

OKLAHOMA ACADEMIC STANDARDS

SCIENCE FRAMEWORK

GRADE 4: OVERVIEW



OKLAHOMA STATE DEPARTMENT OF
EDUCATION
— CHAMPION EXCELLENCE —

The Oklahoma State Department of Education is excited to announce the release of the first resources being offered through the Oklahoma Academic Standards Science Frameworks. The Science Frameworks represent curricular resources developed by Oklahoma teachers to help teachers translate standards into classroom practice. The *Framework Overviews* represent how a group of Oklahoma teachers, at a given grade level, might bundle performance expectations/standards found in the Oklahoma Academic Standards for Science.¹ **Bundling** is how teachers would **group performance expectations/standards** for the purpose of developing **instructional units of study**.

Once bundled, the *Science Framework* writers were then charged with completing **four categories of information** that coincided with the bundle of performance expectations/standards. The categories provide insight into how the Science Framework writers collaborated to begin to translate standards into classroom instruction. The guidance provided in the categories does **not** represent a **directive** to teachers, schools or districts for classroom instruction and should not be viewed as such.

The Oklahoma State Department of Education would like to say a special thank you to the Oklahoma educators who participated in developing the Oklahoma Science Framework Overviews, Doug Paulson of the Minnesota State Department of Education who served as a consultant, Lawton Public Schools and to Quentin Bidy, the project director.

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“The vision of the Overviews is to provide a resource for teachers that encourages them to embrace the new standards and implement them effectively in their classrooms. The suggestions provided by the frameworks project **do not** have to be implemented exactly as they are written and are **not required** to be a successful teacher, but **serve as a guide** to setting up effective lessons that will help students meet the necessary levels of success in a science classroom.” - Oklahoma Science Framework Project Writer

¹ Download the Oklahoma Academic Standards for Science at <http://sde.ok.gov/sde/science>.

How To Read This Document

Below you will find short descriptions about each of the sections of information provided in this document. If you have questions regarding the *Framework Overviews*, please contact Tiffany Neill at 405-522-3524 or Tiffany.Neill@sde.ok.gov

Science Framework Overview: Sections

In Lay Terms

This section aims at providing a brief introduction to the goals outlined in the Performance Expectation Bundles/grouping of standards.

Three Dimensional Storyline

This section aims at providing a comprehensive instructional storyline of how the three dimensions represented in the Performance Expectation Bundles intertwine to support students engaging in science and engineering practices, crosscutting concepts and disciplinary core ideas. Keep in mind each performance expectation includes one **science and engineering practice**, one **crosscutting concept** and one **disciplinary core idea**. The **color-coding** in this section allows teachers to see where components of these three dimensions appear in the instructional storyline. To find out more about the three dimensions and how they are incorporated into the Oklahoma Academic Standards for Science, review pages 7-8 in the Oklahoma Academic Standards for Science² or check out the OKSci PD on Your Plan Module series, Transitioning to the Oklahoma Academic Standards for Science³.

Lesson Level Performance Expectations

This section aims at providing **scaffolding three-dimensional learning targets** that teachers can design instruction around to meet the end goal of the Performance Expectation(s) represented in the bundles or units of study. Keep in mind the performance expectations represent the things students should know, understand and be able to do to show proficiency at the end of instruction they participate in. A teacher can **utilize** the **Lesson Level Performance Expectations** in each bundle **as a way to develop a series of instruction** to meet the end goals of the performance expectations. For example, a teacher can develop or use a lesson, which may allow students to participate in instruction that covers some of the Lesson Level Performance Expectations, but not all. In this case the teacher would then develop or conduct another lesson that covers other Lesson Level Performance Expectations in the bundle.

Misconceptions

This section aims at providing research-based misconceptions that students frequently have related to the science concepts (disciplinary core ideas) embedded in the Performance Expectation Bundles along with matching correct conceptions.

² Download the Oklahoma Academic Standards for Science at <http://sde.ok.gov/sde/science>.

³ Access the OKSci PD on Your Plan Modules at: <https://www.evernote.com/l/AUXXIQC11VZDeLmUkOMPpjhKeJjqS-R8gww>

Bundle: Converting Energy

4-PS3-2

Students who demonstrate understanding can:

Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-4

Students who demonstrate understanding can:

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-PS4-1

Students who demonstrate understanding can:

Develop a model of waves to describe patterns in terms of amplitude and wavelength and to show that waves can cause objects to move

In Lay Terms

Energy can be observed in a variety of situations (motion of objects, transfer of sound, light, heat, electric currents, and motion of waves). By observing these different types of energy, we can see that energy is transferred and can be converted from one form to another. Through observations of waves we see patterns in wave amplitude and wavelength.

Three Dimensional Storyline

Energy can be observed all around us. Energy is present and can be observed through moving objects and through observing how sound, light, and heat are transmitted.

In this bundle of performance expectations, students can make observations and carry out simple investigations whereby they observe phenomenon that allow them to see that energy exists and is transferred within a system. Students can plan and carry out investigations on colliding objects and utilize their observations to begin to explain how energy works in that system. For example, when two basketballs are rolled directly at each other, the system includes the two basketballs, the push by the people rolling the basketballs and the air around the basketballs. Students should be able to explain using models that energy can be transferred between objects. Students can also plan and carry out investigations on objects that produce sound in order to determine a pattern that vibrations accompany sound. Investigations related to light, heat and electrical currents can add to the collection of observational data related to energy. If given the opportunity to explore energy in a variety of situations (motion, sound, light, heat, electrical currents), students should be able to explain how energy exists in each of those situations. Students should also be able to make connections among the situations and identify a pattern, that energy is transferred in each of those situations.

As students **have observed** that **energy can be transferred** between objects, they can **observe** that the **transfer of energy** involves waves, which has **measurable** features such as amplitude and wavelength. Students can **observe and measure** how waves move objects up and down or forward and backward. As students **analyze** the movement of waves, they can **make a model of a wave**. Through this model, students will see the **patterns** in amplitude and wavelengths of waves.

Lesson level Performance Expectations

- Students can **make observations** of objects that produce **forms of energy** (sound, light, heat, and electrical currents).
- Students can **plan and carry out investigations** to discover how **energy is transferred** by sound, light, heat and electrical currents.
- Students can **provide evidence** that **energy can be transferred** from one place to another.
- Students can **create a model to explain** transfer of energy using either sound, light, heat, or electrical currents.
- Students can **apply scientific ideas to observations** and show how **energy can be converted** from one form to another.
- Students can **observe** waves and the motion of an object on the wave.
- Students can **observe patterns** in waves as they travel in the amplitude and the wavelength of the waves.
- Students can **make a model** of a wave.
- Students can **provide evidence** that waves cause objects to move as they **transfer energy** to objects.

Misconceptions

1. Energy can be created.
2. There is no relationship between matter and energy.
3. If energy is conserved, why are we running out of it?

Accurate Concept

1. Energy cannot be created or destroyed only transferred or converted from one form to another.
2. Energy can affect matter.
3. Energy and fuel/energy sources are not the same.

References

- AAAS Science Assessment
 - (Kruger, 1990; Lovrude, 2004; Papadouris et al., 2008)
 - (AAAS Project 2061, n.d.)
- <http://www.nsta.org/elementaryschool/connections/201209AppropriateTopics-ElementaryStudentScienceMisconceptions.pdf>
- <http://www.nsta.org/elementaryschool/connections/201209AppropriateTopics-ElementaryStudentScienceMisconceptions.pdf>

Bundle: Motion

4-PS3-1

Students who demonstrate understanding can:

Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-3

Students who demonstrate understanding can:

Ask questions and predict outcomes about the changes in energy that occur when objects collide.

In Lay Terms

The speed of an object is related to the energy it possesses. Objects moving faster possess more energy than objects moving slower. The energy of objects when they collide with each other can be predicted.

Three Dimensional Storyline

In this bundle of performance expectations, students can **plan and conduct investigations to provide evidence that the speed of an object is related to the energy of that object.** To assist student in **gathering this evidence**, teachers can support students in **observing objects moving at different speeds and colliding with stationary objects.** As students **observe the effects** of the collisions, they will likely begin to **ask questions or consider why** this is happening and what **patterns** they see emerge. Students can be given opportunities to answer these questions by being prompted to think about the **inputs and outputs that are in the system** the objects are in. For example, if a ball collides with another ball, something probably pushed at least one ball to get it moving in the first place. There was **energy being transferred in the system** from the person who pushed the ball, to the ball being pushed, then to the colliding ball. As students **record their observations** about colliding objects, they can attempt to **develop a sketch model or a mental model** about **what is causing** the colliding objects to move they way they do. Students can **construct an explanation, from observational evidence, that an object with a greater speed has more energy than an object with lesser speed.**

Students should **make observations** of different **objects colliding.** As students observe **objects colliding**, they should **ask questions about their observations.** Students should **be able to explain that objects speed up or slow down after a collision.** Students can **use evidence to predict that the object with greater speed slow down after a collision, and the object with lesser speed move faster after a collision.** Students can **use a model to communicate that objects with greater energy transfer some of the energy to the object with lesser energy within the system.** Students can begin to **predict outcomes** in the **changes of speed and energy** of objects after a collision.

Lesson Level Performance Expectations

- Students can **make observations** of objects moving at **different** speeds colliding with a stationary object.
- Students can **plan and conduct investigations in order to record data** about the **effects** of moving objects at different speeds when colliding with a stationary object.
- Students can **analyze the data and construct an explanation** relating the speed of an object to the **energy** of that object.
- Students can **make observations** of moving objects colliding with other moving objects of different speeds.
- Students can **ask questions** about the **changes** in speed they observe as objects collide.
- Students can **record and analyze data** of the **changing** speeds of moving objects after they collide.
- Students can **interpret the data** to understand that when objects collide **energy is transferred** from one object to another.
- Students can **predict outcomes** of the **changes in energy** that occur when objects collide.

Misconceptions

1. Energy is not transferred from one object to another unless those objects are in direct contact with each other.
2. An object has energy within it that is used up as the object moves.
3. A lighter object has more motion energy than a heavier object because lighter objects move faster than heavier objects.
4. The motion energy of an object depends on its size.
5. The motion energy of an object does not depend on speed (the motion energy of an object does not increase as the speed increases).

Accurate Concept

1. Energy can be transferred between objects even at a distance.
2. Energy is transferred between objects within a system. Energy cannot be created or destroyed.
3. Lighter objects require less energy to move than heavy objects.
4. The motion of an object is dependent on the amount of force applied to it.
5. The motion energy (kinetic energy) of an object increases as it travels faster.

References

- AAAS Project 2061, n.d.
- Brook & Driver, 1984; Kesidou & Duit, 1993; Loverude, 2004; Stead, 1980
- Kruger, 1990

Bundle: Organisms

4-LS1-1

Students who demonstrate understanding can:

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2

Students who demonstrate understanding can:

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-PS4-2

Students who demonstrate understanding can:

Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

In Lay Terms

Plants have structures like thorns, stems, and roots, and animals have structures like heart, stomach and lungs that support survival, growth, behavior and reproduction. Animals also have structures that aid them with receiving and processing information through their senses and responding to that information in different ways. One sense that aids animals in processing information is the sense of sight. Sight occurs when light reflects from objects and enters the eye, allowing the objects to be seen.

Three Dimensional Storyline

Plants and animals have many structures or parts that students can observe. When observing plant and animal parts, students can also observe how plant or animal parts interact with things around them and begin to make claims for how those parts play a role in the ability of the organism to survive and grow. For example, thorns on a plant can prevent animals from eating the plant. Therefore the plant can better survive because it has thorns.

In this bundle of performance expectations, students can extend their understanding of the structure and function of animal parts to include animal senses as animal senses represent a behavior structure that guide animals' actions and can help them survive. As students investigate how senses like sight and touch work to collect information, they can create diagrams explaining their understanding of how that information might be transferred within an animal's body. Student diagrams should include the process of information transfer and the parts of the system that might be

impacting this process. For example, the nervous system transfers information about pain from the nerves to the brain. **Keep in mind at this age students are not expected to understand detailed mechanisms by which the brain stores and recalls information or the detailed mechanisms for how sensory receptors function.** Students can **gather information** about **how plants can collect and transfer information leading to a response.**

One sense that students can focus on in this bundle is **sight**. As students **communicate** their understanding about **how information is collected, transferred and responded to by an organism**, students can **analyze** the **mechanisms involved in sight** and **develop a model to understand how this sense works in more detail**. Students should be able **to explain that light reflecting from objects enters into the eye causing sensory receptors in the eye to send signals to the brain that are interpreted as images resulting in the objects being seen**. Students can **collect observational data** that leads them to this conclusion by **examining** a variety of objects in dark and light settings. If given a variety of opportunities to **investigate how visible objects are in light and dark settings**, students can **draw conclusions** that **objects in the dark cannot be seen and that light is required for sight to occur**. Students can then begin to **make the claim** that **objects can be seen when light reflects from its surface and enters the eye**. Students can **display their understanding of this through model diagrams**.

Lesson Level Performance Expectations

- Students can **identify** internal and external **structures** of plants and animals.
- Students can **construct an argument with supporting evidence** that **structures** of plants and animals **support** their survival, growth, behavior, and reproduction.
- Students can **illustrate with a model** the information that animals receive through senses.
- Students can **describe** how information from senses are processed by organisms and **cause** a response from the organism.
- Students can **use a model to describe** different ways that animals respond to information they receive.
- Students can **use a model to describe** how animals are able to **use their senses** and memories **to guide** their actions.
- Students can **use a model to describe** how objects are seen by the eye when light reflects off of them.
- Students can **use a model to describe** how objects are not seen by the eye when light is not present to reflect off of objects.
- Students can **construct an argument** that sight **aids** organisms in survival, growth, behavior, and reproduction.

Misconceptions

1. Only shiny objects that I can see myself in reflect light.
2. Only metals and water reflect light.
3. Everything reflects light but only if it is in the Sun.
4. Light reflects off things if the angle is correct.
5. Our eyes produce light so we can see things.

Accurate Concept

- 1-4. All objects reflect light to some degree.
5. Eyes only receive light input they do not produce light.
6. Traits are developed across generations in response to environmental demands.
7. The eye and the brain work together for vision to occur.

6. Living objects can change to meet their survival needs.
7. The eye is the only organ for sight and the brain is only for thinking.

References

- <http://www.nsta.org/elementaryschool/connections/201404Schleigh.pdf>
- www.mechatronics-mec.org/.../revisedlistmisconceptions?_08.doc
- www.weebly.com/.../common_misconceptions_in_primary_school

Bundle: Information Transfer

4-PS4-3

Students who demonstrate understanding can:

Generate and compare multiple solutions that use patterns to transfer information.

In Lay Terms

Throughout history, people have used many different means for communicating information. Today many different devices are used to transfer information from one person to another over long distances. We receive different forms of information through these different devices. Telescopes communicate information about the universe. Cell phones and computers help us transfer information to each other instantly or through stored information for use at a later time. These devices use patterns to transfer information.

Three Dimensional Storyline

Communication can occur in many ways. At various times throughout history, different codes have been created and used to meet different needs, such as Morse code with telegraphs, QR code with smartphones, and binary code with computers. To explore this idea, students can discuss different ways to send information to someone and identify patterns in that system. For example, Zip Codes and Area Codes follow patterns and give information to people using them about where another person lives. Technology devices, such as computers, receive and decode information digitally to change a signal from data to voice and voice back to data. Students should be able to research digital inventions to discover how they work.

Through their research, students should determine that information can be transferred over long distances. Some examples might include, verbal communication is transferred through phones from state to state, written communication is transferred through computers using email, and visual communication is transferred through televisions and computers over long distances. Students should also observe that information can be stored for future use. Examples of this include, information transferred through computers can be stored in the computer and recovered at a later time, information transferred through the television can be stored for later viewer using a DVR, and information transferred through a cell phone can be recorded on the phone through the voice recorder or text messages as well as email. Students should be able to generate a pattern to communicate information. Students could make and use a code for letters to communicate with each other.

Lesson Level Performance Expectations

- Students can evaluate and compare different communication methods.
- Students can analyze data to understand how information is transmitted over long distances in one form and converted by a device to be used by people.

- Students can **develop a model to explain** how computers or cell phones, can receive and decode information.
- Students can **use evidence to explain** how communication devices transmit data.
- Students can **generate a pattern** that could communicate information.

Misconceptions

1. All waves travel the same way.
2. Sounds can be produced without material objects.
3. In telephones, sounds are carried through the wires.
4. Waves involve the movement of matter.

Accurate Concept

1. Waves can vary.
2. For sound to be produced, vibrations must be produced by matter.
Sound requires a medium to travel through.
3. Phones convert sounds to electrical signals and back to sounds.
4. Waves transfer energy.

References

- http://www.usc.edu/org/cosee-west/Dec0410/wave_misconceptions.pdf
- <http://www.physicsclassroom.com/mop/m12/sl1details.cfm>

Bundle: Earth's Features

4-ESS1-1

Students who demonstrate understanding can:

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

4-ESS2-1

Students who demonstrate understanding can:

Plan and conduct investigations on the effects of water, ice, wind, and vegetation on the relative rate of weathering and erosion.

4-ESS2-2

Students who demonstrate understanding can:

Analyze and interpret data from maps to describe patterns of Earth's features.

In Lay Terms

Earth's surface features have changed and continue to change over time. Water, ice, wind, and vegetation can affect the how fast weathering and erosion occur. As rocks and land formations erode, we are able to see into the rock formations, which helps explain how the landscape had changed over time. Rock formations can be examined to identify patterns in rock layers and fossils found in those rock layers. By looking at maps and identifying changes in the landscape from these maps, students should identify patterns.

Three Dimensional Storyline

In this bundle of performance expectations, students should be given the opportunity to analyze rock formations in order to identify patterns which can be used as evidence to support explanations that Earth's landscapes (surface features) change over time. Students can use the location of fossils in rock layers relative to other rock layers to begin to explain when those rock layers were formed. For example, if students see a layer of shell fossils above a layer of plant fossils, the student can use this evidence to create an explanation that the area where this rock formation was found was land at one time and was then covered with water for a period of time.

This bundle allows students to obtain, record, and interpret data related to the mechanisms that cause changes in land formations over time. Teachers can support students in setting up a variety of investigations that allow them to collect data showcasing the factors that cause weathering and erosion to occur. Through this, students can identify the effects water, ice, wind, living organisms and vegetation might have on landforms. Students can also plan and conduct simple investigations to explore the effects variables like wind speed, water movement, freezing and melting, and vegetation of areas have on landforms. For example, the teacher could use a container of soil with and without vegetation to help students tests these variables.

When students understand that **landforms change over time** and the factors that **cause those changes**, it can facilitate natural connections to allow **students to analyze patterns** of Earth's features in order to **construct explanations** about how **Earth's surface has changed over time**. The **locations of mountain ranges, deep ocean trenches, earthquakes and volcanoes occur in patterns**. Students should be given the opportunity to **interpret and evaluate** maps to **determine and analyze** these **patterns**. Students will **interpret** maps to **determine where earthquakes, volcanoes, mountain chains, and other land and water features occur on Earth**. As students **locate these earth features** they can **support an explanation** that those features **caused the changes** in the earth in the different areas.

Lesson Level Performance Expectations

- Students can **analyze data to determine** that **patterns** of rock formations reveal **changes over time due to** earth forces, such as earthquakes.
- Students can **use evidence to explain** that the presence and location of certain fossil types indicate the order in which rock layers were formed.
- Students can **collect data to explain that** natural occurrences such as rain, wind, ice, and gravity etc. break rocks, soils, and sediments into smaller pieces.
- Students can **develop and use a model to show** that rain, wind, ice, and gravity **move rocks**, soils, and sediments **around** from place to place on Earth's surface.
- Students can **conduct investigations that show** rainfall, wind, or gravity helps to **shape** the land **and affects** the types of living things found in a region.
- Students can **analyze data found in maps to determine** that the locations of landforms such as mountain ranges, ocean floor structures, and volcanoes occur in **patterns**.
- Students can **analyze and interpret data to determine** that most earthquakes and volcanoes **often occur along the boundaries** between continents and oceans.
- Students can **use information from maps to develop a model that shows** that mountain chains **normally form inside** continents or near the edges of continents.
- Students can **obtain and evaluate information** from maps to help locate the different land and water features of Earth.

Misconceptions

1. Wind and water cannot wear away the solid rock of a mountain.
2. Landforms can change in size, but not by the motion of wind and water.
3. Landforms look similar today as they did many millions of years ago. For example, a river on earth today hasn't changed over

Accurate Concept

- 1-8. The surface of the earth is changed as rock material is broken, carried, and dropped in new locations. Small changes to the surface of the earth caused by wind and water can add up to large changes over long

time.

4. Wind can wear away the solid rock of mountains only a small amount (feet or inches) over millions of years, not thousands of feet.
5. Wind can make a valley deeper by only a small amount (feet or inches) over millions of years.
6. Water can wear away only a small amount of a mountain's height (feet or inches) over millions of years.
7. It takes rain a long time to wear away solid rock, even very small amounts that you cannot see.
8. Water can wear down the solid rock of a river valley only a small amount (feet or inches) over millions of years.
9. Wind can only wear down solid rock over long time periods. Changes are not happening over short time periods (i.e., a day or a year).
10. Moving water can only wear down solid rock over long time periods. Changes are not happening over short time periods (i.e., a day or a year).
11. Moving water can only change the surface of the earth over long time periods. Changes are not happening over short time periods (i.e., a day or a year).
12. Wind is wearing away the solid rock of valleys today but did not wear away the solid rock of valleys in the past.
13. Wind wore away the solid rock of valleys in the past but is not wearing away the solid rock of valleys today.
14. Wind and water only change the surface of the earth during rare events, such as huge storms.
15. It only takes hundreds of years for wind and water to wear away the solid rock of a mountain (bedrock) so that the mountain is almost flat.

periods of time (i.e., over thousands to millions of years).

References

- AAAS Science Assessment
 - AAAS Project 2061, n.d. and Dove, 1998; Trend, 1998

Bundle: Human Environment Interactions

4-ESS3-1

Students who demonstrate understanding can:

Obtain and combine information to describe that energy and fuels are derived from renewable and non-renewable resources and how their uses affect the environment.

4-ESS3-2

Students who demonstrate understanding can:

Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

In Lay Terms

All of the energy and fuels that humans use come from natural resources. Some of these resources are renewable and can be used over or can be replaced, while other resources are non-renewable and are limited and cannot be replaced or reused. When humans use resources they in turn affect the environment in different ways. Just as humans can affect the Earth by using resources, the Earth can affect human life through natural disasters. Humans can use natural resources to take steps to reduce the impacts that natural disaster can have on humans.

Three Dimensional Storyline

Earth is composed of many different **sources of energy**. Some of these sources are renewable, such as wind and sunlight (solar) and some are non-renewable, such as natural gas, coal, and oil. Some resources, like trees, are renewable, but can sometimes be used faster than they can be replaced. Using these resources **affects** the environment in many different ways, both positive ways and negative ways. For example, burning fossil fuels pollutes the atmosphere, while using renewable resources can reduce the amount fossil fuels are used and result in less pollutants entering the atmosphere. Students should **obtain and evaluate information** about different resources available and **how using those resources can affect the environment**. Students should **develop and use models to understand the relationships between the use of resources and the effects on the environment**. Students **should be able to use evidence to communicate the pros and cons of using different resources for energy**.

Just as humans impact the Earth by using resources, the Earth also impacts human life. Natural disasters such as hurricanes and tornadoes can have a tremendous **effect** on human life; however, **humans can design solutions to reduce the impact** these natural disasters have on humans and human societies. Students **should research and discuss possible solutions** that could **minimize the impact** of these hazards on human life. Students **should be able to construct different possible solutions and compare the effectiveness of these solutions**.

Lesson Level Performance Expectations

- Students can **use a model to explain** that **energy** and fuel are derived from natural resources.
- Students can **distinguish between** renewable and non-renewable resources.
- Students can **use evidence to explain** what some resources are renewable and some are non-renewable.
- Students can **explain** that using natural resources **can affect** the environment in different ways.
- Students can **construct an argument** for the use of both renewable and non-renewable resources.
- Students can **explain using evidence** how Earth processes, such as natural disasters, impact humans.
- Students can **explore** ways to **minimize the impact** to humans by Earth processes.
- Students can **construct and compare the effectiveness of multiple solutions designed** to **reduce the impact** of natural Earth processes on humans.

Misconceptions

Accurate Concept

1. Ecosystems change little over time.
2. Except for a few major changes due to large volcanoes that have erupted or meteorites that have struck the earth, environmental conditions have stayed the same throughout the history of the earth.
3. If we run out of oil and gas we will just find more.
4. Earth's resources are not finite-there is an endless supply of water, petroleum, and mineral resources. All we have to do is explore for them.

1. Ecosystems change as a result of natural hazards, environmental changes, and human activity.
2. Environmental conditions are dynamic and have changed over the course of Earth's history.
3. Fossil fuels are a limited and finite resource.
4. Some of Earth's resources are renewable, however most are non-renewable and finite or cannot be renewed at the rate they are being consumes.

References

- <http://beyondpenguins.ehe.osu.edu/issue/tundra-life-in-the-polar-extremes/common-misconceptions-about-biomes-and-ecosystems>
- AAAS Science Assessment; AAAS Project 2061, n.d.
- http://hub.mspnet.org/media/data/MiTEP_List_of_Common_Geoscience_Misconceptions.pdf?media_000000007297.pdf

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