Chapter 1 Introduction to Science

Section 1.1 The Nature of Science

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days

Objectives
1. Describe the main branches of natural science and relate them to each other.
2. Describe the relationship between science and technology.
3. Distinguish among facts, theories, and laws.
4. Explain the roles of models and mathematics in scientific theories and laws.

National Science Education Standards Covered
_____ PS 4b: Gravitation is a universal force that each mass exerts on any other mass. The strength of the gravitational attractive force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.

_____ PS 5c: Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature is, the greater the atomic or molecular motion.

_____ UCP 1: Systems, order, and organization

_____ UCP 2: Evidence, models, and explanation

_____ HNS 1: Science as a human endeavor

_____ HNS 2: Nature of science

_____ HNS 3: History of science

Chapter 1 Introduction to Science

Section 1.2 The Way Science Works

Pacing
Regular Schedule: with lab(s): 3 days without lab(s): 2 days

Objectives
1. Understand how to use critical thinking skills to solve problems.
2. Describe the steps of the scientific method.
3. **Know** some of the tools scientists use to investigate nature.
4. **Explain** the objective of a consistent system of units, and identify the SI units for length, mass, and time.
5. **Identify** what each common SI prefix represents, and convert measurements.

**National Science Education Standards Covered**

_____ SAI 2: Understanding about scientific inquiry

_____ UCP 3: Change, consistency, and measurements

_____ ST 2: Understanding about science and technology

_____ HNS 2: Nature of science

_________ HNS 3: History of science

**Chapter 1 Introduction to Science**

**Section 1.3 Organizing Data**

**Pacing**
Regular Schedule: **with lab(s):** 3 days **without lab(s):** 2 days

**Objectives**
1. **Interpret** line graphs, bar graphs, and pie graphs.
2. **Identify** the significant figures in calculations.
3. **Use** scientific notation and significant figures in problem solving.
4. **Understand** the difference between precision and accuracy.

**National Science Education Standards Covered**

_____ UCP 2: Evidence, models, and explanation

_____ HNS 1: Science as a human endeavor

**Chapter 2 Matter**

**Section 2.1 What Is Matter?**

**Pacing**
Regular Schedule: **with lab(s):** N/A **without lab(s):** 2 days
Objectives
1. Explain the relationship between matter, atoms, and elements.
2. Distinguish between elements and compounds.
3. Interpret and write some common chemical formulas.
4. Categorize materials as pure substances or mixtures.

National Science Education Standards Covered
_____PS 2d: The physical properties of compounds reflect the nature of the interactions among its molecules. These interactions are determined by the structure of the molecule, including the constituent atoms and the distances and angles between them.

_____UCP 1: Systems, order, and organization

_____ST 2: Understanding about science and technology

Chapter 2 Matter

Section 2.2 Matter and Energy

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Use the kinetic theory to describe the properties and structures of the different states of matter.
2. Describe the energy transfers involved in changes of state.
3. Describe the laws of conservation of mass and conservation of energy, and explain how they apply to changes of state.

National Science Education Standards Covered
_____PS 2d: The physical properties of compounds reflect the nature of the interactions among its molecules. These interactions are determined by the structure of the molecule, including the constituent atoms and the distances and angles between them.

_____PS 2e: Solids, liquids, and gases differ in the distances and angles between molecules or atoms and therefore the energy that binds them together. In solids, the structure is nearly rigid; in liquids, molecules or atoms move around each other but do not move apart; and in gases, molecules or atoms move almost independently of each other and are mostly far apart.
Chapter 2 Matter

Section 2.3 Properties of Matter

Pacing
Regular Schedule: with lab(s): 3 days without lab(s): 2 days

Objectives
1. Distinguish between chemical and physical properties of matter.
2. Perform calculations involving density.
3. Distinguish between chemical and physical changes in matter.
4. Apply the laws of conservation of mass and conservation of energy to chemical and physical changes.
5. Evaluate materials and their properties for different uses.

National Science Education Standards Covered
_____ SAI 1: Abilities to do scientific inquiry.

_____ PS 5a: The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

_____ PS 5c: Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature, the greater the atomic or molecular motion.

_____ UCP 1: Systems, order, and organization

_____ UCP 2: Evidence, models, and explanation

_____ UCP 5: Form and function

Chapter 3 Atoms and the Periodic Table

Section 3.1 Atomic Structure

Pacing
Regular Schedule: with lab(s): 2.5 days without lab(s): 2 days
Objectives
1. Explain Dalton’s atomic theory and describe why it was more successful than Democritus’s theory.
2. State the charge, mass, and location of each part of an atom according to the modern model of the atom.
3. Compare and contrast Bohr’s model with the modern model of the atom.

National Science Education Standards Covered

PS 1a: Matter is made of minute particles called atoms, and atoms are composed of even smaller components. These components have measurable properties, such as mass and electrical charge. Each atom has a positively charged nucleus surrounded by negatively charged electrons. The electric force between the nucleus and electrons holds the atom together.

PS 1c: The nuclear forces that hold the nucleus of an atom together, at nuclear distances, are usually stronger than the electric forces that would make it fly apart. Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure and is the process responsible for the energy of the sun and other stars.

PS 2b: An element is composed of a single type of atom. When elements are listed in order according to the number of protons (called the atomic number), repeating patterns of physical and chemical properties identify families of elements with similar properties. This Periodic Table is a consequence of the repeating pattern of outermost electrons and their permitted energies.

UCP 2: Evidence, models, and explanation

HNS 1: Science as a human endeavor

HNS 3: History of science

Chapter 3 Atoms and the Periodic Table

Section 3.2 A Guided Tour of the Periodic Table

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Relate the organization of the periodic table to the arrangement of electrons within an atom.
2. Explain why some atoms gain or lose electrons to form ions.
3. **Determine** how many protons, neutrons, and electrons an isotope has, given its symbol, atomic number, and mass number.

4. **Describe** how the abundance of isotopes affects an element’s average atomic mass.

**National Science Education Standards Covered**

_____ **PS 1c:** The nuclear forces that hold the nucleus of an atom together, at nuclear distances, are usually stronger than the electric forces that would make it fly apart. Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure and is the process responsible for the energy of the sun and other stars.

_____ **PS 2a:** Atoms interact with one another by transferring or sharing electrons that are farthest from the nucleus. These outer electrons govern the chemical properties of the element.

_____ **PS 2b:** An element is composed of a single type of atom. When elements are listed in order according to the number of protons (called the atomic number), repeating patterns of physical and chemical properties identify families of elements with similar properties. This Periodic Table is a consequence of the repeating pattern of outermost electrons and their permitted energies.

_____ **UCP 1:** Systems, order, and organization

_____ **UCP 5:** Form and function

**Chapter 3 Atoms and the Periodic Table**

**Section 3.3 Families of Elements**

**Pacing**

Regular Schedule: with lab(s): 2 days without lab(s): 2 days

**Objectives**

1. **Locate** alkali metals, alkaline-earth metals, and transition metals in the periodic table.
2. **Locate** semiconductors, halogens, and noble gases in the periodic table.
3. **Relate** an element’s chemical properties to the electron arrangement of its atoms.

**National Science Education Standards Covered**

_____ **PS 2a:** Atoms interact with one another by transferring or sharing electrons that are farthest from the nucleus. These outer electrons govern the chemical properties of the element.
PS 2b: An element is composed of a single type of atom. When elements are listed in order according to the number of protons (called the atomic number), repeating patterns of physical and chemical properties identify families of elements with similar properties. This Periodic Table is a consequence of the repeating pattern of outermost electrons and their permitted energies.

SAI 1: Abilities to do scientific inquiry

SPSP 2: Populations, resources, and environments

SPSP 5: Science and technology in society

Chapter 4 The Structure of Matter

Section 4.1 Compounds and Molecules

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Distinguish between compounds and mixtures.
2. Relate the chemical formula of a compound to the relative numbers of atoms or ions present in the compound.
3. Use models to visualize a compound’s chemical structure.
4. Describe how the chemical structure of a compound affects its properties.

National Science Education Standards Covered

PS 2c: Bonds between atoms are created when electrons are paired up by being transferred or shared. A substance composed of a single kind of atom is called an element. The atoms may be bonded together into molecules or crystalline solids. A compound is formed when two or more kinds of atoms bind together chemically.

PS 2d: The physical properties of compounds reflect the nature of the interactions among its molecules. These interactions are determined by the structure of the molecule, including the constituent atoms and the distances and angles between them.

PS 2e: Solids, liquids, and gases differ in the distances and angles between molecules or atoms and therefore the energy that binds them together. In solids, the structure is nearly rigid; in liquids, molecules or atoms move around each other but do not move apart; and in gases, molecules or atoms move almost independently of each other and are mostly far apart.
Chapter 4 The Structure of Matter

Section 4.2 Ionic and Covalent Bonding

Objectives
1. Explain why atoms sometimes join to form bonds.
2. Explain why some atoms transfer their valence electrons to form ionic bonds, while other atoms share valence electrons to form covalent bonds.
3. Differentiate between ionic, covalent, and metallic bonds.
4. Compare the properties of substances with different types of bonds.

National Science Education Standards Covered

PS 2a: Atoms interact with one another by transferring or sharing electrons that are farthest from the nucleus. These outer electrons govern the chemical properties of the element.

PS 2c: Bonds between atoms are created when electrons are paired up by being transferred or shared. A substance composed of a single kind of atom is called an element. The atoms may be bonded together into molecules or crystalline solids. A compound is formed when two or more kinds of atoms bind together chemically.

UCP 2: Evidence, models, and explanation

HNS 3: History of science

Chapter 4 The Structure of Matter

Section 4.3 Compound Names and Formulas

Objectives
1. Name simple ionic and covalent compounds.
2. Predict the charge of a transition metal cation in an ionic compound.
3. Write chemical formulas for simple ionic compounds.
4. Distinguish a covalent compound’s empirical formula from its molecular formula.

National Science Education Standards Covered

______SAI 1: Abilities to do scientific inquiry

Chapter 4 The Structure of Matter

Section 4.4 Organic and Biochemical Compounds—Integrating Technology and Society

Pacing
Regular Schedule: with lab(s): 3 days without lab(s): 2 days

Objectives
1. Describe how carbon atoms bond covalently to form organic compounds.
2. Identify the names and structures of groups of simple organic compounds and polymers.
3. Identify what the polymers essential for life are made of.

National Science Education Standards Covered

______PS 2f: Carbon atoms can bond to one another in chains, rings, and branching networks to form a variety of structures, including synthetic polymers, oils, and the large molecules essential to life.

______SPSP 5: Science and technology in society

Chapter 5 Chemical Reactions

Section 5.1 The Nature of Chemical Reactions

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days
Block Schedule: with lab(s): N/A without lab(s): 1 day

Objectives
1. Recognize some signs that a chemical reaction is taking place.
2. Explain chemical changes in terms of the structure and motion of atoms and molecules.
3. Describe the differences between endothermic and exothermic reactions.
4. Identify situations involving chemical energy.
National Science Education Standards Covered

PS 3a: Chemical reactions occur all around us—for example—in health care, cooking, cosmetics, and automobiles. Complex chemical reactions involving carbon-based molecules take place constantly in every cell in our bodies.

PS 3b: Chemical reactions may release or consume energy. Some reactions such as the burning of fossil fuels release large amounts of energy by losing heat and by emitting light. Light can initiate many chemical reactions such as photosynthesis and the evolution of urban smog.

LS 5b: The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.

UCP 1: Systems, order, and organization

UCP 2: Evidence, models, and explanation

Chapter 5 Chemical Reactions

Section 5.2 Reaction Types

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days

Objectives
1. Distinguish among five general types of chemical reactions.
2. Predict the products of some reactions based on the reaction type.
3. Describe reactions that transfer or share electrons between molecules, atoms, or ions.

National Science Education Standards Covered

PS 3c: A large number of important reactions involve the transfer of either electrons (oxidation/reduction reactions) or hydrogen ions (acid/base reactions) between reacting ions, molecules, or atoms. In other reactions, chemical bonds are broken by heat or light to form very reactive radicals with electrons ready to form new bonds. Radical reactions control many processes such as the presence of ozone and greenhouse gases in the atmosphere, the burning and processing of fossil fuels, the formation of polymers, and explosions.

UCP 1: Systems, order, and organization
Chapter 5 Chemical Reactions

Section 5.3 Balancing Chemical Equations

Pacing
Regular Schedule:  with lab(s): 2 days  without lab(s): 2 days

Objectives
1. Demonstrate how to balance chemical equations.
2. Interpret chemical equations to determine the relative number of moles of reactants needed and moles of products formed.
3. Explain how the law of definite proportions allows for predictions about reaction amounts.
4. Identify mole ratios in a balanced chemical equation.
5. Calculate the relative masses of reactants and products from a chemical equation.

National Science Education Standards Covered
SAI 1: Abilities to do scientific inquiry

Chapter 5 Chemical Reactions

Section 5.4 Rates of Change

Pacing
Regular Schedule:  with lab(s): 3 days  without lab(s): 2 days

Objectives
1. Describe the factors affecting reaction rates.
2. Explain the effect a catalyst has on a chemical reaction.
3. Explain chemical equilibrium in terms of equal forward and reverse reaction rates.
4. Apply Le Châtelier’s principle to predict the effect of changes in concentration, temperature, and pressure in an equilibrium process.

National Science Education Standards Covered
PS 3d: Chemical reactions can take place in time periods ranging from the few femtoseconds (10^{-15} seconds) required for an atom to move a fraction of a chemical bond distance to geologic time scales of billions of years. Reaction rates depend on
the frequency with which reacting atoms and molecules encounter one another, the
temperature, and the properties (including shape) of the reacting species.

_____PS 3e: Catalysts, such as metal surfaces, accelerate chemical reactions. Chemical
reactions in living systems are catalyzed by protein molecules called enzymes.

_____LS 4a: The atoms and molecules on Earth cycle among the living and nonliving
components of the biosphere.

_____UCP 1: Systems, order, and organization
_____UCP 2: Evidence, models, and explanation
_____UCP 5: Form and function
_____SPSP 2: Populations, resources, and environments

Chapter 6 Solutions, Acids, and Bases

Section 6.1 Solutions and Other Mixtures

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days

Objectives
1. Distinguish between homogeneous mixtures and heterogeneous mixtures.
2. Compare and contrast the properties of solutions, colloids, and suspensions.
3. Identify ways to separate different kinds of mixtures.

National Science Education Standards Covered
_____SAI 2: Understanding about scientific inquiry

Chapter 6 Solutions, Acids, and Bases

Section 6.2 Dissolving and Solubility

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Describe how a substance dissolves in terms of its solubility, molecular motion, and solute-solvent interactions.
2. Identify several factors that affect the rate at which a substance dissolves.
3. Relate the structure of water to its ability to dissolve many different substances.
4. Distinguish between saturated, unsaturated, and supersaturated solutions.

National Science Education Standards Covered
____SAI 1: Abilities to do scientific inquiry

Chapter 6 Solutions, Acids, and Bases

Section 6.3 Acids, Bases, and pH

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Compare and contrast acids and bases.
2. Relate the pH of a solution to the concentration and strength of a dissolved acid or base.
3. Identify the products of neutralization reactions.

National Science Education Standards Covered
____SAI 1: Abilities to do scientific inquiry
____SPSP 1: Personal health

Chapter 6 Solutions, Acids, and Bases

Section 6.4 Acids and Bases in the Home—Integrating Technology and Society

Pacing
Regular Schedule: with lab(s): 3 days without lab(s): 2 days

Objectives
1. Recognize several acidic and basic substances commonly found in homes.
2. Explain how soap is made and why it can remove dirt and grease.
3. Describe the acidic or basic characteristics of other household items.
National Science Education Standards Covered

_____ SAI 1: Abilities to do scientific inquiry

_____ HNS 3: History of science

_____ SPSP 1: Personal health

_____ SPSP 5: Science and technology in society

Chapter 7 Nuclear Changes

Section 7.1 What Is Radioactivity?

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Identify four types of nuclear radiation and their properties.
2. Balance equations for nuclear decay.
3. Calculate the half-life of a radioactive isotope.

National Science Education Standards Covered

_____ PS 1d: Radioactive isotopes are unstable and undergo spontaneous nuclear reactions, emitting particles and/or electromagnetic radiation. The decay of any one nucleus cannot be predicted, but a large group of identical nuclei decay at a predictable rate. This predictability can be used to estimate the age of materials that contain radioactive isotopes.

_____ UCP 1: Systems, order, and organization

Chapter 7 Nuclear Changes

Section 7.2 Nuclear Fission and Fusion

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Describe how the strong nuclear force affects the composition of a nucleus.
2. Distinguish between fission and fusion, and provide examples of each.
3. **Recognize** the equivalence of mass and energy, and why small losses in mass release large amounts of energy.

4. **Explain** what a chain reaction is, how it is initiated, and how it can be controlled.

**National Science Education Standards Covered**

**PS 1c:** The nuclear forces that hold the nucleus of an atom together, at nuclear distances, are usually stronger than the electric forces that would make it fly apart. Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure and is the process responsible for the energy of the sun and other stars.

**UCP 2:** Evidence, models, and explanation

**Chapter 7 Nuclear Changes**

**7.3 Dangers and Benefits of Nuclear Radiation**

**Pacing**

Regular Schedule: with lab(s): 3 days  
without lab(s): 2 days

**Objectives**

1. **Describe** the dangers and possible health effects of exposure to nuclear radiation.
2. **Identify** several beneficial uses of nuclear radiation.
3. **Explain** the benefits and drawbacks of nuclear power.

**National Science Education Standards Covered**

**SAI 1:** Abilities to do scientific inquiry

**Chapter 8 Motion and Forces**

**Section 8.1 Motion**

**Pacing**

Regular Schedule: with lab(s): N/A  
without lab(s): 2 days

**Objectives**

1. **Relate** speed to distance and time.
2. **Distinguish** between speed and velocity.
3. **Recognize** that all moving objects have momentum.
4. **Solve** problems involving time, distance, velocity, and momentum.

**National Science Education Standards Covered**

_____ **SAI 1**: Abilities to do scientific inquiry.

**Chapter 8 Motion and Forces**

**Section 8.2 Acceleration and Force**

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**Pacing**

Regular Schedule: **with lab(s):** 3 days **without lab(s):** 2 days

**Objectives**

1. **Calculate** the acceleration of an object.
2. **Describe** how force affects the motion of an object.
3. **Distinguish** between balanced and unbalanced forces.
4. **Explain** how friction affects the motion of an object.

**National Science Education Standards Covered**

_____ **PS 4b**: Gravitation is a universal force that each mass exerts on any other mass. The strength of the gravitational attractive force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.

_____ **UCP 2**: Evidence, models, and explanation

**Chapter 8 Motion and Forces**

**Section 8.3 Newton’s Laws of Motion**

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**Pacing**

Regular Schedule: **with lab(s):** 2 days **without lab(s):** 2 days

**Objectives**

1. **State** Newton’s three laws of motion, and apply them to physical situations.
2. **Calculate** force, mass, and acceleration with Newton’s second law.
3. **Recognize** that the free-fall acceleration near Earth’s surface is independent of the mass of the falling object.

4. **Explain** the difference between mass and weight.

5. **Identify** paired forces on interacting objects.

**National Science Education Standards Covered**

**PS 4a:** Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship \( F = ma \), which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.

**UCP 2:** Evidence, models, and explanation

**Chapter 9 Work and Energy**

**Section 9.1 Work, Power, and Machines**

**Pacing**

Regular Schedule: with lab(s): N/A  
without lab(s): 2 days

**Objectives**

1. **Define** work and power.

2. **Calculate** the work done on an object and the rate at which work is done.

3. **Use** the concept of mechanical advantage to **explain** how machines make doing work easier.

4. **Calculate** the mechanical advantage of various machines.

**National Science Education Standards Covered**

**PS 4a:** Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship \( F = ma \), which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.

**UCP 1:** Systems, order, and organization

**UCP 2:** Evidence, models, and explanation

**UCP 3:** Change, consistency, and measurements

**SAI 1:** Abilities to do scientific inquiry
Chapter 9 Work and Energy

Section 9.2 Simple Machines

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Name and describe the six types of simple machines.
2. Discuss the mechanical advantage of different types of simple machines.
3. Recognize simple machines within compound machines.

National Science Education Standards Covered
PS 4a: Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship \( F = ma \), which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.

UCP 1: Systems, order, and organization
UCP 2: Evidence, models, and explanation
UCP 3: Change, consistency, and measurements
UCP 5: Form and function
ST 2: Understanding about science and technology

Chapter 9 Work and Energy

Section 9.3 What is Energy?

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days

Objectives
1. Explain the relationship between energy and work.
2. Define potential energy and kinetic energy.
3. Calculate kinetic energy and gravitational potential energy.
4. **Distinguish** between mechanical and nonmechanical energy.
5. **Identify** nonmechanical forms of energy.

**National Science Education Standards Covered**

_____ **PS 3b:** Chemical reactions may release or consume energy. Some reactions such as the burning of fossil fuels release large amounts of energy by losing heat and by emitting light. Light can initiate many chemical reactions such as photosynthesis and the evolution of urban smog.

_____ **PS 5b:** All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

_____ **PS 5c:** Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature, the greater the atomic or molecular motion.

_____ **LS 5b:** The energy for life derives primarily from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble large molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as a source of energy for life processes.

_____ **LS 5f:** As matter and energy flow through different levels of organization of living systems—cells, organs, organisms, communities—and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.

_____ **ES 1a:** Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the Earth's original formation.

_____ **UCP 1:** Systems, order, and organization

_____ **UCP 2:** Evidence, models, and explanation

_____ **SPSP 2:** Populations, resources, and environments

**Chapter 9 Work and Energy**

**Section 9.4 Conservation of Energy**
Pacing
Regular Schedule: with lab(s): 3 days without lab(s): 2 days

Objectives
1. Identify and describe transformations of energy.
2. Explain the law of conservation of energy.
3. Analyze the efficiency of machines.
4. Explain where energy goes when it seems to disappear.

National Science Education Standards Covered
______PS 5a: The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

______PS 5d: Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

______LS 5f: As matter and energy flow through different levels of organization of living systems—cells, organs, organisms, communities—and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.

______UCP 1: Systems, order, and organization

______UCP 2: Evidence, models, and explanation

______UCP 3: Change, consistency, and measurements

Chapter 10 Heat and Temperature

Section 10.1 Temperature

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Define temperature in terms of the average kinetic energy of atoms or molecules
2. **Convert** temperature readings between the Fahrenheit, Celsius, and Kelvin scales.
3. **Describe** heat as a form of energy transfer.

**National Science Education Standards Covered**

_____ **SAI 1:** Abilities to do scientific inquiry

### Chapter 10 Heat and Temperature

#### Section 10.2 Energy Transfer

**Pacing**

Regular Schedule:  
**with lab(s):** 2 days  
**without lab(s):** 2 days

**Objectives**

1. **Investigate** and demonstrate how energy is transferred by conduction, convection, and radiation.
2. **Identify** and distinguish between conductors and insulators.
3. **Solve** problems involving specific heat.

**National Science Education Standards Covered**

_____ **PS 5d:** Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

### Chapter 10 Heat and Temperature

#### Section 10.3 Using Heat—Integrating Technology and Society

**Pacing**

Regular Schedule:  
**with lab(s):** 3 days  
**without lab(s):** 2 days

**Objectives**

1. **Describe** the mechanisms of different heating and cooling systems, and discuss their advantages and drawbacks.
2. **Compare** different heating and cooling systems in terms of how they decrease the amount of usable energy.
**National Science Education Standards Covered**

________**PS 5d:** Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

**Chapter 11 Waves**

**Section 11.1 Types of Waves**

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**Pacing**

Regular Schedule:
- with lab(s): 2 days
- without lab(s): 2 days

**Objectives**

1. **Recognize** that waves transfer energy.
2. **Distinguish** between mechanical waves and electromagnetic waves.
3. **Explain** the relationship between particle vibration and wave motion.
4. **Distinguish** between transverse waves and longitudinal waves.

**National Science Education Standards Covered**

________**PS 5a:** The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

________**PS 5b:** All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

________**PS 5d:** Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

________**PS 6a:** Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

________**UCP 1:** Systems, order, and organization

________**UCP 2:** Evidence, models, and explanation

________**UCP 5:** Form and function
Chapter 11 Waves

Section 11.2 Characteristics of Waves

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Identify the crest, trough, amplitude, and wavelength of a wave.
2. Define the terms frequency and period.
3. Solve problems involving wave speed, frequency, and wavelength.
4. Describe the Doppler effect.

National Science Education Standards Covered

PS 5a: The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

PS 5d: Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

PS 6a: Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

PS 6b: Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, X rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.

UCP 1: Systems, order, and organization
Chapter 11 Waves

Section 11.3 Wave Interactions

Pacing
Regular Schedule: with lab(s): 3 days without lab(s): 2 days

Objectives
1. Describe how waves behave when they meet an obstacle, pass into another medium, or pass through another wave.
2. Explain what happens when two waves interfere.
3. Distinguish between constructive interference and destructive interference.
4. Explain how standing waves are formed.

National Science Education Standards Covered

PS 4a: Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship $F = ma$, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.

UCP 1: Systems, order, and organization
UCP 2: Evidence, models, and explanation
UCP 4: Evolution and equilibrium
SAI 1: Abilities to do scientific inquiry
ST 1: Abilities of technological design
Chapter 12 Sound and Light

Section 12.1 Sound

Pacing
Regular Schedule: 2 days
without lab(s): 2 days

Objectives
1. Recognize what factors affect the speed of sound.
2. Relate loudness and pitch to properties of sound waves.
3. Explain how harmonics and resonance affect the sound from musical instruments.
4. Describe the function of the ear.
5. Explain how sonar and ultrasound imaging work.

National Science Education Standards Covered—all sections

PS 5a: The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

PS 5c: Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature, the greater the atomic or molecular motion.

PS 5d: Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

PS 6a: Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

UCP 2: Evidence, models, and explanation

UCP 3: Change, consistency, and measurements

UCP 5: Form and function

ST 2: Understanding about science and technology

SPSP 5: Science and technology in society
Chapter 12 Sound and Light

Section 12.2 The Nature of Light

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 1 day

Objectives
1. Recognize that light has both wave and particle characteristics.
2. Relate the energy of light to the frequency of electromagnetic waves.
3. Describe different parts of the electromagnetic spectrum.
4. Explain how electromagnetic waves are used in communication, medicine, and other areas.

National Science Education Standards Covered

PS 5d: Everything tends to become less organized and less orderly over time. Thus, in all energy transfers, the overall effect is that the energy is spread out uniformly. Examples are the transfer of energy from hotter to cooler objects by conduction, radiation, or convection and the warming of our surroundings when we burn fuels.

PS 6a: Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

PS 6b: Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, X rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.

UCP 1: Systems, order, and organization

UCP 2: Evidence, models, and explanation

ST 2: Understanding about science and technology

HSN 1: Science as a human endeavor

HSN 2: Nature of science
HSN 3: History of science

SPSP 3: Natural hazards

SPSP 4: Risks and benefits

SPSP 5: Science and technology in society

Chapter 12 Sound and Light

Section 12.3 Reflection and Color

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days

Objectives
1. Describe how light reflects off smooth and rough surfaces.
2. Explain the law of reflection.
3. Show how mirrors form real and virtual images.
4. Explain why objects appear to be different colors.
5. Describe how colors may be added or subtracted.

National Science Education Standards Covered
UCP 2: Evidence, models, and explanation
UCP 5: Form and function

Chapter 12 Sound and Light

Section 12.4 Refraction, Lenses, and Prisms

Pacing
Regular Schedule: with lab(s): N/A without lab(s): 2 days

Objectives
1. Describe how light is refracted as it passes between mediums.
2. Explain how fiber optics use total internal reflection.
3. **Explain** how converging and diverging lenses work.
4. **Describe** the function of the eye.
5. **Describe** how prisms disperse light and how rainbows form.

**National Science Education Standards Covered**

- **UCP 2**: Evidence, models, and explanation
- **ST 2**: Understanding about science and technology
- **HNS 1**: Science as a human endeavor

**Chapter 13 Electricity**

**Section 13.1 Electric Charge and Force**

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**Pacing**

Regular Schedule:  
with lab(s): 2 days  
without lab(s): 2 days

**Objectives**

1. **Indicate** which pairs of charges will repel and which will attract.
2. **Explain** what factors affect the strength of the electric force.
3. **Describe** the characteristics of the electric field due to a charge.

**National Science Education Standards Covered**

- **PS 1a**: Matter is made of minute particles called atoms, and atoms are composed of even smaller components. These components have measurable properties, such as mass and electrical charge. Each atom has a positively charged nucleus surrounded by negatively charged electrons. The electric force between the nucleus and electrons holds the atom together.

- **PS 4c**: The electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel. The strength of the force is proportional to the charges and, as with gravitation, inversely proportional to the square of the distance between them.

- **PS 5b**: All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

- **PS 6c**: Each kind of atom or molecule can gain or lose energy only in particular discrete amounts and thus can absorb and emit light only at wavelengths corresponding to these amounts. These wavelengths can be used to identify the substance.
Chapter 13 Electricity

Section 13.2 Current

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Describe how batteries are sources of voltage.
2. Explain how a potential difference produces a current in a conductor.
3. Define resistance.
4. Calculate the resistance, current, or voltage for an object, given the other two quantities.
5. Distinguish between conductors, superconductors, semiconductors, and insulators.

National Science Education Standards Covered

_____PS 5b: All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

_____PS 6c: Each kind of atom or molecule can gain or lose energy only in particular discrete amounts and thus can absorb and emit light only at wavelengths corresponding to these amounts. These wavelengths can be used to identify the substance.

_____UCP 1: Systems, order, and organization

_____UCP 2: Evidence, models, and explanation

_____UCP 3: Change, consistency, and measurements
Chapter 13 Electricity

Section 13.3 Circuits

Pacing
Regular Schedule:  with lab(s): 3 days  without lab(s): 2 days

Objectives
1. Use schematic diagrams to represent circuits.
2. Distinguish between series and parallel circuits.
3. Calculate electric power using voltage and current.
4. Explain how fuses and circuit breakers are used to prevent circuit overload.

National Science Education Standards Covered
_____PS 5b: All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

_____UCP 1: Systems, order, and organization
_____UCP 2: Evidence, models, and explanation
_____UCP 3: Change, consistency, and measurements

_____SAI 1: Abilities to do scientific inquiry
_____SAI 2: Understanding about scientific inquiry

_____ST 1: Abilities of technological design

_____ST 2: Understanding about science and technology

_____SPSP 4: Risks and benefits

_____SPSP 5: Science and technology in society
Chapter 14 Magnetism

Section 14.1 Magnets and Magnetic Fields

Pacing
Regular Schedule: with lab(s): 2 days without lab(s): 2 days

Objectives
1. Recognize that like magnetic poles repel and unlike poles attract.
2. Describe the magnetic field around a permanent magnet.
3. Explain how compasses work.
4. Describe the orientation of Earth’s magnetic field.

National Science Education Standards Covered

PS 5b: All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

UCP 1: Systems, order, and organization

UCP 2: Evidence, models, and explanation

UCP 3: Change, consistency, and measurements

UCP 5: Form and function

SAI 1: Abilities to do scientific inquiry

SAI 2: Understanding about scientific inquiry

ST 1: Abilities of technological design

ST 2: Understanding about science and technology

HNS 1: Science as a human endeavor
Chapter 14 Magnetism

Section 14.2 Magnetism from Electric Currents

Objectives
1. Describe how magnetism is produced by electric currents.
2. Interpret the magnetic field of a solenoid and of an electromagnet.
3. Explain the magnetic properties of a material in terms of magnetic domains.
4. Explain how galvanometers and electric motors work.

National Science Education Standards Covered

PS 4e: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. These effects help students to understand electric motors and generators.

PS 5b: All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

UCP 1: Systems, order, and organization

UCP 2: Evidence, models, and explanation

UCP 3: Change, consistency, and measurements

UCP 5: Form and function

SAI 1: Abilities to do scientific inquiry

SAI 2: Understanding about scientific inquiry

ST 1: Abilities of technological design
Chapter 14 Magnetism

Section 14.3 Electric Currents from Magnetism

Objectives
1. Describe the conditions required for electromagnetic induction.
2. Apply the concept of electromagnetic induction to generators.
3. Explain how transformers increase or decrease voltage across power lines.

National Science Education Standards Covered

PS 4e: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. These effects help students to understand electric motors and generators.

PS 5b: All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves.

PS 6b: Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.

UCP 1: Systems, order, and organization

UCP 2: Evidence, models, and explanation

UCP 3: Change, consistency, and measurements
UCP 5: Form and function

SAI 1: Abilities to do scientific inquiry

SAI 2: Understanding about scientific inquiry

ST 1: Abilities of technological design

ST 2: Understanding about science and technology

HNS 1: Science as a human endeavor

HNS 2: Nature of science

HNS 3: History of science

SPSP 5: Science and technology in society