



Alignment of BIOZONE's Physical Sciences for NGSS (1st edition)
to Louisiana Student Standards for Chemistry

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Note 1: Correlation locations are activity numbers (not page numbers).

Note 2: Correlations do not usually include reference to the Science practices chapter

Note 3: Correlations include background material to address the specific standard

Louisiana: Student Standards for Chemistry

Standards source:

<https://www.louisianabelieves.com/resources/library/academic-standards>

TITLE: Physical Sciences for NGSS (1ed):

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Standard	Components	Correlation location
Matter and Its Interactions HS.PS1.1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level and the composition of the nucleus of atoms.		24, 33
Science and Engineering Practices	2. Developing and using models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.	19-24, 33, 82
	2. Developing and using models Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	19-24, 33, 82
Disciplinary Core Ideas	Structure and properties of matter Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS.PS1A.a)	19-22
	Structure and properties of matter The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states.(HS.PS1A.b)	16, 23, 24
	Types of interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.(HS.PS2B.c)	81, 82
Crosscutting Concepts	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.	16, 19-24, 33, 81, 82

Matter and Its Interactions HS.PS1.2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.		54, 55
Science and Engineering Practices	6. Constructing explanations and designing solutions Constructing explanations (science) and designing solutions (engineering) in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.	40, 41, 55
	6. Constructing explanations and designing solutions Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	40, 41, 55
Disciplinary Core Ideas	Structure and properties of matter The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS.PS1A.b)	16, 23, 24
	Chemical reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS.PS1B.c)	40, 41, 54, 55
Crosscutting Concepts	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.	16, 23, 24, 40, 41, 55

Matter and Its Interactions HS.PS1.3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the macroscale to infer the strength of electrical forces between particles.		31
Science and Engineering Practices	3. Planning and carrying out investigations Planning and carrying out investigations to answer questions (science) or test solutions (engineering) to problems in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.	31, 81, 89
	3. Planning and carrying out investigations Plan and conduct an investigation individually and/ or collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	31
Disciplinary Core Ideas	Structure and properties of matter The structure and interactions of matter at the macro scale are determined by electrical forces within and between atoms. (HS.PS1A.c)	81, 89
	Types of interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (secondary) (HS.PS2B.c)	81
Crosscutting Concepts	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.	31, 81

Matter and Its Interactions HS.PS1.4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.		46, 55
Science and Engineering Practices	2. Developing and using models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.	46, 55
	2. Developing and using models Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	46, 55
Disciplinary Core Ideas	Structure and properties of matter A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS.PS1A.d)	60
	Chemical reactions Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS.PS1B.a)	45-49
Crosscutting Concepts	Energy and matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	46, 55

Matter and Its Interactions HS.PS1.5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.		45
Science and Engineering Practices	6. Constructing explanations and designing solutions Constructing explanations (science) and designing solutions (engineering) in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.	45, 49
	6. Constructing explanations and designing solutions Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.	45, 49
Disciplinary Core Ideas	Chemical reactions Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS.PS1B.a)	45-49
Crosscutting Concepts	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.	45, 46

Matter and Its Interactions HS.PS1.6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.		52, 55
Science and Engineering Practices	6. Constructing explanations and designing solutions Constructing explanations (science) and designing solutions (engineering) in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories	50-52, 55
	6. Constructing explanations and designing solutions Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	52, 55
Disciplinary Core Ideas	Chemical reactions In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS.PS1B.b)	49
	Optimizing the design solution Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (secondary) (HS.ETS1C.a)	50-52, 55
Crosscutting Concepts	Stability and change Much of science deals with constructing explanations of how things change and how they remain stable.	49-52

Matter and Its Interactions HS.PS1.7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.		55
Science and Engineering Practices	5. Using mathematics and computational thinking Using mathematics and computational thinking: Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions, including, computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions	40, 41, 55
	5. Using mathematics and computational thinking Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.	40, 41, 55
Disciplinary Core Ideas	Chemical reactions The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS.PS1B.c)	40, 41, 54, 55
Crosscutting Concepts	Energy and matter The total amount of energy and matter in closed systems is conserved.	40, 41, 55

Matter and Its Interactions HS.PS1.8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.		60, 61, 63
Science and Engineering Practices	2. Developing and using models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.	57-61
	2. Developing and using models Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	57-61
Disciplinary Core Ideas	Nuclear processes Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS.PS1C.a)	57-61, 63
Crosscutting Concepts	Energy and matter In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.	57-61, 63

Motion and Stability: Forces and Interactions		89
HS.PS2.6 Communicate scientific and technical information about why the atomic-level, subatomic-level, and/or molecular level structure is important in the functioning of designed materials..		
Science and Engineering Practices	8. Obtaining, evaluating, and communicating information Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.	89
	8. Obtaining, evaluating, and communicating information Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e.,orally, graphically, textually, mathematically).	89
Disciplinary Core Ideas	Structures and properties of matter The structure and interactions of matter at the macro scale are determined by electrical forces within and between atoms. (HS.PS1A.c)	81, 89
	Types of interactions Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS.PS2B.c)	81
	Electromagnetic radiation Photoelectric materials emit electrons when they absorb light of a high-enough frequency. (HS.PS4B.c)	122, 123
	Electromagnetic radiation Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (HS.PS4B.d)	122
Crosscutting Concepts	Structure and function Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.	89

<p>Energy</p> <p>HS.PS3.1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.</p>	<p>105, 110</p>	
<p>Science and Engineering Practices</p>	<p>5. Using mathematics and computational thinking</p> <p>Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions, including, computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.</p>	<p>96, 97, 103, 105, 110</p>
	<p>5. Using mathematics and computational thinking</p> <p>Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.</p>	<p>105, 110</p>
<p>Disciplinary Core Ideas</p>	<p>Definitions of energy</p> <p>Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. There is a single quantity called energy. A system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS.PS3A.a)</p>	<p>93, 103</p>
	<p>Conservation of energy and energy transfer</p> <p>Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS.PS3B.a)</p>	<p>97, 103</p>
	<p>Conservation of energy and energy transfer</p> <p>Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS.PS3B.b)</p>	<p>96, 97, 98, 103</p>
	<p>Conservation of energy and energy transfer</p> <p>Mathematical expressions allow the concept of conservation of energy to be used to predict and describe system behavior. These expressions quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and velocity. (HS.PS3B.c)</p>	<p>103, 105</p>
	<p>Conservation of energy and energy transfer</p> <p>The availability of energy limits what can occur in any system. (HS.PS3B.d)</p>	<p>103</p>
<p>Crosscutting Concepts</p>	<p>Systems and system models</p> <p>Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.</p>	<p>96, 97, 103, 105, 110</p>

Energy HS.PS3.3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	108	
Science and Engineering Practices	6. Constructing explanations and designing solutions Constructing explanations (science) and designing solutions (engineering) in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.	88, 103, 108
	6. Constructing explanations and designing solutions Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	108
Disciplinary Core Ideas	Definitions of energy At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS.PS3A.b)	93
	Energy in chemical processes Although energy cannot be destroyed, it can be converted to other forms—for example, to thermal energy in the surrounding environment. (HS.PS3D.a)	88, 97, 103, 107, 108
	Defining and delimiting engineering problems Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS.ETS1A.a)	N/A
Crosscutting Concepts	Energy and matter Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	88, 93, 97, 103, 107, 108

<p>Energy</p> <p>HS.PS3.4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).</p>	104, 105	
<p>Science and Engineering Practices</p>	<p>3. Planning and carrying out investigations</p> <p>Planning and carrying out investigations to answer questions (science) or test solutions to problems (engineering) in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.</p>	104, 105
	<p>3. Planning and carrying out investigations</p> <p>Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.</p>	104, 105
<p>Disciplinary Core Ideas</p>	<p>Conservation of energy and energy transfer</p> <p>Energy cannot be created or destroyed, but it can be transported from one place to another, transformed into other forms, and transferred between systems. (HS.PS3B.b)</p>	103
	<p>Conservation of energy and energy transfer</p> <p>Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS.PS3B.e)</p>	104, 107, 110
	<p>Energy in chemical processes and everyday life</p> <p>Although energy cannot be destroyed, it can be converted to less useful other forms—for example, to thermal energy in the surrounding environment. (HS.PS3D.a)</p>	46, 47, 48, 52, 55,105
<p>Crosscutting Concepts</p>	<p>System and system models</p> <p>When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.</p>	103-105, 107, 110

Energy HS.PS3.6 Evaluate the validity and reliability of claims in published materials about the viability of nuclear power as a source of alternative energy relative to other forms of energy (e.g., fossil fuels, wind, solar, geothermal).	60	
Science and Engineering Practices	8. Obtaining, evaluating, and communicating information Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.	60
	8. Obtaining, evaluating, and communicating information Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.	60
Disciplinary Core Ideas	Nuclear processes Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS.PS1C.a)	57-61
	Developing possible solutions When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. (HS.ETS1B.a)	N/A
	Natural resources All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS.ESS3A.b)	60
Crosscutting Concepts	Energy and matter In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.	57-61