

**New Hampshire Science Grades 9-12
Curriculum Framework Mapping**

© Boardworks 2009

PHYSICAL SCIENCE	Boardworks High School Chemistry Presentations
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).	
1. COMPOSITION	
Grade 9-11	
S:PS1:11:1.1 Recognize and describe the structure of an atom and explain how the major components interact with one another.	Atomic Structure Introducing Atoms
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.	Atomic Number and Mass Number Electron Structure and The Periodic Table Electron Configuration Patterns of Behavior The Periodic Table
S:PS1:11:1.3 Explain that neutrons and protons are made up of even smaller constituents.	Atomic Structure Introducing Atoms
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.	Isotopes
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]	Introducing Atoms
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]	Electron Configuration Electronegativity
Grade 11-12 (Advanced)	
S:PS1:12:1.1 <i>Understand the basic building blocks of matter are quarks and leptons.</i>	–
S:PS1:12:1.2 <i>Recognize the main ideas of string theory.</i>	–
S:PS1:12:1.3 Identify the sub-orbital shapes and geometric orientations of the orbitals electrons can occupy in atoms.	Orbitals
2. PROPERTIES	
Grade 9-11	

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.	Compounds Giant Covalent Structures Ionic Compounds
S:PS1:11:2.2 Determine whether an atom is either electrically neutral or an ion by referring to its number of electrons.	Formation of Ions
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.	Electron Configuration Electronegativity Ionization Energy
S:PS1:11:2.4 Explain that radioactive materials are unstable and undergo spontaneous nuclear reactions, which emit particles and/or wavelike radiation.	Radioactivity Types of Radiation
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.	Changing State Particles in Action
S:PS1:11:2.6 Use physical and chemical properties as determined through an investigation to identify a substance. [PS1(9-11)INQ-1]	-
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]	Atomic Number and Mass Number Electron Structure and The Periodic Table Electron Configuration Patterns of Behavior The Periodic Table
PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.	
1. CHANGE	
Grade 9-11	
S:PS2:11:1.1 Recognize and explain that atoms may be bonded together into molecules or formula units (crystalline solids).	Compounds
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.	Electron Structure and the Periodic Table Why do Atoms Form Bonds?
S:PS2:11:1.3 Explain that compounds are formed through both ionic and covalent bonding.	Comparing Bonding Covalent Bonding Ionic Bonding Ionic Compounds Why do Atoms Form Bonds?
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.	Concentration, Pressure and Reaction Rates Rate of Reactions Surface Area, Catalysts and Reaction Rates Temperature and Reaction Rates

S:PS2:11:1.5 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles. [PS2(9-11)SAE-7]	–
Grade 11-12 (Advanced)	
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.	Molar Mass What are Moles?
2. CONSERVATION	
Grade 9-11	
S:PS2:11:2.1 Explain that chemical reactions either release or consume energy.	Endothermic Reactions Exothermic Reactions
S:PS2:11:2.2 Explain that chemical reactions can be accelerated by catalysts, such as enzymes.	Surface Area, Catalysts and Reaction Rates
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.	Formation of Ions Ionic Bonding
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.	Polysaccharides Polymers
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]	Energy Transfers
3. ENERGY	
Grade 9-11	
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.	*
S:PS2:11:3.2 Provide examples of how kinetic and potential energy can be transformed from one to the other.	*
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.	Observing Line Spectra
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.	*
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.	*
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.	*

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.	*
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.	Nuclear Fission Nuclear Fusion
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.	*
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]	Exothermic Reactions Endothermic Reactions
Grade 11-12 (Advanced)	
S:PS2:12:3.1 Explain the concept of entropy.	Enthalpy Change
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.	Bonds and Activation Energy
PS3– The motion of an object is affected by force.	
1. FORCES	
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.	*
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.	*
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.	*
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.	Nuclear Fission Nuclear Fusion
S:PS3:11:1.5 Recognize that electromagnetic forces exist within and between atoms.	*
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.	*
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.	—
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]	*
Grade 11-12 (Advanced)	

S:PS3:12:1.1 <i>Understand the four fundamental forces found in nature: gravitation, electromagnetism, strong nuclear force, and weak nuclear force.</i>	–
S:PS3:12:1.2 <i>Describe the gauge particles that are exchanged by each of the fundamental forces.</i>	–
S:PS3:12:1.3 <i>Understand the basic principles of unified field theories.</i>	–
2. MOTION	
S:PS3:11:2.1 <i>Interpret and apply the laws of motion to determine the effects of forces on the motion of objects.</i>	*
S:PS3:11:2.2 <i>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.</i>	–
S:PS3:11:2.3 <i>Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.</i> [PS3(9-11)POC-9]	*
S:PS3:11:2.4 <i>Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky).</i> [PS3(9-11)SAE-10]	*
Grade 11-12 (Advanced)	
S:PS3:12:2.1 <i>Explain general concepts related to the theory of special relativity: time dilation, length contraction, and mass expansion.</i>	–
S:PS3:12:2.2 <i>Understand the basic idea behind the theory of general relativity.</i>	–
S:PS3:12:2.3 <i>Describe the predictions made by the theory of general relativity, and the evidence that supports it.</i>	–

* See Boardworks High School Physics for relevant presentations.