<table>
<thead>
<tr>
<th>Enduring Understandings:</th>
<th>Essential Questions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science is a process of inquiry.</td>
<td>How do scientists answer questions using the different parts of scientific inquiry?</td>
</tr>
<tr>
<td>Scientists use experiments to test hypotheses.</td>
<td>How do I differentiate between theories and hypotheses?</td>
</tr>
<tr>
<td>Many earth science theories cannot be directly tested.</td>
<td>What is the internal structure of an atom?</td>
</tr>
<tr>
<td>We base theories on the best evidence available.</td>
<td>How do atoms combine to form elements?</td>
</tr>
<tr>
<td>A theory is different from a hypothesis.</td>
<td>What elements are found on Earth?</td>
</tr>
<tr>
<td>The process of implementing the scientific method is used in all science.</td>
<td>How do elements combine to form minerals and rocks?</td>
</tr>
<tr>
<td>Understand the features and components of atoms.</td>
<td>How does the Periodic Table classify and organize elements?</td>
</tr>
<tr>
<td>Atoms compose the elements.</td>
<td>How do minerals combine to form rocks?</td>
</tr>
<tr>
<td>The Earth is composed of various elements.</td>
<td>What processes do rocks undergo when going through the rock cycle?</td>
</tr>
<tr>
<td>Rocks are formed by combinations of minerals.</td>
<td>What forces create transitions in the rock cycle?</td>
</tr>
<tr>
<td>Rocks can change from one form to another as they are exposed to the Earth’s forces via</td>
<td>What are the pros and cons of mining minerals from the Earth?</td>
</tr>
<tr>
<td>the Rock Cycle.</td>
<td>Does Earth have an endless supply of resources?</td>
</tr>
<tr>
<td>The Rock Cycle is driven by convection currents deep inside the Earth.</td>
<td>How does the Earth continuously recycle and renew its materials?</td>
</tr>
<tr>
<td>Mining the Earth’s natural resources has costs, benefits, and risks.</td>
<td>How does the Earth continuously recycle and renew its materials?</td>
</tr>
<tr>
<td>All different components of the Earth are linked in the recycling of materials</td>
<td>How does water quality and quantity influence everyday life?</td>
</tr>
<tr>
<td>within Earth’s system.</td>
<td>Where does Arizona groundwater originate?</td>
</tr>
<tr>
<td>Water conservation efforts are vital for a sustainable future.</td>
<td>How does climate affect the amount of water available to people in Arizona?</td>
</tr>
<tr>
<td>The Earth’s materials are redistributed through a series of dynamic processes.</td>
<td>What determines the allotment of water through the CAP?</td>
</tr>
<tr>
<td>Water in Arizona is a limited resource.</td>
<td>How was Tucson’s aquifer created?</td>
</tr>
<tr>
<td>Climate and weather affect the availability of water.</td>
<td>How does human population affect water supply?</td>
</tr>
<tr>
<td>Politics are important in determining the allotment of water in western United States.</td>
<td>How does native vegetation affect water supply?</td>
</tr>
<tr>
<td>Reclamation and conservation of water in Arizona is imperative.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Vocabulary:</th>
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<td>• Hypotheses</td>
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<tr>
<td>• Inquiry</td>
</tr>
<tr>
<td>• Atoms</td>
</tr>
<tr>
<td>• Elements</td>
</tr>
<tr>
<td>• Earth</td>
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<tr>
<td>• Water conservation</td>
</tr>
<tr>
<td>• Sustainable future</td>
</tr>
<tr>
<td>• Redistributed</td>
</tr>
<tr>
<td>Highly-Leveraged Standards¹</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td><strong>Strand 5: Physical Science</strong></td>
</tr>
<tr>
<td><strong>PO1.</strong> Describe substances based on their physical properties.</td>
</tr>
<tr>
<td><strong>PO2.</strong> Describe substances based on their chemical properties.</td>
</tr>
<tr>
<td><strong>PO6.</strong> Describe the following features and components of the atom:</td>
</tr>
<tr>
<td>- Protons, neutrons, electrons, mass, number and type of particles, structure, organization</td>
</tr>
<tr>
<td><strong>Strand 6: Earth and Space Science</strong></td>
</tr>
<tr>
<td><strong>HS.S6.C1 Geochemical Cycles</strong>: Analyze the interactions between the Earth’s structures, atmosphere, and geochemical cycles.</td>
</tr>
<tr>
<td><strong>PO1.</strong> Identify ways materials are cycled within the Earth system (i.e., carbon cycle, water cycle, rock cycle).</td>
</tr>
<tr>
<td><strong>PO2.</strong> Demonstrate how dynamic processes, such as weathering, erosion, sedimentation, metamorphism, and orogenesis relate to redistribution of materials within the Earth system.</td>
</tr>
<tr>
<td><strong>PO4.</strong> Demonstrate how the hydrosphere links the biosphere, lithosphere, cryosphere, and atmosphere.</td>
</tr>
<tr>
<td><strong>PO5.</strong> Describe factors that impact current and future water quantity and quality including surface, ground, and local water issues.</td>
</tr>
<tr>
<td><strong>PO6.</strong> Analyze methods of reclamation and conservation of water.</td>
</tr>
<tr>
<td><strong>PO7.</strong> Explain how the geochemical processes are responsible for the concentration of economically valuable minerals and ores in Arizona and worldwide.</td>
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</table>
### Constant Standards

#### Strand 1: Inquiry Process (HLS-34%)

**HS.S1.C1 Observations, Questions, and Hypotheses**: Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.

- **PO1.** Evaluate scientific information for relevance to a given problem
- **PO2.** Develop questions from observations that transition into testable hypotheses.
- **PO3.** Formulate a testable hypothesis.
- **PO4.** Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).


- **PO1.** Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.
- **PO2.** Identify the resources needed to conduct an investigation.
- **PO3.** Design an appropriate protocol (written plan of action) for testing a hypothesis:
  - Identify dependent and independent variables in a controlled investigation.
  - Determine an appropriate method for data collection (e.g., using balances, thermometers, microscopes, spectrophotometer, using qualitative changes).
  - Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators).
- **PO4.** Conduct a scientific investigation that is based on a research design.
- **PO5.** Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.

**HS.S1.C3 Analysis, Conclusion, and Refinements**: Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.

- **PO1.** Interpret data that show a variety of possible relationship between variables, including:
  - Positive relationship
  - Negative relationship
  - No relationship
- **PO2.** Evaluate whether investigational data support or do not support the proposed hypothesis.
- **PO3.** Critique reports of scientific studies (e.g., published papers, student reports).
- **PO4.** Evaluate the design of an investigation to identify possible sources of procedural error, including:
  - Sample size
  - Trials
  - Controls
  - Analyses
- **PO5.** Design models (conceptual or physical) of the following to represent “real world’ scenarios:
  - Carbon cycle
  - Water cycle
  - Phase change
  - Collisions
- **PO6.** Use descriptive statistics to analyze data, including:
• Mean, Frequency and Range
PO7. Propose further investigations based on the findings of a conducted investigation.

**HS.S1.C4 Communication: Communicate results of investigations.**
PO1. For a specific investigation, choose an appropriate method for communicating the results.
PO2. Produce graphs that communicate data.
PO3. Communicate results clearly and logically.
PO4. Support conclusions with logical scientific arguments.

**Strand 2: History and Nature of Science**
**HS.S2.C1 History of Science as a Human Endeavor: Identify individual, cultural, and technological contributions to scientific knowledge.**
PO1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.
PO2. Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.
PO3. Analyze how specific changes in science have affected society.
PO4. Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.

**HS.S2.C2 Nature of Scientific Knowledge: Understand how science is a process for generating knowledge.**
PO1. Specify the requirements of a valid, scientific explanation (theory), including that it be:
   • Logical
   • Subject to peer review
   • Public
   • Respectful of rules of evidence
PO2. Explain the process by which accepted ideas are challenged or extended by scientific innovation.
PO3. Distinguish between pure and applied science.
PO4. Describe how scientists continue to investigate and critically analyze aspects of theories.

**Strand 3: Science in Personal and Social Perspectives**
**HS.S3.C2 Science and Technology in Society: Develop viable solutions to a need or problem.**
PO1. Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems:
   • Various forms of alternative energy
   • Storage of nuclear waste
   • Abandoned mines
   • Greenhouse gases
   • Hazardous wastes
PO2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.
PO3. Support a position on a science or technology issue.
PO4. Analyze the use of renewable and nonrenewable resources in Arizona.
- Water, land, soil, minerals, air

**PO5. Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).**

**HS.S3.C3 Human Population Characteristics**: Analyze Factors that affect human populations.

**PO1.** Analyze social factors that limit the growth of a human population, including:
- Affluence, education, access to health care, cultural influences

**PO2.** Describe biotic (living) and abiotic (nonliving) factors that affect human populations.

**PO3.** Predict the effect of a change in a specific factor on a human population.

| Standards |
|-----------------|-----------------|
| **Science and Engineering Practices** | **Crosscutting Concepts (CCC)** |
| Practices describe a robust process for how scientists investigate and build models and theories of the natural world or how engineers design and build systems. | Cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world. |
| • Ask questions and define problems | Pattersons |
| • Develop and use models | Cause & Effect |
| • Plan and carry out investigations | Structure & Function |
| • Analyze and interpret data | Stability & Change |
| • Use mathematics and computational thinking | Systems & System Models |
| • Construct explanations and design solutions | Scale, Proportion, & Quantity |
| • Engage in argument from evidence | Energy & Matter |
| • Obtain, evaluate, and communicate information | |

**Social Justice Standards**

**Identity**
Students will know their family history and cultural background and can describe how their own identity is informed and shaped by their membership in multiple identity groups. (ID.9-12.2)

Students will know that all their group identities and the intersection of those identities create unique aspects of who there are and that this is true for other people too. (ID.9-12.3)

Students will express pride and confidence in their identity without perceiving or treating anyone else as inferior. (ID.9-12.4)

**Diversity**
Students will use language and knowledge to accurately and respectfully describe how people (including themselves) are both similar to and different from each other and others in their identity groups. (DI.9-12.7)

Students will respectfully express curiosity about the history and lived experiences of others and will exchange ideas and beliefs in an open-minded way. (DI.9-12.8)

Students will relate to and build connections with other people by showing them empathy, respect and understanding, regardless of their similarities or differences. (DI.9-12.9)

**Justice**
Students will be aware of the advantages and disadvantages they have in society because of their membership in different identity groups, and their knowledge of how this has affected their lives. (JU.9-12.14)

**Action**

Students express empathy when people are excluded or mistreated because of their identities and concern when they personally experience bias. (AC.9-12.16)

Students have the courage to speak up to people when their words, actions or views are biased and hurtful, and they will communicate with respect even when others disagree. (AC.9-12.18)

**Teaching Tolerance Anti-Bias Framework**  [https://www.tolerance.org/frameworks](https://www.tolerance.org/frameworks)

### Adopted Texts and Materials

**Textbook:**
Earth and Space Science (Holt) 2006. Holt Publishing

- [www.earthweek.com](http://www.earthweek.com) ([Weekly current events])
- USGS Website
- NOAA Website
- NASA Website
- Google Earth
- PBS Learning Media
- GeoScience Videos

### Additional Instructional Resources

#### Culturally Responsive Practices ([TUSD SPARKS, SPARKS Strategies](https://www.tolerance.org/frameworks))

**Pre/Post Unit Assessment Examples:**
- Arizona Sample AIMS Guides and Tests
- Lab Practical with Formal Report

**Formative & Performance Assessment Examples**
- Concept Maps: Simulations; Cloud Computing; Modeling software programs; computer presentations and other educational technologies
- Closure Activities
- Quick Writes
- Conduct Research and construct explanations using words, visuals, and data (e.g. concept posters, lab experiments and lab reports)
- Engage in Arguments with Evidence and Reasoning (e.g. to support or refute subject related claims).
- Experimental Design--Design and conduct a fair test experiment identifying and controlling variables and using safe procedures
- Science Rubric Exemplar

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Office of Curriculum, Instruction, and Professional Development  
Last Edited: 3/15/2018
Assessment Resources

- AIMS Science Test Blue Print
- http://pals.sri.com/ Assessment Resource Bank
- MOSART Assessment Resources
- Science Assessment Tool
- Using Rubrics to Assess Learning
- Earth and Space Science Assessments

1Highly-Leveraged Standards are essential for students to learn because they have endurance (knowledge and skills relevant throughout a student’s lifetime); leverage (knowledge and skills used across multiple content areas); and essentiality (knowledge and skills necessary for success in future courses or grade levels). This definition for Highly-Leveraged Standards was adapted from the “power standard” definition on the website of the Millis Public Schools, K-12, Massachusetts, USA, 2016.

2Supporting Standards are emphasized during the quarter as they are integral to achieve mastery of the Highly Leveraged Standards. Mastery of these standards are measured using classroom assessments.

3Constant Standards are repeatedly addressed to reinforce grade-level mastery.
Reading Focus: Informational, Literature
Writing Focus: Narrative, Informative/Explanatory

Unifying Concept:
Students will understand how the Earth has evolved and changed over time as well as the evidence for our basis of knowledge.

Enduring Understandings:
The Earth’s materials are redistributed through a series of dynamic processes.
Results of plate tectonics include: earthquakes, volcanoes, mountain ranges, mid-oceanic ridges, and deep sea trenches.
Radioactive decay maintains the Earth’s internal temperature.
There are different types of seismic waves.

The evolution and existence of biological life on Earth has influenced all of our Earth systems.
Scientists use physical evidence to justify/describe the Earth’s history.
The use of relative and absolute dating can help scientists interpret Earth’s historical evidence.
All different components of the Earth are linked in the recycling of materials within Earth’s system.

Essential Questions:
How does the Earth’s internal heat allow for plate movement?
How can geologic features / occurrences on Earth be used as evidence for plate tectonics?
How can seismic waves be used to determine the structure of the Earth?
How can we justify the scientific explanation of our past?
How can we create a geologic time scale for Earth’s past if we were not there to witness it?

Quarter 2

Academic Vocabulary:
Earth’s materials redistribution
Dynamic processes Plate tectonics
Earthquakes volcanos
Mountain ranges mid-oceanic ridges
Decay radioactive
Deep sea trenches seismic waves
Earth’s internal temperature
Evolution relative dating
Absolute dating recycling
Biological life on Earth’s systems
Physical evidence plate movement
Earth’s historical evidence
Geological features scale
Orogenesis weathering
Erosion sedimentation
Metamorphism

Academic Vocabulary:
Geochemical cycles
Orogenesis
Weathering
Erosion
Sedimentation
Metamorphism
Land masses

Highly-Leveraged Standards

Strand 5: Physical Science
HS.SS.C3: Conservation of Energy and Increase in Disorder: Understand ways that energy is conserved, stored, and transferred.
PO 1. Describe the following ways in which energy is stored in a system:
• mechanical
• electrical
• chemical
• nuclear

Strand 6: Earth and Space Science
HS.S6.C1 Geochemical Cycles: Analyze the interactions between the Earth’s structures, atmosphere, and geochemical cycles.
PO2. Demonstrate how dynamic processes, such as weathering, erosion, sedimentation, metamorphism, and orogenesis relate to redistribution of materials within the Earth system.
PO3. Explain how the rock cycle is related to plate tectonics.


Supporting Standards

Strand 5: Physical Science
HS.SS.C3: Conservation of Energy and Increase in Disorder: Understand ways that energy is conserved, stored, and transferred.
PO 1. Describe the following ways in which energy is stored in a system:
• mechanical
• electrical
• chemical
• nuclear

Academic Vocabulary:
Geochemical cycles
Orogenesis
Weathering
Erosion
Sedimentation
Metamorphism
Land masses
**PO1.** Describe the flow of energy to and from the Earth.

**PO2.** Explain the mechanisms of heat transfer (convection, conduction, radiation) among the atmosphere, land masses, and oceans.

**Internal Energy:**

**PO4.** Demonstrate the relationship between the Earth’s internal convective heat flow and plate tectonics.

**PO5.** Demonstrate the relationships among earthquakes, volcanoes, mountain ranges, mid-oceanic ridges, deep sea trenches, and tectonic plates.

**PO6.** Distinguish among seismic S, P, and surface waves.

**PO7.** Analyze the seismic evidence (S and P waves) used to determine the structure of the Earth.

**PO8.** Describe how radioactive decay maintains the Earth’s internal temperature.

**HS.S6.C3 Origin and Evolution of the Earth System:** Analyze the factors used to explain the history and evolution of the Earth.

**Earth History/Evolution:**

**PO4.** Interpret a geologic time scale.

**PO5.** Distinguish between relative and absolute geologic dating techniques.

**PO6.** Investigate scientific theories of how life originated on Earth (high temperature, low oxygen, clay catalyst model).

**PO7.** Describe how life on Earth has influenced the evolution of the Earth’s systems.

**PO8.** Sequence major events in the Earth’s evolution (e.g., mass extinctions, glacial episodes) using relative and absolute dating data.

**PO9.** Analyze patterns in the fossil record related to the theory of organic evolution.

### Constant Standards

**Strand 1: Inquiry Process (HLS-34%)**

**HS.S1.C1 Observations, Questions, and Hypotheses:** Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.

**PO1.** Evaluate scientific information for relevance to a given problem.

**PO2.** Develop questions from observations that transition into testable hypotheses.

**PO3.** Formulate a testable hypothesis.

**PO4.** Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).


**PO1.** Demonstrate safe and ethical procedures (e.g., use and care of technology, materials, organisms) and behavior in all science inquiry.

**PO2.** Identify the resources needed to conduct an investigation.
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<th>Design an appropriate protocol (written plan of action) for testing a hypothesis:</th>
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<tr>
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<td>• Identify dependent and independent variables in a controlled investigation.</td>
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<th>PO4.</th>
<th>Conduct a scientific investigation that is based on a research design.</th>
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| PO5. | Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers. |

**HS.S1.C3 Analysis, Conclusion, and Refinements:** Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.

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<th>PO7.</th>
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**HS.S1.C4 Communication:** Communicate results of investigations.

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<th>PO3.</th>
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<th>Support conclusions with logical scientific arguments.</th>
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**Strand 2: History and Nature of Science**

**HS.S2.C1 History of Science as a Human Endeavor:** Identify individual, cultural, and technological contributions to scientific knowledge.
PO1. Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.
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PO3. Analyze how specific changes in science have affected society.
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**PO1.** Specify the requirements of a valid, scientific explanation (theory), including that it be:
- Logical
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**Strand 3: Science in Personal and Social Perspectives**

**HS.S3.C2 Science and Technology in Society:** Develop viable solutions to a need or problem.

**PO1.** Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems:
- Various forms of alternative energy
- Storage of nuclear waste
- Abandoned mines
- Greenhouse gases
- Hazardous wastes

**PO2.** Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.

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**HS.S3.C3 Human Population Characteristics:** Analyze Factors that affect human populations.

**PO1.** Analyze social factors that limit the growth of a human population, including:
- Affluence, education, access to health care, cultural influences

**PO2.** Describe biotic (living) and abiotic (nonliving) factors that affect human populations.

**PO3.** Predict the effect of a change in a specific factor on a human population.
Practices describe a robust process for how scientists investigate and build models and theories of the natural world or how engineers design and build systems.

- 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

Cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world.

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3Constant Standards are repeatedly addressed to reinforce grade-level mastery.
**Reading Focus:** Informational, Literature  
**Writing Focus:** Narrative, Informative/Explanatory

**Unifying Concept:** Students will understand how weather and climate are the result of Earth maintaining homeostasis.

**Quarter 3**

**Enduring Understandings:**
There are many factors which determine a location’s weather.
Weather patterns become evident when weather variables, measured by meteorological instruments, are observed and recorded.
By following weather patterns, warnings and alert signals can be given to protect and prepare people for severe weather event.
Many factors determine a location’s climate.
There are many causes for climate change over time.
Each atmospheric layer has different properties.

**Essential Questions:**
- How are weather variables observed and measured?
- What factors influence weather systems?
- How can I predict/forecast a location’s weather?
- How can I prepare for severe weather?
- How is a location’s climate determined?
- How can a location’s climate change?
- What are the main features of each atmospheric layer?

**Academic Vocabulary:**
- Weather
- Patterns
- Evidence
- Variables
- Observation
- Record
- Factors
- Measurement
- Signals
- Climate
- Atmosphere
- Atmospheric layer
- Climate change
- Change over time
- Homeostasis
- Weather systems
- Severe
- Meteorological instruments

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| **Strand 6: Earth and Space Science**  
**HS.S6.C2 Energy in the Earth System (Both Internal and External):** Understand the relationships between the Earth’s land masses, oceans, and atmosphere.  
**PO1.** Describe the flow of energy to and from the Earth.  
**PO2.** Explain the mechanisms of heat transfer (convection, conduction, radiation) among the atmosphere, land masses, and oceans.  
**PO3.** Distinguish between weather and climate.  
**External Energy:**  
**PO9.** Explain the effect of heat transfer on climate and weather.  
**PO10.** Demonstrate the effect of the Earth’s rotation (i.e., Coriolis effect) on the movement of water and air.  
**PO11.** Demonstrate the origin, life cycle, and behavior of weather systems (i.e., air mass, front, high and low systems, pressure gradients).  
**PO12.** Describe the conditions that cause severe weather (e.g., hurricanes, tornadoes, thunderstorms).  
**PO13.** Propose appropriate safety measures that can be taken in preparation for severe weather.  
**PO14.** Analyze how weather is influenced by both natural and artificial Earth features (e.g., mountain ranges, bodies of water, cities, air pollution).  

**Strand 6: Earth and Space Science**  
**HS.S6.C1 Geochemical Cycles:** Analyze the interactions between the Earth’s structures, atmosphere, and geochemical cycles.  
**PO 1.** Identify ways materials are cycled within the Earth system (i.e., carbon cycle, water cycle, rock cycle).  
**PO 4.** Demonstrate how the hydrosphere links the biosphere, lithosphere, cryosphere, and atmosphere.  

**HS.S6.C2 Energy in the Earth System (Both Internal and External):** Understand the relationships between the Earth’s land masses, oceans, and atmosphere.  
**PO2.** Explain the mechanisms of heat transfer (convection, conduction, radiation) among the atmosphere, land masses, and oceans.
| PO15. List the factors that determine climate (e.g., altitude, latitude, water bodies, precipitation, prevailing winds, topography). |
| PO16. Explain the causes and/or effects of climate changes over long periods of time (e.g., glaciation, desertification, solar activity, greenhouse effect). |
| PO17. Investigate the effects of acid rain, smoke, volcanic dust, urban development, and greenhouse gases on climate change over various periods of time. |

**Constant Standards**

**Strand 1: Inquiry Process (HLS-34%)**

**HS.S1.C1 Observations, Questions, and Hypotheses:** Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.

- **PO1.** Evaluate scientific information for relevance to a given problem.
- **PO2.** Develop questions from observations that transition into testable hypotheses.
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- **PO3.** Design an appropriate protocol (written plan of action) for testing a hypothesis:
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  - Determine an appropriate method for recording data (e.g., notes, sketches, photographs, videos, journals (logs), charts, computers/calculators).
- **PO4.** Conduct a scientific investigation that is based on a research design.
- **PO5.** Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.

**HS.S1.C3 Analysis, Conclusion, and Refinements:** Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.

- **PO1.** Interpret data that show a variety of possible relationship between variables, including:
  - Positive relationship
  - Negative relationship
  - No relationship
- **PO2.** Evaluate whether investigational data support or do not support the proposed hypothesis.
- **PO3.** Critique reports of scientific studies (e.g., published papers, student reports).
- **PO4.** Evaluate the design of an investigation to identify possible sources of procedural error, including:
  - Sample size
  - Trials
  - Controls
Analyses

**PO5.** Design models (conceptual or physical) of the following to represent “real world’ scenarios:
- Carbon cycle
- Water cycle
- Phase change
- Collisions

**PO6.** Use descriptive statistics to analyze data, including:
- Mean, Frequency and Range

**PO7.** Propose further investigations based on the findings of a conducted investigation.

**HS.S1.C4 Communication:** Communicate results of investigations.

**PO1.** For a specific investigation, choose an appropriate method for communicating the results.

**PO2.** Produce graphs that communicate data.

**PO3.** Communicate results clearly and logically.

**PO4.** Support conclusions with logical scientific arguments.

**Strand 2: History and Nature of Science**

**HS.S2.C1 History of Science as a Human Endeavor:** Identify individual, cultural, and technological contributions to scientific knowledge.

**PO1.** Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.

**PO2.** Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.

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**PO4.** Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.

**HS.S2.C2 Nature of Scientific Knowledge:** Understand how science is a process for generating knowledge.

**PO1.** Specify the requirements of a valid, scientific explanation (theory), including that it be:
- Logical
- Subject to peer review
- Public
- Respectful of rules of evidence

**PO2.** Explain the process by which accepted ideas are challenged or extended by scientific innovation.

**PO3.** Distinguish between pure and applied science.

**PO4.** Describe how scientists continue to investigate and critically analyze aspects of theories.

**Strand 3: Science in Personal and Social Perspectives**

**HS.S3.C2 Science and Technology in Society:** Develop viable solutions to a need or problem.

**PO1.** Analyze the costs, benefits, and risks of various ways of dealing with the following needs or problems:
- Various forms of alternative energy
- Storage of nuclear waste
- Abandoned mines
- Greenhouse gases
- Hazardous wastes

**PO2.** Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.

**PO3.** Support a position on a science or technology issue.

**PO4.** Analyze the use of renewable and nonrenewable resources in Arizona.
- Water, land, soil, minerals, air

**PO5.** Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology).

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**PO1.** Analyze social factors that limit the growth of a human population, including:
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<td>Scale, Proportion, &amp; Quantity</td>
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**Social Justice Standards**

**Identity**
Students will know their family history and cultural background and can describe how their own identity is informed and shaped by their membership in multiple identity groups. (ID.9-12.2)

Students will know that all their group identities and the intersection of those identities create unique aspects of who there are and that this is true for other people too. (ID.9-12.3)

Students will express pride and confidence in their identity without perceiving or treating anyone else as inferior. (ID.9-12.4)

**Diversity**
Students will use language and knowledge to accurately and respectfully describe how people (including themselves) are both similar to and different from each other and others in their identity groups. (DI.9-12.7)

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Students will relate to and build connections with other people by showing them empathy, respect and understanding, regardless of their similarities or differences. (DI.9-12.9)

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3Constant Standards are repeatedly addressed to reinforce grade-level mastery.
## Reading Focus: Informational, Literature
Writing Focus: Narrative, Informative/Explanatory

## Unifying Concept:
Students will understand how the universe and its components formed and evolved over time.

### Enduring Understandings:
- Earth is a celestial body, which affects and is affected by other components of the solar system.
- There are many factors used to explain the history and evolution of the Earth.
- Astronomers have made celestial observations/instruments throughout history.
- The universe is composed of galaxies, stars, and planets.
- There are many factors used to explain/justify the history and evolution of the universe.
- Galaxies come in various shapes and sizes.
- Stars go through predictable life cycles.

### Essential Questions:
- How did the components of the universe originate?
- How is the universe organized?
- What characteristics/components do different shaped galaxies share?
- How does a star and star system evolve and develop?
- How did the solar system originate?
- How is the solar system organized?
- Where is Earth’s place in the solar system?
- How have we gained knowledge about our solar system?

### Academic Vocabulary:
- celestial body
- solar system
- Earth
- evolution
- Factors
- components
- Astronomers
- observations
- Instruments
- universe
- Galaxies
- stars
- Planets
- life cycles
- Originate
- star system
- Big Bang Theory
- fusion process
- supernova explosions
- scientific theory
- origin
- meteors
- asteroids
- satellites
- comets
- meteors
- phases of the Moon
- eclipses (lunar and solar)
- interactions of the Sun, Moon, and Earth (tidal effect)

### Quarter 4

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<td>PO1. Describe the Big Bang Theory as an explanation for the origin of the universe.</td>
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<td>PO2. Describe the fusion process that takes place in stars.</td>
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<td>PO3. Analyze the evolution of various types of stars using the Hertzsprung-Russell (HR) diagram.</td>
<td>PO 4. Interpret a geologic time scale.</td>
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<td>PO4. Compare the evolution (life cycles) of stars of different masses (low and high mass).</td>
<td>PO 5. Distinguish between relative and absolute geologic dating techniques.</td>
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<td>PO5. Explain the formation of the light elements in stars and the heavier elements (what astronomers call “metals”) in supernova explosions.</td>
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### Earth Origin/System:

**P01.** Describe the scientific theory of the origin of the solar system (solar nebular hypothesis).

**P02.** Describe the characteristics, location, and motions of the various kinds of objects in our solar system, including the Sun, planets, satellites, comets, meteors, and asteroids.

**P03.** Explain the phases of the Moon, eclipses (lunar and solar), and the interactions of the Sun, Moon, and Earth (tidal effect).

### Constant Standards

**Strand 1: Inquiry Process (HLS-34%)**

**HS.S1.C1 Observations, Questions, and Hypotheses:** Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.

**P01.** Evaluate scientific information for relevance to a given problem.

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**P03.** Formulate a testable hypothesis.

**P04.** Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).


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**P04.** Conduct a scientific investigation that is based on a research design.

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**P01.** Interpret data that show a variety of possible relationships between variables, including:
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- Negative relationship
- No relationship

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### Standards

**Science and Engineering Practices**
- Cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world.
- Patterns
- Cause & Effect
- Stability & Change
- Systems & System Models
- Scale, Proportion, & Quantity
- Energy & Matter

**Crosscutting Concepts (CCC)**
- Systems & System Models
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- Energy & Matter

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- Using Rubrics to Assess Learning
- Earth and Space Science Assessments

¹Highly-Leveraged Standards are essential for students to learn because they have endurance (knowledge and skills relevant throughout a student’s lifetime); leverage (knowledge and skills used across multiple content areas); and essentiality (knowledge and skills necessary for success in future courses or grade levels).*

²Supporting Standards are emphasized during the quarter as they are integral to achieve mastery of the Highly Leveraged Standards. Mastery of these standards are used measured using classroom assessments.

³Constant Standards are repeatedly addressed to reinforce grade-level mastery.

*This definition for Highly-Leveraged Standards was adapted from the “power standard” definition on the website of the Millis Public Schools, K-12, Massachusetts, USA, 2016