Physical Science Curriculum

This curricula and accompanying instructional materials have been developed to align with the NJSLS and in accordance with the NJ Department of Education's guidelines to include: a curriculum designed to meet grade level expectations, integrated accommodations and modifications for students with IEPs, 504s, ELLs, and gifted and talented students, assessments including benchmarks, formative, summative, and alternative assessments, a list of core instructional and supplemental materials, pacing guide, interdisciplinary connections, integration of 21st century skills, integration of technology, and integration of 21st Century Life and Career standards.

About the Standards

In 1996, the New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards. The standards described what students should know and be able to do upon completion of a thirteen-year public school education. Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that is used by teachers in their daily lesson plans.

Revised every five years, the standards provide local school districts with clear and specific benchmarks for student achievement in nine content areas. Developed and reviewed by panels of teachers, administrators, parents, students, and representatives from higher education, business, and the community, the standards are influenced by national standards, research-based practice, and student needs. The standards define a "Thorough and Efficient Education" as guaranteed in 1875 by the New Jersey Constitution. Currently the standards are designed to prepare our students for college and careers by emphasizing high-level skills needed for tomorrow's world.

The New Jersey Student Learning Standards include Preschool Teaching and Learning Standards, as well as nine K-12 standards for the following content areas: **21st Century Life and Careers, Comprehensive Health and Physical Education, English Language Arts, Mathematics, Science, Social Studies, Technology, Visual and Performing Arts, World Languages**

Lower Cape May Regional School District
Physical Science
9th Grade

Interdisciplinary Connections

6.3.12.D.1 Analyze the impact of current governmental practices and laws affecting national security and/or individual civil rights/ privacy.

Integration of Technology

9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments. • 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

21st Century Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
9.4.12.CT.3: Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.

9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. •
9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).
9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).

Career Education

9.2.12.CAP.1: Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession. • 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.
9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
9.2.12.CAP.9: Locate information on working papers, what is required to obtain them, and who must sign them.
9.2.12.CAP.10: Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).
9.2.12.CAP.11: Demonstrate an understanding of Free Application for Federal Student Aid (FAFSA) requirements to apply for postsecondary education.
9.2.12.CAP.12: Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.
9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
9.2.12.CAP.14: Analyze and critique various sources of income and available resources (e.g., financial assets,

property, and transfer payments) and how they may substitute for earned income.
9.2.12.CAP.15: Demonstrate how exemptions, deductions, and deferred income (e.g., retirement or medical) can reduce taxable income.
9.2.12.CAP.16: Explain why taxes are withheld from income and the relationship of federal, state, and local taxes (e.g., property, income, excise, and sales) and how the money collected is used by local, county, state, and federal governments.
9.2.12.CAP.17: Analyze the impact of the collective bargaining process on benefits, income, and fair labor practice.
9.2.12.CAP.18: Differentiate between taxable and nontaxable income from various forms of employment (e.g., cash business, tips, tax filing and withholding).
9.2.12.CAP.19: Explain the purpose of payroll deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay, including the cost of employee benefits to employers and self-employment income. •
9.2.12.CAP.20: Analyze a Federal and State Income Tax Return.
9.2.12.CAP.21: Explain low-cost and low-risk ways to start a business.
9.2.12.CAP.22: Compare risk and reward potential and use the comparison to decide whether starting a business is feasible.
9.2.12.CAP.23: Identify different ways to obtain capital for starting a business.

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Lower Cape May Regional School District Physical Science Curriculum
Unit 1 Overview

Content Area: Science

Unit Title: Foundations of Science

Target Course/Grade Level: 9th grade

Unit Summary:

- This unit explores the nature of science, the scientific method of discovery, and the difference between scientific theories and laws.
- This unit also describes how scientists use models and mathematics to describe the world around them.
- Science skills, mathematics, and units of measurement focusing on The Standard International Units of Measurement and the use of the Metric system.
- The different ways data is organized and presented to others is covered.
- The knowledge and skills gained in this chapter will serve as a foundation for the study of science throughout the year.

Unit Outline:

- Nature of Science
- Laws vs. Theories and Models
- Metrics and Standard International Units
- Accuracy vs. Precision
- Collecting, Organizing, and Presenting Data

Cross-Cutting Concepts

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1), (HS-PS2-5)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

Connections to Nature of Science

Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Theories and laws provide explanations in science. (HS-PS2-1), (HS-PS2-4)
- Laws are statements or descriptions of the relationships among observable phenomena.

(HS-PS2-1), (HS-PS2-4)

Science and Engineering Practices

Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)

Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HSPS1-3)

Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Disciplinary Core ideas

Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)

The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)

The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HSPS1-3)

Interdisciplinary Connections:

Literacy and Mathematics

- RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1)
- RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS1-3), (HS-PS1-5)
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2)
- MP.2 Reason abstractly and quantitatively. (HS-PS1-5), (HS-PS1-7)
- MP.4 Model with mathematics. (HS-PS1-4), (HS-PS1-8)
- HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8)
- HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),

(HS-PS1-7), (HS-PS1-8)

- HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8)

1),(HS-PS2-4)

Unit Enduring Questions:	**Unit Enduring Understandings:**
● How does science take place? ● What are the differences between laws and theories? ● How are models used to explain scientific theories and laws? ● How do we use scientific methods? ● What are science skills? ● Why do scientists use scientific notation and SI units. ● Why is the metric system used as international units of measurement?	● Science takes place through observation, descriptions, and experimentation. ● Scientific methods guides our thinking and actions when learning about natural phenomena. ● Laws describes a process in nature that can be tested by repeated experiments. Laws are used to make predictions about how a system will behave. Theories are a system of ideas that explains many related observations and is supported by a large body of evidence acquired through scientific investigation. ● The metric system is a base ten system of measurement used by scientists all around the world.

Unit Objectives: *Students will know….* ● How many branches of science is organized. ● Students will know that science takes a systematic and an interdisciplinary approach to learning about the world around them. ● Students will know that Laws describe what will happen and Theories will explain why things happen. ● Science skills include ability to observe, make measurements, infer connections, and present information in a universal manner.	Unit Objectives: *Students will be able to……* ● Describe how science takes place. ● Identify and classify the main branches of science and explain the interdisciplinary nature of science. ● Design experiments to solve hypothetical problems. Confirm results by designing and repeating experiments. ● Interpret data from graphs; determine trends and draw predictions, hypotheses, and draw conclusions. ● Organize and display data in tables, graphs, and charts.

Lower Cape May Regional School District Physical Science Curriculum
Unit 2 Overview

Content Area: Physical Science

Unit Title: Chemistry - Matter and Its Interactions

Target Course/Grade Level: 9th grade Integrated Science

Unit Summary:

- **The Properties of Matter** - Chemical and physical properties are investigated. The concept of density and calculations involving density are introduced. Difference between mass and weight explained and examples given. Measuring the mass and volume of a liquid, and volume of solid objects and using the data to identify unknown objects.
- **The Structure of Matter** - Atoms, elements, molecules and compounds are investigated. The development of atomic history is examined. Identifying elements based on sub-atomic structures is shown and practiced.
- **Classifying Matter** - Using the Periodic Table to organize matter into groups in order to recognize patterns between the elements and properties. Metals, Non-metals, and Noble Gases will be investigated.
- **Compounds** - Characteristics of Compounds will be investigated. How compounds form along recognizing and writing chemical formulas will be presented and practiced. Acids and Bases will also be investigated and properties between each will be identified.
- **Changes in Matter** - Types of chemical reactions will be investigated. Using Chemical Equations will be taught to show reactions. Nuclear Process are introduced.

Unit Outline:

- Define Chemistry – Branches of Chemistry
- Laboratory Environment – Lab Safety and Lab Equipment
- Classifying Matter
- Physical and Chemical properties
- Periodic Table
- Elements and Compounds
- Chemical Reactions

Crosscutting Concepts:

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS- PS1-3),(HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Science and engineering complement each other in the cycle known as research and development (R&D). (HS-PS4-5)

Influence of Engineering, Technology, and Science on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-PS4-2),(HS-PS4-5)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS- PS4-2)

Interdisciplinary Connections:

Literacy and Math

· RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

· RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS2-1)

· MP.2 Reason abstractly and quantitatively. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4)

MP.4 Model with mathematics. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4)

- HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4), (HS-PS2-5), (HS-PS2-6)

Standard 9.1 21st-Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

- 9.1.12.A.1 Apply critical thinking and problem solving strategies during structured learning experiences.
- 9.1.12.B.1 Present resources and data in a format that effectively communicates the meaning of the data and its implications for solving problems, using multiple perspectives.
- 9.1.12.B.3 Assist in the development of innovative solutions to an onsite problem by incorporating multiple perspectives and applying effective problem-solving strategies during structured learning experiences.
- 9.1.12.F.1 Explain the impact of current and emerging technological advances on the demand for increased and new types of accountability and productivity in the global workplace.
- 9.1.12.F.2 Demonstrate a positive work ethic in various settings, including the classroom and during structured learning experiences.

Standard 9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

- 9.3.8.B.16 Relate academic achievement, as represented by high school diplomas, college degrees, and industry credentials, to employability and potential level of income.
- 9.3.12.C.2 Characterize education and skills needed to achieve career goals, and take steps to prepare for postsecondary options, including making course selections, preparing for and taking assess.
- 9.3.12.C.11 Evaluate the responsibilities of employers and employees for maintaining workplace safety, and explain health rights related to a particular occupation/career.
- 9.3.12.C.16 Determine the consequences of quality control failures in the United States and in another country based on issues reported in the media.

Learning Standards

Next Generation Science Standard Identifier	Next Generation Science Standard
HS-PS1-1	**Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.** [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.]

HS-PS1-2	**Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.** [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.
HS-PS1-3	**Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.** [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules,
	and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.]
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.]
HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.]

HS-PS1-6	**Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.** [Clarification Statement: Emphasis is on the application of Le Chatelier's Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.]
HS-PS1-7	**Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.** [Clarification Statement: Emphasis is on using mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.]
HS-PS1-8	**Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.** [Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive.]
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (Use of Fossil Fuels, Minerals, Natural Resources; (Food & Water),
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit Enduring Questions:	**Unit Enduring Understandings:**
● What happens to energy when atoms collide? ● Which factor, mass or velocity, affects kinetic energy more? ● What makes substances different from one another? ● How is the periodic table arranged? ● When atoms get close to each other, what happens to their potential energy? ● What are ionic compounds and how are they named? ● What are covalent bonds? ● What are the diatomic elements and how is the language of chemistry written? ● How are simple (covalent) molecules named? ● How are compounds with transition metals named? ● How is matter conserved in a reaction? ● How is a chemical equation written to show conservation of mass/matter?	**Disciplinary Core Ideas** PS1.A: Structure and Properties of Matter ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) ● The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1),(HS-PS1-2) ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3),(secondary to HS-PS2-6) ● A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4) PS1.B: Chemical Reactions
	● Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HSPS1-4),(HS-PS1-5) ● In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6) ● The fact that atoms are conserved, together with knowledge of the chemical properties of the elements

Unit Objectives: ***Students will know…***	**Unit Objectives:** ***Students will be able to***
● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change. ● Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and rearrangements of atoms into new molecules, with consequent changes in total binding energy (i.e., the sum of all bond energies in the set of molecules)	● Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms ● Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. ● Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. ● Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
that are matched by changes in kinetic energy. In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. ● The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe, and predict chemical reactions. Chemical processes and properties of materials underlie many important biological and geophysical phenomena.	● Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs ● Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

Lower Cape May Regional School District Physical Science Curriculum
Unit 3 Overview

Content Area: Physical Science

Unit Title: Physics 1 – Motion, Forces, and Energy

Target Course/Grade Level: 9th grade Integrated Science

Unit Summary:

- **Describing Motion** – Kinematics - Differences between distance and displacement are investigated and various graphs, distance-time graphs and positions time graphs are used to represent motion. Students will participate in the 40m dash and use their data to for distance, displacement, and speed calculations.
- **Speed and Acceleration** - Differences in constant speed, instantaneous, and average speed are examined. Students will make calculations determining positive and negative acceleration using real time data and computer simulations.
- **Representing Forces** - Students will examine different type of contact forces, (applied, spring, elastic, and chemical) and field forces (electrical and magnetic forces) and how they originate from the four fundamental forces; Strong Nuclear, Weak Nuclear, Electromagnetic, and Gravitational forces.
- **Forces and Motion** - Students will plan an investigation to show how an object's motion depends on the sum of the forces on the objects and mass of the object. Balanced and unbalanced forces can change or maintain the motion of an object. Newton's Laws of Motion are examined through actual real time investigations and using computer simulations.
- **Forms of Energy** - The different forms of energy will be identified and investigated and will include mechanical and non-mechanical forms. Students will investigate the transfer and transformation from one kind of energy to another using the roller coaster to investigate mechanical forms of energy. Students will also design and build a basic still to evaporate and collect freshwater from salt water.
- **Conservation of Energy** - The question, "Why doesn't a roller coaster go forever and why a ball doesn't bounce to its original height will drive the student investigation why energy doesn't last forever, or at least not in the form it originated from.

Unit Outline:

- Defining Motion
- Displacement and Speed; Average, Instantaneous, and Constant
- Velocity and Acceleration
- Forces – Fundamental, Contact and Field Forces
- Free Body Diagrams
- Forms of Energy – Mechanical and Non-Mechanical
- Conservation of Energy

Cross Cutting Relationships

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS2-4)

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5)
- Systems can be designed to cause a desired effect. (HS-PS2-3)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-PS2-6)

Cause and Effect

- Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS3-5)

Systems and System Models

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-PS3-4)
- Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. (HS-PS3-1)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Science and engineering complement each other in the cycle known as research and development (R&D). (HS-PS4-5)

Influence of Engineering, Technology, and Science on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-PS4-2),(HS-PS4-5)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS- PS4-2)

Interdisciplinary Connections:

Literacy and Math

• RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS2-1), (HS-PS2-6)

• RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS2-1)

• WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS2-6)

• WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources,

using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS2-5)

• WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS2-1), (HS-PS2-5)

• MP.2 Reason abstractly and quantitatively. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4)

• MP.4 Model with mathematics. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4)

• HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4), (HS-PS2-5), (HS-PS2-6)

Disciplinary Core Ideas in Physical Science (DCI)
PS1: Matter and Its Interactions
PS1.A: Structure and Properties of Matter
PS1.B: Chemical Reactions
PS1.C: Nuclear Processes
PS2: Motion and Stability: Forces and Interactions
PS2.A: Forces and Motion
PS2.B: Types of Interactions
PS2.C: Stability and Instability in Physical Systems
PS3: Energy • PS3.A: Definitions of Energy
PS3.B: Conservation of Energy and Energy Transfer
PS3.C: Relationship Between Energy and Forces
PS3.D: Energy in Chemical Processes and Everyday Life
PS4: Waves and Their Applications in Technologies for Information Transfer
PS4.A: Wave Properties
PS4.B: Electromagnetic Radiation
PS4.C: Information Technologies and Instrumentation

Learning Targets	
CPI #	**Cumulative Progress Indicators (CPI) for Unit**

HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. [Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object sliding down a ramp, or a moving object being pulled.
HS-PS2-2	**Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.** [Clarification Statement: Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle.] [Assessment Boundary: Assessment is limited to systems of two macroscopic bodies moving in one dimension.]

HS-PS2-3	**Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.** [Clarification Statement: Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it. Examples of a device could include a football helmet or a parachute.] [Assessment Boundary: Assessment is limited to qualitative evaluations and/or algebraic manipulations.]
HS-PS2-4	**Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.** [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]
HS-PS2-5	**Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.** [Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.]

HS-PS2-6	**Communicate scientific and technical information about why the molecular- level structure is important in the functioning of designed materials.** [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.]
Energy **HS-PS3-1**	**Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.** [Clarification Statement: Emphasis is on explaining the meaning of mathematical expressions used in the model.] [Assessment Boundary: Assessment is limited to basic algebraic expressions or computations; to systems of two or three components: and to thermal energy, kinetic energy, and/or the energies in gravitational, magnetic, or electric fields.
HS-PS3-2	**Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles objects.** Clarification Statement: Examples of phenomena at the macroscopic scale could include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above the earth, and the energy stored between two electrically-charged plates. Examples of models could include diagrams, drawings, descriptions, and computer simulations.
HS-PS3-3	**Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.** Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.] [Assessment Boundary: Assessment does not include using quantum theory.]
HS-PS3-4	**Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.** Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [Assessment Boundary: Assessment is li.mited to

	qualitative descriptions
HS-PS3-5	**Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.** Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology. [Assessment Boundary: Assessments are limited to qualitative information. Assessments do not include band theory.
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (Use of Fossil Fuels, Minerals, Natural Resources,(Food & Water),
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit Enduring Questions:	**Unit Enduring Understandings:**
● How can one explain and predict interactions between objects and within systems of objects? ● How do Newton's Laws explain the nature of physics? ● How can one predict an object's continued motion, changes in motion, or stability? ● How is flight possible? ● How does the laws of physics apply to a rollercoaster? ● How does the laws of physics apply to a rollercoaster? ● How does energy change form? ● How can energy be transferred from one material to another?	PS1.A: Structure and Properties of Matter ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (secondary to HS-PS2-6) PS2.A: Forces and Motion ● Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1) ● Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (HS-PS2-2) ● If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3) PS2.B: Types of Interactions ● Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) ● Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5) ● Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS2-

	6),*(secondary to HS-PS1-1)*,*(secondary to HS-PS1-3)* PS3.A: Definitions of Energy ● "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. *(secondary to HS- PS2-5)* ● Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HSPS3-1),(HS-PS3-2) ● At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2) (HS-PS3-3) These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2) PS3.B: Conservation of Energy and Energy ● Transfer Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system.(HS-PS3-1) ● Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4) ● Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass

	and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1) ● When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5) ETS1.A: Defining and Delimiting Engineering Problems ● Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary to HS-PS3-3)
Unit Objectives: ***Students will know….*** ● Why two different frames of reference would describe motion differently. Motion diagrams represent position and velocity of an object and displacement can be calculated is not equal to distance traveled. ● How to calculate speed and interpret acceleration of an object based on the calculation of velocity at different locations. Using a position vs. time graph based on collected data to interpret acceleration by understanding the slope of the line. ● For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first but in the	**Unit Objectives:** ***Students will be able to……*** HS-PS2 Motion and Stability ● Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. ● Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. ● Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*Define and explain motion and speed ● Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and

opposite direction (Newton's third law).

- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. Forces on an object can also change its shape or orientation. All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared.
- Newton's second law accurately predicts changes in the motion of macroscopic objects.
- Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. In any system, total momentum is always conserved. If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.

- Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.
- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.

electrostatic forces between objects.

- Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
- Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS-PS3 Energy

- Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles.
- Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
- Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system.
- Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum
Unit 4 Overview

Content Area: Physical Science

Unit Title: Physics 2: Sound and Light (3 weeks)

Target Course/Grade Level: 9th grade

Unit Summary: Content/Objective

- **Describing Mechanical Waves** - Students will investigate the difference between mechanical wave by comparing ocean waves with sound waves. How sounds are produced and how they are measured will be identified.
- **Properties of Waves** - Students will investigate the physical properties of waves by learning how sound waves are used to discover oil and used to diagnose and heal the body. Investigating other uses of waves in our world.
- **Electromagnetic Waves** - Students will investigate how new discoveries are made in space using the different types of electromagnetic waves. The various uses of all the different types of electromagnetic waves used in our everyday world be be recognized. How radar is used to predict weather, keep track of airplanes in the air and ships at sea will be compared.
- **Waves and Magnetism** - Understanding how electromagnetic waves are a more reliable way to encode and transmit information than analog signals will drive learning. Investigating how data is stored and transmitted will be highlighted.
- **Dual Nature of Light** - Through learning about renewable energy resources such as solar power, students will investigate the photoelectric effect and the dual nature of electromagnetic radiation. The students will also look to see how electromagnetic radiation is used in the medical profession, in addition to different career paths there in associated with radiation.

Unit Outline:

- Defining Waves – Mechanical (Sound) vs. Electromagnetic (Light)
- Properties of Waves – Frequency, Wavelength, Amplitude, Crest, Trough
- Electromagnetic Waves – Radio, Microwave, Infrared, UV, X-Rays, and Gamma Rays
- Uses of Electromagnetic Waves – Communication, Remote Sensing, Medical Uses
- Dual Nature of Light – Particle vs Photon

Cross Cutting Relationships

Waves and their Applications in Technology for Information Transfer

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS4-1)
- Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS4-4)
- Systems can be designed to cause a desired effect. (HS-PS4-5)

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-PS4-3)

Stability and Change

- Systems can be designed for greater or lesser stability. (HS-PS4-2)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Science and engineering complement each other in the cycle known as research and development (R&D). (HS-PS4-5)

Influence of Engineering, Technology, and Science on Society and the Natural World

- Modern civilization depends on major technological systems. (HS-PS4-2),(HS-PS4-5)
- Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (HS- PS4-2)

Interdisciplinary Connections:

Literacy and Math

- RST.9-10.8 Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-PS4-2), (HS-PS4-3), (HS-PS4-4)
- RST.11-12.1 Write arguments focused on discipline-specific content. (HS-PS4-3), (HS-PS4-4)
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-PS4-1), (HS-PS4-4)
- RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-PS4-2), (HS-PS4-3), (HS-PS4-4)
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS4-5)
- WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS4-4)
- MP.2 Reason abstractly and quantitatively. (HS-PS4-1), (HS-PS4-3)

- MP.4 Model with mathematics. (HS-PS4-1)

Learning Targets	
CPI #	**Cumulative Progress Indicators (CPI) for Unit**
HS-PS4-1	**Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.** [Clarification Statement: Examples of data could include electromagnetic radiation traveling in a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the earth.] [Assessment Boundary: Assessment is limited to algebraic relationships and describing those relationships qualitatively.]

HS-PS4-2.	**Evaluate questions about the advantages of using digital transmission and storage of information.** [Clarification Statement: Examples of advantages could include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Disadvantages could include issues of easy deletion, security, and theft.]
HS-PS4-3.	**Evaluate the claims, evidence, and the reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.** Clarification Statement: Emphasis is on how the experimental evidence supports the claim and how a theory is generally modified in light of new evidence. Examples of a phenomenon could include resonance, interference, diffraction, and photoelectric effect.] [*Assessment Boundary: Assessment does not include using quantum theory.*]

HS-PS4-4.	**Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.** [Clarification Statement: Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias.] [*Assessment Boundary: Assessment is limited to qualitative descriptions.*]
HS-PS4-5.	**Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.** [Clarification Statement: Examples could include solar cells capturing light and converting it to electricity; medical imaging; and communications technology.] [*Assessment Boundary: Assessments are limited to qualitative information. Assessments*

	do not include band theory.]

	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (Use of Fossil Fuels, Minerals, Natural Resources,(Food & Water),
	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Unit Enduring Questions:	**Unit Enduring Understandings:**
● How are different kinds of mechanical waves different from each other? ● What is the difference between an ocean	**Disciplinary Core Ideas** PS4.A: Wave Properties ● The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) ● Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2),(HS-PS4-5) ● Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (Boundary: The discussion at this grade level is qualitative only; it can be based on the fact that two different sounds can pass a location in different directions without getting mixed up.) (HS-PS4-3)

wave and a sound wave? ● How are waves used to transfer energy and send and store information? ● How is sound used to discover oil and find fish? ● How is sound used in medicine? ● What is electromagnetic radiation? ● What are the different uses of the different types of waves in the electromagnetic spectrum? ● How does solar power work?	are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) ● Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2),(HS-PS4-5) ● [From the 3–5 grade band endpoints] Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (Boundary: The discussion at this grade level is qualitative only; it can be based on the fact that two different sounds can pass a location in different directions without getting mixed up.) (HS-PS4-3) PS4.B: Electromagnetic Radiation ● Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave ● model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. (HS-PS4-3) ● When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS-PS4-4) ● Photoelectric materials emit electrons when they absorb light of a high-enough frequency. (HS-PS4-5) PS4.C: Information Technologies and Instrumentation ● Multiple technologies based on the

	understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4-5)
Unit Objectives: ***Students will know….*** ● The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. ● Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. ● Waves can add or cancel one another as they cross, depending on their relative phase but they emerge unaffected by each other. ● Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. ● When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation	**Unit Objectives:** ***Students will be able to……*** ● Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. ● Evaluate questions about the advantages of using a digital transmission and storage of information. ● Evaluate the claims, evidence, and the reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. ● Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter ● Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

(ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. ● Photoelectric materials emit electrons when they absorb light of a high- enough frequency. Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy. ● Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them.	

Lower Cape May Regional School District (Insert Subject/Content Area) Curriculum Evidence of Learning
Specific Formative Assessments Utilized in Daily Lessons: ● Lesson assessments, Chapter Self-Study Guide, Chapter assessment, Warm-Up Activity, Exit Ticket, Quick- Labs, Oral questioning, Publisher based concept reviews, portfolios, interviews ● Technology based assessments - Quizlet is used to introduce key vocabulary and allows teacher to monitor students progress. Kahoot is used to review important concept from each respective chapter or unit. Google Docs Quiz maker is used to assess individual student progress for important concepts from each respective chapter or unit.

Summative Assessment Utilized throughout Units:

- End of Unit Assessments/Modeling Projects
- End of Unit Performance Based Tasks (e.g. Rocket Engineering Design Project, Static Proof Comb/Brush Design)

Benchmark

All 9th grade students take the Quarterly STAR Renaissance benchmark

Alternative Assessments

Allow Project Based Learning to show understanding
Allow oral explanation of content
Use word banks
Abbreviate content
As per IEP/ 504/ GT Plan

Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:

ELLs

Teacher tutoring
Peer tutoring
Cooperative Learning Groups

Special Education

Modified Assignments
Modified texts
Differentiated Instruction
Response to Intervention (www.help4teachers.com)

504

Follow all IEP and 504 modifications
Adaptive Technology

Gifted and Talented

Modified assignments
Modified texts

Students at Risk of Failure

Allow opportunities to make up missing assignments
Allow opportunities to retest
I&RS Plan/ Recommended accommodations
Parent Contact Log should be utilized

Teacher Notes:

- As required by the NJ Department of Education, teachers in all content areas will integrate the 21st Century Life and Careers Standards. As the NJDOE indicates, "Providing New Jersey students with the life and career skills needed to function optimally within this dynamic context is a critical focus and organizing principle of K-12 public education. New Jersey has both an obligation to prepare its young people to thrive in this environment, and a vested economic interest in grooming an engaged citizenry made up of productive members of a global workforce that rewards innovation, creativity, and adaptation to change."

Project-based Learning Tasks:

Design of a Static-Resistant Comb/Brush using understanding of how atomic interactions influence objects on the bulk scale

Creating a device to collect fresh water from salt water. Fresh water Distilling Project

Designing a way to minimize the forces involved upon impact. Bottle Rocket Project

Investing Forces and Motion through constructing planes. Plane Project

Properties of Water and Forces associated with Hurricanes. Hurricane Project.

Vocabulary:

- In-text vocabulary should be incorporated into every unit. Word journals, vocabulary walls, and/or various other activities should be utilized by the instructor to teach vocabulary.
- Quizlet and Kahoot used to introduce and reinforce key terms and concepts.

The Research Process:

- The research process must be integrated within each course curriculum. Student will be provided with opportunities to investigate issues from thematic units of study. As the NJSLS indicate, students will develop proficiency with MLA or APA format as applicable.
- Bottle Rocket: https://www.nasa.gov/stem-ed-resources/rockets.html
- Plane
- Hurricane: https://learn.concord.org/interactions

Technology:

- Students must engage in technology applications integrated throughout the curriculum. Applicable technology utilized in this curriculum are included below:
- Use of spreadsheet programs to analyze large data of numbers. Google Sheets
- Calculators used in complex calculations.
- Use of Phet science interactive simulations.
- Use of Explore Learning Gizmo applets for Chemistry and Physics concepts.
- Use of Chromebooks to access content, and complete assignments, quizzes, and tests through Google Classroom. Chromobooks allow students to work in groups outside the classroom to complete assignments.
- Vernier probes for science labs

Resources:

- Youtube channels (Science World, Nova)
- Bozeman Science NGSS

Curriculum development Resources/Instructional Materials:

List Ancillary Resources Here:

- Gizmo applets

Board of Education Approved Text(s)
Holt Science Spectrum Physical Science