Learning Progressions for K-5 Science

This supplemental document is designed to be used in conjunction with the Arizona Science Standard (approved 2004). The purpose of this document is to assist educators as they plan curricula and instruction designed to help students develop grade-level conceptual understanding of the big ideas in science education. This document organizes the learning progressions outlined in A Framework for K-12 Science Education under big ideas in science and correlates them to the strands and concepts contained within Arizona's Science Standard. The performance objectives within Arizona's Science Standard are designed to be taught together (not in isolation) and build foundational skills for developing conceptual understanding in science.

While this document is divided into three sections that match the dimensions in the Framework (Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas), science instruction is most effective when all three dimensions are included within a lesson or series of lessons.

Section 1: Science and Engineering Practices: Pages 5 - 13

Section 2: Crosscutting Concepts: Pages 14- 15

Section 3: Disciplinary Core Ideas

A. Life Science: Pages 16 - 21
B. Physical Science: Pages 22 - 28
C. Earth and Space Science: Pages 29 - 33
D. Engineering, Technology and Applications of Science: Pages 34 - 37

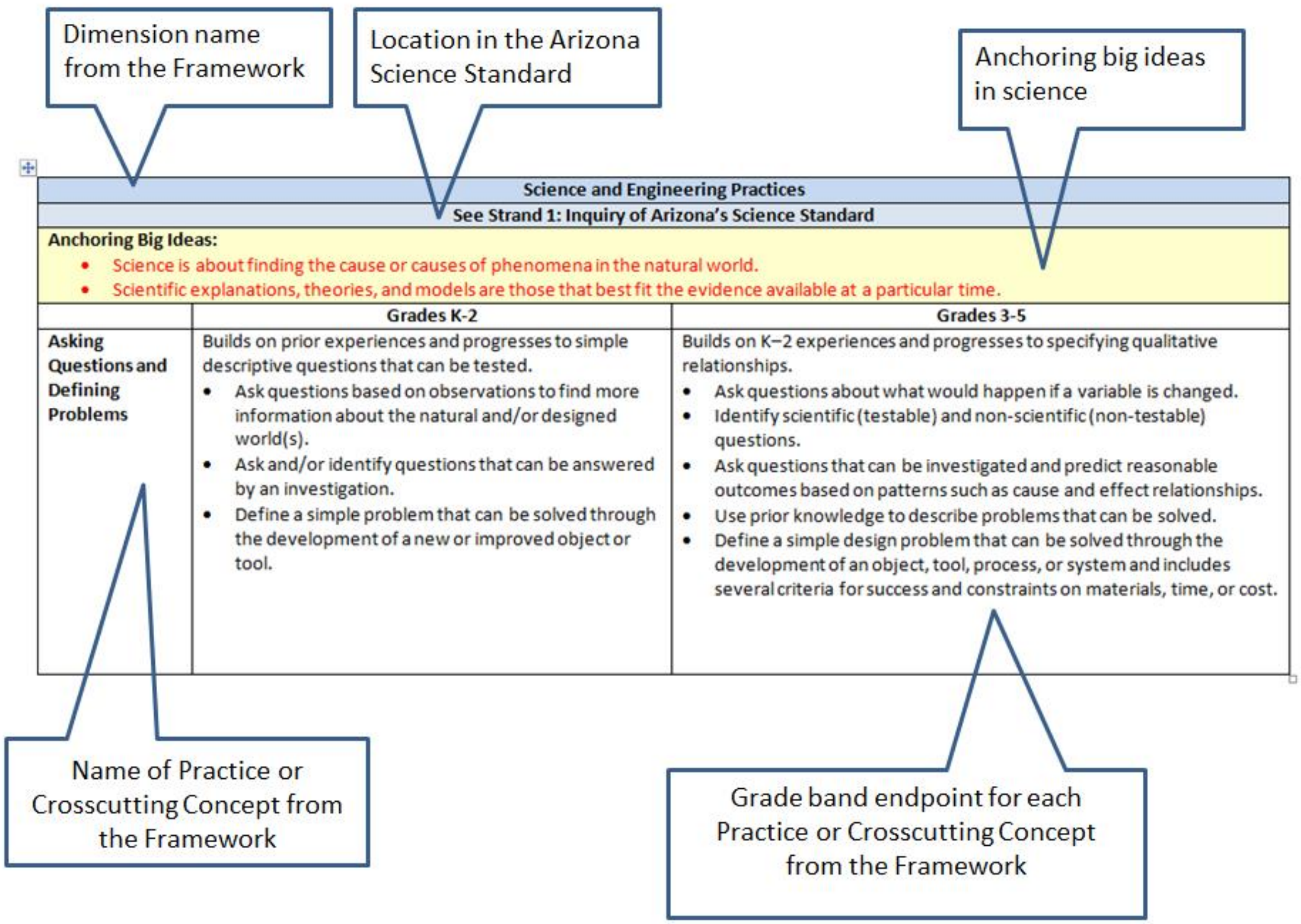
Strands, concepts, and performance objectives in Arizona's Science Standard develop understanding across 14 anchoring big ideas in science.

	Anchoring Big Ideas in Arizona's Science Standard
Nature of Science See Arizona Strands 1-3	Science is about finding the cause or causes of phenomena in the natural world.
	Scientific explanations, theories and models are those that best fit the evidence available at a particular time.
	The knowledge produced by science is used in engineering and technologies to create products to serve human ends.
	Applications of science often have ethical, social, economic and political implications.
Life Science See Arizona Strand 4	Organisms are organized on a cellular basis and have a finite life span.
	Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.
	Genetic information is passed down from one generation of organisms to another.
	The diversity of organisms, living and extinct, is the result of evolution.
Physical Science See Arizona Strand 5	All matter in the Universe is made of very small particles.
	Objects can affect other objects at a distance.
	Changing the movement of an object requires a net force to be acting on it.
	The total amount of energy in the Universe is always the same but can be transferred from one energy store to another during an event.
Earth Science See Arizona Strand 6	The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.
	Our solar system is a very small part of one of billions of galaxies in the Universe.

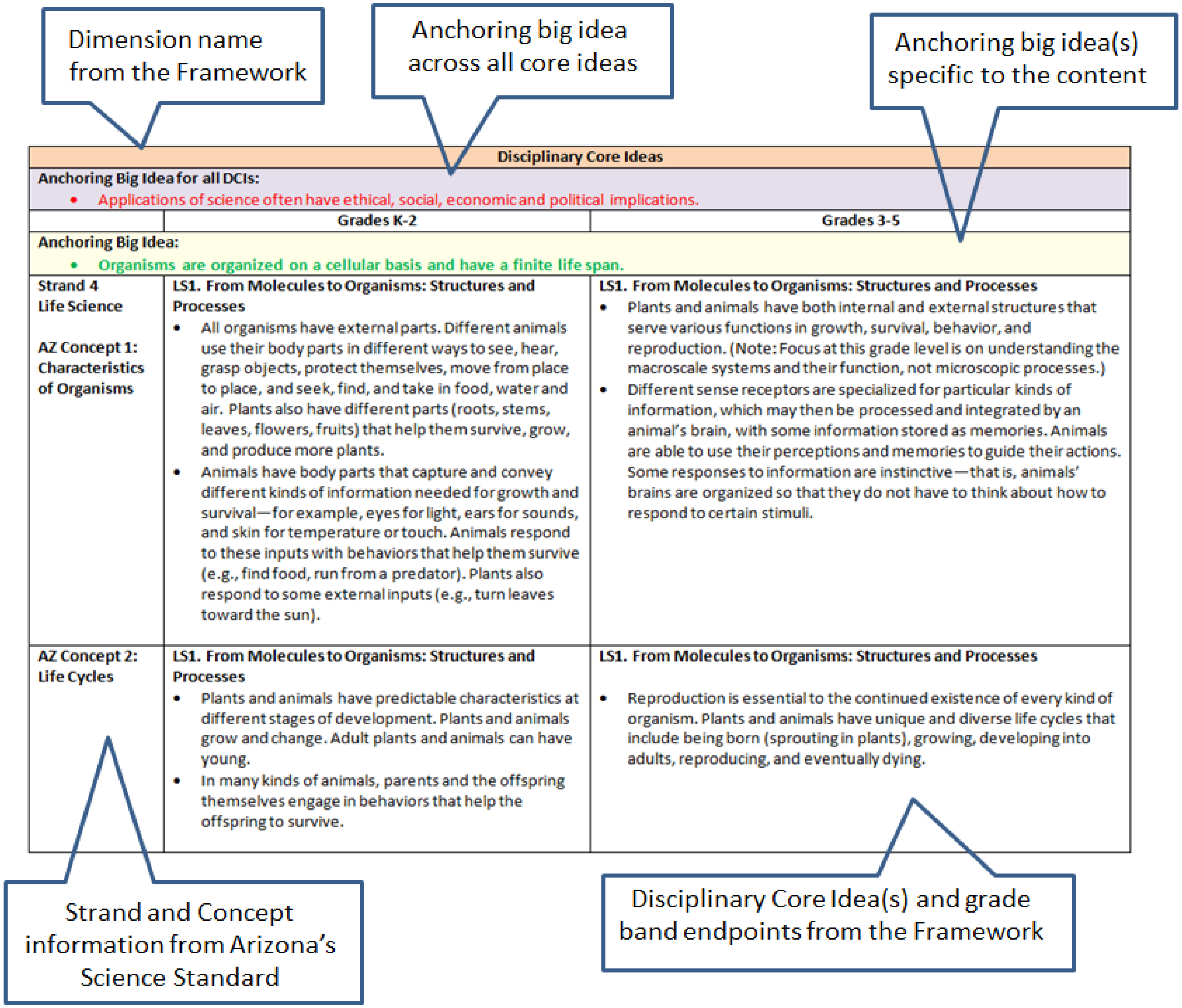
Adapted from "Working with Big Ideas in Science Education" – edited by Wynne Harlen 2015

How to read this document

For Section 1 (Science and Engineering Practices) and Section 2 (Crosscutting Concepts)



For Section 3 (Disciplinary Core Ideas)



Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • Organisms are organized on a cellular basis and have a finite life span.		
Strand 4 **Life Science** **AZ Concept 1: Characteristics of Organisms**	**LS1. From Molecules to Organisms: Structures and Processes** • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants. • Animals have body parts that capture and convey different kinds of information needed for growth and survival—for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun).	**LS1. From Molecules to Organisms: Structures and Processes** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (Note: Focus at this grade level is on understanding the macroscale systems and their function, not microscopic processes.) • Different sense receptors are specialized for particular kinds of information, which may then be processed and integrated by an animal's brain, with some information stored as memories. Animals are able to use their perceptions and memories to guide their actions. Some responses to information are instinctive—that is, animals' brains are organized so that they do not have to think about how to respond to certain stimuli.
AZ Concept 2: Life Cycles	**LS1. From Molecules to Organisms: Structures and Processes** • Plants and animals have predictable characteristics at different stages of development. Plants and animals grow and change. Adult plants and animals can have young. • In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.	**LS1. From Molecules to Organisms: Structures and Processes** • Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles that include being born (sprouting in plants), growing, developing into adults, reproducing, and eventually dying.

Section 1: Science and Engineering Practices

Arizona Science Standard Strand 1: Inquiry	A Framework for K-12 Science Education
Concept 1: Observations, Questions, and Hypotheses Formulate predictions, questions, or hypotheses based on observations. Locate appropriate resources.	1. Asking questions and defining problems 8. Obtaining… information
Concept 2: Scientific Testing (Investigating and Modeling) Design and conduct investigations.	2. Developing and using models 3. Planning and carrying out investigations 6. … Designing solutions 8. Obtaining… information
Concept 3: Analysis and Conclusions Analyze and interpret data to explain correlations and results; formulate new questions.	4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations and designing solutions 8. …Evaluating and communicating information
Concept 4: Communication Communicate results of investigations.	6. Constructing explanations … 7. Engaging in argument from evidence 8. …Communicating information

This chart shows how concepts in Strand 1 of Arizona's Science Standard and the eight Science and Engineering Practices from the *Framework* complement and can be taught in conjunction with each other.

<table>
<tr><th colspan="3">Science and Engineering Practices</th></tr>
<tr><th colspan="3">See Strand 1: Inquiry of Arizona’s Science Standard</th></tr>
<tr><td colspan="3">Anchoring Big Ideas:
• Science is about finding the cause or causes of phenomena in the natural world.
• Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.</td></tr>
<tr><th></th><th>Grades K-2</th><th>Grades 3-5</th></tr>
<tr><td>Asking Questions and Defining Problems</td><td>Builds on prior experiences and progresses to simple descriptive questions that can be tested.
• Ask questions based on observations to find more information about the natural and/or designed world(s).
• Ask and/or identify questions that can be answered by an investigation.
• Define a simple problem that can be solved through the development of a new or improved object or tool.</td><td>Builds on K–2 experiences and progresses to specifying qualitative relationships.
• Ask questions about what would happen if a variable is changed.
• Identify scientific (testable) and non-scientific (non-testable) questions.
• Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
• Use prior knowledge to describe problems that can be solved.
• 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.</td></tr>
</table>

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Developing and Using Models	Builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Distinguish between a model and the actual object, process, and/or events the model represents. • Compare models to identify common features and differences. • Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).	Builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Identify limitations of models. • Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events. • Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. • Develop and/or use models to describe and/or predict phenomena. • Develop a diagram or simple physical prototype to convey a proposed object, tool, or process. • Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. Develop a simple model based on evidence to represent a proposed object or tool.

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Planning and Carrying Out Investigations	Builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • With guidance, plan and conduct an investigation in collaboration with peers (for K). • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. • Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question. • Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons. • Make observations (firsthand or from media) and/or measurements of a proposed object or tool or solution to determine if it solves a problem or meets a goal. • Make predictions based on prior experiences.	Builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. • Evaluate appropriate methods and/or tools for collecting data. • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. • Make predictions about what would happen if a variable changes. • Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Analyzing and Interpreting Data	Builds on prior experiences and progresses to collecting, recording, and sharing observations. • Record information (observations, thoughts, and ideas). • Use and share pictures, drawings, and/or writings of observations. • Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems. • Compare predictions (based on prior experiences) to what occurred (observable events). • Analyze data from tests of an object or tool to determine if it works as intended.	Builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Represent data in tables and/or various graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. • Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. • Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. • Analyze data to refine a problem statement or the design of a proposed object, tool, or process. • Use data to evaluate and refine design solutions.

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Using Mathematics and Computational Thinking	Builds on prior experience and progresses to recognizing that mathematics can be used to describe the natural and designed world(s). • Decide when to use qualitative vs. quantitative data. • Use counting and numbers to identify and describe patterns in the natural and designed world(s). • Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. • Use quantitative data to compare two alternative solutions to a problem.	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. • Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. • Organize simple data sets to reveal patterns that suggest relationships. • Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and engineering questions and problems. • Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem.

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Constructing Explanations and Designing Solutions	Builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. • Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem. • Generate and/or compare multiple solutions to a problem.	Builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena. Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard). • Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. • Identify the evidence that supports particular points in an explanation. • Apply scientific ideas to solve design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Engaging in Argument from Evidence	Builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). • Identify arguments that are supported by evidence. • Distinguish between explanations that account for all gathered evidence and those that do not. • Analyze why some evidence is relevant to a scientific question and some is not. • Distinguish between opinions and evidence in one's own explanations. • Listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument. • Construct an argument with evidence to support a claim. • Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.	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). • Compare and refine arguments based on an evaluation of the evidence presented. • Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. • Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions. • Construct and/or support an argument with evidence, data, and/or a model. • Use data to evaluate claims about cause and effect. • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Science and Engineering Practices		
See Strand 1: Inquiry of Arizona's Science Standard		
Anchoring Big Ideas: • Science is about finding the cause or causes of phenomena in the natural world. • Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.		
	Grades K-2	**Grades 3-5**
Obtaining, Evaluating, and Communicating Information	Builds on prior experiences and uses observations and texts to communicate new information. • Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s). • Describe how specific images (e.g., a diagram showing how a machine works) support a scientific or engineering idea. • Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim. • Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.	Builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence. • Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices. • Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices. • Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. • Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts.

Section 2: Crosscutting Concepts

Arizona Science Standard Unifying Concepts	A Framework for K-12 Science Education Crosscutting Concepts
1. Systems, Order, and Organization	1. Patterns 4. Systems and System Models 5. Energy and Matter
2. Evidence, Models, and Explanation	2. Cause and Effect 4. Systems and System Models 5. Energy and Matter
3. Constancy, Change, and Measurement	3. Scale, Proportion and Quantity 7. Stability and Change
4. Evolution and Equilibrium	7. Stability and Change
5. Form and Function	6. Structure and Function

This chart shows how the Unifying Concepts on page viii of the introduction of Arizona's Science Standard and the seven crosscutting concepts from the *Framework* complement and can be taught in conjunction with each other.

Crosscutting Concepts		
See Page viii of Arizona's Science Standard for Unifying Concepts		
	Grades K-2	**Grades 3-5**
Patterns	Students recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.	Students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and to use these patterns to make predictions.
Cause and Effect	Students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.	Students routinely identify and test causal relationships and use these relationships to explain change. They understand events that occur together with regularity might or might not signify a cause and effect relationship.
Scale, Proportion, and Quantity	Students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length.	Students recognize that natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.
Systems and System Models	Students understand that objects and organisms can be described in terms of their parts; and systems in the natural and designed world have parts that work together.	Students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.
Energy and Matter	Students observe that objects may break into smaller pieces, be put together into larger pieces, or change shapes.	Students learn that matter is made of particles and energy can be transferred in various ways and between objects. Students observe the conservation of matter by tracking matter flows and cycles before and after processes and recognizing the total weight of substances does not change.
Structure and Function	Students observe that the shape and stability of structures of natural and designed objects are related to their function(s).	Students learn that different materials have different substructures, which can sometimes be observed; and substructures have shapes and parts that serve functions.
Stability and Change	Students observe that some things stay the same while other things change, and things may change slowly or rapidly.	Students measure change in terms of differences over time, and observe that change may occur at different rates. Students learn some systems appear stable, but over long periods of time they will eventually change.

Section 3A. Disciplinary Core Ideas – Life Sciences

Arizona Science Standard (Grades K-4) Strand 4 - Life Science	A Framework for K-12 Science Education Core Ideas in Life Sciences
Concept 1: Characteristics of Organisms	**LS1.** From Molecules to Organisms: Structures and Processes
Concept 3: Organisms and Environments	**LS2.** Ecosystems: Interactions, Energy and Dynamics
Concept 2: Life Cycles (Heredity)	**LS3.** Heredity: Inheritance and Variation of Traits
Concept 4: Diversity, Adaptation, and Behavior	**LS4.** Evolution: Unity and Diversity

This chart shows how concepts in Strand 4 of Arizona's Science Standard and the Disciplinary Core Ideas in Life Sciences from the *Framework* complement and can be taught in conjunction with each other.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **Organisms are organized on a cellular basis and have a finite life span.**		
Strand 4 **Life Science** **AZ Concept 1: Characteristics of Organisms**	**LS1. From Molecules to Organisms: Structures and Processes** • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants. • Animals have body parts that capture and convey different kinds of information needed for growth and survival—for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun).	**LS1. From Molecules to Organisms: Structures and Processes** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (Note: Focus at this grade level is on understanding the macroscale systems and their function, not microscopic processes.) • Different sense receptors are specialized for particular kinds of information, which may then be processed and integrated by an animal's brain, with some information stored as memories. Animals are able to use their perceptions and memories to guide their actions. Some responses to information are instinctive—that is, animals' brains are organized so that they do not have to think about how to respond to certain stimuli.
AZ Concept 2: Life Cycles	**LS1. From Molecules to Organisms: Structures and Processes** • Plants and animals have predictable characteristics at different stages of development. Plants and animals grow and change. Adult plants and animals can have young. • In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.	**LS1. From Molecules to Organisms: Structures and Processes** • Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles that include being born (sprouting in plants), growing, developing into adults, reproducing, and eventually dying.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.**		
Strand 4 **Life Science** **AZ Concept 3: Organisms and Environments**	**LS2: Ecosystems: Interactions, Energy, and Dynamics** • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. • Animals depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. Animals depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to gather, catch, eat, and chew the food. Plants depend on air, water, minerals (in the soil), and light to grow. Animals can move around, but plants cannot, and they often depend on animals for pollination or to move their seeds around. Different plants survive better in different settings because they have varied needs for water, minerals, and sunlight. • Organisms obtain the materials they need to grow and survive from the environment. Many of these materials come from organisms and are used again by other organisms. • The places where plants and animals live often change, sometimes slowly and sometimes rapidly. When animals and plants get too hot or too cold, they may die. If they cannot find enough food, water, or air, they may die. • Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.	**LS2: Ecosystems: Interactions, Energy, and Dynamics** • Animals and plants alike generally need to take in air and water, animals must take in food, and plants need light and minerals; anaerobic life, such as bacteria in the gut, functions without air. Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion. Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions (e.g., at night). • The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Either way, they are "consumers." Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil for plants to use. • Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. • Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, water, and minerals from the environment and release waste matter (gas, liquid, or solid) back into the environment. • When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.**		
		organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. • Groups can be collections of equal individuals, hierarchies with dominant members, small families, groups of single or mixed gender, or groups composed of individuals similar in age. Some groups are stable over long periods of time; others are fluid, with members moving in and out. Some groups assign specialized tasks to each member; in others, all members perform the same or a similar range of functions.

<table>
<tr><th colspan="3">Disciplinary Core Ideas</th></tr>
<tr><td colspan="3">Anchoring Big Idea for all DCIs:
• Applications of science often have ethical, social, economic and political implications.</td></tr>
<tr><td></td><td>Grades K-2</td><td>Grades 3-5</td></tr>
<tr><td colspan="3">Anchoring Big Idea:
• Genetic information is passed down from one generation of organisms to another.</td></tr>
<tr><td>Strand 4
Life Science

AZ Concept 2:
Life Cycles</td><td>LS3: Heredity: Inheritance and Variation of Traits
• Organisms have characteristics that can be similar or different. Young animals are very much, but not exactly, like their parents and also resemble other animals of the same kind. Plants also are very much, but not exactly, like their parents and resemble other plants of the same kind.
• Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.</td><td>LS3: Heredity: Inheritance and Variation of Traits
• Many characteristics of organisms are inherited from their parents. Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.
• Offspring acquire a mix of traits from their biological parents. Different organisms vary in how they look and function because they have different inherited information. In each kind of organism there is variation in the traits themselves, and different kinds of organisms may have different versions of the trait. The environment also affects the traits that an organism develops—differences in where they grow or in the food they consume may cause organisms that are related to end up looking or behaving differently.</td></tr>
</table>

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **The diversity of organisms, living and extinct, is the result of evolution.**		
Strand 4 **Life Science** **AZ Concept 4: Diversity, Adaptation and Behavior**	**LS4: Biological Evolution: Unity and Diversity** • Some kinds of plants and animals that once lived on Earth (e.g., dinosaurs) are no longer found anywhere, although others now living (e.g., lizards) resemble them in some ways. • Living things can survive only where their needs are met. If some places are too hot or too cold or have too little water or food, plants and animals may not be able to live there. • There are many different kinds of living things in any area, and they exist in different places on land and in water.	**LS4: Biological Evolution: Unity and Diversity** • Fossils provide evidence about the types of organisms (both visible and microscopic) that lived long ago and also about the nature of their environments. Fossils can be compared with one another and to living organisms according to their similarities and differences. • Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. • Changes in an organism's habitat are sometimes beneficial to it and sometimes harmful. For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. • Scientists have identified and classified many plants and animals. Populations of organisms live in a variety of habitats, and change in those habitats affects the organisms living there. Humans, like all other organisms, obtain living and nonliving resources from their environments.

Section 3B. Disciplinary Core Ideas – Physical Sciences

Arizona Science Standard (Grades K-4) Strand 5 – Physical Science	A Framework for K-12 Science Education Core Ideas in Physical Sciences
Concept 1: Properties of Objects and Materials	**PS1.** Matter and Its Interactions
Concept 2: Position and Motion of Objects	**PS2.** Motion and Stability: Forces and Interactions
Concept 3: Energy and Magnetism	**PS3.** Energy
	PS4. Waves and Their Applications in Technologies for Information Transfer

This chart shows how concepts in Strand 5 of Arizona's Science Standard and the Disciplinary Core Ideas in Physical Sciences from the *Framework* complement and can be taught in conjunction with each other.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **All matter in the Universe is made of very small particles.**		
Strand 5 **Physical Science** **AZ Concept 1: Properties of Objects and Materials**	**PS1: Matter and Its Interactions** • Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either solid or liquid, depending on temperature. • Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses, and by whether it occurs naturally or is manufactured. • Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces (e.g., blocks, construction sets). Objects or samples of a substance can be weighed, and their size can be described and measured. (Note: volume is introduced only for liquid measure.) • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible (e.g., melting and freezing), and sometimes they are not (e.g., baking a cake, burning fuel).	**PS1: Matter and Its Interactions** • 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 (e.g., by weighing or by its effects on other objects). ○ For example, 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 (e.g., leaves in wind, dust suspended in air); and the appearance of visible scale water droplets in condensation, fog, and, by extension, also in clouds or the contrails of a jet. • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish (e.g., sugar in solution, evaporation in a closed container). Measurements of a variety of properties (e.g., hardness, reflectivity) can be used to identify particular materials. (Note: 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.) • When two or more different substances are mixed, a new substance with different properties may be formed; such occurrences depend on the substances and the temperature. No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Note: Mass and weight are not distinguished at this grade level).

<table>
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Applications of science often have ethical, social, economic and political implications.</td></tr>
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Objects can affect other objects at a distance.
Changing the movement of an object requires a net force to be acting on it.</td></tr>
<tr><td>Strand 5
Physical Science

AZ Concept 2: Position and Motion of Objects</td><td>PS2: Motion and Stability: Forces and Interactions
Objects pull or push each other when they collide or are connected. Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
An object sliding on a surface or sitting on a slope experiences a pull due to friction on the object due to the surface that opposes the object's motion.
When objects touch or collide, they push on one another and can change motion or shape. Whether an object stays still or moves often depends on the effects of multiple pushes and pulls on it (e.g., multiple players trying to pull an object in different directions). It is useful to investigate what pushes and pulls keep something in place (e.g., a ball on a slope, a ladder leaning on a wall) as well as what makes something change or move.</td><td>PS2: Motion and Stability: Forces and Interactions
Each force acts on one particular object and has both a strength and a direction.
An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Note: Qualitative and conceptual, but not quantitative, addition of forces are used at this level.)
The patterns of an object's motion in various situations can be observed and measured; when past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)
Objects in contact exert forces on each other (friction, elastic pushes and pulls). Electric, magnetic, and gravitational forces between a pair of objects do not require that the objects be in contact—for example, magnets push or pull at a distance. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.
A system can change as it moves in one direction (e.g., a ball rolling down a hill), shifts back and forth (e.g., a swinging pendulum), or goes through cyclical patterns (e.g., day and night). Examining how the forces on and within the system change as it moves can help to explain the system's patterns of change. A system can appear to be unchanging when processes within the system are occurring at opposite but equal rates (e.g., water behind a dam is at a constant height because water is</td></tr>
</table>

Disciplinary Core Ideas		
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	Grades K-2	**Grades 3-5**
Anchoring Big Ideas: • **Objects can affect other objects at a distance.** • **Changing the movement of an object requires a net force to be acting on it.**		
		flowing in at the same rate that water is flowing out). Changes can happen very quickly or very slowly and are sometimes hard to see (e.g., plant growth). Conditions and properties of the objects within a system affect how fast or slowly a process occurs (e.g., heat conduction rates).

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• Changing the movement of an object requires a net force to be acting on it.</td></tr>
<tr><td>Strand 5
Physical Science

AZ Concept 3:
Energy and Magnetism</td><td>PS3: Energy
• Sunlight warms Earth’s surface.
• A bigger push or pull makes things go faster. Faster speeds during a collision can cause a bigger change in shape of the colliding objects.
• When two objects rub against each other, this interaction is called friction. Friction between two surfaces can warm of both of them (e.g., rubbing hands together). There are ways to reduce the friction between two objects.</td><td>PS3: Energy
• The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (Boundary: At this grade level, no attempt is made to give a precise or complete definition of energy.)
• Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.
  ○ Light also transfers energy from place to place. For example, energy radiated from the sun is transferred to Earth by light. When this light is absorbed, it warms Earth’s land, air, and water and facilitates plant growth.
  ○ Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy (e.g., moving water driving a spinning turbine which generates electric currents).
• When objects collide, the contact forces transfer energy so as to change the objects’ motions. Magnets can exert forces on other magnets or on magnetizable materials, causing energy transfer between them (e.g., leading to changes in motion) even when the objects are not touching.
• The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use—for example, the stored energy of water behind a dam is released so that it flows downhill and drives a turbine generator to produce electricity. Food and fuel also release energy when they are digested or burned. When</td></tr>
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Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
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		machines or animals “use” energy (e.g., to move around), most often the energy is transferred to heat the surrounding environment. The energy released by burning fuel or digesting food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (Note: The fact that plants capture energy from sunlight is introduced at this grade level, but details of photosynthesis are not.) • It is important to be able to concentrate energy so that it is available for use where and when it is needed. For example, batteries are physically transportable energy storage devices, whereas electricity generated by power plants is transferred from place to place through distribution systems.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Ideas: • **Objects can affect other objects at a distance.** • **Changing the movement of an object requires a net force to be acting on it.**		
Strand 5 Physical Science **AZ Concept 3: Energy and Magnetism**	**PS4: Waves and Their Applications in Technologies for Information Transfer** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave—observe, for example, a bobbing cork or seabird—except when the water meets the beach. • Sound can make matter vibrate, and vibrating matter can make sound. • Objects can be seen only when light is available to illuminate them. Very hot objects give off light (e.g., a fire, the sun). • Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them (i.e., on the other side from the light source), where the light cannot reach. Mirrors and prisms can be used to redirect a light beam. (Note: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) • People use their senses to learn about the world around them. Their eyes detect light, their ears detect sound, and they can feel vibrations by touch. • People also use a variety of devices to communicate (send and receive information) over long distances.	**PS4: Waves and Their Applications in Technologies for Information Transfer** • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (Note: The discussion at this grade level is qualitative only; it can be based on the fact that two different sounds can pass a location in different directions without getting mixed up.) • Earthquakes cause seismic waves, which are waves of motion in Earth's crust. A great deal of light travels through space to Earth from the sun and from distant stars. An object can be seen when light reflected from its surface enters the eyes; the color people see depends on the color of the available light sources as well as the properties of the surface. (Note: This phenomenon is observed, but no attempt is made to discuss what confers the color reflection and absorption properties on a surface. The stress is on understanding that light traveling from the object to the eye determines what is seen.) • Because lenses bend light beams, they can be used, singly or in combination, to provide magnified images of objects too small or too far away to be seen with the naked eye. Lenses can be used to make eyeglasses, telescopes, or microscopes in order to extend what can be seen. The design of such instruments is based on understanding how the path of light bends at the surface of a lens. • Digitized information (e.g., the pixels of a picture) can be stored for future recovery or transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.

Section 3C. Disciplinary Core Ideas – Earth and Space Sciences

Arizona Science Standard (Grades K-4) Strand 6 – Earth and Space Science	A Framework for K-12 Science Education Core Ideas in Earth and Space Sciences
Concept 1: Properties of Earth Materials **Concept 2:** Objects in the Sky (Grades K-3)	**ESS1.** Earth's Place in the Universe
Concept 1: Properties of Earth Materials **Concept 2:** Earth's Processes and Systems (Grades 4-8) **Concept 3:** Changes in the Earth and Sky	**ESS2.** Earth's Systems
Strand 3 Concept 1: Changes in Environments	**ESS3.** Earth and Human Activity

This chart shows how concepts in Strand 3 and Strand 6 of Arizona's Science Standard and the Disciplinary Core Ideas in Earth and Space Sciences from the *Framework* complement and can be taught in conjunction with each other.

<table>
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<tr><td colspan="3">Anchoring Big Idea:
Our solar system is a very small part of one of billions of galaxies in the Universe.</td></tr>
<tr><td>Strand 6
Earth and Space Science

AZ Concept 2: Objects in the Sky (Grades K-3)

AZ Concept 2: Earth's Processes and Systems (Grades 4-8)</td><td>ESS1: Earth's Place in the Universe
Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. At night one can see the light coming from many stars with the naked eye, but telescopes make it possible to see many more and to observe them and the moon and planets in greater detail.
Seasonal patterns of sunrise and sunset can be observed, described, and predicted.
Some events on Earth occur in cycles, like day and night, and others have a beginning and an end, like a volcanic eruption. Some events, like an earthquake, happen very quickly; others, such as the formation of the Grand Canyon, occur very slowly, over a time period much longer than one can observe.</td><td>ESS1: Earth's Place in the Universe
The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their size and distance from Earth.
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 and seasonal changes in the length and direction of shadows; phases of the moon; and different positions of the sun, moon, and stars at different times of the day, month, and year.
Some objects in the solar system can be seen with the naked eye. Planets in the night sky change positions and are not always visible from Earth as they orbit the sun. Stars appear in patterns called constellations, which can be used for navigation and appear to move together across the sky because of Earth's rotation.</td></tr>
</table>

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.		
AZ Concept 1: Properties of Earth Materials **AZ Concept 2: Earth's Processes and Systems (Grades 4-8)**	**ESS1: Earth's Place in the Universe** • Some events on Earth occur in cycles, like day and night, and others have a beginning and an end, like a volcanic eruption. Some events, like an earthquake, happen very quickly; others, such as the formation of the Grand Canyon, occur very slowly, over a time period much longer than one can observe.	**ESS1: Earth's Place in the Universe** • Earth has changed over time. Understanding how landforms develop, are weathered (broken down into smaller pieces), and erode (get transported elsewhere) can help infer the history of the current landscape. 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. Patterns of tree rings and ice cores from glaciers can help reconstruct Earth's recent climate history.
AZ Concept 1: Properties of Earth Materials **AZ Concept 2: Earth's Processes and Systems (Grades 4-8)**	**ESS2: Earth's Systems** • Wind and water can change the shape of the land. The resulting landforms, together with the materials on the land, provide homes for living things. • Plants and animals (including humans) depend on the land, water, and air to live and grow. They in turn can change their environment (e.g., the shape of land, the flow of water).	**ESS2: Earth's Systems** • Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. Rainfall helps shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. Human activities affect Earth's systems and their interactions at its surface. • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features where people live and in other areas of Earth.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate.**		
		• Living things affect the physical characteristics of their regions (e.g., plants' roots hold soil in place, beaver shelters and human-built dams alter the flow of water, and plants' respiration affects the air). Many types of rocks and minerals are formed from the remains of organisms or are altered by their activities.
AZ Concept 3: Changes in the Earth and Sky	**ESS2: Earth's Systems** • Rocks, soils, and sand are present in most areas where plants and animals live. There may also be rivers, streams, lakes, and ponds. Maps show where things are located. One can map the shapes and kinds of land and water in any area. • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. It carries soil and rocks from one place to another and determines the variety of life forms that can live in a particular location. • Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.	**ESS2: Earth's Systems** • Water is found almost everywhere on Earth: as vapor; as fog or clouds in the atmosphere; as rain or snow falling from clouds; as ice, snow, and running water on land and in the ocean; and as groundwater beneath the surface. The downhill movement of water as it flows to the ocean shapes the appearance of the land. Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. • Weather is the minute-by-minute to day-by-day variation of the atmosphere's condition on a local scale. Scientists record the patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. Climate describes the ranges of an area's typical weather conditions and the extent to which those conditions vary over years to centuries.

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<tr><td>Strand 3 Science in Personal and Social Perspectives

AZ Concept 1: Changes in Environments</td><td>ESS3: Earth and Human Activity
• Living things need water, air, and resources from the land, and they try to live in places that have the things they need. Humans use natural resources for everything they do: for example, they use soil and water to grow food, wood to burn to provide heat or to build shelters, and materials such as iron or copper extracted from Earth to make cooking pans.
• Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that communities can prepare for and respond to these events.
• Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things—for example, by reducing trash through reuse and recycling.</td><td>ESS3: Earth and Human Activity
• All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.
• A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions, severe weather, floods, coastal erosion). Humans cannot eliminate natural hazards but can take steps to reduce their impacts.
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. For example, they are treating sewage, reducing the amounts of materials they use, and regulating sources of pollution such as emissions from factories and power plants or the runoff from agricultural activities.
If Earth's global mean temperature continues to rise, the lives of humans and other organisms will be affected in many different ways.</td></tr>
</table>

Section 3D. Disciplinary Core Ideas – Engineering, Technology and Applications of Science

Arizona Science Standard (Grades K-4) Strand 2 – History and Nature of Science Strand 3 – Science in Personal and Social Perspective	A Framework for K-12 Science Education Core Ideas in Engineering, Technology and Applications of Science
Strand 3 Concept 2: Science and Technology in Society	**ETS1.** Engineering Design
Strand 2 Concept 1: History of Science as a Human Endeavor	**ETS2.** Links Among Engineering, Technology, Science and Society

This chart shows how concepts in Strand 2 and Strand 3 of Arizona's Science Standard and the Disciplinary Core Ideas in Engineering, Technology, and Applications of Science from the *Framework* complement and can be taught in conjunction with each other.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **The knowledge produced by science is used in engineering and technologies to create products to serve human ends.**		
Strand 3 Science in Personal and Social Perspectives **AZ Concept 2: Science and Technology in Society**	**ETS1: Engineering Design** • A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. • Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem. • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. To design something complicated, one may need to break the problem into parts and attend to each part separately but must then bring the parts together to test the overall plan. • Because there is always more than one possible solution to a problem, it is useful to compare designs, test them, and discuss their strengths and weaknesses.	**ETS1: Engineering Design** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. • Research on a problem should be carried out—for example, through Internet searches, market research, or field observations—before beginning to design a solution. An often productive way to generate ideas is for people to work together to brainstorm, test, and refine possible solutions. • Testing a solution involves investigating how well it performs under a range of likely conditions. Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. 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. • There are many types of models, ranging from simple physical models to computer models. They can be used to investigate how a design might work, communicate the design to others, and compare different designs. • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Disciplinary Core Ideas		
Anchoring Big Idea for all DCIs: • Applications of science often have ethical, social, economic and political implications.		
	Grades K-2	**Grades 3-5**
Anchoring Big Idea: • **The knowledge produced by science is used in engineering and technologies to create products to serve human ends.**		
Strand 2 History and Nature of Science **AZ Concept 1 : History of Science as a Human Endeavor**	**ETS2: Links Among Engineering, Technology, and Applications of Science** • People encounter questions about the natural world every day. There are many types of tools produced by engineering that can be used in science to help answer these questions through observation or measurement. • Observations and measurements are also used in engineering to help test and refine design ideas. • People depend on various technologies in their lives; human life would be very different without technology. Every human-made product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world, even when the materials are not themselves natural—for example, spoons made from refined metals. Thus, developing and using technology has impacts on the natural world.	**ETS2: Links Among Engineering, Technology, and Applications of Science** • Tools and instruments (e.g., rulers, balances, thermometers, graduated cylinders, telescopes, microscopes) are used in scientific exploration to gather data and help answer questions about the natural world. • Engineering design can develop and improve such technologies. Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. Knowledge of relevant scientific concepts and research findings is important in engineering. • Over time, people's needs and wants change, as do their demands for new and improved technologies. Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), to decrease known risks (e.g., seatbelts in cars), and to meet societal demands (e.g., cell phones). When new technologies become available, they can bring about changes in the way people live and interact with one another.

Sources:
Strand and Concept information: 2004 Arizona Science Standard.
Learning Progressions: A Framework for K-12 Science Education. 2012. National Academies of Science.
APPENDIX F – Science and Engineering Practices in the NGSS
Big Ideas: Working with the Big Ideas in Science Education 2015 edited by Wynne Harlen