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 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 M08-S2C1-01)* PO 2. Use appropriate research information, not limited to a single source, to use in the development of a testable hypothesis. (See R08-S3C2-03 and W-E8-01) PO 3. Generate a hypothesis that can be tested.

<table>
<tr>
<td rowspan="7">Concept 2: Scientific Testing (Investigating and Modeling)
Design and conduct controlled investigations.</td>
<td rowspan="7">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.</td>
<td>PO 1. Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.</td>
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<tr>
<td>PO 2. Design a controlled investigation to support or reject a hypothesis.</td>
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<tr>
<td>PO 3. Conduct a controlled investigation to support or reject a hypothesis.</td>
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<tr>
<td>PO 4. Perform measurements using appropriate scientific tools (e.g., balances, microscopes, probes, micrometers).</td>
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<tr>
<td>PO 5. Keep a record of observations, notes, sketches, questions, and ideas using tools such as written and/or computer logs.</td>
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</table>

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CONCEPT	CATS CONCEPTS	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 M08-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. Interpret data that show a variety of possible relationships between two variables, including: • positive relationship • negative relationship • no relationship PO 4. Formulate a future investigation based on the data collected. PO 5. Explain how evidence supports the validity and reliability of a conclusion.

		PO 6. Identify the potential investigational error that may occur (e.g., flawed investigational design, inaccurate measurement, computational errors, unethical reporting).
		PO 7. Critique scientific reports from periodicals, television, or other media.
		PO 8. Formulate new questions based on the results of a previous 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. 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	PO 1. Communicate the results of an investigation. *PO 2. Choose an appropriate graphic representation for collected data:* • *line graph* • *double bar graph* • *stem and leaf plot* • *histogram* *(See M08-S2C1-03)*

	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 3. Present analyses and conclusions in clear, concise formats. (See W-E6-PO1)
		PO 4. Write clear, step-by-step instructions for conducting investigations or operating equipment (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 CONCEPTS	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 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.	*PO 1. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Watson and Crick [scientists], support Strand 4; Rosalind Franklin [scientist], supports Strand 4; Charles Darwin [scientist], supports Strand 4; George Washington Carver [scientist, inventor], supports Strand 4;* ***Joseph Priestley [scientist], supports Strand 5; Sir Frances Bacon [philosopher], supports Strand 5****; Isaac Newton [scientist], supports Strand 5).* PO 2. Evaluate the effects of the following major scientific milestones on society: • Mendelian Genetics • Newton's Laws PO 3. Evaluate the impact of a major scientific development occurring within the past decade.

	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. Evaluate career opportunities related to life and physical sciences.

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CONCEPT	CATS CONCEPTS	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. 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* *PO 2. Describe how scientific knowledge is subject to change as new information and/or technology challenges prevailing theories* PO 3. Defend the principle that accurate record keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society. PO 4. Explain why scientific claims may be questionable if based on very small samples of data, biased samples, or samples for which there was no control.

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 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 the risk factors associated with natural, human induced, and/or biological hazards, including: • waste disposal of industrial chemicals • greenhouse gases PO 2. Analyze possible solutions to address the environmental risks associated with chemicals and biological systems.

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. 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 a problem 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 1. Propose viable methods of responding to an identified need or problem. 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. PO 4. Compare risks and benefits of the following technological advances: • radiation treatments • genetic engineering (See Strand 4 Concept 2) • **airbags (See Strand 5 Concept 2)**

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 2: Reproduction and Heredity Understand the basic principles of heredity.	Goal 3: Inquiry A. Explore and analyze structure and functions of organism cells and the principles of heredity. B. Infer the form and functions of various cell structures and parts based on observations. C. Collect and evaluate information from relevant sources in relation to structure and functions in living systems to heredity. Goal 4: Critical and Creative Thinking A. Evaluate the relationships between form and function. B. Select an appropriate organizational pattern to show differences between dominant and recessive traits in humans. Goal 5: Communication A. Develop and present a classification system based on observations and research.	PO 1. Explain the purposes of cell division: • growth and repair • reproduction PO 2. Explain the basic principles of heredity using the human examples of: • eye color • widow's peak • blood type PO 3. Distinguish between the nature of dominant and recessive traits in humans.

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CONCEPT	CATS CONCEPTS	PERFORMANCE OBJECTIVE
Concept 4: Diversity, Adaptation, and Behavior Identify structural and behavioral adaptations.	Goal 3: Inquiry A. Explore structural and behavioral adaptations. B. Analyze observable changes that occur in a population to determine survival in an environment. C. Determine external environmental factors leading to changes in an organisms internal environment. Goal 4: Critical and Creative Thinking A. Evaluate the cause and effect relationship between changes in environmental to diversity, adaptation and behavior among organisms. Goal 5: Communication A. Create and present examples of the relationship between diversity, adaptation, and behavior in regards to environmental differences.	PO 1. Explain how an organism's behavior allows it to survive in an environment PO 2. Describe how an organism can maintain a stable internal environment while living in a constantly changing external environment. PO 3. Determine characteristics of organisms that could change over several generations. PO 4. Compare the symbiotic and competitive relationships in organisms within an ecosystem (e.g., lichen, mistletoe/tree, clownfish/sea anemone, native/non-native species). PO 5. Analyze the following behavioral cycles of organisms: • hibernation • migration • dormancy (plants)

		PO 6. Describe the following factors that allow for the survival of living organisms: • protective coloration • beak design • seed dispersal • pollination

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	PERFORMANCE OBJECTIVE	MATERIALS	ASSESSMENT
Concept 1: Properties and Changes of Properties in Matter Understand physical and chemical properties of matter.	Goal 3: Inquiry A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of properties and changes of properties in matter. B. Analyze various characteristics and differences between physical and chemical properties. Goal 4: Critical and Creative Thinking A. Use effective critical thinking skills and deductive reasoning skills to model changes of matter. B. Analyze and model the complexities matter. Goal 5: Communication A. Synthesize knowledge pertaining to physical and chemical properties of matter.	PO 1. Identify different kinds of matter based on the following physical properties: • states • density • boiling point • melting point • solubility PO 2. Identify different kinds of matter based on the following chemical properties: • reactivity • pH • oxidation (corrosion) PO 3. Identify the following types of evidence that a chemical reaction has occurred: • formation of a precipitate • generation of gas • color change • absorption or release of heat PO 4. Classify matter in terms of elements, compounds, or mixtures. PO 5. Classify mixtures as being homogeneous or heterogeneous.	

		PO 6. Explain the systematic organization of the periodic table.
		PO 7. Investigate how the transfer of energy can affect the physical and chemical properties of matter.

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CONCEPT	PERFORMANCE OBJECTIVE	
Concept 2: Motion and Forces Understand the relationship between force and motion.	Goal 3: Inquiry A. Develop a model that demonstrates an in depth inquiry investigation of the complexity and abstractness of motion and forces. B. Analyze various relationships between force and motion. Goal 4: Critical and Creative Thinking A. Use effective critical thinking skills and deductive reasoning skills to model the relationship and theories between force and motion. B. Analyze and model the complexities of force and motion. C. Apply divergent thinking processes to explore theories and laws of force and motion. Goal 5: Communication A. Synthesize knowledge and ideas pertaining to force and motion.	PO 1. Demonstrate velocity as the rate of change of position over time. PO 2. Identify the conditions under which an object will continue in its state of motion (Newton's 1st Law of Motion). PO 3. Describe how the acceleration of a body is dependent on its mass and the net applied force (Newton's 2nd Law of Motion). PO 4. Describe forces as interactions between bodies (Newton's 3rd Law of Motion). PO 5. Create a graph devised from measurements of moving objects and their interactions, including: • position-time graphs • velocity-time graphs