Grade 8: Physical Science 2011
Unit 1: Chemical Interactions

Students learn the atomic theory and use this notion to think theoretically about familiar materials and chemical interactions, such as the behavior of oil and water, rusting, dissolving common materials, plastics, and melting ice with salt. The history of the development of the periodic table of the elements will guide an inquiry into the properties of the elements found on Earth. Students will use their gained knowledge of atoms and elements to develop their understanding of chemical bonds and structures.

Essential Questions: How is matter composed?
How does the arrangement and motion of atoms and molecules determine the phase of matter and affect the amount of energy in the system?
What are the properties of elements and how are they organized?
How can physical and chemical changes be compared?
How is energy and mass conserved during a chemical reaction?
How is energy transferred in a chemical reaction?

Resources: *Prentice Hall* Science Explorer Physical Science Textbook and FOSS Chemical Interactions Resources

NJ Cummlative Progress Indicator (CPI):

5.2.8.A.1: Explain that all matter is made of atoms, and give examples of common elements.

5.2.8.A.2: Analyze and explain the implications of the statement "all substances are composed of elements."

5.2.8.A.3: Use the kinetic molecular model to predict how solids, liquids, and gases would behave under various physical circumstances, such as heating or cooling.

5.2.8.A.4 Predict the physical and chemical properties of elements based on their positions on the Periodic Table.

5.2.8.A.5: Identify unknown substances based on data regarding their physical and chemical properties.

5.2.8.A.6: Determine whether a substance is a metal or nonmetal through student-designed investigations.

5.2.8.A.7 Determine the relative acidity and reactivity of common acids, such as vinegar or cream of tartar, through a variety of student-designed investigations.

5.2.8.B.1 Explain, using an understanding of the concept of chemical change, why the mass of reactants and the mass of products remain constant

5.2.8.B.2 Compare and contrast the physical properties of reactants with products after a chemical reaction, such as those that occur during photosynthesis and cellular respiration.

Science Content (Declarative Conceptual Knowledge) **Students Will Know and Understand:**	**NJCCCS**
Atoms are the building blocks of all matter and may join together to form molecules.	**5.2.8.A.1**
Atomic Theories have changed over time, the current model is the electron cloud model.	**5.2.8.A.1**
Atoms consist of three parts: electrons, protons, and neutrons.	**5.2.8.A 1** **5.2.8.A. 2**
An element is a pure substance that cannot be broken down into another substance by physical or chemical means.	**5.2.8.A 1**
There are about 100 identified elements.	**5.2.8.A. 2** **5.2.8.A. 3**
Dmitri Mendeleev created the periodic table by identifying patterns among elements.	**5.2.8.A. 4**
Elements are grouped according to similar properties.	**5.2.8.A.3** **5.2.8.A.4**
Phase of matter is determined by the activity of the atoms.	**5.2.8.A.3**
The reactivity of elements is related to valence electrons in atoms.	**5.2.8.A.5**
A chemical bond is the force that holds atoms together.	**5.2.8.B.1**
Atoms create chemical bonds (ionic, covalent, metallic) with other elements in order to become more stable.	**5.2.8.B.1**
A physical change is any change that alters the form or appearance of a substance, but that does not make the substance into another substance.	**5.2.8.B.2**
A chemical change is a change in which one or more substances combine or break apart to form new substances.	**5.2.8.B.2**
Chemical reactions involve two main kinds of changes that you can observe; formation of new substances and changes in energy (endothermic and exothermic).	**5.2.8.B.1** **5.2.8.B.2**
During a chemical reaction mass is conserved; the total mass of the reactants must equal the total mass of the products.	**5.2.8.B.1**
A chemical equation contains information that describes a chemical reaction.	**5.2.8.B.1**
Properties of an acid include sour taste, color change of an indicator.	**5.2.8. A.7**
Acids tend to react with bases to form water and a salt.	**5.2.8. A.7**

Thinking Processes (Procedural Knowledge) **Students Will Be Able To:**	**NJCCCS**
Compare and contrast atomic theories.	**5.2.8.A.1**
Create a modern model of an atom.	**5.1.8.A.2** **5.2.8.A.1**
Read and interpret information from the periodic table.	**5.2.8.A.2**
Identify the names and symbols of at least 40 common elements.	**5.2.8.A.2**
Conduct experiments to compare how energy relates to phase of matter.	**5.1.8.D.1** **5.2.8.A.3**
Recognize that the phase of matter is determined by the arrangement and motion of atoms and molecules and that the motion of these particles is related to the energy of the system.	**5.2.8.A.3**
Identify similar properties of the element families.	**5.2.8.A.4**
Predict the physical and chemical properties of elements based on their positions on the Periodic Table.	**5.2.8.A.4**
Identify unknown substances based on data regarding their physical and chemical properties.	**5.2.8.A.5**
Determine whether a substance is a metal or nonmetal through student-designed investigations.	**5.1.8.D.3** **5.2.8.A.6**
Determine the relative acidity and reactivity of common acids, such as vinegar or cream of tartar, through a variety of student-designed investigations.	**5.2.8.A.7**
Demonstrate that regardless of how substances within a simple closed system interact, the total mass of the system remains the same.	**5.1.8.D.3** **5.2.8.B.1**
Illustrate how atoms are rearranged when substances react, but that the total number of atoms and the total mass of the products remains the same as the original substances.	**5.2.8.B.1**
Balance chemical equations.	**5.2.8.B.2**
Describe and identify types of chemical bonds.	**5.2.8.B.2**
Conduct experiments to determine if physical or chemical changes have taken place.	**5.1.8.D.3** **5.2.8.B.2**
Compare and contrast the physical properties of reactants with products after a chemical reaction, such as those that occur during photosynthesis and cellular respiration.	**5.2.8.B.2**

Unit 2: Force and Motion

Students investigate linear motion, including position, and several aspects of change of position-distance, speed, and acceleration. They investigate fundamental forces (gravity and electromagnetism) in familiar environments, such as pushes, pulls, impacts, and falls. Interaction and outcomes are represented graphically to help students think mathematically about their observations. Investigations of opposing forces and additive forces help students develop the idea that a net force on an object produces a change in motion. An object in motion has momentum, and momentum is conserved. Students acquire the most fundamental and most important understanding about the interplay between force and motion: Force = mass x acceleration.

Essential Questions: How can motion be described?
How can motion be measured?
How do unbalanced forces affect motion?
What forces are involved in creating and/or maintaining motion?
How does mass and distance affect gravitational force?

Resources: FOSS Force and Motion Resources and *Prentice Hall* Science Explorer Physical Science Textbook

NJ Cummlative Progress Indicator (CPI):

5.2.6. E.3 Demonstrate and explain the frictional force acting on an object with the use of a physical model.

5.2.6. E.4 Predict if an object will sink or float using evidence and reasoning.

5.2.8. E.1 Calculate the speed of an object when given distance and time.

5.2.8. E.2 Compare the motion of an object acted on by balanced forces with the motion of an object acted on by unbalanced forces in a given specific scenario.

5.4.8. A.3 Predict how the gravitational force between two bodies would differ for bodies of different masses or bodies that are different distances apart.

5.4.8. A.4 Analyze data regarding the motion of comets, planets, and moons to find general patterns of orbital motion.

Science Content (Declarative Conceptual Knowledge) **Students Will Know and Understand:**	**NJCCCS**
Position is the location of an object at any given time.	**5.2.6.E.1**
Motion is the act of changing position.	**5.2.6.E.1** **5.2.8.E.1**
Distance is the amount of change of position.	**5.2.6.E.1**
A reference point is an arbitrary point on an object, used to establish its position.	**5.2.6.E.1**
Calculate distance (*d*) using the distance equation.	**5.2.6.E.1**
Speed is the rate of change of position of an object: $v = d/\Delta t$.	**5.2.8.E.1**
The slope of the line on a speed graph represents speed; steeper slopes represent higher speeds.	**5.2.8.E.1**
The equation for calculating distance when speed and time are known is $d = v \times \Delta t$.	**5.2.8.E.1**
Average speed is the total distance traveled by an object divided by the total time needed to go that distance.	**5.2.8.E.1**
The slope of a line on a distance-versus-time graph represents speed and can be used to determine speed.	**5.2.8.E.1**
The difference between an object's initial and final positions is displacement.	**5.2.8.E.1**
Constant speed and average speed yield straight lines on distance-versus-time graphs.	**5.2.8.E.1**
Complex motion events can be analyzed into coherent segments called legs.	**5.2.8.E.1**
Acceleration is change of velocity per unit time, measured in units of change of position per unit time per unit time.	**5.2.8.E.1**
Objects rolling down slopes accelerate; acceleration is greater on steeper slopes.	**5.2.8.E.1**
The mass of a rolling car has little effect on its acceleration.	**5.2.8.E.1**
A force is a push or pull.	**5.2.8.E.2**
Net force is the sum of all the forces acting on a mass.	**5.2.8.E.2**
A net force applied to a mass produces acceleration.	**5.2.8.E.2**
Friction is a force that acts to resist movement.	**5.2.6.E.3** **5.2.8.E.2**
Gravity is a force pulling masses toward each other; the strength of the force depends on the object's masses.	**5.2.8.E.2**
The force of gravity accelerates objects in a free fall and objects rolling downhill.	**5.2.8.E.2**
The acceleration produced by the force of gravity is 9.8 m/s^2 toward the Earth.	**5.2.8.E.2**

Terminal velocity is the point when a falling object stops accelerating because the upward and downward forces have equalized.	**5.2.8.E.2**
Momentum is inertia in motion; it is the product of an object's velocity and mass.	**5.2.8.E.2**
A net force applied to an object can change its momentum.	**5.2.8.E.2**
An impulse is force applied for a period of time.	**5.2.8.E.2**
The laws that describe motion are called Newton's Laws of Motion.	**5.2.8.E.2**

Thinking Processes (Procedural Knowledge) **Students Will Be Able To:**	**NJCCCS**
Observe and describe an object's motion in terms of change of position.	**5.2.6.E.1**
Explain how to use a reference point to determine the distance moved by an object.	**5.2.6.E.1**
Measure distance in standard metric units.	**5.2.8.E.1**
Conduct experiments to acquire distance and time data and to determine speed.	**5.2.8.E.1**
Use mathematics to solve problems involving unknown quantities.	**5.2.8.E.1**
Use graphs to interpret speed data.	**5.1.8.B.3** **5.2.8.E.1**
Transform narrative accounts of motion events into graphic representations.	**5.2.8.E.1**
Generate motion scenarios from graphs of motion events.	**5.2.8.E.1**
Explain the difference between displacement and distance.	**5.2.8.E.1**
Explain what a horizontal line on a speed graph represents.	**5.2.8.E.1**
Use tools to collect time and distance data and mathematics to organize and analyze the data.	**5.1.8.A.3** **5.2.8.E.1**
Use equations to calculate acceleration, displacement, and velocity of rolling objects.	**5.1.8.B.3** **5.2.8.E.1**
Identify and interpret graphs of accelerating motion and constant velocity.	**5.2.8.E.1**
Analyze illustrations of forces in motion.	**5.2.8.E.2**
Describe change of motion as a result of net force.	**5.2.8.E.2**
Determine the relationship between mass and the force of gravity, using spring scales.	**5.2.8.E.2**
Explain gravity as a universal force.	**5.2.8.E.2**
Discuss Galileo's discovery of acceleration due to gravity.	**5.2.8.E.2**
Use a force scale to determine the force needed to stop cars traveling at different speeds.	**5.2.8.E.2**
Calculate momentum.	**5.2.8.E.2**
Explain and apply the interplay of force and time (impulse) and momentum in crashes.	**5.2.8.E.2**

Unit 3: Energy Transfer

Energy is the ability to do work or cause change. It comes in various forms and constantly changes from one form to another. Students investigate heat, light, sound, mechanical, and electrical energy and trace energy transformations from one form to another. They will experiment with different materials to determine their effect on the flow of energy and build thermos devices to monitor and predict the flow of heat energy over time.

Essential Questions:
What are the various forms of energy and how are they transferred from one form to another?
How can heat energy be transferred from one substance to another?
How does light energy interact with matter?
How does the arrangement of circuits affect the flow of an electric current?

Resources: *Prentice Hall* Science Explorer Physical Science Textbook and FOSS Resources

NJ Cummlative Progress Indicator (CPI):

5.2.6.C.3 Relate the transfer of heat from oceans and land masses to the evolution of a hurricane.

5.2.8.C.2 Model and explain current technologies used to capture solar energy for the purposes of converting it to electrical energy.

5.2.6.D.1 Use simple circuits involving batteries and motors to compare and predict the current flow with different circuit arrangements.

5.2.8.D.1 Relate the kinetic and potential energies of a roller coaster at various points on its path.

5.2.8.D.2 Describe the flow of energy from the Sun to the fuel tank of an automobile.

Science Content (Declarative Conceptual Knowledge) **Students Will Know and Understand:**	**NJCCCS**
Energy comes in a variety of forms: including kinetic, potential, chemical, electromagnetic, electrical, and thermal.	**5.2.8.C.2**
Electromagnetic energy is a form of energy that travels through space as waves, such as visible light, radio waves, infrared rays, ultraviolet rays, and x-rays.	**5.2.8.C.2**
Electrical energy is the energy of electrically charged particles moving from one atom to another.	**5.2.8.C.2** **5.2.6.D.1**
Thermal energy is the energy that is transferred as heat through conduction, convection, or radiation.	**5.2.6.C.3**
Kinetic energy is the energy of motion.	**5.2.8.D.1**
Potential energy is the energy an object has due to position.	**5.2.8.D.1**
Energy is transformed from one form to another and is conserved.	**5.2.8.D.2**
Some materials transfer energy better than others these are called conductors, materials that slow the transfer of energy are called insulators.	**5.2.8.D.2**

Thinking Processes (Procedural Knowledge) **Students Will Be Able To:**	**NJCCCS**
Recognize that the sun is a major source of the Earth's energy and that solar energy includes visible, infrared, and ultraviolet radiation.	**5.2.8.C.2**
Describe the nature of various forms energy including heat, light, sound, chemical, mechanical, and electrical and trace energy transformations from one form to another.	**5.1.8.B.4** **5.2.8.C.2**
Build an insulating device that slows the transfer of heat.	**5.2.8.C.2** **5.2.8.D.2**
Use thermometers to monitor temperature change.	**5.2.8.C.2**
Calculate heat transfer in calories and joules.	**5.1.8.B.3** **5.2.8.C.2**
Create time versus temperature graphs to predict heat loss over time.	**5.2.8.C.2**
Demonstrate how different materials affect the transfer of energy.	**5.2.8.C.2** **5.2.8.D.2**
Demonstrate how potential energy can change into kinetic energy	**5.2.8.D.1**
Relate the kinetic and potential energies of a roller coaster at various points on its path.	**5.2.8.D.1**
Conduct experiments to demonstrate how energy transfers from one form to another.	**5.2.8.C.2**
Build electrical circuits and describe the flow of energy within a system.	**5.1.8.B.3**

	5.2.8.C.2
Demonstrate how different materials affect the transfer of energy.	**5.2.8.C.2** **5.2.8.D.2**
Demonstrate how electrical energy can be changed into sound and light energy.	**5.2.8.C.2**

Connections to "Common Core" Reading and Writing: Reading:

Key Ideas and Details

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.
- RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Craft and Structure

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics*.
- RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
- RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

Integration of Knowledge and Ideas

- RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- RST.6-8.8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
- RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Range of Reading and Level of Text Complexity

- RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Writing:

Text Types and Purposes

- WHST.6-8.1. Write arguments focused on *discipline-specific content*.
    - Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
    - Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
    - Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
    - Establish and maintain a formal style.
    - Provide a concluding statement or section that follows from and supports the argument presented.
- WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
    - Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
    - Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
    - Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
    - Use precise language and domain-specific vocabulary to inform about or explain the topic.
    - Establish and maintain a formal style and objective tone.
    - Provide a concluding statement or section that follows from and supports the information or explanation presented.
- WHST.6-8.3. (See note; not applicable as a separate requirement)

Production and Distribution of Writing

- WHST.6-8.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

Research to Build and Present Knowledge

- WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- WHST.6-8.9. Draw evidence from informational texts to support analysis reflection, and research.

Range of Writing

- WHST.6-8.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.