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SCIENCE

Academic Standards
Three Dimensions of Science Learning
Learning Goals

June 2021

HONORS-ADV
FIELD SCIENCE

HIGH SCHOOL

HONORS ADVANCED FIELD SCIENCE

HIGH SCHOOL HONORS ADVANCED FIELD SCIENCE OVERVIEW

High School Honors Advanced Field Science is a fourth year research-based science course that focuses on how biological and physical systems interact to produce the biogeographical and geological phenomena seen in the natural world today. Students grapple with the challenges of working in a natural system while at the same time developing an understanding of its complexities and subsystems. Students plan and conduct field investigations using statistical field research. Fluency with physical processes, the taxonomy and behavior of local flora and fauna at the family and species levels, and the science and engineering practices, are critical skills applied in this course.

The standards for Honors Advanced Field Science are categorized according to the topics listed below. The list does not imply the instructional sequence or how the standards will be organized for instruction. Educators will make decisions about instructional sequence and how standards will be grouped by units for classroom instruction and assessment to best meet student needs.

High School Honors Advanced Field Science Topics:

- Life Science:
  - Phenomena in Natural Systems
  - Biogeography
  - Ethnobiology
- Earth & Space Sciences:
  - Geospatial Technologies,
  - Geologic Time

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Navigating the Science Standards: Abbreviated Version

The standards serve as the basis for the design of instruction and assessment of the district's science curriculum.

- **Standards** are what a student needs to know, understand, and be able to do by the end of each grade or course. They build across grade levels in a progression of increasing understanding and through a range of cognitive demand levels.
- **Curriculum** refers to the resources used for teaching and learning the standards (units, lessons, texts, materials, tech apps, assessments, etc.).
- **Instruction** refers to the methods or methodologies used by teachers to teach their students. Instructional techniques are employed by individual teachers in response to the needs of students in their classes to help them progress through the curriculum to achieve the standards.

Grade Level or Course and **Topic Area** for standard.

Life Science Description of what students will learn for the area of science under study (K-8 only).

Standard – What is Assessed Describes what students should be able to do at the end of instruction to show what they have learned. Combines Science and Engineering Practices, Core Ideas, and Crosscutting Concepts.

Learning Goals Indicators or evidence of learning at the end of a lesson or unit as aligned to the standard.

Core Ideas for Knowing and Using Science "Understandings" or big ideas for physical, earth and space, and life sciences that build in complexity across grade levels and students develop over time. **Background Information (Content)** is provided under each Core Idea.

Science and Engineering Practices Skills and knowledge that scientists and engineers engage in to either understand the world or solve a problem.

Three Dimensions (3-D) of Science: The Practices, Core Ideas, and Crosscutting Concepts that were used to create the standards.

Crosscutting Concepts Concepts that cut across all disciplines and help students deepen their understanding of core ideas.

KINDERGARTEN

LIFE SCIENCE: LIVING AND NON-LIVING THINGS

Students develop an understanding that the world is comprised of living and non-living things. They investigate the relationship between structure and function in living things; plants and animals use specialized parts to help them meet their needs and survive.

Science Standard: K.L2U1.8 **Observe, ask questions, and explain the differences between the characteristics of living and non-living things.**

Learning Goals

I can:

- Based on prior experiences, ask questions about living and non-living things.
- Make direct or indirect observations about living and non-living things:
  - Identify traits of living and non-living things.
  - Record observations (*e.g., through pictures and/or words*).
  - Make inferences about the characteristics of living and non-living things.
- List the characteristics of living things (*i.e., move, reproduce, react to stimuli*).
- Use evidence to explain how the characteristics of living things differ from the characteristics of non-living things.

Core Ideas

Knowing Science

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

- There is a wide variety of living things (organisms), including plants and animals. They are distinguished from non-living things by their ability to move, reproduce, and react to certain stimuli.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students ask questions to frame their exploration of living and non-living things.
- Students make observations about living and non-living things.
- Students use the evidence from their observations to make inferences about the characteristics of living and non-living things.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions based on observations of the natural and/or designed world. **Constructing Explanations and Designing Solutions** • Use information from direct or indirect observations to construct explanations. • Distinguish between opinions and evidence in one's own explanations.	**Patterns** • Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). **Systems and System Models** • Objects and organisms can be described in terms of their parts.

LIFE SCIENCE

HIGH SCHOOL HONORS ADVANCED FIELD SCIENCE

LIFE SCIENCE

PHENOMENA IN NATURAL SYSTEMS

Science Standard: HS.AFS.L2U1.1 Plan and conduct field investigations about biological phenomena in natural systems including microhabitats, plant distribution in ecosystems, and ecological relationships.

Learning Goals

I can:

- Plan field investigations individually and collaboratively to explore biological phenomena in natural systems (*i.e., microhabitats, plant distribution in ecosystems, ecological relationships in Southern Arizona*):
    - Ask investigative questions regarding relationships between independent and dependent variables.
    - Determine the data (*e.g., types, amount, and accuracy*) needed to produce reliable qualitative and/or quantitative observations and/or measurements of microhabitats.
    - Consider limitations on the precision of the data (*e.g., number of trials, cost, risk, time*), and refine the design accordingly.
    - Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
    - Select appropriate tools to collect, record, analyze, and evaluate data (*e.g., how, when, and/or where observations/measurements will be taken; how samples or measurements will be repeated; how sampling/measurement method is consistent or systematic*).
- Conduct investigations individually and collaboratively to explore biological phenomena in natural systems (*i.e., microhabitats in Southern Arizona*):
    - Conduct investigations in a safe and ethical manner including considerations of environmental, social, and personal impacts.
    - Collect data from the investigation about microhabitats in a natural environment *(e.g., observations/measurements recorded systematically; location, date, time of day and description of study site, including weather).*
    - Analyze and interpret data about microhabitats (including plant distribution in various ecosystems) in a natural environment to identify relationships and/or patterns and trends and how they provide evidence to support a conclusion/explanation or claim.
    - Consider limitations *(e.g., measurement error, sample selection)* when analyzing and interpreting data.
    - Compare and contrast various types of data sets *(e.g., self-generated, class aggregated, and archival*).
    - Use evidence from the investigation to support an explanation or to make a qualitative or quantitative claim that responds to the research question related to natural processes associated with microhabitats.

Core Ideas

Knowing Science

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

- Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). Biological extinction, being irreversible, is a critical factor in reducing the planet's natural capital. Humans depend on the living world for the resources and other benefits provided by biodiversity.
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students use data from a variety of sources to make sense of the relationships between patterns of local and global distribution of organisms and their potential future effect on Earth's ecosystems.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, theory, or unexpected results. **Planning and Carrying Out Investigations** • Design an investigation individually and collaboratively as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled. • Design and conduct an investigation individually and collaboratively, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. • Select appropriate tools to collect, record, analyze, and evaluate data. • Design and conduct investigations and test design solutions in a safe and ethical manner including considerations of environmental, social, and personal impacts. • Use investigations to gather evidence to support explanations or concepts.	**Patterns** • Mathematical representations are needed to identify some patterns. **Cause and Effect: Mechanism and Prediction** • Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. **Scale, Proportion, and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

HIGH SCHOOL HONORS ADVANCED FIELD SCIENCE

LIFE SCIENCE

BIOGEOGRAPHY

Science Standard: HS.AFS.L2U1.2 Obtain, evaluate, and communicate information about the distribution of organisms around the world based on evidence from Earth's past (geological and biological) and present day.

Learning Goals

I can:

- Obtain information about past and present distribution of organisms around the world, including the Southwest United States' Sky Islands, based on evidence from Earth's past:
    - Ask questions about the distribution patterns of organisms to frame the collection of information.
    - Gather information from a variety of sources (*e.g., scientific texts, investigations, media, data sets, models, etc.*) in response to the investigative questions.
    - Determine the central ideas or conclusions of a complex scientific text.
    - Summarize and paraphrase complex concepts, processes, or information in simpler, but still accurate terms.
- Evaluate information about past and present distribution of organisms based on evidence:
    - Evaluate evidence supporting claims about past and present distribution patterns of organisms *(i.e., mammal, bird, and plant distribution)*.
    - Evaluate evidence supporting current published theories on the distribution of animals *(i.e., diversity of animals, degree of endemism, shared species)* in biogeographical realms around the world.
    - Compare, integrate and evaluate evidence from multiple sources of information presented in different media or formats (e.g., visually, quantitatively) on ecological analogs from multiple biomes around the world.
- Communicate scientific ideas about past and present distribution of organisms around the world, including the Southwest United States' Sky Islands:
    - Explain causes and effects of distribution patterns of mammals, birds, and plants.
    - Explain the relationship between ecological analogs and the distribution of organisms around the world, past and present.
    - Produce scientific/technical writing and/or oral presentations (*e.g., blog post, newspaper column, position paper, Socratic Seminar*) that present evidence of current published theories and research on the global distribution of organisms in biogeographical realms around the world *(i.e., diversity of animals, degree of endemism, shared species)*.
    - Base explanations on valid and reliable empirical evidence from multiple biogeographical patterns of local and global distributions of organisms.
    - Predict changes in the Earth's ecosystems over the next 50 years using scientific evidence on biogeographical distribution patterns of organisms.
    - Revise explanations based on evidence obtained from a variety of sources *(e.g., scientific principles, models, theories, simulations)* and peer review.

Core Ideas

Knowing Science

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

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). Sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth.
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Moreover, anthropogenic changes (induced by human activity) in the environment —including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change —can disrupt an ecosystem and threaten the survival of some species.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students use data from a variety of sources to make sense of the relationships between patterns of local and global distribution of organisms and their potential future effect on Earth's ecosystems.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, theory, or unexpected results. **Obtaining, Evaluating, and Communicating Information** • Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • Synthesize, communicate, and evaluate the validity and reliability of claims, methods, and designs that appear in scientific and technical texts or media reports, verifying the data when possible. • Produce scientific and/or technical writing and/or oral presentations that communicate scientific ideas and/or the process of development and the design and performance of a proposed process or system. • Compare, integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) in order to address a scientific question or solve a problem.	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Cause and Effect: Mechanism and Prediction** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. • Changes in systems may have various causes that may not have equal effects. **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. • Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

HIGH SCHOOL HONORS ADVANCED FIELD SCIENCE

LIFE SCIENCE

ETHNOBIOLOGY

Science Standard: HS.AFS.L2U3.3 Obtain, evaluate, and communicate the positive and negative ethical, social, economic, and political implications of human use of organisms on the biodiversity of the planet.

Learning Goals

I can:

- Obtain information about the positive and negative ethical, social, economic, and political implications of human use of organisms on the biodiversity of the planet:
  - Ask questions about the ethical, social, economic, and political implications of human use of organisms and the effect on biodiversity to frame the collection of information.
  - Gather information and evidence from a variety of sources (*e.g., texts, investigations, media, data sets, models, etc.*) in response to the investigative questions *(including identification of organisms and anatomical parts, and their associated food items; origin or native source of organisms used in food items, historical and current uses of local plants, and ethnological data about local perceptions and knowledge of food)*.
  - Determine the central ideas or conclusions of complex scientific texts and ethnological data.
  - Summarize and paraphrase complex concepts, processes, or information in simpler, but still accurate terms.
- Evaluate information about the positive and negative ethical, social, economic, and political implications of human use of organisms on the biodiversity of the planet:
  - Compare, integrate, and evaluate multiple sources of information presented in different media and formats on the current uses of organisms in cultures around the world (including student generated evidence from ethnological interviews).
  - Evaluate the validity and reliability of evidence supporting claims about the ethical issues and consequences associated with world food production methods and the impact of biodiversity loss and change.
  - Verify data across texts and other informational sources.
- Communicate scientific ideas about the positive and negative ethical, social, economic, and political implications of human use of organisms on the biodiversity of the planet:
  - Present perspectives on current human uses of organisms in cultures around the world and comparative consequences based on food production methods and impact on biodiversity (including food and non-food items from non-Western cultures).
  - Produce technical writing and oral presentations that explain the relationships between scientific ideas of human use of organisms and local perceptions and knowledge of food and its uses.
  - Explain the implications of human use of organisms and world food production methods on biodiversity loss and change around the world.
  - Explain the effects of human consumption of organisms on biodiversity.
  - Describe the historical and current uses of local plants and the implications of human use and production of local plant-based items and biodiversity loss and change.
  - Revise explanations based on evidence obtained from a variety of sources *(e.g., scientific principles, models, theories, simulations)* and peer review.

Core Ideas

Knowing Science

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

- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). Sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth.
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different

ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. Moreover, anthropogenic changes (induced by human activity) in the environment —including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change —can disrupt an ecosystem and threaten the survival of some species.

Using Science

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

- There are multiple ethical, social, economic, and political perspectives on the causes and effects of human activities on biodiversity. Students examine and evaluate these perspectives when weighing the consequences of world food production methods and the impacts of biodiversity loss and change.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, theory, or unexpected results. **Obtaining, Evaluating, and Communicating Information** • Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. • Synthesize, communicate, and evaluate the validity and reliability of claims, methods, and designs that appear in scientific and technical texts or media reports, verifying the data when possible. • Produce scientific and/or technical writing and/or oral presentations that communicate scientific ideas and/or the process of development and the design and performance of a proposed process or system. • Compare, integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) in order to address a scientific question or solve a problem.	**Cause and Effect: Mechanism and Prediction** • Systems can be designed to cause a desired effect. **Stability and Change** • Systems can be designed for greater or lesser stability. **Structure and Function** • Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. **Scale, Proportion, and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.

EARTH & SPACE SCIENCES

HIGH SCHOOL HONORS ADVANCED FIELD SCIENCE
EARTH AND SPACE SCIENCES
GEOSPATIAL TECHNOLOGIES

Science Standard: HS.FS.E1U1.4 Generate and analyze data using geospatial mapping tools and technologies in order to interpret natural phenomena in the context of field research.

Learning Goals

I can:

- Use geospatial tools, technologies, and/or models *(e.g., computational, mathematical)* to generate, analyze, and interpret data on Earth's surface:
  - Ask questions to frame data analysis and interpretation.
  - Interpret digital, multi-layer Geographic Information Systems (GIS) databases *(i.e., elevation and terrain features in Southern Arizona).*
  - Navigate to specific locations using mapping data and tools *(i.e., GIS databases, compasses).*
  - Use Global Positioning Systems (GPS) technologies/tools to collect geospatial data and create Geographic Information Systems (GIS) databases that represent various types of field data in Southern Arizona *(i.e., characteristics of microhabitats, plant distribution in ecosystems).*
  - Compare and contrast data sets to examine consistency of measurements and observations.
  - Triangulate data sources *(i.e., field observations, GPS data, GIS database data)* to evaluate limitations *(e.g., measurement error, sample selection)* when analyzing and interpreting geospatial data.

Core Ideas

Knowing Science

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

- Geospatial mapping technologies and tools contribute to the geographic mapping and analysis of the Earth and human societies. This technology enables us to acquire data that is referenced to the Earth and use it for analysis, modeling, simulations, and visualization. Then informed decisions can be made based on the importance and priority of resources most of which are limited in nature.
- GIS is a mapping tool for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map, such as streets, buildings, and vegetation. GIS can be used to study geologic features, analyze soils and strata, assess seismic information, analyze rock information characteristics, and/or create three-dimensional displays of geographic features.
- Global Positioning Systems (GPS) are used to find the exact location of things. GPS is perhaps the most well-known geospatial technology. It defines the tools, systems, and data that are used to study and understand features, such as geography, weather patterns, sociopolitical movements, geology, and the impact of natural disasters. Modern geospatial technology includes a vast range of tools, software applications, and systems used for analyzing spatial information.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Students use various types of data to make sense of phenomena on Earth's surface. They compare and combine data to identify and interpret patterns.

Science and Engineering Practices	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, theory, or unexpected results. **Analyzing and Interpreting Data** • Use tools, technologies, and/or models (e.g., computational, mathematical) to generate and analyze data in order to make valid and reliable scientific claims or determine an optimal design solution. • Consider limitations (e.g., measurement error, sample selection) when analyzing and interpreting data. • Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Systems and System Models** • Systems can be designed to do specific tasks.

HIGH SCHOOL HONORS ADVANCED FIELD SCIENCE
EARTH AND SPACE SCIENCES

GEOLOGIC TIME

Science Standard: HS.AFS.E1U1.5 Construct a scientific explanation about Earth's geologic and paleontologic history based on theories and evidence from ancient Earth materials and major events (including the geological and paleontological history of southern Arizona).

Learning Goals

I can:

- Apply scientific reasoning, theories, and evidence (*e.g., from models, simulations, data sets, etc.*) to construct and support oral, written, and/or visual explanations about the geological and paleontological history of Earth:
  - Describe how the relative order of events is determined on the geologic time scale (*e.g., patterns of layering in rock strata and relative ages of rocks, specific changes in fossils over time [formation of mountain chains, formation of ocean basins, volcanic eruptions, asteroid impacts, extinction of groups of organisms], major events in Earth's history*).
  - Represent and support explanations of the physical, chemical, and tectonic evolution of Earth and changes on Earth's surface through geologic history.
  - Explain the principles of relative dating and absolute dating used to chart the history of Earth and its organisms through geologic time.
  - Interpret and explain geologic history using rocks, fossils, and geologic mapping tools (*i.e., the probable age and physical origin of field-collected rocks*).
  - Connect evidence to support an explanation for how the geologic time scale uses reasoning and the assumption that theories and laws that describe the natural world, operate today as they did in the past and will continue to do so in the future.

Core Ideas

Knowing Science

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

- Radioactive decay lifetimes and isotopic content in rocks provide a way of dating rock formations and thereby fixing the scale of geological time. Continental rocks, which can be older than 4 billion years, are generally much older than rocks on the ocean floor, which are less than 200 million years old.
- Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust.
- Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.

Using Science

U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

- Geologic time is a complex concept that students examine through various sources. Students will select evidence to construct scientific explanations about Earth's geologic history.

Science and Engineering Practices	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Apply scientific reasoning, theory, and models to link evidence to claims to assess the extent to which the reasoning and data support the explanation or conclusion.	**Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. **Systems and System Models**

• Construct and revise explanations based on evidence obtained from a variety of sources (e.g., scientific principles, models, theories, simulations) and peer review. • Base causal explanations on valid and reliable empirical evidence from multiple sources and the assumption that natural laws operate today as they did in the past and will continue to do so in the future.	• Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Scale Proportion and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. • Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly.