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 OBJECTIVE
Concept 1: Observations, Questions, and Hypotheses Observe, ask questions, and make predictions.	Goal 3: Inquiry A. Identify a topic and formulate complex questions for investigation. B. Identify and formulate a problem for investigation and analyze the problem for areas to be researched. C. Demonstrate research skills necessary to support the hypothesis or prediction. D. Construct hypothesis or prediction and design experiments to test them. Goal 4: Critical and Creative Thinking A. Demonstrate effective use of critical and creative thinking in devising hypotheses or prediction. Goal 5: Communication A. Synthesize knowledge and skills to communicate questions and make hypothesis or predictions.	PO 1. Formulate relevant questions about the properties of objects, organisms, and events of the environment using observations and prior knowledge. (See M03-S2C1-01) PO 2. Predict the results of an investigation based on observed patterns, not random guessing.
Concept 2: Scientific Testing (Investigating and Modeling) Participate in planning and	Goal 2: Concepts, Themes, and Issues (Aligns with PO3) A. Demonstrate comprehension of a discipline as a system of knowledge.	*PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use of instruments, materials, organisms) in all science inquiry.*

conducting investigations, and recording data.	*B.* Analyze the content of a discipline in terms of major concepts, themes, and issues of that discipline. *C.* Analyze a concept, theme, problem, or issue within and across the disciplines by using the different perspectives of those disciplines. *D.* Analyze the ethical dimensions of ideas, issues, problems, and themes. Goal 3: Inquiry A. Define central problem or issue. B. Collect and evaluate information from relevant sources to the issue or problem. C. Design an investigation to address problem or issue. D. Demonstrate appropriate methods and procedures. E. Demonstrate management skills in recording data. F. Apply ethical standards in conducting research. Goal 4: Critical and Creative Thinking A. Demonstrate effective use of critical and creative thinking skills in conducting an investigation.	*PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use of instruments, materials, organisms) in all science inquiry.* PO 2. Plan a simple investigation (e.g., one plant receives adequate water, one receives too much water, and one receives too little water) based on the formulated questions. PO 3. Conduct simple investigations (e.g., related to plant life cycles, changing the pitch of a sound, properties of rocks) in life, physical, and earth and space sciences. PO 4. Use metric and U.S. customary units to measure objects. (See M03-S4C4-04) PO 5. Record data in an organized and appropriate format (e.g., t-chart, table, list, written log). (See W-F4-01)

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CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 3: Analysis and Conclusions Organize and analyze data; compare to predictions.	Goal 3: Inquiry A. Collect, synthesize, and evaluate information from a scientific investigation. Goal 4: Critical and Creative thinking A. Demonstrate effective use of critical and creative thinking skills by comparing the data to the hypothesis and formulating a conclusion. Goal 5: Communication A. Synthesize collected data and communicate ideas, relationships and issues effectively through writing or verbally presenting a conclusion. B. Analyze and evaluate the quality, effectiveness, and substantive content of investigation.	PO 1. Organize data using the following methods with appropriate labels: • bar graphs • pictographs • tally charts (See M03-S2C1-02)
		PO 2. Construct reasonable interpretations of the collected data based on formulated questions. (See M03-S2C1-03)
		PO 3. Compare the results of the investigation to predictions made prior to the investigation. *(See M03-S2C2-05)*
		PO 4. Generate questions for possible future investigations based on the conclusions of the investigation.
		PO 5. Record questions for further inquiry based on the conclusions of the investigation.

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CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 4: Communication Communicate results of investigations.	Goal 3: Inquiry A. Assess relevant information to be communicated. B. Apply intellectual standards and aesthetic criteria to assess the quality of their research products and presentations. Goal 4: Critical and Creative Thinking A. Demonstrates effective depth of knowledge when communicating results of investigation. Goal 5: Communication A. Clearly defend solutions, strategies and relationships investigated.	PO 1. Communicate investigations and explanations using evidence and appropriate terminology. (See W-F5-01) PO 2. Describe an investigation in ways that enable others to repeat it. (See LS-F1) *PO 3. Communicate with other groups to describe the results of an investigation.* *(See LS-E1)*

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.

CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 1: History of Science as a Human Endeavor Identify individual and cultural contributions to scientific knowledge.	Goal 2: Concepts and Themes A. Analyze a scientific issue or topic in regards to its historical impact. Goal 3: Inquiry A. Evaluate how scientists of the past have used science process skills to contribute and influence modern science. Goal 4: Critical and Creative Thinking A. Critique scientific investigations from the past and analyze their influence on scientific investigations and science-related career opportunities in the present and future. Goal 5: Communication A. Investigate science-related careers via interviews and various forms of communication.	*PO 1. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., John Muir [naturalist], supports Strand 4; Thomas Edison [inventor], supports Strand 5; Mae Jemison [engineer, physician, astronaut], supports Strand 6,; Edmund Halley [scientist], supports Strand 6).* PO 2. Describe science-related career opportunities.

Concept 2: Nature of Scientific Knowledge Understand how science is a process for generating knowledge.	Goal 2: Concepts and Themes A. Explain and model the dynamic nature of knowledge and how scientists generate ideas through experimentation. Goal 3: Inquiry A. Critique various scientific ideas and systems related to scientific experimentation. Goal 4: Critical and Creative Thinking A. Compare and contrast components of a system. B. Compare and contrast interactions between systems. Goal 5: Communicate A. Synthesize and communicate ideas about relationships within and between systems.	PO 1. Describe how, in a system (e.g., terrarium, house) with many components, the components usually influence one another. PO 2. Explain why a system may not work if a component is defective or missing.

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.

CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 1: Changes in Environments Describe the interactions between human populations, natural hazards, and the environment.	Goal 3: Inquiry 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. Goal 4: Critical and creative thinking 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. Goal 5: Communication 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.	PO 1. Describe the major factors that could impact a human population (e.g., famine, drought, disease, improved transportation, medical breakthroughs). PO 2. Describe the beneficial and harmful impacts of natural events and human activities on the environment (e.g., forest fires, flooding, pesticides).

Concept 2: Science and Technology in Society Understand the impact of technology.	Goal 3: Inquiry 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 of human lives. Goal 4: Creative and Critical Thinking 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.	PO 1. Identify ways that people use tools and techniques to solve problems. PO 2. Describe the development of different technologies (e.g., communication, entertainment, transportation, medicine) in response to resources, needs, and values. PO 3. Design and construct a technological solution to a common problem or need using common materials.

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.

CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 1: Characteristics of Organisms Understand that basic structures in plants and animals serve a function.	Goal 3: Inquiry 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. Goal 4: Critical and Creative Thinking A. Evaluate the relationships between form and function and form and function in regards to classification. Goal 5: Communication A. Develop and present a classification system based on observations and research.	PO 1. Describe the function of the following plant structures: • roots – absorb nutrients • stems – provide support • leaves – synthesize food • flowers – attract pollinators and produce seeds for reproduction
Concept 2: Life Cycles Understand the life cycles of plants and animals.	Goal 3: Inquiry A. Explore and analyze life cycles of plants and animals.	PO 1. Compare life cycles of various plants (e.g., conifers, flowering plants, ferns).

	D. Infer the functions of the life cycle based on observations. E. Collect and evaluate information from relevant sources in relation to life cycles. Goal 4: Critical and Creative Thinking B. Evaluate the relationships between growth, death, and decay to the life cycle and the environment. Goal 5: Communication B. Develop and present a classification system based on observations and research.	PO 2. Explain how growth, death, and decay are part of the plant life cycle.
Concept 3: Organisms and Environments Understand the relationships among various organisms and their environment.	Goal 3: Inquiry A. Investigate then compare and contrast living and nonliving components of an ecosystem. B. Collect and evaluate information from relevant sources in regards to microscopic and macroscopic organisms. Goal 4: Critical and creative thinking A. Generate higher level questions about the interrelationships among plants and animals in different environments. B. Develop a defensible conclusion based on details relating to various organisms and their environment. C. Analyze persuasive communications to formulate a point of view based on the environmental topic. F. Analyze the importance of environmental issues in regards to life and physical sciences.	PO 1. Identify the living and nonliving components of an ecosystem. PO 2. Examine an ecosystem to identify microscopic and macroscopic organisms. PO 3. Explain the interrelationships among plants and animals in different environments: • producers – plants • consumers – animals • decomposers – fungi, insects, bacteria PO 4. Describe how plants and animals cause change in their environment.

	Goal 5: Communication 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.	PO 5. Describe how environmental factors (e.g., soil composition, range of temperature, quantity and quality of light or water) in the ecosystem may affect a member organism's ability to grow, reproduce, and thrive.

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CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 4: Diversity, Adaptation, and Behavior Identify plant and animal adaptations.	Goal 3: Inquiry A. Explore trends in physical traits of a population over time. B. Analyze observable changes that occur in a population to determine successful traits. C. Determine environmental factors leading to changes in a populations traits which can lead to extinction. Goal 4: Critical and Creative Thinking A. Evaluate the cause and effect relationship between changes in environmental conditions and plant and animal adaptations. Goal 5: Communication A. Create and present examples of the relationship between diversity, adaptation, and behavior in regards to environmental differences.	PO 1. Identify adaptations of plants and animals that allow them to live in specific environments. PO 2. Describe ways that species adapt when introduced into new environments. PO 3. Cite examples of how a species' inability to adapt to changing conditions in the ecosystem led to the extinction of that species.

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 OBJECTIVE
Concept 3: Energy and Magnetism Investigate different forms of energy.	Goal 3: Inquiry A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of different forms of energy. B. Analyze various forms and characteristics of energy. Goal 4: Critical and Creative Thinking A. Use effective critical thinking skills and deductive reasoning skills to solve a simple logic problem relating to energy. B. Analyze and model the complexities of light and sound behavior. C. Apply divergent thinking processes to explore societies dependency on light and sound. Goal 5: Communication A. Synthesize knowledge and ideas pertaining the behavior of light and sound.	PO 1. Demonstrate that light can be: • reflected (with mirrors) • refracted (with prisms) • absorbed (by dark surfaces) PO 2. Describe how light behaves on striking objects that are: • transparent (clear plastic) • translucent (waxed paper) • opaque (cardboard) PO 3. Demonstrate that vibrating objects produce sound. PO 4. Demonstrate that the pitch of a sound depends on the rate of the vibration (e.g., a long rubber band has a lower pitch than a short rubber band).

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 OBJECTIVE
Concept 1: Properties of Earth Materials Identify the basic properties of earth materials.	Goal 3: Inquiry A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of the basic properties of earth materials. B. Analyze various earth layers, rock formation and their physical properties, the fossil record, and how fossils formed. Goal 4: Critical and Creative Thinking A. Use effective critical thinking skills and deductive reasoning skills to model interactions with earth's properties and materials. D. Analyze the complexities of the interrelationships between interactions with earth's properties and materials. E. Apply divergent thinking processes to explore the effect of changes in earth's properties and materials. Goal 5: Communication A. Communicate evidence of environmental factors and human uses that changed earth's properties and materials.	PO 1. Identify the layers of the Earth: • crust • mantle • core (inner and outer) PO 2. Describe the different types of rocks and how they are formed: • metamorphic • igneous • sedimentary PO 3. Classify rocks based on the following physical properties: • color • texture PO 4. Describe fossils as a record of past life forms. PO 5. Describe how fossils are formed.

		PO 6. Describe ways humans use earth materials (e.g., fuel, building materials, growing food).