Treasure Coast Science Scope and Sequence 2012-2013

Course: Earth/Space Science **Course Code: 2001310** **Quarter: 1A**

Topic(s) of Study: Approaches to Science

Bodies of Knowledge: Nature of Science

Standard(s): 1: The Practice of Science, 2: The Characteristics of Scientific Knowledge, 3: The Roles of Theories, Laws, Hypotheses and Models,

Essential Questions: How do scientists design an investigation to answer a scientific question and communicate their findings? Why is scientific argumentation necessary in scientific inquiry and what role does in play in the generation and validation of scientific knowledge?

Concept Map(s): Click here
Resources: Click here
Syllabus: Click here
CCSS Literacy Standards: Click here

NGSSS	OUTLINE OF CONTENT (CONCEPT/SKILLS)	TARGETS
SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: Cognitive Complexity: High 1. pose questions about the natural world, 2. conduct systematic observations, 3. examine books and other sources of information to see what is already known, 4. review what is known in light of empirical evidence, 5. plan investigations, 6. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),	I What is science? A. Science is the study of the natural world around us 1. Pure Science 2. Pseudoscience a. Astrology b. Phrenology 3. Answers questions that deal with the natural world unlike religion, art, and philosophy 4. Provides an empirically-based perspective to inform society's decision making B. Scientists come from all walks of life and they explore questions that arise in a variety of ways: 1. Observation a. Can lead to inference which can be studied b. Examples: 2. Empirical Evidence 3. Systematic Investigations	• Define a scientific problem or question based on the specific body of knowledge correlated to the Earth/Space Science course. (I,VI) • Explain the difference between an experiment and other types of scientific investigations. (I, VI) • Recognize systematic inference as one form of scientific investigation. (I) • Use appropriate reference materials to support scientific investigations of various types, such as systematic observation or experiments. (I, VI) • Describe the creative means scientists must use to design an investigation. (I) • Explain that science is based on evidence based facts. (I) • Differentiate between science and pseudoscience. (I) • Develop a hypothesis with one independent variable (tested variable). (I) • Distinguish between dependent variables (outcome variable), independent variables (tested variable), controls, and variables that are held constant in a variety of activities. (I, VI) • Develop hypotheses and determine what data should be collected to test

7. pose answers, explanations, or descriptions of events,
8. generate explanations that explicate or describe natural phenomena (inferences),
9. use appropriate evidence and reasoning to justify these explanations to others,
10. communicate results of scientific investigations, and
11. evaluate the merits of the explanations produced by others.

SC.912.N.1.2 Describe and explain what characterizes science and its methods. Cognitive Complexity: Moderate

SC.912.N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. Cognitive Complexity: Low

SC.912.N.1.4 Identify sources of information and assess their reliability according to the strict standards of scientific investigation. Cognitive Complexity: High

SC.912.N.1.5 Describe and provide examples of how similar

a. Field investigation
   i. Descriptive
   ii. Comparative
   iii. Correlative
b. Controlled Investigations

4. Experimentation
5. Inquiry
6. Research
   a. Quantitative
   b. Qualitative
7. Lab equipment/ tools and chemicals
   a. Lab safety
   b. MSDS sheets

C. Scientists finding are presented as
   1. Theories
   2. Laws
   3. Models
      a. Visual/Physical
      b. Conceptual
      c. Mathematical
      d. Benefits
      e. Limitations
   4. Must be replicable by other scientists around the world

D. Scientists communicate their findings with the scientific community
   1. Debate
   2. Confirmation

E. Research background information on topic
   1. Address reliable research materials
   2. Address how to cite sources

the hypothesis.(I, VI)

- Determine tools and methods that should be used to collect valid data. (I, VI)
- Determine how data will be collected to analyze the data. (I, VI)
- Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment. (I, VI)
- Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following: bar graphs, line graphs, scatter plots, cumulative frequency graphs. (I, VI)
- Calculate and determine the % error of the data. (I, VI)
- Explain why scientific investigations should be replicable. (I. VI)
- Conduct, discuss, and compare similar investigations by working cooperatively in groups. (I, VI)
- Collect and organize data in charts, tables, and graphics. (I, VI)
- Present individual or group data after a scientific investigation, analyze the evidence, and reach a class consensus.(I, VI)
- Justify conclusions based upon all the available evidence, not on expressed opinions. (I, VI)
- Distinguish the difference between a scientific law and theory vs. a societal law. (I, VI)
- Describe the role consensus plays in the historical development of a theory in Earth/Space Science. (I,)
- Give examples of how advances in technology have affected scientific theories and laws. (I, III, IV)
- Describe the effects of technology on environmental quality. (I)
- Explain why models are used in science to observe processes that happen too

investigations conducted in many parts of the world result in the same outcome. Cognitive Complexity: Moderate

SC.912.N.1.6 Describe how scientific inferences are drawn from scientific observations and provide examples from the content bein g studied Cognitive Complexity: Moderate

SC.912.N.1.7 Recognize the role of creativity in constructing scientific questions, methods and explanations. Cognitive Complexity: Low

SC.912.N.2.1 Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science). Cognitive Complexity: High

SC.912.N.2.2 Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion. Cognitive Complexity: High

SC.912.N.2.3 Identify examples of pseudoscience (such as astrology, phrenology) in society. Cognitive Complexity: Low

SC.912.N.2.4 Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can

accurately
3. Address Plagiarism

F. Scientific knowledge is open to change
1. It is reexamined with rigor
2. Becomes stronger with each examination
3. Becomes more durable through experimentation

II Scientists background can
A. Influence their inferences based on data
B. Strengthen current lines of thinking through debate and argumentation
C. Generate new testable ideas

III Theory
A. Culmination of many investigations
B. Draws together the current evidence on a particular phenomenon
C. Represents the most powerful explanation scientists have to offer.
D. Will never become laws of science
E. Well supported **explanation**

IV Laws
A. Descriptions of particular relationships under specific conditions in nature
B. Are not derived from

slowly, too quickly, or are too small or vast for direct observation. (I, VI)
- Give examples of visual/physical, mathematical, and conceptual models as used in science. (I, VI)
- Describe the limitations and misconceptions perceived by models.
- Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals. (II)
- Identify reliable sources of information and assess their reliability according to the strict standards of scientific investigation while conducting research. (II)
- Recognize, identify and know how to safely and accurately use lab equipment.(I)
- Identify the safety equipment in the science lab/classroom (safety shower, fire extinguisher, fire blanket, hood, eye wash, first aid kit, gloves, sharps container, MSDS sheets). (I)
- Identify protective clothing worn in the lab: safety goggles, aprons, gloves. (I)
- Recognize that different types of wastes are disposed of in specific ways. (I)
- Recognize the importance of the lab safety contract and explain why parent and student signatures are required. (I)
- Distinguish science from other activities involving thought. (I)
- Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered. (I)
- Distinguish between a scientific theory and a general claim. (III)
- Distinguish between laws and theories by understanding that laws describe *the what* and theories explain *the why*. (III, IV)

change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability. Cognitive Complexity: High

SC.912.N.1.7 Recognize the role of creativity in constructing scientific questions, methods and explanations. Cognitive Complexity: Low

SC.912.N.3.1 Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer. Cognitive Complexity: High

SC.912.N.3.2 Describe the role consensus plays in the historical development of a theory in any one of the disciplines of science. Cognitive Complexity: Moderate

SC.912.N.3.3 Explain that scientific laws are descriptions of specific relationships under given conditions in nature, but do not offer explanations for those relationships. Cognitive Complexity: Moderate

SC.912.N.3.4 Recognize that theories do not become laws, nor do laws become theories; theories are well supported theories

C. Do not offer explanations for these relationships
D. Well supported **descriptions**

V Costs and benefits of alternative strategies for problem solving
A. Human
B. Economic
C. Environmental

VI Experimental Design
A. Ask a question
B. Plan investigation
   1. Identify independent variable (**test variable**)
   2. Determine the dependent variable (**outcome variable**)
   3. Identify constants
   4. Ensure you have a control group
C. Research background information on topic
   1. Address appropriate research materials
   2. Address how to cite sources accurately
   3. Address plagiarism
D. Collect and record data
   1. Graphs
   2. Charts
   3. Visual representations
E. Share findings
   1. Draw conclusions using data
   2. Uses repeated trials
   3. Discuss, compare and

- Compare and contrast the terms that describe examples of scientific knowledge such as: theory, law, hypothesis, and model. (III, IV)
- Give examples of how advances in technology have affected scientific theories and laws. (III, IV)
- Distinguish the difference between a scientific law and theory vs. a societal law. (III, IV)
- Describe the role consensus plays in the historical development of a theory in Earth/Space Science. (III, IV)
- Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making. (V)

explanations and laws are well supported descriptions. Cognitive Complexity: Moderate SC.912.N.3.5 Describe the function of models in science, and identify the wide range of models used in science. Cognitive Complexity: Moderate SC.912.N.4.1 Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making. Cognitive Complexity: Moderate MA.912.S.1.2 Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment. Cognitive Complexity: Moderate MA.912.S.3.2 Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following: • bar graphs • line graphs • stem and leaf plots • circle graphs • histograms • box and whisker plots • scatter plots • cumulative frequency (ogive) graphs Cognitive Complexity: High	negotiate methods used, results obtained, and explanations among groups of students conducting the same investigation. 4. Ask new questions and develop new investigations A. TEACHER NOTE: Refer to ISEF (International Science and Engineering Fair) forms on resource page.	

Treasure Coast Science Scope and Sequence 2012-2013

Course: Earth Space Science **Course Code: 2001310** **Quarter: 1B**

Topic(s) of Study: Atomic Structure and Bonding

Bodies of Knowledge: Physical Science, Nature of Science

Standard(s): 5: Earth in Space and Time, 8: Matter, 10: Energy

Essential Questions: How has the understanding of matter and the structure of the atom improved our quality of life? Why should we learn to use the periodic table as a tool, instead of memorizing it? How has the advancement of nuclear reaction foundational information affected our daily lives? How do scientists design an investigation to answer a scientific question and communicate their findings?

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NGSSS	OUTLINE OF CONTENT (CONCEPT/SKILLS)	TARGETS
SC.912.P.8.1 Differentiate among the four states of matter. Cognitive Complexity: Moderate SC.912.P.8.4 Explore the scientific theory of atoms (also known as atomic theory) by describing the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom. Cognitive Complexity: High SC.912.P.10.4 Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter. Cognitive Complexity: High SC.912.P.10.10 Compare the magnitude and range of the four fundamental forces (gravitational, electromagnetic, weak nuclear, strong nuclear). Cognitive Complexity: Moderate	I States of Matter A. Solid B. Liquid C. Gas D. Plasma II Structure of atoms A. Protons 1. Mass 2. Electrical Charge 3. Location B. Neutrons 1. Mass 2. Electrical Charge 3. Location C. Electrons 1. Mass 2. Electrical Charge 3. Location III Transfer of thermal energy A. Conduction B. Convection C. Radiation IV Four Fundamental Forces A. Gravitational 1. Magnitude 2. Range	• Compare and contrast the four states of matter and the energy associated with each. (I) • Distinguish between the subatomic particles(II) • Describe the role of atomic number in determining the identity of an atom(II) • Define an isotope and explain why atomic masses are not whole numbers(II) • Describe the organization of elements on the periodic table(II) • Differentiate how the Law of Conservation of Energy relates to an open, closed and isolated system.(III) • Recognize and identify how energy is transferred by convection(III) • Recognize and identify how energy is transferred by conduction(III) • Recognize and identify how energy is transferred by radiation(III) • Compare and contrast the transfer of thermal energy by conduction, convection, and radiation.(III) • Describe the four fundamental forces.(IV) • Compare and contrast the magnitude and range of the four

SC.912.P.10.11 Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues. Cognitive Complexity: High SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following: Cognitive Complexity: High 12. pose questions about the natural world, 13. conduct systematic observations, 14. examine books and other sources of information to see what is already known, 15. review what is known in light of empirical evidence, 16. plan investigations, 17. use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), 18. pose answers, explanations, or descriptions of events, 19. generate explanations that explicate or describe natural phenomena	B. Electromagnetic 1. Magnitude 2. Range C. Weak Nuclear 1. Magnitude 2. Range D. Strong Nuclear 1. Magnitude 2. Range V. Energy associated with A. Nuclear reactions 1. Radioactive Decay 2. Fission 3. Fusion	fundamental forces(IV) • Describe how the Law of Conservation of energy describes specific relationships under given conditions in nature, but does not off an explanation for the relationship.(V) ***Objectives below are from Quarter 1A and should be embedded in this topic of study.*** • Define a scientific problem or question based on the specific body of knowledge correlated to the Earth/Space Science course. • Explain the difference between an experiment and other types of scientific investigations • Define a scientific problem or question based on the specific body of knowledge correlated to the Earth/Space Science course. • Explain the difference between an experiment and other types of scientific investigations • Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered. • Describe the role consensus plays in the historical development of a theory in Earth/Space Science. • Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.

(inferences), 20. use appropriate evidence and reasoning to justify these explanations to others, 21. communicate results of scientific investigations, and 22. evaluate the merits of the explanations produced by others. SC.912.N.1.3 Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. Cognitive Complexity: Low SC.912.N.1.6 Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied Cognitive Complexity: Moderate SC.912.N.2.4 Explain that scientific knowledge is both durable and robust and open to change. Scientific knowledge can change because it is often examined and re-examined by new investigations and scientific argumentation. Because of these frequent examinations, scientific knowledge becomes stronger, leading to its durability. Cognitive Complexity: High SC.912.N.3.5 Describe the		

function of models in science, and identify the wide range of models used in science. Cognitive Complexity: Moderate SC.912.N.4.1 Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making. Cognitive Complexity: Moderate MA.912.S.1.2 Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment. Cognitive Complexity: Moderate MA.912.S.3.2 Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following: • bar graphs • line graphs • stem and leaf plots • circle graphs • histograms • box and whisker plots • scatter plots • cumulative frequency (ogive) graphs Cognitive Complexity: High		