

Physical Science Overview

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Physical Science		
PS1– All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).		
	K-2	3-4
1. COMPOSITION	<p>S:PS1:2:1.1 Recognize that objects can be composed of different types of materials, such as wood, metal, and paper.</p> <p>S:PS1:2:1.2 Recognize that objects can be made of one or more materials.</p>	<p>S:PS1:4:1.1 Explain that materials may be composed of parts that are too small to be seen without magnification.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS1:4:1.2 Use measures of weight (data) to demonstrate that the whole equals the sum of its parts. [PS1(K-4)SAE-3]</p> </div>
2. PROPERTIES	<p>S:PS1:2:2.1 Identify the observable properties of different objects, such as color, size, shape, weight and texture.</p>	<p>S:PS1:4:2.1 Recognize that substances can be classified by observable properties.</p> <p>S:PS1:4:2.2 Explain that some materials can exist in different states; and describe the distinct physical properties of each state of matter.</p> <p>S:PS1:4:2.3 Explain how some materials, such as water, can change from one state to another by heating or cooling.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS1:4:2.4 Make a prediction about what might happen to the state of common materials when heated or cooled; or categorize materials as solid, liquid, or gas. [PS1(K-4)POC-2]</p> </div> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS1:4:2.5 Collect and organize data about physical properties in order to classify objects or draw conclusions about objects and their characteristic properties (e.g., temperature, color, size, shape, weight, texture, flexibility). [PS1(K-4)INQ-1]</p> </div>

Physical Science		
PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.		
	K-2	3-4
1. CHANGE	<p>S:PS2:2:1.1 Describe how the properties of certain materials can change when specific actions are applied to them, such as freezing, mixing, heating, cutting, dissolving and bending.</p> <p>S:PS2:2:1.2 Recognize that not all materials react the same way when an action is applied to them.</p>	S:PS2:4:1.1 Recognize that energy has the ability to create change.
2. CONSERVATION	<i>None at this grade span.</i>	<i>None at this grade span.</i>

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	K-2	3-4
3. ENERGY	<p>S:PS2:2:3.1 Recognize that sound is produced by vibrating objects and that the pitch of the sound can be varied by changing the rate of vibration.</p> <p>S:PS2:2:3.2 Explain that the Sun provides the Earth with heat and light.</p> <p>S:PS2:2:3.3 Describe that heat can be produced in a variety of ways, such as burning, rubbing, and mixing substances together.</p> <p>S:PS2:2:3.4 Recognize that energy comes from different sources, such as electricity and water, and is utilized in many common objects.</p>	<p>S:PS2:4:3.1 Identify the various forms of energy, such as electrical, light, heat, sound.</p> <p>S:PS2:4:3.2 Recognize that electricity in circuits can produce light, heat, sound, and magnetic effects.</p> <p>S:PS2:4:3.3 Identify and describe the organization of a simple circuit.</p> <p>S:PS2:4:3.4 Differentiate between objects and materials that conduct electricity and those that are insulators of electricity.</p> <p>S:PS2:4:3.5 Explain that light travels in a straight line until it strikes an object; and describe how it can be reflected by a mirror, bent by a lens, or absorbed by the object.</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>S:PS2:4:3.6 Given a specific example or illustration (e.g., simple closed circuit, rubbing hands together) predict the observable effects of energy (i.e., the bulb lights, a bell rings, hands warm up). A test item may ask, “What will happen when...?” [PS2(K-4)SAE-4]</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>S:PS2:4:3.7 Use observations of light in relation to other objects/substances to describe the properties of light (i.e., can be reflected, refracted, or absorbed). [PS2(K-4)SAE-5]</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>S:PS2:4:3.8 Experiment, observe, or predict how heat might move from one object to another. [PS2(K-4) INQ+SAE-6]</p> </div>

Physical Science		
PS3– The motion of an object is affected by force.		
	K-2	3-4
1. FORCES	<p>S:PS3:2:1.1 Describe the properties of magnetism and demonstrate how magnets can be used to move some things without touching them.</p> <p>S:PS3:2:1.2 Describe and demonstrate that things close to the Earth drop to the ground unless something supports them.</p>	<p>S:PS3:4:1.1 Recognize that magnets attract certain kinds of other materials; and classify objects by those magnets will attract and those they will not.</p> <p>S:PS3:4:1.2 Recognize that magnets attract and repel each other.</p> <p>S:PS3:4:1.3 Explain that electrically charged material pulls on all other materials and can attract or repel other charged materials.</p> <p>S:PS3:4:1.4 Recognize that the Earth’s gravitational force pulls any object toward it.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS3:4:1.5 Use observations of magnets in relation to other objects to describe the properties of magnetism (i.e., attract or repel certain objects or has no effect). [PS3(K-4)INQ+SAE-8]</p> </div>
2. MOTION	<p>S:PS3:2:2.1 Describe the many different ways things can move, such as in a straight line, zigzag or circular motion, back and forth, and fast and slow.</p> <p>S:PS3:2:2.2 Describe and demonstrate how the position and motion of an object can be changed by applying force, such as pushing and pulling; and explain that the greater the force, the greater the change.</p> <p>S:PS3:2:2.3 Describe the position of an object by referencing its location in relation to another object or background.</p>	<div style="border: 2px solid black; padding: 5px;"> <p>S:PS3:4:2.1 Use data to predict how a change in force (greater/less) might affect the position, direction of motion, or speed of an object (e.g., ramps and balls). [PS3(K-4)INQ+SAE-7]</p> </div>

Physical Science		
PS4– The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.		
	K-2	3-4
1. DESIGN TECHNOLOGY	S:PS4:2:1.1 Recognize that new objects can be made out of physical materials, such as cloth and paper.	S:PS4:4:1.1 Understand that materials are used in certain products based on their properties, such as strength and flexibility. S:PS4:4:1.2 Recognize that products are made using a combination of technologies, such as how an escalator uses both a pulley system and an electrical motor.
2. TOOLS	S:PS4:2:2.1 Identify tools and simple machines, such as a wheel, and explain how they work. S:PS4:2:2.2 Demonstrate how to use tools, such as rulers, scales, balances, magnifiers and thermometers to measure properties of objects, such as size, weight, temperature.	S:PS4:4:2.1 Demonstrate how to use tools, such as magnifiers, scales, balances, rulers, and thermometers to gather data and extend the senses. S:PS4:4:2.2 Describe how some tools can be used to modify natural materials by processes such as separating, shaping, and joining, to produce new materials.
3. SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	S:PS4:2:3.1 Provide examples of how man uses energy in everyday life, such as providing light, warmth in winter, cooling in summer, TVs, computers, telephones, transportation, factories. S:PS4:2:3.2 Provide examples of items that are manufactured or produced.	S:PS4:4:3.1 Give examples of transportation systems used in New Hampshire, such as buses, trains, cars, and bicycles; and describe the sources of energy they use. S:PS4:4:3.2 Explain that manufactured products are designed to solve a problem or meet a need. S:PS4:4:3.3 Provide an example to illustrate that manufacturing involves changing natural materials into finished products; and explain that this results in the production of a large number of objects that look almost identical.
4. CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:2:4.1 Recognize that some jobs/careers require knowledge and use of physical science content and/or skills.	S:PS4:4:4.1 Identify some jobs/careers that require knowledge and use of physical science content and/or skills.

Physical Science		
PS1– All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).		
	5-6	7-8
1. COMPOSITION	<p>S:PS1:6:1.1 Recognize that all matter is composed of minute particles called atoms; and explain that all substances are composed of atoms, each arranged into different groupings.</p> <p>S:PS1:6:1.2 Identify elements as substances that contain only one kind of atom; and explain that elements do not break down by normal laboratory reactions, such as heating, exposure to electric current, and reaction to acid.</p> <p>S:PS1:6:1.3 Recognize that over one hundred elements exist, and identify the periodic table as a tool for organizing the information about them.</p>	<p>S:PS1:8:1.1 Explain that atoms often combine to form a molecule or formula unit (crystal).</p> <p>S:PS1:8:1.2 Recognize that elements can combine in a variety of ways to form compounds.</p> <p>S:PS1:8:1.3 Differentiate between an atom and an molecule.</p> <p>S:PS1:8:1.4 Differentiate between a mixture and a pure substance.</p> <p>S:PS1:8:1.5 Identify methods used to separate mixtures, such as boiling, filtering, chromatography and screening.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS1:8:1.6 Collect data or use data provided to infer or predict that the total amount of mass in a closed system stays the same, regardless of how substances interact (conservation of matter). [PS1(5-8)INQ+SAE-3]</p> </div> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS1:8:1.7 Given graphic or written information, classify matter as atom/molecule or element/compound (not the structure of an atom). [PS1(5-8)MAS-5]</p> </div>

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2. PROPERTIES	<p>S:PS1:6:2.1 Identify elements according to their common properties, such as highly reactive metals, less reactive metals, highly reactive non-metals and almost non-reactive gases.</p> <p>S:PS1:6:2.2 Identify substances by their physical and chemical properties, such as magnetism, conductivity, density, solubility, boiling and melting points.</p> <p>S:PS1:6:2.3 Differentiate between weight and mass.</p> <p>S:PS1:6:2.4 Identify energy as a property of many substances.</p>	<p>S:PS1:8:2.1 Differentiate between volume and mass and define density.</p> <p>S:PS1:8:2.2 Explain how different substances of equal volume usually have different weights.</p> <p>S:PS1:8:2.3 Identify a molecule as the smallest part of a substance that retains its properties.</p> <div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p>S:PS1:8:2.4 Investigate the relationships among mass, volume and density. [PS1(5-8)INQ-1]</p> </div> <div style="border: 2px solid black; padding: 5px; margin-bottom: 10px;"> <p>S:PS1:8:2.5 Given data about characteristic properties of matter (e.g., melting and boiling points, density, solubility), identify, compare, or classify different substances. [PS1(5-8)INQ+POC-2]</p> </div> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS1:8:2.6 Represent or explain the relationship between or among energy, molecular motion, temperature, and states of matter. [PS1(5-8)SAE+MAS-4]</p> </div>

Physical Science		
PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.		
	5-6	7-8
1. CHANGE	S:PS2:6:1.1 Differentiate between a physical change, such as melting, and a chemical change, such as rusting.	<p>S:PS2:8:1.1 Explain how substances react chemically with other substances to form new substances, known as compounds, and that in such recombinations, the properties of the new substances may be very different from those of the old.</p> <p>S:PS2:8:1.2 Identify factors that affect reaction rates, such as temperature, concentration and surface area; and explain that dissolving substances in liquids often accelerates reaction rates.</p> <p>S:PS2:8:1.3 Explain that oxidation involves combining oxygen with another substance, as in burning or rusting.</p> <p>S:PS2:8:1.4 Explain that states of matter depend on the arrangement of the molecules and their motion.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS2:8:1.5 Given a real-world example, show that within a system, energy transforms from one form to another (i.e., chemical, heat, electrical, gravitational, light, sound, mechanical). [PS2(5-8)SAE+POC-6]</p> </div>
2. CONSERVATION	S:PS2:6:2.1 Describe how mass remains constant in a closed system and provide examples relating to both physical and chemical change.	<p>S:PS2:8:2.1 Explain the law of conservation of energy.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS2:8:2.2 Collect data or use data provided to infer or predict that the total amount of mass in a closed system stays the same, regardless of how substances interact (conservation of matter). [PS1(5-8)INQ+SAE-3]</p> </div>

Physical Science		
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	5-6	7-8
3. ENERGY	<p>S:PS2:6:3.1 Explain that the pitch of a sound is dependent on the frequency of the vibration producing it.</p> <p>S:PS2:6:3.2 Explain that sound vibrations move at different speeds, have different wavelengths; and establish wave-like disturbances that emanate from the source.</p> <p>S:PS2:6:3.3 Recognize that energy, in the form of heat, is usually a by-product when one form of energy is changed to another, such as when machines convert stored energy to motion.</p> <p>S:PS2:6:3.4 Explain that heat energy moves from warmer materials or regions to cooler ones through conduction, convection, and radiation.</p> <p>S:PS2:6:3.5 Explain how electrical circuits can be used to transfer energy in order to produce heat, light, sound, and chemical changes.</p>	<p>S:PS2:8:3.1 Differentiate between kinetic energy, which is the energy of motion and potential energy, which depends on relative position.</p> <p>S:PS2:8:3.2 Recognize the Sun is a major energy source for the Earth, and describes how it affects the planet’s surface.</p> <p>S:PS2:8:3.3 Describe ways light can interact with matter, such as transmission (which includes refraction), absorption, and scattering (which includes reflection).</p> <p>S:PS2:8:3.4 Explain that the human eye can only detect wavelengths of electromagnetic radiation within a narrow range; and explain that the differences of wavelength within that range of visible light are perceived as differences in color.</p> <p>S:PS2:8:3.5 Recognize that most chemical and nuclear reactions involve a transfer of energy.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS2:8:3.6 Use data to draw conclusions about how heat can be transferred (convection, conduction, radiation). [PS2(5-8)INQ+SAE+POC-7]</p> </div>

Physical Science		
PS3– The motion of an object is affected by force.		
	5-6	7-8
1. FORCES	<p>S:PS3:6:1.1 Recognize that just as electric currents can produce magnetic forces, magnets can cause electric currents.</p> <p>S:PS3:6:1.2 Explain that when a force is applied to an object, it reacts in one of three ways: the object either speeds up, slows down, or goes in a different direction.</p> <p>S:PS3:6:1.3 Describe the relationship between the strength of a force on an object and the resulting effect, such as the greater the force, the greater the change in motion.</p>	<p>S:PS3:8:1.1 Explain that the force of gravity gets stronger the closer one gets to an object and decreases the further away one gets from it.</p> <p>S:PS3:8:1.2 Recognize the general concepts related to gravitational force.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS3:8:1.3 Use data to determine or predict the overall (net) effect of multiple forces (e.g., friction, gravitational, magnetic) on the position, speed, and direction of motion of objects. [PS3(5-8)INQ+POC-8]</p> </div>
2. MOTION	<p>S:PS3:6:2.1 Explain the how balanced and unbalanced forces are related to an object’s motion.</p> <p>S:PS3:6:2.2 Explain that an object’s motion can be tracked and measured over time and that the data can be used to describe its position.</p>	<p>S:PS3:8:2.1 Explain that an object in motion that is unaffected by a force will continue to move at a constant speed and in a straight line.</p> <p>S:PS3:8:2.2 Explain how the motion of an object can be described by its position, direction of motion, and speed; and illustrate how that motion can be measured and represented graphically.</p>

Physical Science		
PS4– The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.		
	5-6	7-8
1. DESIGN TECHNOLOGY	S:PS4:6:1.1 Understand that scientific principles are used in the design of technology.	S:PS4:8:1.1 Understand that design features, such as size shape, weight, and function, must be considered when designing new technology.
2. TOOLS	S:PS4:6:2.1 Recognize that manufacturing processes use a variety of tools and machines to separate, form, combine and condition natural and synthetic materials.	S:PS4:8:2.1 Demonstrate appropriate use of tools, such as rulers, calculators, balances, and graduated cylinders to measure and calculate volume and mass.
3. SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	S:PS4:6:3.1 Explain how a battery changes chemical energy into electrical energy. S:PS4:6:3.2 Demonstrate how to produce a magnetic force with an electric current, such as an electromagnet, and how to produce an electric current with a magnet, such as a generator. S:PS4:6:3.3 Provide an example to show that manufacturing processes involve changing natural materials into finished products through a series of processes that involve physical and/or chemical changes.	S:PS4:8:3.1 Explain how humans use natural resources, such as flowing water and burning of coal, oil, or natural gas to generate electrical energy in power plants. S:PS4:8:3.2 Describe how natural resources, such as coal, oil and natural gas are tapped for use in power plants, and how alternative sources, such as solar, wind, water, nuclear are tapped for power; and compare the advantages and disadvantages of each source. S:PS4:8:3.3 Differentiate between durable goods, which are designed to operate for a long period of time, and non-durable goods, which are only intended to operate for a short period of time.
4. CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:6:4.1 Understand that some form of science is used in most jobs/careers and that some jobs/careers specifically require knowledge of physical science.	S:PS4:8:4.1 Understand that some scientific jobs/careers involve the application of physical science content knowledge and experience in specific ways that meet the goals of the job.

Physical Science		
PS1– All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).		
	9-11	11-12 (Advanced)
1. COMPOSITION	<p>S:PS1:11:1.1 Recognize and describe the structure of an atom and explain how the major components interact with one another.</p> <p>S:PS1:11:1.2 Recognize how elements are arranged in the periodic table; and explain how this arrangement illustrates the repeating patterns among elements with similar properties, such as the relationship between atomic number and atomic mass.</p> <p>S:PS1:11:1.3 Explain that neutrons and protons are made up of even smaller constituents.</p> <p>S:PS1:11:1.4 Define isotopes; recognize that most elements have two or more isotopes; and explain that although the number of neutrons has little affect on how the atom interacts with others, they do affect the mass and stability of the nucleus.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS1:11:1.5 Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that changed our understanding of the atom and the development of atomic theory. [PS1(9-11)MAS+NOS-2]</p> </div> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS1:11:1.6 Model and explain the structure of an atom or explain how an atom’s electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms. [PS1(9-11)MAS+FAF-4]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p> <p>S:PS1:12:1.1 Understand the basic building blocks of matter are quarks and leptons.</p> <p>S:PS1:12:1.2 Recognize the main ideas of string theory.</p> <p>S:PS1:12:1.3 Identify the sub-orbital shapes and geometric orientations of the orbitals electrons can occupy in atoms.</p>

Physical Science		
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	9-11	11-12 (Advanced)
2. PROPERTIES	<p>S:PS1:11:2.1 Explain that the physical properties of a compound are determined by its molecular structure and the interactions among the molecules.</p> <p>S:PS1:11:2.2 Determine whether an atom is either electrically neutral or an ion by referring to its number of electrons.</p> <p>S:PS1:11:2.3 Explain how the chemical properties of an element are governed by the electron configuration of atoms, and describe how atoms interact with one another by transferring or sharing the outermost electrons.</p> <p>S:PS1:11:2.4 Explain that radioactive materials are unstable and undergo spontaneous nuclear reactions, which emit particles and/or wavelike radiation.</p> <p>S:PS1:11:2.5 Explain that states of matter rely on the arrangement and motion of molecules; and differentiate between the structures of solids, liquids, and gases.</p> <div style="border: 2px solid black; padding: 5px; margin: 5px 0;"> <p>S:PS1:11:2.6 Use physical and chemical properties as determined through an investigation to identify a substance. [PS1(9-11)INQ-1]</p> </div> <div style="border: 2px solid black; padding: 5px; margin: 5px 0;"> <p>S:PS1:11:2.7 Explain how properties of elements and the location of elements on the periodic table are related. [PS1(9-11)POC-3]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p>

Physical Science		
PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.		
	9-11	11-12 (Advanced)
1. CHANGE	<p>S:PS2:11:1.1 Recognize and explain that atoms may be bonded together into molecules or formula units (crystalline solids).</p> <p>S:PS2:11:1.2 Recognize that atoms interact with one another by transferring or sharing electrons that are furthest from the nucleus; and explain that the outer electrons govern the chemical properties of an element.</p> <p>S:PS2:11:1.3 Explain that compounds are formed through both ionic and covalent bonding.</p> <p>S:PS2:11:1.4 Recognize that the rates of chemical reactions can vary greatly; and identify the factors that influence these reaction rates, such as how often the reacting atoms and molecules encounter one another, the temperature, and the properties of the reacting species, including shape.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS2:11:1.5 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles. [PS2(9-11)SAE-7]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p> <p>S:PS2:12:1.1 Explain the complete mole concept and identify ways in which it can be used, such as to differentiate between actual and relative mass.</p>

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	9-11	11-12 (Advanced)
2. CONSERVATION	<p>S:PS2:11:2.1 Explain that chemical reactions either release or consume energy.</p> <p>S:PS2:11:2.2 Explain that chemical reactions can be accelerated by catalysts, such as enzymes.</p> <p>S:PS2:11:2.3 Recognize that a large number of important reactions involve the transfer of either electrons or hydrogen ions between reacting ions, molecules, or atoms.</p> <p>S:PS2:11:2.4 Identify the variety of structures that may be formed from the bonding of carbon atoms, and describe their roles in various chemical reactions, including those required for life processes.</p> <div style="border: 2px solid black; padding: 5px; margin-top: 10px;"> <p>S:PS2:11:2.5 Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and physical systems). [PS2(9-11)POC+SAE-5]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p>

Physical Science		
PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.		
	9-11	11-12 (Advanced)
3. ENERGY	<p>S:PS2:11:3.1 Explain that all energy can be considered to be either kinetic energy, potential energy, or energy contained by a field.</p> <p>S:PS2:11:3.2 Provide examples of how kinetic and potential energy can be transformed from one to the other.</p> <p>S:PS2:11:3.3 Describe how the energy associated with individual atoms and molecules can be used to identify the substances they comprise; and explain that each kind of atom or molecule can gain or lose energy only in particular discrete amounts, absorbing and emitting light only at wavelengths corresponding to these amounts.</p> <p>S:PS2:11:3.4 Explain the range of the electromagnetic spectrum as it relates to both wavelength and energy; and provide examples of practical applications of the different wavelengths in the spectrum.</p> <p>S:PS2:11:3.5 Recognize that the human eye can only see a narrow range of wavelengths within the electromagnetic spectrum; and explain how the variations of wavelength within that range of visible light are perceived as differences in color.</p> <p>S:PS2:11:3.6 Describe the relationship between heat and temperature, explaining that heat energy consists of the random motion and vibrations of atoms, molecules, and ions; and that the higher the temperature, the greater the atomic or molecular motion.</p>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p> <p>S:PS2:12:3.1 Explain the concept of entropy.</p> <p>S:PS2:12:3.2 Understand that activation energy is required to make a chemical reaction proceed, whether or not it is exothermic or endothermic.</p>

Physical Science		
PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.		
	9-11	11-12 (Advanced)
	<p>S:PS2:11:3.7 Explain that waves, such as light, seismic, sound waves, have energy and can transfer energy when they interact with matter.</p> <p>S:PS2:11:3.8 Explain that nuclear reactions convert a fraction of the mass of interacting particles into energy and release much greater amounts of energy than atomic interactions.</p> <p>S:PS2:11:3.9 Describe how electrons flow easily in some materials, such as metals, whereas in insulating materials, such as glass, they can hardly flow at all.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS2:11:3.10 Using information provided about chemical changes, draw conclusions about the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions). [PS2(9-11)INQ+SAE-6]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p>

Physical Science		
PS3– The motion of an object is affected by force.		
	9-11	11-12 (Advanced)
1. FORCES	<p>S:PS3:11:1.1 Explain that magnetic forces are related to the action of electrons and can be thought of as different aspects of a single electromagnetic force; and describe how the interplay of these forces is the basis for electric motors, generators, radio, television, and many other modern technologies.</p> <p>S:PS3:11:1.2 Recognize that the strength of the electric force between two charged objects is proportional to the charges and, as with gravitation, is inversely proportional to the square of the distance between them.</p> <p>S:PS3:11:1.3 Recognize that the strength of the gravitational force between two masses is proportional to the masses and inversely proportional to the square of the distance between them.</p> <p>S:PS3:11:1.4 Compare the strength of nuclear, electromagnetic and gravitational forces; and explain that the strength of nuclear forces account for the great amounts of energy released from the nuclear reactions in atomic or hydrogen bombs, and in the Sun and other stars.</p> <p>S:PS3:11:1.5 Recognize that electromagnetic forces exist within and between atoms.</p> <p>S:PS3:11:1.6 Recognize that different kinds of materials respond to electric forces in various ways; and differentiate between insulators, semiconductors, conductors and superconductors.</p> <p>S:PS3:11:1.7 Describe the difference between materials that contain equal proportions of positive and negative charges and those that have a very small excess or deficit of negative charges.</p> <div style="border: 2px solid black; padding: 5px;"> <p>S:PS3:11:1.8 Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects. [PS3(9-11)INQ+POC-8]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p> <p>S:PS3:12:1.1 Understand the four fundamental forces found in nature: gravitation, electromagnetism, strong nuclear force, and weak nuclear force.</p> <p>S:PS3:12:1.2 Describe the gauge particles that are exchanged by each of the fundamental forces.</p> <p>S:PS3:12:1.3 Understand the basic principles of unified field theories.</p>

Physical Science		
PS3– The motion of an object is affected by force.		
	9-11	11-12 (Advanced)
2. MOTION	<p>S:PS3:11:2.1 Interpret and apply the laws of motion to determine the effects of forces on the motion of objects.</p> <p>S:PS3:11:2.2 Recognize that apparent changes in wavelength can provide information about changes in motion; explain that the observed wavelength of a wave depends upon the relative motion of the source and the observer; and relate these to the differences between shorter and longer wavelengths.</p> <div style="border: 2px solid black; padding: 5px; margin: 5px 0;"> <p>S:PS3:11:2.3 Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions. [PS3(9-11)POC-9]</p> </div> <div style="border: 2px solid black; padding: 5px; margin: 5px 0;"> <p>S:PS3:11:2.4 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky). [PS3(9-11)SAE-10]</p> </div>	<p><i>Schools should include expectations and competencies from Advanced Science Courses and Science-related Career and Technical Education Courses.</i></p> <p>S:PS3:12:2.1 Explain general concepts related to the theory of special relativity: time dilation, length contraction, and mass expansion.</p> <p>S:PS3:12:2.2 Understand the basic idea behind the theory of general relativity.</p> <p>S:PS3:12:2.3 Describe the predictions made by the theory of general relativity, and the evidence that supports it.</p>

Physical Science		
PS4– The growth of scientific knowledge in Physical Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.		
	9-11	11-12 (Advanced)
1. DESIGN TECHNOLOGY	S:PS4:11:1.1 Recognize that the basic principles of energy, work and power are related to design technology.	S:PS4:12:1.1 Relate the transfer of energy through conduction, convection and radiation to design technologies.
2. TOOLS	S:PS4:11:2.1 Identify tools, such as thermostats and thermal sensors, and explain their use in environmental control systems.	S:PS4:12:2.1 Demonstrate the appropriate use of a variety of input devices, such as scanners, voice/sound recorders, and digital cameras.
3. SOCIAL ISSUES (LOCAL AND GLOBAL) ENERGY, POWER, AND TRANSPORTATION MANUFACTURING	<p>S:PS4:11:3.1 Explain that power systems have a source of energy, a process, loads, and some have a feedback system.</p> <p>S:PS4:11:3.2 Demonstrate and explain how an engine converts chemical energy in the form of fuel, into mechanical energy in the form of motion.</p> <p>S:PS4:11:3.3 Calculate the efficiency of an engine, and explain why a perfectly efficient engine is impossible.</p> <p>S:PS4:11:3.4 Explain the relationship between energy and power.</p> <p>S:PS4:11:3.5 Explain the benefits of standardization of parts.</p>	<p>S:PS4:12:3.1 Compare two different energy systems that are used to produce large amounts of electrical power for New Hampshire residents, and describe the advantages and disadvantages of each system.</p> <p>S:PS4:12:3.2 Design a transportation system that meets most humans' need for reliable and affordable transportation, while having a minimal impact on the environment.</p> <p>S:PS4:12:3.3 Describe the various types of manufacturing systems, such as customized production, batch production, and continuous production, and explain that manufacturing results in two types of good, durable and non-durable goods.</p> <p>S:PS4:12:3.4 Understand that a manufacturing system includes design of the product and methods of obtaining raw materials, as well as actual production, marketing, sales, maintenance, servicing, repair, and final disposal of the remains of the product.</p>
4. CAREER TECHNICAL EDUCATION CONNECTIONS	S:PS4:11:4.1 Explain the kinds of applications of knowledge and skills necessary for jobs/careers specific to the physical sciences.	S:PS4:12:4.1 Understand the various scientific fields that use scientific content and skills and distinguish between professional and skilled science jobs/careers in the physical sciences.