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Strand 1: Inquiry Process

Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, and communicating results.

CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVES
Concept 1: Observations, Questions, and Hypotheses Observe, ask questions, and make predictions.	Goal 3: Inquiry A. Collect and evaluate information related to an investigation. B. Identify relative information to support a hypothesis. C. Demonstrate research skills necessary to support the hypothesis. Goal 4: Critical and Creative Thinking A. Demonstrate effective use of critical and creative thinking in devising hypotheses.	PO 1. Differentiate inferences from observations.
		PO 2. Formulate a relevant question through observations that can be tested by an investigation. (See M04-S2C1-01)
		PO 3. Formulate predictions in the realm of science based on observed cause and effect relationships.
		PO 4. Locate information (e.g., book,

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	<p>devising hypotheses.</p> <p>Goal 5: Communication</p> <p>A. Synthesize knowledge and skills to communicate questions and make hypothesis.</p>	<p>article, website) related to an investigation. (See W-E8-01)</p>
<p>Concept 2: Scientific Testing (Investigating)</p>	<p>Goal 2: Concepts, Themes, and Issues (Aligns with PO3)</p> <p>A. Demonstrate comprehension of a discipline as a system of knowledge.</p>	<p><i>PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.</i></p>

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<p>(Investigating and Modeling) Participate in planning and conducting investigations, and recording data.</p>	<p>B. Analyze the content of a discipline in terms of major concepts, themes, and issues of that discipline.</p> <p>C. Analyze a concept, theme, problem, or issue within and across the disciplines by using the different perspectives of those disciplines.</p> <p>D. Analyze the ethical dimensions of ideas, issues, problems, and themes.</p> <p>Goal 3: Inquiry</p> <p>A. Define central problem or issue.</p> <p>B. Collect, synthesize, and evaluate information from relevant to the issue or problem.</p> <p>C. Design an investigation to address problem or issue.</p> <p>D. Demonstrate appropriate methods and procedures.</p> <p>E. Demonstrate management skills in recording data.</p> <p>F. Apply ethical standards in conducting research.</p> <p>Goal 4: Critical and Creative Thinking</p> <p>A. Demonstrate effective use of critical and creative thinking skills in conducting an investigation.</p>	PO 2. Plan a simple investigation that identifies the variables to be controlled.
		PO 3. Conduct controlled investigations (e.g., related to erosion, plant life cycles, weather, magnetism) in life, physical, and earth and space sciences.
		PO 4. Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary). (See M04-S4C4-03 and M04-S4C4-07)
		PO 5. <i>Record data in an organized and appropriate format (e.g., t-chart, table, list, written log).</i>

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<p>Concept 3: Analysis and Conclusions Organize and analyze data; compare to predictions.</p>	<p>Goal 3: Inquiry</p> <p>A. Collect, synthesize, and evaluate information from a scientific investigation.</p>	<p>PO 1. Analyze data obtained in a scientific investigation to identify trends. (See M04-S2C1-03)</p>
	<p>Goal 4: Critical and Creative thinking</p> <p>A. Demonstrate effective use of critical and creative thinking skills by comparing the data to the hypothesis and formulating a conclusion.</p>	<p>PO 2. Formulate conclusions based upon identified trends in data. (See M04-S2C1-03)</p>
	<p>Goal 5: Communication</p>	<p>PO 3. Determine that data collected is consistent with the formulated question.</p>
	<p>A. Synthesize collected data and communicate ideas, relationships and issues effectively through writing or verbally presenting a conclusion.</p> <p>B. Analyze and evaluate the quality, effectiveness, and substantive content of investigation.</p>	<p>PO 4. Determine whether the data supports the prediction for an investigation. (See M04-S2C2-05)</p>
		<p>PO 5. Develop new questions and predictions based upon the data collected in the investigation.</p>
<p>Concept 4: Communication</p>	<p>Goal 3: Inquiry</p> <p>A. Assess relevant information to be communicated.</p>	<p>PO 1. Communicate verbally or in writing the results of an inquiry. (See W-E6-01)</p>

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Communicate results of investigations.	<p>B. Apply intellectual standards and aesthetic criteria to assess the quality of their research products and presentations.</p> <p>Goal 4: Critical and Creative Thinking</p> <p>A. Demonstrates effective depth of knowledge when communicating results of investigation.</p>	<p>PO 2. Choose an appropriate graphic representation for collected data:</p> <ul style="list-style-type: none"> • bar graph • line graph • Venn diagram • model <p>(See M04-S2C1-02)</p>
	<p>Goal 5: Communication</p> <p>A. Clearly defend solutions, strategies and relationships investigated.</p> <p>B. Analyze and evaluate quality and effectiveness of an investigation.</p>	<p>PO 3. Communicate with other groups or individuals to compare the results of a common investigation.</p>

Strand 2: History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

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<p>Concept 1: History of Science as a Human Endeavor Identify individual and cultural contributions to scientific knowledge.</p>	<p>Goal 2: Concepts and Themes</p> <p style="padding-left: 20px;">A. Analyze a scientific issue or topic in regards to its historical impact.</p>	<p><i>PO 1. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Margaret Mead [anthropologist], supports Strand 4; Nikola Tesla [engineer, inventor] supports Strand 5; Michael Faraday [scientist], supports Strand 5; Benjamin Franklin [scientist], supports Strand 5).</i></p>
	<p>Goal 3: Inquiry</p> <p style="padding-left: 20px;">A. Evaluate how scientists of the past have used science process skills to contribute and influence modern science.</p> <p>Goal 4: Critical and Creative Thinking</p> <p style="padding-left: 20px;">A. Critique scientific investigations from the past and analyze their influence on scientific investigations and science-related career opportunities in the present and future.</p> <p>Goal 5: Communication</p> <p style="padding-left: 20px;">A. Investigate science-related careers via interviews and various forms of communication.</p>	
<p>Concept 2: Nature of Scientific Knowledge</p>	<p>Goal 2: Concepts and Themes</p> <p style="padding-left: 20px;">A. Explain and model the dynamic nature of knowledge and how scientists generate ideas through experimentation.</p>	<p>PO 1. Explain the role of experimentation in scientific inquiry.</p> <p>PO 2. Describe the interaction of components in a system (e.g., flashlight, radio).</p>

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<p>Knowledge Understand how science is a process for generating knowledge.</p>	<p>Goal 3: Inquiry</p> <p style="padding-left: 40px;">A. Critique various scientific ideas and systems related to scientific experimentation.</p> <p>Goal 4: Critical and Creative Thinking</p> <p style="padding-left: 40px;">A. Compare and contrast components of a system. B. Compare and contrast interactions between systems.</p> <p>Goal 5: Communicate</p> <p style="padding-left: 40px;">A. Synthesize and communicate ideas about relationships within and between systems.</p>	<p>PO 3. Explain various ways scientists generate ideas (e.g., observation, experiment, collaboration, theoretical and mathematical models).</p>
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Strand 3: Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the world – as living creatures, consumers, decision makers, problem solvers, managers, and planners.

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<p>Concept 1: Changes in Environments Describe the interactions between human populations, natural hazards, and the environment.</p>	<p>Goal 3: Inquiry</p> <ul style="list-style-type: none"> A. Investigate then compare and contrast various consequences in regards to human interactions with the environment. B. Collect and evaluate information from relevant sources in regards to natural hazards in the environment. <p>Goal 4: Critical and creative thinking</p> <ul style="list-style-type: none"> A. Generate higher level questions about an environmental topic. B. Develop a defensible conclusion based on details relating to an environmental topic. C. Analyze persuasive communications to formulate a point of view based on the environmental topic. <p>Goal 5: Communication</p> <ul style="list-style-type: none"> A. Communicate point of view demonstrating effective depth of knowledge. B. Evaluate and present various points of view in regards to an issue while effectively defending an individual point of view. C. Critique substantive content of the presentations formulate a conclusion. 	<p>PO 1. Describe how natural events and human activities have positive and negative impacts on environments (e.g., fire, floods, pollution, dams).</p>
	<p>PO 2. Evaluate the consequences of environmental occurrences that happen either rapidly (e.g., fire, flood, tornado) or over a long period of time (e.g., drought, melting ice caps, the greenhouse effect, erosion).</p>	
<p>Concept 2: Science and Technology in Society Understand the impact of technology</p>	<p>Goal 3: Inquiry</p> <ul style="list-style-type: none"> A. Investigate then compare and contrast various consequences in regards to technological advancement and the impacts on society. B. Collect and evaluate information from relevant sources in regards to the impact of technology. C. Evaluate technology standards and aesthetic criteria to the quality 	<p>PO 1. Describe how science and technology (e.g., computers, air conditioning, medicine) have improved the lives of many people.</p>
		<p>PO 2. Describe benefits (e.g., easy communications, rapid transportation) and risks (e.g., pollution, destruction of natural resources) related to the use of technology.</p>

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technology.	<p>of human lives.</p> <p>Goal 4: Creative and Critical Thinking</p> <ul style="list-style-type: none"> A. Generate higher level questions about science and technological impacts on society. B. Develop a defensible conclusion based on details relating to a technological advance. C. Use divergent thinking processes in construction of a technological solution. 	<p><i>PO 3. Design and construct a technological solution to a common problem or need using common materials.</i></p>
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Strand 4: Life Science

Life Science expands students' biological understanding of life by focusing on the characteristics of living things, the diversity of life, and how organisms and populations change over time in terms of biological adaptation and genetics. This understanding includes the relationship of structures to their functions and life cycles, interrelationships of matter and energy in living organisms, and the interactions of living organisms with their environment.

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<p>Concept 1: Characteristics of Organisms</p> <p>Understand that basic structures in plants and animals serve a function.</p>	<p>Goal 3: Inquiry</p> <ul style="list-style-type: none"> A. Explore and analyze plant and animal structures. B. Infer the functions of various structures based on observations. C. Collect and evaluate information from relevant sources in relation to animal classification. <p>Goal 4: Critical and Creative Thinking</p> <ul style="list-style-type: none"> A. Evaluate the relationships between form and function and form and function in regards to classification. <p>Goal 5: Communication</p> <ul style="list-style-type: none"> A. Develop and present a classification system based on observations and research. 	<p>PO 1. Compare structures in plants (e.g., roots, stems, leaves, flowers) and animals (e.g., muscles, bones, nerves) that serve different functions in growth and survival.</p>
	<p>PO 2. Classify animals by identifiable group characteristics:</p> <ul style="list-style-type: none"> • vertebrates – mammals, birds, fish, reptiles, amphibians • invertebrates – insects, arachnids 	<p>PO3.C. Classify animals based upon simple physiological differences.</p> <ul style="list-style-type: none"> • locomotion • breathing mechanisms • types of births • survival mechanisms • niches
<p>Concept 3: Organisms and Environments</p> <p>Understand the relationships among various</p>	<p>Goal 3: Inquiry</p> <ul style="list-style-type: none"> A. Investigate then compare and contrast various consequences in regards to the use of various resources. B. Collect and evaluate information from relevant sources in regards to renewable and nonrenewable resources. 	<p>PO 1. Describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of a population.</p>
	<p>PO 2. Differentiate renewable resources from nonrenewable resources.</p>	

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organisms and their environment.	<p>Goal 4: Critical and creative thinking</p> <ul style="list-style-type: none"> A. Generate higher level questions about conservation and or preservation. B. Develop a defensible conclusion based on details relating to conservation and or preservation. C. Analyze persuasive communications to formulate a point of view based on the environmental topic. D. Analyze the importance of environmental issues in regards to life and physical sciences. <p>Goal 5: Communication</p> <ul style="list-style-type: none"> A. Communicate point of view demonstrating effective depth of knowledge. B. Evaluate and present various points of view in regards to an issue while effectively defending an individual point of view. C. Critique substantive content of the presentations formulate a conclusion. 	<p>PO 3. Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.</p>
		<p>PO 4. Describe ways in which resources can be conserved (e.g., by reducing, reusing, recycling, finding substitutes).</p>

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CONCEPT		PERFORMANCE OBJECTIVES
Concept 4: Diversity, Adaptation, and	<p>Goal 3: Inquiry</p> <ul style="list-style-type: none"> A. Explore trends in physical traits of a population over time. 	<p>PO 1. Recognize that successful characteristics of populations are inherited traits that are favorable in a particular environment.</p>

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<p>Adaptation, and Behavior Identify plant and animal adaptations.</p>	<p>B. Analyze observable changes that occur in a population to determine successful traits. C. Determine environmental factors leading to changes in a population's trait.</p> <p>Goal 4: Critical and Creative Thinking</p> <p>A. Evaluate the cause and effect relationship between changes in environmental conditions and plant and animal adaptations.</p> <p>Goal 5: Communication</p> <p>A. Create and present examples of the relationship between diversity, adaptation, and behavior in regards to environmental differences.</p>	<p>PO 2. Give examples of adaptations that allow plants and animals to survive.</p> <ul style="list-style-type: none"> • camouflage – horned lizards, coyotes • mimicry – Monarch and Viceroy butterflies • physical – cactus spines • mutualism – species of acacia that harbor ants, which repel other harmful insects
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Strand 5: Physical Science

Physical Science affords students the opportunity to increase their understanding of the characteristics of objects and materials they encounter daily. Students gain an understanding of the nature of matter and energy, including their forms, the changes they undergo, and their interactions. By studying objects and the forces that act upon them, students develop an understanding of the fundamental laws of motion, knowledge of the various ways energy is stored in a system, and the processes by which energy is transferred between systems and surroundings.

CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVES
<p>Concept 3: Energy and Magnetism Investigate different forms of energy.</p>	<p>Goal 3: Inquiry</p> <p>A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of energy and magnetism. B. Analyze various forms and characteristics of energy and magnetism.</p>	<p>PO 1. Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.</p> <p>PO 2. Construct series and parallel electric circuits.</p>

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	<p>magnetism.</p> <p>Goal 4: Critical and Creative Thinking</p> <p>A. Use effective critical thinking skills and deductive reasoning skills to solve a simple logic problem relating to energy and magnetism.</p> <p>B. Analyze and model the complexities of electrical flow.</p> <p>C. Apply divergent thinking processes to explore societies dependency on production of electrical energy.</p> <p>Goal 5: Communication</p> <p>A. Synthesize knowledge and ideas pertaining to production of electrical energy.</p> <p>B. Communicate a point of view on conserving energy.</p>	<p>PO 3. Explain the purpose of conductors and insulators in various practical applications.</p>
	<p>PO 4. Investigate the characteristics of magnets (e.g., opposite poles attract, like poles repel, the force between two magnet poles depends on the distance between them).</p>	
	<p>PO 5. State cause and effect relationships between magnets and circuitry.</p>	

Strand 6: Earth and Space Science

Earth and Space Science provides the foundation for students to develop an understanding of the Earth, its history, composition, and formative processes, and an understanding of the solar system and the universe. Students study the regularities of the interrelated systems of the natural world. In doing so, they develop understandings of the basic laws, theories, and models that explain the world (NSES, 1995). By studying the Earth from both a historical and current time frame, students can make informed decisions about issues affecting the planet on which they live.

CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVES
<p>Concept 2: Earth's Processes and Systems</p>	<p>Goal 3: Inquiry</p> <p>A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of earth processes</p>	<p>PO 1. Identify the earth processes that cause erosion.</p>
		<p>PO 2. Describe how currents and wind cause erosion and land changes.</p>

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<p>Systems Understand the processes acting on the Earth and their interaction with the earth systems.</p>	<p>investigation of the complexity and abstractness of earth processes that alters the Earth's surface features.</p> <p>B. Analyze various earth events that cause changes to the environment.</p> <p>Goal 4: Critical and Creative Thinking</p>	<p>PO 3. Describe the role that water plays in the following processes that alter the Earth's surface features:</p> <ul style="list-style-type: none"> • erosion • deposition • weathering
	<p>A. Use effective critical thinking skills and deductive reasoning skills to model interactions within earth's systems.</p> <p>D. Analyze the complexities of the interrelationships between interactions within earth's systems.</p> <p>E. Apply divergent thinking processes to explore the effect of changes in the earth's systems.</p>	<p>PO 4.C. Compare rapid and slow processes that change the Earth's surface, including:</p> <ul style="list-style-type: none"> • rapid – earthquakes, volcanoes, floods • slow – wind, weathering
	<p>Goal 5: Communication</p>	<p>PO 5. Identify the earth events that cause changes in atmospheric conditions (e.g., volcanic eruptions, forest fires).</p>
	<p>A. Communicate evidence of environmental factors that changed earth's systems.</p>	<p>PO 6. Analyze evidence that indicates life and environmental conditions have changed (e.g., tree rings, fish fossils in desert regions, ice cores).</p>

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CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVES
Concept 3: Changes in the Earth and Sky Understand characteristics of weather conditions and climate.	Goal 3: Inquiry A. Demonstrate research skills necessary to support the hypothesis. B. Collect, synthesize, and evaluate information from relevant resources relating to weather.	PO 1. Identify the sources of water within an environment (e.g., ground water, surface water, atmospheric water, glaciers).
	Goal 4: Critical and Creative Thinking A. Analyze the relationship between climates and sources of water in the environment in regards to their weather conditions.	PO 2. Describe the distribution of water on the Earth's surface.
	Goal 5: Communication B. Compare various geographical areas in regards to climate, weather and water source.	PO 3. Differentiate between weather and climate as they relate to the southwestern United States.
		PO 4. Measure changes in weather (e.g., precipitation, wind speed, barometric pressure).
		PO 5. C. Collect and evaluate measurements for various weather conditions and identify relative information to support a weather prediction.

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		<p>PO 6. Interpret the symbols on a weather map or chart to identify the following:</p> <ul style="list-style-type: none">• temperatures• fronts• precipitation <p>(See 3SS-E1)</p>
		<p>PO 7. Compare weather conditions in various locations (e.g., regions of Arizona, various U.S. cities, coastal vs. interior geographical regions).</p>