### Quarter 1

#### Unifying Concept:
Students will understand how to ask scientific questions and communicate ideas about sustainability.

#### Reading Focus: Informational, Literature

#### Writing Focus: Narrative, Informative/Explanatory

#### Enduring Understandings:
- True sciences must meet specific criteria to be deemed as such. (Science v. pseudo-science)
- Science deals only with natural, observable patterns and explanations and concentrates on discovery of new knowledge.
- Scientific Knowledge is gained through testing and observation and open to change with compelling new evidence.
- A growth mindset for continuous learning and gaining new knowledge is essential for scientific discovery.
- Technological advances have been occurring throughout human history. These advances have increased human quality of life as well as increased our understanding of the world around us and our place in it.
- Engineering concentrates on solving problems within certain parameters.
- Creative problem solving, collaboration and perseverance are critical skills for engineers.
- Math is the “language” through which scientific discoveries can be quantified and communicated.
- Statistics can be used to predict testing outcomes based on previous observations.
- Constraints and requirements for solving problems through the engineering process can be quantified using math and mathematical models.
- Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- Two key concepts are 1) the concept of **needs**, in particular the essential needs of the world's poor, to which overriding priority should be given; and 2) the idea of **limitations** imposed by the state of technology and social organization on the environment's ability to meet present and future needs.
- The quality of life of individuals and societies is affected by energy choices.
- All humans require energy (food), nutrients (vitamins and minerals), water, oxygen, and a moderate temperature to survive.

#### Essential Questions:
- What is the nature of Science?
- What criteria do we use to determine if something is scientific?
- Why is a mindset of inquiry and curiosity essential to gaining scientific knowledge?
- Why is technology important for scientific investigations and discovery?
- What are some of the major technological advances that have increased our scientific understanding of the world?
- How is engineering different from science and what is the process and mindset needed?
- How will I use math to solve problems through the engineering process?
- What is sustainable development and why is the concept of sustainability important?
- What are the essential needs for human life and needs beyond those for physical survival?

#### Academic Vocabulary:
- Pseudo-science
- Explanations
- Scientific Knowledge
- Statistics
- Limitations
- Inquiry
- Sustainability
- observable patterns
- discovery
- Technological advances
- mathematical models
- nature of Science
- engineering process
Beyond physical needs, humans also have love and belonging needs, self-esteem needs, and self-actualization needs. Current commercial agriculture and food distribution practices affect ecological, economic, and social sustainability in several complex ways. Malnutrition can mean not only not getting enough food but also eating food that is unhealthy, leading to disease and long term health problems that have social and economic implications. Beyond personal actions to support sustainable agriculture and increased health from proper nutrition, social and political action must be taken to ensure food production/quality meets the requirements of sustainability. Significant changes to infrastructure, political, and economic policies will be required in order to decrease carbon emissions to a point that rising temperatures are no longer a threat to human survival. Slavery has not been eradicated from the world. Many products that Americans take for granted, are produced by a network and infrastructure of slavery.

<table>
<thead>
<tr>
<th>Standards</th>
</tr>
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<tbody>
<tr>
<td><strong>Highly-Leveraged Standards</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
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**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. |
| **Supporting Standards**<sup>2</sup> |
| **HS.S2.C2 Nature of Scientific Knowledge: Understand how science is a process for generating knowledge** |
| **PO 1.** Specify the requirements of a valid, scientific explanation (theory), including that it be:  
- logical  
- subject to peer review  
- public  
- respectful of rules of evidence  
**PO 2.** Explain the process by which accepted ideas are challenged or extended by scientific innovation.  
**PO 3.** Distinguish between pure and applied science.  
**PO 4.** Describe how scientists continue to investigate and critically analyze aspects of theories. |
| **Strand 4: Life Science (HLS-46%)** |
| **HS.S4.C3 Interdependence of Organisms**: Analyze the relationships among various organisms and their environment.  
**PO1.** Identify the relationships among organisms within populations, communities, ecosystems, and biomes. |
• 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.

**PO2.** Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment.

**PO3.** Assess how the size and the rate of growth of a population are determined by birth rate, death rate, immigration, emigration, and carrying capacity of the environment.
### 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.

### Constant Standards

#### 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.

#### 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.
Science and Engineering Practices

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

Crosscutting Concepts (CCC)

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
- Structure & Function
- Stability & Change
- Systems & System Models
- Scale, Proportion, & Quantity
- Energy & Matter

Social Justice Standards

**Identity**

Students will know their family history and cultural background and can describe how their own identify 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:**


- Argument driven inquiry
- Socratic Seminar video
### Instructional and Assessment Guides

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<th>Culturally Responsive Practices</th>
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</tr>
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<tbody>
<tr>
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<td>- Experimental Design--Design/conduct a fair test experiment identifying variables and safe procedures</td>
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<td>- Science Rubric Exemplar</td>
<td>- Julie Ann Wrigley Global Institute of Sustainability</td>
</tr>
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<td>- Technology Resources</td>
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<td>Assessment Resource Bank; MOSART Assessment Resources; Science Assessment Tool; Using Rubrics to Assess Learning; Science Assessments</td>
<td>- NGSS Life Science resources</td>
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<td>- Lab Aids – Science and Sustainability Online Textbook</td>
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<td><a href="#">TUSD SPARKS, SPARKS Strategies</a></td>
<td><a href="#">Username: tucsonteachers</a> <a href="#">Username: tucson1</a></td>
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Supporting 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.

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

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<td>Students will understand different types of resources and energy as well as human impact on the environment.</td>
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**Enduring Understandings:**

The quality of life of individuals and societies is affected by our energy choices. Looking for and analyzing patterns is foundational to understanding the position of elements of the Periodic Table and their subsequent chemical combinations. How we live impacts others both in Arizona and around the world, now and into the future.

Earth’s resources are both limited and not equitable; they need to be conserved. There are positive and negative effects of using natural resources. Water is essential to all life. Different regions of the globe have renewable and non-renewable energy resources. Various sources of energy can be used to power human activities. Most energy sources used by humans today are non-renewable. Energy decisions are influenced by economic, political, environmental and social factors.

The Laws of Physics are fundamental to understanding energy use and transfer. Energy is a physical quantity that follows precise natural laws. Science and technology (research and development) are both needed to create and manage Earth’s fuel resources.

The climate of Earth has been changing for billions of years. There have been times in geologic history where the concentration of CO₂ has been much higher than current and even higher than current forecasts of concentrations if carbon emissions are not reduced. Use of alternative power sources (solar, wind, hydroelectric, etc.) can reduce carbon emissions. Fresh clean water is a finite resource on Earth and millions of people do not have access to clean water. Water is used in ways that are not obvious (actual vs virtual water use). There is currently a drought in the Southwest that could affect access to water and products that require water at affordable prices. There are personal actions that can be taken to reduce an individual’s water footprint.

**Essential Questions:**

- What are renewable resources?
- How much water on earth is usable by humans to meet survival needs?
- How many people do not have access to clean water?
- How much water do I use? What can I do to conserve water?
- What is our personal impact on our planet and what are options to lessen impact?
- What is global climate change and what role do humans play?
- What technologies have been developed resulting in less human consumption of fossil fuels?
- Can individual action alone have a positive impact on reducing global climate change? What personal actions affect the community, environment, the globe?
- Are there ways to use technology to obtain or create more water in places where water is needed most?
- If enough food is produced to feed everyone, why is there hunger?
- Is current food production sustainable?

**Academic Vocabulary:**

- Energy choices
- Periodic Table
- Limited resources
- Renewable
- Influenced
- Political
- social factors
- Laws of Physics
- Fuel
- Climate
- alternative power sources
- wind
- finite
- patterns
- elements
- human activities
- non-renewable
- economic
- environmental
- natural laws
- technology
- carbon emissions
- weather
- solar
- hydroelectric
- footprint (personal action)
Beyond personal action, political changes to water rights laws and social/political systems are needed in order to conserve water and secure it as a resource for everyone everywhere in the future.

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<td><strong>Strand 4: Life Science</strong></td>
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<td><strong>PO3.</strong> Diagram the following biogeochemical cycles in an ecosystem:</td>
</tr>
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<td>- Water, Carbon and Nitrogen</td>
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<td><strong>PO4.</strong> Diagram the energy flow in an ecosystem through a food chain.</td>
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<td><strong>PO5.</strong> Describe the levels of organization of living things from cells, through tissues, organs, organ systems, organisms, populations, and communities to ecosystems.</td>
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<tr>
<td><strong>Strand 5: Physical Science</strong></td>
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<td><strong>HS.S5.C5 Interactions of Energy and Matter:</strong> Understand the interactions of energy and matter.</td>
</tr>
<tr>
<td><strong>PO1.</strong> Describe various ways in which matter and energy interact (e.g., photosynthesis, phase change).</td>
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| **Supporting Standards**<sup>2</sup> |
| **Strand 4: Life Science**  |
| **HS.S4.C3: Interdependence of Organisms** |
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| **PO 1.** Identify the relationships among organisms within populations, communities, ecosystems, and biomes. |
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| **Strand 1: Inquiry Process (HLS-34%)**  |
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| **PO1.** Evaluate scientific information for relevance to a given problem |
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2018-2019 Science Curriculum Map, STEM, Q2

- 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

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

Social Justice Standards

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Teaching Tolerance Anti-Bias Framework  https://www.tolerance.org/frameworks

Adopted Texts and Materials

Textbook:
- Science and Sustainability online Teacher and student editions
- Material World: A Global Family Portrait: Teacher reference

Digital Age Learning Standards: ISTE
Julie Ann Wrigley Global Institute of Sustainability
Technology Resources
NGSS Life Science resources
Argument driven inquiry classroom activities
Socratic Seminar video
### Instructional and Assessment Guides

- **Culturally Responsive Practices** ([TUSD SPARKS, SPARKS Strategies](#))

  - **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

### Additional Instructional Resources

- AZ AIMS Science Performance Level Descriptors
- Science and Engineering Practices
- Safety in the Science Classroom
- High School Lab Safety videos
- Investigating Matter through Inquiry
- Study of Matter resources
- How Much Water
- Sustainable Development Goals- United Nations
- Global Footprint Network
- Water Availability Teacher Guide-GLOBE
- United Nations Environment Programme
- Climate Literacy
- Design Labs resources/software

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

Unifying Concept:
Students will understand that energy is a quantifiable entity and the physical laws that govern it.

Enduring Understandings:
Energy can be stored in a system and can be transferred from one system to another.
Energy is conserved in a closed system and can be quantitatively determined.
Methods of energy production are often determined by availability of resources and may have deleterious environmental and health side effects.
The quality of life of individuals and societies is affected by energy choices.
Various sources of energy can be used to power human activities, and often this energy.
Different regions of the globe have renewable and non-renewable energy resources.
Energy decisions are influenced by economic, political, environmental and social factors.
The Laws of Physics are fundamental to understanding energy use and transfer.
Energy is a physical quantity that follows precise natural laws.
Science and technology (research and development) are both needed to create and manage Earth’s fuel resources.

Essential Questions:
How do objects interact with one another?
What is energy and how does it change its form?
How is energy stored in objects?
How can energy be transferred at different rates?
Is there an impartial scientific way to 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?

Academic Vocabulary:
Energy  quantifiable
Physical laws  conserved
Closed system  energy production
Deleterious environmental side effects
Human activities  energy choices
Influenced  economic
Political  environmental factors
Social factors  Laws of Physics
Transfer  natural laws
Technology  research
Development  alternative energy
Nuclear waste  abandoned mines
Greenhouse gases  hazardous wastes

Standards

<table>
<thead>
<tr>
<th>Highly-Leveraged Standards ¹</th>
<th>Supporting Standards ²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strand 5: Physical Science</strong></td>
<td></td>
</tr>
</tbody>
</table>
PO1. Describe substances based on their physical properties. |
PO2. Describe substances based on their chemical properties. |
| **Strand 5: Physical Science**  |
PO 5. Describe the properties of electric charge and the conservation of electric charge. |
<table>
<thead>
<tr>
<th>PO6.</th>
<th>Describe the following features and components of the atom:</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>Protons, neutrons, electrons, mass, number and type of particles, structure, organization</td>
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</table>

**HS.S5.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

**PO 2.** Describe various ways in which energy is transferred from one system to another (e.g., mechanical contact, thermal conduction, electromagnetic radiation.)

**PO 3.** Recognize that energy is conserved in a closed system.

**PO 4.** Calculate quantitative relationships associated with the conservation of energy.

**PO 5.** Analyze the relationship between energy transfer and disorder in the universe (2nd Law of Thermodynamics).

**PO 6.** Distinguish between heat and temperature.

**PO 7.** Explain how molecular motion is related to temperature and phase changes.

---

**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.

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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 they 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)

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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)

### Adopted Texts and Materials

**Textbook:**
- Science and Sustainability online Teacher and student editions
- Material World: A Global Family Portrait: Teacher reference

### Instructional and Assessment Guides

### Additional Instructional Resources

**Argument driven inquiry** classroom activities
**Socratic Seminar** video
**KWL strategies** **Hess’s Matrix** **DOK Levels** **DOK Stems**
**Reading and Writing in the Science Classroom** professional reading
**Unifying Themes of Science** professional reading
**Tucson Unified School District - Science Resources**
## Culturally Responsive Practices (TUSD SPARKS, SPARKS Strategies)

### 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
- Experimental Design
- Science Rubric Exemplar

### Assessment Resources:
- MOSART Assessment Resources
- Science Assessment Tool  Using Rubrics to Assess Learning
- Science Assessments

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1. **Highly-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.

2. **Supporting 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.

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

### Unifying Concept:
Students will understand how forces impact an object’s motion.

### Quarter 4

#### Enduring Understandings:
- Speed and velocity can be expressed graphically.
- Newton’s first law describes inertia.
- Newton’s second law can be expressed by the equation $F=ma$.
- Newton’s third law states that for every action there is an opposite and equal reaction (momentum).

#### Essential Questions:
- What are different ways to describe motion?
- What is the difference between speed and velocity?
- What changes when an object accelerates?
- What is momentum?

#### Academic Vocabulary:
- Speed
- Velocity
- Graphically
- Newton's first law
- Newton's second law
- Newton's third law
- Momentum
- Motion
- Equal reaction
- Acceleration

### Standards

#### Highly-Leveraged Standards

**Strand 5: Physical Science**

**HS.S5.C2: Motions and Forces**:
Analyze relationships between forces and motion.

**PO 1.** Determine the rate of change of a quantity (e.g., rate of erosion, rate of reaction, rate of growth, velocity).

**PO 2.** Analyze the relationships among position, velocity, acceleration, and time:
- graphically
- mathematically

**PO 3.** Explain how Newton’s 1st Law applies to objects at rest or moving at constant velocity.

**PO 4.** Using Newton’s 2nd Law of Motion, analyze the relationships among the net force acting on a body, the mass of the body, and the resulting acceleration:
- graphically
- mathematically

**PO 5.** Use Newton’s 3rd Law to explain forces as interactions between bodies (e.g., a table pushing up on a vase that is pushing down on it; an athlete pushing on a basketball as the ball pushes back on her).

**PO 6.** Analyze the two-dimensional motion of objects by using vectors and their components.

**PO 7.** Give an example that shows the independence of the horizontal and vertical components of projectile motion.

**PO 13.** Analyze the impulse required to produce a change in momentum.

#### Supporting Standards

**Strand 5: Physical Science**

**HS.S5.C3: Concept 3: 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

**PO 2.** Describe various ways in which energy is transferred from one system to another (e.g., mechanical contact, thermal conduction, electromagnetic radiation.)

**PO 3.** Recognize that energy is conserved in a closed system.
PO 14. Quantify interactions between objects to show that the total momentum is conserved in both collision and recoil situations.

### 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.

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

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**Assessment Resources**

http://pals.sri.com/ Assessment Resource Bank
MOSART Assessment Resources
Science Assessment Tool Using Rubrics to Assess Learning

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