# Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

***SPARTAN MISSION:***
*Meeting the needs of all students with a proud tradition of academic excellence.*

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**Curriculum Development Timeline**

**School:** Ocean Township High School

**Course:** Principles of Chemistry and Physics

**Department:** Science

| Board Approval | Supervisor | Notes |
| --- | --- | --- |
| July 2015 | Patrick Sullivan | Born Date |
| August 2017 | Patrick Sullivan | Revisions |
| March 2019 | Patrick Sullivan | Review |
| August 2021 | Patrick Sullivan | Alignment to Standards and Revisions |
| August 2022 | Patrick Sullivan | Incorporate State Mandate |
| August 2024 | Patrick Sullivan | Updated to include New State Mandates |

# Township of Ocean Schools

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DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

| Township of Ocean Pacing Guide | | | |
|---|---|---|---|
| **Week** | **Marking Period 1** | **Week** | **Marking Period 3** |
| 1 | Lab Safety & The Nature of Science | 11 | Motion & Forces |
| 2 | Solids, Liquids & Gases | 12 | Motion & Forces |
| 3 | Solids, Liquids & Gases | 13 | Motion & Forces |
| 4 | Classification of Matter & Solutions | 14 | Work & Energy |
| 5 | Classification of Matter & Solutions | 15 | Work & Energy |
| **Week** | **Marking Period 2** | **Week** | **Marking Period 4** |
| 6 | Properties of Atoms & The Periodic Table | 16 | Waves & Sound Energy |
| 7 | Properties of Atoms & The Periodic Table | 17 | Waves & Sound Energy |
| 8 | Chemical Bonds & Chemical Reactions | 18 | Electromagnetic Waves & Light |
| 9 | Chemical Bonds & Chemical Reactions | 19 | Electromagnetic Waves & Light |
| 10 | Acids & Bases | 20 | Energy Sources & The Environment |

**Climate Change:** Energy Sources & The Environment (NJSLS-S: HS-ESS3-1)

| Core Instructional & Supplemental Materials including various levels of Texts |
|---|
| **Texts:** |

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

Glencoe Physical Science - McGraw Hill Companies, Inc. 2012

**Digital Resources Across All Levels:** (D=differentiated)
Edpuzzle (D)
Gizmo (D)
Streaming YouTube Videos
New York Times Articles
PhET Interactive Simulations (D)
Science News (D)
Ted Talks

| **Time Frame** | **1 Week** |
|---|---|
| Topic | |
| Lab Safety & The Nature of Science | |
| Alignment to Standards | |
| **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.<br>**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). | |
| Learning Objectives and Activities | |
| **Learning Objectives:**<br>● Apply knowledge of appropriate safety precautions<br>● Apply scientific practices to solve problems<br>● How to manipulate numbers in decimal and scientific notation<br>● Convert from one size SI unit to another<br>● Correctly plot/graph experimental data and determine slope<br>● Understand the purpose of various graphs in presentation of data<br><br>**Learning Activities:**<br>● Scientists ask questions & perform investigations to learn more about the natural world<br>● Describe the activities that are part of the scientific process<br>● List the basic safety rules that must be followed when working in the laboratory | |

- Scientists often graph their data to detect patterns
- Lab Safety Story - reading to learn science
- Scientific Practices Vocabulary Scavenger Hunt Game
- Make a Model - design a paper airplane activity
- Reading/History Activity - the “Hand” Measurement for Horses
- Make Your Own Thermometer Activity

## Assessments

**Formative:**
- Do Now - scientific inquiry
- Strategic questioning - lab safety scenarios
- Group discussion - safety in the lab

**Summative:**
- Lab Safety Assessment
- Analyze & Interpret various types of graphed data
- The Nature of Science Assessment - open ended

**Benchmark:**
- Principles of Chemistry and Physics Skills Benchmark

**Alternative:**
- Lab Portfolio
- Lab Safety Informational Poster
- Digital Lab Safety Breakout

## Interdisciplinary Connections

**ELA:**
RI.CT.9-10.8. Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) seminal and informational text of historical and scientific significance, including how they relate in terms of themes and significant concepts.

## Career Readiness, Life Literacies, and Key Skills

**9.4.12.CI.1:** Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

| Technology Integration |
|---|
| |
| **Career Education** |
| **CRP-2:** Students use knowledge and skills through their lab work.<br>**CRP-6:** Students use creativity and innovation in designing lab safety posters to demonstrate proper conduct while in a lab setting<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **2 Weeks** |
|---|---|
| Topic | |
| Solids, Liquids & Gases | |
| Alignment to Standards | |
| **HS-PS3-3:** Design, build and refine a device that works within given constraints to convert one form of energy into another form of energy.<br>**HS-PS3-4:** 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 (second law of thermodynamics).<br>**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. | |
| Learning Objectives and Activities | |
| **Learning Objectives:**<br>● What is the kinetic theory of matter?<br>● What is Archimedes' Principle?<br>● What is Pascal's Principle?<br>● What is Bernoulli's principle?<br>● What are some applications of the above principles?<br>● How is a gas affected when pressure, temperature or volume change?<br>● Students should be able to understand and demonstrate that fluids flow and exert forces on objects<br>● Through studying the properties of gases, students should understand that gases | |

respond to changes in pressure, temperature and volume in predictable ways

**Learning Activities**:
- Altitude & cooking activity
- Cross-curricular: Amorous solids - The Art of Glass Making
- Floating and density lab
- Inquiry: Preserving a Solid State - How should you pack and transport a fragile chocolate sculpture?
- Lab: Phase Changes - Heating and Cooling Curve
- Mini-Lab: Relate Density & Buoyancy
- Mini-Lab: Observe Pressure
- Lab: Viscosity of Various Common Liquids
- Engineering Design Process - Sink or Float Challenge
- Engineering Design Process - Ice Cube Challenge

## Assessments

**Formative:**
- Do Now - States of Matter
- Strategic questioning - Why some objects are more buoyant than others
- Group discussion - What causes a substance to change from one state of matter to another
- Do Now - Boyle's and Charles' Law
- Heating/cooling curve graph

**Summative:**
- States of Matter scenarios
- Solids, liquids & gases assessment - open ended
- States of matter lab activity

**Benchmark:** N/A

**Alternative:**
- Students create questions to be used in a review game
- Lab Portfolio
- Design a boat that will hold the most pennies

## Interdisciplinary Connections

**ELA:**

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**RI.CT.9-10.8.** Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) seminal and informational text of historical and scientific significance, including how they relate in terms of themes and significant concepts.

**Mathematics:**
A.REI.C.6 Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.

S.IC.B.6 ( + ) Evaluate reports based on data (e.g. interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed).

| Career Readiness, Life Literacies, and Key Skills |
|---|
| **9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). |
| Technology Integration |
| |
| Career Education |
| **CRP-4:** Communicate clearly and effectively and with reason.<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **2 Weeks** |
|---|---|
| Topic | |
| Classification of Matter & Solutions | |
| Alignment to Standards | |
| **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. | |

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**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.

## Learning Objectives and Activities

**Learning Objectives:**

- How is matter classified?
- How are suspensions, colloids and solutions different?
- What is a solute and solvent?
- What factors affect the rates at which solids dissolve in liquids?
- What is solubility?
- What are saturated, unsaturated and supersaturated solutions?
- How do solutes affect the freezing point and boiling points of solvents?
- What are the chemical and physical properties and changes of matter?
- How does the law of conservation of mass apply to chemical change?

**Learning Activities:**

- Classify examples of matter as pure substances or mixtures
- Identify the states and the physical and chemical properties of matter
- Virtual lab: Properties of Matter
- Lab: Pure Substances vs. Mixtures
- Mini-Lab: Identify Changes
- Lab: Making Ice Cream
- Reading/Writing: Ice Cream Article
- Lab: Saturated Solutions
- Making Snowflakes
- Lab: Boiling Points of Solutions
- Mini-Lab: Observe the effects of surface area on a solute

## Assessments

**Formative:**

- Do Now - Students will be able to compare and contrast the difference between a pure substance and a mixture
- Identify Changes mini lab
- Diagram differences between pure substances and mixtures
- Strategic questioning - how would you separate various mixtures?

**Summative:**

- Chapter Review

- Boiling points of solutions lab
- Separating a mixture lab
- Classification of matter and solutions assessment - open ended

**Benchmark:** N/A

**Alternative:**
- Elements, compounds and mixtures children's book
- Separating mixtures google slides

## Interdisciplinary Connections

**ELA:**
W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

**Mathematics:**
S.IC.B.3 ( + ) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each

A.REI.C.6 Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.

## Career Readiness, Life Literacies, and Key Skills

**9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

## Technology Integration

## Career Education

**CRP-12:** Students work productively in collaborative groups using culturally global competence.
**CRP-11:** Use technology to enhance productivity.

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

| **Time Frame** | **2 Weeks** |
|---|---|
| Topic | |
| Properties of Atoms & the Periodic Table | |
| Alignment to Standards | |
| **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.<br>**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<br>**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).<br>**HS-ESS1-3:** Communicate scientific ideas about the way stars, over their life cycle, produce elements. | |
| Learning Objectives and Activities | |
| **Learning Objectives:**<br>● What are the names and symbols of common elements?<br>● Who were the early scientists that led to the current model of the atom?<br>● What is the electron cloud model of the atom?<br>● What are isotopes?<br>● How is the periodic table organized?<br>● What are the trends on the periodic table?<br><br>**Learning Activities:**<br>● Given the name of an element, write its correct symbol; from the symbol, write the correct name<br>● Use the periodic table to identify the groups and the period of an element and decide whether it is a metal, metalloid or a nonmetal<br>● Discuss contributions that scientists made to the periodic table<br>● Explain why elements in a group have similar properties<br>● Create models of elements from the periodic table<br>● Foldable Activity - history of the atom<br>● Window Pane Activity<br>● Adopt an Element Activity<br>● Element Cube Activity | |

- Atoms Mini Project
- Creating Atomic Models
- History of the Atom - research activity/presentation
- Atom Gizmo

## Assessments

**Formative:**
- Do Now - element symbols
- Strategic questioning - types of elements
- Group discussion - what are the uses of different elements
- Strategic questioning - why the periodic table is set up the way that it is
- Do Now - metal, nonmetal or metalloid

**Summative:**
- Describe the trends and patterns to the periodic table
- Periodic table assessment
- Scientific contributions to the periodic table

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio
- Adopt An Element - project/presentation

## Interdisciplinary Connections

**ELA:**
RI.CT.9-10.8. Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) seminal and informational text of historical and scientific significance, including how they relate in terms of themes and significant concepts.

**Mathematics:**
S.IC.B.3 (+) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each

A.REI.C.6 Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.

## Career Readiness, Life Literacies, and Key Skills

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

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|---|
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| Technology Integration |
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| Career Education |
| **CRP-4:** Communicate clearly and effectively and with reason.<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **2 Weeks** |
|---|---|
| Topic | |
| Chemical Bonds & Chemical Reactions | |
| Alignment to Standards | |
| **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.<br>**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.<br>**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.<br>**HS-PS1-7:** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.<br>**HS-PS2-6:** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. | |
| Learning Objectives and Activities | |
| **Learning Objectives:**<br>● Why does bonding occur?<br>● What are the reactants and products in a chemical reaction?<br>● Why are chemical reactions important in everyday life?<br>● How can chemists affect the rates of chemical reactions?<br>● Students will use factors such as temperature, concentration, volume, pressure, surface area along with catalysts and inhibitors to control the rates of chemical | |

reactions

**Learning Activities:**
- A chemical bond is a force that holds atoms together in a compound
- Using the octet rule, write the symbols for both atoms and the single ions for the representative elements
- A chemical reaction is a process that involves one or more reactants changing into one or more products
- The rates of chemical reactions can be manipulated by changing the conditions under which the reaction takes place
- Le Chatelier's principle describes an equilibrium response to a stress in a chemical reaction
- Electronic Cereal
- Lab: Atomic Trading Cards
- Mini-Lab: Observe Bond type
- Launch Lab: A Chemical Reaction
- Mini-Lab: Design a Team Equation
- Balancing Chemical Equations Tutorial - Chromebook Activity
- Lab: Balancing Equations
- Reading Article: Carbon Monoxide - real life accounts
- Lab: To Glow or Not to Glow
- Lab: Reaction Rates
- Lab: Dancing Raisins

## Assessments

**Formative:**
- Do Now - ionic or covalent
- Ionic bonds gizmo
- Do Now - Lewis dot structures
- Describe the characteristics of both ionic and covalent bonds

**Summative:**
- A Match Made in Heaven - An Elemental Love Story (reading/writing activity)
- Assessment - chemical bonding and reactions (multiple choice, open ended)

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio
- Research Activity - Pauling Scale

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

| Interdisciplinary Connections |
|---|
| **ELA:**<br>W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.<br><br>**Mathematics:**<br>S.IC.B.3 (+) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each<br><br>A.REI.C.6 Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables. |
| Career Readiness, Life Literacies, and Key Skills |
| |
| Technology Integration |
| |
| Career Education |
| **CRP-11:** Use technology to enhance productivity.<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **1 Week** |
|---|---|
| Topic | |
| Acids & Bases | |
| Alignment to Standards | |
| **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.<br>**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.

## Learning Objectives and Activities

**Learning Objectives:**
- What defines an acid or a base?
- How are common acids and bases used in everyday life?
- What are some common properties of acids and bases?
- What is the pH scale?
- Why acids and bases are important substances in health, industry and the environment
- Looking at a pH scale, be able to classify solutions as acidic, neutral or basic

**Learning Activities:**
- Describe the pH scale
- Acids and bases are classified based on pH
- Buffers are solutions that minimize the effects of the addition of an acid or base on pH
- Neutralization is a chemical reaction between an acid and a base
- Reading (article & questions): the effects of acid rain
- Mini-Lab: observe acid relief (how antacids work)
- The pH Lab
- Lab: Acid Concentrations
- Lab: Be a Soda Scientist

## Assessments

**Formative:**
- Strategic questioning - what is the difference between an acid and a base
- Do Now - acid or base?
- Effects of acid rain article - comments

**Summative:**
- Describe the nature of a solution based on the pH scale
- pH lab

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio
- Acid/base slide presentations

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

| Interdisciplinary Connections |
|---|
| **ELA:**<br>W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.<br><br>**Mathematics:**<br>S.IC.B.3 (+) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each<br><br>A.REI.C.6 Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables. |
| **Career Readiness, Life Literacies, and Key Skills** |
| **9.4.12.CI.1:** Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a). |
| **Technology Integration** |
| |
| **Career Education** |
| **CRP-4:** Communicate clearly and effectively and with reason.<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **3 Weeks** |
|---|---|
| **Topic** | |
| Motion & Forces | |
| **Alignment to Standards** | |
| **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. | |

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**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.
**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.
**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.
**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.
**HS-PS3-5:** 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.
**HS-ESS1-4:** Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

## Learning Objectives and Activities

**Learning Objectives:**
- What is inertia and how is it related to Newton's first law?
- How can you calculate acceleration using Newton's second law?
- According to Newton's third law of motion, how are the forces between interacting objects related?
- How does Newton's first law explain what happens in a car crash?
- How does Newton's second law explain the effects of air resistance?
- When is momentum conserved?
- Use both speed and velocity to describe an object's speed and direction of motion
- Demonstrate understanding of how acceleration describes how the velocity of an object is changing with time
- Understand objects that interact exert forces on each other
- Demonstrate how unbalanced forces cause the motion of objects to change
- Study gravity, weight and friction to understand our physical world
- Explain Newton's three laws both qualitatively and quantitatively
- Use Newton's laws to explain everyday events, such as falling and collisions

**Learning Activities**:
- Motion occurs when an object changes its position relative to a reference point
- Interpret distance - time graphs and calculate slope
- Calculate acceleration
- Calculate net forces
- Newton's laws of motion relate changes in an object's motion with the forces acting on it
- Virtual lab: Inquiry - Speed

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- Mini-Lab: Measure Average Speed
- Virtual Lab: Speed Distance Graphs Gizmo
- Activity: Momentum and Sports
- Mini-Lab: Determining the Direction of Acceleration
- Lab: Motion Graphs
- The Scooter Games
- Lab: The Momentum of Colliding Objects
- Foldable Activity: Newton's Laws
- Reading Activity: Newton's Laws and Car Crashes
- Mini-Lab: Compare Friction and Gravity
- Mini-Lab: Observe Inertia
- Demo: Newton's Third Law - Balloon Rocket
- Lab: The Effects of Air Pressure
- Lab: Motion From Different Forces
- Activity: Research the Physics of…..
- Activity: Create A Car

## Assessments

**Formative:**
- Group discussion - what are some real world examples of Newton's laws
- Do Now - Speed problems
- Problems - Force = mass X acceleration
- Do Now - Newton's second law problems
- Observe inertia mini-lab

**Summative:**
- Motion Quiz
- Motion and Forces assessment (multiple choice and open ended)
- The momentum of colliding objects lab

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio
- Phet interactive simulations - Forces & Motion
- Create A Car activity
- Explain real world scenarios using Newton's Laws of Motion

## Interdisciplinary Connections

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**ELA:**
**W.IW.9-10.2.** Write informative/explanatory texts **(including the narration of historical events, scientific procedures/ experiments, or technical processes)** to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
**Mathematics:**
A.REI.C.6 Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.
S.IC.B.6 ( + ) Evaluate reports based on data (e.g. interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed).

| Career Readiness, Life Literacies, and Key Skills |
| --- |
| |
| **Technology Integration** |
| **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) |
| **Career Education** |
| **CRP-11:** Use technology to enhance productivity.<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **2 Weeks** |
| --- | --- |
| Topic | |
| Work & Energy | |
| Alignment to Standards | |
| **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).<br>**HS-PS3-3:** Design, build and refine a device that works within given constraints to convert | |

one form of energy into another form of energy.
**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.

## Learning Objectives and Activities

**Learning Objectives:**
- How can work be calculated when force and motion are parallel to each other?
- What are mechanical advantages and efficiency?
- How can you calculate kinetic energy?
- How can you calculate gravitational potential energy?
- What is the law of conservation of energy?
- How are power and energy related?
- Explain scenarios in which work is done, identify the forces, displacement and energy transfer
- Quantitatively calculate work
- Categorize a wedge and screw as variations of inclined planes, a pulley and wheel and axle as variations of a lever
- Exemplify the relationship between kinetic energy, potential energy and heat to illustrate the total energy is conserved in mechanical systems such as a pendulum and roller coaster.

**Learning Activities:**
- Energy can be transferred and transformed from one form into another
- Many modern technologies, such as automobile engines and power plants, transform one form of energy into another
- Lab: Mechanical Advantage & Efficiency
- Mini-Lab: Interpret Data From A Slingshot
- Virtual Lab: Energy Conservation
- Reading/History: Newton's Apple Article & Questions
- Mini-Lab: Calculate Your Power
- Lab: Swinging Energy

## Assessments

**Formative:**
- Group discussion - how is energy transformed
- Do Now - Types of Energy
- Mechanical advantage practice problems
- Calculate your power mini-lab

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**Summative:**
- Compare and contrast simple and complex machines
- Generate and discuss types of energy
- Assessment - work and energy (multiple choice and open ended)

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio
- Roller Coaster Physics Gizmo

## Interdisciplinary Connections

**ELA:**
**RI.CT.9-10.8**. Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) seminal and informational text of historical and scientific significance, including how they relate in terms of themes and significant concepts.

**Mathematics:**
S.IC.B.4 (+) Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling

S.IC.B.6 (+) Evaluate reports based on data (e.g. interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed).

## Career Readiness, Life Literacies, and Key Skills

## Technology Integration

## Career Education

**CRP-11:** Use technology to enhance productivity.

DEPARTMENT: **Science** COURSE: **Principles of Chemistry and Physics**

**CRP-12:** Students work productively in collaborative groups using culturally global competence.

| Time Frame | 2 Weeks |
|---|---|
| Topic | |
| Waves & Sound Energy | |
| Alignment to Standards | |
| **HS-PS4-1:** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength and speed of waves traveling in various media.<br>**HS-PS4-2:** Evaluate questions about the advantages of using a digital transmission and storage of information.<br>**HS-PS4-3:** 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. | |
| Learning Objectives and Activities | |

**Learning Objectives:**
- How do waves transfer energy?
- What is the law of reflection?
- How does sound travel through different mediums?
- What affects the speed of sound?
- How does your ear enable you to hear?
- What is the Doppler Effect?
- What are some of the factors that affect the design of concert halls and movie theaters?
- How do some animals use sound to hunt and navigate?
- How does sonar work?
- How is ultrasound used in medicine?
- Explain and understand that waves transfer energy from place to place without transferring matter
- Understand that wave properties depend on the vibrations of the wave source and the material in which the wave travels
- Learn how waves interact with matter and with each other
- Understand that sound waves are longitudinal waves produced by vibrations
- Loudness of a sound depends on its intensity and the pitch of a sound depends on its

frequency
- Sound waves are used to locate objects, to form images and to treat medical problems

**Learning Activities**:
- A wave is a repeating disturbance that transfers energy through matter and space
- Waves carry energy without transporting matter
- Sound cannot travel through a vacuum
- The ear detects sound waves and converts them to electrical impulses
- Sound intensity is measured in decibels
- The Doppler Effect is the change in wave frequency due to a wave source moving toward an observer
- Acoustics is the study of sound
- Sound waves are used by animals and the medical field
- Mini-Lab: Wave Type Slinky Activity
- Virtual Lab: Waves
- Mini-Lab: Observe Wavelength
- Lab: Wave Speed & Tension
- Lab: Wavelength, Frequency & Wave Speed
- Virtual Lab: Animal Hearing
- Mini-Lab: Compare Sounds
- Mini-Lab: Measure Sound Intensities

## Assessments

**Formative:**
- Transverse vs. Longitudinal waves Venn diagram
- Measure sound intensities mini-lab
- Group discussion - Doppler Effect
- Do Now - Parts of Wave
- Slinky Wave - type activity
- Group discussion - how are sound waves used in medicine?

**Summative:**
- Chapter Quiz - Sound Waves
- Sound Energy assessment (multiple choice and short answers)
- Wave Speed & Tension Lab

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio

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- Choose an animal, research its sound and how it uses it
- Create various scenarios of how the Doppler Effect is observed in real life

## Interdisciplinary Connections

**ELA:**
**RI.CT.9-10.8**. Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) seminal and informational text of historical and scientific significance, including how they relate in terms of themes and significant concepts.

**Mathematics:**
S.IC.B.4 (+) Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling

S.IC.B.5 (+) Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

## Career Readiness, Life Literacies, and Key Skills

## Technology Integration

## Career Education

**CRP4:** Communicate clearly and effectively and with reason.
**CRP-12:** Students work productively in collaborative groups using culturally global competence.

| | |
|---|---|
| **Time Frame** | **2 Weeks** |

## Topic

Electromagnetic Waves & Light

## Alignment to Standards

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**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.
**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.
**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.
**HS-ESS1-2:** Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe
**HS-ESS3-5:** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

## Learning Objectives and Activities

**Learning Objectives:**
- How does a vibrating electric charge produce an electromagnetic wave?
- What properties describe electromagnetic waves?
- How are carrier waves modulated to transmit information?
- What is the difference between amplitude modulation and frequency modulation?
- What technologies use radio waves and microwaves for communication?
- Explain and understand that electromagnetic waves transfer energy through matter and through space
- The electromagnetic spectrum is divided into several sections, each with a certain range of frequencies and specific properties
- Radio waves and microwaves can be used to transmit signals and information
- Understand that visible light waves are electromagnetic waves that enable us to see
- Demonstrate that materials can absorb, transmit or reflect light waves
- Light waves of different wavelengths or combinations of wavelengths cause the human eye to detect different colors

**Learning Activities:**
- An electromagnetic wave consists of a vibrating electric field and a vibrating magnetic field
- Electromagnetic waves carry radiant energy
- All light colors can be created by mixing the primary light colors - red, green and blue
- Mini-Lab: Investigate Electromagnetic Waves
- Virtual Lab: Wavelength
- Mini-Lab: Investigate the Effects of Microwaves
- Lab: The Speed of Light
- Lab: Radio Broadcasts (internet research)
- Mini-Lab: Observe Refraction in Water

- Light Activities: Explore & Explain
- Activity: Fun with Filters
- Inquiry Lab: Combining Colors
- Virtual Lab: How Are Colors Created?
- Lab: The Color Lab

## Assessments

**Formative:**
- Strategic questioning - parts of a wave
- Group Discussion- how to make different colors
- Do Now - Light Problems
- Do Now - Colors
- Electromagnetic Puzzle
- Electromagnetic WebQuest

**Summative:**
- Assessment - electromagnetic radiation
- List examples of how solar radiation and climate change are linked

**Benchmark:** N/A

**Alternative:**
- Lab Portfolio
- Presentation on the electromagnetic spectrum

## Interdisciplinary Connections

**ELA;**
**RI.CT.9-10.8**. Analyze and reflect on (e.g. practical knowledge, historical/cultural context, and background knowledge) seminal and informational text of historical and scientific significance, including how they relate in terms of themes and significant concepts.

**Mathematics:**
S.IC.B.4 (+) Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling

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| |
|---|
| S.IC.B.5 (+) Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. |
| Career Readiness, Life Literacies, and Key Skills |
| |
| Technology Integration |
| |
| Career Education |
| **CRP-11:** Use technology to enhance productivity.<br>**CRP-12:** Students work productively in collaborative groups using culturally global competence. |

| **Time Frame** | **1 Week** |
|---|---|
| Topic | |
| Energy Sources & The Environment | |
| Alignment to Standards | |
| **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.<br>**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.<br>**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<br>**HS-ESS1-1:** Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.<br>**HS-ESS3-1:** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards and climate change have influenced human activity. | |

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## Learning Objectives and Activities

**Learning Objectives:**

- Which energy resources do you use daily?
- How do nuclear reactors convert nuclear energy into thermal energy?
- What are the advantages and disadvantages of using nuclear energy to generate electricity?
- What are renewable energy sources?
- How does human population affect Earth's carrying capacity?
- What are the causes and effects of pollution on land, water and air?
- What are some methods used to control the types and sources of pollution?
- How can you help protect and preserve Earth's natural resources?
- Human impact on land, water and air affects the natural resources available for use

**Learning Activities:**

- Wind energy is converted into electrical energy using a propeller attached to an electrical generator
- Alternative energy sources can help replace human dependence on fossil fuels
- Human impact on Earth affects the natural resources available for use to thrive
- Foldable Activity: Energy Sources
- Mini-Lab: Design an Efficient Water Heater
- Virtual Lab: Energy Output
- Mini-Lab: Use Solar Power at Home
- Lab: Solar Heating
- Lab: Energy-Efficient Building
- Reading/Design Activity: Read about Earth Day & design an Earth Day logo

## Assessments

**Formative:**

- Strategic Questioning - how is energy transformed to other types of energy
- Do Now - Types of Energy Sources

**Summative:**

- Alternative Energy Google slide presentation

**Benchmark:**

- Multiple choice end of course benchmark
- Principles of Chemistry & Physics Skills Benchmark

**Alternative:**

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- Design Earth Day Logo
- Lab Portfolio
- Energy Efficient Building Lab

## Interdisciplinary Connections

**ELA:**
**W.AW.9-10.1.** Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant
**W.WR.9–10.5**. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

**Mathematics:**
**S.IC.B.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each

**S.IC.B.4** Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling

## Career Readiness, Life Literacies, and Key Skills

**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).

## Technology Integration

## Career Education

**CRP-4:** Communicate clearly and effectively and with reason.
**CRP-12:** Students work productively in collaborative groups using culturally global competence.

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| Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans) |
|---|
| ***ELL***:<br>● Work toward longer passages as skills in English increase<br>● Use visuals<br>● Introduce key vocabulary before lesson<br>● Teacher models reading aloud daily<br>● Provide peer tutoring<br>● Use of Bilingual Dictionary<br>● Guided notes and/or scaffold outline for written assignments<br>● Provide students with English Learner leveled readers.<br><br>***Supports for Students With IEPs***:<br>● Allow extra time to complete assignments or tests<br>● Guided notes and/or scaffold outline for written assignments<br>● Work in a small group<br>● Allow answers to be given orally or dictated<br>● Use large print books, Braille, or books on CD (digital text)<br>● Follow all IEP modifications<br><br>***At-Risk Students***:<br>● Guided notes and/or scaffold outline for written assignments<br>● Introduce key vocabulary before lesson<br>● Work in a small group<br>● Lesson taught again using a differentiated approach<br>● Allow answers to be given orally or dictated<br>● Use visuals / Anchor Charts<br>● Leveled texts according to ability<br><br>***Gifted and Talented***:<br>● Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)<br>● Provide options, alternatives and choices to differentiate and broaden the curriculum<br>● Organize and offer flexible small group learning activities<br>● Provide whole group enrichment explorations<br>● Teach cognitive and methodological skills |

- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

***Supports for Students With 504 Plans:***
- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns