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 CONCEPT	PERFORMANCE OBJECTIVE
Concept 1: Observations, Questions, and Hypotheses Formulate predictions, questions, or hypotheses based on observations. Locate appropriate resources.	Goal 3: Inquiry A. Collect, synthesize and evaluate information related to an investigation. B. Identify relative information to support a hypothesis. C. Demonstrate research skills necessary to support the hypothesis. D. Formulate a hypothesis. Goal 4: Critical and Creative Thinking A. Demonstrate effective use of critical and creative thinking in devising hypotheses. Goal 5: Communication A. Synthesize knowledge and skills to communicate questions and make hypothesis and predictions.	PO 1. Formulate questions based on observations that lead to the development of a hypothesis. (See M07-S2C1-01) PO 2. Select appropriate resources for background information related to a question, for use in the design of a controlled investigation. (See W-E8-01) PO 3. Explain the role of a hypothesis in a scientific inquiry.

Concept 2: Scientific Testing (Investigating and Modeling) Design and conduct controlled investigations.	Goal 3: Inquiry A. Define central problem or issue. B. Collect, synthesize, 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 and care of technology, materials, organisms) in all science inquiry.* *PO 2. Design an investigation to test individual variables using scientific processes.* PO 3. Conduct a controlled investigation, utilizing multiple trials, to test a hypothesis using scientific processes. *PO 4. Perform measurements using appropriate scientific tools (e.g., balances, microscopes, probes, micrometers).* *PO 5. Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs.*

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CONCEPT	CATS CONCEPT	PERFORMANCE OBJECTIVE
Concept 3: Analysis and Conclusions Analyze and interpret data to explain correlations and results; formulate new questions.	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. Analyze data obtained in a scientific investigation to identify trends. (See M07-S2C1-08)* PO 2. Form a logical argument about a correlation between variables or sequence of events (e.g., construct a cause-and-effect chain that explains a sequence of events). PO 3. Analyze results of data collection in order to accept or reject the hypothesis. PO 4. Determine validity and reliability of results of an investigation. PO 5. Formulate a conclusion based on data analysis. PO 6. Refine hypotheses based on results from investigations. PO 7. Formulate new questions based on the results of a previous investigation.

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CONCEPT	CATS CONCEPT	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. C. Sythesize and analyze data gathered and patterns identified to draw conclusions and present findings in appropriate graphic representations without bias and distortion as a means of communication. Goal 4: Critical and Creative Thinking A. Demonstrates effective depth of knowledge when communicating results of investigation. B. Assess the effectiveness of a specified form of argument when communicating results. C. Construct an appropriate form of argument when creating persuasive communication. Goal 5: Communication A. Clearly defend solutions, strategies and relationships investigated. B. Analyze and evaluate quality and effectiveness of an investigation.	PO 1. *Choose an appropriate graphic representation for collected data:* • *line graph* • *double bar graph* • *stem and leaf plot* • *histogram* *(See M07-S2C1-03)* *PO 2. Display data collected from a controlled investigation.* (See M07-S2C1-03) *PO 3. Communicate the results of an investigation with appropriate use of qualitative and quantitative information.* PO 4. Write clear, step-by-step instructions for following procedures (without the use of personal pronouns). PO 5. Communicate the results and conclusion of the investigation.

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 CONCEPT	PERFORMANCE OBJECTIVE
Concept 1: History of Science as a Human Endeavor Identify individual, cultural, and technological 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. B. Investigate then compare and contrast various consequences in regards to technological advancement and the impacts on scientific knowledge. C. Collect and evaluate information from relevant sources in regards to the impact of technology. D. Evaluate technology standards and aesthetic criteria to the quality of human lives. Goal 4: Critical and Creative Thinking A. Critique scientific investigations from the past and	PO 1. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Rachel Carson [scientist], supports Strand 4; Luis Alvarez [scientist] and Walter Alvarez [scientist], support Strand 6; Percival Lowell [scientist], supports Strand 6; Copernicus [scientist], supports Strand 6). PO 2. Describe how a major milestone in science or technology has revolutionized the thinking of the time (e.g., global positioning system, telescopes, seismographs, photography). PO 3. Analyze the impact of a major scientific development occurring within the past decade.

	analyze their influence on scientific investigations and science-related technology in the present and future. B. Generate higher level questions about science and technological impacts on society. C. Develop a defensible conclusion based on details relating to a technological advance. D. Use divergent thinking processes in construction of a technological solution. Goal 5: Communication A. Investigate science-related technology contributions and their effects on cultural, individual, and scientific knowledge. B. Investigate science-related careers and the use of technology via interviews and various forms of communication.	PO 4. Analyze the use of technology in science-related careers.

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CONCEPT	CATS CONCEPT	PERFORMANCE OBJECTIVE
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. B. Analyze how scientific knowledge and ideas change as technological advancements change. Goal 3: Inquiry A. Critique various scientific ideas and systems related to scientific experimentation. B. Select and apply an appropriate methodology for researching a given topoc, problem, or issue. Goal 4: Critical and Creative Thinking A. Analyze various past experiments, theories and ideas by describing their influence on present/future experiments, theories and ideas. Goal 5: Communicate A. Synthesize and communicate ideas about relationships with past, present, and future theories, ideas and experiments.	*PO 1. Describe how science is an ongoing process that changes in response to new information and discoveries.* *PO 2. Describe how scientific knowledge is subject to change as new information and/or technology challenges prevailing theories.* *PO 3. Apply the following scientific processes to other problem solving or decision making situations:* • *observing* • *questioning* • *communicating* • *comparing* • *measuring* • *classifying* • *predicting* • *organizing data* • *inferring* • *generating hypotheses* • *identifying variables*

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 CONCEPT	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 natural hazards in the environment and their effects on human populations. B. Collect and evaluate information from relevant sources in regards to natural hazards in the environment and their effects on human populations. 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. Analyze environmental risks (e.g., pollution, destruction of habitat) caused by human interaction with biological or geological systems. PO 2. Analyze environmental benefits of the following human interactions with biological or geological systems: • reforestation • habitat restoration • construction of dams PO 3. Propose possible solutions to address the environmental risks in biological or geological systems. *PO 1. Propose viable methods of responding to an identified need or problem.*

Concept 2: Science and Technology in Society Develop viable solutions to a need or problem.	Goal 3: Inquiry A. Investigate then compare and contrast various consequences in regards to a problem or technological discovery. B. Collect, synthesize and evaluate information related to an investigation. C. Apply case study and comparative study techniques to research an appropriate topic, problem or technological discovery.	*PO 2. Compare solutions to best address an identified need or problem.*
		PO 3. Design and construct a solution to an identified need or problem using simple classroom materials.
	Goal 4: Critical and Creative Thinking A. Demonstrate effective use of critical and creative thinking in devising hypotheses. B. Generate higher level questions about science and technological impacts on society. C. Develop a defensible conclusion based on details relating to aproblem or technological advance. D. Use divergent thinking processes in construction of a problem or technological solution. Goal 5: Communication B. Synthesize knowledge and skills to communicate questions and make hypothesis and predictions.	PO 4. Describe a scientific discovery that influences technology.

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 CONCEPT	PERFORMANCE OBJECTIVE
Concept 1: Structure of the Earth Describe the composition and interactions between the structure of the Earth and its atmosphere.	Goal 3: Inquiry A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of the composition and interaction between the structure of earth and its atmosphere. B. Analyze the composition, properties, and structure of earth and its atmosphere. Goal 4: Critical and Creative Thinking A. Use effective critical thinking skills and deductive reasoning skills to model interactions between the structure of earth and it's atmosphere. B. Analyze the complexities of the interrelationships between interactions within earth's systems. C. Apply divergent thinking processes to explore the effect of changes in the earth's systems that can explain the rock and fossil record.	PO 1. Classify rocks and minerals by the following observable properties: • grain • color • texture • hardness PO 2. Describe the properties and the composition of the following major layers of the Earth: • crust • mantle • core PO 3. Explain the following processes involved in the formation of the Earth's structure: • erosion • deposition • plate tectonics • volcanism

	Goal 5: Communication A. Communicate evidence of environmental factors and human impact that changed earth's composition and interaction between earth and its atmosphere. B. Apply evidence of environmental factors and human impacts that have changed earth's composition and atmosphere to the rock and fossil record.	PO 4. Describe how the rock and fossil record show that environmental conditions have changed over geologic and recent time.

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CONCEPT	CATS CONCEPT	PERFORMANCE OBJECTIVE
Concept 2: Earth's Processes and Systems Understand the processes acting on the Earth and their interaction with the earth systems.	Goal 3: Inquiry A. Demonstrate research skills necessary to support the hypothesis. B. Collect, synthesize, and evaluate information from relevant resources relating to processes acting on earth to their interaction with earth systems and earth's physical features. Goal 4: Critical and Creative Thinking A. Analyze the relationship between processes acting on earth to the interaction of earth systems and earth's physical features in the environment. Goal 5: Communication C. Compare various geographical areas in regards to physical features on earth.	PO 1. Explain the rock cycle. PO 2. Distinguish the components and characteristics of the rock cycle for the following types of rocks: • igneous • metamorphic • sedimentary PO 3. Analyze the evidence that lithospheric plate movements occur. PO 4. Explain lithospheric plate movement as a result of convection. PO 5. Relate plate boundary movements to their resulting landforms, including: • mountains • faults • rift valleys • trenches • volcanoes PO 6. Describe how earthquakes are measured.

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CONCEPT	CATS CONCEPT	PERFORMANCE OBJECTIVE
Concept 3: Earth in the Solar System Understand the relationships of the Earth and other objects in the solar system.	Goal 3: Inquiry A. Collect, synthesize, and evaluate information from relevant resources relating the relationships of earth and other objects in the solar system. B. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of the positions of solar objects and earth. Goal 4: Critical and Creative Thinking	PO 1. Explain the phases of the Moon in terms of the relative positions of the Earth, Sun, and Moon. PO 2. Construct a model for the relative positions of the Earth, Sun, and Moon as they relate to corresponding eclipses. PO 3. Explain the interrelationship between the Earth's tides and the Moon. PO 4. Explain the seasons in the Northern and Southern Hemispheres in terms of the tilt of the Earth's axis relative to the Earth's revolution around the Sun.

	A. Analyze the position of earth in relation to the sun and moon positions. B. Use effective critical thinking skills and deductive reasoning skills to model interactions between the sun, moon and earth. C. Analyze the complexities of the interrelationships between interactions within sun, moon and earth. D. Apply divergent thinking processes to explore the effect of changes in the sky due to the position of earth and other solar objects. Goal 5: Communication D. Produce models to demonstrate understanding the relationships of the Earth and other objects in the solar system.	PO 5. Identify the following major constellations visible (seasonally) from the Northern Hemisphere: • Orion • Ursa Major (Great Bear) • Cygnus • Scorpius • Cassiopeia

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 CONCEPT	PERFORMANCE OBJECTIVE
Concept 3: Populations of Organisms in an Ecosystem Analyze the relationships among various organisms and their environment.	Goal 3: Inquiry A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness between environmental conditions and various organisms. B. Analyze various characteristics of environmental conditions and organism interactions. Goal 4: Critical and Creative Thinking A. Use effective critical thinking skills and deductive reasoning skills to model changes in environmental conditions and the affects on various organisms. B. Analyze and model the complexities of various organisms and their environment. Goal 5: Communication A. Synthesize knowledge pertaining various organisms and their environment.	PO 1. Compare food chains in a specified ecosystem and their corresponding food web. PO 2. Explain how organisms obtain and use resources to develop and thrive in: • niches • predator/prey relationships PO 3. Analyze the interactions of living organisms with their ecosystems: • limiting factors • carrying capacity PO 4. Evaluate data related to problems associated with population growth (e.g., overgrazing, forest management, invasion of non-native species) and the possible solutions. PO 5. Predict how environmental factors (e.g., floods, droughts, temperature changes) affect survival rates in living organisms. PO 6. Create a model of the interactions of living organisms within an ecosystem.