Forensic Science 1 (#2002480)

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Course Standards

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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: 1. **Pose questions about the natural world,** (Articulate the purpose of the investigation and identify the relevant scientific concepts). 2. **Conduct systematic observations,** (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines). 3. **Examine books and other sources of information to see what is already known,** 4. **Review what is known in light of empirical evidence,** (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models). 5. **Plan investigations,** (Design and evaluate a scientific investigation). 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),** (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage). 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. **Clarifications:** Science is characterized by empirical observations, testable questions, formation of hypotheses, and experimentation that results in stable and replicable results, logical reasoning, and coherent theoretical constructs. Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of 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. **Clarifications:** Assess the reliability of data and identify reasons for inconsistent results, such as sources of error or uncontrolled conditions. Florida Standards Connections: MAFS.K12.MP.2: Reason abstractly and quantitatively; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others
SC.912.N.1.4:	Identify sources of information and assess their reliability according to the strict standards of scientific investigation. **Clarifications:** Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories. Strict standards of science include controlled variables, sufficient sample size, replication of results, empirical and measurable evidence, and the concept of falsification. Florida Standards Connections: LAFS.910.RST.1.1 / LAFS.1112.RST.1.1.
SC.912.N.1.6:	Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied. **Clarifications:** Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data. Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.
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). **Clarifications:** Science is the systematic and organized inquiry that is derived from observations and experimentation that can be verified or tested by further investigation to explain natural phenomena (e.g. Science is testable, pseudo-science is not; science seeks falsifications, pseudo-science seeks confirmations.)
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. **Clarifications:** Recognize that ideas with the most durable explanatory power become established theories, but scientific explanations are continually subjected to change in the face of new evidence.

	Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.
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. **Clarifications:** Explain that a scientific theory is a well-tested hypothesis supported by a preponderance of empirical evidence. Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them; and, MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.
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. **Clarifications:** Recognize that scientific argument, disagreement, discourse, and discussion create a broader and more accurate understanding of natural processes and events. Florida Standards Connections: MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others.
SC.912.N.3.5:	Describe the function of models in science, and identify the wide range of models used in science. **Clarifications:** Describe how models are used by scientists to explain observations of nature. Florida Standards Connections: MAFS.K12.MP.4: Model with mathematics.
SC.912.N.4.1:	Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making. **Clarifications:** Recognize that no single universal step-by-step scientific method captures the complexity of doing science. A number of shared values and perspectives characterize a scientific approach. MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.
SC.912.N.4.2:	Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental. **Clarifications:** Identify examples of technologies, objects, and processes that have been modified to advance society, and explain why and how they were modified. Discuss ethics in scientific research to advance society (e.g. global climate change, historical development of medicine and medical practices). Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them, and MAFS.K12.MP.2: Reason abstractly and quantitatively.

SC.912.E.5.8:	Connect the concepts of radiation and the electromagnetic spectrum to the use of historical and newly-developed observational tools. **Clarifications:** Describe how frequency is related to the characteristics of electromagnetic radiation and recognize how spectroscopy is used to detect and interpret information from electromagnetic radiation sources.
SC.912.L.14.1:	Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science. **Clarifications:** Describe how continuous investigations and/or new scientific information influenced the development of the cell theory. Recognize the contributions of scientists in the development of the cell theory.
SC.912.L.14.2:	Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).
SC.912.L.14.4:	Compare and contrast structure and function of various types of microscopes.
SC.912.L.14.6:	Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.
SC.912.L.14.11:	Classify and state the defining characteristics of epithelial tissue, connective tissue, muscle tissue, and nervous tissue.
SC.912.L.14.12:	Describe the anatomy and histology of bone tissue.
SC.912.L.14.34:	Describe the composition and physiology of blood, including that of the plasma and the formed elements.
SC.912.L.14.35:	Describe the steps in hemostasis, including the mechanism of coagulation. Include the basis for blood typing and transfusion reactions.
SC.912.L.14.51:	Describe the function of the vertebrate integumentary system.
SC.912.L.15.15:	Describe how mutation and genetic recombination increase genetic variation.
SC.912.L.16.2:	Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.
SC.912.L.16.9:	Explain how and why the genetic code is universal and is common to almost all organisms.
SC.912.L.16.10:	Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues. **Clarifications:** Annually assessed on Biology EOC.
SC.912.L.16.11:	Discuss the technologies associated with forensic medicine and DNA identification, including restriction fragment length polymorphism (RFLP) analysis.
SC.912.L.16.12:	Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).
SC.912.L.17.1:	Discuss the characteristics of populations, such as number of individuals, age structure, density, and pattern of distribution.

	Clarifications: Florida Standards Connections: MAFS.K12.MP.7: Look for and make use of structure.
SC.912.L.18.1:	Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules. **Clarifications:** Annually assessed on Biology EOC. Also assesses SC.912.L.18.11.
SC.912.P.8.1:	Differentiate among the four states of matter. **Clarifications:** Differentiate among the four states of matter (solid, liquid, gas and plasma) in terms of energy, particle motion, and phase transitions. (Note: Currently five states of matter have been identified.)
SC.912.P.8.2:	Differentiate between physical and chemical properties and physical and chemical changes of matter. **Clarifications:** Discuss volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing, melting and boiling points. Describe simple laboratory techniques that can be used to separate homogeneous and heterogeneous mixtures (e.g. filtration, distillation, chromatography, evaporation).
SC.912.P.8.7:	Interpret formula representations of molecules and compounds in terms of composition and structure. **Clarifications:** Write chemical formulas for simple covalent (HCl, SO2, CO2, and CH4), ionic (Na+ + Cl- +NaCl) and molecular (O2, H2O) compounds. Predict the formulas of ionic compounds based on the number of valence electrons and the charges on the ions.
SC.912.P.8.11:	Relate acidity and basicity to hydronium and hydroxyl ion concentration and pH. **Clarifications:** Use experimental data to illustrate and explain the pH scale to characterize acid and base solutions. Compare and contrast the strengths of various common acids and bases.
SC.912.P.8.12:	Describe the properties of the carbon atom that make the diversity of carbon compounds possible. **Clarifications:** Explain how the bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.
SC.912.P.10.1:	Differentiate among the various forms of energy and recognize that they can be transformed from one form to others. **Clarifications:**

	Differentiate between kinetic and potential energy. Recognize that energy cannot be created or destroyed, only transformed. Identify examples of transformation of energy: Heat to light in incandescent electric light bulbs; Light to heat in laser drills; Electrical to sound in radios; Sound to electrical in microphones; Electrical to chemical in battery rechargers; Chemical to electrical in dry cells; Mechanical to electrical in generators [power plants]; Nuclear to heat in nuclear reactors; Gravitational potential energy of a falling object is converted to kinetic energy then to heat and sound energy when the object hits the ground.
SC.912.P.10.18:	Explore the theory of electromagnetism by comparing and contrasting the different parts of the electromagnetic spectrum in terms of wavelength, frequency, and energy, and relate them to phenomena and applications. **Clarifications:** Describe the electromagnetic spectrum (i.e., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays and gamma rays) in terms of frequency, wavelength and energy. Solve problems involving wavelength, frequency, and energy.
SC.912.P.10.20:	Describe the measurable properties of waves and explain the relationships among them and how these properties change when the wave moves from one medium to another. **Clarifications:** Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period, reflection and refraction) and explain the relationships among them. Recognize that the source of all waves is a vibration and waves carry energy from one place to another. Distinguish between transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves). Describe sound as a longitudinal wave whose speed depends on the properties of the medium in which it propagates.
SC.912.P.10.21:	Qualitatively describe the shift in frequency in sound or electromagnetic waves due to the relative motion of a source or a receiver. **Clarifications:** Describe the apparent change in frequency of waves due to the motion of a source or a receiver (the Doppler effect).
SC.912.P.12.1:	Distinguish between scalar and vector quantities and assess which should be used to describe an event. **Clarifications:** Distinguish between vector quantities (e.g., displacement, velocity, acceleration, force, and linear momentum) and scalar quantities (e.g., distance, speed, energy, mass, work). MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors.
SC.912.P.12.2:	Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time. **Clarifications:** Solve problems involving distance, velocity, speed, and acceleration. Create and interpret graphs of 1-dimensional motion, such as position versus time, distance versus time, speed versus time, velocity versus time, and acceleration versus time where acceleration is constant.

	Florida Standards Connections: MAFS.912.N-VM.1.3 (+) Solve problems involving velocity and other quantities that can be represented by vectors.
SC.912.P.12.3:	Interpret and apply Newton's three laws of motion. **Clarifications:** Explain that when the net force on an object is zero, no acceleration occurs; thus, a moving object continues to move at a constant speed in the same direction, or, if at rest, it remains at rest (Newton's first law). Explain that when a net force is applied to an object its motion will change, or accelerate (according to Newton's second law, F = ma). Predict and explain how when one object exerts a force on a second object, the second object always exerts a force of equal magnitude but of opposite direction and force back on the first: F1 on 2 = -F1 on 1 (Newton's third law).
SC.912.P.12.5:	Apply the law of conservation of linear momentum to interactions, such as collisions between objects. **Clarifications:** (e.g. elastic and completely inelastic collisions).
SC.912.P.12.7:	Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving. **Clarifications:** Recognize that regardless of the speed of an observer or source, *in a vacuum* the speed of light is always *c*.
SC.912.P.12.9:	Recognize that time, length, and energy depend on the frame of reference. **Clarifications:** The energy *E* and the momentum *p* depend on the frame of reference in which they are measured (e.g. Lorentz contraction).
SC.912.P.12.12:	Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction. **Clarifications:** Various factors could include: temperature, pressure, solvent and/or solute concentration, sterics, surface area, and catalysts. The rate of reaction is determined by the activation energy, and the pathway of the reaction can be shorter in the presence of enzymes or catalysts. Examples may include: decomposition of hydrogen peroxide using manganese (IV) oxide; nitration of benzene using concentrated sulfuric acid; hydrogenation of a C=C double bond using nickel.