Ninth Grade Physical Science Content Standards and Objectives

The Ninth Grade Physical Science objectives continue the development of foundational knowledge in chemistry, physics, earth science and astronomy. Through a spiraling, inquiry-based program of study, all students will demonstrate scientific literacy and the use of 21st Century Skills across these major fields of science. Students will explore occupational opportunities in chemistry, engineering, earth science, and technology and evaluate the required academic preparations. Students will engage in active inquiries, investigations and hands-on activities for a minimum of 50 percent of the instructional time to develop conceptual understanding and research/laboratory skills. Safety instruction is integrated in all activities. Building on the knowledge and skills acquired in Eighth Grade Science, students in Ninth Grade Physical Science will expand and deepen their understanding of major concepts such as energy interactions, chemical changes and earth processes. The West Virginia Standards for 21st Century Learning include the following components: 21st Century Content Standards and Objectives and 21st Century Learning Skills and Technology Tools. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools and content standards and objectives.

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<tr><td>Grade Nine</td><td colspan="5">Physical Science</td></tr>
<tr><td>Standard: 1</td><td colspan="5">Nature and Application of Science</td></tr>
<tr><td>SC.S.PS.1</td><td colspan="5">Students will
demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists.
demonstrate the ability to use the inquiry process to solve problems.
relate science-technology-societal issues while using a variety of sources to construct and defend their solutions</td></tr>
<tr><td colspan="6">Performance Descriptors SC.PD.PS.1</td></tr>
<tr><td colspan="2">Distinguished</td><td>Above Mastery</td><td>Mastery</td><td>Partial Mastery</td><td>Novice</td></tr>
<tr><td colspan="2">Ninth grade students at the distinguished level will implement safe practices as they design, conduct, and revise experiments to solve real world problems, analyze data for errors, and base conclusions on observations and experimental evidence. They will relate science-technology-societal issues while using a variety of sources to construct solutions and defend their ideas to an authentic audience.</td><td>Ninth grade students at the above mastery level will implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence. They will relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.</td><td>Ninth grade students at the mastery level will implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence. They will relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.</td><td>Ninth grade students at the partial mastery level will implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence. They will relate science-technology-societal issues while using a variety of sources to construct their solutions.</td><td>Ninth grade students at the novice level will implement safe practices as they conduct experiments and base conclusions on observations and experimental evidence. They will relate science-technology-societal issues while using a variety of sources to construct their solutions.</td></tr>
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Objectives	DOK	Students will
SC.O.PS.1.1	1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.PS.1.2	2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.PS.1.3	3	conduct and/or design investigations that incorporate the skills and attitudes and/or values of scientific inquiry (e.g., established research protocol, accurate record keeping, replication of results and peer review, objectivity, openness, skepticism, fairness, or creativity and logic).
SC.O.PS.1.4	4	design, conduct, evaluate and revise experiments (e.g., compose a question to be investigated, design a controlled investigation that produces numeric data, evaluate the data in the context of scientific laws and principles, construct a conclusion based on findings, propose revisions to investigations based on manipulation of variables and/or analysis of error, or communicate and defend the results and conclusions).
SC.O.PS.1.5	3	draw conclusions from a variety of data sources to analyze and interpret systems and models (e.g., use graphs and equations to measure and apply variables such as rate and scale, evaluate changes in trends and cycles, or predict the influence of external variances such as potential sources of error, or interpret maps).
SC.O.PS.1.6	3	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.PS.1.7	3	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.PS.1.8	1	relate societal, cultural and economic issues to key scientific innovations.
SC.O.PS.1.9	2	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).

Grade Nine	**Physical Science**			
Standard: 2	Content of Science			
SC.S.PS.2	Students will • demonstrate knowledge understanding and applications of scientific facts, concepts, principles, theories, and models delineated in the objectives. • demonstrate an understanding of the interrelationships among physics, chemistry, biology, earth/environmental science, and astronomy; and apply knowledge, understanding and skills of science subject matter/concepts to daily life.			
Performance Descriptors SC.PD.PS.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Ninth grade students at the distinguished level will apply dimensional analysis and metric notations when determining relations, deriving equations, and solving for unknowns. They will predict chemical and physical properties of	Ninth grade students at the above mastery level will apply dimensional analysis and metric notations when collecting data, determining relationships, and solving for unknowns. They will predict chemical and physical properties of	Ninth grade students at the mastery level will apply dimensional analysis and metric notations when collecting data, determining relationships, and solving for unknowns. They will characterize the properties of elements, molecules and	Ninth grade students at the partial mastery level will apply dimensional analysis and metric notations when collecting data, examining relationships, and solving for unknowns. They will characterize the properties of elements, molecules and	Ninth grade students at the novice level will use the proper units when collecting data and solving for unknowns. They will list the properties of elements and ionic structures and identify chemical names. As they balance equations, students

elements based on electron structure quantitatively distinguish ionic, nonpolar and polar covalent compounds. Students will predict and verify the identity of observable products of chemical reactions when given the reactants. They will quantitatively determine the energy produced during exothermic reactions. They will calculate the magnitudes of interacting magnetic fields and build circuits for specified scenarios. They will design experiments to determine relationships in the forces and motions of systems. They will research and evaluate evidence for theories for the origin and composition of the Earth and solar system and use models of waves and heat transfer to explain changes that occur.	elements based on electron structure quantitatively. When given chemical formulas, students will determine the oxidation numbers of the elements, balance the equations, and predict the products. They will design and conduct an experiment to differentiate between heat and temperature and the present results. They will predict and experimentally determine interacting magnetic fields and build circuits for specified scenarios. They will extrapolate data to solve for unknown forces and motions in systems. They will research and site evidence for theories for the origin of the Earth and solar system and use models of waves and heat transfer to explain their composition and changes that occur	ionic structures and write formulas and names of ions. As they determine coefficients, students will classify and cite evidence for the chemical reactions and apply the Laws of Conservation. They will conduct experiments to determine the relationships between molecular motion, kinetic energy, heat, and temperature. They will experimentally determine magnetic fields and circuits as they solve for unknowns and determine their relationships. They will use Newton's Laws to make predictions and solve for unknown forces and motions in systems. They will investigate theories for the origin and composition of the Earth and solar system and use models of waves and heat transfer to explain their composition and changes that occur.	ionic structures and identify chemical names. As they balance equations, students will classify, describe chemical reactions and apply the Laws of Conservation. They will explain the relationships of molecular motion, kinetic energy, heat, and temperature. They will experimentally determine and diagram magnetic fields and circuits as they solve for unknowns. They will make predictions solve for unknown forces and motions in systems. They will diagram the composition of the Earth and solar system and use models of waves and heat transfer to explain changes that occur.	will identify chemical reactions and state the Laws of Conservation. They will state relate molecular motion and kinetic energy to heat and temperature. They will diagram magnetic fields and circuits as they solve for unknowns. They will identify the forces and the motions they cause in systems. They will diagram the solar system and use models to describe waves and the heat transfer that occurs on Earth and sun.

Objectives	DOK	Students will
SC.O.PS.2.1	2	apply dimensional analysis and scientific notation in making metric calculations.
SC.O.PS.2.2	1	predict chemical and physical properties of an element using its position in the periodic table.
SC.O.PS.2.3	3	collect data to infer the relationships among density, mass and volume and apply to earth models (e.g., plate tectonics, weather systems, ocean currents).
SC.O.PS.2.4	1	relate molecular motion and the amount of kinetic energy to the temperature of a system.
SC.O.PS.2.5	1	characterize compounds as ionic, nonpolar covalent or polar covalent and distinguish the difference between molecular and ionic structures.
SC.O.PS.2.6	1	write formulas and name compounds given oxidation numbers of monatomic and polyatomic ions.

SC.O.PS.2.7	**2**	determine the coefficients and classify the reaction type of a chemical equation (e.g., synthesis or combination, decomposition, single replacement, or double replacement and combustion).
SC.O.PS.2.8	**2**	cite evidence for the occurrence of a chemical reaction from student generated experimental data (e.g., production of color, light, heat, sound, smell, gas, or precipitate).
SC.O.PS.2.9	**2**	qualitatively and quantitatively describe the law of conservation of mass/energy (e.g., mechanical, thermal, chemical, electrical and nuclear).
SC.O.PS.2.10	**2**	compare the types of particles liberated in nuclear decay and interpret half-life graphs (e.g., radiometric dating, nuclear medicine and nuclear waste disposal).
SC.O.PS.2.11	**2**	experimentally demonstrate the relationship between heat and temperature (i.e., specific heat, melting point, latent heat).
SC.O.PS.2.12	**1**	predict, experimentally determine and diagram magnetic fields of magnets.
SC.O.PS.2.13	**2**	construct and diagram DC circuits and solve for unknown variables using Ohm's Law and power equations.
SC.O.PS.2.14	**2**	qualitatively explain the relationship between electricity and magnetism.
SC.O.PS.2.15	**2**	conduct experiments to verify the inverse square relationship between gravity, distance and intensity of light and sound.
SC.O.PS.2.16	**2**	experimentally obtain data and apply graphs, vectors and mathematical models to quantify Newton's Laws of motion (i.e., velocity, acceleration, force, momentum, and time).
SC.O.PS.2.17	**2**	conduct an experiment to calculate the mechanical advantages, work in/out and efficiencies of simple machines.
SC.O.PS.2.18	**3**	design, conduct and analyze experiments to determine variables affecting the period of pendulums.
SC.O.PS.2.19	**1**	differentiate between transverse and longitudinal waves and model examples of each type and relate to water, light and sound waves.
SC.O.PS.2.20	**2**	examine seismographic and geologic evidence to determine structure, composition and age of the Earth.
SC.O.PS.2.21	**2**	predict and present a weather forecast using a weather map and meteorological data.
SC.O.PS.2.22	**1**	analyze latitude, altitude and surface features to predict climatic conditions.
SC.O.PS.2.23	**2**	research and organize evidence to support the theory and effects of plate tectonics including density, force, mountain building, fossil and/or magnetic evidence.
SC.O.PS.2.24	**1**	apply fusion, heat transfer, gravity, and electromagnetism to the sun's evolution and its impact on the solar system.
SC.O.PS.2.25	**1**	investigate theories for the origin and configuration of the solar system (e.g. nebular theory, Earth-Moon formation, heliocentric and geocentric models).