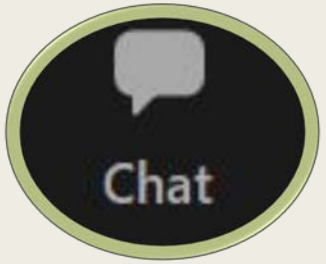
CORE IDEAS: 1 OF THE 3 DIMENSIONS OF THE AZ SCIENCE STANDARDS

Who's in the room?

Complete the poll that will be on your screen.

Webinar Expectations



- Microphones are disabled
- Utilize the chat room for discussion/comments

Objectives

- Recognize how phenomena can be used by students to deepen their understanding of core science ideas.
- Describe how core ideas progress through the grade bands to support student learning.
- Explain how core ideas are an integral dimension to the Arizona Science Standards for students to be scientific literate.

Norms

- **A**sk questions
- **E**mbrace mistakes
- **I**ntegrate new information
- **O**pen your mind to diverse views
- **U**tilize what you learn

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How did you gain full understanding of the storyline?

Chat


SINK
FLOAT
- penny
- crayon
- straw
- paper clip
- plastic spoon


1
2

No more “mile wide, inch deep”

*“…the framework focuses on a **limited number of core ideas**… Reduction of the sheer sum of details to be mastered is intended to **give time** for students to engage in scientific investigations and argumentation and to achieve **depth of understanding** of the core ideas presented.”*

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States. Appendix E: Progressions within the Next Generation Science Standards*. Washington, DC: The National Academies Press.

2004 AZ Science Standards

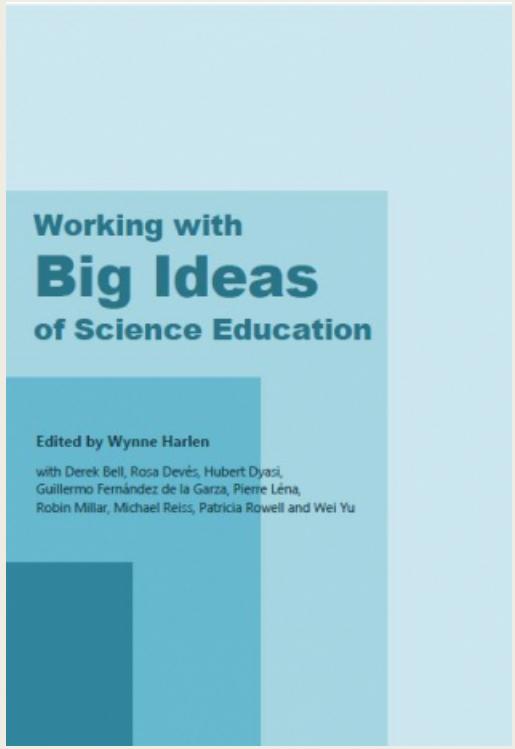
- Identify observable similarities and differences between/among different groups of animals.
- Distinguish between voluntary and involuntary responses
- Explain the hierarchy of cells, tissues, organs, and systems.
- Describe the purposes and processes of cellular reproduction

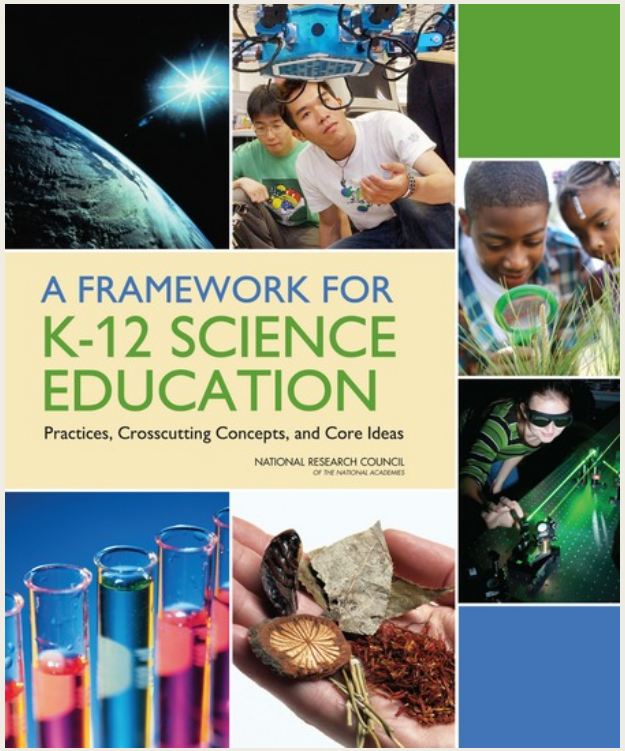
Learning as a progression

"[The framework] is built on the notion of learning as a developmental progression. It is designed to help children continually build on and revise their knowledge and abilities."

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States. Appendix E: Progressions within the Next Generation Science Standards*. Washington, DC: The National Academies Press.

Core Ideas





CCC's &
SEP's

BACKGROUND OF AZ SCIENCE STANDARDS

SCIENCE!

SCIENCE!

Core Ideas for Knowing Science

Core Ideas for Using Science

SCIENCE!

Core Ideas for Knowing Science

Core Ideas for Using Science

Physical Science

Life Science

Earth & Space Science

Nature of Science & Engineering

SCIENCE!

Core Ideas for Knowing Science

Core Ideas for Using Science

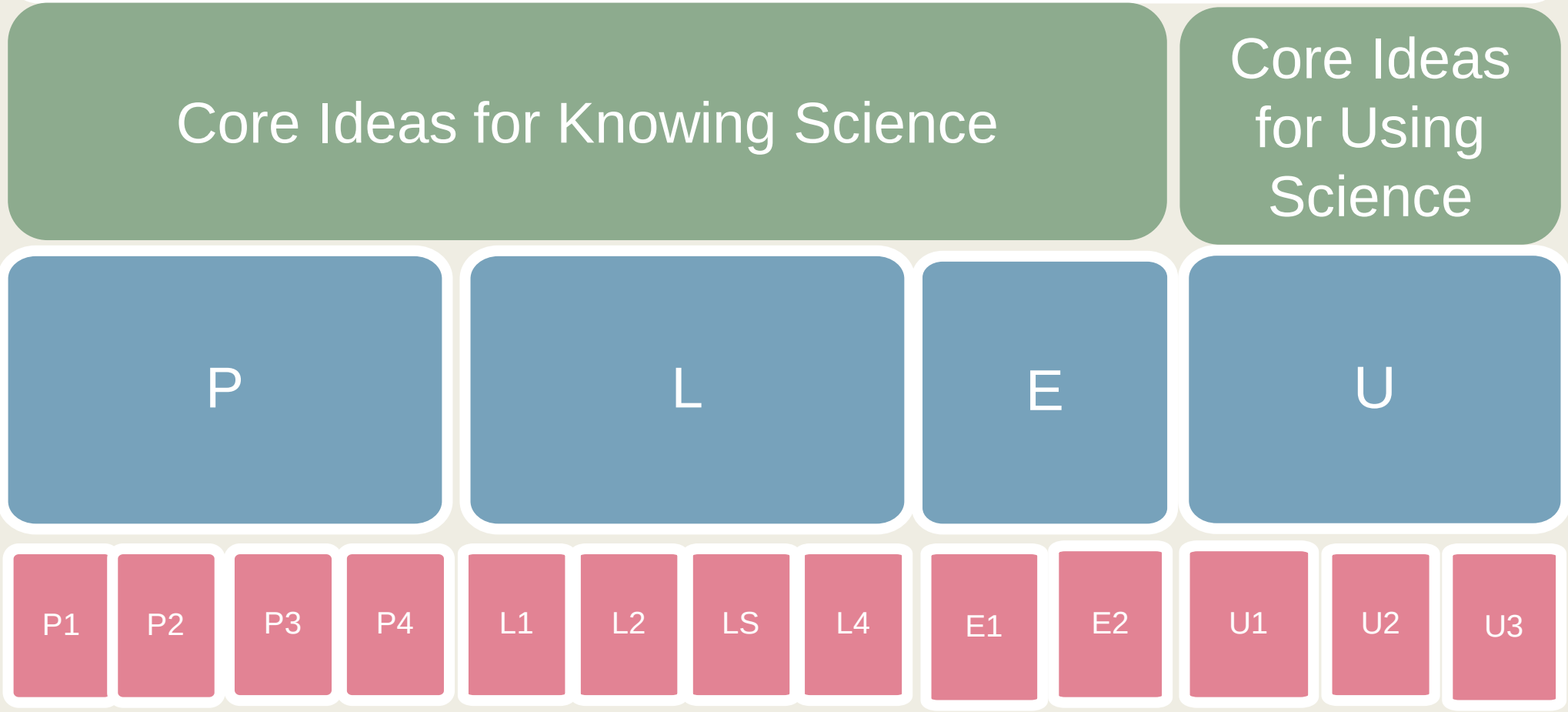
P

L

E

U

SCIENCE!


Core Ideas for Knowing Science
Core Ideas for Using Science
P
L
E
U
P1
P2
P3
P4
L1
L2
LS
L4
E1
E2
U1
U2
U3

Core Ideas (CIs)

Core ideas should:

1. Have broad importance across multiple sciences or engineering disciplines or be a key organizing principle of a single discipline

2. Provide a key tool for understanding or investigating more complex ideas and solving problems.

3. Relate to the interests and life experiences of students or be connected to societal or personal concerns

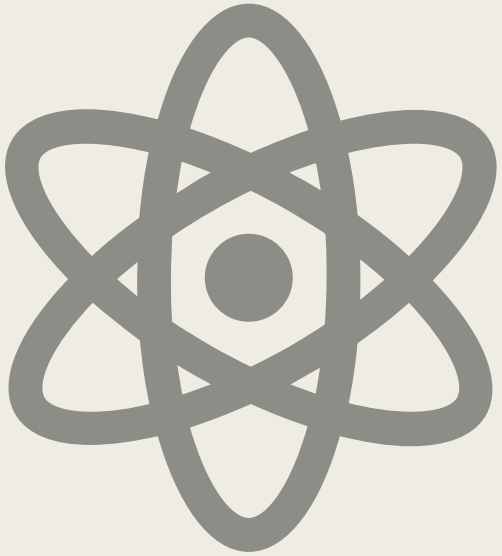
4. Be teachable and learnable over multiple grades at increasing levels of depth and sophistication

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

Arizona Science Standards Core Ideas (CI)

Core Ideas for Knowing Science*		Core Ideas for Using 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.		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.

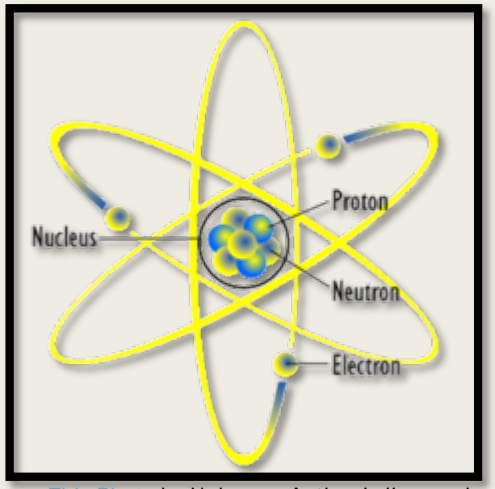
***Adapted from *Working with Big Ideas in Science Education*[2]**

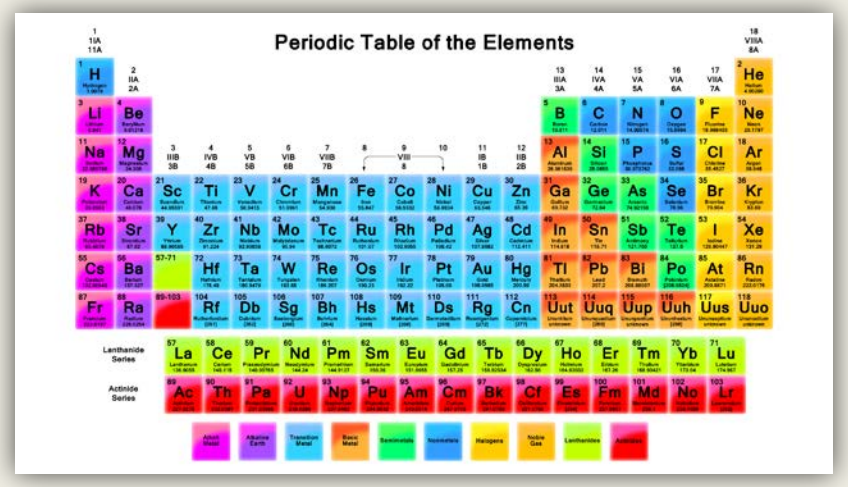


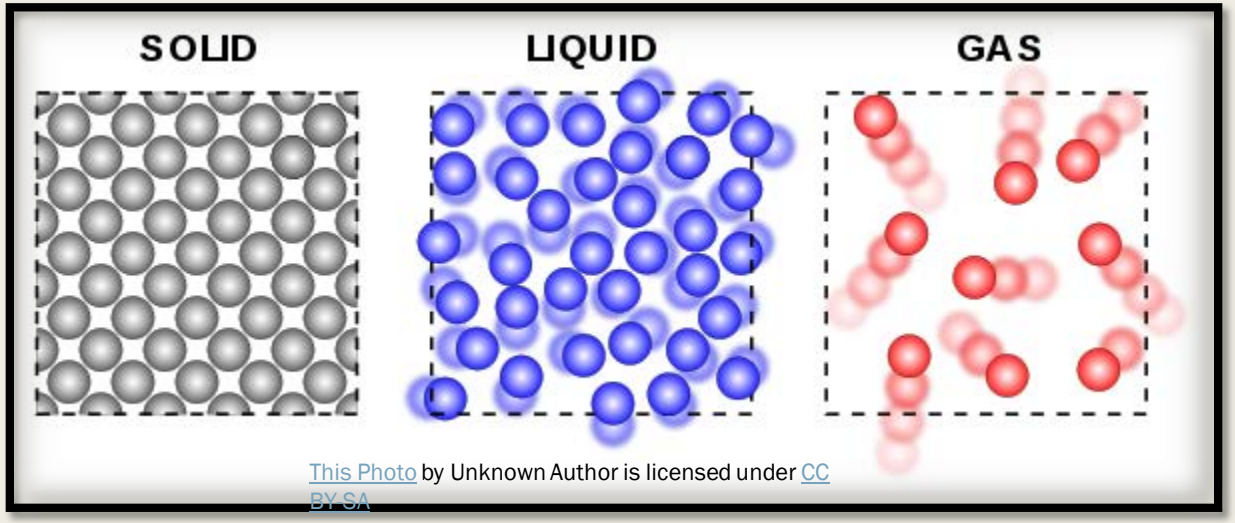
Core Ideas of Knowing Physical Science

- 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.

P1: All matter in the Universe is made of very small particles.







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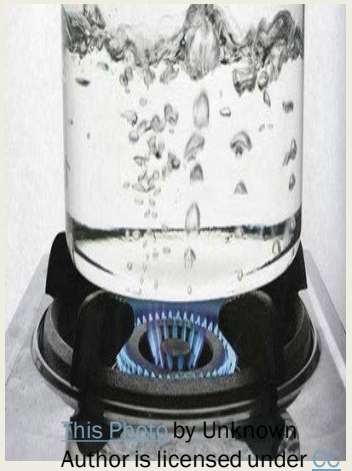


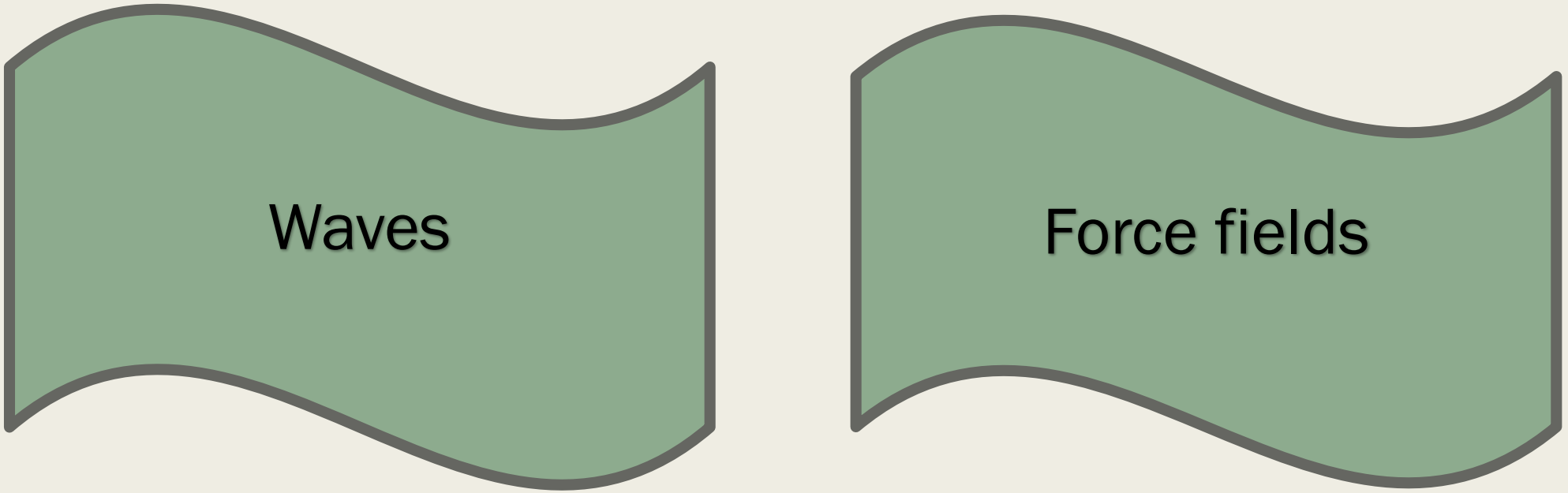
Why does water boil at 100°C but carbon dioxide at much lower temperature?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

Why does a piece of iron rust but gold does not change?

How can there be so many different materials in the world?

P2: Objects can affect other objects at a distance.



P2: Objects can affect other objects at a distance.

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

How can a satellite stay in orbit?

How is it that a tiny spark can trigger an explosion?

Why do clothes stick together when they come out of the dryer?

P3: Changing the movement of an object requires a net force to be acting on it.

- Forces & Motion
- Types of Interactions
- Stability & Instability in Physical Systems

P3: Changing the movement of an object requires a net force to be acting on it.

Why did my coffee spill?

What happens to a ball sitting in a wagon when the wagon moves?

Why didn't the mass of the object affect its rate of falling?

Why are bumpers necessary on cars?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

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.

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Why is it important to conserve energy resources if energy can't be destroyed?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

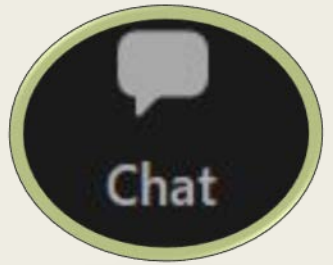
4 Criteria to be a Core Idea

- Have broad importance across multiple sciences or be a key organizing principle of a single discipline
- Provide a key tool for understanding or investigating more complex ideas and solving problems.
- Relate to the interests and life experiences of students or be connected to societal or personal concerns
- Be teachable and learnable over multiple grades at increasing levels of depth and sophistication

Core Ideas of Knowing 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.

What evidence do you have that these 4 CI fit at least 2 of the criteria for being a CI?



Core Ideas of Knowing Earth & 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.

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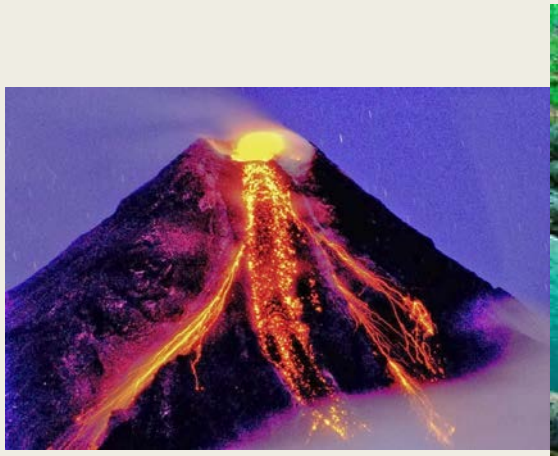


E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.

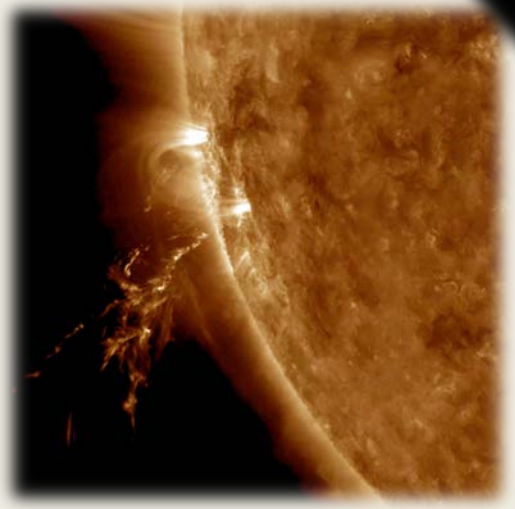
How can it be 94 degrees one day and then snow the next day?

What causes earthquakes?

What causes Old Faithful to erupt?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.



E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

When did Earth form?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

Why are object with similar physical properties found at similar distances from the Sun?

How can I see the moon during the day, but sometimes I don't see it at night?

Core Ideas of Knowing Earth & Space Science

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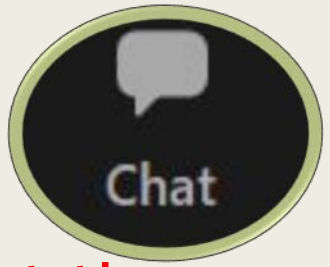


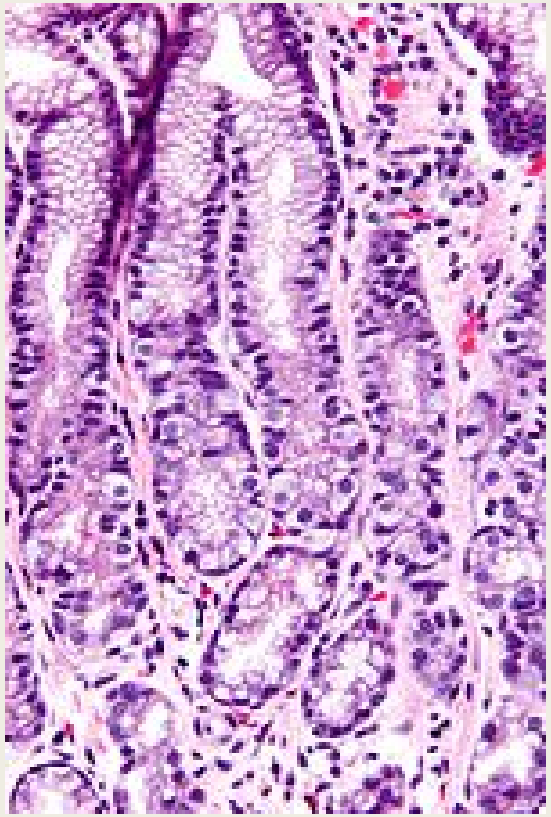
What do you notice about the Earth and space science core ideas?

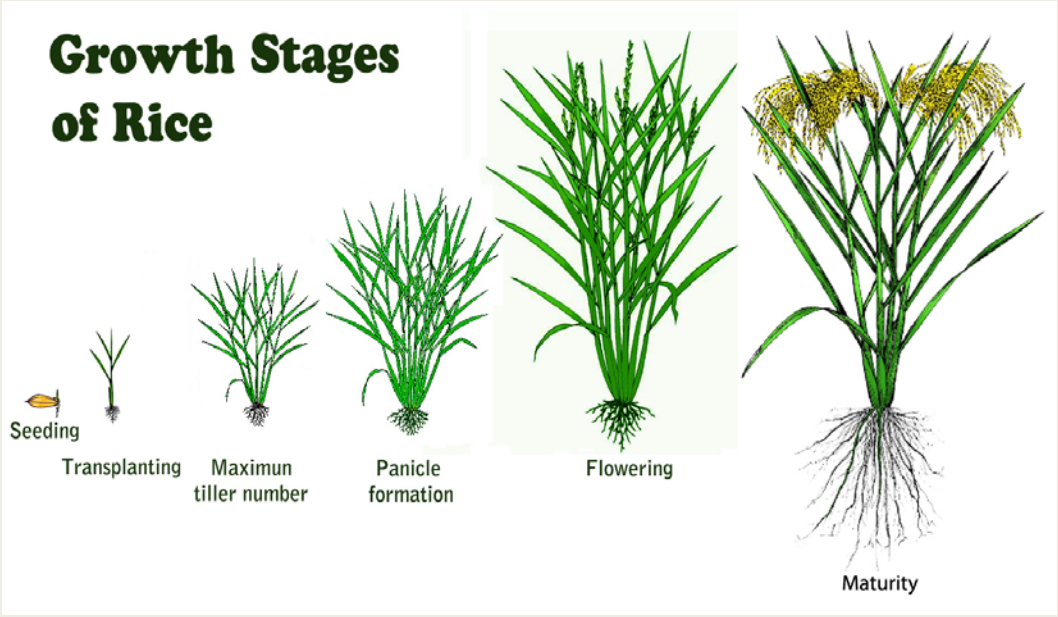
Which science and engineering practice(s) do you predict will be essential for your students to be engaged in while studying these core ideas? Why?

Core Ideas of Knowing 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.

L1: Organisms are organized on a cellular basis and have a finite life span.





L1: Organisms are organized on a cellular basis and have a finite life span.

How does a cut heal?

How do cancer tumors form?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

Why is it difficult to smell with a stuffy nose?

Why don't bacteria have lungs?

L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.

Why is this core idea important to teach our students?

- Experience and appreciation of the natural world
- Understanding ecosystem services
- Projecting how ecosystems will respond to disturbances

Pg 124 Disciplinary Core Ideas: Reshaping Teaching & Learning

L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.

https://www.fs.usda.gov/rmrs/sites/default/files/styles/default_photo__800px_max_/public/old-growth%20spotlight%20photo.JPG?itok=dZ5oqZHZ

How will pine trees in Northern Arizona deal with increase climate change?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
Energy & matter: Flows, cycles, & conservation
Structure & function
Stability & change

How do the penguins deal with the intense competition for nesting grounds?

Why are big fierce creatures rare?

L3: Genetic information is passed down from one generation of organisms to another.

TABLE 8.1

Progression of Disciplinary Core Idea LS3

Grade Band	Inheritance of Traits	Variation of Traits
K–2	Young organisms are very much, but not exactly, like their parents and also resemble other organisms of the same kind.	
3–5	Different organisms vary in how they look and function because they have different inherited information; the environment also affects the traits that an organism develops.	
6–8	• Genes chiefly regulate a specific protein, which affects an individual's traits.	• In sexual reproduction, each parent contributes half of the genes acquired by the offspring, resulting in variation between parent and offspring. Genetic information can be altered because of mutations, which may result in beneficial, negative, or no change to proteins in or traits of an organism.
9–12	• DNA carries instructions for forming species' characteristics. Each cell in an organism has the same genetic content, but genes expressed by cells can differ.	• The variation and distribution of traits in a population depend on genetic and environmental factors. Genetic variation can result from mutations caused by environmental factors or errors in DNA replication or from chromosomes swapping sections during meiosis.

Source: NGSS Lead States 2013.

L3: Genetic information is passed down from one generation of organisms to another.

Why are organisms similar but not identical to parents?

How are some individuals genetically resistant to HIV?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
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Structure & function
Stability & change

https://www.garlandjohnsondds.com/wp-content/uploads/2016/04/Hereditary.jpg

How is it possible that an udder cell to give rise to a whole sheep named Dolly?

https://api.time.com/wp-content/uploads/2016/06/dolly.jpeg?quality=85&w=553&h=628&crop=1

L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

"Evolutionary principles help us make sense of two broad classes of phenomena: the ***unifying characteristics of life*** and the ***patterns of biological diversity*** we see across space and over time."

--pg 166 Disciplinary Core Ideas: Reshaping Teaching & Learning

4 Component Ideas

- *Evidence of common ancestry and diversity*
- *Natural selection*
- *Adaptation*
- *Biodiversity and humans*

L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

Why do species share so many traits?

Why do we see more kinds of species in certain places?

How do species go extinct?

How did giraffes come to have the trait of long necks when their ancestral species did not?

Crosscutting Concepts
Patterns
Cause & effect: Mechanism & explanation
Scale, proportion, & quantity
Systems & system models
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Structure & function
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https://cdn.mos.cms.futurecdn.net/mEuBJTDhXuTfSKdLefzSKg.jpg

- Core Ideas of Knowing Life Science
  - *L1: Organisms are organized on a cellular basis and have a finite life span.*
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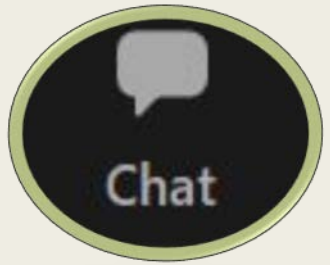
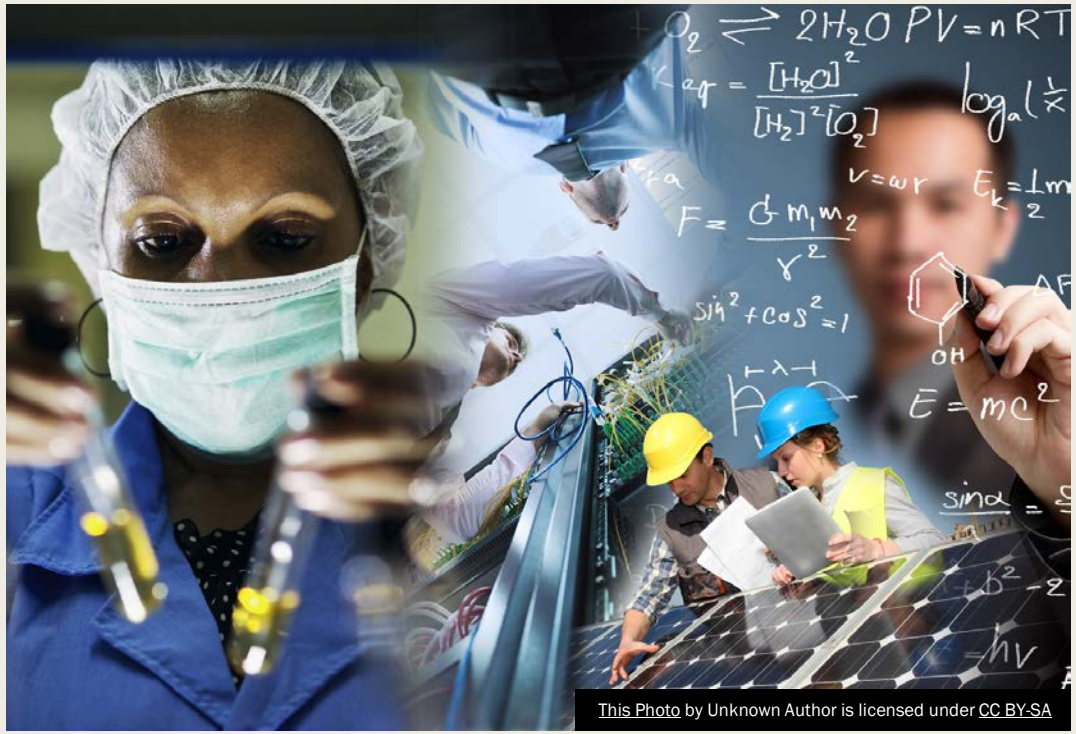


What are some ways of taking the “knowing of life science” core ideas into “doing” life science core ideas?



Core Ideas of 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.

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.

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.

Scientific investigations uses a variety of methods

Scientific knowledge is based on empirical evidence

Scientific knowledge is open to revision in light of new evidence

Science models, laws, mechanisms, and theories explain natural phenomena

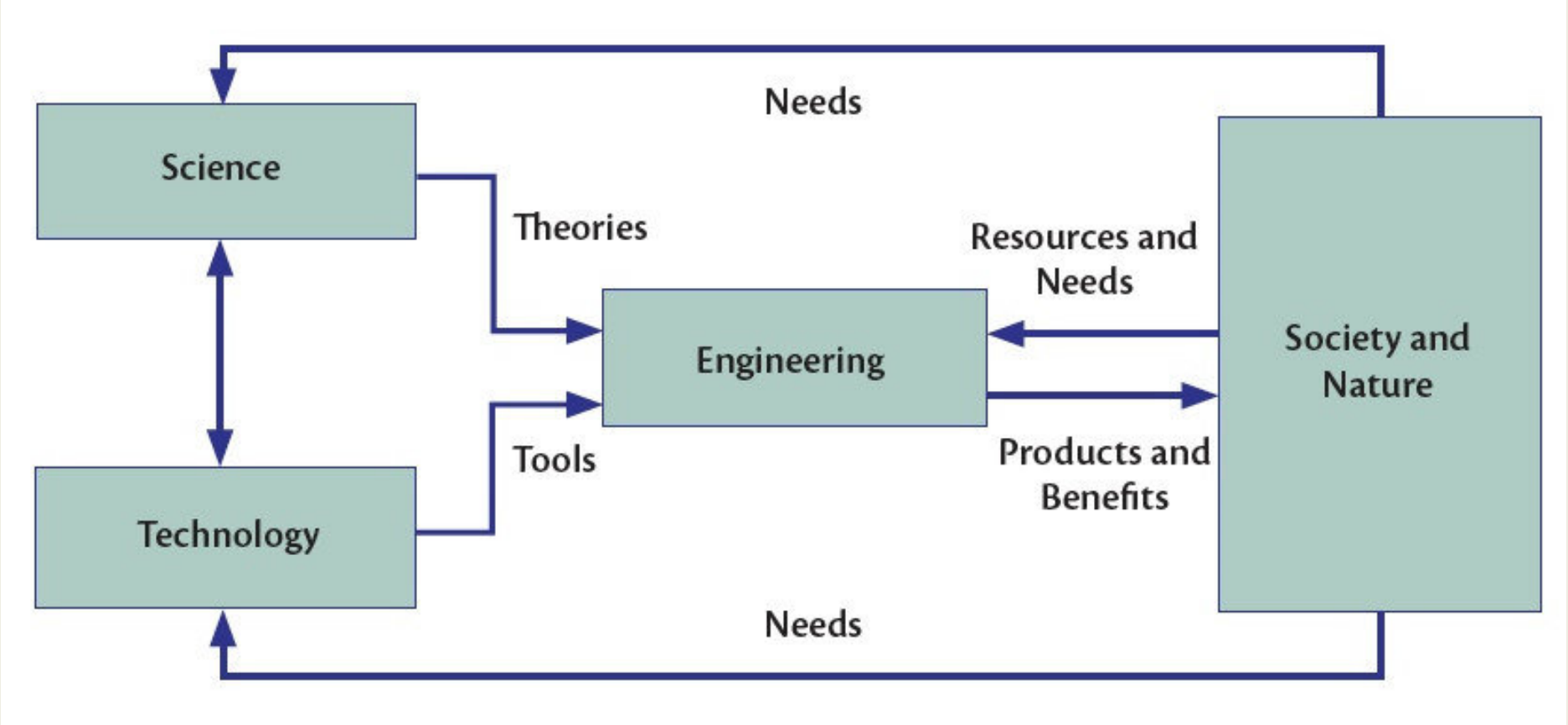
Science is a way of knowing

Scientific knowledge assumes an order and consistency in natural systems

Science is a human endeavor

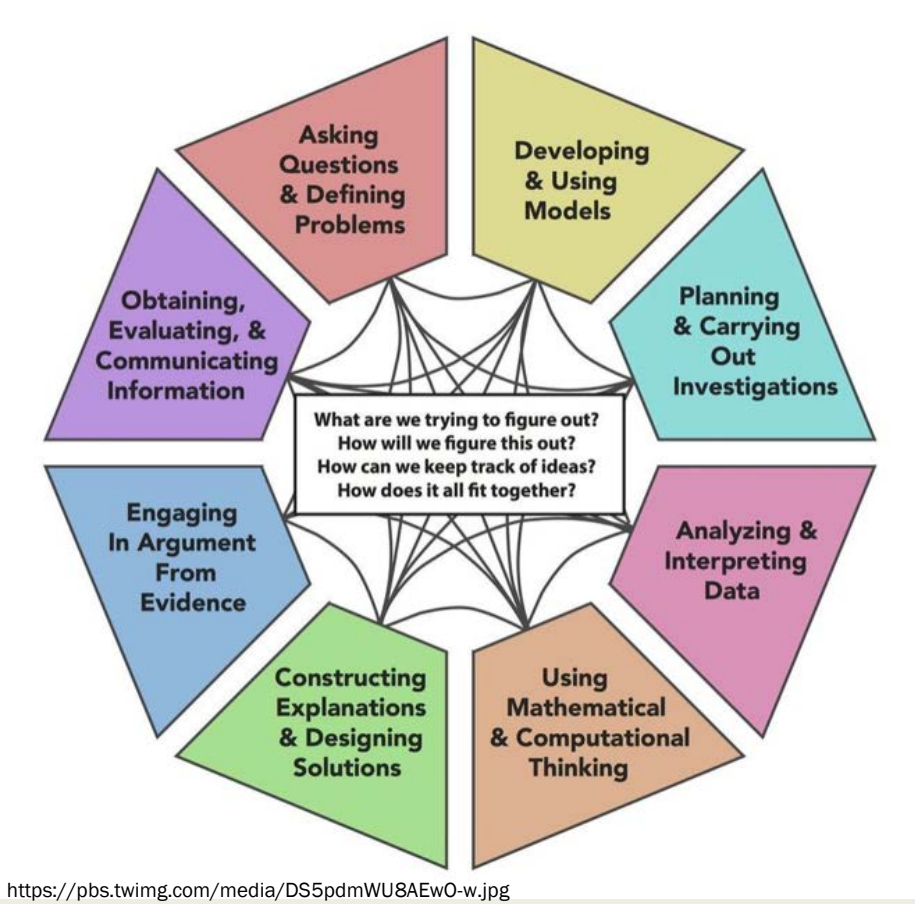
Science addresses questions about the natural and material world

U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products



https://www.researchgate.net/figure/Relationship-among-science-engineering-and-technology-Marjoram-and-Zhong-2010_fig1_236894920

U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products



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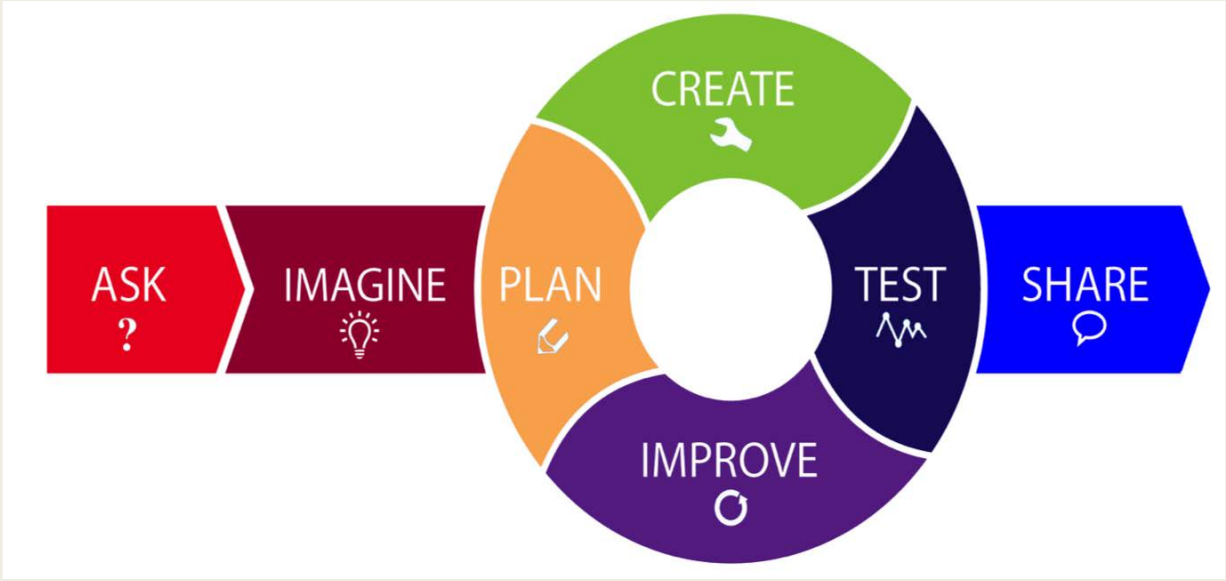
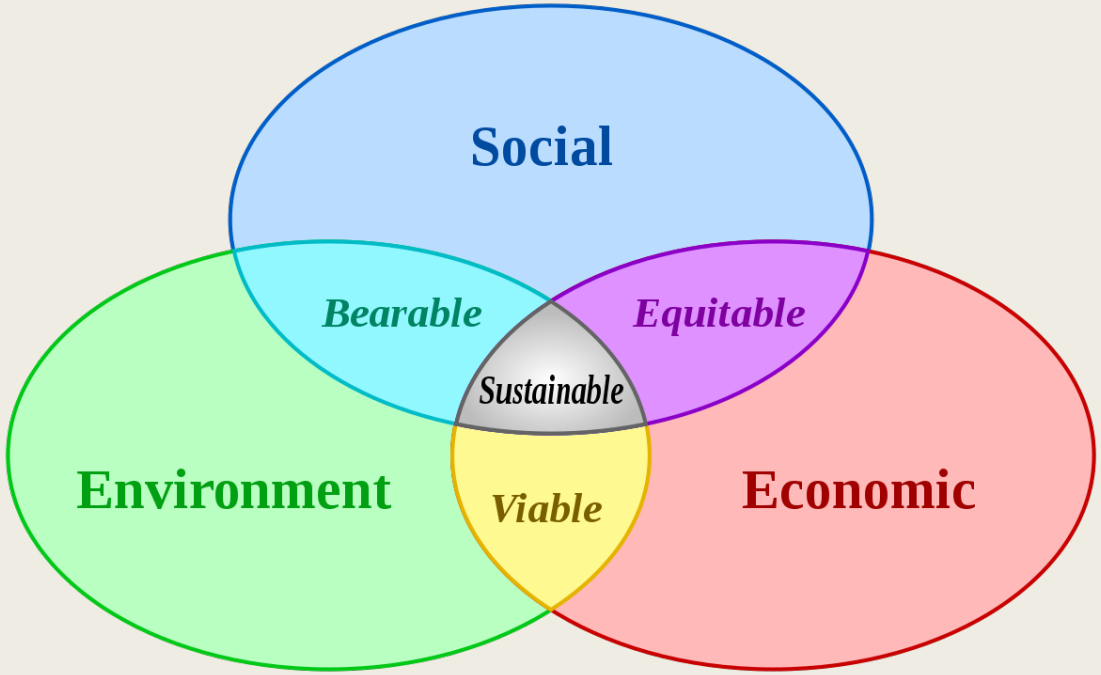


U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications



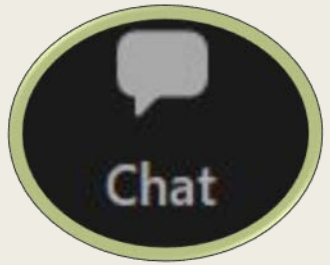
“From the earliest forms of agriculture to the latest technologies, all human activity has drawn on natural resources and has had both short- and long-term consequences, positive as well as negative, for the health of both people and the natural environment”

--A Framework for K-12 Science Education, pg 212

U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications

Core Ideas of 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.*



Each AZ Science Standard include a Using and Knowing Science Core Ideas (eg. 5.P2U2.3).

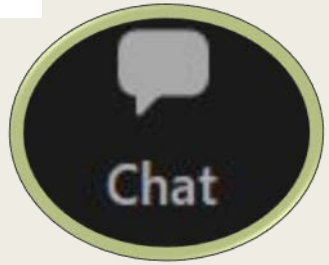
What is the advantage of having them intertwined in a standard?

Core Ideas (CI)

Core Ideas for Knowing Science*		Core Ideas for Using 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.		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.

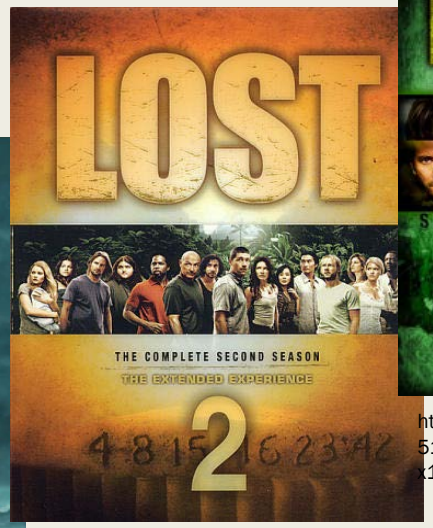
*Adapted from ***Working with Big Ideas in Science Education***[2]

What are some themes/titles of episodes that you have thought of?



WHAT QUESTIONS DO YOU HAVE?

Progression



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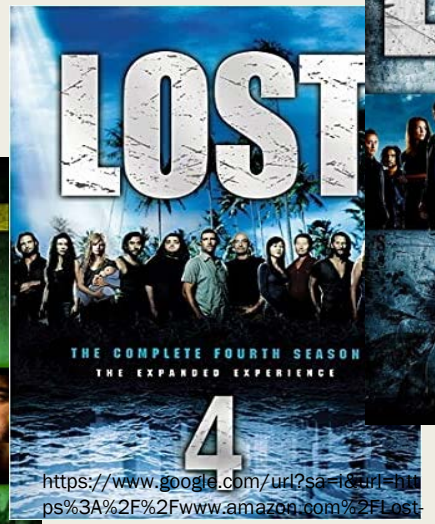

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Academic Standards

Learning begins at birth and continues throughout every stage of life. The Academic Standards team oversees the standards for learning for children and students in Arizona from birth to high school graduation. The Academic Standards team leads standards work across the state by writing, revising, and implementing the standards with different stakeholders. This team provides professional learning opportunities, resources, guidance, and technical assistance to build educator and caregiver capacity in best practices across the birth through twelfth grade continuum. The Academic Standards team leads state-level work related to early childhood, literacy, computer science, educational technology, English Language Arts, history and social sciences, math, science, and world and native languages.

Standards & Competencies

- Computer Science
- Educational Technology
- English Language Arts
- Mathematics

Standards & Competencies

- Arts Education Standards
- Health Education Standards
- Other Standards
- Physical Education Standards
- Science Standards

Early Childhood

- Family Engagement
- Headstart
- Professional Development
- Publications
- Resources

RESOURCES | PROFESSIONAL DEVELOPMENT

NEW STANDARDS (2018) *(Adopted October 2018)* Complete Standards document | PDF

- Grades Kindergarten - Highschool

NEW STANDARDS SUPPORT MATERIALS

- Planning Tools *NEW
- Administrator Tool Kit *NEW
- Vertical Progressions
- Distribution of Core Ideas
- Timeline and Resources

PROFESSIONAL DEVELOPMENT

- Professional Development
- Recorded Webinars
- Science Standards Videos

Contact

Academic Standards Front Desk
(602) 364-2333
acadstandards@azed.gov

Grades Kindergarten - Highschool

NEW STANDARDS SUPPORT MATERIALS

Planning Tools *NEW

Administrator Tool Kit *NEW

Vertical Progressions

Arizona State Science Standards

- Vertical Progression of Knowing Science
- ***Accessibility Versions*** Vertical Progression of Knowing Science
- Vertical Progression of Crosscutting Concepts
- Vertical Progression of Science and Engineering Practices

Distribution of Core Ideas

Vertical Alignment

Progression of - Knowing Science

Physical Science	P1: All matter in the Universe is made of very small particles.
2.P1U1.1	**Plan and carry out an investigation** to determine that matter has mass, takes up space, and is recognized by its observable properties; use the collected evidence to **develop and support an explanation**.
2.P1U1.2	**Plan and carry out investigations** to gather evidence to support an explanation on how heating or cooling can cause a phase change in matter.
5.P1U1.1	**Analyze and interpret data** to explain that matter of any type can be subdivided into particles too small to see and, in a closed system, if properties change or chemical reactions occur, the amount of matter stays the same.
5.P1U1.2	**Plan and carry out investigations** to demonstrate that some substances combine to form new substances with different properties and others can be mixed without taking on new properties.
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.
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.
Essential 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.
Plus 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.
Plus 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.
Plus HS+C.P1U1.3	**Analyze and interpret data** to develop and support an explanation for the relationships between kinetic molecular theory and gas laws.


SINK
FLOAT
- penny
- crayon
- straw
- paper clip
- plastic spoon


1
2

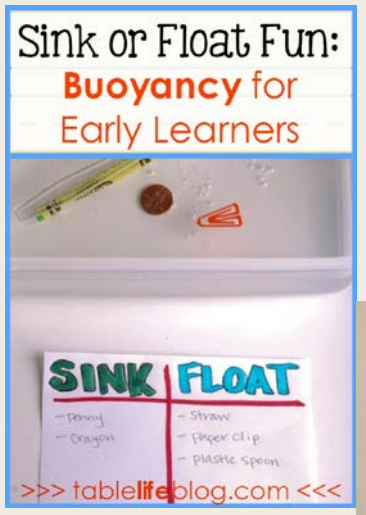
P1: All matter in the Universe is made of very small particles.

2.P1U1.1	5.P1U1.1 5.P1U1.2	6.P1U1.3 8.P1U1.2	HS.P1U1.1

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.

7.E1U1.5 7.E1U1.6 7.E1U2.7 8.E1U3.7	HS.E1U1.11 HS E1U1.12 HS.E1U1.13

Key takeaway



Core Ideas build a conceptual tool kit that allow students to continue to learn, explore, and explain throughout their lives.

WHAT QUESTIONS DO YOU HAVE?

Thank you!

Sara Torres

sstorres71@gmail.com