Scope and Sequence Chart

Unit 1: The Physical World						
Chapter 1: Atoms in the Universe						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Basic Unit of the Physical World • Modern View of the Atom • Identity of the Element	• The formation of the elements during the Big Bang and during stellar evolution • The distribution of the chemical elements and the isotopes in the universe	• Make a creative representation of the historical development of the atom or the chemical element in a timeline	• Give evidence for and explain the formation of light elements in the universe • Give evidence for and describe the formation of heavier elements during star formation and evolution • Write the nuclear fusion reactions that take place in stars, which leads to the formation of new elements • Describe how elements heavier than iron are formed	• What are the characteristics of the three subatomic particles and how do they differ from each other? • How is the identity of an element determined using the information on the subatomic particles? • How is the periodic table of elements used as a tool in the study of chemistry?	• Describe the modern view of the atom and the subatomic particles • Recognize that the identity of the element is dependent on the number of protons • Utilize the periodic table of elements as an important tool in the study of chemistry	• Exercises • Quizzes • Sci-Search • Sci-Select • Sci-Scale • Sci-Scene
• Origin of the Elements • Big Bang Theory and the Birth of a Star				• What is the big bang theory? • What are the indirect evidences presented by scientists for the big bang theory?	• Describe the different theories on the origin of the elements • Give evidence for and explain the formation of the light elements in the big bang theory	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
				• What are the arguments for and against the big bang theory?	• Recognize contributions of relevant scientists who came up with the theories • Participate in a debate on the creationist model versus the big bang theory	
• Isotopes and Nuclear Fusion				• What are isotopes? • How are elements heavier than hydrogen formed? • What happens to the particles during nuclear fusion?	• Describe isotopes • Recognize that alpha particle is the nucleus of helium • Explain the principle of nuclear fusion	
• Nuclear Reactions				• What happens in a nuclear reaction? • How are new elements formed in a nuclear reaction? • How are nuclear equations balanced?	• Describe processes that occur in a nuclear reaction • Write the nuclear fusion reactions that take place in stars, which lead to the formation of new elements • Balance nuclear equations	

Topics	Content Standards	Performance	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Formation and Evolution of Stars • Synthesis of Heavier Elements and Stability of Iron • Formation of Elements Heavier than Iron • Empirical Evidence for the Theory of Nucleosynthesis				• What nuclear reactions occur as a star is formed? • How are heavier elements formed as stars evolve? • What are the different stages of a star?	• Give evidence for and describe the formation of heavier elements during star formation and evolution • Describe the nuclear reactions that occur during the formation and evolution of stars • Describe how elements heavier than iron are formed • Write and balance equations of the nuclear reactions that take place in stars, which lead to the formation of heavier elements • Balance nuclear equations	

Chapter 2: The Atomic World						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Ancient Ideas About Matter • The Alchemists' View of Matter	• How the concept of the atom evolved from ancient Greeks to the present • How the concept of the element evolved from ancient Greeks to the present	• Make a creative representation of the historical development of the atom or the chemical element in a timeline	• Describe the ideas of the ancient Greeks on the atom • Describe the ideas of the ancient Greeks on the elements • Describe the contributions of the alchemists to the science of chemistry • Point out the main ideas in the discovery of the structure of the atom and its subatomic particles • Cite the contributions of J.J. Thomson, Ernest Rutherford, Henry Moseley, and Niels Bohr to the understanding of the structure of the atom • Describe the nuclear model of the atom and the location of its major components (protons, neutrons, and electrons) • Explain how the concept of atomic number led to the synthesis of new elements in the laboratory	• What are the ideas presented by the ancient Greeks in describing the fundamental substance of matter? • Is there any basis for the activities of the alchemists? • What are the contributions of the alchemists in the advancement of science?	• Describe the ideas of the ancient Greeks on the elements • Describe the ideas of the ancient Greeks on the atom • Describe the contributions of the alchemists to the study of chemistry	• Graphic organizer • Report • Essay • Quizzes • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale
• Systematic Approach to Science • Dalton's Atomic Theory				• Why is experimentation necessary before generating a conclusion? • What are the contributions of Boyle, Dalton, and Lavoisier in advancing systematic science? • What are the arguments for and against Dalton's atomic theory?	• Describe the systematic approach to science as demonstrated by Boyle and Lavoisier • Explain the importance of experimentation in doing science • State Dalton's atomic theory • Cite the contribution of Dalton toward the understanding of the concept of the chemical elements	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
			• Write the nuclear reactions involved in the synthesis of new elements • Cite the contribution of John Dalton toward the understanding of the concept of the chemical elements • Explain how Dalton's theory contributed to the discovery of other elements		• Explain how Dalton's theory contributed to the discovery of other elements • Analyze the validity of Dalton's theory as compared to modern view of the atom	
• Inside of the Atom • The Nucleus • The Neutron				• What is the composition of the atom? How do atoms look like? • How are the subatomic particles arranged in the atom? How do they behave? • How does one atom in one element differ from the atom of another element?	• Point out the main ideas in the discovery of the structure of the atom and its subatomic particles • Cite the contributions of J.J. Thomson, Ernest Rutherford, and James Chadwick to the understanding of the structure of the atom • Describe the nuclear model of the atom and the location of the subatomic particles	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Atomic Number and Artificial Transmutation				• What are the consequences of the arrangement of subatomic particles in nuclear reactions? • How are new elements formed in a nuclear reaction? • How are nuclear equations balanced?	• Write the nuclear reactions involved in the synthesis of new elements • Describe processes that occur in artificial transmutation • Explain how the concept of atomic number led to the synthesis of new elements in the laboratory • Balance nuclear equations	
• The Electron				• How do electrons behave? • Is there an order that electrons follow? • How come the electrons play very important roles in most studies of chemistry?	• Cite the contributions of Niels Bohr to the understanding of the structure of the atom • Describe how electrons are arranged in the atom • Describe the behavior of the electron	

Chapter 3: The Molecular World						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Forces that Hold Atoms Together	• How the uses of different materials are related to their properties and structures • Relationship between the function and structure of biological macromolecules	• Make a PowerPoint presentation and report in class the structure and property relationships of materials	• Determine if a molecule is polar or nonpolar given its structure • Relate the polarity of a molecule to its property • Describe the general types of intermolecular forces • Give the type of intermolecular forces in the properties of substances • Explain the effect of intermolecular forces on the properties of substances • Explain how the uses of the following materials depend on their properties: medical implants and prosthesis, sports equipment, electronic devices, construction supplies for buildings and furniture, and household gadgets	• What forces hold metal atoms together? • Why do electrons become mobile in metal? Why are metals more stable as ions than as atoms? • What forces hold metal and nonmetal atoms together in an ionic compound? • What are the differences between a metallic bond and an ionic bond? • Why are most elements more stable as ions than they are as atoms? • Why do atoms share electrons? • What are the characteristics of the shared electrons? How do shared electrons differ from lone electron pairs? • What are the consequences of equal and unequal sharing of electrons?	• Describe the bonding between metallic atoms • Explain the properties of metals in light of the metallic bond concept • Draw a model of metallic bond • Describe the ionic bond between a metal and a nonmetal • Explain the properties of salt using the concept of ionic bond • Draw a model of ionic bond in NaCl • Describe the ideas on covalent bonding between atoms • Compare and contrast metallic bond, ionic bond, and covalent bond • Explain polar covalent bond	• Graphic organizers • Quizzes • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
			• Explain how the properties of the above materials are determined by their structure • Explain how the structures of biological macromolecules such as carbohydrates, lipids, nucleic acids, and proteins determine their properties and functions			
• Shape of Molecules				• What is VSEPR? • How are the shapes of molecules determined? • In what way does the shape of molecule define the property?	• Describe the valence shell electron pair repulsion (VSEPR) principle • Draw Lewis dot structures of molecules • Identify the shape of a molecule • Determine the relationship of the shape of a molecule to the polarity of the molecule	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Polarity of Molecules				• How do molecules become polar? • How can polarity of molecules be predicted using the Lewis structure? • How does polarity of molecules relate to its properties?	• Determine if a molecule is polar or nonpolar given its structure • Describe the principle of polarity • Show the relationship of the polarity of a molecule to its properties	
• Forces Between Molecules				• How do molecules interact with other molecules? • What are the intermolecular forces present in chemical systems? • How do intermolecular forces affect the properties of substances?	• Describe the general types of intermolecular forces • Relate the type of intermolecular forces to the properties of substances • Explain the effect of intermolecular forces on the properties of substances	
• Structure–Function Relationship of Matter				• How do structures of materials define their properties for specific applications? • What is the relationship between structure and properties of materials? • How are materials determined for specific applications?	• Explain how the uses of the following materials depend on their properties: medical implants and prostheses, sports equipment, electronic devices, construction supplies for buildings and furniture, and household gadgets	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
					• Explain how the properties of the above materials are determined by their structure	
• Structure–Property Relationship of Biochemical Molecules				• How do structures of biomolecules define its properties? • What is the relationship between structure and properties of biomolecules? • How do biomolecules function using their structure?	• Explain how the structures of biological macromolecules such as carbohydrates, lipids, nucleic acids, and proteins determine their properties and functions • Explain how the structure of biomolecules define their properties	

Unit 2: The Chemical World						
Chapter 4: Chemical Reactions						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Reaction Principles	• The following aspects of chemical changes: how fast a reaction takes place; how much reactants are needed; and how much products are formed in a reaction • How much energy is involved in a reaction; and how energy is harnessed	• Make a poster, flyer, or brochure on a product (such as fuels, household, or personal care products) indicating its uses, properties, mode of action, and precautions on its use	• Use simple collision theory to explain the effects of concentration, temperature, and particle size on the rate of reaction • Define catalyst and describe how it affects reaction rate • Calculate the amount of substances used or produced in a chemical reaction • Calculate percent yield of a reaction • Determine the limiting reactant in a reaction and calculate the amount of product formed	• Why do atoms and molecules react? • What is the driving force that allows atoms and molecules to react? • What are catalysts and how do they enhance the rate of chemical reaction?	• Describe collision theory • Use simple collision theory to explain the effects of concentration, temperature, and particle size on the rate of reaction • Define catalyst and describe how it affects reaction rate • Write chemical equations using appropriate symbols	• Graphic organizers • Quizzes • Exercises • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale
• Stoichiometry				• What is the principle behind the balancing of chemical equations? • What are mole and Avogadro's number? What is their relevance to chemical reactions? • How is the amount of substances used or produced in a chemical reaction calculated?	• Write and balance chemical equations • Define mole and describe the mole equivalencies • Calculate the amount of substances used or produced in a chemical reaction	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Limiting Reagents				• What is a limiting reagent? • How is a limiting reagent determined? • How can the amount of the product be predicted if two masses from the starting materials are provided?	• Explain limiting reagent • Determine the limiting reagent in a reaction and calculate the amount of product formed • Use stoichiometry calculations involving a limiting reagent	
• Reaction Yield				• What is the difference between theoretical yield and actual yield? • How is percent yield in a chemical reaction calculated? • Why is percent yield in chemical reactions usually lower than 100%?	• Compare actual yield and theoretical yield • Calculate percent yield of a reaction • Identify factors affecting the loss of yield in a chemical reaction	

Chapter 5: Energy in Chemical Reactions						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Chemical Energy	• How energy is involved in a reaction • How energy is harnessed	• Make a poster, flyer, or brochure on interpreting nutrition labels	• Recognize that energy is released or absorbed during a chemical reaction • Describe how energy is harnessed from different sources: fossil fuels, biogas, geothermal, hydrothermal, batteries, solar cells, and biomass	• What is energy? • Can energy be produced? • Why do chemical reactions involve energy?	• Define energy • Differentiate between endothermic and exothermic reactions • Write thermochemical equations • Calculate the energy involved in thermochemical equations	• Activities • Poster, flyer, or brochure • Quizzes • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale
• Energy in Food				• Why is energy involved in consuming food products? • How is the nutrition facts labels interpreted? • Do the nutrition facts labels provide essential information to us?	• Describe the energy that comes from the food that we eat • Interpret nutrition facts labels • Explain the information written in nutrition facts labels • Calculate the energy involved in consuming food products using the nutrition facts labels	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Energy in Society • Energy Sources				• How can we produce energy? • Can energy be harnessed for practical purposes? • What factors contribute to the generation of sustainable and clean energy? • What is REDOX? • What is done to identify if a substance undergoes reduction or oxidation? • What are half reactions for?	• Describe how energy is harnessed from geothermal and hydrothermal sources and fossil fuels, biogas, batteries, solar cells, and biomass • Identify the advantages and disadvantages of the use of each energy source • Demonstrate appreciation of the power source available near their area • Explain oxidation and reduction reactions • Describe that oxidation and reduction reactions are associated with gain or loss of electrons • Write half reactions	

Chapter 6: Chemistry in the Household						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Cleaning Agents	• Properties and modes of action of cleaning materials and cosmetics	• Create a green cleaning program for the school by proposing new practices and alternative products that are safe for people and the environment	• Give common examples of cleaning materials for the house and for personal care • From product labels, identify the active ingredient/s of cleaning products used at home • Give the use of the other ingredients in cleaning agents • Give common examples of personal care products used to enhance the appearance of the human body • Identify the major ingredients of cosmetics such as body lotion, skin whitener, deodorants, shaving cream, and perfume • Explain the precautionary measures indicated in various cleaning products and cosmetics	• What are the ingredients of household-cleaning products and personal care products? • What are the purposes of these ingredients? • How do cleaning agents work? • What is hard water? • What is the difference between soap and detergent?	• Interpret labels of cleaning agents and cosmetics • Classify ingredients according to use • Identify the active ingredient/s of cleaning products used in houses based on product labels • Give the use of the other ingredients in cleaning agents • Compare ingredients of two different brands of the same type of products • Describe the different properties of water and dirt • Explain the cleaning action of cleaning agents • Differentiate hydrophobic from hydrophilic • Explain the difference between soap and detergent • Describe hard water	• Activities • Research • PowerPoint presentation • Quizzes • Further Exercises • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Personal Care Products				• What are the ingredients common among personal care products? • What are the functions of the ingredients added in personal care products? • Why do people use products to enhance their looks?	• Give common examples of personal care products used to enhance the appearance of the human body • Identify the major ingredients of cosmetics, such as body lotion, skin whitener, deodorants, shaving cream, and perfume	
• Health and Environmental Impact of Cleaning Agents and Personal Care Products • Safety Precautions in Handling Cleaning Agents at Home				• What is the impact of the use of specific ingredients for cleaning agents and personal care products on health and environment? • Why are precautions necessary in handling cleaning agents? • What are the safety considerations in handling cleaning agents?	• Realize that cleaning agents and personal care products have health and environmental impact that need to be considered • Identify the safety precautions necessary in handling cleaning agents	

Unit 3: Motion On Earth and Beyond						
Chapter 7: Motion In The Universe						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Ancient Beliefs About the Universe • Geocentric and Heliocentric Theories of the Universe • Galileo's and Newton's Views on the Heliocentric Theory	• Events that formed ancient beliefs about the universe • Differences between geocentric and heliocentric theory of the universe • Laws of planetary motion by Johannes Kepler • Terminologies associated with the motion of any planets around a star	Create the following: • Poster-style biography of different philosophers and scientists who developed the present understanding of the universe • Infographic that contains the proponents, descriptions, illustrations, and supporting evidences of geocentric and heliocentric theories • Photo essay showing the development of heliocentric theory from ancient times to Newton's publication of *Principia*	• Explain what the Greeks considered to be the three types of terrestrial motion • Explain what is meant by diurnal motion, annual motion, precession of the equinoxes • Explain how the Greeks knew that the Earth is spherical • Explain how Plato's problem of *Saving the Appearances* constrained Greek models of the universe • Compare and contrast the models or descriptions of the universe by Eudoxus, Aristotle, Aristarchus, Ptolemy, and Copernicus • Cite examples of astronomical phenomena known to astronomers before the advent of telescopes	• What is theory? • Can theory be considered as absolute truth?	• Compare and contrast various historical models of the solar system, including geocentric and heliocentric • Explain that theories may change if enough evidence is presented • Identify which scientists developed and supported each model	• Graphic organizers • Activities • Quizzes • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
			• Compare and contrast explanations and models of astronomical phenomena (Copernican, Ptolemaic, and Tychonic) • Explain how Galileo's astronomical discoveries and observations (lunar craters, phases of Venus, moons of Jupiter, sun spots, supernovas, the apparently identical size of stars as seen through the naked eye, and telescope observations) helped weaken the support for the Ptolemaic model • Explain how Brahe's innovations and extensive collection of data in observational astronomy paved the way for Kepler's discovery of his laws of planetary motion • Apply Kepler's third law of planetary motion to objects in the solar system			

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Kepler's Laws of Planetary Motion				• How do the period and speed of a planet vary with distance from the sun?	• Explain the relation between radial distance and period • Solve planetary motion problems • Apply ideas in algebra and geometry to Kepler's laws	
• Motions of Earth				• How can the motion of the Earth affect our lives?	• Define and describe rotation, revolution and precession of the Earth	

Chapter 8: Motion						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Motion in One Dimension	• Key terminologies encountered in kinematics • Constant acceleration in freely falling objects • Projectile motion as combination of free fall and constant speed motion • Analyze graphs involving motion	• Make a simple investigation in determining average velocity and acceleration in real life and present using PowerPoint presentations, data table, and graphs • Compose a simple song or music video about the concepts	• Compare and contrast the Aristotelian and Galilean conceptions of vertical motion, horizontal motion, and projectile motion • Explain how Galileo inferred that objects in vacuum fall with uniform acceleration and that force is not necessary to sustain horizontal motion • Explain how the position versus time and velocity versus time graphs of constant velocity motion are different from those of constant acceleration motion • Recognize that the everyday usage and the physics usage of the term acceleration differ	• What is the fundamental difference between velocity and acceleration? • What makes uniformly accelerated motion unique in terms of object's position or distance traveled and velocity?	• Differentiate distance and displacement • Differentiate speed and velocity • Define acceleration • Solve problems involving kinematics • Describe the position and velocity of an object having uniform acceleration • Derive the equations for uniform acceleration • Solve problems involving uniform acceleration	• Activity • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Motion in Two Dimensions • Graphs of Motion				• Is projectile motion the same as free-falling motion? • What is uniform circular motion? • Why is uniform circular motion considered accelerated motion? • What does the slope represent in position-time and velocity-time graphs?	• Describe the motion of objects undergoing free fall and projectile motion • Solve problems involving free fall and projectile motion effectively • Describe the motion of objects undergoing uniform circular motion • Analyze and interpret position-time and velocity-time graphs of motion • Solve problems involving uniform circular motion and graphical analysis of motion	

Chapter 9: Interactions						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Fundamental Forces of Nature • Contact and Field Forces • Free-Body Diagrams	• Fundamental forces of nature and basic properties of each type of force • Newton's laws of motion (i.e., three laws of motion and law of gravitation) • Work, energy, and their respective conservation law • Momentum, impulse, and their respective conservation law	• Build a Rube Goldberg machine	• Explain each of Newton's three laws of motion • Explain the subtle distinction between Newton's 1st Law of Motion (or Law of Inertia) and Galileo's assertion that force is not necessary to sustain horizontal motion • Use algebra, Newton's 2nd Law of Motion, and Newton's Law of Universal Gravitation to show that in the absence of air resistance, objects close to the surface of the earth fall with identical accelerations independent of their mass • Explain the statement "Newton's laws of motion are axioms, while Kepler's laws of planetary motion are empirical laws."	• What would the universe or nature look like if fundamental forces of nature are non-existent?	• Describe forces, their significance, and types • Differentiate the four fundamental forces in nature • Draw free-body diagrams	• Activity • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale
• Newton's Laws of Motion • Universal Law of Gravitation				• What are Newton's laws of motion? • How are the Newton's laws of motion applied to everyday life?	• State Newton's laws of motion according to their understanding • Cite applications where Newton's laws of motion are applied • Solve problems involving Newton's laws of motion	
• Work • Kinetic Energy and Potential Energy • Conservation of Mechanical Energy • Power				• What is the distinction among work, energy, and power?	• Differentiate meaning of work in physics and in everyday language • Relate work done on an object to its kinetic and potential energy • State conservation of mechanical energy • Distinguish power and energy • Solve problems involving work, energy, and power	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
			• Explain the contributions of scientists to our understanding of mass, momentum, and energy conservation • Use the law of conservation of momentum to solve one-dimensional collision problems			
• Momentum and Impulse • Conservation of Momentum				• What is the advantage of learning the law of conservation of momentum?	• Define momentum • Apply the concept of momentum-impulse theorem in collisions • State conservation of linear momentum • Analyze collision problems using law of conservation of momentum	

Unit 4: Light and Cosmos						
Chapter 10: The Nature of Light						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Waves • Properties of Light	• Diffraction and interference • Wave and corpuscular theories of light • Plane and curved mirrors • Colors and light phenomena, including rainbow, halo, selective reflection, selective transmission, blue sky, red sunset, white clouds, and dark rainclouds	• Create a collection of pictures of light phenomena	• Describe what happens when light is reflected, refracted, transmitted, and absorbed • Explain how Newton and Descartes described the emergence of light in various colors through prisms • Cite examples of waves (e.g., water, sound, string, and light waves) • Describe how the propagation of light, reflection, and refraction are explained by the wave model and the particle model of light • Apply the wavelength-speed-frequency relation	• How are reflection and refraction similar and different? • How does the behavior of light affect our everyday lives? • Although sound and light are waves, why is it that when someone makes a sound far from an opening or hole, the sound can be heard but the source is not visible?	• Solve problems involving reflection and refraction • Relate total internal reflection to law of refraction • Differentiate between bright and dark fringes in an interference pattern • Cite applications of diffraction and interference in everyday life • Solve problems involving diffraction and interference	• Activities • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
			• Describe how Galileo and Roemer contributed to the eventual acceptance of the view that the speed of light is finite • Cite experimental evidence showing that electrons can behave like waves • Differentiate dispersion, scattering, interference, and diffraction • Explain various light phenomena such as your reflection on the concave and convex sides of a spoon looks different; mirages; haloes, sundogs, primary rainbows, secondary rainbows; why clouds are usually white and rainclouds dark; and why the sky is blue and sunsets are reddish			

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Theories on the Nature of Light • Image Formation in Plane and Curved Mirrors				• When is light a particle, and when is it a wave?	• Differentiate the particle and wave theories of light • Explain the phenomena of reflection and refraction using the particle and wave theories of light • Describe the images formed in plane and curved mirrors	
• Colors and Light Phenomena				• How do we see colors?	• Differentiate selective reflection and transmission • Use the concept of selective reflection and transmission in addition or subtraction of primary colors of light • Describe and explain numerous phenomena in nature that involves the white light, dispersion, rainbow, halo, blue sky, red sunset, white clouds, and dark rainclouds	

Chapter 11: Electromagnetic Waves and Basic Quantum Mechanics						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Electromagnetic Induction • Applications of Electromagnetic Induction	• Relationship of wavelength and frequency of electromagnetic waves in the electromagnetic spectrum • Wave nature of light in terms of diffraction and interference of light • Particle nature of light in terms of photoelectric effect and Compton scattering • Wave nature of matter, complementarity principle, and uncertainty principle	• Design a functional electromagnet, electric motor, transformer, or generator	• Explain the contributions of Franklin, Coulomb, Oersted, Ampere, Biot-Savart, Faraday, and Maxwell to our understanding of electricity and magnetism • Describe how Hertz produced radio pulses • Explain how the photon theory of light accounts for atomic spectra • Explain how the photon concept and the fact that the energy of a photon is directly proportional to its frequency	• What is the practical way of producing induced current in a wire?	• Explain the different ways to produce induced current in a wire loop • Explain how a generator and transformer work • Apply Faraday's electromagnetic induction law	• Activities • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale
• Electromagnetic Waves • Electromagnetic Spectrum • Atomic Spectra				• Why is it important to astronomers to make telescopes that detect different kinds of electromagnetic waves? • Why is it important for a scientist to have a radical thinking?	• Enumerate the types of electromagnetic waves • Calculate frequency or wavelength of electromagnetic waves • Cite various applications of different types of electromagnetic waves	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
					• Explain diffraction and interference of electromagnetic waves • Differentiate between continuous and line spectra • Explain the line spectrum phenomena using Bohr's concept of energy level	
• Photoelectric Effect • Compton Scattering				• Why does light behave as a particle?	• Explain the nature of light as a particle in terms of photoelectric effect and Compton scattering • Solve problems involving photoelectric effect and Compton scattering	
• Wave Nature of Matter • Basic Quantum Mechanics				• How will you observe everyday activity if the Planck's constant has a high value?	• Explain the symmetry shown by nature due to wave-particle duality of radiation and matter • Solve problems involving de Broglie wavelength and uncertainty principle	

Chapter 12: Relativity						
Topics	**Content Standards**	**Performance Standards**	**Learning Competencies**	**Essential Questions**	**Learning Objectives**	**Assessment Tools**
• Galilean Relativity • Postulates of the Special Theory of Relativity • Relativity of Simultaneity	• Galilean relativity and its contrast to Einstein's special relativity • Postulates of relativity and relativity of simultaneity • Time dilation and length contraction • Relativistic momentum and energy • Doppler effect in light • Basic concepts of general relativity and its consequences	• Explain paradoxical consequences of special relativity	• Explain how special relativity resolved the conflict between Newtonian mechanics and Maxwell's electromagnetic theory • Explain the consequences of the postulates of special relativity (e.g., relativity of simultaneity, time dilation, length contraction, mass-energy equivalence, and cosmic speed of light) • Explain the consequences of the postulates of general relativity (e.g., correct predictions of shifts in the orbit of Mercury, gravitational bending of light, and black holes) • Explain how the speeds and distances of far-off objects are estimated (e.g., Doppler effect and cosmic distance ladder)	• Einstein said, "Common sense is the collection of prejudices acquired by age eighteen." What does he mean by this?	• State and explain postulates of special relativity • Explain the relativity of simultaneity	• Group report • Sci-Search • Sci-Scene • Sci-Select • Sci-Scale
• Relativity of Time: Time Dilation • Relativity of Length: Length Contraction • Other Consequences of Special Relativity: Revised Momentum and Energy Principles • Doppler Effect in Light				• If you travel close to the speed of light, will the relativistic effects be applicable on you? • Is reality relative?	• Differentiate proper and dilated time • Differentiate proper and contracted length • Explore the consequences of time dilation and length contraction formula • Describe the effects of time dilation, length contraction, and Doppler effect • Solve problems involving time dilation and length contraction • Explain the mass-energy equivalence	

Topics	Content Standards	Performance Standards	Learning Competencies	Essential Questions	Learning Objectives	Assessment Tools
• Basics of the General Theory of Relativity • Curving of Space-time • Consequences of the General Theory of Relativity			• Explain how we know that we live in an expanding universe, which used to be hot and is approximately 14 billion years old • Explain how the Doppler shifts and transits can be used to detect extra solar planets • Explain why Pluto was once thought to be a planet but is no longer considered one	• Is there any way to see or visualize the curving of three-dimensional space? • Is gravity a force?	• State the equivalence principle • Describe the consequences of equivalence principle • Differentiate Newtonian and Einsteinian gravity • Explain, describe, and appreciate various consequences of general relativity	