

## Standards, Curriculum, Instruction, and Assessment

**Standards** - What a student needs to know, understand, and be able to do by the end of each grade. Standards build across grade levels in a progression of increasing understanding and through a range of cognitive demand levels. Standards are adopted at the state level by the State Board of Education.

**Curriculum** - The resources used for teaching and learning the standards. Curricula are adopted at a local level by districts and schools. Curricula include scope and sequence of K-12 standards and/or learning objectives/targets aligned to the state standards. Comprehensive curricula are necessary to plan the pace of instruction, alignment standards and grade level expectations horizontally and vertically, set district assessment and professional development calendars and guide teachers as they deliver instruction.

**Instruction** - The methods and processes used by teachers in planning, instruction and assessment. Instructional techniques are employed by individual teachers in response to the needs of the students in their classes to help them progress through the curriculum in order to master the standards.

**Assessment** - The process of gathering information about student learning to inform education-related decisions. Assessments can reflect a wide variety of learning goals/targets using a range of methods serving many important users and uses at a variety of levels from the classroom to the boardroom. In this sense, assessment is an essential part of informing the teaching and learning process.

## Innovations for 2018 Science Standards

- 1. Three-Dimensional Learning:** An instructional approach where students make sense of phenomena of the natural world through “engaging in science and engineering practices and their application of the crosscutting concepts” (Bybee pg. 2). The three dimensions work together by reinforcing inner-related concepts, giving students a way of organizing and applying their knowledge across a broad spectrum
- 2. Explaining Phenomena and Designing Solutions to Problems:** Providing a context for lessons, units, and programs that spark students’ curiosity about the phenomena of the natural world and provides a motivation to learn the core ideas of science. The content becomes meaningful, and students are engaged with learning the content to explain the phenomena or to design solutions to a problem.
- 3. Incorporating Engineering Design:** Incorporating engineering design and nature of science are practiced and experienced by students throughout the Arizona Science Standard.
- 4. Building K-12 Progression:** Science engineering practices, crosscutting concepts, and core ideas build coherent learning progressions both within a grade level and across grade levels so students can continually build on and revise their knowledge and skills throughout their schooling.
- 5. Connecting to ELA/literacy and Mathematics:** Literacy and mathematics are part of science. Integrating these disciplines with science provides broad and deep conceptual understanding in all three subject areas.

### Sources:

Bybee, R.W. (2015). *NGSS Innovations*. Retrieved from <https://www.amnh.org/content/download/133084/2214178/file/NGSS%20Innovations.pdf>

Harlen, W. (2015). *Working with big ideas of science education*. Global Network of Science Academies (IAP) Science Education Programme: Trieste, Italy.

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National Research Council (NRC). (2012). *A Framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: The National Academies Press.

Schwarz, C.V., Passmore, C., Reiser, B.J. (2017). *Helping students make sense of the world using next generation science and engineering practices*. Arlington, VA: NSTA Press

What are NGSS Performance Expectations? (2017). Retrieved from <https://www.albert.io/blog/what-are-ngss-performance-expectations/>



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – K-12

While there is some correlation between the 2004 and 2018 science content standards, the 2018 standards encompass many performance objectives in one core idea. The depth and focus of the 2018 standards do not correlate to the 2004 standards well. Therefore, a crosswalk between 2004 and 2018 standards will not be provided.

## Why Move Toward Broad Standards and Away from Performance Objectives?

AzSS standards are expectations of student performance. Neuroscience research has identified factors that facilitate effective learning. A relevant finding is that ideas that are connected are more readily used in new situations than unconnected ideas. In other words, a few big ideas enable understanding of the world and our experiences in it, rather than disjointed facts of content (Big Ideas pg. 5).

### Moving Toward Broad Standards

- Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning
- Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
- Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
- Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
- Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information
- Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
- Student writing of journals, reports, posters, and media presentations that explain and argue
- Provision of supports so that all students can engage in sophisticated science and engineering practices

### Moving Away from Performance Objectives

- Rote memorization of facts and terminology
- Learning of ideas disconnected from questions about phenomena
- Teachers providing information to the whole class
- Teachers posing questions with only one right answer
- Students reading textbooks and answering questions at the end of the chapter
- Pre-planned outcome for "cookbook" laboratories or hands-on activities
- Worksheets
- Oversimplification of activities for students who are perceived to be less able to do science and engineering

Source: National Research Council. (2015). Guide to Implementing the Next Generation Science Standards (pp. 8-9). Washington, DC: National Academies Press. <http://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards>.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – K-12

Three Dimensions of Science		
Sense-making in science occurs with the integrating of three essential dimensions: science and engineering practices, crosscutting concepts, and core ideas.		
Science and Engineering Practices	Crosscutting Concepts	Core Ideas
<p><b>Science and engineering practices</b> describe a robust process for how scientists investigate and build models and theories of the natural world or how engineers design and build systems. As students conduct investigations, they engage in multiple practices as they gather information to solve problems, answer their questions, reason about how the data provide evidence to support their understanding, and then communicate their understanding of phenomena. Student investigations may be observational, experimental, use models or simulations, or use data from other sources. These eight practices identified in <i>A Framework for K-12 Science Education</i> are critical components of scientific literacy, not instructional strategies:</p> <ul style="list-style-type: none"> <li>• Asking questions (for science) and defining problems (for engineering)</li> <li>• Developing and using models</li> <li>• Planning and carrying out investigations</li> <li>• Analyzing and interpreting data</li> <li>• Using mathematics and computational thinking</li> <li>• Constructing explanations (for science) and designing solutions (for engineering)</li> <li>• Engaging in argument from evidence</li> <li>• Obtaining, evaluating, and communicating information</li> </ul>	<p><b>Crosscutting concepts</b> are a tool for students that cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world. Their purpose is to provide a lens to help students deepen their understanding of the core ideas as they make sense of phenomena. The seven crosscutting concepts identified in <i>A Framework for K-12 Science Education</i> are:</p> <ul style="list-style-type: none"> <li>• Patterns</li> <li>• Cause and effect: Mechanism and explanation</li> <li>• Scale, proportion, and quantity</li> <li>• Systems and system models</li> <li>• Energy and matter: Flow, cycles and conservations</li> <li>• Structure and function</li> <li>• Stability and change</li> </ul>	<p><b>Core ideas</b> for knowing science and using science develop scientific literacy through science content knowledge, understanding the nature of science, applications of science and engineering, and social implications. The thirteen core ideas modified from <i>Working with Big Ideas of Science Education</i> are:</p> <p><b>Physical Science</b></p> <p>P1: All matter in the Universe is made of very small particles.  P2: Objects can affect other objects at a distance.  P3: Changing the movement of an object requires a net force to be acting on it.  P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.</p> <p><b>Earth and Space Science</b></p> <p>E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.  E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.</p> <p><b>Life Science</b></p> <p>L1: Organisms are organized on a cellular basis and have a finite life span.  L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.  L3: Genetic information is passed down from one generation of organisms to another.  L4: The unity and diversity of organisms, living and extinct, is the result of evolution.</p> <p><b>Using Science</b></p> <p>U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.  U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.  U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.</p>



The intention of this document is to help Arizona educators determine if a Next Generation Science Standard (NGSS) resource could be used when planning for instruction with the Arizona Science Standards (AzSS). This document describes how the Arizona Science Standards may or may not align to the Next Generation Science Standards.

# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – Kindergarten

## Kindergarten Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

The ADE acknowledges that the acronym “NGSS” is consistently used throughout science resources. To avoid confusion, we want to ensure the community understands that Arizona is not considered an “NGSS” state. To further clarify, AzSS and the NGSS were both designed using the research document, *A Framework for K-12 Science Education*. Both sets of standards include a strong focus on three-dimensional instruction, which includes: Science and Engineering Practices, Crosscutting Concepts, and Core Ideas. The major difference between the AzSS and the NGSS is that Arizona used an additional research document, *Working with Big Ideas of Science Education*, in the development of the Core Ideas of Knowing and Using Science.

### Alignment of the AzSS to NGSS Performance Expectations

**Note: An “S” or “P” alignment indicates that an NGSS resources could be used. An “NC” indicates that an NGSS resources cannot be used.**

- **S = Strong: Both the Core Idea and Science and Engineering Practice (SEP\*) are the same**
- **P = Partial: Core idea is closely related; SEP may or may not match**
- **NC\*\* = Not Closely Correlated: There is no strong or partial correlation in this grade band**

*\*The bolded section of each standard refers to the Science and Engineering Practice that correlates to each standard. However, others should be utilized throughout the learning for this grade level. Naturally, one practice can lead to the use of others.*

*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts: Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students explore how their senses can detect light, sound, and vibration and how technology can be used to extend their senses.**

Arizona Science Standards- Kindergarten Physical		Next Generation Science Standards- Kindergarten Physical
<b>K.P2U1.1 Investigate</b> how senses can detect light, sound, and vibrations even when they come from far away; use the collected evidence to <b>develop and support an explanation.</b>	NC	There is not strong or partial correlation to an NGSS standard in this grade band.
<b>K.P2U2.2 Design and evaluate</b> a tool that helps people extend their senses.	NC	There is not strong or partial correlation to an NGSS standard in this grade band.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – Kindergarten

**Earth and Space Sciences: Students develop an understanding of patterns to understand changes in local weather, seasonal cycles, and daylight.**

Arizona Science Standards- Kindergarten Earth & Space		Next Generation Science Standards- Kindergarten Earth & Space
<b>K.E1U1.3 Observe, record, and ask questions</b> about temperature, precipitation, and other weather data to identify patterns or changes in local weather.	S	<b>K-ESS2-1</b> Use and share observations of local weather conditions to describe patterns over time.
<b>K.E1U1.4 Observe, describe, ask questions</b> , and predict seasonal weather patterns; and how those patterns impact plants and animals (including humans).	P	<b>K-ESS2-1</b> Use and share observations of local weather conditions to describe patterns over time.
<b>K.E2U1.5 Observe and ask questions</b> about patterns of the motion of the sun, moon, and stars in the sky.	S	<b>1-ESS1-1</b> Use observations of the Sun, Moon, and stars to describe patterns that can be predicted.

**Life Science: Students develop an understanding that the world is comprised of living and non-living things. They investigate the relationship between structure and function in living things; plants and animals use specialized parts to help them meet their needs and survive.**

Arizona Science Standards- Kindergarten Life		Next Generation Science Standards- Kindergarten Life
<b>K.L1U1.6 Obtain, evaluate, and communicate</b> information about how organisms use different body parts for survival.	P	<b>K-LS1-1</b> Use observations to describe patterns of what plants and animals (including humans) need to survive.
<b>K.L1U1.7 Observe, ask questions, and explain</b> how specialized structures found on a variety of plants and animals (including humans) help them sense and respond to their environment.	P	<b>1-LS1-1</b> Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
<b>K.L2U1.8 Observe, ask questions, and explain</b> the differences between the characteristics of living and non-living things.	NC	There is not strong or partial correlation to an NGSS standard in this grade band.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 1st Grade

## 1<sup>st</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

**Note: An “S” or “P” alignment indicates that an NGSS resources could be used. An “NC” indicates that an NGSS resources cannot be used.**

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*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts:** Patterns; **Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; **Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students develop an understanding of the effects of forces and waves, and how they can impact or be impacted by objects near and far away. They explore the relationships between sound and vibrating materials, as well as light and materials including the ability of sound and light to travel from place to place.**

Arizona Science Standards- 1 <sup>st</sup> Grade Physical		Next Generation Science Standards- 1 <sup>st</sup> Grade Physical
<b>1.P2U1.1 Plan and carry out investigations</b> demonstrating the effect of placing objects made with different materials in the path of a beam of light and predict how objects with similar properties will affect the beam of light.	S	<b>1-PS4-3</b> Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam light.
<b>1.P2U1.2 Use models</b> to provide evidence that vibrating matter creates sound and sound can make matter vibrate.	P	<b>1-PS4-1</b> Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
<b>1.P3U1.3 Plan and carry out investigations</b> which demonstrate how equal forces can balance objects and how unequal forces can push, pull, or twist objects, making them change their speed, direction, or shape.	P	<b>K-PS2-1</b> Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 1st Grade

Arizona Science Standards- 1 <sup>st</sup> Grade Physical		Next Generation Science Standards- 1 <sup>st</sup> Grade Physical
<b>1.P4U2.4 Design and evaluate</b> ways to increase or reduce heat from friction between two objects.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.

**Earth Science: Students develop an understanding that earth materials are essential for organisms survival.**

Arizona Science Standards- 1 <sup>st</sup> Grade Earth & Space		Next Generation Science Standards- 1 <sup>st</sup> Grade Earth & Space
<b>1.E1U1.5 Obtain, evaluate, and communicate information</b> about the properties of Earth materials and <b>investigate</b> how humans use natural resources in everyday life.	P	<b>K-ESS3-1</b> Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

**Life Science: Students develop an understanding that Earth has supported, and continues to support, a large variety of organisms. These organisms can be distinguished by their physical characteristics, life cycles, and their different resource needs for survival. Different types of organisms live where there are different earth resources such as food, air, and water.**

Arizona Science Standards- 1 <sup>st</sup> Grade Life		Next Generation Science Standards- 1 <sup>st</sup> Grade Life
<b>1.L1U1.6 Observe, describe, and predict</b> life cycles of animals and plants.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>1.L2U2.7 Develop and use models</b> about how living things use resources to grow and survive; design and evaluate habitats for organisms using earth materials.	P	<b>K-ESS3-1</b> Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
<b>1.L2U1.8 Construct an explanation</b> describing how organisms obtain resources from the environment including materials that are used again by other organisms.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>1.L3U1.9 Obtain, evaluate, and communicate information</b> to support an evidence-based explanation that plants and animals produce offspring of the same kind, but offspring are generally not identical to each other or their parents.	S	<b>1-LS3-1</b> Make observations to construct an evidence-based account that young plants and animals are like, but exactly like, their parents.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 1st Grade

Arizona Science Standards- 1 <sup>st</sup> Grade Life		Next Generation Science Standards- 1 <sup>st</sup> Grade Life
<b>1.L4U1.10 Develop a model</b> to describe how animals and plants are classified into groups and subgroups according to their similarities.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>1.L4U3.11 Ask questions</b> and explain how factors can cause species to go extinct.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.





# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 2nd Grade

## 2<sup>nd</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

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*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts:** Patterns; Cause and Effect; Scale, Proportion and Quantity; **Systems and System Models**; **Energy and Matter**; Structure and Function; Stability and Change

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students develop an understanding of observable properties of matter and how changes in energy (heating or cooling) can affect matter or materials.**

Arizona Science Standards- 2 <sup>nd</sup> Grade Physical		Next Generation Science Standards- 2 <sup>nd</sup> Grade Physical
<b>2.P1U1.1 Plan and carry out an investigation</b> to determine that matter has mass, takes up space, and is recognized by its observable properties; use the collected evidence <b>to develop and support an explanation.</b>	S	<b>2-PS1-1</b> Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
<b>2.P1U1.2 Plan and carry out investigations to gather evidence</b> to support an explanation on how heating or cooling can cause a phase change in matter.	P	<b>2-PS1-4</b> Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
<b>2.P4U1.3 Obtain, evaluate and communicate</b> information about ways heat energy can cause change in objects or materials.	P	<b>2-PS1-4</b> Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 2nd Grade

**Earth and Space: Students develop an understanding of the distribution and role of water and wind in weather, shaping the land, and where organisms live. Wind and water can also change environments, and students learn humans and other organisms can change environments too. Students develop an understanding of changing patterns in the sky, including the position of Sun, Moon, and stars, and the apparent shape of the Moon.**

Arizona Science Standards- 2 <sup>nd</sup> Grade Earth & Space		Next Generation Science Standards- 2 <sup>nd</sup> Grade Earth & Space
<b>2.E1U1.4 Observe and investigate</b> how wind and water change the shape of the land resulting in a variety of landforms.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>2.E1U1.5 Develop and use models</b> to represent that water can exist in different states and is found in oceans, glaciers, lakes, rivers, ponds, and the atmosphere.	P	<b>2-ESS2-2</b> Develop a model to represent the shapes and kinds of land and bodies of water in an area.
	P	<b>2-ESS2-3</b> Obtain information to identify where water is found on Earth and that it can be solid or liquid.
<b>2.E1U2.6 Analyze patterns</b> in weather conditions of various regions of the world and <b>design, test, and refine solutions</b> to protect humans from severe weather conditions.	P	<b>K-ESS2-1</b> Use and share observation of local weather conditions to describe weather patterns over time.
<b>2.E1U3.7 Construct an argument from evidence</b> regarding positive and negative changes in water and land systems that impact humans and the environment.	S	<b>K-ESS3-3</b> Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
<b>2.E2U1.8 Observe and explain</b> the Sun's position at different times during a twenty-four-hour period and changes in the apparent shape of the Moon from one night to another.	P	<b>1-ESS1-1</b> Use observations of the Sun, Moon, and stars to describe patterns that can be predicted.

**Life Science: Students develop an understanding that life on Earth depends on energy from the Sun or energy from other organisms to survive.**

Arizona Science Standards- 2 <sup>nd</sup> Grade Life		Next Generation Science Standards- 2 <sup>nd</sup> Grade Life
<b>2.L2U1.9 Obtain, analyze, and communicate</b> evidence that organisms need a source of energy, air, water, and certain temperature conditions to survive.	P	<b>K-LS1-1</b> Use observations to describe patterns of what plants and animals (including humans) need to survive.
<b>2.L2U1.10 Develop a model</b> representing how life on Earth depends on energy from the Sun and energy from other organisms.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 3rd Grade

## 3<sup>rd</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

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*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts:** Patterns; Cause and Effect; Scale, Proportion and Quantity; **Systems and System Models**; Energy and Matter; **Structure and Function**; Stability and Change

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students develop an understanding of the sources, properties, and characteristics of energy along with the relationship between energy transfer and the human body.**

Arizona Science Standards- 3 <sup>rd</sup> Grade Physical Science		Next Generation Science Standards- 3 <sup>rd</sup> Grade Physical Science
<b>3.P2U1.1 Ask questions and investigate</b> the relationship between light, objects and the human eye.	P	<b>4-PS4-2</b> Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
<b>3.P2U1.2 Plan and carry out an investigation</b> to explore how sound waves affect objects at varying distances.	P	<b>4-PS4-1</b> Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
<b>3.P4U1.3 Develop and use models to describe</b> how light and sound waves transfer energy.	P	<b>4-PS3-2</b> Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 3rd Grade

**Earth and Space: Students develop an understanding of how the Sun provides light and energy for Earth systems.**

Arizona Science Standards- 3 <sup>rd</sup> Grade Earth & Space		Next Generation Science Standards- 3 <sup>rd</sup> Grade Earth & Space
<b>3.E1U1.4 Construct an explanation</b> describing how the Sun is the primary source of energy impacting Earth systems.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.

**Life Science: Students develop an understanding of the flow of energy in a system beginning with the Sun to and among organisms. They also understand that plants and animals (including humans) have specialized internal and external structures and can respond to stimuli to increase survival.**

Arizona Science Standards- 3 <sup>rd</sup> Grade Life		Next Generation Science Standards- 3 <sup>rd</sup> Grade Life
<b>3.L1U1.5 Develop and use models</b> to explain that plants and animals (including humans) have internal and external structures that serve various functions that aid in growth, survival, behavior, and reproduction.	P	<b>4-LS1-1</b> Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
<b>3.L2U1.6 Plan and carry out investigations</b> to demonstrate ways plants and animals react to stimuli.	P	<b>4-LS1-2</b> Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways
<b>3.L2U1.7 Develop and use system models</b> to describe the flow of energy from the Sun to and among living organisms.	S	<b>5-PS3-1</b> 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>3.L2U1.8 Construct an argument from evidence</b> that organisms are interdependent.	P	<b>5-LS2-1</b> Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.



# Arizona’s 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 4th Grade

## 4<sup>th</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

The ADE acknowledges that the acronym “NGSS” is consistently used throughout science resources. To avoid confusion, we want to ensure the community understands that Arizona is not considered an “NGSS” state. To further clarify, AzSS and the NGSS were both designed using the research document, *A Framework for K-12 Science Education*. Both sets of standards include a strong focus on three-dimensional instruction, which includes: Science and Engineering Practices, Crosscutting Concepts, and Core Ideas. The major difference between the AzSS and the NGSS is that Arizona used an additional research document, *Working with Big Ideas of Science Education*, in the development of the Core Ideas of Knowing and Using Science.

### Alignment of the AzSS to NGSS Performance Expectations

**Note: An “S” or “P” alignment indicates that an NGSS resources could be used. An “NC” indicates that an NGSS resources cannot be used.**

- **S = Strong: Both the Core Idea and Science and Engineering Practice (SEP\*) are the same**
- **P = Partial: Core idea is closely related; SEP may or may not match**
- **NC\*\* = Not Closely Correlated: There is no strong or partial correlation in this grade band**

*\*The bolded section of each standard refers to the Science and Engineering Practice that correlates to each standard. However, others should be utilized throughout the learning for this grade level. Naturally, one practice can lead to the use of others.*

*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts:** Patterns; Cause and Effect; Scale, Proportion and Quantity; **Systems and System Models**; **Energy and Matter**; Structure and Function; **Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students develop an understanding of how Earth’s resources can be transformed into different forms of energy. Students develop a better understanding of electricity and magnetism.**

Arizona Science Standards- 4 <sup>th</sup> Grade Physical		Next Generation Science Standards- 4 <sup>th</sup> Grade Physical
<b>4.P4U1.1 Develop and use a model</b> to demonstrate how a system transfers energy from one object to another even when the objects are not touching.	P	<b>3-PS2-3</b> Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
<b>4.P4U1.2 Develop and use a model</b> that explains how energy is moved from place to place through electric currents.	P	<b>3-PS2-3</b> Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
	P	<b>4-PS3-2</b> Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
<b>4.P2U1.3 Develop and use a model</b> to demonstrate magnetic forces.	P	<b>3-PS2-3</b> Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 4th Grade

Arizona Science Standards- 4 <sup>th</sup> Grade Physical		Next Generation Science Standards- 4 <sup>th</sup> Grade Physical
<b>4.P4U3.4 Engage in argument from evidence</b> on the use and impact of renewable and nonrenewable resources to generate electricity.	P	<b>4-ESS3-1</b> Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
<b>Earth and Space: Students develop an understanding of the different Earth systems and how they interact with each other. They understand how geological systems change and shape Earth and the evidence that is used to understand these changes. They also understand how weather, climate, and human interactions can impact the environment.</b>		
Arizona Science Standards- 4 <sup>th</sup> Grade Earth & Space		Next Generation Science Standards- 4 <sup>th</sup> Grade Earth & Space
<b>4.E1U1.5 Use models</b> to explain seismic waves and their effect on the Earth.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>4.E1U1.6 Plan and carry out an investigation</b> to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.	P	<b>4-ESS2-1</b> Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
	P	<b>5-ESS2-1</b> Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
<b>4.E1U1.7 Develop and/or revise a model</b> using various rock types, fossils location, and landforms to show evidence that Earth's surface has changed over time.	P	<b>4-ESS2-2</b> Analyze and interpret data from maps to describe patterns of Earth's features.
	P	<b>4-ESS1-1</b> Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
<b>4.E1U1.8 Collect, analyze, and interpret data</b> to explain weather and climate patterns.	S	<b>3-ESS2-1</b> Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
	P	<b>3-ESS2-2</b> Obtain and combine information to describe climates in different regions of the world.
<b>4.E1U3.9 Construct and support an evidence-based argument</b> about the availability of water and its impact on life.	P	<b>5-ESS2-2</b> 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.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 4th Grade

Arizona Science Standards- 4 <sup>th</sup> Grade Earth & Space		Next Generation Science Standards- 4 <sup>th</sup> Grade Earth & Space
4.E1U2.10 Define problem(s) and design solution(s) to minimize the effects of natural hazards.	P	3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
	P	4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

**Life Science: Students develop an understanding of the diversity of past and present organisms, factors impacting organism diversity, and evidence of change of organisms over time.**

Arizona Science Standards- 4 <sup>th</sup> Grade Life		Next Generation Science Standards- 4 <sup>th</sup> Grade Life
4.L4U1.11 Analyze and interpret environmental data to demonstrate that species either adapt and survive, or go extinct over time.	P	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.



# Arizona’s 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 5th Grade

## 5<sup>th</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

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*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts: Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students develop an understanding that changes can occur to matter/objects on Earth or in space, but both energy and matter follow the pattern of being conserved during those changes.**

Arizona Science Standards- 5 <sup>th</sup> Grade Physical		Next Generation Science Standards- 5 <sup>th</sup> Grade Physical
<b>5.P1U1.1 Analyze and interpret data</b> to explain that matter of any type can be subdivided into particles too small to see and, in a closed system, if properties change or chemical reactions occur, the amount of matter stays the same.	P	<b>5-PS1-1</b> Develop a model to describe that matter is made of particles too small to be seen.
	P	<b>5-PS1-2</b> 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>5.P1U1.2 Plan and carry out investigations</b> to demonstrate that some substances combine to form new substances with different properties and others can be mixed without taking on new properties.	S	<b>5-PS1-4</b> Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
<b>5.P2U1.3 Construct an explanation</b> using evidence to demonstrate that objects can affect other objects even when they are not touching.	P	<b>3-PS2-3</b> Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.





## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 5th Grade

Arizona Science Standards- 5 <sup>th</sup> Physical		Next Generation Science Standards- 5 <sup>th</sup> Physical
<b>5.P3U1.4 Obtain, analyze, and communicate evidence</b> of the effects that balanced and unbalanced forces have on the motion of objects.	P	<b>3-PS2-1</b> Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
<b>5.P3U2.5 Define problems and design solutions</b> pertaining to force and motion.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>5.P4U1.6 Analyze and interpret data</b> to determine how and where energy is transferred when objects move.	P	<b>4-PS3-3</b> Ask questions and predict outcomes about the changes in energy that occur when objects collide.
	P	<b>4-PS3-1</b> Use evidence to construct an explanation relating the speed of an object to the energy of that object.

### Earth and Space: Students develop an understanding of the how gravitational forces in space cause observable patterns due to the position of Earth, Sun, Moon, and stars.

Arizona Science Standards- 5 <sup>th</sup> Grade Earth & Space		Next Generation Science Standards- 5 <sup>th</sup> Grade Earth & Space
<b>5.E2U1.7 Develop, revise, and use models based on evidence to construct explanations</b> about the movement of the Earth and Moon within our solar system.	P	<b>5-ESS1-2</b> 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>5.E2U1.8 Obtain, analyze, and communicate evidence</b> to support an explanation that the gravitational force of Earth on objects is directed toward the planet's center.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 5th Grade

**Life Science: Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop the understanding of how genetic information and environmental features impact the survival of an organism.**

Arizona Science Standards- 5 <sup>th</sup> Grade Life		Next Generation Science Standards- 5 <sup>th</sup> Grade Life
<b>5.L3U1.9 Obtain, evaluate, and communicate information</b> about patterns between the offspring of plants, and the offspring of animals (including humans); <b>construct an explanation</b> of how genetic information is passed from one generation to the next.	P	<b>3-LS3-1</b> 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.
<b>5.L3U1.10 Construct an explanation</b> based on evidence that the changes in an environment can affect the development of the traits in a population of organisms.	S	<b>3-LS3-2</b> Use evidence to support the explanation that traits can be influenced by the environment.
<b>5.L4U3.11 Obtain, evaluate, and communicate evidence</b> about how natural and human-caused changes to habitats or climate can impact populations.	P	<b>3-LS4-4</b> 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.
<b>5.L4U3.12 Construct an argument based on evidence</b> that inherited characteristics can be affected by behavior and/or environmental conditions.	P	<b>3-LS4-4</b> 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.
	P	<b>3-LS3-2</b> Use evidence to support the explanation that traits can be influenced by the environment.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 6th Grade

## 6<sup>th</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

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*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts: Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students develop an understanding of forces and energy and how energy can transfer from one object to another or be converted from one form to another. They also develop an understanding of the nature of matter.**

Arizona Science Standards- 6 <sup>th</sup> Grade Physical		Next Generation Science Standards- 6 <sup>th</sup> Grade Physical
<b>6.P1U1.1 Analyze and interpret data</b> to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).	P	<b>MS-PS1-4</b> Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
<b>6.P1U1.2</b> Plan and carry out an investigation to demonstrate that variations in temperature and/or pressure affect changes in state of matter.	P	<b>MS-PS1-4</b> Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
<b>6.P1U1.3 Develop and use models</b> to represent that matter is made up of smaller particles called atoms.	S	<b>MS-PS1-1</b> Develop models to describe the atomic composition of simple molecules and extended structures.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 6th Grade

Arizona Science Standards- 6 <sup>th</sup> Physical		Next Generation Science Standards- 6 <sup>th</sup> Physical
<b>6.P2U1.4 Develop and use a model</b> to predict how forces act on objects at a distance.	P	<b>MS-PS2-5</b> Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
<b>6.P4U2.5 Analyze</b> how humans use technology to store (potential) and/or use (kinetic) energy.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.

### Earth and Space: Students develop an understanding of the scale and properties of objects in the solar system and how forces (gravity) and energy cause observable patterns in the Sun-Earth-Moon system.

Arizona Science Standards- 6 <sup>th</sup> Grade Earth & Space		Next Generation Science Standards- 6 <sup>th</sup> Grade Earth & Space
<b>6.E1U1.6 Investigate and construct an explanation</b> demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.	P	<b>MS-ESS2-6</b> Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
<b>6.E2U1.7</b> Use ratios and proportions to <b>analyze and interpret data</b> related to scale, properties, and relationships among objects in our solar system.	S	<b>MS-ESS1-3</b> Analyze and interpret data to determine scale properties of objects in the solar system.
<b>6.E2U1.8 Develop and use models</b> to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>6.E2U1.9 Develop and use models to construct an explanation</b> of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.	S	<b>MS-ESS1-1</b> Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
<b>6.E2U1.10 Use a model</b> to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.	S	



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 6th Grade

**Life Science Standards: Students develop an understanding of how energy from the Sun is transferred through ecosystems.**

Arizona Science Standards- 6 <sup>th</sup> Grade Life		Next Generation Science Standards- 6 <sup>th</sup> Grade Life
<b>6.L2U3.11 Use evidence to construct an argument</b> regarding the impact of human activities on the environment and how they positively and negatively affect the competition for energy and resources in ecosystems.	P	<b>MS-LS2-4</b> Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
<b>6.L2U3.12 Engage in argument from evidence</b> to support a claim about the factors that cause species to change and how humans can impact those factors.	P	<b>MS-LS4-5</b> Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
<b>6.L2U1.13 Develop and use models</b> to demonstrate the interdependence of organisms and their environment including biotic and abiotic factors.	P	<b>MS-LS2-1</b> Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
<b>6.L2U1.14 Construct a model</b> that shows the cycling of matter and flow of energy in ecosystems.	S	<b>MS-LS2-3</b> Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.



The intention of this document is to help Arizona educators determine if a Next Generation Science Standard (NGSS) resource could be used when planning for instruction with the Arizona Science Standards (AzSS). This document describes how the Arizona Science Standards may or may not align to the Next Generation Science Standards.

# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 7th Grade

## 7<sup>th</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

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**Crosscutting Concepts: Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students will explore how cause and effect take place within and between a wide variety of force and motion systems from forces on individual objects to the forces that shape our Earth.**

Arizona Science Standards- 7 <sup>th</sup> Grade Physical		Next Generation Science Standards- 7 <sup>th</sup> Grade Physical
7.P2U1.1 <b>Collect and analyze data</b> demonstrating how electromagnetic forces can be attractive or repulsive and can vary in strength.	P	<b>MS-PS2-3</b> Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
7.P2U1.2 <b>Develop and use a model</b> to predict how forces act on objects at a distance.	P	<b>MS-PS2-5</b> Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
7.P3U1.3 <b>Plan and carry out an investigation</b> that can support an <b>evidence-based explanation</b> of how objects on Earth are affected by gravitational force.	P	<b>MS-PS2-4</b> Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
7.P3U1.4 Use non-algebraic <b>mathematics and computational thinking</b> to explain Newton’s laws of motion.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.



The intention of this document is to help Arizona educators determine if a Next Generation Science Standard (NGSS) resource could be used when planning for instruction with the Arizona Science Standards (AzSS). This document describes how the Arizona Science Standards may or may not align to the Next Generation Science Standards.

## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 7th Grade

### Earth and Space: Students develop an understanding of the patterns of energy flow along with matter cycling within and among Earth's systems.

Arizona Science Standards- 7 <sup>th</sup> Grade Earth & Space		Next Generation Science Standards- 7 <sup>th</sup> Grade Earth & Space
7.E1U1.5 <b>Construct a model</b> that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.	P	<b>MS-ESS2-1</b> Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
	P	<b>MS-ESS2-4</b> Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
7.E1U1.6 <b>Construct a model</b> to explain how the distribution of fossils and rocks, continental shapes, and seafloor structures provides evidence of the past plate motions.	P	<b>MS-ESS2-3</b> Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
7.E1U2.7 <b>Analyze and interpret data to construct an explanation</b> for how advances in technology has improved weather prediction.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.

### Life Science: Students develop an understanding of the structure and function of cells.

Arizona Science Standards- 7 <sup>th</sup> Grade Life		Next Generation Science Standards- 7 <sup>th</sup> Grade Life
7.L1U1.8 <b>Obtain, evaluate, and communicate information</b> to provide evidence that all living things are made of cells, cells come from existing cells, and cells are the basic structural and functional unit of all living things.	P	<b>MS-LS1-1</b> Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
7.L1U1.9 <b>Construct an explanation</b> to demonstrate the relationship between major cell structures and cell functions (plant and animal).	P	<b>MS-LS1-2</b> Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.
7.L1U1.10 <b>Develop and use a model</b> to explain how cells, tissues, and organ systems maintain life (animals).	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
7.L1U1.11 <b>Construct an explanation</b> for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
7.L2U1.12 <b>Construct an explanation</b> for how some plant cells convert light energy into food energy.	P	<b>MS-LS1-6.</b> Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 8th Grade

## 8<sup>th</sup> Grade Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

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### Alignment of the AzSS to NGSS Performance Expectations

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*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts:** Patterns; **Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models; **Energy and Matter**; Structure and Function; **Stability and Change**

*\*Bolded crosscutting concepts are a focus throughout this grade level.*

**Physical Science: Students apply stability and change to explore chemical properties of matter and chemical reactions to further understand energy and matter.**

Arizona Science Standards- 8 <sup>th</sup> Grade Physical		Next Generation Science Standards- 8 <sup>th</sup> Grade Physical
<b>8.P1U1.1 Develop and use a model</b> to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.	S	<b>MS-PS1-5</b> Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
<b>8.P1U1.2 Obtain and evaluate information</b> regarding how scientists identify substances based on unique physical and chemical properties.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>8.P4U1.3 Construct an explanation</b> on how energy can be transferred from one energy store to another.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.





## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 8th Grade

Arizona Science Standards- 8 <sup>th</sup> Physical		Next Generation Science Standards- 8 <sup>th</sup> Physical
<b>8.P4U1.4 Develop and use mathematical models</b> to explain wave characteristics and interactions.	S	<b>MS-PS4-1</b> Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
	S	<b>MS-PS4-2</b> Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
<b>8.P4U2.5 Develop a solution</b> to increase efficiency when transferring energy from one source to another.	P	<b>MS-PS3-3</b> Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

### Earth and Space Standards: Students explore natural and human-induced cause-and-effect changes in Earth systems over time.

Arizona Science Standards- 8 <sup>th</sup> Grade Earth & Space		Next Generation Science Standards- 8 <sup>th</sup> Grade Earth & Space
<b>8.E1U1.6 Analyze and interpret data</b> about the Earth's geological column to <b>communicate</b> relative ages of rock layers and fossils.	P	<b>MS-ESS1-4</b> Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
	P	<b>MS-LS4-1</b> Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
<b>8.E1U3.7 Obtain, evaluate, and communicate</b> information about data and historical patterns to predict natural hazards and other geological events.	P	<b>MS-ESS3-2</b> Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
<b>8.E1U3.8 Construct and support an argument</b> about how human consumption of limited resources impacts the biosphere.	S	<b>MS-ESS3-4</b> Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.



## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 8th Grade

**Life Science Standards: Students develop an understanding of patterns and how genetic information is passed from generation to generation. They also develop an understanding of how traits within populations change over time.**

Arizona Science Standards- 8 <sup>th</sup> Grade Life		Next Generation Science Standards- 8 <sup>th</sup> Grade Life
<b>8.L3U1.9 Construct an explanation</b> of how genetic variations occur in offspring through the inheritance of traits or through mutations.	P	<b>MS-LS3-2</b> Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
<b>8.L3U3.10 Communicate</b> how advancements in technology have furthered the field of genetic research and use <b>evidence to support an argument</b> about the positive and negative effects of genetic research on human lives.	P	<b>MS-LS4-5</b> Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
<b>8.L4U1.11 Develop and use a model</b> to explain how natural selection may lead to increases and decreases of specific traits in populations over time.	P	<b>MS-LS4-6</b> Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
<b>8.L4U1.12 Gather and communicate evidence</b> on how the process of natural selection provides an explanation of how new species can evolve.	P	<b>MS-LS4-4</b> Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – High School

## HS Essential Arizona Science Standards (AzSS) Alignment to Next Generation Science Standards (NGSS)

The ADE acknowledges that the acronym “NGSS” is consistently used throughout science resources. To avoid confusion, we want to ensure the community understands that Arizona is not considered an “NGSS” state. To further clarify, AzSS and the NGSS were both designed using the research document *A Framework for K-12 Science Education*. Both documents include a strong focus on three-dimensional instruction, which includes: Science and Engineering Practices, Crosscutting Concepts, and Core Ideas. The major difference between the AzSS and the NGSS is that Arizona used an additional research document, *Working with Big Ideas of Science Education*, in the development of the Core Ideas of Knowing and Using Science.

### Alignment of the AzSS to NGSS Performance Expectations

**Note: An “S” or “P” alignment indicates that an NGSS resources could be used. An “NC” indicates that an NGSS resources cannot be used.**

- **S = Strong: Both the Core Idea and Science and Engineering Practice (SEP\*) are the same**
- **P = Partial: Core idea is closely related; SEP may or may not match**
- **NC\*\* = Not Closely Correlated: There is no strong or partial correlation in this grade band**

*\*The bolded section of each standard refers to the Science and Engineering Practice that correlates to each standard. However, others should be utilized throughout the learning for this grade level. Naturally one practice can lead to the use of others.*

*\*\*The NGSS performance expectation may be in a different grade level.*

**Crosscutting Concepts:** Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change

### Physical Science Essential Standards

Physical science encompasses physical and chemical sub-processes that occur within systems. At the high school level, students gain an understanding of these processes at both the micro and macro levels through the intensive study of matter, energy, and forces. Students are expected to apply these concepts to real world phenomena to gain a deeper understanding of causes, effects, and solutions for physical processes in the real world. The essential standards are those that every high school student is expected to know and understand. It is suggested to use the metric system within measurement.

Arizona Science Standards- HS Physical Science		Next Generation Science Standards- HS Physical Science
<b>Essential HS.P1U1.1</b>  <b>Develop and use models</b> to explain the relationship of the structure of atoms to patterns and properties observed in the Periodic Table and describe how these models are revised with new evidence.	P	<b>HS-PS1-1</b> Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
	P	<b>HS-PS1-2</b> Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
<b>Essential HS.P1U1.2</b>  <b>Develop and use models</b> for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.	P	<b>HS-PS1-2</b> Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
	P	<b>HS-PS1-3</b> Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.



The intention of this document is to help Arizona educators determine if a Next Generation Science Standard (NGSS) resource could be used when planning for instruction with the Arizona Science Standards (AzSS). This document describes how the Arizona Science Standards may or may not align to the Next Generation Science Standards.

# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – High School

Arizona Science Standards- HS Physical Science		Next Generation Science Standards- HS Physical Science
<p><b>Essential HS.P1U1.3</b></p> <p><b>Ask questions, plan, and carry out investigations</b> to explore the cause and effect relationship between reaction rate factors.</p>	p	<p><b>HS-PS1-5</b> Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.</p>
<p><b>Essential HS.P1U3.4</b></p> <p><b>Obtain, evaluate, and communicate information</b> about how the use of chemistry related technologies have had positive and negative ethical, social, economic, and/or political implications.</p>	NC	<p>There is no strong or partial correlation to an NGSS standard in this grade band.</p>
<p><b>Essential HS.P2U1.5</b></p> <p><b>Construct an explanation</b> for a field's strength and influence on an object (electric, gravitational, magnetic).</p>	P	<p><b>HS-PS3-5</b> Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.</p>
	P	<p><b>HS-PS2-4</b> Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.</p>
<p><b>Essential HS.P3U1.6</b></p> <p><b>Collect, analyze and interpret data</b> regarding the change in motion of an object or system in one dimension, to construct an explanation using Newton's Laws.</p>	P	<p><b>HS-PS2-1</b> Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.</p>
	P	<p><b>HS-PS2-2</b> Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.</p>
<p><b>Essential HS.P3U2.7</b></p> <p><b>Use mathematics and computational thinking</b> to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.</p>	P	<p><b>HS-PS2-1</b> Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.</p>
<p><b>Essential HS.P4U1.8</b></p> <p><b>Engage in argument from evidence</b> that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.</p>	P	<p><b>HS-PS3-1</b> Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.</p>
	P	<p><b>HS-PS3-4</b> Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).</p>



The intention of this document is to help Arizona educators determine if a Next Generation Science Standard (NGSS) resource could be used when planning for instruction with the Arizona Science Standards (AzSS). This document describes how the Arizona Science Standards may or may not align to the Next Generation Science Standards.

## Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – High School

Arizona Science Standards- HS Physical Science		Next Generation Science Standards- HS Physical Science
<b>Essential HS.P4U3.9</b> <b>Engage in argument from evidence</b> regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>Essential HS.P4U1.10</b> <b>Construct an explanation</b> about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.	P	<b>HS-PS4-1</b> Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

### Earth and Space Science Essential Standards

Earth and space science encompass processes that occur on Earth while also addressing Earth's place within our solar system and galaxy. At the high school level, students gain an understanding of these processes through a wide scale: unimaginably large to invisibly small.<sup>1</sup> Earth and Space Sciences, more than any other discipline, are rooted in other scientific disciplines. Students, through the close study of earth and space, will find clear applications for their knowledge of gravitation, energy, magnetics, cycles, and biological processes. Educators should use the "connections" designations within these standards to assist students in making connections between scientific disciplines. Additionally, students are expected to apply these concepts to real-world phenomena to gain a deeper understanding of causes, effects, and solutions for physical processes in the real world. The essential standards are those that every high school student is expected to know and understand.

Arizona Science Standards- HS Earth & Space		Next Generation Science Standards- HS Earth & Space
<b>Essential HS.E1U1.11</b> <b>Analyze and interpret data</b> to determine how energy from the Sun affects weather patterns and climate.	P	<b>HS-ESS2-4</b> Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
<b>Essential HS.E1U1.12</b> <b>Develop and use models</b> of the Earth that explains the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).	S	<b>HS-ESS2-3</b> Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
	P	<b>HS-ESS2-4</b> Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
	P	<b>HS-ESS2-6</b> Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – High School

Arizona Science Standards- HS Earth & Space		Next Generation Science Standards- HS Earth & Space
<b>Essential HS.E1U1.13</b> <b>Evaluate explanations</b> and theories about the role of energy and matter in geologic changes over time.	P	<b>HS-ESS2-3</b> Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
<b>Essential HS.E1U3.14</b> <b>Engage in argument from evidence</b> about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.	P  P	<b>HS-ESS3-1</b> Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.  <b>HS-ESS3-6</b> Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
<b>Essential HS.E2U1.15</b> <b>Construct an explanation</b> based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.	P	<b>HS-ESS1-1</b> Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
<b>Essential HS.E2U1.16</b> <b>Construct an explanation</b> of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.	P	<b>HS-ESS1-4</b> Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
<b>Essential HS.E2U1.17</b> <b>Construct an explanation</b> of the origin, expansion, and scale of the universe based on astronomical evidence.	S	<b>HS-ESS1-2</b> Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – High School

## Life Science Essential Standards

Life science focuses on the patterns, processes, and relationships of living organisms. At the high school level, students apply concepts learned in earlier grades to real-world situations and investigations using the science and engineering practices to fully explore phenomena and to develop solutions to societal problems related to food, energy, health, and environment. The field of life science is rapidly advancing and new technology and information related to the study of life processes is being developed daily. Students in high school should have access to up-to-date information in the field while simultaneously gaining understanding of the historical developments which shaped today's understandings within the field. The standards for life science encompass the areas of cells and organisms; ecosystems, interactions, energy and dynamics; heredity; and biological diversity. Like earth and space sciences and physical sciences, "connections" with the life science standards allow educators to make connections across scientific disciplines. The essential standards are those that every high school student is expected to know and understand.

Arizona Science Standards- HS Life		Next Generation Science Standards- HS Life
<p><b>Essential HS.L2U3.18</b></p> <p><b>Obtain, evaluate, and communicate</b> about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.</p>	<p>P</p> <p>P</p>	<p><b>HS-LS2-2</b> Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.</p> <p><b>HS-LS2-7</b> Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</p>
<p><b>Essential HS.L2U1.19</b></p> <p><b>Develop and use models</b> that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment</p>	<p>P</p> <p>P</p>	<p><b>HS-LS2-4</b> Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.</p> <p><b>HS-LS2-5</b> Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.</p>
<p><b>Essential HS.L1U1.20</b></p> <p><b>Ask questions</b> and/or make predictions based on observations and evidence to demonstrate how cellular organization, structure, and function allow organisms to maintain homeostasis.</p>	<p>P</p>	<p><b>HS-LS1-3</b> Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.</p>
<p><b>Essential HS.L2U1.21</b></p> <p><b>Obtain, evaluate, and communicate</b> data showing the relationship of photosynthesis and cellular respiration; flow of energy and cycling of matter.</p>	<p>P</p> <p>p</p>	<p><b>HS-LS2-3</b> Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.</p> <p><b>HS-LS2-5</b> Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.</p>



# Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – High School

Arizona Science Standards- HS Life		Next Generation Science Standards- HS Life
<b>Essential HS.L1U1.22</b> <b>Construct an explanation</b> for how cellular division (mitosis) is the process by which organisms grow and maintain complex, interconnected systems.	P	<b>HS-LS1-4</b> Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
<b>Essential HS.L1U3.23</b> <b>Obtain, evaluate, and communicate</b> the ethical, social, economic and/or political implications of the detection and treatment of abnormal cell function.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>Essential HS.L3U1.24</b> <b>Construct an explanation</b> of how the process of sexual reproduction contributes to genetic variation.	P	<b>HS-LS3-2</b> Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
<b>Essential HS.L3U1.25</b> <b>Obtain, evaluate, and communicate</b> information about the causes and implications of DNA mutation.	P	<b>HS-LS3-2</b> Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
<b>Essential HS.L3U3.26</b> <b>Engage in argument from evidence</b> regarding the ethical, social, economic, and/or political implications of a current genetic technology.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
<b>Essential HS.L4U1.27</b> <b>Obtain, evaluate, and communicate</b> evidence that describes how changes in frequency of inherited traits in a population can lead to biological diversity.	P  P	<b>HS-LS4-3</b> Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.  <b>HS-LS4-5</b> Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
<b>Essential HS.L4U1.28</b> <b>Gather, evaluate, and communicate</b> multiple lines of empirical evidence to explain the mechanisms of biological evolution.	S	<b>HS-LS4-1</b> Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

