

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.

Grade Nine		Physical Science		
Standard: 1		Nature and Application of Science		
SC.S.PS.1	Students will	<ul style="list-style-type: none"> 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 		
Performance Descriptors SC.PD.PS.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Ninth grade students at the distinguished level in the nature and applications of science:	Ninth grade students at the above mastery level in the Nature and Applications of Science:	Ninth grade students at the mastery level in the Nature and Applications of Science:	Ninth grade students at the partial mastery level in the Nature and Applications of Science:	Ninth grade students at the novice level in the Nature and Applications of Science:
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, and	implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and	implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and	implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and	implement safe practices as they conduct experiments and base conclusions on observations and experimental evidence, and
relate science-technology-societal issues while using a variety of sources to	relate science-technology-societal issues while using a variety of sources to	relate science-technology-societal issues while using a variety of sources to	relate science-technology-societal issues while using a variety of sources to	relate science-technology-societal issues while using a variety of sources to

construct solutions and defend their ideas to an authentic audience.	construct and defend their solutions.	construct and defend their solutions.	construct their solutions.	construct their solutions.
Objectives	Students will			
SC.O.PS.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.			
SC.O.PS.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.			
SC.O.PS.1.3	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	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	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	investigate, compare and design scientific and technological solutions to address personal and societal problems.			
SC.O.PS.1.7	given current science-technology-societal issues, construct and defend potential solutions.			
SC.O.PS.1.8	relate societal, cultural and economic issues to key scientific innovations.			
SC.O.PS.1.9	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 <ul style="list-style-type: none"> 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 in content of science:	Ninth grade students at the above mastery level in content of science:	Ninth grade students at the mastery level in content of science:	Ninth grade students at the partial mastery level in content of science:	Ninth grade students at the novice level in content of science:
apply dimensional analysis and metric notations when determining relations,	apply dimensional analysis and metric notations when collecting data, determining	apply dimensional analysis and metric notations when collecting data, determining	apply dimensional analysis and metric notations when collecting data, examining	use the proper units when collecting data and solving for unknowns;

<p>deriving equations, and solving for unknowns;</p> <p>predict chemical and physical properties of elements based on electron structure quantitatively distinguish ionic, nonpolar and polar covalent compounds;</p> <p>predict and verify the identity of observable products of chemical reactions when given the reactants;</p> <p>quantitatively determine the energy produced during exothermic reactions;</p> <p>calculate the magnitudes of interacting magnetic fields and build circuits for specified scenarios;</p> <p>design experiments to determine relationships in the forces and motions of systems, and</p> <p>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.</p>	<p>relationships, and solving for unknowns;</p> <p>predict chemical and physical properties of elements based on electron structure quantitatively;</p> <p>determine the oxidation numbers of the elements, balance the equations, and predict the products;</p> <p>design and conduct an experiment to differentiate between heat and temperature and the present results;</p> <p>predict and experimentally determine interacting magnetic fields and build circuits for specified scenarios;</p> <p>extrapolate data to solve for unknown forces and motions in systems, and</p> <p>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</p>	<p>relationships, and solving for unknowns;</p> <p>characterize the properties of elements, molecules and ionic structures and write formulas and names of ions;</p> <p>classify and cite evidence for the chemical reactions and apply the Laws of Conservation;</p> <p>conduct experiments to determine the relationships between molecular motion, kinetic energy, heat, and temperature;</p> <p>experimentally determine magnetic fields and circuits as they solve for unknowns and determine their relationships;</p> <p>use Newton's Laws to make predictions and solve for unknown forces and motions in systems, and</p> <p>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.</p>	<p>relationships, and solving for unknowns;</p> <p>characterize the properties of elements, molecules and ionic structures and identify chemical names;</p> <p>classify, describe chemical reactions and apply the Laws of Conservation;</p> <p>explain the relationships of molecular motion, kinetic energy, heat, and temperature;</p> <p>experimentally determine and diagram magnetic fields and circuits as they solve for unknowns;</p> <p>make predictions solve for unknown forces and motions in systems; and</p> <p>diagram the composition of the Earth and solar system and use models of waves and heat transfer to explain changes that occur.</p>	<p>list the properties of elements and ionic structures and identify chemical names;</p> <p>identify chemical reactions and state the Laws of Conservation;</p> <p>state relate molecular motion and kinetic energy to heat and temperature;</p> <p>diagram magnetic fields and circuits as they solve for unknowns;</p> <p>identify the forces and the motions they cause in systems, and</p> <p>diagram the solar system and use models to describe waves and the heat transfer that occurs on Earth and sun.</p>
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Objectives	Students will
SC.O.PS.2.1	apply dimensional analysis and scientific notation in making metric calculations.
SC.O.PS.2.2	predict chemical and physical properties of an element using its position in the periodic table.
SC.O.PS.2.3	collect data to infer the relationships among density, mass and volume and apply to earth models: <ul style="list-style-type: none"> • plate tectonics • weather systems • ocean currents
SC.O.PS.2.4	relate molecular motion and the amount of kinetic energy to the temperature of a system.
SC.O.PS.2.5	characterize compounds as ionic, nonpolar covalent or polar covalent and distinguish the difference between molecular and ionic structures.
SC.O.PS.2.6	write formulas and name compounds given oxidation numbers of monatomic and polyatomic ions.
SC.O.PS.2.7	determine the coefficients and classify the reaction type of a chemical equation: <ul style="list-style-type: none"> • synthesis or combination • decomposition • single replacement or double replacement • combustion
SC.O.PS.2.8	cite evidence for the occurrence of a chemical reaction from student generated experimental data: <ul style="list-style-type: none"> • production of color • light • heat • sound • smell • gas • precipitate
SC.O.PS.2.9	qualitatively and quantitatively describe the law of conservation of mass/energy: <ul style="list-style-type: none"> • mechanical • thermal • chemical • electrical • nuclear
SC.O.PS.2.10	compare the types of particles liberated in nuclear decay and interpret half-life graphs: <ul style="list-style-type: none"> • radiometric dating • nuclear medicine • nuclear waste disposal
SC.O.PS.2.11	experimentally demonstrate the relationship between heat and temperature: <ul style="list-style-type: none"> • specific heat • melting point • latent heat

SC.O.PS.2.12	predict, experimentally determine and diagram magnetic fields of magnets.
SC.O.PS.2.13	construct and diagram DC circuits and solve for unknown variables using Ohm's Law and power equations.
SC.O.PS.2.14	qualitatively explain the relationship between electricity and magnetism.
SC.O.PS.2.15	conduct experiments to verify the inverse square relationship between gravity, distance and intensity of light and sound.
SC.O.PS.2.16	experimentally obtain data and apply graphs, vectors and mathematical models to quantify Newton's Laws of motion: <ul style="list-style-type: none"> • velocity • acceleration • force • momentum • time
SC.O.PS.2.17	conduct an experiment to calculate the mechanical advantages, work in/out and efficiencies of simple machines.
SC.O.PS.2.18	design, conduct and analyze experiments to determine variables affecting the period of pendulums.
SC.O.PS.2.19	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	examine seismographic and geologic evidence to determine structure, composition and age of the Earth.
SC.O.PS.2.21	predict and present a weather forecast using a weather map and meteorological data.
SC.O.PS.2.22	analyze latitude, altitude and surface features to predict climatic conditions.
SC.O.PS.2.23	research and organize evidence to support the theory and effects of plate tectonics including: <ul style="list-style-type: none"> • density • force • mountain building • fossil • magnetic evidence
SC.O.PS.2.24	apply fusion, heat transfer, gravity, and electromagnetism to the sun's evolution and its impact on the solar system.
SC.O.PS.2.25	investigate theories for the origin and configuration of the solar system: <ul style="list-style-type: none"> • nebular theory • Earth-Moon formation • heliocentric • geocentric models

Earth Science Content Standards and Objectives

Earth Science is an advanced level lab course that is an elective designed for students who desire a broader understanding of the fundamentals of earth science and includes geology, oceanography, meteorology and astronomy. This course is designed to build on knowledge, skills, and dispositions developed during the science progression, which included the traditional disciplines of biology, chemistry, and physics where appropriate. Students will engage in active inquiries, investigations and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and research/laboratory skills. Safety instruction is integrated into all activities. 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.

High School	Earth Science				
Standard: 1	Nature of Science				
SC.S.ES.1	Students will <ul style="list-style-type: none"> 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. 				
Performance Descriptors SC.PD.ES.1					
	Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
	Earth Science students at the distinguished level will analyze the importance of scientific innovation and relate these innovations to the utilization of scientific methodology, variability in experimental results in advances in societal, cultural and economic issues; design, conduct, communicate, evaluate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and interpret models.	Earth Science students at the above mastery level will analyze the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to design, conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and models.	Earth Science students at the mastery level will examine the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from data sources and models.	Earth Science students at the partial mastery level will describe the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural or economic issues; use scientific methodology to conduct and communicate experiments utilizing safe procedure and appropriate technology; select an appropriate conclusion from a list of possible conclusions drawn from experimental data.	Earth Science students at the novice level will identify the importance of scientific innovation and associate these innovations with advances in societal; cultural or economic issues; conduct experiment utilizing safe procedures and appropriate technology; differentiate between observations and conclusions.
Objectives	Students will				
SC.O.ES.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in				

	experimental results.
SC.O.ES.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues (e.g., “scientific method”).
SC.O.ES.1.3	relate societal, cultural, and economic issues to key scientific innovations.
SC.O.ES.1.4	conduct and/or design investigations that incorporate the skills and attitudes and/or values of scientific inquiry (e.g., established research protocols, accurate record keeping, replication of results and peer review, objectivity, openness, skepticism, fairness, or creativity and logic).
SC.O.ES.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.ES.1.6	use appropriate technology solutions within a problem solving setting to measure and collect data; interpret data; analyze and/or report data; interact with simulations; conduct research; and to present and communicate conclusions.
SC.O.ES.1.7	design, conduct, evaluate and revise experiments (e.g., compose a question to be investigated, design a controlled investigation that produces numerical data, evaluate the data in the context of scientific laws and principles, construct a conclusion bases 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.ES.1.8	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, predict the influence of external variances such as potential sources of error, or interpret maps).

High School	Earth Science
Standard: 2	Content of Science
SC.S.ES.2	<p>Students will</p> <ul style="list-style-type: none"> demonstrate knowledge, understanding and applications of scientific facts, concepts, principles, theories and models as delineated in the objectives. demonstrate an understanding of the interrelationships among physics, chemistry, biology, earth/environmental science and astronomy. apply knowledge, understanding and skills of science subject matter/concepts to daily life experiences.

Performance Descriptors SC.PD.ES.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Earth Science students at the distinguished level will evaluate data supporting theories relating to the structure, origin, and evolution of Earth’s spheres’ analyze seismic, density, gravity, and magnetic data to explain the structure of the earth; contrast the eras, epochs, and periods; analyze radiometric dating	Earth Science students at the above mastery level will contrast the theories relating to the structure, origin, and evolution of Earth’s sphere; analyze seismic, density, gravity, and magnetic data to explain the structure of the earth; contrast the eras, epochs and periods; analyze radiometric data	Earth Science students at the mastery level will identify and describe the structure, origin, and evolution of Earth’s spheres; analyze seismic, density, gravity, and magnetic data to explain the structure of the earth; characterize the eras, epochs and periods; analyze radiometric dating	Earth Science students at the partial mastery level will identify and describe the structure, origin, and evolution of Earth’s spheres; use seismic, density, gravity, and magnetic data to explain the structure of the earth; characterize the eras, epoch and periods; describe radiometric dating	Earth Science students at novice level will identify the structure origin, and evolution of Earth’s spheres; state seismic, density, gravity, and magnetic data are used to explain the structure of the earth; sequence the eras, epochs and periods; recognize that analyze radiometric dating and rock

<p>and rock and fossil evidence to determine the age of substances; create new uses for common materials based on their properties; predict paleoenvironments or geologic conditions which existed during the formation of rock samples; predict weathering related to water properties; prove the effectiveness of agents and processes of degradation; design structures that withstand effects of geologic activities; use seismic information to predict earthquakes; evaluate current explanations of plate tectonics; analyze the long term effect of forces that change Earth's surface; analyze and revise topographic maps; create models to represent properties and features of oceans; analyze the characteristics, evolution and effects of the oceans; apply heat transfer to meteorological phenomena and weather forecasting; design models that demonstrate global change; connect Newton's Laws to Kepler's Laws; analyze several origin theories of the solar system and universe and use them to explain celestial bodies and their</p>	<p>and rock and fossil evidence to determine the age of substances; explain how the properties common minerals determine their economic uses; predict paleoenvironments or geologic conditions which existed during the formation of rock samples; investigate and explain water properties which contribute to weathering; experimentally determine agents and processes of degradation; predict the effects of geologic activity at plate boundaries; analyze seismic information to investigate earthquakes; evaluate current explanations for of plate tectonics; compare forces that change Earth's surface; use ground-truthing to analyze topographic maps; investigate properties and features of oceans; analyze the characteristics, evolution and effects of the oceans; investigate heat transfer and gather meteorological evidence to forecast weather; cite evidence of global change; apply Newton's Law of Universal Gravitation; analyze several origin</p>	<p>and rock and fossil evidence to determine the age of substances; use properties to distinguish between common minerals and explain their economic uses; predict paleoenvironments or geologic conditions which existed during the formation of rock samples; investigate and describe water properties which contribute to weathering; compare and contrast the effectiveness of agents and processes of degradation; predict geologic activity associated with specific plate boundaries and interactions; analyze seismic information to investigate earthquakes; evaluate current explanations of plate tectonics; relate forces to changes on Earth's surface; construct and/or interpret topographic maps; compare and contrast properties and features of oceans; analyze the characteristics, evolution and effects of the oceans; investigate heat transfer and use meteorological evidence to forecast weather; examine global change; apply Newton's Law of Universal</p>	<p>and rock and fossil evidence to determine the age of substances; relate the properties of common minerals to their economic uses; relate paleoenvironments or geologic conditions to specific rock formations; describe water properties which contribute to weathering; compare and contrast agents and processes of degradation; relate geologic activity to plate boundaries; use seismic information to determine epicenter of an earthquake; describe the effects of plate tectonics; classify forces that effect Earth's surface; interpret topographic maps; describe properties and features of oceans; describe the evolution and effects of the oceans; use meteorological evidence to forecast weather; describe global changes; apply Newton's Law of Universal Gravitation; compare several origin theories of the solar system and universe; relate astronomy to the development of the calendar and navigation; list uses for wavelengths in the electromagnetic spectrum; relate earth processes to</p>	<p>and fossil evidence is used to determine the age of substances; explain the economic uses of common minerals; describe paleoenvironments or geologic conditions which existed during the formation of a given rock sample; describe water properties which contribute to weathering; identify agents and processes of degradation; relate geologic activity to plate boundaries; define magnitude and epicenter; illustrate plate tectonics; list forces that effect Earth's surface; interpret topographic maps; illustrate properties and features of oceans; describe the evolution and effects of the oceans; use meteorological evidence to forecast weather; recognize that global changes occur; cite evidence for Newton's Law of Universal Gravitation; list several origin theories of the solar system and universe; record the angle and apparent movement of the sun in a calendar; construct a diagram of the wavelengths in the electromagnetic spectrums; relate earth processes to natural disasters; list</p>
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movements; investigate methods used to study astronomy and apply them to the development of the calendar and navigation; explain the electromagnetic spectrum and its occurrence in the universe; analyze the relationship between earth processes, natural disasters, and humans; create an action plan for responsible stewards of the earth; evaluate the pros and cons responsible stewards of the earth; evaluate the pros and cons of using alternative energy sources.	theories of the solar system and universe and use them to explain celestial bodies and their movements; investigate astronomy and the development of the calendar and navigation; explain the electromagnetic spectrum and its occurrence in the universe; analyze the relationship between earth processes, natural disasters, and humans; develop a logical argument for being a responsible steward of the earth; cite evidence for using alternative energy sources.	Gravitation; analyze several origin theories of the solar system and universe and use them to explain celestial bodies and their movements; compare methods of studying and uses for astronomy; use the electronic spectrum to investigate the universe; compare the relationship between earth processes and natural disasters; evaluate our need to act as responsible stewards of the earth; research and evaluate alternative energy sources.	natural disasters; describe appropriate behaviors for responsible stewards of the earth; research alternative energy sources.	appropriate behaviors for responsible stewards of the earth; describe alternative energy sources.
Objectives	Students will			
SC.O.ES.2.1	identify and describe the structure, origin, and evolution of the lithosphere, hydrosphere, atmosphere and biosphere.			
SC.O.ES.2.2	analyze seismic, density, gravity, and magnetic data to explain the structure of the earth.			
SC.O.ES.2.3	characterize the eras, epochs and periods in relation to earth history and geologic development.			
SC.O.ES.2.4	analyze radiometric dating and rock and fossil evidence to determine the age of substances.			
SC.O.ES.2.5	use chemical and physical properties to distinguish between common minerals and explain their economic uses.			
SC.O.ES.2.6	use rock characteristics to predict paleoenvironments or geologic conditions which existed during the formation of a given rock sample.			
SC.O.ES.2.7	investigate and describe the properties of water, which contribute to its critical role in physical and chemical weathering.			
SC.O.ES.2.8	compare and contrast the effectiveness of agents and processes of degradation, i.e., <ul style="list-style-type: none"> • weathering by gravity, • wind, • water, • ice. 			
SC.O.ES.2.9	predict geologic activity associated with specific plate boundaries and interactions.			
SC.O.ES.2.10	analyze modern and historical seismic information to determine epicenter location and magnitude of earthquakes.			
SC.O.ES.2.11	evaluate current explanations for mechanisms, which drive the motion of plates (convection, slab-pull, plate push).			
SC.O.ES.2.12	relate the effect of degradation and tectonic forces on the earth's surface features, i.e., <ul style="list-style-type: none"> • weathering, • physical features of the ocean floor, 			

	<ul style="list-style-type: none"> • life with the oceans.
SC.O.ES.2.13	construct and/or interpret information on topographic maps.
SC.O.ES.2.14	identify and describe chemical and physical properties of oceans, i.e., <ul style="list-style-type: none"> • composition, • currents, • physical features of the ocean floor.
SC.O.ES.2.15	compare and contrast characteristics of the various oceans, including their lateral and vertical motions.
SC.O.ES.2.16	analyze the evolution of the ocean floor including ocean crust, sedimentation, active and passive continental margins.
SC.O.ES.2.17	examine the stratification of the oceans, i.e., <ul style="list-style-type: none"> • temperature, • salinity zones, • biological zones.
SC.O.ES.2.18	investigate to explain heat transfer in the atmosphere and its relationship to meteorological processes (e.g., pressure, winds, evaporation, condensation, or precipitation).
SC.O.ES.2.19	predict the effects of ocean currents on climate.
SC.O.ES.2.20	use meteorological evidence and weather maps (including air masses, wind, barometric pressure, and temperature data) to forecast weather.
SC.O.ES.2.21	examine global change over time, i.e., <ul style="list-style-type: none"> • climatic trends, • global warming, • ozone depletion.
SC.O.ES.2.22	apply Newton's Law of Universal Gravitation to the motion of celestial objects to explain phenomenon observed in the sun-earth-moon system.
SC.O.ES.2.23	analyze several origin theories of the solar system and universe and use them to explain the celestial bodies and their movements.
SC.O.ES.2.24	compare ancient and modern methods of studying and uses for astronomy (e.g., calendar, navigation).
SC.O.ES.2.25	use various wavelengths of the electromagnetic spectrum to investigate the observable universe.
SC.O.ES.2.26	compare the relationship between earth processes and natural disasters with their impact on humans.
SC.O.ES.2.27	evaluate the potential conflicts, which arise between societal reliance on natural resources and the need to act as responsible stewards to reclaim the earth, including disposal of hazardous and non-hazardous waste.
SC.O.ES.2.28	research alternative energy sources and evaluate the ecological, environmental and economic cost-benefit ratio.

High School	Earth Science
Standard: 3	Application of Science
SC.S.ES.3	Students will <ul style="list-style-type: none"> • demonstrate the ability to use inquiry process to explore systems, models, and changes. • demonstrate an understanding of the interdependence between science and technology. • demonstrate an understanding of the utilization of technology to gather data and communicate designs, results and conclusions.

	<ul style="list-style-type: none"> demonstrate an understanding of personal and societal benefits of science, and an understanding of public policy decisions as related to health, population, resource and environmental issues. 			
Performance Descriptors SC.PD.ES.3				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Earth Science student at the distinguished level will construct, test and analyze complex systems, models, and changes across science disciplines; use a technology solution and analyze the science used in the technology; evaluate how a specific discovery impacts public policy decisions regarding health, population resources and environmental issues.	Earth Science students at the above mastery level will construct, test and analyze data to explore systems, models, and changes across science disciplines; analyze technological innovations and identify the science that makes them possible; evaluate the personal and societal benefits of a scientific discovery; assess the impacts of a public policy decision regarding health, population resources or environmental issues.	Earth Science students at the mastery level will test, record and analyze data to explore systems, models, and changes; analyze a technological innovations that identify the science that makes it possible; assess positive outcomes and unintended consequences of a scientific discovery; explain the impacts of a public policy decision regarding health, population resource or environmental issues.	Earth Science students at the above mastery level will test and record data to explore systems, models, and changes; explain a technological innovation and identify the science that makes it possible; identify positive outcomes and unintended consequences of a scientific discovery; identify the impacts of public policy decision regarding health, population resources or environmental issues.	Earth Science students at the novice level will test and record data to explore systems, models or changes; identify a technological innovation and the science that makes it possible; identify positive outcomes or unintended consequences of a scientific discovery; identify the impact of a public policy decision regarding health, population resources or environmental issues.
Objectives	Students will			
SC.O.ES.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, system, or change over time).			
SC.O.ES.3.2	investigate, compare and design scientific and technological solutions to address personal and societal problems.			
SC.O.ES.3.3	communicate experimental designs, results and conclusions using advanced technology tools.			
SC.O.ES.3.4	collaborate to present research on current environmental and technological issues and predict possible solutions.			
SC.O.ES.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.			
SC.O.ES.3.6	given a current science-technology-societal issue, construct and defend potential solutions.			

Physics Content Standards and Objectives

Physics is an advanced level course that is an elective designed for students desiring a broader, in-depth study of the content found in the science field of physics. As a college preparatory course, Advanced Physics is a laboratory driven, advanced study of nature's universal laws with emphasis on process skills, using 21st century skills. This course is designed to build upon and extend the Physics concepts, skills, and knowledge from the science program. The course emphasizes a mathematical approach to the areas of kinematics, dynamics, thermodynamics, light and optics, electricity and magnetism and modern physics. Students will engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and research/laboratory skills. Safety instruction is integrated into all activities. 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.

High School		Physics		
Standard: 1		Nature of Science		
SC.S.P.1		Students will <ul style="list-style-type: none"> 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. 		
Performance Descriptors SC.PD.P.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics students at the distinguished level will analyze the importance of scientific innovation and relate these innovations to the utilization of scientific methodology, variability in experimental results to advances in societal, cultural and economic issues; design, conduct, communicate, evaluate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and interpretation of models.	Physics students at the above mastery level will analyze the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to design, conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and models.	Physics students at the mastery level will examine the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from data sources and models.	Physics students at the partial mastery level will describe the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural or economic issues; use scientific methodology to conduct and communicate experiments utilizing safe procedures and appropriate technology; select an appropriate conclusion from a list of possible conclusions drawn from experimental data.	Physics students at the novice level identify the importance of scientific innovation and associate these innovations with advances in societal, cultural or economic issues; conduct experiments utilizing safe procedures and appropriate technology; differentiate between observations and conclusions.

Objectives	Students will
SC.O.P.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.P.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues (e.g., “scientific method”).
SC.O.P.1.3	relate societal, cultural and economic issues to key scientific innovations.
SC.O.P.1.4	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.P.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.P.1.6	use appropriate technology solutions within a problem solving setting to measure and collect data, interpret data, analyze and/or report data, interact with simulations, conduct research, and present and communicate conclusions.
SC.O.P.1.7	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.P.1.8	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, predict the influence of external variances such as potential sources of error, or interpret maps).

High School	Physics
Standard: 2	The Content of Science
SC.S.P.2	<p>Students will</p> <ul style="list-style-type: none"> demonstrate knowledge, understanding, and applications of scientific facts, concepts, principles, theories, and models as delineated in the objectives. demonstrate an understanding of the interrelationships among physics, chemistry, biology, and the earth and space sciences. apply knowledge, understanding, and skills of science subject matter/concepts to daily life experiences.

Performance Descriptors SC.PD.P.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics students at the distinguished level will derive formula of best-fit for representation of motion (velocity, acceleration); test the theoretical basis of mathematical methods for motion in one and/or two dimensions; evaluate methods to solve problems	Physics students at the above mastery level will given formula, match the graph of position versus time, velocity versus time or acceleration versus time; test the theoretical basis of mathematical methods for motion in one and/or two dimensions; solve problems	Physics students at the mastery level will construct and interpret graphs of position versus time, velocity versus time and acceleration versus time; analyze data, for motion in one and/or two dimensions then select the correct mathematical method for	Physics students at the partial mastery level will construct graphs of position versus time, velocity versus time and acceleration versus time; relate data from motion in one- or two-dimension to mathematical functions; solve one-step problems involving velocity,	Physics students at the novice level will match the unit to the correct measurement of motion (position, speed, velocity, acceleration); collect data for motion in one- or two-dimensions; match the unit with the variable; define vectors; state Newton’s

<p>involving velocity, acceleration, momentum and net force using more than one equation; create graphical, algebraic and/or trigonometric solutions problems involving vector components and resultants; experimentally verify Newton's Laws of Motion in terms of equilibrium and net force situations; experimentally verify the conservation of energy and momentum and deduce solutions for elastic and inelastic collisions; calculate the density of an unknown liquid given the buoyant behavior of an object of known density; solve problems involving pressure using more than one equation; apply Bernoulli's principle to everyday object; explain mathematically the reflective, refractive and diffractive properties of mechanical and transverse waves; apply calculations to determine the speed of a seismic waves; apply knowledge of simple harmonic motion (e.g., springs, pendulums and other oscillating objects) to calculate the kinetic and potential energies of the oscillating system; calculate the apparent frequency</p>	<p>involving velocity, acceleration, momentum and net force using more than one equation; create graphical, algebraic and/or trigonometric solutions problems involving vector components and resultants; experimentally verify Newton's Laws of Motion in terms of equilibrium and net force situations; evaluate the conservation of energy and momentum and deduce solutions for elastic and inelastic collisions; calculate the density of an unknown liquid given the buoyant behavior of an object of known density; calculate pressure when given depth, density and volume; apply Bernoulli's principle to everyday object (for example, paint sprayer or perfume bottle); explain mathematically the reflective, refractive and diffractive properties of mechanical and transverse waves; given wavelength, calculate the energy of a wave; experimentally determine the factors that affect an oscillating system; calculate the apparent frequency caused by Doppler shift; differentiate the properties concave or convex mirrors or lenses;</p>	<p>communicating the value of unknown variable; develop solutions for multistep problems involving velocity, acceleration, momentum and net force; interpret graphical, algebraic and/or trigonometric solutions to prove the values for vector components and resultants; experimentally verify Newton's Laws of Motion in terms of equilibrium and net forces situations; evaluate the conservation of energy and momentum and deduce solutions for elastic and inelastic collisions; experimentally verify that the apparent weight of a submerged object depends upon density; compare the pressure exerted by a fluid to the depth of an object in the fluid; anticipate the effects of Bernoulli's principle on fluid motion; examine the reflective, refractive and diffractive properties of mechanical and transverse waves; perform calculations to determine wavelength, frequency, velocity or energy of a wave; investigate simple harmonic motion as result of an object's displacement; research applications of Doppler shift in determining</p>	<p>acceleration, momentum and net force; draw vector solutions; perform calculations involving equilibrium and net force situations; define the law of conservation of energy; assess the magnitude of buoyant force on submerged and floating objects; recognize that fluids exert force on objects in the fluid; demonstrate Bernoulli's principle; define reflective, refractive and diffractive properties of mechanical and transverse waves; label a transverse and longitudinal wave with the parts of the wave; relate the restoring force to displacement; diagram waves showing the Doppler effect; experimentally find the image of a lens or mirror using an optic bench; calculate Ohm's law problems for series circuits; distinguish between direct and alternating current and identify ways of generating each type; recognize a projectile moves in both horizontal and vertical direction.</p>	<p>Laws of Motion; describe elastic and inelastic collisions; express the difference between weight and mass; define pressure as force/area; state Bernoulli's principle; define reflective and refractive properties of mechanical and transverse waves; label a transverse wave with the parts of the wave; define simple harmonic motion; define Doppler effect; define focal point, image, image distance and object distance; state Ohm's law; define direct current and identify ways of generating it; recognize projectile motion.</p>
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caused by Doppler shift and interpret the results; differentiate mathematically the properties concave or convex mirrors or lenses; construct and analyze electrical circuits and calculate Ohm's law problems for complete circuits; calculate kilowatt-hours for an alternating current and determine the cost of using that current; apply knowledge of projectile motion to determine horizontal and vertical velocities and/or distances.	construct and analyze electrical circuits and calculate Ohm's law problems for complex circuits; calculate power of direct and alternating current using resistance, current and voltage; determine the forces acting on the projectile.	an approaching or receding source in wave propagation; apply ray optics diagrams to lenses and mirrors; use the lens/mirror equation and the magnification equation to solve optics problems; construct and analyze electrical circuits and calculate Ohm's law problems for series and parallel circuits; distinguish between direct and alternating current and identify ways of generating each type; analyze the motion of a projectile.		
Objectives	Students will			
SC.O.P.2.1	construct and interpret graphs of position versus time, velocity versus time and acceleration versus time.			
SC.O.P.2.2	appraise data, either textbook generated or laboratory collected, for motion in one and/or two dimensions, then select the correct mathematical method for communicating the value of unknown variables.			
SC.O.P.2.3	develop solutions for multi-step problems involving velocity, acceleration, momentum and net force.			
SC.O.P.2.4	interpret graphical, algebraic and/or trigonometric solutions to prove the values for vector components and resultants.			
SC.O.P.2.5	justify Newton's Laws of Motion in terms of equilibrium and net force situations.			
SC.O.P.2.6	evaluate the conservation of energy and momentum and deduce solutions for elastic and inelastic collisions.			
SC.O.P.2.7	assess the magnitude of buoyant force on submerged and floating objects.			
SC.O.P.2.8	compare the pressure exerted by a fluid to the depth of an object in the fluid.			
SC.O.P.2.9	anticipate the effects of Bernoulli's principle on fluid motion.			
SC.O.P.2.10	examine the reflective, refractive and diffractive properties of mechanical and transverse waves.			
SC.O.P.2.11	perform calculations to determine wavelength, frequency, velocity or energy of a wave.			
SC.O.P.2.12	compare and contrast the physical properties of mechanical and transverse waves.			
SC.O.P.2.13	research applications of Doppler shift in determining an approaching or receding source in wave propagation.			
SC.O.P.2.14	apply ray optics diagrams to lenses and mirrors; use the lens/mirror equation and the magnification equation to solve optics problems.			
SC.O.P.2.15	justify the image results obtained by diagramming the ray optics of lenses and mirrors and/or by deducing the image information from the lens/mirror equation.			
SC.O.P.2.16	construct and analyze electrical circuits and calculate Ohm's law problems for series and parallel circuits.			
SC.O.P.2.17	distinguish between direct and alternating current and identify ways of generating each type.			

SC.O.P.2.18	analyze the motion of a projectile.
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High School	Physics
Standard: 3	Application of Science
SC.S.P.3	<p>Students will</p> <ul style="list-style-type: none"> • demonstrate the ability to use inquiry process to explore systems, models, and changes. • demonstrate an understanding of the interdependence between science and technology. • demonstrate an understanding of the utilization of technology to gather data and communicate designs, results and conclusions. • demonstrate an understanding of personal and societal benefits of science, and an understanding of public policy decisions as related to health, population, resource and environmental issues.

Performance Descriptors SC.PD.P.3

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics students at the distinguished level will construct, test and analyze complex systems, models, and changes across science disciplines; use a technology solution and analyze the science used in the technology; evaluate how a scientific discovery impacts public policy decisions regarding health, population resources and environmental issues.	Physics students at the above mastery level will construct, test and analyze data to explore systems, models, and changes across science disciplines; analyze technological innovations and identify the science that makes them possible; evaluate the personal and societal benefits of a scientific discovery; assess the impacts of a public policy decision regarding health, population resources or environmental issues.	Physics students at the mastery level will test, record and analyze data to explore systems, models, and changes; analyze a technological innovation and identify the science that makes it possible; assess positive outcomes and unintended consequences of a scientific discovery; explain the impacts of a public policy decision regarding health, population resources or environmental issues.	Physics students at the partial mastery level will test and record data to explore systems, models, and changes; explain a technological innovation and identify the science that makes it possible; identify positive outcomes and unintended consequences of a scientific discovery; identify the impacts of public policy decision regarding health, population resources or environmental issues.	Physics students at the novice level will test and record data to explore systems, models or changes; identify a technological innovation and the science that makes it possible; identify positive outcomes or unintended consequences of a scientific discovery; identify the impact of a public policy decision regarding health, population resources or environmental issues.

Objectives	Students will
SC.O.P.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).
SC.O.P.3.2	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.P.3.3	communicate experimental designs, results and conclusions using advanced technology tools.
SC.O.P.3.4	collaborate to present research on current environmental and technological issues to predict possible solutions.
SC.O.P.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.
SC.O.P.3.6	given a current science-technology-societal issue, construct and defend potential solutions.

Conceptual Physics Content Standards and Objectives

Conceptual Physics is an advanced level course that is an elective designed for students who desire a physics course that will prepare them for technical careers. This course is an alternative to the traditional mathematical approach to physics. This approach covers the physics principles in a traditional sequence with an emphasis on conceptual understanding. While mathematics is de-emphasized, laboratory work will require traditional physics measurements to be made. Emphasis will be on the concepts that underlie the natural laws of the universe. Students will engage in active inquiries, investigations, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and research/laboratory skills. Safety instruction is integrated into all activities. 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.

High School		Conceptual Physics		
Standard: 1		Nature of Science		
SC.S.CP.1		Students will		
		<ul style="list-style-type: none"> 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. 		
Performance Descriptors SC.PD.CP.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Physics students at the distinguished level will analyze the importance of scientific innovations to the utilization of scientific methodology, variability in experimental results to advances in societal, cultural and economic issues, design, conduct, communicate, evaluate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and interpretation of models.	Conceptual Physics students at the above mastery level will analyze the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to design, conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and models.	Conceptual Physics students at the mastery level will examine the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from data sources and models.	Conceptual Physics students at the partial mastery level will describe the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural or economic issues; use scientific methodology to conduct and communicate experiments utilizing safe procedures and appropriate technology; select an appropriate conclusions from a list of possible conclusions drawn from experimental data.	Conceptual Physics students at the novice level will identify the importance of scientific innovations and associate these innovations with advances in societal, cultural or economic issues; conduct experiments utilizing safe procedures and appropriate technology; differentiate between observations and conclusions.
Objectives	Students will			

SC.O.CP.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.CP.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues. (e.g., “scientific method”).
SC.O.CP.1.3	relate societal, cultural and economic issues to key scientific innovations.
SC.O.CP.1.4	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.CP.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.CP.1.6	use appropriate technology solutions within a problem solving setting to measure and collect data, interpret data, analyze and/or report data, interact with simulations, conduct research, and present and communicate conclusions.
SC.O.CP.1.7	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; communicate and defend the results and conclusions).
SC.O.CP.1.8	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, predict the influence of external variances such as potential sources of error, or interpret maps).

High School	Conceptual Physics			
Standard: 2	Content of Science			
SC.S.CP.2	<p>Students will</p> <ul style="list-style-type: none"> demonstrate knowledge, understanding and applications of scientific facts, concepts, principles, theories and models as delineated in the objectives. demonstrate an understanding of the interrelationships among physics, chemistry, biology, earth/environmental science and astronomy. apply knowledge, understanding and skills of science subject matter/concepts to daily life/experiences. 			
Performance Descriptors SC.PD.CP.2				
Distinguished	Above Mastery	Master	Partial Mastery	Novice
Conceptual Physics students at the distinguished level will solve vector problems both graphically and algebraically; interpret graphs relating distance, velocity and acceleration to time; apply knowledge of projectile motion to determine horizontal and vertical velocities and/or	Conceptual Physics students at the above mastery level will solve vector problems graphically or algebraically; draw a graph relating distance, velocity and acceleration to time; determine the horizontal and vertical distances of projectile motion; illustrate forces	Conceptual Physics students at the mastery level will solve right triangle vector problems both graphically and algebraically; compare and contrast distance, velocity and acceleration of moving objects to describe accelerated and non-accelerated motions of a	Conceptual Physics students at the partial mastery level will solve right triangle vector problems graphically or algebraically; define the units distance, velocity and acceleration; recognize a projectile moves in both horizontal and vertical direction; identify forces acting on an	Conceptual Physics students at the novice level will draw a right triangle; define distance, velocity and acceleration; recognize projectile motion; identify force as a vector; state one of Newton’s Laws; state that energy is conserved within a system; define work, energy and power;

<p>distances; calculate the net force acting on a two body system; determine the net force acting on a system; mathematically verify that mechanical energy is conserved; experimentally determine mechanical advantage of a mechanical system; solve equations for Archimedes' and/or Pascal's principles; apply Bernoulli's principle to everyday object (for example, paint sprayer or perfume bottle); interpret a phrase change diagram; appraise the role of heat transfer involved in environmental and energy conservation issues and predict ways to eliminating the heat transfer; defend that heat added to a system will raise the internal energy or increase the amount of work done externally by the system; evaluate sound and light waves using the concepts of reflection, refraction, diffraction, and interference; given wavelength calculate the energy of a wave; examine factors that affect the speed of sound; explain why the speed of light is a constant; predict the effect of changing the frequency of a standing wave; demonstrate the effect of changing the</p>	<p>acting on a two body system with a free body diagram; apply Newton's Laws as a system to explain natural phenomena; calculate kinetic and potential energy; experimentally determine mechanical advantage of a mechanical system; recognize a floating object displaces a weight of fluid equal to its own weight and recognize that pressure is equal at all points in an enclosed system; apply Bernoulli's principle to everyday object (for example, paint sprayer or perfume bottle); experimentally determine the melting point of a substance and graph the results; examine the role of heat transfer involved in environmental and energy conservation issues and predict ways of eliminating the heat transfer; analyze the first law of thermodynamics and relate it to energy conservation; analyze sound and light waves using the concepts of reflection, refraction, diffraction and interference; given wavelength, calculate the energy of a wave; determine factors that affect the speed of sound;</p>	<p>particle from textbook or lab collected data; analyze the motion of a projectile; illustrate forces acting on objects with free body diagrams; interpret Newton's Laws in terms of natural phenomena; compare and contrast kinetic and potential energies and recognize situations where mechanical energy is conserved; deduce work, energy, power and efficiency in mechanical systems; analyze Archimedes' and Pascal's principles to solve problems involving equilibrium and stability of floating systems; recognize the effects of Bernoulli's principle on fluid motion; compare and contrast the common temperature scales, convert from one temperature scale to another and evaluate temperature in terms of kinetic energy; apply the mechanism of heat transfer and relate to environmental and energy conservation issues; relate the first law of thermodynamics to energy conservation; compare and contrast sound and light waves using the concepts of reflection, refraction, diffraction and interference;</p>	<p>object; state Newton's Laws; define and give examples of kinetic and potential energies; define efficiency in a mechanical system and state the formulas for work, energy and power; distinguish between weight and mass; demonstrate Bernoulli's principle; distinguish between heat and temperature; compare and contrast the three methods of heat transfer; state the first law of thermodynamics; compare sound and light waves using the concepts of reflection, refraction, diffraction and interference; label a transverse and longitudinal wave with the parts of the wave; determine factors that affect the speed of sound; recognize that the speed of light is a constant; construct a standing wave; identify examples of Doppler shift for either sound or light waves; find the image location involving plane and spherical mirrors, concave and convex lenses on an optical bench; compare primary and secondary colors of light and pigment; sketch the concept of polarization; relate Ohm's Law to simple circuits;</p>	<p>recognize a floating object displaces fluid; state Bernoulli's principle; identify the common temperature scales and their units; list the three methods of heat transfer; state the Law of Energy Conservation; define reflection, refraction, diffraction and interference; label a transverse wave with the parts of the wave; define a standing wave; define the Doppler shift; find the image location involving plane and spherical mirrors on an optical bench; list primary and secondary colors of light and pigment; define polarization; list and define the variables of Ohm's Law.</p>
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frequency; calculate the apparent change in frequency that occurs with either a moving source or a moving detector; predict, illustrate, and calculate image location involving plane and spherical mirrors, concave and convex lenses; analyze the applications of colored lights and pigments; relate the concept of polarization to three dimensional viewing; calculate any variable in a complex circuit using Ohm's Law and compare and contrast between the flow of electrons in AC and DC circuits.	recognize that the speed of light is a constant; identify the nodes and antinodes of a standing wave and demonstrate the relationship between frequency and the creation of more nodes; investigate the uses of Doppler shift in astronomy and cosmology; calculate image location involving plane and spherical mirrors, concave and convex lenses; compare and contrast the applications of colored lights and pigments; analyze the concept of polarization; calculate any variable in a simple circuit using Ohm's Law and distinguish between the flow of electrons in AC and DC circuits.	solve problems involving wave speed, frequency and wavelength; determine factors that affect the speed of sound; recognize that the speed of light is a constant; model the production of a standing wave and propose a practical application of such a wave; compare the Doppler shift effect for sound and light and point out examples of its occurrences and applications; diagram image location involving plane and spherical mirrors, concave and convex lenses; illustrate the applications of colored lights and pigments; examine the concept of polarization; analyze simple direct current circuits using Ohm's Law, distinguish between direct current and alternating current circuits and describe how AC is converted to DC.	distinguish between direct and alternating current.	
Objectives	Students will			
SC.O.CP.2.1	solve right triangle vector problems both graphically and algebraically.			
SC.O.CP.2.2	compare and contrast distance, velocity and acceleration of moving objects to describe accelerated and non-accelerated motions of a particle from textbook or lab collected data.			
SC.O.CP.2.3	analyze the motion of a projectile.			
SC.O.CP.2.4	illustrate forces acting on objects with free body diagrams.			
SC.O.CP.2.5	interpret Newton's Laws in terms of natural phenomena.			
SC.O.CP.2.6	compare and contrast kinetic and potential energies and recognize situations where mechanical energy is conserved.			
SC.O.CP.2.7	deduce work, energy, power and efficiency in mechanical systems.			
SC.O.CP.2.8	analyze Archimedes' and Pascal's principles to solve problems involving equilibrium and stability of floating systems.			
SC.O.CP.2.9	recognize the effects of Bernoulli's principle on fluid motion.			
SC.O.CP.2.10	compare and contrast the common temperature scales, convert from one temperature scale to another and evaluate temperature in			

	terms of kinetic energy.
SC.O.CP.2.11	apply the mechanism of heat transfer and relate to environmental and energy conservation issues.
SC.O.CP.2.12	relate the first law of thermodynamics to energy conservation.
SC.O.CP.2.13	compare and contrast sound and light waves using the concepts of reflection, refraction, and interference.
SC.O.CP.2.14	solve problems involving wave speed, frequency and wavelength; determine factors that affect the speed of sound; recognize that the speed of light is a constant.
SC.O.CP.2.15	model the production of a standing wave and propose a practical application of such a wave.
SC.O.CP.2.16	compare the Doppler shift effect for sound and light and point out examples of its occurrences and applications.
SC.O.CP.2.17	diagram image location involving plane and spherical mirrors, concave and convex lenses.
SC.O.CP.2.18	illustrate the applications of colored lights and pigments.
SC.O.CP.2.19	examine the concept of polarization.
SC.O.CP.2.20	analyze simple direct current circuits using Ohm's Law.
SC.O.CP.2.21	distinguish between direct current and alternating current circuits and describe how AC is converted to DC.

High School	Conceptual Physics
Standard: 3	Application of Science
SC.S.CP.3	<p>Students will</p> <ul style="list-style-type: none"> • demonstrate the ability to use inquiry process to explore systems, models, and changes. • demonstrate an understanding of the interdependence between science and technology. • demonstrate an understanding of the utilization of technology to gather data and communicate designs, results and conclusions. • demonstrate an understanding of personal and societal benefits of science, and an understanding of public policy decisions as related to health, population, resource and environmental issues.

Performance Descriptors SC.PD.CP.3				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Physics students at the distinguished level will construct, test and analyze complex systems, models, and changes across science disciplines; use a technology solution and analyze the science used in the technology; evaluate how a scientific discovery impacts public policy decisions regarding health, population resources and	Conceptual Physics students at the above mastery level will construct, test and analyze data to explore systems, models and changes across science disciplines; analyze technological innovations and identify the science that makes them possible; evaluate the personal and societal benefits of a scientific discovery; assess the impacts of a public	Conceptual Physics students at the mastery level will test, record and analyze data to explore systems, models, and changes; analyze a technological innovation and identify the science that makes it possible; assess positive outcomes and unintended consequences of a scientific discovery; explain the impacts of a public policy decision	Conceptual Physics students at the partial mastery level will test and record data to explore systems, models, and changes; explain a technological innovation and identify the science that makes it possible; identify positive outcomes and unintended consequences of a scientific discovery; identify the impacts of public policy decision regarding	Conceptual Physics students at the novice level will test and record data to explore systems, models or changes; identify a technological innovation and the science that makes it possible; identify positive outcomes or unintended consequences of a scientific discovery; identify the impact of a public policy decision regarding health, population resources or

environmental issues.	policy decision regarding health, population resources or environmental issues.	regarding health, population resources or environmental issues.	health, population resources or environmental issues.	environmental issues.
Objectives	Students will			
SC.O.CP.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).			
SC.O.CP.3.2	investigate, compare and design scientific and technological solutions to personal and societal problems.			
SC.O.CP.3.3	communicate experimental designs, results and conclusions using advanced technology tools.			
SC.O.CP.3.4	collaborate to present research on current environmental and technological issues to predict possible solutions.			
SC.O.CP.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.			
SC.O.CP.3.6	given a current science-technology-societal issue, construct and defend potential solutions.			

Physics II Content Standards and Objectives

Physics II advanced level course that is an elective designed for students who have completed Physics and desire a broader, in-depth study of physics content beyond those studied in Physics. As a college preparatory course, Physics II is a laboratory driven, advanced study of nature's universal laws with emphasis on process skills, using 21st century skills. This course is designed to build upon and extend the Physics concepts, skills, and knowledge from the science program. The course emphasizes a mathematical approach to the area of mechanics, thermodynamics, light and optics, electricity and magnetism and modern physics. Students will engage in active inquires, investigations, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and research/laboratory skills. Safety instruction is integrated into all activities. 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.

High School		Physics II		
Standard: 1		Natural Science		
SC.S.PII.1	Students will <ul style="list-style-type: none"> 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. 			
Performance Descriptors SC.PD.PII,1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics II students at the distinguished level will analyze the importance of scientific innovations to the utilization of scientific methodology, variability in experimental results to advances in societal, cultural and economic issues, design, conduct, communicate, evaluate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and interpretation of models.	Physics II students at the above mastery level will analyze the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to design, conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from multiple data sources and models.	Physics II students at the mastery level will examine the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural and economic issues; use scientific methodology to conduct, communicate and revise experiments utilizing safe procedures and appropriate technology; draw conclusions from data sources and models.	Physics II students at the partial mastery level will describe the importance of scientific innovation and recognize the role of these innovations in advancing societal, cultural or economic issues; use scientific methodology to conduct and communicate experiments utilizing safe procedures and appropriate technology; select an appropriate conclusions from a list of possible conclusions drawn from experimental data.	Physics II students at the novice level will identify the importance of scientific innovations and associate these innovations with advances in societal, cultural or economic issues; conduct experiments utilizing safe procedures and appropriate technology; differentiate between observations and conclusions.
Objectives	Students will			

SC.O.PII.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.PII.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues (e.g., “scientific method”).
SC.O.PII.1.3	relate societal, cultural and economic issues to key scientific innovations.
SC.O.PII.1.4	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.PII.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.PII.1.6	use appropriate technology solutions with a problem solving setting to measure and collect data; interpret data; analyze and/or report data; interact with simulations; conduct research; and present and communicate conclusions.
SC.O.PII.1.7	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 analyze of error, or communicate and define the results and conclusions).
SC.O.PII.1.8	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, predict the influence of external variances such as potential sources of error, or interpret maps).

High School	Physics
Standard: 2	Content of Science
SC.S.PII.2	<p>Students will</p> <ul style="list-style-type: none"> demonstrate knowledge, understanding, and applications of scientific facts, concepts, principles, theories, and models as delineated in the objectives. demonstrate an understanding of the interrelationships among physics, chemistry, biology, and the earth and space sciences. apply knowledge, understanding, and skills of science subject matter/concepts to daily life experiences.

Performance Descriptors SC.PD.PII.2				
Distinguished	Above Mastery	Master	Partial Mastery	Novice
Physical Science II students at the distinguished level will differentiate among linear, quadratic, and inverse relationships found in graphs of motion in terms of position, velocity, acceleration, and time; evaluate data to deduce mathematical relationships involving one and two	Physical Science II students at the above mastery level will compose equations to express the relationships found in graphs of motion in terms of position, velocity, acceleration, and time; summarize data to deduce mathematical relationships involving one and two dimensional motion; design	Physical Science II students at the mastery level will apply graphical analysis to interpret motion in terms of position, velocity, acceleration, and time; use data to deduce mathematical relationships involving one and two dimensional motion; experimentally verify laws of	Physical Science II students at the partial mastery level will draw motion graphs to show motion in terms of position, velocity, acceleration, and time; use data to deduce mathematical relationships involving one dimensional motion; recognize that laws of motion including	Physical Science II students at the novice level will measure distance and time to calculate velocity and acceleration; describe mathematical relationships involving one dimensional motion; perform experiments on motion topics including Newton’s Laws, Conservation of

<p>dimensional motion; critique experiments to verify laws of motion including Newton's Laws, Conservation of Momentum, and Conservation of Energy; using knowledge of linear motion equations, synthesize concepts of rotational motion; design experiments to verify the effect of variables on the properties and dynamics of fluids; justify experimental results using concepts of thermal physics; appraise the relative values of electric force and field strength based on the magnitude of and the distance from the point charge; design, construct, diagram and evaluate complex electrical circuits; defend predictions and interpretations of magnetic forces and magnetic fields, and apply their effect on the motion of a point charge and to the electric current in a wire or coil; critique electromagnetic induction and justify its application to particular electric circuits and various devices; investigate, analyze, and evaluate the concepts of solid-state physics and the application of semiconductors and superconductors in the</p>	<p>experiments to verify laws of motion including Newton's Laws, Conservation of Momentum, and Conservation of Energy; using knowledge of linear motion equations, synthesize concepts of rotational motion; evaluate the effect of variables to the properties and dynamics of fluids; relate experimental results using concepts of thermal physics; summarize the relative values of electric force and field strength based on the magnitude of and the distance from the point charge; design, construct, diagram and evaluate complex electrical circuits; defend predictions and interpretations of magnetic forces and magnetic fields, and apply their effect on the motion of a point charge and to the electric current in a wire or coil; critique electromagnetic induction and evaluate its application to electric circuits and various devices; investigate, analyze, and evaluate the concepts of solid-state physics and the application of semiconductors and superconductors in the advancement of electronics</p>	<p>motion including Newton's Laws, Conservation of Momentum, and Conservation of Energy; using knowledge of linear motion equations, synthesis concepts of rotational motion; predict and verify the effect of variables on the properties and dynamics of fluids; interpret and apply concepts of thermal physics; deduce the relative values of electric force and field strength based on the magnitude of and the distance from the point charge; construct, diagram and evaluate complex electrical circuits; predict and interpret magnetic forces and magnetic fields, and apply their effect on the motion of a point charge and to the electric current in a wire or coil; critique electromagnetic induction and evaluate its application to electric circuits and various devices; investigate, analyze, and evaluate the concepts of solid-state physics and the application of semiconductors and superconductors in the advancement of electronics through the development of diodes, transistors, and integrated circuits; apply</p>	<p>Newton's Laws, Conservation of Momentum, and Conservation of Energy can be verified experimentally; perform calculations involving the concepts of rotational motion; apply Pascal's Archimedes', and Bernoulli's, principles in everyday situations; apply concepts of thermal physics; relate electric fields to electric forces and distinguish between them; construct, diagram and evaluate simple electrical circuits; relate magnetic forces and magnetic fields, and apply their effect on the motion of a point charge and to the electric current in a wire or coil; apply electromagnetic induction to electric circuits and various devices; investigate the concepts of solid-state physics and the application of semiconductors and superconductors in the advancement of electronics through the development of diodes, transistors, and integrated circuits; calculate the kinetic and potential energies of the oscillating system; review wave properties and their interactions; research the application of wave</p>	<p>Momentum, and Conservation of Energy; define the concepts of rotational; define the properties and dynamics of fluids; state concepts of thermal physics; calculate the field strength using Coulomb's Law; construct and diagram simple electrical circuits; relate magnetism to electric charge and electricity; describe electromagnetic induction; investigate the applications of semiconductors and superconductors in the advancement of electronics through the development of diodes, transistors, and integrated circuits; calculate the kinetic and/or potential energies of the oscillating system; list wave properties and their interactions; list optical and acoustical devices and identify the property that is the basis of the device; arrange the models of the atom historically; list evidence for the historical development of the quantum mechanical theory; calculate an atom's binding energy; define stable and unstable nuclei and list types of decay that the unstable nuclei could display.</p>
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<p>advancement of electronics through the development of diodes, transistors, and integrated circuits; assess and contrast the kinetic and potential energies and energy transformations of different oscillating systems; evaluate wave properties and their interactions; predict how optical and acoustical devices will incorporate new materials to improve their effectiveness; appraise the role of technology in the development of historical models of the atom; summarize and critique evidence for the historical development of the quantum mechanical theory; justify an atom's binding energy as related to Einstein's special theory of relativity, and interpret the nuclear forces present; categorize nuclei based on their placement on the periodic table and proton to neutron ratio to demonstrate different types of decay processes.</p>	<p>through the development of diodes, transistors and integrated circuits; compare and contrast the kinetic and potential energies and energy transformations of different oscillating systems; analyze wave properties and their interactions; compare and contrast optical and acoustical devices for their effective application of wave properties; analyze the role of technology in the development of historical models of the atom; categorize evidence for the historical development of the quantum mechanical theory; analyze an atom's binding energy as related to Einstein's special theory of relativity, and interpret the nuclear forces present; using the proton to neutron ratio, predict the type of nuclear decay that could occur for nuclei.</p>	<p>knowledge of simple harmonic motion to calculate the kinetic and potential energies of the oscillating system; examine wave properties and their interactions; evaluate the application of wave properties of the development of optical and acoustical devices; critique the role of technology in the development of historical models of the atom; examine evidence for the historical development of the quantum mechanical theory; calculate an atom's binding energy as related to Einstein's special theory of relativity, and interpret the nuclear forces present; differentiate between stable and nuclear nuclei, and if the nucleus is unstable predict the type(s) of nuclear decay.</p>	<p>properties to the development of optical and acoustical devices; research the development of historical models of the atom; describe evidence for the historical development of the quantum mechanical theory; calculate an atom's binding energy as related to Einstein's special theory of relativity; differentiate between stable and unstable nuclei and list types of decay that the unstable nuclei could display.</p>	
Objectives	Students will			
SC.O.PII.2.1	apply graphical analysis to interpret motion in terms of position, velocity, acceleration, and time.			
SC.O.PII.2.2	use data to deduce mathematical relationships involving one and two dimensional motion.			
SC.O.PII.2.3	experimentally verify laws of motion including Newton's Laws, Conservation of Momentum (linear and angular), and Conservation of Energy.			
SC.O.PII.2.4	using knowledge of linear motion equations, synthesize concepts of rotational motion (e.g., angular speed and acceleration, centripetal acceleration, Newtonian gravitation, Kepler's Laws, torque).			
SC.O.PII.2.5	predict and verify the effect of variables on the properties and dynamics of fluids.			

SC.O.PII.2.6	interpret and apply concepts of thermal physics (e.g., distinction of heat and temperature, thermal expansion, properties of Ideal Gases, Kinetic Theory, specific heat, and energy transfer).
SC.O.PII.2.7	deduce the relative values of electric force and field strength based on the magnitude of and the distance from the point charge (e.g., Coulomb's Law and inverse square law).
SC.O.PII.2.8	construct, diagram and evaluate complex electrical circuits.
SC.O.PII.2.9	predict and interpret magnetic forces and magnetic fields, and apply their effect on the motion of a point charge and to the electric current in a wire or coil.
SC.O.PII.2.10	critique electromagnetic induction and evaluate its application to electric circuits and various devices.
SC.O.PII.2.11	investigate, analyze, and evaluate the concepts of solid-state physics and the application of semiconductors and superconductors in the advancement of electronics through the development of diodes, transistors, and integrated circuits.
SC.O.PII.2.12	apply knowledge of simple harmonic motion (e.g., springs, pendulums and other oscillating objects) to calculate the kinetic and potential energies of the oscillating system.
SC.O.PII.2.13	examine wave properties and their interactions (e.g., reflection, refraction, dispersion, total internal deflection, interference, diffraction, Doppler Shift, beats, and polarization).
SC.O.PII.2.14	evaluate the application of wave properties to the development of optical and acoustical devices.
SC.O.PII.2.15	critique the role of technology in the development of historical models of the atom (e.g., radioactivity, atomic spectra, particle accelerators, etc.).
SC.O.PII.2.16	examine evidence for the historical development of the quantum mechanical theory (e.g., Planck's blackbody radiation, Einstein's photoelectric effect, deBroglie's duality).
SC.O.PII.2.17	calculate an atom's binding energy as related to Einstein's special theory of relativity, and interpret the nuclear forces present.
SC.O.PII.2.18	differentiate between stable and unstable nuclei, and if the nucleus is unstable predict the type(s) of nuclear decay.

High School	Physics II			
Standard: 3	Application of Science			
SC.S.PII.3	<p>Students will</p> <ul style="list-style-type: none"> demonstrate the ability to use inquiry process to explore systems, models, and changes. demonstrate an understanding of the interdependence between science and technology. demonstrate an understanding of the utilization of technology to gather data and communicate designs, results and conclusions. demonstrate an understanding of personal and societal benefits of science, and an understanding of public policy decisions as related to health, population, resource and environmental issues. 			
Performance Descriptors SC.PD.PII.3				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics II students at the distinguished level will construct, test and analyze complex systems, models, and changes across science disciplines; use a	Physics II students at the above mastery level will construct, test and analyze data to explore systems, models and changes across science disciplines; analyze	Physics II students at the mastery level will test, record and analyze data to explore systems, models, and changes; analyze a technological innovation	Physics II students at the partial mastery level will test and record data to explore systems, models, and changes; explain a technological innovation	Physics II students at the novice level will test and record data to explore systems, models or changes; identify a technological innovation

technology solution and analyze the science used in the technology; evaluate how a scientific discovery impacts public policy decisions regarding health, population resources and environmental issues.	technological innovations and identify the science that makes them possible; evaluate the personal and societal benefits of a scientific discovery; assess the impacts of a public policy decision regarding health, population resources or environmental issues.	and identify the science that makes it possible; assess positive outcomes and unintended consequences of a scientific discovery; explain the impacts of a public policy decision regarding health, population resources or environmental issues.	and identify the science that makes it possible; identify positive outcomes and unintended consequences of a scientific discovery; identify the impacts of public policy decision regarding health, population resources or environmental issues.	and the science that makes it possible; identify positive outcomes or unintended consequences of a scientific discovery; identify the impact of a public policy decision regarding health, population resources or environmental issues.
Objectives	Students will			
SC.O.PII.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and functions, systems, or change over time).			
SC.O.PII.3.2	investigate, compare and design scientific and technological solutions to address personal and societal problems.			
SC.O.PII.3.3	communicate experimental designs, results and conclusions using advanced technology tools.			
SC.O.PII.3.4	collaborate to present research on current environmental and technological issues to predict possible solutions.			
SC.O.PII.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.			
SC.O.PII.3.6	given a current science-technology-societal issue, construct and defend potential solutions.			