COMPONENT	OBJECTIVES	COMPETENCY
I Science Skills and Attitudes, Applications, and Contexts of the Physical Sciences	1. Use careful observations and exploratory activities to identify variables and to develop problem statements. **(SC.H.1.4.0)** 2. Distinguish among descriptive (laboratory and field observations), comparative (comparing two experiments with one common manipulated variable), and experimental (controlled experiment) investigation designs commonly used in the physical sciences. **(SC.H.1.4.1) (SC.H.3.4.1)** 3. Write hypotheses leading to different types of experimental designs for selected problem statements using variables identified as manipulated (independent) and responding (dependent). **(SC.H.1.4.0)** 4. Routinely analyze experiments in terms of: problem statement, hypothesis, manipulated and responding variables, quantification of variables, identification of variables held constant, the number of tests and trials, and the use of an experimental control. **(SC.H.2.4.2)** 5. Based upon an appropriate number of experimental trials and samples, systematically collect and organize data into tables or charts and properly distinguish among the types of qualitative (nominal and ordinal) and quantitative (interval and ratio) data analyzed. **(SC.H.1.4.0)** 6. Interpret experimental data by reordering and/or plotting graphs and then describing the central tendency of the data by the appropriate use of the mean, median, and/or mode and the variation of the data by the appropriate use of the range and/or the frequency distribution. **(SC.H.1.4.0)** 7. Write conclusions that cover the following seven points: state what was investigated; describe whether or not the hypothesis was supported by the results; include sample results; compare the results with other investigations; provide possible explanations about the results; recommend additional studies; and discuss possible applications. **(SC.H.1.4.3)**	A. Apply science investigation skills to design and carry out appropriate types of experiments and to analyze the data collected to form conclusions on physical science topics using established laboratory and safety procedures.

COMPONENT	OBJECTIVES	COMPETENCY
	8. Analyze conclusions by classifying each sentence as a statement based upon either: an observation, the result of information gathered through the senses; an inference, the explanation or interpretation of observations; a fact, the activities performed during the investigation; or an opinion, inferences not directly supported by observations. **(SC.H.1.4.7)** 9. Identify the parts, functions, proper care, and use of appropriate scientific equipment, e.g., balances, and demonstrate accurate metric measurement by reading common laboratory apparatus to the nearest unit of measure and describing the uncertainty of these measures. **(SC.H.1.4.0)** 10. Select attire (aprons, eye protection, containment of hair, clothes) to ensure personal protection and practice accepted safety procedures using appropriate science equipment for all science activities. **(SC.H.1.4.0)** 11. Identify appropriate safety procedures for typical laboratory emergencies such as broken glass, chemical spills, chemical splashes on the skin or in the eye, and the prevention of fires. **(SC.H.1.4.0)** 1. Determine that results are tentative, are subject to different interpretations, and should be replicable by other experimenters. **(SC.H.1.4.3)** 2. Describe how discoveries made by physical scientists can have both beneficial and detrimental affects on the quality of human life. **(SC.H.3.4.3)** 3. Identify how technology and conservation have affected the rate of consumption of our common natural renewable and nonrenewable resources. **(SC.H.3.4.6)**	B. Apply physical science knowledge, principles and skills to clarify and make decisions involving critical social issues.

COMPONENT	OBJECTIVES	COMPETENCY
	4. Explore research and career opportunities in the physical sciences. **(SC.H.3.4.4)** 5. Identify and describe the scientific contributions of physical science researchers from various ethnic and cultural backgrounds and recognize the importance of the continuous development and sharing of scientific information. **(SC.H.1.4.5)**	
II Physical and Chemical Properties of Matter	1. Use laboratory activities to identify and describe the physical properties of common solids and liquids including boiling point, melting point, solubility, conductivity, and density. **(SC.A.1.4.0) (SC.A.1.4.2)** 2. Investigate boiling point elevation and freezing point depression as it relates to common solutions such as antifreeze and salt water and ice. **(SC.A.1.4.3)** 3. Based upon laboratory activities, define a chemical property as the ability to undergo chemical change such as burning or corrosion. **(SC.A.1.4.1)** 4. Use the Kinetic Theory to explain how substances can exist as solids, liquids or gases. 5. In laboratory activities, demonstrate the differences between mixtures and compounds by using physical properties to separate mixtures, e.g., separate salt and water by evaporation or distillation. **(SC.A.1.4.3)** 6. Using laboratory activities, investigate the variables (particle size and temperature) that affect the solubility of a solute in a solvent as they relate to saturated and unsaturated solutions. **(SC.A.2.4.2)**	A. In a laboratory, use physical and chemical properties to differentiate among elements, mixtures, and compounds.

COMPONENT	OBJECTIVES	COMPETENCY
	7 Demonstrate the relationships among ionic or covalent properties, organic and inorganic compounds, and their conductivity in solutions and then classify them as electrolytes or nonelectrolytes. **(SC.A.1.4.5)**	
III The Atomic Theory of Matter	1. Classify common elements as metals, non-metals, and metalloids, based upon their location on the Periodic Table. **(SC.A.2.4.5)** 2. Classify elements into groups based on their outer shell electron configuration and the periodicity of selected properties. **(SC.A.2.4.5)** 3. Use the atomic number, atomic mass, and the Bohr atomic model to derive the number of protons, neutrons, electrons, and valence electrons and identify their locations in an atom for common elements and selected isotopes. **(SC.A.2.4.0) (SC.A.2.4.1)**	A. Using the Periodic Table, categorize elements into metals, non-metals, or metalloids and identify the common outer shell configuration within each group.
	1. Define a radioactive isotope. List several examples of radioactive isotopes and some typical uses. **(SC.A.2.4.3)** 2. Describe common methods of detecting and measuring radioactivity. **(SC.A.2.4.3)** 3. Describe the four natural forces (electromagnetic force, gravitational force, strong nuclear force and weak nuclear force) and their interactions in atomic and subatomic structure. **(SC.A.1.4.2) (SC.C.2.4.3) (SC.C.2.4.4)** 4. Distinguish between a nuclear fission and fusion reaction. **(SC.C.A.2.4.4) (SC.B.2.4.0)** 5. Describe at least three applications of nuclear reactions, e.g., nuclear medicine, nuclear energy, and nuclear weapons. **(SC.A.2.4.4)**	B. Analyze a typical use of a radioactive isotope and explain how the isotope is produced, detected, and measured for that application.

COMPONENT	OBJECTIVES	COMPETENCY
IV Chemical Reactions of Matter	1. Use the valence shell model of the atom to describe the role of electrons in covalent, ionic, and metallic bonding in terms of different ways of attaining a stable octet configuration. **(SC.A.1.4.1) (SC.A.1.4.5)** 2. Determine the type and number of bonds for simple compounds by applying a set of rules regarding valence electrons and the attainment of a stable octet. **(SC.A.1.4.5)** 3. Name and write formulas of binary compounds that result when elements of group 1(IA) (Na, K) and 2(IIA) (Mg, Ca) react with elements in group 16(VIA) (O, S) or 17(VIIA) (Cl, Br, I). **(SC.A.2.4.5)** 4. Identify common polyatomic ions such as; ammonium (NH_4^{+1}), hydroxide (OH^-), nitrate (NO_3^{-1}), bicarbonate (HCO_3^{-1}), carbonate (CO_3^{-2}), sulfate (SO_4^{-2}), and phosphate (PO_4^{-3}), in common compounds. **(SC.A.2.4.2)** 5. Use a diagram to explain how water molecules are polar and describe how the polarity of water molecules produces bonds between other molecules and therefore contributes to special characteristics, such as solvent activity or high boiling point. **(SC.A.1.4.2)**	A. Based upon laboratory experience, the concept of ionic and covalent bonding, the valence shell model of the atom, and the periodic table, write the formulas of common binary compounds.
	1. Identify the products and the reactants for given equations and classify the specific reaction as composition, decomposition, single replacement or double replacement. **(SC.A.1.4.4)** 2. Use ball-and-stick models to build reactant molecules and simulate a chemical reaction by rearranging the atoms to construct the molecules of the product, making sure that no atoms are lost, nor do any suddenly appear. **(SC.B.1.4.2)**	B. Based upon laboratory experience, use the formulas of common binary compounds and the principle of conservation of mass to balance simple composition and single replacement reactions.

COMPONENT	OBJECTIVES	COMPETENCY
	3. Balance simple composition and single replacement equations using the principle of conservation of mass. **(SC.B.1.4.2)**	
	1. Based on experimentation, relate the temperature changes to the energy changes in an endothermic reaction, e.g., NH_4Cl dissolved in water, and an exothermic reaction, e.g., $CaCl_2$ dissolved in water. **(SC.B.1.4.2) (SC.B.1.4.3)** 2. By measuring pH, identify neutralization reactions between an acid and a base, e.g., dilute HCl plus dilute NaOH or NH_4OH and CH_3COOH. **(SC.A.1.4.5)** 3. Explain how the burning of fossil fuels such as coal contributes to the production of acid rain (H_2SO_4 and HNO_3) and describe several possible effects of acid rain. **(SC.G.2.4.5) (SC.G.2.4.6)**	C. Analyze experimental pH data of an incomplete neutralization reaction, describe the reactants and products, and determine which reactant should be increased to produce a neutral solution.
V Motion and Forces	1. Differentiate between speed, velocity, and acceleration. **(SC.C.1.4.2)** 2. Based on laboratory activities using a timing device, e.g., a dot timer, graph and calculate the speed of a moving object. **(SC.C.1.4.0)** 3. Using examples from the everyday world, identify and describe different types of motion as linear, projectile (trajectory), simple harmonic (pendular), or orbital. **(SC.C.1.4.0)** 4. Use Newton's three laws of motion to explain common situations in terms of balanced and unbalanced forces. **(SC.C.2.4.0) (SC.C.2.4.6)**	A. Based upon laboratory experience, use Newton's Laws of Motion to explain the relationship between drag force and terminal velocity.

COMPONENT	OBJECTIVES	COMPETENCY
	5. Describe friction as a force that opposes motion in everyday situations including atmospheric effects on falling objects. **(SC.C.2.4.0)** 6. Design and conduct experiments to study factors that influence friction. **(SC.H.1.4.1)** 7. Distinguish between weight and mass. **(SC.C.2.4.1)**	
VI Relationships Among Work, Kinetic Energy, Thermal Energy, and Matter	1. Describe the forms of energy, how they are produced, and how they are used, e.g., mechanical, electrical, heat, light, chemical, sound, and nuclear energy. **(SC.B.1.4.7) (SC.B.2.4.0)** 2. Investigate how and where transitions between potential and kinetic energy occur, e.g., gravitational, elastic, and magnetic forces. **(SC.B.2.4.0)** 3. Using laboratory activities, investigate energy transformations from one form to another, e.g., chemical to electrical to thermal, kinetic to potential to kinetic, mechanical to thermal to mechanical. **(SC.B.1.4.0)** 4. In laboratory situations, investigate the ways in which simple machines change the amount of the force, the direction of the force, and the distance the force moves. **(SC.C.2.4.0)** 5. List common applications of the six simple machines. **(SC.C.2.4.0)** 6. Using laboratory experiences, calculate the work done and power used to lift common objects. **(SC.C.2.4.0)**	A. Design and carryout experiments to investigate the transformation among kinetic energy, potential energy, thermal energy, and work in situations such as an oscillating mass on a rubber band.

COMPONENT	OBJECTIVES	COMPETENCY
	1. Compare three methods of heat transfer in solids, liquids, and gases (conduction, convection, and radiation). **(SC.B.1.4.6)** 2. Using laboratory experiences, plot temperature versus time graphs for the phase changes of water and describe the energy goes during the phase change. **(SC.B.1.4.3)** 3. Investigate the relationship among temperature and volume, and pressure and volume, for gases and use these observations to confirm Charles' Law and Boyle's Law. **(SC.B.1.4.3)** 4. Describe the relationship between the greenhouse effect and global warming. **(SC.G.2.4.6)** 5. Use a simple calorimeter to measure the heat of fusion of water. **(SC.A.1.4.3)**	B. Describe how thermal changes in gases or in phase changes can do mechanical work.
VII Wave Behaviors in Matter	1. Investigate the common features of waves, frequency, wavelength, amplitude, and energy. **(SC.A.2.4.6)** 2. Name the component parts of the electromagnetic spectrum including radio/TV waves, microwaves, infra-red, visible light, ultra-violet, and X-rays. **(SC.B.1.4.4)** 3. Describe how different sources produce light, e.g., incandescent, fluorescent, and laser. **(SC.B.1.4.4)** 4. Explain colors of opaque, translucent, or transparent objects in terms of absorption, transmitance, and/or reflection of light energy. **(SC.A.2.4.6)**	A. Describe how wavelengths of light and pitches of sound carry energy from a source to a detector.

COMPONENT	OBJECTIVES	COMPETENCY
	5. List and contrast the primary and complementary colors of light with color pigments. **(SC.A.2.4.6)** 6. Describe the relationship between frequency and pitch and the relationship between amplitude and loudness. **(SC.A.2.4.6)**	
	1. Based on ripple-tank demonstrations, illustrate common wave behaviors such as, reflection, diffraction, and interference. **(SC.A.2.4.6)** 2. In laboratory activities, demonstrate the principles of reflection and refraction of light, and measure the angles of incidence and reflection. **(SC.A.2.4.6)** 3. Observe interference of light using a diffraction grating. **(SC.A.2.4.6)** 4. Explain how sound is produced and transmitted. **(SC.A.2.4.6)** 5. Describe uses of concave and convex mirrors and lenses in common optical equipments. **(SC.A.2.4.6)**	B. In laboratory activities, investigate the behavior of water, sound, and light waves, e.g., refraction and interference, and develop theories to explain these behaviors.
VIII Electricity and Magnetism	1. Based upon laboratory experiences, explain the differences between static and current electricity. **(SC.B.1.4.4) (SC.C.2.4.2)** 2. Construct a simple circuit that includes batteries, resistors (bulbs), an ammeter in series and a voltmeter connected across the resistors to investigate the relationship between electric current, voltage, and resistance, by plotting different sets of data on a graph of current versus voltage. **(SC.C.2.4.2)**	A. Design and complete activities using ammeters and voltmeters to quantitatively investigate Ohm's law and electric power in simple resistive circuits consisting of batteries and bulbs.

COMPONENT	OBJECTIVES	COMPETENCY
	3. Use Ohm's Law to calculate the voltage drop across a resistor. **(SC.C.2.4.2)** 4. Calculate the electric power consumed by a simple resistive circuit. **(SC.C.2.4.2)** 5. Using laboratory experiences, construct, diagram, and compare the advantages and disadvantages of simple series and parallel circuits. **(SC.C.2.4.2)** 6. Diagram the structure of a battery (electric cell) and show the flow of electrons. **(SC.C.2.4.2)** 7. Using laboratory experiences demonstrate how electric currents are used to produce heat and light. **(SC.B.1.4.0)** 8. Relate watts, amps, volts, and kilowatt hours to energy use and energy conservation in common home appliances. **(SC.B.1.4.0)**	
	1. Using laboratory experiences, demonstrate the effects of magnetic lines of force and the attraction and repulsion of a magnet.ain **(SC.C.2.4.3)** 2. Design and conduct laboratory investigations of the relationships among the amount of current, the number of turns of wire, and the magnetic field of an electromagnet. **(SC.C.2.4.3)** 3. Explain how simple motors and generators operate. **(SC.C.2.4.3)** 4. Identify sources and uses of direct (DC) and alternating (AC) current. **(SC.C.2.4.3)**	B. Demonstrate Faraday induction using a length of wire, a strong magnet and a sensitive ammeter or voltmeter and describe how mechanical energy is converted into electrical energy.

COMPONENT	OBJECTIVES	COMPETENCY
	5. Trace the flow of electricity from the power plant to an appliance in the home, keeping track of voltage, current, and frequency. **(SC.C.2.4.3)**	