

Secondary Science Curriculum Adoption Committee Meeting

Thursday, February 2, 2023
SUSD Oak Campus

Call to Order



Role Call and Welcome

Roll Call

Sign In Sheet

Please record arrival time on the sign-in sheet as you arrive. Record departure time if you are leaving before the meeting officially adjourns.

THE Committee

Middle School Group

Christen Anderson - Teacher
Keri Cavanaugh - Teacher
Tammy Clow-Kennedy - Counselor
Chris Hain - Teacher
Stacy Hency - Teacher
Amanda Holley - Teacher
Jena Krahll - Teacher
Lori Kelly - ELD Coach
Janeva Mammina - Teacher
D'Anne McDaniel - Teacher
Jodi Meyers - Parent
Kelsea Reimer - Teacher
Holli Scharf - Administrator
Dr. Thomas Weaver - SPED Department

Life Science Group

Angie Berk - Teacher
Elizabeth Bond - Teacher
Sean Collier - Teacher
Betsy Fisher-Pai - Parent
Danielle Hawkins - Teacher
Julie Koshy - Teacher
Paula Sabato - Teacher
Luke Strohmeyer - Teacher

Chemistry Group

Rissel Langbecker - Parent
Anne Milligan - Teacher
Dr. Bradley Wagstaff - Teacher
Laura Weeshoff - Community Member

Physics Group

Patricia Bordonaro - Teacher
Jill Dunican - Parent
Hannah McKolay - Teacher
Philip Root - Community Member

Committee Support

Dr. Kim Dodds Keran - Director of Teaching and Learning

- Committee Co-Chair

Johanna Kaiser - Science Academic Coach

- Committee Co-Chair

Dede Johnston - Instructional Materials Coordinator

Tyler Carey - Former Instructional Materials Coordinator

Minutes from January 26, 2023

Discussion and Approval of Meeting Minutes from January 26, 2023

[Draft Minutes PDF](#)
[Draft Minutes](#)

Agenda and Norms

Agenda for Thursday, February 2, 2023

1. Call to Order
2. Welcome and role call

Information/Discussion and Possible Action

3. Approval of Committee Meeting Minutes from January 26, 2023 meeting - **Action Item**
4. Review of Agenda and Norms
5. Course/Unit Alignment with Arizona Science Standards
6. Arizona Science Standards and Next Generation Science Standards
7. Rubric for Evaluating Science Instructional Materials
8. Open Education Resources and Vendor Letter
9. Future Meeting

Norms

Be fully present.

Listen to understand and ask questions for clarification.

Take care of your needs.

Be open to new ideas.

Invite and welcome the contributions of every member.

Support the group's recommendation after consensus is reached.

Be mindful of how often and how long you speak.

Questions and challenges are welcomed. Question and challenge the idea, not the person.

Course/Unit Alignment with Arizona Science Standards

Courses Included in this Adoption Process

Middle School Units

- 6th Grade: Science Practices and Methods, Earth and Space Science
- 7th Grade: Earth and Space Science, Life Science
- 8th Grade: Earth and Space Science, Life Science

High School Life Science

- Biology (Biology I, Biology I Honors, Pre-AP Biology, Pre-AP Biology Honors)
- Exercise Science

High School Physical Science - Chemistry

- Chemistry (Chemistry I, Chemistry I Honors, Pre-AP Chemistry, Pre-AP Chemistry Honors)

High School Physical Science - Physics

- Physics (Physics I, Physics I Honors, Physics First, Physics First Honors)
- AP Physics 1
- AP Physics 2

Placemats

Side 1: Standards for Course/Grade

Side 2: Standard Elements

Arizona Science Standards - 8th Grade

Three Dimensions of Science

Sensemaking in science occurs with the integration of three essential dimensions.

Science and Engineering Practices

- ask questions and define problems
- develop and use models
- plan and carry out investigation
- analyze and interpret data
- use mathematics and computational thinking
- construct explanations and design solutions
- engage in argument from evidence
- obtain, evaluate, and communicate information

Crosscutting Concepts

- patterns
- cause and effect
- structure and function
- systems and system models
- stability and change
- scale, proportion, and quantity
- energy and matter

Core Idea

Physical Science

P1: All matter in the Universe is made of matter.
P2: Objects can affect other objects.
P3: Changing the movement of an object changes its energy.
P4: The total amount of energy in a system is conserved.

Earth and Space Science

E1: The composition of the Earth and the other planets in the solar system is determined by their formation.
E2: The Earth and our solar system are part of a larger system, the Universe.

Life Science

L1: Organisms are organized on a hierarchical level.
L2: Organisms require a supply of energy to live.
L3: Genetic information is passed from parents to offspring.
L4: The unity and diversity of organisms are explained by evolution.

Core Idea

U1: Scientists explain phenomena using scientific investigations. Evidence science of phenomena. As new evidence is discovered, scientific models are revised.
U2: The knowledge produced by science is used to solve problems and/or create products.
U3: Applications of science often have societal and/or political implications.

Physical Science Standards

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

Life Science Standards

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

Arizona Essential Standards: Physics I, Honors Physics I, Physics First, Honors Physics First

*Essential standards are standards that will be assessed on the state exam and are intended for ALL students to have learned by the end of 3 credits of high school science courses.

Physical Science Plus (+) Standards HS+P are supporting standards designed to be used with the essential standards for students taking a high school physics course.

Physical Science Standards: Physics

*HS.P2U1.5	Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic).
HS+Phy.P2U1.1	Plan and carry out investigations to design, build, and refine a device that works within given constraints to demonstrate that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
*HS.P3U1.6	Collect, analyze, and interpret data regarding the change in motion of an object or system in one dimension, to construct an explanation using Newton's Laws.
HS+Phy.P3U1.2	Develop and use mathematical models of Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects.
HS+Phy.P3U1.3	Develop a mathematical model, using Newton's laws, to predict the motion of an object or system in two dimensions (projectile and circular motion).
HS+Phy.P3U1.4	Engage in argument from evidence regarding the claim that the total momentum of a system is conserved when there is no net force on the system.
*HS.P3U2.7	Use mathematics and computational thinking to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.

Physical Science Standards: Physics

*HS.P4U1.8	Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.
*HS.P4U3.9	Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.
HS+Phy.P4U1.6	Analyze and interpret data to quantitatively describe changes in energy within a system and/or energy flows in and out of a system.
HS+Phy.P4U2.7	Design, evaluate, and refine a device that works within given constraints to transfer energy within a system.
HS+Phy.P4U1.8	Use mathematics and computational thinking to explain the relationships between power, current, voltage, and resistance.
*HS.P4U1.10	Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.

Physical Science Standards: Chemistry

*HS.P1U1.1	Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.
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Earth and Space Science Standards

*HS.E1U1.11	Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.
*HS.E1U1.12	Develop and use models of the Earth that explain the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).
*HS.E2U1.15	Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.
*HS.E2U1.16	Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.
*HS.E2U1.17	Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence.

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Updated 01/09/20

Arizona Science Standards - 8th Grade		
Core Ideas for Knowing Science: Elements for Physical, Earth & Space, and Life Science Standards		
Elements of Physical Science Standards	Elements of Earth and Space Science Standards	Elements of Life Science Standards con't
8.P1U1.1 Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds in the total number of each type of atom conserved. Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change.	8.E1U1.6 Analyze and interpret data about the Earth's geological column to communicate relative ages of rock layers and fossils. The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analysis of rock strata and the fossil record provide only relative dates, not an absolute scale. 8.E1U3.7 Obtain, evaluate, and communicate information about data and historical patterns to predict natural hazards and other geological events. Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events. 8.E1U3.8 Construct and support an argument about how human consumption of limited resources impacts the biosphere. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing extinction of many other species. But changes to Earth's environment can have different impacts (negative and positive) for different living things. Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	8.L3U3.10 Communicate how advancements in technology have furthered the field of genetic research and use evidence to support an argument about the positive and negative effects of genetic research on human lives. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (8.L3U1.9) In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. 8.L4U1.11 Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time. Natural selection leads to the predominance of certain traits in a population and the suppression of others. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (8.L4U1.12)
P1U1.2 Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties. Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.	P4U1.3 Construct an explanation on how energy can be transferred from one energy store to another. Energy is transferred out of hotter regions or objects and into colder ones by the processes of conduction, convection, and radiation.	8.L4U1.12 Gather and communicate evidence on how the process of natural selection provides an explanation of how new species can evolve. The natural selection of organisms with certain features that enable them to survive in particular environmental conditions has been going since the first form of life appeared on Earth. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (8.L4U1.11) In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (8.L3U3.10)
P4U1.4 Develop and use mathematical models to explain wave characteristics and interactions. A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. A sound wave needs a medium through which it is transmitted. When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials where the light bends. A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. Since light can travel through space, it cannot be a matter wave, like sound or water waves. Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking. Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.	P4U2.5 Develop a solution to increase efficiency when transferring energy from one source to another. The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. Energy is spontaneously transferred out of hotter regions or objects and into colder ones.	Elements of Life Science Standards
		8.L3U1.9 Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations. Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of a specific protein, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (8.L3U3.10)
The elements are not to be used as a check-off list, but rather a useful tool to help educators identify the specific pieces of knowledge and skill that make up the practice, crosscutting concept, or core idea at that grade-band.		



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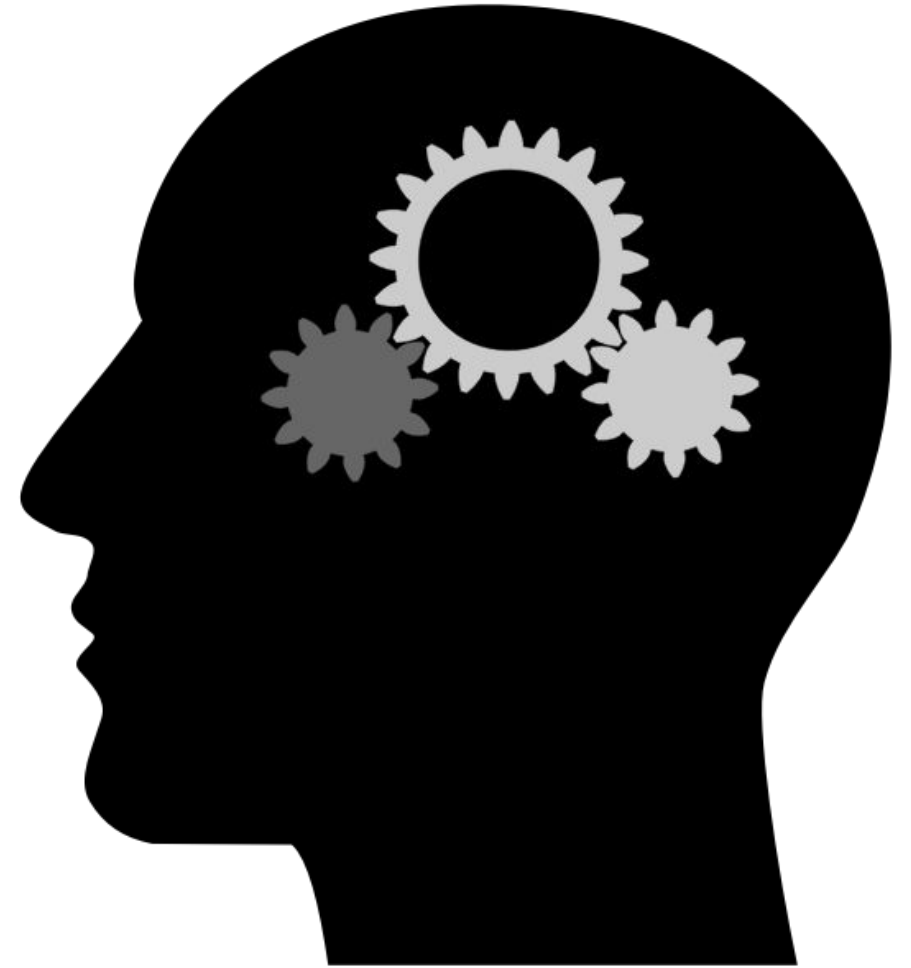


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Looking at the Standards

As you take a closer look at the standards covered in the courses/units for which you are reviewing materials, think about and discuss:

- What do students need to DO?
- What do students need to KNOW?
- How would students demonstrate their understanding of that standard?



Arizona Science Standards - 6th Grade

Three Dimensions of Science Sensory living in science occurs with the integration of three essential dimensions.		Life Science Standards 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.		Physical Science Standards 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.	
Science and Engineering Practices - ask questions and define problems - develop and use models - plan and carry out investigations - analyze and interpret data - use mathematics and computational thinking - construct explanations and design solutions - engage in argument from evidence - obtain, evaluate, and communicate information		Crosscutting Concepts - patterns - cause and effect - structure and function - systems and system models - stability and change - scale, proportion, and quantity - energy and matter		Core Ideas	
Core Ideas for Knowing Science		Key Crosscutting Concepts in 6th Grade <i>Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change</i>		Earth and Space Science Standards Students develop an understanding of how the Sun provides light and energy for Earth systems.	
Physical Science 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.		Life Science 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.		Earth and Space Science 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.	
Core Ideas for Using Science 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.		Phenomena are observable events that can be explained or explored. Science aims to explain the causes of these events, or phenomena, using scientific ideas, concepts, and practices (3-dimensions).		Physical Science 6.P1U1.1 Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory). 6.P1U1.2 Plan and carry out an investigation to demonstrate that variations in temperature and/or pressure affect changes in state of matter. 6.P1U1.3 Develop and use models to represent that matter is made up of smaller particles called atoms. 6.P2U1.4 Develop and use a model to predict how forces act on objects at a distance. 6.P4U2.5 Analyze how humans use technology to store (potential) and/or use (kinetic) energy.	
				Earth and Space Science 6.E1U1.6 Investigate and construct an explanation demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere. 6.E2U1.7 Use ratios and proportions to analyze and interpret data related to scale, properties, and relationships among objects in our solar system. 6.E2U1.8 Develop and use models to explain how constellations and other night sky patterns appear to move due to Earth's rotation and revolution. 6.E2U1.9 Develop and use models to construct an explanation of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system. 6.E2U1.10 Use a model to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons.	

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6th Grade Units

- Science Practices and Methods
- Earth and Space Science Unit

Arizona Science Standards - 7th Grade

Three Dimensions of Science

Sensemaking in science occurs with the integration of three essential dimensions.

Science and Engineering Practices

- ask questions and define problems
- develop and use models
- plan and carry out investigations
- analyze and interpret data
- use mathematics and computational thinking
- construct explanations and design solutions
- engage in argument from evidence
- obtain, evaluate, and communicate information

Crosscutting Concepts

- patterns
- cause and effect
- structure and function
- systems and system models
- stability and change
- scale, proportion, and quantity
- energy and matter

Core Ideas

Core Ideas for Knowing Science

Physical Science

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.

Earth and Space Science

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.

Life Science

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.

Core Ideas for Using Science

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.

Physical Science Standards

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.

7.P2U1.1	Collect and analyze data demonstrating how electromagnetic forces can be attractive or repulsive and can vary in strength.
7.P2U1.2	Develop and use a model to predict how forces act on objects at a distance.
7.P3U1.3	Plan and carry out an investigation that can support an evidence-based explanation of how objects on Earth are affected by gravitational force.
7.P3U1.4	Use non-algebraic mathematics and computational thinking to explain Newton's laws of motion.

Earth and Space Science Standards

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

7.E1U1.5	Construct a model that shows the cycling of matter and flow of energy in the atmosphere, hydrosphere, and geosphere.
7.E1U1.6	Construct a model to explain how the distribution of fossils and rocks, continental shapes, and seafloor structures provides evidence of the past plate motions.
7.E1U2.7	Analyze and interpret data to construct an explanation for how advances in technology has improved weather prediction.

Phenomena are observable events that can be explained or explored. Science aims to explain the causes of these events, or phenomena, using scientific ideas, concepts, and practices (3-dimensions).

Life Science Standards

Students develop an understanding of the structure and function of cells.

7.L1U1.8	Obtain, evaluate, and communicate information 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.
7.L1U1.9	Construct an explanation to demonstrate the relationship between major cell structures and cell functions (plant and animal).
7.L1U1.10	Develop and use a model to explain how cells, tissues, and organ systems maintain life (animals).
7.L1U1.11	Construct an explanation for how organisms maintain internal stability and evaluate the effect of the external factors on organisms' internal stability.
7.L1U1.12	Construct an explanation for how some plant cells convert light energy into food energy.

Key Crosscutting Concepts in 7th Grade
Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change

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Department of Education

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7th Grade Units

- Life Science Unit
- Earth and Space Science Unit

Arizona Science Standards - 8th Grade

Three Dimensions of Science

Sensemaking in science occurs with the integration of three essential dimensions.

Science and Engineering Practices

- ask questions and define problems
- develop and use models
- plan and carry out investigations
- analyze and interpret data
- use mathematics and computational thinking
- construct explanations and design solutions
- engage in argument from evidence
- obtain, evaluate, and communicate information

Crosscutting Concepts

- patterns
- cause and effect
- structure and function
- systems and system models
- stability and change
- scale, proportion, and quantity
- energy and matter

Core Ideas

Core Ideas for Knowing Science

Physical Science

- 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.

Earth and Space Science

- 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.

Life Science

- 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.

Core Ideas for Using Science

- 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.

Physical Science Standards

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

8.P1U1.1	Develop and use a model 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.
8.P1U1.2	Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties.
8.P4U1.3	Construct an explanation on how energy can be transferred from one energy store to another.
8.P4U1.4	Develop and use mathematical models to explain wave characteristics and interactions.
8.P4U2.5	Develop a solution to increase efficiency when transferring energy from one source to another.

Earth and Space Science Standards

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

8.E1U1.6	Analyze and interpret data about the Earth's geological column to communicate relative ages of rock layers and fossils.
8.E1U3.7	Obtain, evaluate, and communicate information about data and historical patterns to predict natural hazards and other geological events.
8.E1U3.8	Construct and support an argument about how human consumption of limited resources impacts the biosphere.

Life Science Standards

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

8.L3U1.9	Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.
8.L3U3.10	Communicate how advancements in technology have furthered the field of genetic research and use evidence to support an argument about the positive and negative effects of genetic research on human lives.
8.L4U1.11	Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.
8.L4U1.12	Gather and communicate evidence on how the process of natural selection provides an explanation of how new species can evolve.

Key Crosscutting Concepts in 8th Grade

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

Phenomena are observable events that can be explained or explored. Science aims to explain the causes of these events, or phenomena, using scientific ideas, concepts, and practices (3-dimensions).

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8th Grade Units

- Life Science Unit
- Earth and Space Science Unit



Arizona Essential Standards: Biology I, Honors Biology I, Pre-AP Biology, Pre-AP Biology Honors

★Essential standards are standards that will be assessed on the state exam and are intended for ALL students to have learned by the end of 3 credits of high school science courses.

Life Science Standards	
★HS.L2U3.18	Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.
HS+B.L2U1.1	Develop a model showing the relationship between limiting factors and carrying capacity, and use the model to make predictions on how environmental changes impact biodiversity.
HS+B.L4U1.2	Engage in argument from evidence that changes in environmental conditions or human interventions may change species diversity in an ecosystem.
★HS.L2U1.19	Develop and use models that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment.
HS+B.L2U1.3	Use mathematics and computational thinking to support claims for the cycling of matter and flow of energy through trophic levels in an ecosystem.
★HS.L1U1.20	Ask questions and/or make predictions based on observations and evidence to demonstrate how cellular organization, structure, and function allow organisms to maintain homeostasis.
HS+B.L1U1.4	Develop and use models to explain the interdependency and interactions between cellular organelles.
HS+B.L1U1.5	Analyze and interpret data that demonstrates the relationship between cellular function and the diversity of protein functions.
HS+B.L1U1.6	Develop and use models to show how transport mechanisms function in cells.
HS+B.L1U1.7	Develop and use models to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms (plant and animal).

Life Science Standards	
★HS.L2U1.21	Obtain, evaluate, and communicate data showing the relationship of photosynthesis and cellular respiration; flow of energy and cycling of matter.
HS+B.L2U1.8	Develop and use models to develop a scientific explanation that illustrates how photosynthesis transforms light energy into stored chemical energy and how cellular respiration breaks down macromolecules for use in metabolic processes.
★HS.L1U1.22	Construct an explanation for how cellular division (mitosis) is the process by which organisms grow and maintain complex, interconnected systems.
★HS.L1U3.23	Obtain, evaluate, and communicate the ethical, social, economic and/or political implications of the detection and treatment of abnormal cell function.
HS+B.L1U1.9	Develop and use a model to communicate how a cell copies genetic information to make new cells during asexual reproduction (mitosis).
★HS.L3U1.24	Construct an explanation of how the process of sexual reproduction contributes to genetic variation.
★HS.L3U1.25	Obtain, evaluate, and communicate information about the causes and implications of DNA mutation.
★HS.L3U3.26	Engage in argument from evidence regarding the ethical, social, economic, and/or political implications of a current genetic technology.
HS+B.L3U1.10	Use mathematics and computational thinking to explain the variation that occurs through meiosis and calculate the distribution of expressed traits in a population.
HS+B.L3U1.11	Construct an explanation for how the structure of DNA and RNA determine the structure of proteins that perform essential life functions.
HS+B.L3U1.12	Analyze and interpret data on how mutations can lead to increased genetic variation in a population.

Life Science Standards	
★HS.L4U1.27	Obtain, evaluate, and communicate evidence that describes how changes in frequency of inherited traits in a population can lead to biological diversity.
★HS.L4U1.28	Gather, evaluate, and communicate multiple lines of empirical evidence to explain the mechanisms of biological evolution.
HS+B.L4U1.13	Obtain, evaluate, and communicate multiple lines of empirical evidence to explain the change in genetic composition of a population over successive generations.
HS+B.L4U1.14	Construct an explanation based on scientific evidence that the process of natural selection can lead to adaptation.

Earth and Space Science Standards	
★HS.E1U1.13	Evaluate explanations and theories about the role of energy and matter in geologic changes over time.
★HS.E1U3.14	Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.

Physical Science Standards	
★HS.P1U1.2	Develop and use models for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.
★HS.P1U1.3	Ask questions, plan, and carry out investigations to explore the cause and effect relationship between reaction rate factors.

Life Science Plus (+) Standards HS+B are supporting standards designed to be used with the essential standards to enhance the rigor of general science courses.

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Updated 01/09/2023

HS Biology I

- Biology I
- Honors Biology I
- Pre-AP Biology
- Pre-AP Biology Honors

DRAFT Exercise Science Standards Placemat

Life Science Standards	Physical Science Standards
HS.L2U1.18	HS.P1U1.1
HS.L2U1.20	HS.P1U1.2
HS+B.L2U1.4	HS.P1U1.3
HS+B.L2U1.5	HS.P1U1.4
HS+B.L2U1.6	HS.P1U1.5
HS.L2U1.7	HS.P1U1.6
HS.L2U1.21	HS.P1U1.7
HS.L2U1.22	HS.P1U1.8
HS+B.L2U1.10	HS.P1U1.9
	HS.P1U1.10
	HS.P1U1.11
	HS.P1U1.12
	HS.P1U1.13
	HS.P1U1.14
	HS.P1U1.15
	HS.P1U1.16
	HS.P1U1.17
	HS.P1U1.18
	HS.P1U1.19
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	HS.P1U1.96
	HS.P1U1.97
	HS.P1U1.98
	HS.P1U1.99
	HS.P1U1.100

Sports, Exercise, and Health Science



Arizona Essential Standards: Chemistry I, Honors Chemistry I, Pre-AP Chemistry, Pre-AP Chemistry Honors

★Essential standards are standards that will be assessed on the state exam and are intended for ALL students to have learned by the end of 3 credits of high school science courses.

Physical Science Plus (+) Standards HS+C are supporting standards designed to be used with the essential standards to enhance the rigor of general science courses.

Physical Science Standards: Chemistry

★HS.P1U1.1	Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.
HS+C.P1U1.1	Develop and use models to demonstrate how changes in the number of subatomic particles (protons, neutrons, electrons) affect the identity, stability, and properties of the element.
HS+C.P1U1.2	Obtain, evaluate, and communicate the qualitative evidence supporting claims about how atoms absorb and emit energy in the form of electromagnetic radiation.
HS+C.P1U1.3	Analyze and interpret data to develop and support an explanation for the relationships between kinetic molecular theory and gas laws.
★HS.P1U1.2	Develop and use models for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.
★HS.P1U1.3	Ask questions, plan, and carry out investigations to explore the cause and effect relationship between reaction rate factors.
HS+C.P1U1.4	Develop and use models to predict and explain forces within and between molecules.
HS+C.P1U1.5	Plan and carry out investigations to test predictions of the outcomes of various reactions, based on patterns of physical and chemical properties.
HS+C.P1U1.6	Construct an explanation, design a solution, or refine the design of a chemical system in equilibrium to maximize production.
HS+C.P1U1.7	Use mathematics and computational thinking to determine stoichiometric relationships between reactants and products in chemical reactions.
★HS.P1U3.4	Obtain, evaluate, and communicate information about how the use of chemistry related technologies have had positive and negative ethical, social, economic, and/or political implications.
HS+C.P1U3.8	Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of fission, fusion, and radioactive decay.

Physical Science Standards: Physics

★HS.P2U1.5	Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic).
★HS.P4U1.8	Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.
★HS.P4U3.9	Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.
★HS.P4U1.10	Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.



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Chemistry I

- Chemistry I
- Honors Chemistry I
- Pre-AP Chemistry
- Pre-AP Chemistry Honors



Arizona Essential Standards: Physics I, Honors Physics I, Physics First, Honors Physics First

★Essential standards are standards that will be assessed on the state exam and are intended for ALL students to have learned by the end of 3 credits of high school science courses.

Physical Science Plus (+) Standards HS+P are supporting standards designed to be used with the essential standards for students taking a high school physics course.

Physical Science Standards: Physics		Physical Science Standards: Physics		Earth and Space Science Standards	
★HS.P2U1.5	Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic).	★HS.P4U1.8	Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.	★HS.E1U1.11	Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.
HS+Phy.P2U1.1	Plan and carry out investigations to design, build, and refine a device that works within given constraints to demonstrate that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.	★HS.P4U3.9	Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.	★HS.E1U1.12	Develop and use models of the Earth that explain the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).
★HS.P3U1.6	Collect, analyze, and interpret data regarding the change in motion of an object or system in one dimension, to construct an explanation using Newton's Laws.	HS+Phy.P4U1.6	Analyze and interpret data to quantitatively describe changes in energy within a system and/or energy flows in and out of a system.	★HS.E2U1.15	Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.
HS+Phy.P3U1.2	Develop and use mathematical models of Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects.	HS+Phy.P4U2.7	Design, evaluate, and refine a device that works within given constraints to transfer energy within a system.	★HS.E2U1.16	Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.
HS+Phy.P3U1.3	Develop a mathematical model, using Newton's laws, to predict the motion of an object or system in two dimensions (projectile and circular motion).	HS+Phy.P4U1.8	Use mathematics and computational thinking to explain the relationships between power, current, voltage, and resistance.	★HS.E2U1.17	Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence.
HS+Phy.P3U1.4	Engage in argument from evidence regarding the claim that the total momentum of a system is conserved when there is no net force on the system.	★HS.P4U1.10	Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.		
★HS.P3U2.7	Use mathematics and computational thinking to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.				
		Physical Science Standards: Chemistry			
		★HS.P1U1.1	Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.		



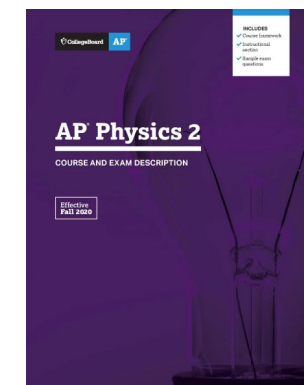
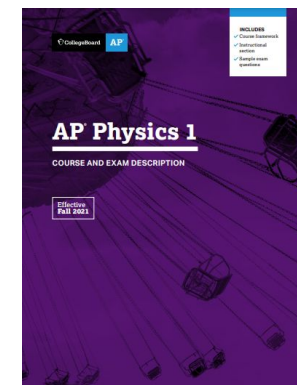
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Updated 01/09/2023

Physics I

- Physics I
- Honors Physics I
- Physics First
- Honors Physics First

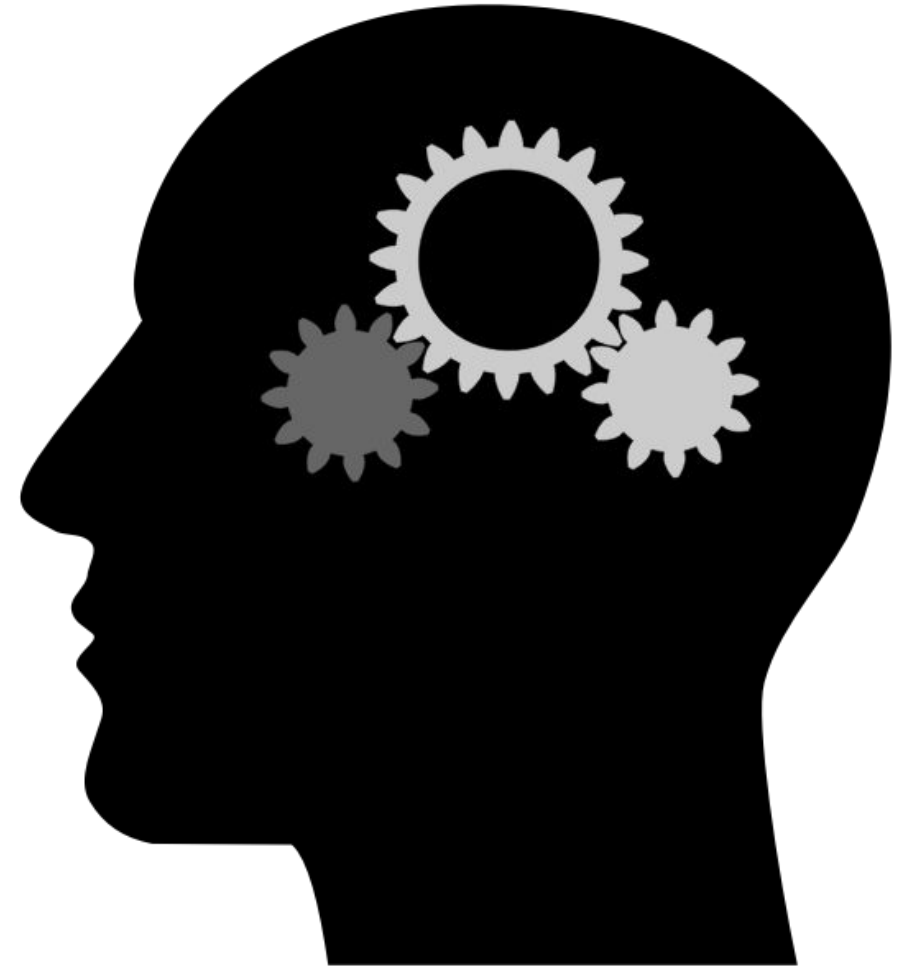
AP Physics 1 and Ap Physics 2



Looking at the Standards

As you take a closer look at the standards covered in the courses/units for which you are reviewing materials, think about and discuss:

- What do students need to DO?
- What do students need to KNOW?
- How would students demonstrate their understanding of that standard?



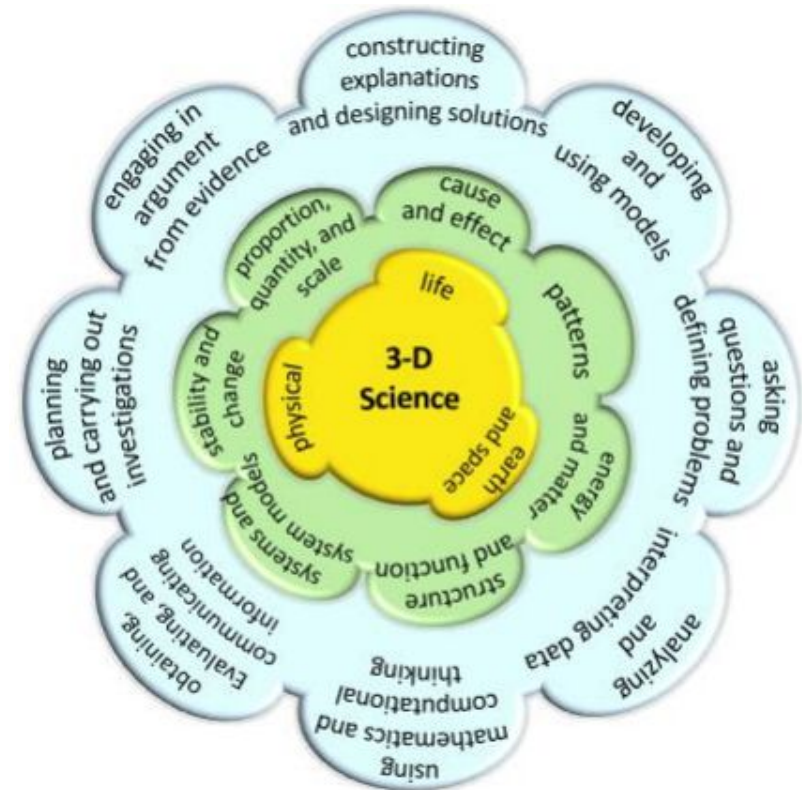
AZSS vs. NGSS

AZSS: Three Dimensions of Teaching and Learning Science

Science and Engineering Practices

Crosscutting Concepts

Disciplinary Core Ideas



Less Of...More Of

ADE Resource:

Instructional Shifts: A New Vision for Science Education

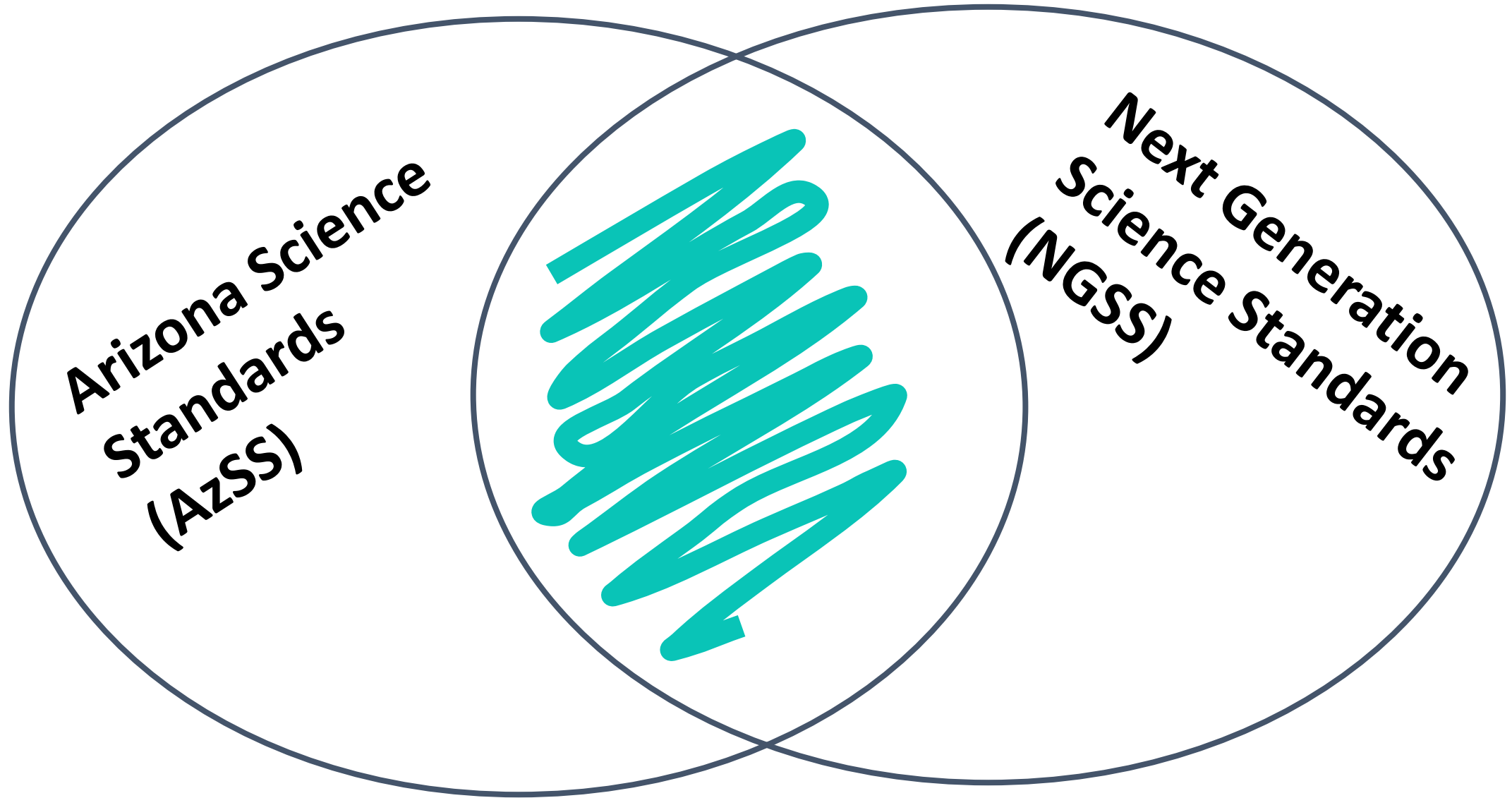
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A New Vision for Science Education

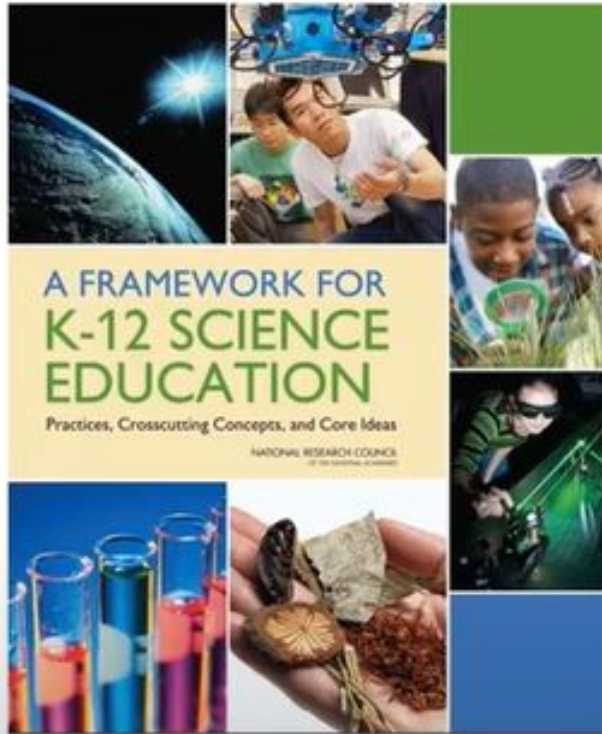
Implications of the Vision of the Framework for K-12
Science Education and the Arizona Science Standards

SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from questions about phenomena	Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
Teachers providing information to the whole class	Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
Teachers posing questions with only one right answer	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading textbooks and answering questions at the end of the chapter	Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information.
Pre-planned outcome for "cookbook" laboratories or hands-on activities	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Worksheets	Student writing of journals, reports, posters, and media presentations that explain and argue
Oversimplification of activities for students who are perceived to be less able to do science and engineering	Provision of supports so that all students can engage in sophisticated science and engineering practices

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/18801/guide-to-implementing-the-next-generation-science-standards>



NGSS



AzSS

Working with **Big Ideas** of Science Education

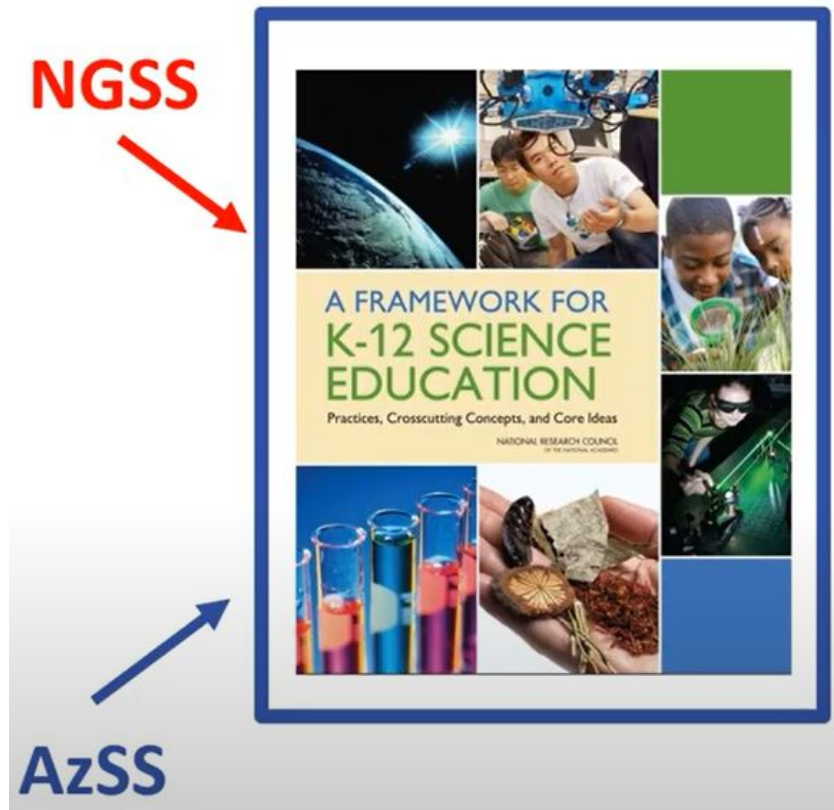
Edited by Wynne Harlen

with Derek Bell, Rosa Daniels, Hubert Dyson,
Guillermo Fernández de la Campa, Wayne Laine,
Robin Miller, Michael Reiss, Patricia Rowell and Wei Yu



AzSS

What is the **SAME** between AZSS and NGSS?



Three-Dimensional Learning

- Science and Engineering Practices
- Crosscutting Concepts
- ~~Disciplinary Core Ideas~~

Phenomena Drives Instruction

What is **DIFFERENT** between AZSS and NGSS?

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions & defining problems 2. Developing & using models 3. Planning & carrying out investigations 4. Analyzing & interpreting data 5. Using mathematics & computational thinking 6. Constructing explanations & designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, & communicating information	Physical Science PS 1: Matter & its interactions PS 2: Motion & stability: Forces & interactions PS 3: Energy PS 4: Waves & their applications; technologies for information transfer Life Sciences LS 1: From molecules to organisms: structures & processes LS 2: Ecosystems: interactions, energy, & dynamics LS 3: Heredity: inheritance & variation LS 4: Biological evolution: Unity & diversity Earth & Space Sciences ESS 1: Earth's place in the universe ESS 2: Earth's systems ESS 3: Earth & human activity Engineering, Technology, & the Application of Science ETS 1: Engineering design ETS 2: Links among engineering, technology, science, & society	1. Patterns 2. Cause & effect 3. Scale, proportion, & quantity 4. Systems & system models 5. Energy & matter 6. Structure & function 7. Stability & change

SAME

DIFFERENT

SAME

What is DIFFERENT between AZSS and NGSS Core Ideas?

NGSS

Disciplinary Core Ideas

Physical Science

- PS 1:** Matter & its interactions
PS 2: Motion & stability: Forces & interactions
PS 3: Energy
PS 4: Waves & their applications in technologies for information transfer

Life Sciences

- LS 1:** From molecules to organisms: structures & processes
LS 2: Ecosystems: Interactions, energy, & dynamics
LS 3: Heredity: Inheritance & variation of traits
LS 4: Biological evaluation: Unity & diversity

Earth & Space Sciences

- ESS 1:** Earth's place in the universe
ESS 2: Earth's systems
ESS 3: Earth & human activity

Engineering, Technology, & the Application of Science

- ETS 1:** Engineering design
ETS 2: Links among engineering, technology, science, & society

AZSS

Core Ideas for Knowing Science

Physical Science

- 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.

Earth and Space Science

- 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.

Life Science

- 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.

**Adapted from Working with Big Ideas in Science Education²*

Core Ideas for Using Science

- 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.

NGSS

**Disciplinary
Core ideas**

BOTH

***K-12 Framework for
Science Education***

3-Dimensional

**Science & Engineering
Practices**

Crosscutting Concepts

Phenomena-Based

AzSS

Core Ideas

**Also incorporates
research from
*Working with Big
Ideas of Science
Education***

****Locations of SEPs and Core Ideas vary by grade level****

Example Standards- Physical Science

NGSS

Students who demonstrate understanding can:

- MS-PS1-1.** Develop models to describe the atomic composition of simple molecules and extended structures. *[Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]*

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

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to predict and/or describe phenomena.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

Crosscutting Concepts

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

AzSS

Physical Science Standards	Learning Progressions, Key Terms, and Crosscutting Concepts
8.P1U1.1	
Develop and use a model 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.	All materials, anywhere in the universe, living and non-living, are made of a very large numbers of basic 'building blocks' called atoms , of which there are about 100 different kinds. Substances made of only one kind of atom are called elements . Atoms of different elements can ~~combine together~~ to form a very large number of compounds . A chemical reaction involves a rearrangement of the atoms in the reacting substances to form new substances, while the total amount of matter remains the same. The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made. ² (p. 20)
8.P1U1.2	
Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties.	Crosscutting Concepts: patterns; cause and effect ; scale, proportion and quantity; systems and system models; energy and matter ; stability and change ; structure and function ⁴

Example Standards- Side by Side

	NGSS	AzSS
Coding:	MS-PS1-1 ✓	8.P1U1.1 ✓
Standard:	Develop models to describe the atomic composition of simple molecules and extended structures. ✓	Develop and use a model 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. ✓
Science & Engineering Practice:	Develop Models ✓	Develop and Use Models ✓
Core Idea:	PS1.A: Structure & Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). ✓	P1: All matter in the Universe is made of very small particles. 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. ✓
Crosscutting Concept:	Scale, Proportion, & Quantity ✓	Any of the 7 Crosscutting Concepts, suggested: Cause & Effect, Stability & Change, Energy & Matter ✓



Example Standards- Side by Side

	NGSS	AzSS
Coding:	5-LS2-1 ✗	3.L2U1.8 ✗
Standard:	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. ✗	Construct an argument from evidence that organisms are interdependent. ✗
Science & Engineering Practice:	Develop a Model ✗	Construct an argument ✗
Core Idea:	LS2.A: Interdependent Relationships in Ecosystems The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. [omitted the rest] ✓	L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. 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. ✓
Crosscutting Concept:	Systems & System Models ✓	Any of the 7 Crosscutting Concepts, suggested: Systems and System Models, Structure and Function ✓



Why is this important to know and understand?

Arizona's Science Standards Summary

AzSS vs. NGSS Planning Guide – K-12

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

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.
 Moulding, B.D., Bybee, R.W., Paulson, N. (2015). *A vision and plan for science teaching and learning*. USA: Essential Teaching and Learning Publications.
 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/>

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.

12.2.21 | Page 1 of 32

Alignment of the AzSS to NGSS Performance Expectations Note: An

- 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

[illegible]

Pause and Reflect

Reflect on the information presented.



Break

Rubric

Rubric Creation

Sample SUSD Rubric Template

- Sections, Criteria, Rating Scale



**Secondary Science Curriculum Adoption
Curriculum Evaluation Rubric**

Course Title: _____

XXX (Teacher/Adoptive Parent) _____

Publisher/Author: _____ Member ID #: _____

Text Name: _____

Section 1 Title	None	Some	All	Comments
Criteria	0	1	2	
Criteria	0	1	2	
...	0	1	2	
	0	1	2	

Section 1 Title: _____ / Total Points

Section 2 Title	None	Some	All	Comments
	0	1	2	
	0	1	2	
	0	1	2	
	0	1	2	

Section 2 Title: _____ / Total Points

Section 2 Title	None	Some	All	Comments
	0	1	2	
	0	1	2	
	0	1	2	
	0	1	2	

Section 3 Title: _____ / Total Points

Total

____ /# + ____ /# + ____ /# = ____ /# (Total Points)

Criteria

Let's remind ourselves of the criteria for vendors that the committee reviewed last week.



Scottsdale *Unified* School District

Engaging all students in world-class, future-focused learning

SECONDARY SCIENCE CURRICULUM ADOPTION COMMITTEE

SUSD's VISION: Engaging all students in world-class, future-focused learning.

SUSD's MISSION: We inspire, motivate, and empower all to think critically, act collaboratively, and embrace diversity for a life of intellectual exploration, community engagement, and personal growth.

Criteria for determining the quality of instructional materials include:

Accuracy and Alignment:

- Aligned to Arizona Science Standards (must provide an explicit Arizona Science Standards alignment document).
- Aligned to course and exam content of AP courses (if applicable).
- Uses scientifically accurate and grade appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.
- Curriculum is research-based with supporting evidence.
- Designed so students make sense of phenomena and/or design solutions to problems by actively engaging students in three-dimensional learning (Science and Engineering Practices, Crosscutting Concepts, and Core Ideas).
- When appropriate, links are made to Arizona Science Standards in all the domains (life science, physical science, and Earth and space science). Core ideas from different disciplines are used together to explain phenomena.
- Curriculum is consistently laboratory/investigation-based (devoted to providing an opportunity for students to manipulate equipment, materials, or specimens to develop skills in observation and analysis, and to discover, demonstrate, illustrate, or test scientific principles or concepts).
- Appropriate lessons, investigations, and assessments that prepare students for high stakes assessments, performance-based tasks, and advanced coursework.

Engagement and the Ability to Meet Student Needs

- Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.
- Provides guidance and resources for teachers to differentiate instruction and assessment (both support and extensions).
- Questions and learning tasks encourage the development and application of collaboration, communication, creativity and critical thinking.
- Problem-based learning and simulations relevant to the lives of students.
- Differentiation in each unit (content, process, product for readiness, language ability, learning style, etc.).
- Resources spark student interest and include interdisciplinary, real world connections.

Ease of Use and Support

- Layout and organization of curriculum materials contribute to ease of use.
- Resources are available in multiple formats for both students and teachers (hard-copy, digital, etc.). Digital resources can be accessed by teachers and students through SUSD's learning management systems (Clever, Google Classroom, Synergy, etc.).
- Curriculum is designed to link student engagement and knowledge across lessons and units and is arranged in a logical sequence.
- Curriculum provides support to teachers that buttress student academic honesty.
- Scoring guidelines and rubrics are provided for assessments.
- Professional development is provided to support implementation of curriculum.

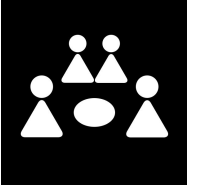
Reviewing Other Tools/Rubrics

Alone Zone - 5 minutes

- Browse the 8 resources
- Mark criteria/language that you would like to see in our rubric.



Table Whip-Around - 5 minutes



- Go around the table and share the high-priority criteria/language for our rubric.
- Only one person speaks. No additional comments, reactions (verbal or non-verbal, by tablemates that reinforce or reject the contributor's input.
- Continue to go around the table until time is called

Rubric Sections

Our Criteria Document

- Accuracy and Alignment
- Engagement and the Ability to Meet Student Needs
- Ease of Use and Support

EQUIP Rubric

- 3D Design
- Instructional Supports
- Monitoring Student Progress

Georgia's Rubric

- 3D Science Criteria
 - Making sense of Phenomena and Designing Solutions to Problems
 - Three Dimensions
 - Integrating the Three Dimensions for Instruction and Assessment
- Additional Criteria
 - Student Instructional Materials
 - Teacher Instructional Materials and Support
 - Equitable Opportunity to Learn in Instructional Materials
 - Assessment in Instructional Materials

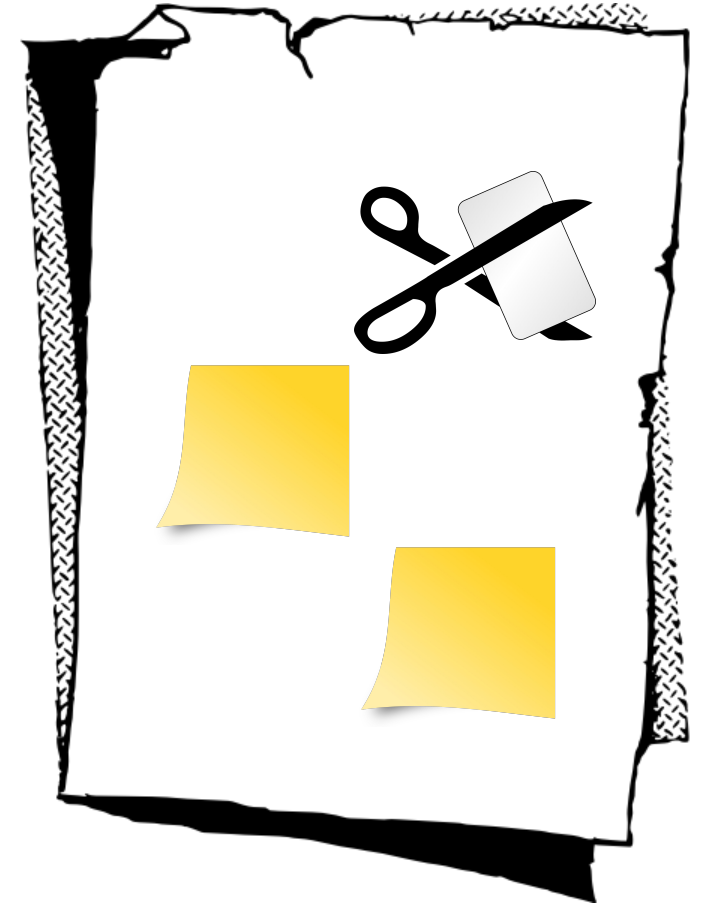
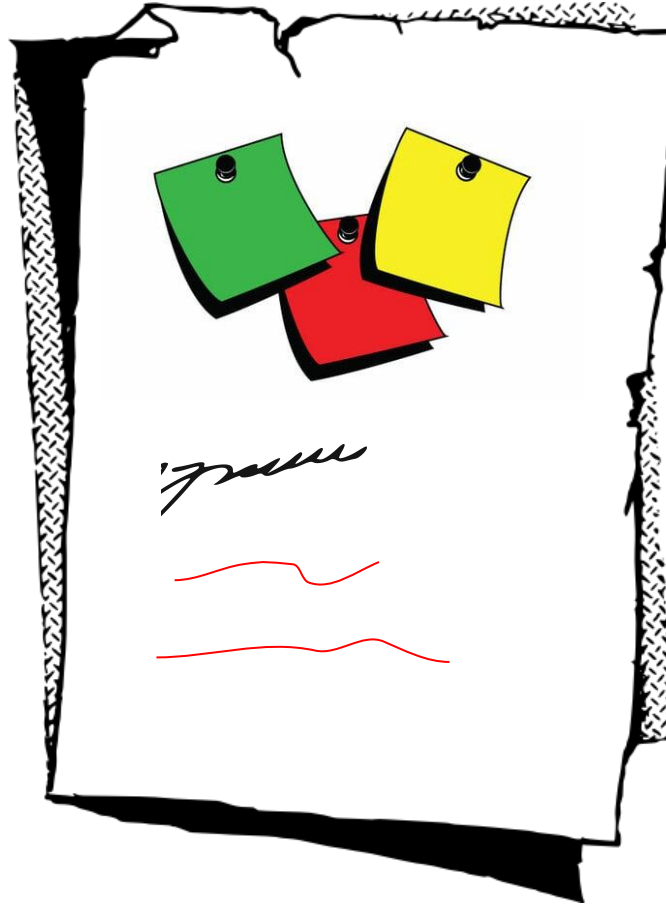
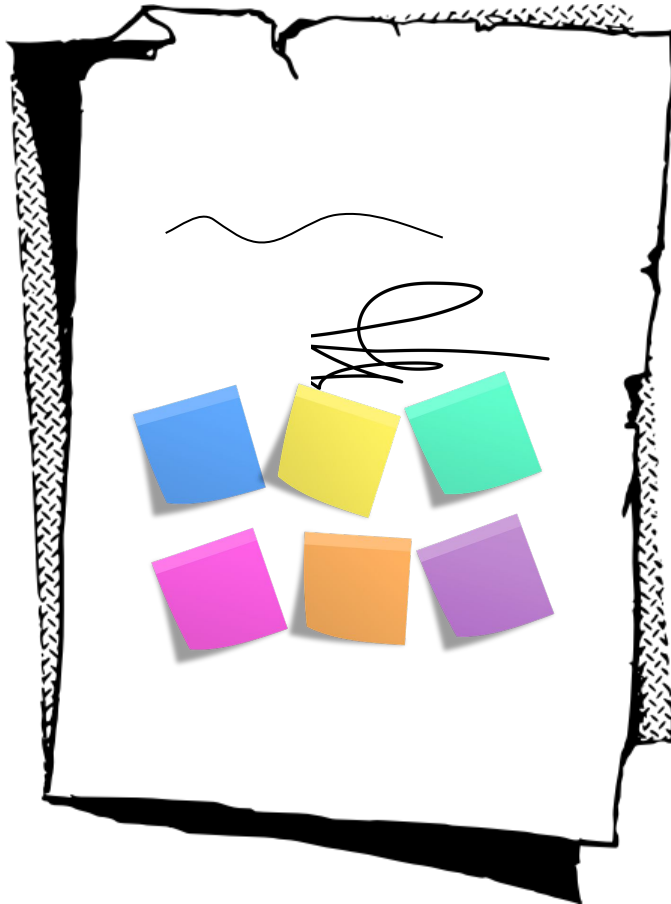
Iowa's Rubric

No sections
9 Criteria

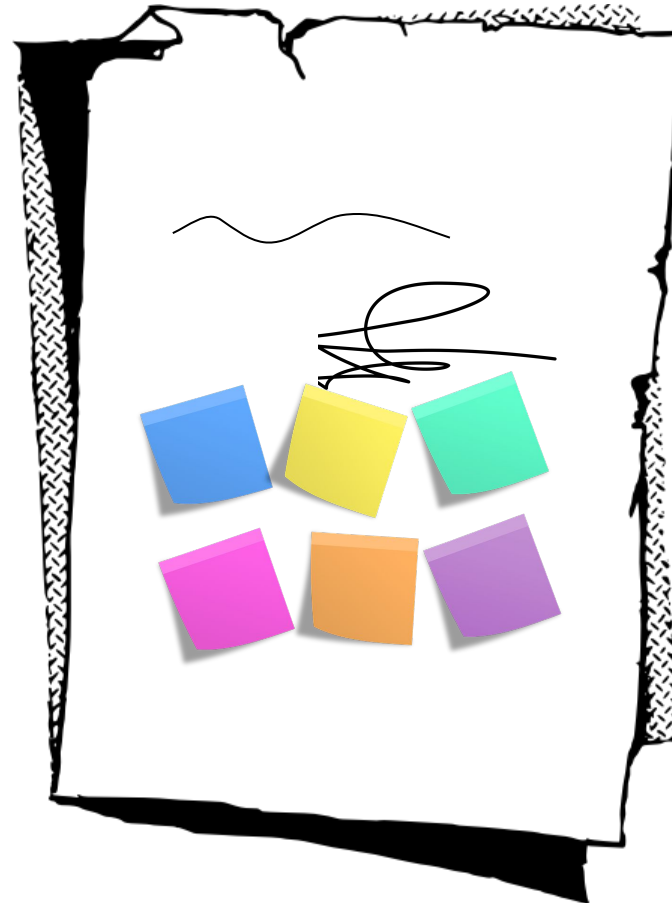
Wisconsin's Rubric

No sections
14 Criteria

Group Work



Sharing Work and Whole Group Input



Draft Rubric Creation

- Sections
- Criteria
- Rating Scale

The committee will view and test out the draft rubric in a calibration activity next Thursday.



**Secondary Science Curriculum Adoption
Curriculum Evaluation Rubric**

Course Title: _____

XXX (Teacher/Adopt-Parent) _____

Publisher/Author: _____ Member ID #: _____

Text Name: _____

Section 1 Title	None	Some	All	Comments
Criteria	0	1	2	
Criteria	0	1	2	
...	0	1	2	
	0	1	2	

Section 1 Title: _____ / Total Points

Section 2 Title	None	Some	All	Comments
	0	1	2	
	0	1	2	
	0	1	2	
	0	1	2	

Section 2 Title: _____ / Total Points

Section 2 Title	None	Some	All	Comments
	0	1	2	
	0	1	2	
	0	1	2	
	0	1	2	

Section 3 Title: _____ / Total Points

Total

____ /# + ____ /# + ____ /# = ____ /# (Total Points)

OER Resources and Vendor Solicitations

Proposed Open Enrollment Resources for Review

OpenSciEd

CK-12

Phenomenon-Driven Storylines: A Full Biology Course Curricular Replacement

inquiryHUB (IHUB)

Georgia Virtual

OpenStax

Next Generation Science Storylines

Vendor Letter

February 14th - vendor deadline to submit a Letter of Participation and/or complete the Participation Google Form

February 27th - Deadline for vendor materials to be received by SUSD

March 2nd - Committee members begin reviewing materials submitted by vendors

Future Meeting

Next Meeting

Thursday, February 9, 2023 from 4:00 - 6:30
at SUSD Oak Learning Campus 7501 E Oak St, Scottsdale, AZ 85257

Meeting
adjourned!

Thank you!

