solving, and decision making
5. Digital citizenship
6. Technology operations and concepts

## RESOURCES / REFERENCES

National Research Council [NRC]. (2012). [A Framework for K-12 Science Education](#): Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press.

NGSS Lead States (2013). [Next Generation Science Standards: For States, By States](#). Washington, DC: National Academies Press.

National Research Council. (2015). [Guide to Implementing the Next Generation Science Standards](#) (pp. 8-9). Washington, DC: National Academies Press.

# How to Read This Document

## Earth's Place in the Universe [4-ESS1-1]

Grade Level

Performance Expectations (PE) are the benchmarks; the skills and content students should master.

Clarification Statements provide further explanation or examples to support educators.

The State Assessment Boundary is to be considered when developing classroom and district assessments and gives limitations to the state assessment.

Symbol denotes WY examples are given or can be considered in instruction



### Performance Expectations (Benchmark)

**4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.**

*Clarification Statement: Examples of evidence from patterns (may include, but not limited to, Wyoming specific examples) could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom indicating that over time a river cut through the rock.*

*State Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.*

### Three Dimensions of Learning

Crosscutting Concepts

Patterns can be used as evidence to support an explanation.

Disciplinary Core Ideas

**The History of Planet Earth:**

- Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes.
- The presence and location of certain fossil types indicate the order in which rock layers were formed.

Science & Engineering Practices

**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.**

- Identify the evidence that supports particular points in an explanation.

### Wyoming Cross-Curricular Connections

ELA / Literacy Connections	Social Studies Connections	Mathematics Connections
<p><b>W.4.7</b> Conduct short research projects that build knowledge through investigation of different aspects of a topic.</p> <p><b>W.4.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.</p> <p><b>W.4.9</b> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>	<p><b>SS5.5.2</b> Explain how physical features, patterns, and systems impact different regions and how these features may help us generalize and compare areas within the state, nation, or world.</p>	<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>4.MD.A.1</b> Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.</p>

Science Standard Code [4.ESS1-1] means Grade 4, Earth & Space Science, Standard 1, Benchmark 1

Crosscutting Concepts (CCC) represent themes that span across engineering and science disciplines.

Disciplinary Core Ideas (DCI) represent a set of ideas for K-12 science education.

Science & Engineering Practices (SEP) will help students develop problem solving skills and understand their world through investigation.

Wyoming Cross-Curricular Connections identify possible connections to other WY Content & Performance Standards. These are intended to be suggestions and may be relevant depending on curriculum and instruction.

# 2016 WYOMING SCIENCE CONTENT AND PERFORMANCE STANDARDS

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## Elementary Standards

Students in kindergarten through fifth grade begin to develop an understanding of the four **disciplinary core ideas**: physical sciences; life sciences; earth and space sciences; and engineering, technology, and applications of science. In the earlier grades, students begin by recognizing patterns and formulating answers to questions about the world around them. By the end of fifth grade, students are able to demonstrate grade-appropriate proficiency in gathering, describing, and using information about the natural and designed world(s). The performance expectations in elementary school grade bands develop ideas and skills that will allow students to explain increasingly complex phenomena in the four disciplines as they progress to middle school and high school. The performance expectations shown in kindergarten through fifth grade couple particular practices and **crosscutting concepts** with specific disciplinary core ideas. However, instructional decisions should include use of additional practices and **crosscutting concepts** that lead to the performance expectations.

### Fifth Grade



Fifth grade performance expectations include **PS1, PS2, PS3, LS1, LS2, ESS1, ESS2, and ESS3 Disciplinary Core Ideas** adapted from the NRC Framework. The performance expectations in fifth grade help students formulate answers to questions such as: “When matter changes, does its weight change? How much water can be found in different places on Earth? Can new substances be created by combining other substances? How does matter cycle through ecosystems? Where does the energy in food come from and what is it used for? 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 able to describe that matter is made of particles too small to be seen through the development of a model. Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. They describe and graph data to provide evidence about the

distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth primarily 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. 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.

The **Crosscutting Concepts** and Connections to Engineering, Technology, and Applications of Science, listed below, are the organizing concepts for these **Disciplinary Core Ideas**.

#### Crosscutting Concepts

- Patterns
- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

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

- Interdependence of science, engineering, and technology
- Influence of science, engineering, and technology on society and the natural world

In the fifth grade performance expectations, students are expected to demonstrate understanding of the **core ideas** and grade appropriate proficiency in using the **Science and Engineering Practices** below:

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



# Matter and Its Interactions [5-PS1-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.</b></p> <p><i>Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.</i></p> <p><i>State Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.</i></p>	<b>Crosscutting Concepts</b>	<b>Natural objects exist from the very small to the immensely large.</b>
	<b>Disciplinary Core Ideas</b>	<p><b>Structure and Properties of Matter:</b></p> <ul style="list-style-type: none"> <li>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.</li> <li>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; the effects of air on larger particles or objects.</li> </ul>
	<b>Science &amp; Engineering Practices</b>	<p><b>Developing and using models 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.</b></p> <ul style="list-style-type: none"> <li>Develop a model to describe phenomena.</li> </ul>

## Wyoming Cross-Curricular Connections

<b>ELA / Literacy Connections</b>	<b>Mathematics Connections</b>
<p><b>RI.5.7</b> 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.</p>	<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>5.NBT.A.1</b> Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.</p> <p><b>10. 5.NF.B.7</b> Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.</p> <p><b>5.MD.C.3</b> Recognize volume as an attribute of solid figures and understand concepts of volume measurement.</p> <p><b>5.MD.C.4</b> Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft., and improvised units.</p>



# Matter and Its Interactions [5-PS1-2]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>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.</b></p> <p><i>Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.</i></p> <p><i>State Assessment Boundary: Assessment does not include distinguishing mass and weight.</i></p>	<b>Crosscutting Concepts</b>	<b>Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.</b>
	<b>Disciplinary Core Ideas</b>	<p><b>Structure and Properties of Matter:</b></p> <ul style="list-style-type: none"> <li>The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.</li> </ul> <p><b>Chemical Reactions:</b></p> <ul style="list-style-type: none"> <li>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.)</li> </ul>
	<b>Science &amp; Engineering Practices</b>	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>Measure and graph quantities such as weight to address scientific and engineering questions and problems.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>W.5.7</b> Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.</p> <p><b>W.5.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</p> <p><b>W.5.9</b> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>MP.5</b> Use appropriate tools strategically.</p> <p><b>5.MD.A.1</b> Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.</p>



# Matter and Its Interactions [5-PS1-3]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-PS1-3. Make observations and measurements to identify materials based on their properties.</b></p> <p><i>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, luster, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.</i></p> <p><i>State Assessment Boundary: Assessment does not include density or distinguishing mass and weight.</i></p>	<p><b>Crosscutting Concepts</b></p>	<p><b>Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.</b></p>
	<p><b>Disciplinary Core Ideas</b></p>	<p><b>Structure and Properties of Matter:</b></p> <ul style="list-style-type: none"> <li>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.)</li> </ul>
	<p><b>Science &amp; Engineering Practices</b></p>	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>W.5.7</b> Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.</p> <p><b>W.5.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</p> <p><b>W.5.9</b> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>MP.5</b> Use appropriate tools strategically.</p>



# Matter and Its Interactions [5-PS1-4]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.</b></p> <p><i>Clarification Statement: Determination of the new substance is based on the properties of the resulting substance, which could include quantitative (e.g. weight) and qualitative properties (e.g. state of matter, color, texture, and odor).</i></p> <p><i>State Assessment Boundary: Assessment does not include identification of the new substance.</i></p>	Crosscutting Concepts	Cause and effect relationships are routinely identified, tested, and used to explain change.
	Disciplinary Core Ideas	<p><b>Chemical Reactions:</b></p> <ul style="list-style-type: none"> <li>When two or more different substances are mixed, a new substance with different properties may be formed.</li> </ul>
	Science & Engineering Practices	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>W.5.7</b> Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.</p> <p><b>W.5.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</p> <p><b>W.5.9</b> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>		N/A



# Motion and Stability: Forces and Interactions [5-PS2-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.</b></p> <p><b>Clarification Statement:</b> “Down” is a local description of the direction that points toward the center of the spherical Earth.</p> <p><b>State Assessment Boundary:</b> Assessment does not include mathematical representation of gravitational force.</p> <p>Engineering, Technology &amp; Application of Science Connections            3-5-ETS1-1 (pg. 101)            3-5-ETS1-2 (pg. 102)            3-5-ETS1-3 (pg. 103)</p>	<p><b>Crosscutting Concepts</b></p>	<p>Cause and effect relationships are routinely identified, tested, and used to explain change.</p>
	<p><b>Disciplinary Core Ideas</b></p>	<p><b>Types of Interactions:</b></p> <ul style="list-style-type: none"> <li>The gravitational force of Earth acting on an object near Earth’s surface pulls that object toward the planet’s center.</li> </ul>
	<p><b>Science &amp; Engineering Practices</b></p>	<p>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).</p> <ul style="list-style-type: none"> <li>Support an argument with evidence, data, or a model.</li> </ul>
Wyoming Cross-Curricular Connections		
ELA / Literacy Connections		Mathematics Connections
<p><b>RI.5.1</b> Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</p> <p><b>RI.5.9</b> Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.</p> <p><b>W.5.1</b> Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</p>		<p>N/A</p>

# Energy [5-PS3-1]



Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>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.</b></p> <p><i>Clarification Statement: Examples of models could include diagrams, and flow charts.</i></p>	Crosscutting Concepts	Energy can be transferred in various ways and between objects.
	Disciplinary Core Ideas	<p><b>Energy in Chemical Processes and Everyday Life:</b></p> <ul style="list-style-type: none"> <li>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).</li> </ul> <p><b>Organization of Matter and Energy Flow in Organisms:</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>
	Science & Engineering Practices	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>Use models to describe phenomena.</li> </ul>
Wyoming Cross-Curricular Connections		
<b>ELA / Literacy Connections</b>		<b>Mathematics Connections</b>
<p><b>RI.5.7</b> 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.</p> <p><b>SL.5.5</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p>		N/A



# From Molecules to Organisms: Structure and Processes [5-LS1-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-LS1-1. Support an argument that plants get the materials they need for growth primarily from air and water.</b></p> <p><i>Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.</i></p>	<b>Crosscutting Concepts</b>	<b>Matter is transported into, out of, and within systems.</b>
	<b>Disciplinary Core Ideas</b>	<b>Organization for Matter and Energy Flow in Organisms:</b> <ul style="list-style-type: none"> <li>Plants acquire their material for growth chiefly from air and water.</li> </ul>
	<b>Science &amp; Engineering Practices</b>	<b>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.</b> <ul style="list-style-type: none"> <li>Support an argument with evidence, data, or a model.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>RI.5.1</b> Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</p> <p><b>RI.5.9</b> Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.</p> <p><b>W.5.1</b> Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>MP.5</b> Use appropriate tools strategically.</p> <p><b>5.MD.A.1</b> Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.</p>



# Ecosystems: Interactions, Energy, and Dynamics [5-LS2-1]

<b>5th</b> <b>Performance Expectations</b> <b>(Benchmark)</b>	<b>Three Dimensions of Learning</b>	
<p><b>5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.</b></p> <p><i>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.</i></p> <p><i>State Assessment Boundary: Assessment does not include molecular explanations.</i></p>	<b>Crosscutting Concepts</b>	<b>A system can be described in terms of its components and their interactions.</b>
	<b>Disciplinary Core Ideas</b>	<p><b>Interdependent Relationships in Ecosystems:</b></p> <ul style="list-style-type: none"> <li>The food of almost any kind of animal can be traced back to plants.</li> <li>Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.</li> <li>Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.”</li> <li>Decomposition eventually restores (recycles) some materials back to the soil.</li> <li>Organisms can survive only in environments in which their particular needs are met.</li> <li>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.</li> <li>Newly introduced species can damage the balance of an ecosystem.</li> </ul> <p><b>Cycles of Matter and Energy Transfer in Ecosystems:</b></p> <ul style="list-style-type: none"> <li>Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die.</li> <li>Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.</li> </ul>
	<b>Science &amp; Engineering Practices</b>	<p><b>Developing and using models 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.</b></p> <ul style="list-style-type: none"> <li>Develop a model to describe phenomena.</li> </ul>

## Wyoming Cross-Curricular Connections

<b>ELA / Literacy Connections</b>	<b>Mathematics Connections</b>
<p><b>RI.5.7</b> 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.</p> <p><b>SL.5.5</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p>	<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p>



# Earth's Place in the Universe [5-ESS1-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>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.</b></p> <p><i>State Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).</i></p>	Crosscutting Concepts	Natural objects exist from the very small to the immensely large.
	Disciplinary Core Ideas	<p><b>The Universe and Its Stars:</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>
	Science & Engineering Practices	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>Support an argument with evidence, data, or a model.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>RI.5.1</b> Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</p> <p><b>RI.5.7</b> 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.</p> <p><b>RI.5.8</b> Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).</p> <p><b>RI.5.9</b> Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.</p> <p><b>W.5.1</b> Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>5.NBT.A.2</b> Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.</p>



# Earth's Place in the Universe [5-ESS1-2]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>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.</b></p> <p><b>Clarification Statement:</b> Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.</p> <p><b>State Assessment Boundary:</b> Assessment does not include causes of seasons.</p>	<p><b>Crosscutting Concepts</b></p>	<p>Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.</p>
	<p><b>Disciplinary Core Ideas</b></p>	<p><b>Earth and the Solar System:</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>
	<p><b>Science &amp; Engineering Practices</b></p>	<p>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.</p> <ul style="list-style-type: none"> <li>Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>SL.5.5</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>5.G.A.2</b> Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.</p>



# Earth's Systems [5-ESS2-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</b></p> <p><i>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; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.</i></p> <p><i>State Assessment Boundary: Assessment is limited to the interactions of two systems at a time.</i></p> <p>Engineering, Technology &amp; Application of Science Connections            3-5-ETS1-1 (pg. 101)            3-5-ETS1-2 (pg. 102)            3-5-ETS1-3 (pg. 103)</p>	<b>Crosscutting Concepts</b>	<b>A system can be described in terms of its components and their interactions.</b>
	<b>Disciplinary Core Ideas</b>	<b>Earth Materials and System:</b> <ul style="list-style-type: none"> <li>• 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.</li> <li>• The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate.</li> <li>• Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.</li> </ul>
	<b>Science &amp; Engineering Practices</b>	<b>Developing and using models 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.</b> <ul style="list-style-type: none"> <li>• Develop a model using an example to describe phenomena.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>RI.5.7</b> 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.</p> <p><b>SL.5.5</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p> <p><b>5.G.A.2</b> Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.</p>



# Earth's Systems [5-ESS2-2]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.</b></p> <p>State Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.</p>	<b>Crosscutting Concepts</b>	<b>Standard units are used to measure and describe physical quantities such as weight and volume.</b>
	<b>Disciplinary Core Ideas</b>	<b>The Roles of Water in Earth's Surface Processes:</b> <ul style="list-style-type: none"> <li>Nearly all of Earth's available water is in the ocean.</li> <li>Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.</li> </ul>
	<b>Science &amp; Engineering Practices</b>	<b>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.</b> <ul style="list-style-type: none"> <li>Describe and graph quantities such as area and volume to address scientific questions.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections		Mathematics Connections
<p><b>RI.5.7</b> 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.</p> <p><b>W.5.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</p> <p><b>SL.5.5</b> Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.</p>		<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p>



# Earth and Human Activity [5-ESS3-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to conserve Earth’s resources and environment.</b></p> <p>Engineering, Technology &amp; Application of Science Connections</p> <p>3-5-ETS1-1 (pg. 101) 3-5-ETS1-2 (pg. 102) 3-5-ETS1-3 (pg. 103)</p>	Crosscutting Concepts	<p><b>A system can be described in terms of its components and their interactions.</b></p>
	Disciplinary Core Ideas	<p><b>Human Impacts on Earth Systems:</b></p> <ul style="list-style-type: none"> <li>Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. However, individuals and communities are doing things to help protect Earth’s resources and environments.</li> </ul>
	Science & Engineering Practices	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections	Social Studies Connections	Mathematics Connections
<p><b>RI.5.1</b> Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</p> <p><b>RI.5.7</b> 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.</p> <p><b>RI.5.9</b> Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.</p> <p><b>W.5.8</b> Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.</p> <p><b>W.5.9</b> Draw evidence from literary or informational texts to support analysis, reflection, and research.</p>	<p><b>SS5.3.3</b> Identify and describe how science and technology have affected production and distribution locally, nationally, and globally (e.g., trains and natural resources).</p>	<p><b>MP.2</b> Reason abstractly and quantitatively.</p> <p><b>MP.4</b> Model with mathematics.</p>



# Engineering, Technology, & Applications of Science [3-5-ETS1-1]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>3-5-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.</b></p> <p>Science Standards Connections            5-PS2-1 (pg. 92)            5-ESS2-1 (pg. 98)            5-ESS3-1 (pg. 100)</p>	Crosscutting Concepts	People’s needs and wants change over time, as do their demands for new and improved technologies.
	Disciplinary Core Ideas	<p><b>Defining and Delimiting Engineering Problems:</b></p> <ul style="list-style-type: none"> <li>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 prepared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.</li> </ul>
	Science & Engineering Practices	<p><b>Asking questions and Defining Problems in 3-5 builds on grades K-2 experiences and progresses to specifying qualitative relationships.</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections	Social Studies Connections	Career & Vocational Education Connections	Mathematics Connections
N/A	<p><b>SS.5.4.2</b> Describe how tools and technology makes life easier; describe how one tool or technology evolves into another (e.g., telegraph to telephone to cell phone or horse-drawn wagon to railroad to car); identify a tool or technology that impacted history (e.g., ships allowed for discovery of new lands or boiling water prevented spread of disease).</p> <p><b>SS5.6.2</b> Distinguish between fiction and non-fiction.</p>	<b>CV5.5.1.4</b> Students complete tasks within an allotted time acquiring, storing, organizing, and using materials and space efficiently.	N/A



# Engineering, Technology, & Applications of Science [3-5-ETS1-2]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>3-5-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.</b></p> <p>Science Standards Connections            5-PS2-1 (pg. 92)            5-ESS2-1 (pg. 98)            5-ESS3-1 (pg. 100)</p>	Crosscutting Concepts	<p>Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.</p>
	Disciplinary Core Ideas	<p><b>Developing Possible Solutions:</b></p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> </ul>
	Science & Engineering Practices	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>• Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections	Social Studies Connections	Career & Vocational Education Connections	Mathematics Connections
N/A	SS5.6.2 Distinguish between fiction and non-fiction.	CV5.5.1.4 Students complete tasks within an allotted time acquiring, storing, organizing, and using materials and space efficiently.	N/A



# Engineering, Technology, & Applications of Science [3-5-ETS1-3]

Performance Expectations (Benchmark)	Three Dimensions of Learning	
<p><b>3-5-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.</b></p> <p>Science Standards Connections            5-PS2-1 (pg. 92)            5-ESS2-1 (pg. 98)            5-ESS3-1 (pg. 100)</p>	Crosscutting Concepts	<i>Intentionally Left Blank</i>
	Disciplinary Core Ideas	<p><b>Developing Possible Solutions:</b></p> <ul style="list-style-type: none"> <li>Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.</li> </ul> <p><b>Optimizing the Design Solution:</b></p> <ul style="list-style-type: none"> <li>Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.</li> </ul>
	Science & Engineering Practices	<p><b>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.</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul>

## Wyoming Cross-Curricular Connections

ELA / Literacy Connections	Social Studies Connections	Career & Vocational Education Connections	Mathematics Connections
N/A	SS5.6.2 Distinguish between fiction and non-fiction.	CV5.5.1.4 Students complete tasks within an allotted time acquiring, storing, organizing, and using materials and space efficiently.	N/A

## **Appendices/Resources that are available include:**

- **Appendix A - A Model of the Three Dimensions of Science Learning**
- **Appendix B - Three Dimensions of Learning Framework**
- **Appendix C - ISTE Standards (International Society of Technology in Education)**
- **Appendix D - Connections to the Literacy Standards, ELA, and Mathematics Standards**
- **Appendix E - Disciplinary Core Ideas**
- **Appendix F - Science & Engineering Practices**
- **Appendix G - Crosscutting Concepts**
- **Appendix H - Nature of Science**
- **Appendix I - Engineering, Technology, and Applications of Science**
- **Appendix J - Glossary**
- **Appendix K - Acronyms**

**These and other resources can be found at**

**<https://edu.wyoming.gov/educators/standards/science>**