WEST VIRGINIA
SECRETARY OF STATE
NATALIE E. TENNANT
ADMINISTRATIVE LAW DIVISION

Form #2

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OFFICE OF WEST VIRGINIA
SECRETARY OF STATE

NOTICE OF A COMMENT PERIOD ON A PROPOSED RULE

AGENCY: West Virginia Board of Education TITLE NUMBER: 126

RULE TYPE: Legislative ; CITE AUTHORITY: W. Va. Constitution, Article XII, §2, W.Va. Code §18-2-5 and §18-9A-22

AMENDMENT TO AN EXISTING RULE: YES X NO ____

IF YES, SERIES NUMBER OF RULE BEING AMENDED: 44R

TITLE OF RULE BEING AMENDED: 21st Century Science 9-12 Content Standards and Objectives for West Virginia Schools (2520.35)

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: _____

TITLE OF RULE BEING PROPOSED: _____

IN LIEU OF A PUBLIC HEARING, A COMMENT PERIOD HAS BEEN ESTABLISHED DURING WHICH ANY INTERESTED PERSON MAY SEND COMMENTS CONCERNING THESE PROPOSED RULES. THIS COMMENT PERIOD WILL END ON March 15, 2010 AT 4:00 p.m. . ONLY WRITTEN COMMENTS WILL BE ACCEPTED AND ARE TO BE MAILED TO THE FOLLOWING ADDRESS:

Robin Anglin
Office of Instruction
West Virginia Department of Education
Capitol Building 6, Room 608
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0330

Comments to be considered are **limited to the CONTENT STANDARDS AND OBJECTIVES for the Environmental Science** portion of this proposed rule.

Jack McClanahan
Deputy State Superintendent of Schools

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

EXECUTIVE SUMMARY
WEST VIRGINIA DEPARTMENT OF EDUCATION

Policy Number and Title: Policy 2520.35 - 21st Century Science 9-12 Content Standards and Objectives for West Virginia

Background: The current emphasis on the environment has created a request and a need for an elective environmental science course. The objectives for this course were organized and the Performance Descriptors written succinctly to indicate the student level of achievement. The creation of this course is a result of the requests from stakeholders.

The individuals involved with the changes of this policy are: Carla Williamson, Executive Director of the Office of Instruction; Marty Burke, Assistant Director of the Office of Instruction; Robin Anglin, Science Coordinator in the Office of Instruction; Timothy Butcher, Coordinator in the Office of Assessment/Accountability; Terri Sappington, Teacher from Monongalia County; Stefan Smolski, Teacher from Hancock County; and William Moore, Teacher from Hampshire County.

Proposals: Revisions to Policy 2520.35 are being recommended for:

- Environmental Science Content Standard and Objectives were written for an elective course. The objectives were clustered to concepts and written succinctly in the Performance Descriptors of SC.EVS.1 and SC.S.EVS.2 to indicate the level of achievement.

Impact: The proposed creation of the Content Standards and Objectives for 21st Century Science 9-12 Standards and Objectives for the elective course; Environment Science will provide for the students a rich understanding of the impact man has on the environment and the need to appreciate that symbiotic relationship. The Performance Descriptors will provide teachers information about the levels of knowledge and skills the students must acquire and will provide parents an explanation of their child's knowledge and conceptual understanding that should be acquired at each level.

Response to Comments:

TITLE 126
LEGISLATIVE RULE
BOARD OF EDUCATION

SERIES 44R
21st CENTURY SCIENCE 9-12 CONTENT STANDARDS AND OBJECTIVES FOR WEST VIRGINIA SCHOOLS (2520.35)

§126-44R-1. General.

1.1. Scope. – West Virginia Board of Education Policy 2510 provides a definition of a delivery system for, and an assessment and accountability system for, a thorough and efficient education for West Virginia public school students. Policy 2520.35 defines the content standards (or instructional goals) and objectives for science 9-12 as required by W. Va. 126CSR42 (Policy 2510).

1.2. Authority. -- W. Va. Constitution, Article XII, §2, W. Va. Code §18-2-5 and §18-9A-22.

1.3. Filing Date. -- ~~August 14, 2009~~.

1.4. Effective Date. -- ~~September 14, 2009~~.

1.5. Repeal of former rule. – This legislative rule amends W. Va. 126CSR44R West Virginia Board of Education Policy 2520.35 "21st Century Science 9-12 Mathematics Content Standards and Objectives for West Virginia Schools (2520.35)" filed August 14, 2009~~May 18, 2009~~ and effective September 14, 2009~~July 1, 2009~~.

§126-44R-2. Purpose.

2.1. This policy defines the content standards (or instructional goals) and objectives for the program of study required by Policy 2510 in science 9-12.

§126-44R-3. Incorporation by Reference.

3.1. A copy of 21st Century Science 9-12 Content Standards and Objectives for West Virginia Schools is attached and incorporated by reference into this policy. Copies may be obtained in the Office of the Secretary of State and in the West Virginia Department of Education, Office of Instruction.

§126-44R-4. Summary of the Content Standards and Objectives.

4.1. The West Virginia Board of Education has the responsibility for establishing high quality standards pertaining to all educational standards (W. Va. Code §18-9A-22). The content standards and objectives provide a focus for teachers to teach and students to learn those skills and competencies essential for future success in the workplace and further education. The document includes content standards for science, an explanation of terms, objectives that reflect a rigorous and challenging curriculum, and performance descriptors.

West Virginia Department of Education

West Virginia Board of Education Policy 2520.35 21st Century Science 9-12 Content Standards and Objectives for West Virginia Schools

Steven L. Paine
State Superintendent

Foreword

A 21st century science curriculum is an increasingly important component in the development learners prepared for success in the 21st century. Thus, the West Virginia Board of Education and the West Virginia Department of Education are pleased to present Policy 2520.35, 21st Century Science 9-12 Content Standards and Objectives for West Virginia Schools. The West Virginia Science Standards for 21st Century Learning includes 21st century *content* standards and objectives as well as 21st century standards and objectives for *learning skills* and *technology tools*. This broadened scope of science curriculum is built on the firm belief that quality engaging instruction must be built on a curriculum that triangulates rigorous 21st century content, 21st century learning skills and the use of 21st century technology tools.

Committees of educators from across the state convened to revise the content standards and objectives. The overarching goal was to build a rigorous, relevant and challenging science curriculum that would prepare students for the 21st century. West Virginia educators, including regular classroom teachers, special education teachers, and teachers representing higher education institutions played a key role in shaping the content standards to align with national standards, rigorous national assessments, and research and best practice in the field of science education. The contribution of these professionals was critical in creating a policy that is meaningful to classroom teachers and appears in a format that can easily be used and understood.

Policy 2520.35 is organized around the three major components of a standards-based curriculum: learning standards, instructional objectives and performance descriptors. The learning standards are the *broad descriptions* of what *all* students must know and be able to do at the conclusion of the instructional sequence. The accompanying grade-level objectives are specific descriptors of knowledge, skills and attitudes that when mastered will enable the student to attain the standard. The instructional objectives guide instructional *planning* and provide a basis for determining appropriate *assessments, instructional strategies and resources.* The performance descriptors provide the basis for *assessing* overall student competence of grade level standards. The performance descriptors define the five student performance levels ranging from novice to distinguished. With the ultimate goal of "learning for all," these descriptors allow the teacher, students and parents to judge the *level* of student proficiency in each 21st century learning standard.

In combination, the use of learning standards, instructional objectives and performance descriptors become a comprehensive guide for delivering a rigorous and relevant science curriculum to all West Virginia students. These elements, when used to guide the instructional process and when delivered with the creativity and instructional expertise of West Virginia teachers, will become a powerful resource for preparing students to meet the challenges of the 21st century.

Steven L. Paine
State Superintendent of Schools

Explanation of Terms

Content Standards are broad descriptions of what students should know and be able to do in a content area. Content standards describe what students' knowledge and skills should be at the end of a K-12 sequence of study.

Objectives are incremental steps toward accomplishment of content standards. Objectives are listed by course title and are organized around the content standards. .

Performance Descriptors describe in narrative format how students demonstrate achievement of the content standards. Line breaks within the narrative format indicate clusters of concepts and skills. West Virginia has designed five performance levels: distinguished, above mastery, mastery, partial mastery and novice. Performance Descriptors serve two functions. Instructionally, they give teachers more information about the level of knowledge and skills students need to acquire. Performance levels and descriptors are also used to categorize and explain student performance on statewide assessment instruments.

> **Distinguished:** A student at this level has demonstrated exemplary performance. The work shows a distinctive and sophisticated application of knowledge and skills in real world situations that go beyond course or grade level applications.
>
> **Above Mastery:** A student at this level has demonstrated effective performance and exceeds the standard. The work shows a thorough and effective application of knowledge and skills in real world situations within the subject matter and grade level..
>
> **Mastery:** A student at this level has demonstrated competency over challenging subject matter, including knowledge and skills that are appropriate to the subject matter and grade level. The work is accurate, complete and addresses real world applications. The work shows solid academic performance at the course or grade level.
>
> **Partial Mastery:** A student at this level has demonstrated limited knowledge and skills toward meeting the standard. The work shows basic but inconsistent application of knowledge and skills characterized by errors and/or omissions. Performance needs further development.
>
> **Novice:** A student at this level has demonstrated minimal fundamental knowledge and skills needed to meet the standard. Performance at this level is fragmented and/or incomplete and needs considerable development

Numbering of Standards

The number for each content standard is composed of four parts, each part separated by a period:

- the content area code is SC for Science,
- the letter S, for Standard,
- the grade level and
- the standard number.

Illustration: SC.S.C.1 refers to Chemistry science content standard #1.

Numbering of Objectives

The number of each objective is composed of five parts, each part separated by a period:

- the content area code (SC for Science),
- the letter O is for Objective,
- the course title,
- the number of the content standard addressed, and
- the objective number.

Illustration: SC.O.C.2.3 refers to a Chemistry objective that addresses standard #2 in science, and that is the third objective listed under that standard.

Numbering of Performance Descriptors

The number for each group of three performance descriptors is composed of four parts, each part separated by a period:

- the content area (SC for Science),
- the letters PD are for Performance Descriptors,
- the course title, and
- the standard number.

Illustration: SC.PD.C.2 refers to science performance descriptors for Chemistry, content standard 2.

Unique Electronic Numbers (UENs)

Unique Electronic Numbers (or UENs) are numbers that help to electronically identify, categorize and link specific bits of information. Once Policy 2520.35 is available on the Web, each standard, each objective, and each group of five performance descriptors will have a Unique Electronic Number (UEN) that will always remain the same.

The codes printed in Policy 2520.35 form the basis of the UENs. The only additional set of numbers that will be added to each code to formulate its UEN will be a prefix that indicates the year and month that a particular version of Policy 2520.35 is approved by the State Board of Education.

The prefix for the UENs for each content area in Policy 2520.35 is noted at the top of each page containing standards, objectives and performance descriptors. As sections of 2520.35 are revised, UENs will be changed to reflect the new approval date.

UENs (Unique Electronic Numbers) are unique numbers that facilitate implementation of WV Standards into Electronic formats such as Databases and XML Files. The WV Department of Education encourages everyone who is going to use the WV Content Standards in any kind of electronic distribution, alignment, or software development to use the UENs so that all efforts can be cross-referenced and there is consistency across initiatives.

Illustration: The UEN for fifth grade science standard #2 will be "200602.SC.S.5.2".

Abbreviations

Content Areas

SC	Science

Other Abbreviations

PD	Performance Descriptors
O	Objective
S	Standard (Content Standard)
B	Biology
BII	Biology II
C	Chemistry
CII	Chemistry II
CB	pConceptual Biology
CC	Conceptual Chemistry
CP	Conceptual Physics
E	Earth Science
ENV	Environmental Science
HA	Human Anatomy and Physiology
P	Physics
PII	Physics II
PS	Physical Science

SCIENCE – POLICY 2520.35

The high school science content standards identify what students should know, understand and be able to do in the natural sciences throughout the eighth grade. Because each content standard utilizes the knowledge and skills of other standards, they are designed to be used as an integrated whole. Although material can be added to the content standards, using only a subset of the standards will leave gaps in the students' scientific literacy.

A three-dimensional instructional strategy model must be utilized to address the science curriculum and assure students' depth of understanding and breadth of knowledge in Ninth Grade Science, and Tenth Grade Science. That model uses the nature, content and application of science concepts to develop scientific inquiry and reasoning skills in students.

Standard 1: Nature of Science
The study of science as a human endeavor provides for the acquisition of ideas leading toward the current knowledge base that represents science content. The nature of science encompasses the basic values and beliefs that make up the scientific world view, how scientists go about their work and the general culture of scientific enterprise. Studying historical and current discoveries of scientists and scientific milestones provides students with information about how discoveries have influenced current scientific thought and advancements. Students should understand that the continuous development of scientific knowledge shapes history. The study of the history and nature of science clarifies scientific inquiry and the role of science in the development of world cultures. Students will engage in active inquiry through investigations and hands-on activities a minimum of 50% of the instructional time. Developing scientific literacy requires a learning environment in which students actively participate in meaningful hands-on activities while developing current technology skills. These investigations explore the natural world, require critical thinking and develop process skills. Learning activities are sequenced to shape, modify and develop students' knowledge in order for them to become independent inquirers.

Standard 2: Content of Science
Science subject matter focuses on the scientific facts, concepts, principles, theories and models that are important for all students to know, understand and apply. Through the integration of the fields of science and the development of unifying themes, students will understand the interrelationships among biology, chemistry, physics and the earth sciences. Scientifically literate students will make connections in the formal education setting and will apply their knowledge and skills to daily life experiences. The objectives describe the specific subject matter/concepts that students are to master at each grade level.

Standard 3: Application of Science
Broad unifying themes complement the perspectives presented in the other content standards. These themes are fundamental to understanding and unifying the various science disciplines. Major unifying themes are systems, models and changes. Scientific design and application permits the extension of senses, the enhancement of the knowledge base, transportation of materials and information, synthesizing of new products and the modification of the world. Students must learn to use technology to analyze situations, gather relevant information, generate and evaluate creative ideas, pose tangible solutions and communicate their analyses, results and suggestions concisely. The need to adapt to the rapid changes that are likely to occur in the future makes it imperative that students develop a broad spectrum of technology-related skills and an openness to change. Applying science and technological innovations to personal and social issues such as health, populations, resources and environment helps students to develop decision-making skills. As students expand their conceptual horizons, they should recognize that collective individual actions manifest as societal issues. Students must recognize that society cannot afford to deal only with symptoms; personal and societal actions must be focused on elimination of the causes of problems. Students should recognize that unless imposed by legislation social

change involves negotiation among different interest groups. Students must be allowed to encounter and examine social change in a variety of current and historical contexts.

A two-dimensional instructional strategy model must be utilized to address the science curriculum and assure students' depth of understanding and breadth of knowledge in Ninth Grade Physical Science, Biology, Conceptual Biology, Biology II, Chemistry, Conceptual Chemistry, Chemistry II, Physics, Conceptual Physics, Physics II, Earth Science, Environmental Science, and Human Anatomy and Physiology . This model uses the content of science with the nature and application of science to develop scientific inquiry and reasoning skills in students.

Standard 1: Nature and Application of Science
The study of science as a human endeavor provides for the acquisition of ideas leading toward the current knowledge base that represents science content. The nature and application of science encompasses the basic values and beliefs that make up the scientific world view, how scientists go about their work and the general culture of scientific enterprise. Students should understand that the continuous development of scientific knowledge shapes history. Students will engage in active inquiry through investigations and hands-on activities a minimum of 50% of the instructional time using safe procedures and practices. Developing scientific literacy requires a learning environment in which students actively participate in meaningful hands-on activities while developing current technology skills. Scientific design and application permits the extension of senses, the enhancement of the knowledge base, transportation of materials and information, synthesizing of new products and the modification of the world. These investigations explore the natural world, require critical thinking and develop process skills. Learning activities are sequenced to shape, modify and develop students' knowledge in order for them to become independent inquirers. Students must learn to analyze situations, gather relevant information, generate and evaluate creative ideas, pose tangible solutions and communicate their analyses, results and suggestions concisely.

Standard 2: Content of Science
Science subject matter focuses on the scientific facts, concepts, principles, theories and models that are important for all students to know, understand and apply. Through the integration of the fields of science and the development of unifying themes, students will understand the interrelationships among biology, chemistry, physics and the earth sciences. Scientifically literate students will make connections in the formal education setting and will apply their knowledge and skills to daily life experiences. The objectives describe the specific subject matter/concepts that students are to master at each grade level.

The Role of Technology
West Virginia's vision for education includes the integration of technology throughout the curriculum so that all West Virginia students have the opportunity to develop technology skills that support learning and provide the ability to adapt to change. Successful learning environments provide opportunities for students to use education technology interwoven with relevant curricular content. West Virginia teachers are responsible for integrating technology appropriately in the students' learning environment.

Organization of the Science Program of Study
The West Virginia Science Program of Study is drawn from the National Science Education Standards and the Project 2061 Benchmarks to promote a rigorous and challenging science curriculum. Through experiencing a spiraling, inquiry-based program of study, students in grades K-8 will develop foundational knowledge and skills in the physical sciences, the life sciences, and the earth and space sciences. To assure scientific literacy for all students, a coordinated, integrated approach is utilized in grades K-8. Students in the 9th, 10th, 11th and 12th grades participate in advanced in-depth laboratory-based elective courses designed to expand their conceptual understanding and enhance their research and laboratory skills.

Ninth Grade Science Content Standards and Objectives

The Ninth Grade Science objectives continue the development of foundational knowledge in biology, chemistry, physics, earth/environmental 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. Subject matter is delivered through a coordinated, integrated approach with an emphasis on the development of the major science themes of systems, changes, and models. 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 Science will expand and deepen their understanding of major concepts such as energy interactions, genetic probabilities, chemical changes and mineral composition of local rock layers. 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 9	Science			
Standard: 1	Nature of Science			
SC.S.9.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems.			
Performance Descriptors SC.PD.9.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
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	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.	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.	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.	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 experiments utilizing safe procedures and appropriate technology; differentiate between observations and conclusions.

interpretation of models.				
Objectives	Students will			
SC.O.9.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.			
SC.O.9.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues (e.g., "scientific method").			
SC.O.9.1.3	relate societal, cultural and economic issues to key scientific innovations.			
SC.O.9.1.4	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.9.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.			
SC.O.9.1.6	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.9.1.7	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.9.1.8	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).			

Grade 9	**Science**			
Standard: 2	Content of Science			
SC.S.9.2	Students will • demonstrate knowledge understanding and applications of scientific facts, concepts, principles, theories, and models delineated in the objectives. • demonstrate an understanding of the interrelationships among physics, chemistry, biology, earth/environmental science, and astronomy; and apply knowledge, understanding and skills of science subject matter/concepts to daily life.			
Performance Descriptors SC.PD.9.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Students at the distinguished level will solve and interpret dihybrid cross; populate an environment with appropriate organisms; compare the structure and function of cells, tissues and systems of different organisms; demonstrate conservation of matter and	Students at the above mastery level will solve dihybrid cross; design environments to model interdependent populations; compare and contrast cells, tissues and systems of different organisms; relate conservation of matter and energy to cellular	Students at the mastery level will perform and interpret monohybrid crosses; design environments to model interdependent populations; compare cells, tissues and systems of different organisms; trace matter and energy through cellular	Students at the partial mastery level will solve monohybrid crosses; match populations to environments; compare cells and tissues of different organisms; trace matter through cellular processes; construct models of states of matter	Students at the novice level will complete a Punnett square; list populations in an environment; compare systems of different organisms; trace matter through a cellular process; identify models of states of matter; classify synthesis and decomposition

energy through cellular processes; predict how states of matter react as kinetic energy changes; write formulas for ionically and covalently bonded compounds, balance coefficients, predict products and classify types of chemical reactions; predict density values with change of state; calculate the amount of energy produced by nuclear changes; measure the specific heat of a material; compare the properties of different magnetic fields; evaluate a circuit using Ohm's Law and power equation; calculate inverse square relations; predict the effects of a change in location on motion of a pendulum; compare and contrast transverse and longitudinal waves; make long-range weather forecasts from meteorological data; use properties to identify unknown minerals; predict the paleo-environment in which a rock type was formed; use evidence to explain the structure of the moon; explain the absence of plate tectonics on the moon; evaluate the accuracy of absolute and	processes; predict the state of matter given relative amounts of kinetic energy; write formulas, balance coefficients, predict products and classify types of chemical reactions and bonds; predict density value when mass and volume changes; write equations for types of nuclear changes; relate the properties of a material to its absorption or dissipation of heat; compare the properties of different magnets; construct an electric circuit applying Ohm's Law and power equation; predict inverse square relations; explain the effect of gravity on the motion of pendulums; classify waves as transverse or longitudinal; construct and interpret a weather map from data; test properties to classify minerals; predict the type of rock that forms in a paleo-environment; use evidence to explain differences in Earth's layers; evaluate evidence for the forces and mechanisms of plate tectonics; interpret data to determine absolute and relative ages.	processes; relate state of matter to amount of kinetic energy; write formulas, balance coefficients, and classify types of chemical reactions; classify bond types; predict density value when mass and/or volume changes; compare types of nuclear changes; assess a material's ability to absorb or dissipate heat; explore properties of a magnet; construct an electric circuit using Ohm's Law and power equation; recognize inverse square relations; examine variables that affect the motion of pendulums; differentiate transverse and longitudinal waves; predict weather using maps; relate properties to minerals; relate rocks to the environment in which they form; use evidence to interpret Earth's structure; compare and contrast the forces and mechanisms of plate tectonics; use dating techniques.	to indicate kinetic energy; write formulas and classify types of chemical reactions; name types of bonds; calculate density when mass or volume change; identify the uses of energy produced by nuclear changes; recognize that materials absorb and dissipate heat differently; list the properties of a magnet; construct an electric circuit using Ohm's Law; recognize that changing distance of a light source affects perceived brightness; construct a pendulum and record data; model transverse and longitudinal waves; interpret weather maps; list the parts of the rock cycle; group minerals using properties; model the layers of the earth; identify heat source and model a convection cell; use relative dating techniques.	reactions; define an ionic and covalent bond; define density; recognize that energy is produced by nuclear changes; identify objects as conductors or insulators of heat; list a property of a magnet; construct an electric circuit; observe that changing distance of a light source affects perceived brightness; construct a pendulum; model transverse and longitudinal waves; read weather maps; state the difference between rocks and minerals; name the layers of the earth; identify Earth's internal heat source; use the law of superposition to date strata.

relative dating techniques.				
Objectives	Students will			
SC.O.9.2.1	apply principles of Mendelian genetics to solve heredity problems.			
SC.O.9.2.2	illustrate meiosis and mitosis and relate to chromosome number and production of sperm, egg and body cells.			
SC.O.9.2.3	analyze cyclic changes in populations of organisms.			
SC.O.9.2.4	design an environment that demonstrates the interdependence of plants and animals (e.g., energy and chemical cycles, adaptations of structures and behaviors).			
SC.O.9.2.5	compare and contrast the structure and function of cells, tissues and systems of different organisms.			
SC.O.9.2.6	diagram the transfer of matter and energy in the chemical/molecular processes of photosynthesis, respiration and fermentation.			
SC.O.9.2.7	predict chemical and physical properties of an element using its position in the periodic table.			
SC.O.9.2.8	compare the types of radioactive decay in terms of particles and energy generated.			
SC.O.9.2.9	predict the changes in density as mass and volume change.			
SC.O.9.2.10	relate molecular motion, kinetic energy and states of matter.			
SC.O.9.2.11	write formulas and name compounds given oxidation numbers of monatomic and polyatomic ions.			
SC.O.9.2.12	propose the results of changing the number of protons, neutrons or electrons on the properties of an atom.			
SC.O.9.2.13	determine formulas and names for binary compounds.			
SC.O.9.2.14	classify a binary chemical bond as ionic, nonpolar covalent or polar covalent.			
SC.O.9.2.15	given a chemical equation deduce the coefficients and classify the reaction type (e.g., synthesis or combination, decomposition, single replacement, or double replacement and combustion).			
SC.O.9.2.16	assess and provide evidence to justify the occurrence of a chemical reaction (e.g., production of color, light, heat, sound, smell, gas, or precipitate).			
SC.O.9.2.17	differentiate various forms of energy and energy transformations including fission and fusion.			
SC.O.9.2.18	assess absorption and dissipation of heat by various materials.			
SC.O.9.2.19	experimentally deduce and diagram the magnetic field of a bar magnet.			
SC.O.9.2.20	construct electric circuits and mathematically model electric circuits using Ohm's Law and power equations.			
SC.O.9.2.21	establish the relationship between distance and the intensity of light, charge and gravitational attraction (e.g., inverse square law).			
SC.O.9.2.22	interpret and draw conclusions from speed-distance-time data and graphs.			
SC.O.9.2.23	analyze experiments to determine which variables affect the motion of pendulums.			
SC.O.9.2.24	differentiate between transverse and longitudinal waves and model examples of each type (e.g., light, sound, or seismic).			
SC.O.9.2.25	predict weather based on the relationships of temperature, air pressure, wind speed, wind direction and humidity as depicted on a weather map and meteorological data.			
SC.O.9.2.26	analyze the relationships among latitude, altitude and climate.			
SC.O.9.2.27	classify common rock forming minerals by examining their physical and chemical properties.			
SC.O.9.2.28	analyze the processes of the rock cycle to predict the paleo-environment in which a rock sample is formed.			
SC.O.9.2.29	examine seismographic and geologic evidence to determine structure and composition of the Earth's interior.			
SC.O.9.2.30	use relative dating techniques to determine the ages of stratagraphic layers.			
SC.O.9.2.31	interpret a half-life graph to determine the absolute age of a given sample.			
SC.O.9.2.32	compare and contrast theoretical models explaining forces driving lithospheric plate motion (e.g., slab pull, plate push, or convection).			
SC.O.9.2.33	research and organize evidence to support the theory of plate tectonics.			

SC.O.9.2.34	apply fusion, heat transfer, gravity, and electromagnetism to the sun, its evolution and its impact on earth.

Grade 9	**Science**			
Standard: 3	Application of Science			
SC.S.9.3	Students will • 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.9.3				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
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.	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.	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.	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.	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.9.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).			
SC.O.9.3.2	investigate, compare and design scientific and technological solutions to personal and societal problems.			
SC.O.9.3.3	communicate experimental designs, results and conclusions using advanced technology tools.			
SC.O.9.3.4	collaborate to present research on current environmental and technological issues to predict possible solutions.			
SC.O.9.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.			
SC.O.9.3.6	given a current science-technology-societal issue, construct and defend potential solutions.			

Tenth Grade Science Content Standards and Objectives

The Tenth Grade Science objectives conclude the development of foundational knowledge of biology, chemistry, physics, and the earth and space sciences. Through a spiraling, inquiry-based program of study, all students will demonstrate scientific literacy and use of 21st century skills in the fields of biology, chemistry, physics and earth/environmental science and astronomy. The subject matter is delivered through a coordinated, integrated approach with an emphasis on the development of the major science themes of systems, changes, and models. 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 Ninth Grade Science, students in Tenth Grade Science will expand their depth of understanding of major concepts such as energy transformation qualifications; cellular biology; molecular genetics; embryology; physical, chemical and nuclear changes; fossils and environmental concerns. 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 10	**Science**			
Standard: 1	Nature of Science			
SC.S.10.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems.			
Performance Descriptors SC.PD.10.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Students at the distinguished level will evaluate the importance of scientific innovation; relate these innovations to the utilization of scientific methodology, variability in experimental results and interpret the impact of these advances in societal, cultural and economic issues; design, conduct, communicate, evaluate and revise experiments utilizing safe procedures and appropriate technology;	Students at the above mastery level will evaluate 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; compile data to draw conclusions from	Students at the mastery 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	Students at the partial mastery level will recognize the importance of scientific innovation and relate these innovations to the utilization of scientific methodology, variability in experimental results to advances in societal, cultural or economic issues; conduct and communicate experiments utilizing safe procedures and appropriate technology; draw conclusions from data and generate models.	Students at the novice level will identify scientific innovations and associate these innovations with the utilization of scientific methodology in advancing societal, cultural or economic issues; conduct experiments utilizing safe procedures and appropriate technology and describe results; differentiate between observations and conclusions.

validate and draw conclusions from experimental results using historical and student collected data and constructed models.	multiple data sources and interpretation of models.	data sources and interpretation of models.		

Objectives	Students will
SC.O.10.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.10.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues (e.g., "scientific method").
SC.O.10.1.3	relate societal, cultural and economic issues to key scientific innovations.
SC.O.10.1.4	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.10.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.10.1.6	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.10.1.7	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.10.1.8	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).

Grade 10	Science
Standard: 2	Content of Science
SC.S.10.2	Students will • 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.10.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Students at the distinguished level will suggest cell functions based on structure; debate ethics	Students at the above mastery level will classify cells based on structure and function; analyze historical	Students at the mastery level will relate cell structure to function; apply DNA's structure to its role in	Students at the partial mastery level will recognize that cells have different structures and functions; list	Students at the novice level will recognize that cells have different structures; recognize that DNA is the

of DNA research; assess the statement "ontogeny recapitulates phylogeny"; construct a simple cladogram; explain interactions among biogeochemical cycles; associate diseases with chemical imbalances; analyze fossil and modern evidence of adaptations in response to changing environments; experimentally determine data to predict trends in characteristics among unknown substances; design experiments to demonstrate the relationships among temperature-pressure-volume and heat in substances during physical/chemical changes; relate the frequency of electromagnetic waves to energy; explain how electricity produces magnetism and how magnets produce electricity; assess error in measuring energy conservation; interpret calculations and graphs of rate, force, momentum, work and time; suggest a simple machine to provide optimum mechanical advantage; measure calculate the spring constant and relate	research leading to current DNA knowledge; compare ontogeny and phylogeny of a variety of animals; interpret a cladogram of a group of organisms; explain interactions between two biogeochemical cycles; describe the role of chemicals in human body systems; trace fossil and modern adaptations in response to changing environments; experimentally determine relationships among substances; experimentally and mathematically validate the relationships among temperature-pressure-volume and heat in substances during physical/chemical changes; calculate the frequency of electromagnetic waves; explain how electricity produces magnetism; describe conservation of all forms of energy; interpret calculations and/or graphs of rate, force, momentum, work and time; compare calculated mechanical advantage of similar simple machines; measure calculate the spring constant; evaluate the gravitational effects of the moon and sun on tidal phenomenon; predict the	heredity; compare ontogeny and phylogeny of an animal; compare traditional and modern classification systems; diagram biogeochemical cycles; describe how human body systems work together; describe fossil and modern adaptations of plant and animal populations to their changing environment; experimentally determine characteristics of substances; mathematically determine the relationships among temperature-pressure-volume and heat in substances during physical /chemical changes; characterize electromagnetic waves and their uses; describe the relationship between electricity and magnetism; quantitatively determine conservation of thermal energy; relate Newton's Laws of Motion to rate, force, momentum, work and time; calculate mechanical advantage of simple machines; compare the effect of different forces on vibrating systems; predict tidal phenomenon; determine impacts of geological and biological processes on climate; explain geological and	properties of DNA; trace ontogeny or phylogeny of an animal; identify a group of organisms whose historical classification has changed; diagram the carbon or nitrogen cycle; explain the interaction of two human body systems; recognize that populations change in response to environmental changes; experimentally determine characteristics of some substances; mathematically determine the relationships among temperature-pressure-volume; list electromagnetic waves and their uses; diagram a magnetic field around an electrical wire; recognize that energy is conserved in transformations; define Newton's Laws of Motion, rate, force, momentum, work and time; calculate mechanical advantage of some simple machines; recognize vibrating systems; explain that the moon causes tides; list geological and biological processes that affect climate; explain some processes that form fossils; state theories of cosmology.	material of heredity; recognize that embryos developmentally change; place organisms in a classification system; diagram the water cycle; identify human body systems; recognize that populations change over time; list characteristics of substances; state relationship among temperature-pressure-volume; list some electromagnetic waves; recognize that electricity and magnetism are interrelated; state that energy is conserved; state the three Laws of Motion; calculate mechanical advantage of a simple machine; recognize a pendulum is an example of a vibrating system; define tides; recognize that geological and biological processes affect climate; explain a process that forms fossils; state a scientifically accepted theory for the origin of the universe.

to its properties; evaluate multiple gravitational effects of the Earth-Moon system; predict the effects of geological and biological events on climate; critique geological and chemical conditions to predict fossil formation; evaluate theories of cosmology using electromagnetic evidence.	effects of geological or biological event on climate; evaluate conditions necessary for fossil formation; compare theories of cosmology using electromagnetic evidence.	biological processes of fossil formation; explain theories of cosmology using electromagnetic evidence.		

Objectives	Students will
SC.O.10.2.1	relate the structure of cell organelles to their functions.
SC.O.10.2.2	apply knowledge of cells to variations in cells, tissues, and organs of different organisms.
SC.O.10.2.3	compare and contrast mechanisms for the movement of materials into and out of cells.
SC.O.10.2.4	explore the discovery of DNA and its structure; examine nucleotide bonding to the importance of to the double helix structure.
SC.O.10.2.5	apply DNA analysis to current societal and technological issues (e.g., DNA's role in protein synthesis, heredity, cell division, or cellular functions).
SC.O.10.2.6	integrate DNA mutations, chromosomal crossing over and linkage with the principles of genetics.
SC.O.10.2.7	compare the ontogeny and phylogeny using the embryonic development of invertebrate and vertebrate animals.
SC.O.10.2.8	compare traditional and modern classification systems.
SC.O.10.2.9	construct a scientific explanation for variation in the species and common ancestors using fossil records, homologous features and selective pressures.
SC.O.10.2.10	compare and contrast theories for the development, diversity and/or extinction of a species (e.g., natural selection, Lamarckism, or catastrophism).
SC.O.10.2.11	construct diagrams showing energy flow and cycles of matter between chemical and biological systems including photosynthesis, stored chemical energy, decomposition, carbon and nitrogen cycles.
SC.O.10.2.12	integrate the human body systems to the functioning of the entire organism.
SC.O.10.2.13	design an investigation in which the needs of growing plants are determined.
SC.O.10.2.14	evaluate environmental factors that affect succession, populations and communities.
SC.O.10.2.15	model the flow of matter and energy flow through the respiration process.
SC.O.10.2.16	compare and contrast by investigation the properties of solutions including density, conductivity, solubility, concentration, pH and colligative properties.
SC.O.10.2.17	compare and contrast the characteristics of physical, chemical and nuclear changes/reactions.
SC.O.10.2.18	determine the relationships among temperature, pressure and volume in gases and interpret graphs that depict these relationships (e.g., Charles' Law, Boyle's Law, Gay-Lussac's Law).
SC.O.10.2.19	characterize by investigation variance in thermal energy in physical and chemical changes.
SC.O.10.4.20	compare and contrast the characteristics and uses of electromagnetic waves and relate the frequency of the wave to its application.
SC.O.10.2.21	correlate the motion of a body to its Doppler shift.

SC.O.10.2.22	qualitatively explain the relationship between electricity and magnetism.
SC.O.10.2.23	qualitatively and quantitatively describe the conservation of energy (e.g., thermal, chemical, or mechanical).
SC.O.10.2.24	apply Newton's Laws of Motion to depict the relationship among rate, force, momentum, work, and time using kinematics graph and mathematical models.
SC.O.10.2.25	describe and quantify how machines can provide mechanical advantage.
SC.O.10.2.26	determine the effect of different forces on vibrating systems (e.g., pendulums, or springs).
SC.O.10.2.27	apply the characteristics and behaviors of mechanical waves to earth processes.
SC.O.10.2.28	predict the amplitude and frequency of tides using the concepts of gravity and positions of the earth-sun-moon (e.g., spring and neap tides).
SC.O.10.2.29	evaluate the effects of geological events on weather and climate (e.g., volcanism and bolide impact).
SC.O.10.2.30	analyze the effects of mechanical and chemical weathering mechanisms on the earth's surface to produce sediments.
SC.O.10.2.31	relate the theories of electric and magnetic fields to the dynamics of the earth's magnetosphere.
SC.O.10.2.32	examine the effects of plate tectonics on geological and biological processes (e.g., rock cycle and paleo-geography).
SC.O.10.2.33	correlate geological and chemical processes to fossil formation (e.g., petrification, permineralization, or rapid burial).
SC.O.10.2.34	explain theories of cosmology using electromagnetic evidence.

Grade 10	**Science**
Standard: 3	Application of Science
SC.S.10.3	Students will • 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.10.3				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Students at the distinguished level will, construct, test, analyze, and evaluate complex systems, models, and changes across science disciplines; choose a technology solution and analyze the science used in the technology; evaluate how scientific discoveries impact public policy decisions	Students at the above mastery 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,	Students at the 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	Students at the partial 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; list positive outcomes and unintended consequences of a scientific discovery; identify the impacts of a	Students at the novice level will test and record data to explore systems, models, and changes; use technological innovations and state that science makes them possible; identify a positive outcome or a negative consequence of a scientific discovery; identify an impact of a public policy decision

regarding health, population resources and environmental issues.	population resources and environmental issues.	the impacts of a public policy decision regarding health, population resources or environmental issues.	public policy decision regarding health, population resources or environmental issues.	regarding health, population resources or environmental issues.

Objectives	Students will
SC.O.10.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).
SC.O.10.3.2	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.10.3.3	communicate experimental designs, results and conclusions using advanced technology tools.
SC.O.10.3.4	collaborate to present research on current environmental and technological issues to predict possible solutions.
SC.O.10.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.
SC.O.10.3.6	given a current science-technology-societal issue, construct and defend potential solutions.

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 • 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: 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 relate science-technology-societal issues while using a variety of sources to	Ninth grade students at the above mastery level in the Nature and Applications of Science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Ninth grade students at the mastery level in the Nature and Applications of Science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Ninth grade students at the partial mastery level in the Nature and Applications of Science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Ninth grade students at the novice level in the Nature and Applications of Science: 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

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 • 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: apply dimensional analysis and metric notations when determining relations,	Ninth grade students at the above mastery level in content of science: apply dimensional analysis and metric notations when collecting data, determining	Ninth grade students at the mastery level in content of science: apply dimensional analysis and metric notations when collecting data, determining	Ninth grade students at the partial mastery level in content of science: apply dimensional analysis and metric notations when collecting data, examining	Ninth grade students at the novice level in content of science: use the proper units when collecting data and solving for unknowns;

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

changes that occur.	changes that occur	changes that occur.		

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 • 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 • synthesis or combination • decomposition • single replacement • double replacement • combustion.
SC.O.PS.2.8	cite evidence for the occurrence of a chemical reaction from student generated experimental data (e.g., production of color, light, heat, sound, smell, gas, or precipitate).
SC.O.PS.2.9	qualitatively and quantitatively describe the law of conservation of mass/energy • mechanical • thermal • chemical • electrical • nuclear.
SC.O.PS.2.10	compare the types of particles liberated in nuclear decay and interpret half-life graphs: • radiometric dating • nuclear medicine • nuclear waste disposal.
SC.O.PS.2.11	experimentally demonstrate the relationship between heat and temperature: • 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: • 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: • 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: • nebular theory • Earth-Moon formation • heliocentric • geocentric models.

Biology Content Standards and Objectives

Biology is a course designed for students who desire a broader, in-depth study of the content found in many biological fields of endeavor. This course is designed to build upon and extend the Biology concepts, skills, and knowledge from the science program, using skills for the 21st Century. Students will explore occupational opportunities in health, engineering, and technology and evaluate the required academic preparations while expanding laboratory skills and experiences. 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. 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 Ten	Biology			
Standard: 1	Nature and Application of Science			
SC.S.B.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.			
Performance Descriptors SC.PD.B.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Biology students at the distinguished 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 relate science-technology-societal issues while using a variety of sources to construct solutions and defend their ideas to an	Biology students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence; and relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.	Biology students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence; and relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.	Biology students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence; and relate science-technology-societal issues while using a variety of sources to construct their solutions.	Biology students at the novice level in the nature and applications of science: 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 construct their solutions.

authentic audience.				

Objectives	Students will
SC.O.B.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.B.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.B.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.B.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.B.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.B.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.B.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.B.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.B.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 Ten	**Biology**
Standard: 2	Content of Science
SC.S.B.2	Students will • 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.B.2

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Biology students at the distinguished level in content of science: investigate the chemistry of cellular processes and biological molecules and relate structure to function in various cells and organisms;	Biology students at the above mastery level in content of science: investigate the chemistry of cellular processes and biological molecules and relate variations in structures to efficiencies of functions in	Biology students at the mastery level in content of science: investigate the chemistry of cellular processes and biological molecules and relate structure to function in various cells, organisms,	Biology students at the partial mastery level in content of science: describe the chemistry of cellular processes and biological molecules and relate structure to function in various cells and	Biology students at the novice level in content of science: describe the chemistry of cellular processes and biological molecules and define the structures and functions of various cells

	various cells and organisms;	and viruses;	organisms;	and organisms;
analyze the flow of energy in cells, organisms, and the environment;	quantitatively analyze and explain the flow of energy in cells, organisms, and the environment;	analyze the flow of energy in cells, organisms, and the environment;	diagram and describe the flow of energy in cells, organisms, and the environment;	diagram the flow of energy in cells, organisms, and the environment;
determine the effectiveness and consequences of asexual or sexual reproduction within a species;	analyze cellular reproduction processes and use Mendel's Laws of Genetics to explain variations within species;	analyze cellular reproduction processes and determine probable offspring by applying Mendel's Laws of Genetics;	describe cellular reproduction processes and use Punnett squares to predict outcomes for monohybrid crosses;	identify the products of cellular reproduction processes and use Punnett squares to predict outcomes for monohybrid crosses;
research how scientists experimentally determined the role of tRNA, mRNA, and rRNA as agents in peptide formation and present arguments regarding the potential use and abuse of specific genetic engineering technologies, and	create and use DNA and RNA models to explain protein synthesis and mutations, and research various genetic engineering technologies as potential solutions to real world problems, and	use DNA and RNA models to explain protein synthesis, mutations, and gene therapy, and	use DNA and RNA models to explain replication, transcription and translation, and	identify DNA and RNA models and define replication, transcription, and translation, and
research various biomes, analyze the interrelationships of organisms and explain factors the affect coevolution.	determine how changing environmental factors disrupt the interrelationships of organisms and affect the carrying capacity of an ecosystem.	determine how changing environmental factors disrupt the interrelationships of organisms within an ecosystem and alter energy flow.	describe how abiotic variables determine an ecosystem and identify interrelationships between organisms.	list biotic and abiotic variables within an ecosystem and identify interrelationships between organisms.

Objectives	Students will
SC.O.B.2.1	investigate and correlate the properties of chemical and biological molecules to their function in biochemical pathways.
SC.O.B.2.2	relate the structure of cellular organelles to their functions and interactions in eukaryotic cells.
SC.O.B.2.3	compare and contrast cell types: • prokaryotic/eukaryotic • plant/animal • archaea/bacteria • various body cells.
SC.O.B.2.4	relate the structure and function of individual body systems to the overall functioning of the organism.
SC.O.B.2.5	predict and assess responses of organisms to internal and environmental stimuli.

SC.O.B.2.6	analyze the chemistry and fluid mosaic model of the cell membrane as they relate to import and export of molecules necessary for life including: • osmosis • diffusion • active transport • passive transport • dialysis.
SC.O.B.2.7	quantitatively analyze the flow of energy through cellular processes: • photosynthesis • cellular respiration • fermentation.
SC.O.B.2.8	differentiate mechanisms of homeostasis in living systems (negative and positive feedback).
SC.O.B.2.9	examine the processes of binary fission, mitosis, meiosis and relate them to: • the number of chromosomes • production of daughter cells, somatic cells, and gametes • variations or lack of variations within a species.
SC.O.B.2.10	use Punnett squares to predict genotypic and phenotypic ratios by applying Mendel's Laws of Genetics: • in monohybrid and dihybrid crosses • complete dominance • incomplete dominance • codominance • sex-linked traits • multiple alleles.
SC.O.B.2.11	analyze karyotypes and pedigrees as diagnostic tools.
SC.O.B.2.12	construct and use models of DNA to explain replication and mutations.
SC.O.B.2.13	differentiate the structure and function of messenger, transfer and ribosomal RNA in the process of transcription and translation.
SC.O.B.2.14	research and debate the application of DNA technology in the context of social, ethical, and political issues.
SC.O.B.2.15	evaluate the evidence for natural selection including: • speciation • fossil record evidence • molecular similarities • homologous structures.
SC.O.B.2.16	evaluate the influence of the historical social context on the development of evolutionary theory.
SC.O.B.2.17	compare morphological, cladistic and other classification systems including domains, kingdoms and other taxa.
SC.O.B.2.18	justify the placement of viruses in classification systems.
SC.O.B.2.19	examine the cycle of viruses and compare disease prevention: • vaccinations • vector control

	• drug therapy.
SC.O.B.2.20	evaluate environmental factors that affect succession, populations and communities.
SC.O.B.2.21	propose ecosystem models that incorporate interactions of biotic and abiotic environmental variables in biogeochemical cycles.
SC.O.B.2.22	interpret changes in energy as it flows through an ecosystem to illustrate conservation of energy in the energy pyramid, food web, and food chain.
SC.O.B.2.23	analyze interrelationships of organisms within an ecosystem • competition • predation • symbiosis o commensalism o mutualism o parasitism.
SC.O.B.2.24	analyze graphs, GIS data and traditional maps reflecting changes in population to predict limiting factors in ecosystems as they determine carrying capacity.

Conceptual Biology Content Standards and Objectives

Conceptual Biology is an introductory course designed for students who are interested in the field of technical biology which will give them the scientific knowledge, opportunities to develop the inquiry, problem solving skills, and decision making abilities necessary for their future vocation. Conceptual Biology is an alternative to Biology and is designed to prepare students for entry-level careers, using skills for the 21st Century. Students will explore occupational opportunities in health, engineering, and technology and evaluate the required academic preparations while expanding their knowledge and laboratory experiences. The course will provide an in-depth study in the chemical nature of life, cellular functions, microbiology, ecology, biotechnology, zoology and botany with an emphasis on application. 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.

Grade Ten	**Conceptual Biology**			
Standard: 1	Nature and Application of Science			
SC.S.CB.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.			
Performance Descriptors SC.PD.CB.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Biology students at the distinguished 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 relate science-technology-	Conceptual Biology students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-	Conceptual Biology students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-	Conceptual Biology students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-	Conceptual Biology students at the novice level in the nature and applications of science: 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 construct solutions and defend their ideas to an authentic audience.	societal issues while using a variety of sources to construct and defend their solutions.	societal issues while using a variety of sources to construct and defend their solutions.	societal issues while using a variety of sources to construct their solutions.	societal issues while using a variety of sources to construct their solutions.
Objectives	Students will			

SC.O.CB.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.CB.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.CB.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.CB.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.CB.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.CB.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.CB.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.CB.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O CB.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 Ten	**Conceptual Biology**
Standard: 2	Content of Science
SC.S.CB.2	Students will • 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.CB.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Biology students at the distinguished level in content of science:	Conceptual Biology students at the above mastery level in content of science:	Conceptual Biology students at the mastery level in content of science:	Conceptual Biology students at the partial mastery level in content of	Conceptual Biology students at the novice level will in content of

			science:	science:
analyze the chemistry of cellular processes and explain consequences of variations of biological molecules as they relate structure to function in various cells, organisms and viruses;	analyze the chemistry of cellular processes and biological molecules and relate structure to function in various cells, organisms and viruses;	investigate the chemistry of cellular processes and biological molecules and relate structure to function in various cells, organisms, and viruses;	describe the chemistry of cellular process and biological molecules, as they relate to function in various cells, organisms and virus;	recognize different types of cells;
compare and contrast mechanisms of energy flow in cells, organisms, and the environment;	compare mechanisms of energy flow in cells, organisms and the environment;	analyze the flow of energy in cells, organisms, and the environment;	diagram the flow of energy in cells, organisms and the environment;	identify that energy input is necessary for all living things;
determine the effectiveness and predict consequences of asexual and sexual reproduction within a species;	determine the effectiveness and consequences of asexual and sexual reproduction within a species;	determine the effectiveness of asexual and sexual reproduction within a species;	compare sexual and asexual reproduction;	characterize sexual and asexual reproduction;
trace the history and the importance of the discovery of DNA and RNA structures as they relate to the development modern biological innovations in science;	trace the history and the importance of DNA and RNA structures as they relate to modern biological science;	trace the history and the importance of DNA and RNA structures as they relate to everyday life;	create a monohybrid cross with a Punnett square;	complete a simple monohybrid Punnett square;
relate disease controls measures to the viral cycle;	explain events of the viral cycle as they relate to disease transmission;	predict outcomes from populations applying Mendel's laws;	recognize the structure of DNA and RNA;	recognize the general structure of DNA;
apply genetic principles to predict and calculate population variances and sustainability of ecosystems, and	apply genetic principles to predict long range outcomes of populations, and	relate viral cycle to disease control, and	make connections between viral cycles and disease control, and	relate viruses to the diseases they cause, and
manipulate multiple variables to determine environmental	manipulate multiple variables and analyze	use modern evidence to predict and analyze	recognize variables affecting interactions of	recognize changes in organisms, populations,

effects and analyze the interdependence of organisms.	changes to determine the interdependence of organisms and their environment.	changes in populations as they determine the interdependence of organisms.	organisms, and identify factors causing changes in populations with their environment.	and environment.

Objectives	Students will
SC.O.CB.2.1	relate molecules to their functions in biochemical pathways.
SC.O.CB.2.2	relate the structure of cellular organelles to their functions and interactions in eukaryotic cells.
SC.O.CB.2.3	compare and contrast cell types: • prokaryotic/eukaryotic • plant/animal • various body cells.
SC.O.CB.2.4	incorporate the structure and function of individual body systems to the overall functioning of the organism.
SC.O.CB.2.5	predict and assess responses of organisms to internal and environmental stimuli: • homeostasis metabolism • cyclic behaviors.
SC.O.CB.2.6	correlate the properties of molecules to their movement through biological membranes: • osmosis • diffusion.
SC.O.CB.2.7	analyze the flow of energy through cellular processes: • photosynthesis • cellular respiration • fermentation.
SC.O.CB.2.8	apply the absorption spectrum of photosynthetic pigments to the action of spectrum of photosynthesis.
SC.O.CB.2.9	examine the processes of binary fission, mitosis, and meiosis and relate them to: • the number of chromosomes • production of daughter cells • variations or lack of variations within a species.
SC.O.CB.2.10	use Punnett squares to determine genotypic and phenotypic ratios by applying Mendel's Laws of Genetics: • monohybrid and dihybrid crosses • complete dominance • incomplete dominance • codominance • sex-linked traits • multiple alleles.
SC.O.CB.2.11	explore the discovery of DNA and examine the molecular structure of the double helix.
SC.O.CB.2.12	analyze karyotypes and pedigrees as diagnostic tools.
SC.O.CB.2.13	compare and contrast the social, political, and ethical implications of genetic engineering using current DNA technology.
SC.O.CB.2.14	evaluate the evidence of evolution through natural selection

	• speciation • fossil record evidence • molecular similarities • homologous structures.
SC.O.CB.2.15	compare morphological and other classification systems including domains, kingdoms and other taxa.
SC.O.CB.2.16	examine the cycle of viruses and compare disease prevention; • vaccinations • vector control • drug therapy.
SC.O.CB.2.17	evaluate forest and wildlife best management practices as they affect succession, populations and communities.
SC.O.CB.2.18	assess the implications of invasive species on native wildlife and their habitat requirements.
SC.O.CB.2.19	interpret changes in energy as it flows through an ecosystem to illustrate conservation of energy in the energy pyramid, food web, and food chain.
SC.O.CB.2.20	characterize complex interactions of organisms with ecosystems based on their niches including interspecific and intraspecific competition and symbiosis.
SC.O.CB.2.21	analyze graphs, GIS data, and traditional maps reflecting changes in populations to predict limiting factors in ecosystems and determine carrying capacity.
SC.O.CB.2.22	predict the effects of human activities on biogeochemical cycles of matter and energy in the biosphere over time: • water quality • air quality • recycling • climate change

Biology II Content Standards and Objectives

Biology II is an advanced course that is an elective designed for students who have completed Biology or Conceptual Biology and desire an in-depth and rigorous study of the content found in many biological fields of endeavor. This course is designed to build upon and extend the Biology and Conceptual Biology concepts, skills and knowledge from a science program, using skills for the 21st Century. Students interested in health and scientific related careers will evaluate the required academic preparations while building and expanding their laboratory skills and experiences. 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.

Grade 11/12	Biology II			
Standard: 1	Nature and Application of Science			
SC.S.BII.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.BII.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Biology II students at the distinguished 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 relate science-technology-societal issues while using a variety of sources to construct solutions and	Biology II students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct and defend their	Biology II students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.	Biology II students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct their solutions.	Biology II students at the novice level in the nature and applications of science: 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 construct their solutions.

defend their ideas to an authentic audience.	solutions.			

Objectives	Students will
SC.O.BII.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.BII.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.BII.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.BII.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.BII.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.BII.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.BII.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.BII.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.BII.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 11/12	**Biology II**
Standard: 2	Content of Science
SC.S.BII.2	Students will • 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.BII.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Biology II students at the distinguished level: analyze how size, shape and functional group determines the unique properties of organic molecules;	Biology II students at the above mastery level: correlate size, shape and functional group to unique properties of organic molecules to biochemical pathways;	Biology II students at the mastery level: correlate functional groups to unique molecules to biochemical pathways;	Biology II students at the below mastery level: identify the properties of the functional groups of organic molecules found in biochemical pathways;	Biology II students at the novice level: list the functional groups of organic molecules in biochemical pathways;

analyze energy flow of cellular processes and evaluate other compounds with water-like properties and predict whether or not those compounds can be substituted for water in biological systems;	analyze the interrelationships of energy cycles in different systems and how they affect the energy flow to entropy;	analyze the value of water in the energy cycles of living systems and its importance in biological systems;	trace the flow of energy in condensation and hydrolysis reactions of organic molecules;	identify condensation and hydrolysis reactions of organic molecules;
design multiple generation investigations for the application of Mendelian genetics to explanations of phenotypic probabilities and genetic abnormalities;	design investigations for the application of Mendelian genetics to explanations of phenotypic probabilities and genetic abnormalities;	apply Mendelian genetics to explanations of phenotypic probabilities and genetic abnormalities;	understand the application of Mendelian genetics to explanations of phenotypic probabilities and genetic abnormalities;	identify the application of Mendelian genetics to explanations of phenotypic probabilities and genetic abnormalities;
research and design investigations using the development of technology as it relates to analyzing chromosomal abnormalities and correcting genetic disorders;	research and use the development of technology as it relates to analyzing chromosomal abnormalities and correcting genetic disorders;	use the development of technology as it relates to analyzing chromosomal abnormalities and correcting genetic disorders;	recognize the use of technology as it relates to analyzing chromosomal abnormalities and correcting genetic disorders;	relate the use of technology as it relates to analyzing chromosomal abnormalities and correcting genetic disorders;
examine the evidence that some viruses cause cancer;	compare and contrast historical and current treatments for varying viral infections;	evaluate treatment of viral diseases based on lytic and lysogenic cycles;	describe the lytic and lysogenic cycles and the treatments of viral diseases;	trace the life cycle of viruses and list of the treatments of viral diseases;
interpret the interrelatedness of living organisms through their characteristics and investigate their structures;	interpret the interrelatedness of living organisms through their characteristics;	classify and analyze living organisms by their characteristics;	describe the differences in living organisms by their characteristics;	list the characteristics of organisms;
explain how the embryonic development of animals provide evidence of a shared ancestry, and	examine the common stages of embryonic development of animals, and	survey embryonic development of animals, and	outline the embryonic development of animals, and	list the embryonic development of animals, and

examine the roles of innate and learned animal behaviors in the evolution of a species.	examine the historical study of innate and learned animal behaviors.	examine types of innate and learned animal behaviors.	compare and contrast innate and learned animal behaviors.	identify type of innate behaviors and types of learned animal behaviors.
Objectives	Students will			
SC.O.BII.2.1	correlate functional groups to unique properties of organic molecules to biochemical pathways.			
SC.O.BII.2.2	describe the transfer of energy during condensation and hydrolysis reactions of organic molecules (e.g., ATP, enzyme substrate and active site).			
SC.O.BII.2.3	summarize the electrochemical gradients in various cells and their corresponding environments.			
SC.O.BII.2.4	analyze the properties of water and its importance in biological systems: • polarity • solubility • specific heat • pH • and buffers.			
SC.O.BII.2.5	examine the flow of energy through specific molecules in: • light dependent and light independent photosynthesis reactions • glycolysis • Kreb's cycle • EPS • fermentation.			
SC.O.BII.2.6	interpret important research leading to the current knowledge of molecular genetics: • Griffith • Avery • Hershey & Chase • Chargaff • Franklin & Wilkins • Waston & Crick.			
SC.O.BII.2.7	explain the use of restriction enzymes, vectors, plasmids and probes in recombinant DNA.			
SC.O.BII.2.8	conduct and interpret DNA investigations such as RFLP and PCR.			
SC.O.BII.2.9	analyze the process of DNA replication including: • DNA polymerase • semi-conservative replication • base-pairing.			
SC.O.BII.2.10	apply the processes of transcription and translation to gene expression.			
SC.O.BII.2.11	demonstrate the role of DNA in determining phenotype and illustrate ways of controlling and regulating expression and function of genes.			

SC.O.BII.2.12	distinguish between chromosomal and gene mutations and their potential effects.
SC.O.BII.2.13	analyze a karyotype to determine chromosomal abnormalities.
SC.O.BII.2.14	predict phenotypic ratios of crosses: • pleiotropy • epistasis • multiple alleles • polygenic inheritance.
SC.O.BII.2.15	evaluate treatment of viral diseases based on lytic and lysogenic cycles.
SC.O.BII.2.16	analyze the criteria for classifications of protists: • motility • cellular structures • reproduction • energy sources.
SC.O.BII.2.17	survey the fungi kingdom: • characteristics • reproduction • relationship to humans and the ecosystem.
SC.O.BII.2.18	compare and contrast members of the plant kingdom in terms of their reproductive systems.
SC.O.BII.2.19	compare and contrast members of the animal kingdom in terms of their complexity: • tissues • nervous • digestive systems.
SC.O.BII.2.20	survey embryonic development of animals: • gastrulation • development of different body cavities • and tissues develop from germ layers.
SC.O.BII.2.21	examine types of innate and learned animal behaviors: • competitive • reproductive • social • cyclic • communication.

Chemistry Content Standards and Objectives

Chemistry is an advanced level course designed for students who desire a broader, in-depth study of the content found in the science field of chemistry. Chemistry is the study of matter, its composition and its changes. This course is designed to build upon and extend the Chemistry concepts, skills and knowledge from the science program using skills for the 21st century. This course is designed to prepare a student for college chemistry, requiring a strong mathematical base. The relationship between chemistry concepts and mathematics will be emphasized. 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 as they evaluate the academic requirements and prepare for occupational opportunities in biology, chemistry, engineering, and technology. 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.

Grade Eleven	**Chemistry**			
Standard: 1	Nature and Application of Science			
SC.S.C.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.C.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Chemistry students at the distinguished 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 relate science-technology-societal issues while using a variety of sources to	Chemistry students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Chemistry students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Chemistry students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Chemistry students at novice level in the nature and applications of science: 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 construct their solutions.

construct solutions and defend their ideas to an authentic audience.	construct and defend their solutions.	construct and defend their solutions.	construct their solutions.	

Objectives	Students will
SC.O.C.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.C.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.C.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.C.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.C.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.C.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.C.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.C.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.C.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 Eleven	Chemistry
Standard: 2	Content of Science
SC.S.C.2	Students will • 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.C.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Chemistry students at the distinguished level : quantitatively determine the identity of a substance using physical properties	Chemistry students at the above mastery level: qualitatively identify a substance by its physical and chemical properties;	Chemistry students at the mastery level: classify pure substances by their chemical and physical properties;	Chemistry students at the partial mastery level: list the physical properties of a given pure substance;	Chemistry students at the novice level: define pure substances and chemical and physical properties;

such as density, melting points, specific heat, etc;				
draw conclusions from historical development of the periodic table and atomic theory to validate modern theories of bonding;	formulate scientific explanations based on historical observations and experimental evidence to explain atomic theory and bonding;	relate scientific explanations based on historical observations and experimental evidence to explain atomic theory, bonding, structure and periodic trend	research atomic theory to locate an atom on the periodic table and to construct models of elements and compounds;	use the periodic table to produce atomic models;
create the correct molecular formula and communicate the correct name for the hydrocarbons	generate the correct molecular formula and/or name for binary, ternary and oxy-acids;	generate the correct formula and/or name ionic or molecular compounds;	write formulas for/or name simple ionic and molecular compounds	write formulas for/or name simple binary compounds
construct the appropriate balanced equation for laboratory experiments;	predict the products, write and classify balanced chemical reactions;	write and classify balanced chemical reactions;	write and recognize the types of chemical reactions;	identify the types of chemical reactions;
explain from experimental data and appropriate stoichoimetric applications the limiting reactant, excess reactant, and theoretical yield;	apply stoichiometric principles to various chemical conversions;	perform the following "mole" calculations: molarity, percentage composition, empirical and molecular formula, formulas of hydrates and theoretical yield;	calculate molarity and percentage composition;	calculate basic mole conversions;
determine experimentally the properties of solution ;	determine experimentally the effects of temperature, concentration and vapor pressure on solution properties;	determine experimentally the effects of temperature and concentration on solution properties;	determine experimentally the effects of temperature on solution properties and water's role as a solvent;	define solute, solvent and solution
perform gas stoichiometric calculations;	perform calculations using the Ideal Gas equation;	perform calculations using the combined gas laws;	perform calculations using Boyle's, Charles' or Gay-Lussac's Laws;	identify pressure, temperature, and volume units;
conduct a neutralization experiment to construct and	conduct a neutralization experiment to determine an	compare methods of measuring pH while	define Arrhenius and Brönsted-Lowry acids and	classify solutions as acidic or basic using pH values;

interpret a titration curve; design a properly working electrolytic cell based on redox principles, and predict and explain how shifts in equilibrium affect the solubility of a solid.	unknown molarity; describe the parts of an electrolytic cell, and calculate the solubility product, $K_{sp.}$	conducting a neutralization experiment; apply the appropriate oxidation numbers to balance redox reactions, and identify oxidation numbers **to determine** electron movement.	select an appropriate indicator given the pH range of a solution; relate the role of the electron to oxidation numbers , and identify factors that can cause a shift in equilibrium.	identify oxidation numbers, and state an equilibrium expression and *K* from a chemical equation.

Objectives	Students will
SC.O.C.2.1	classify pure substances by their chemical and physical properties.
SC.O.C.2.2	research and evaluate contributions to the evolution of the atomic theory.
SC.O.C.2.3	describe atoms using the Quantum Model.
SC.O.C.2.4	produce electron configurations and orbital diagrams for any element on the periodic table and predict the chemical properties of the element from the electron configuration.
SC.O.C.2.5	illustrate Lewis' dot structures for representative (main group) elements.
SC.O.C.2.6	generate the correct formula and/or name for ionic and molecular compounds.
SC.O.C.2.7	analyze periodic trends in atomic size, ionic size, electronegativity, ionization energy and electron affinity.
SC.O.C.2.8	predict the type of bonding that occurs between atoms and characterize the properties of the ionic, covalent or metallic substances.
SC.O.C.2.9	identify oxidation numbers to determine electron movement.
SC.O.C.2.10	construct models to explain the structure and geometry of organic and inorganic molecules.
SC.O.C.2.11	given the reactants, anticipate the products and create balanced equations for the five general types of chemical reactions: • synthesis or combination, • decomposition, • single replacement, • double replacement and • combustion.
SC.O.C.2.12	determine experimentally the effects of temperature and concentration on solution properties: • solubility, • conductivity, • density and • colligative properties.
SC.O.C.2.132	classify reactions as exothermic and endothermic reactions by the direction of heat flow in a chemical reaction.
SC.O.C.2.14	explain the chemical and physical concepts involved in dynamic equilibrium.
SC.O.C.2.15	generate mole conversions that demonstrate correct application of scientific notation and significant:

	• mass to number of particles, • number of particles to volume, • volume to mass.
SC.O.C.2.116	perform calculations using the combined gas laws.
SC.O.C.2.17	perform the following "mole" calculations showing answers rounded to the correct number of significant figures: • molarity • percentage composition • empirical formulas • molecular formulas • formulas of hydrates • mole-mole and mass-mass stoichiometry • determination of limiting reactant • theoretical yield.
SC.O.C.2.18	compare and contrast the Arrhenius and Bronsted-Lowry definitions of acids and bases.
SC.O.C.2.19	compare methods of measuring pH: • indicators • indicator papers • pH meters.
SC.O.C.2.20	predict the product of an acid-base reaction.
SC.O.C.2.21	investigate and explain water's role as a solvent based upon principles of polarity of substances.

Conceptual Chemistry Content Standards and Objectives

Conceptual Chemistry is an introductory level course designed for students in the skilled pathway who desire an alternative to a traditional college preparatory course emphasizing real life applications of chemical principles. Mathematical based problem solving is de-emphasized. Conceptual Chemistry is the study of matter, its composition and its changes. Emphasis is placed on the important role chemistry plays in a student's personal life, career opportunities, environment and society while developing 21st century skills. 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 as they evaluate the academic requirements and prepare for occupational opportunities in biology, chemistry, engineering, and technology. 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.

Grade Eleven	**Conceptual Chemistry**			
Standard: 1	Nature and Application of Science			
SC.S.CC.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.CC.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Chemistry students at the distinguished 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 relate science-technology-societal issues while using a variety of sources to	Conceptual Chemistry students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Conceptual Chemistry students at the mastery level in the nature and applications of science: will implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Conceptual Chemistry students at the partial mastery level in the nature and applications of science: will implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Conceptual Chemistry students at the novice level in the nature and applications of science: will 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

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.CC.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.CC.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.CC.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.CC.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.CC.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.CC.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.CC.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.CC.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.CC.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 Eleven	Conceptual Chemistry
Standard: 2	Content of Science
SC.S.CC.2	Students will • 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.CC.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Chemistry student at the distinguished level: design and conduct an investigation to compare the	Conceptual Chemistry student at the above mastery level: predict the physical and chemical properties of	Conceptual Chemistry student at the mastery level: classify matter as pure substance or mixture by	Conceptual Chemistry student at the partial mastery level: use position on the periodic table to classify elements	Conceptual Chemistry student at the novice level: define chemical and physical properties, pure

conductivity and malleability of metals, nonmetals and metalloids, to separate a mixture, and/or to identify an unknown pure substance using its chemical and physical properties;	common objects based on their composition and examine experimentally the methods of separating mixtures;	listing physical and chemical properties;	and chemical and physical properties to classify compounds and mixtures;	substances and mixtures, metals, nonmetals and metalloids;
predict the behavior of an ideal gas and compare the behaviors of ideal and real gas;	predict the outcome of changing a variable in a gaseous system by applying the kinetic molecular theory;	use the kinetic molecular theory to explain states of matter and perform calculations using the combined gas laws;	illustrates the states of matter at the molecular level and perform calculation for Boyle's, Charles' and/or Gay-Lussac's law;	define states of matter and identify pressure, temperature and volume units;
analyze the periodic table to produce and use electron configurations to predict the chemical properties of elements;	analyze the periodic table to compare chemical properties based on changes in electron configuration for elements in a period, and characterize the properties of the ionic, covalent or metallic substances;	analyze the periodic table to predict trends, to illustrate Lewis' dot structures for representative (main group) elements and to produce and use electron configurations to explain chemical properties;	use the periodic table to produce an electron configuration, to compare two elements and describe differences in periodic properties, and to match a Bohr model to the Lewis' dot structure for representative elements;	use the periodic table to match an element to its group and period, to recognize that placement on the periodic table determines the common ionic charge, and to classify elements as metallic or nonmetallic;
generate the correct molecular formula for binary and oxy-acids;	generate the correct formula and/or name for simple ionic and molecular compounds and predict the type of bonding;	generate the correct formula and/or name for simple ionic and molecular compounds then characterize the properties of the ionic, covalent or metallic substance formed;	predict the type of bonding that occurs between atoms as ionic or covalent;	identify the number of valence electrons in atoms of representative metals and nonmetals;
calculate the enthalpy of reactions from balanced equations;	create balanced equations for the five general types of chemical reactants and classify reactions as exothermic or endothermic reactions;	given the reactants, predict the products, balance the equations for the five general types of chemical reactants and classify reactions as exothermic or endothermic reactions;	given the formulas, place the coefficient to balance chemical equations, and classify reactions as exothermic or endothermic reactions;	identify the type of chemical reaction, and define exothermic and endothermic reactions;

generate complex mole conversions that require three or more conversion factors and perform all calculations that use the mole as a conversion factor;	generate multi-step mole conversions that require three or more conversion factors and perform all calculations that use the mole as a conversion factor;	perform the following "mole" calculations: molarity, percentage composition, empirical and molecular formula, formulas of hydrates and theoretical yield;	write conversion factors and calculate molarity and percentage composition;	define the mole; calculate molar mass;
construct models of organic molecules and apply electronegativity values and molecular shape to classify the molecules as polar or nonpolar;	construct models of organic molecules and apply electronegativity values to classify the bonds as polar or nonpolar;	construct models to explain the structure and geometry or organic and inorganic molecules;	differentiate among linear, trigonal planar, and tetrahedral shapes;	construct ball and stick models for simple molecules;
determine experimentally the properties of solution and identify the intermolecular forces;	investigate the solubility of various materials in water and determine experimentally the effects of temperature, concentration and vapor pressure on solution properties;	investigate and explain the water's role as a solvent determine, and experimentally demonstrate the effects of temperature and concentration on solution properties;	describe properties of solutions and illustrate water as a polar molecule;	define solute, solvent and solution, and polarity
conduct a neutralization experiment to construct and interpret a titration curve, and	conduct a neutralization experiment to determine an unknown molarity, and	compare methods of measuring pH while conducting a neutralization experiment, and	define Arrhenius and Brönsted-Lowry acids and select an appropriate indicator given the pH range of a solution, and	classify solutions as acidic or basic using pH values, and
write nuclear equations for fission and fusion reactions.	given the initial isotope, write the decay series until a stable isotope is reached.	given the reactants, write and balance nuclear reactions.	balance nuclear reactions	define alpha, beta and gamma emissions.

Objectives	Students will
SC.O.CC.2.1	classify pure substances by their chemical and physical properties.
SC.O.CC.2.2	classify examples of matter as pure substance or mixture.
SC.O.CC.2.3	compare and contrast the properties of metals, nonmetals and metalloids.
SC.O.CC.2.4	use the kinetic molecular theory to explain states of matter.
SC.O.CC.2.5	perform calculations using the combined gas laws.
SC.O.CC.2.6	produce and use electron configuration to explain chemical properties of elements.

SC.O.CC.2.7	generate the correct formula and/or name for ionic and molecular compounds.
SC.O.CC.2.8	predict the type of bonding that occurs between atoms and characterize the properties of the ionic, covalent or metallic bond formed.
SC.O.CC.2.9	given the reactants, anticipate the products and create balanced equations for the five general types of chemical reactions: • synthesis or combination • decomposition • single replacement • double replacement • combustion.
SC.O.CC.2.10	analyze the periodic table to predict trends: • atomic size • ionic size • electronegativity • ionization energy • electron affinity
SC.O.CC.2.11	illustrate Lewis' dot structures for representative (main group) elements.
SC.O.CC.2.12	generate mole conversions that demonstrate the ability to convert from one type of quantity to another: • mass to number of particles • number of particles to volume • or volume to mass.
SC.O.CC.2.13	perform the following "mole" calculations: • molarity • percentage composition • empirical and molecular formula • formulas of hydrates • theoretical yields.
SC.O.CC.2.14	construct models to explain the structure and geometry of organic and inorganic molecules and the lattice structures of crystals.
SC.O.CC.2.15	determine experimentally the effects of temperature and concentration on solution properties • solubility • conductivity • density • colligative properties.
SC.O.CC.2.16	compare methods of measuring pH: • indicators • indicator papers • pH meters.
SC.O.CC.2.17	investigate and explain water's role as a solvent based upon principles of polarity of substances.
SC.O.CC.2.18	compare and contrast the Arrhenius and Bronsted-Lowry definitions of acids and bases.
SC.O.CC.2.19	classify reactions as exothermic and endothermic reactions by the direction of heat flow in a chemical reaction.

SC.O.CC.2.20	given the reactants, anticipate the products and create balanced equations for nuclear reactions.

Chemistry II Content Standards and Objectives

Chemistry II is an advanced level course that is an elective designed for students who have completed Chemistry and desire a broader, in-depth study of the content found in the science field of chemistry. Chemistry is the study of matter, its composition and its changes. This course is designed to prepare students to be critical and independent thinkers who are able to function effectively in a scientific and technological society, and to build upon and extend the chemistry concepts, skills and knowledge from the previous chemistry class. This course is designed not only to prepare a student for college chemistry but to make the college chemistry experience much easier as the student will have already studied much of the material reserved for college chemistry at the high school level. 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 as they evaluate the academic requirements and prepare for occupational opportunities in biology, chemistry, engineering, and technology. 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.

Grade Twelve	**Chemistry II**			
Standard: 1	Nature and Application of Science			
SC.S.CII.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.CII.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Chemistry II students at the distinguished 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 relate science-technology-	Chemistry II students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-	Chemistry II students at the mastery level will in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-	Chemistry II students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-	Chemistry II students at the novice level in the nature and applications of science: 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 construct solutions and defend their ideas to an authentic audience.	societal issues while using a variety of sources to construct and defend their solutions.	societal issues while using a variety of sources to construct and defend their solutions.	societal issues while using a variety of sources to construct their solutions.	societal issues while using a variety of sources to construct their solutions.

Objectives	Students will
SC.O.CII.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.CII.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.CII.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.CII.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.CII.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.CII.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.CII.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.CII.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.CII.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 Twelve	Chemistry II
Standard: 2	Content of Science
SC.O.CII.2	Students will • 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 sciences and astronomy. • apply knowledge, understanding and skills of science subject matter/concepts to daily life experiences.

Performance Descriptors SC.PD.CII.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Chemistry II students at the distinguished level: utilize VSEPR theory to	Chemistry II students at the above mastery level: utilize VSEPR theory to	Chemistry II students at the mastery level: investigate valence bonds	Chemistry II students at the partial mastery level: match types of bonding	Chemistry II students at the novice level: describe valence bonds and

make predictions about valence bonds that can be used to compare and contrast binding forces;	explain valence bonding; and the types of binding forces;	and binding forces;	forces including all that contain valence bonds;	types of binding forces;
justify the ideal gas laws on the basis of the kinetic-molecular theory;	assess the ideal gas laws on the basis of the kinetic-molecular theory;	interpret the ideal gas laws on the basis of the kinetic-molecular theory;	explain the ideal gas laws on the basis of the kinetic-molecular theory;	state the ideal gas laws and describe their basis on kinetic molecular theory;
predict theoretical yield, limiting reactant, excess reactant, percent yield, and experimental error from a designed experiment that includes the appropriate stoichiometric applications;	explain from experimental data and appropriate stoichoimetric applications the limiting reactant, excess reactant, and theoretical yield;	perform stoichiometric calculations utilizing Avogadro's concepts, significant figures, and mathematical applications for molar mass, theoretical yield, and limiting reactant;	perform stoichiometric calculations utilizing Avogadro's concepts, significant figures, and mathematical applications for molar mass, theoretical yield, and limiting reactant;	calculate theoretical yield that is expressed in correct significant figures and determine the molar mass, theoretical yield, and limiting reactant;
design an experiment to illustrate the effect of changing concentration on the colligative properties of solutions, change of state, and molar mass;	evaluate experiments that effect colligative properties and states of matter by changing concentration;	explain by concentration calculations the effect of changing concentration on the colligative properties of solutions and on changes of state;	calculate molar mass and concentration then describe the effect of changing concentration on colligative properties and change of state:	match molar mass and the effect of concentration changes on colligative properties and changes of state;
evaluate systems based on the physical and chemical dynamic equilibrium concepts that include equilibrium constants and system directional change according to Le Chatelier's principle ;	illustrate physical and chemical dynamic equilibrium concepts by calculating equilibrium constants and applying Le Chatelier's principle to predict system change:	explain the physical and chemical dynamic equilibrium concepts through calculation of equilibrium constants and application of Le Chatelier's principle;	describe the physical and chemical dynamic equilibrium concepts that include the calculation of equilibrium constants and Le Chatelier's principle;	define physical and chemical dynamic equilibrium concepts, equilibrium constants and Le Chatelier's principle;
design an effective battery using the voltage calculated from the Nernst equation;	predict the voltage using the Nernst equation and use this to compare chemical cells;	Identify oxidation numbers for the ions that are used to calculate the electron movement in a redox reaction and calculate the voltage using the Nernst equation;	use oxidation numbers for ions in a compound to calculate the electron movement in a redox reaction and calculate the voltage using the Nernst equation;	recognize the oxidation numbers for ions in a compound used to calculate the electron movement in a redox reaction and match the voltage using the Nernst equation;

design and conduct experiments to collect and graphically analyze data to investigate reaction rate and predict reactant order;	demonstrate reactant order, rate constants, reaction rate laws, rate calculations and predict the effect of temperature on rate changes;	determine reactant order, rate constants, and reaction rate laws using rate calculation and describe the effect of temperature on rate changes;	estimate reactant order using rate constants, reaction rate laws, rate calculations, and temperature's influence on rate changes;	match reactant order, rate constants, or reaction rate laws, calculate the rate of reaction and describe the effect of temperature on rate changes;
design and conduct experiments to experimentally and mathematically demonstrate the first and second law of thermodynamics including the reaction spontaneity;	demonstrate experimentally and mathematically applications of Hess's Law, spontaneous reactions, and the second law of thermodynamics;	determine the heat of formation, heat of reaction, heat of vaporization and heat of fusion while using applications of Hess's Law and use the second law of thermodynamics;	state the second law of thermodynamics and applications of Hess's Law that include calculations of the free energy of formation and the free energy of reaction;	identify Hess's Law and the dependence of free energy on enthalpy and entropy changes:
calculate and explain the relationships among weak acids, pH, pOH, pK, K_a, K_b, K_w, ionization constants, and percent ionization, K_{sp};	explain weak electrolytes, ionization constants, and percent ionization;	identify weak electrolytes, pH, pOH, pK, K_a, K_b, K_w, K_{sp} and calculate pH and pOH; measure pH with indicator papers and electronic meters;	identify weak electrolytes, pH, pOH, pK, K_a, K_b, K_w, K_{sp} and calculate pH and pOH; measure pH with indicator papers and electronic meters;	define weak electrolytes, pH, pOH, pK, K_a, K_b, K_w, K_{sp}; calculate pH and pOH and measure pH with indicator papers or electronic meters;
prove the presence of specific cations and anions in an unknown mixture through experimental data;	design a qualitative analysis for an unknown mixture;	analyze a solution that contains known cations and a solution that contains known anions;	construct a data table for cation and anion analysis;	identify the colors of specific cation and anion precipitates;
solve complex problems involving radioactive decay and write nuclear equations for decay, fission, and fusion;	investigate the similarities and differences between radioactive processes, nuclear fission, and fusion;	express radioactive decay in an equation format and solve simple problems for the half-life of an isotope;	categorize by using the properties of the different types of radiation emitted during radioactive decay;	identify a nuclear equation and generally describe radioactive decay;
perform calculations involving the addition of a strong acid or base to a buffer; experimentally justify the hydrolysis of a salt and equivalence point of a	predict the pH of a salt from its formula then calculate the pH of the salt; write the reaction of hydrolyzed salt; interpret the effect of a buffer on an aqueous	identify the components of a buffer and the use of buffers, and	identify salts that undergo hydrolysis and match the reaction for the ion with water; interpret a titration curve to identify the equivalence point, and	identify the equivalence point on a titration curve, and

titration curve, and evaluate organic structures and compounds based on functional groups.	system, and differentiate, classify and characterize simple organic functional groups and compounds.	recognize and classify simple organic functional groups.	identify simple organic functional groups and compounds.	match simple organic functional groups and compounds.

Objectives	Students will
SC.O.CII.2.1	identify types of binding forces such as: • ionic • covalent • metallic • van der Waals forces (including London) and relate binding forces to state, structure, and properties of matter.
SC.O.CII.2.2	investigate the valence bond including the concepts of: • hybridization of orbitals • resonance • formation of sigma and pi bonds and demonstrate an understanding of the VSEPR theory.
SC.O.CII.2.3	apply the principles of chemical reactivity, products of chemical reactions, and relationships on periodic table to predict the ions in a descriptive chemistry experiment.
SC.O.CII.2.4	interpret the ideal gas laws on the basis of the kinetic-molecular theory.
SC.O.CII.2.5	relate Avogadro's hypothesis and its relation to the mole concept.
SC.O.CII.2.6	define changes of state, including critical temperatures and triple points, based on the kinetic molecular theory.
SC.O.CII.2.7	calculate concentration and explain the effect of changing concentration on the colligative properties of solutions.
SC.O.CII.2.8	identify oxidation numbers for ions and for any element in a compound to calculate the electron movement in a redox reaction and calculate the voltage using the Nernst equation.
SC.O.CII.2.9	explain physical and chemical dynamic concepts; calculate equilibrium constants K_p, K_c, K_{sp}, K_a, and apply Le Chatelier's principle.
SC.O.CII.2.10	use experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws, calculate the rate of reaction and explain the effect of temperature on rate changes.
SC.O.CII.2.11	determine the heat of formation, heat of reaction, heat of vaporization and heat of fusion; apply Hess's Law.
SC.O.CII.2.12	using the second law of thermodynamics, calculate the free energy of formation, free energy of reaction and the dependence of free energy on enthalpy and entropy changes.
SC.O.CII.2.13	perform all calculations with attention given to significant figures, precision of measured values, and the use of logarithmic and exponential relationships.
SC.O.CII.2.14	calculate molar masses from gas density, freezing-point, and boiling-point measurements.
SC.O.CII.2.15	experimentally determine the properties of acids: • identify weak electrolytes; • define pH, pOH, pK, K_a, K_b, K_w, ionization constant, percent ionization, K_{sp};

	• calculate pH and pOH; • measure pH with indicator papers and electronic meters; • recognize salts that undergo hydrolysis • write a reaction for the ion with water • interpret a titration curve to identify the equivalence point and • calculate the range of a buffer.
SC.O.CII.2.16	perform stoichiometric calculations to produce values for theoretical yield and to decide the limiting reactant of a given chemical reaction.
SC.O.CII.2.17	recognize simple organic functional groups and classify simple organic compounds by name.
SC.O.CII.2.18	given the reactants, anticipate the products and create balanced equations for nuclear reactions.

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 as they evaluate the academic requirements and prepare for occupational opportunities in geology, astronomy, astronomy, and ecology. 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 and Application of Science			
SC.S.ES.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.ES.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Earth Science students at the distinguished 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 relate science-technology-societal issues while using a variety of sources to construct solutions and	Earth Science students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct and defend their	Earth Science students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.	Earth Science students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct their solutions.	Earth Science students at the novice level in the nature and applications of science: 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 construct their solutions.

defend their ideas to an authentic audience.	solutions.			

Objectives	Students will
SC.O.ES.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.ES.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.ES.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.ES.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.ES.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.ES.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.ES.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.ES.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.ES.1.9	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).

High School	Earth Science
Standard: 2	Content of Science
SC.S.ES.2	Students will • 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 of science content: investigate and evaluate geological evidence related to the structures, origin, and	Earth Science students at the above mastery level of science content: investigate and analyze geological evidence related to the structures, origin, and	Earth Science students at the mastery level of science content:: investigate geological evidence related to the structures, origin, and age	Earth Science students at the partial mastery level of science content: will describe geological structures and the origin and age of the Earth;	Earth Science students at the novice level of science content:: identify Earth's structures and state the age of the Earth;

age of the Earth; assess evidence and use it to explain the significance of processes that have caused slow and rapid changes to the Earth's surface; relate meteorological evidence to weather phenomena and forecasting; experimentally determine the factors that affect climate; and debate global climatic change issues; use models and mathematical calculations to explain how the principles of physics and chemistry are used to determine the movements and compositions of structures within the solar system and universe, and research and debate solutions to ecological, economical, and societal conflicts.	age of the Earth; examine evidence and use it to explain the significance of processes that have caused slow and rapid changes to the Earth's surface; relate meteorological evidence to weather phenomena and forecasting; explain the factors that affect climate; and evaluate evidence about global climatic changes; use models to explain how the principles of physics and chemistry are used to determine the movements and composition of structures within the solar system and universe, and research propose solutions to ecological, economical, and societal conflicts.	of the Earth; investigate the processes and explain the significance of the slow and rapid changes of the Earth's surface; use meteorological tools and technology to gather data as they make forecasts and explain weather phenomena; describe the factors that affect climate; and assess evidence related to global climatic changes; use models to relate principles of physics and chemistry to the movements and composition of structures within the solar system and universe, and research and evaluate factors ecological, economical, and societal conflicts.	explain the processes that have caused slow and rapid changes to the Earth's surface; use meteorological tools to gather data as they make forecasts and explain weather phenomena; list factors that affect climate; and research evidence about global climatic changes; use diagrams and models to explain the movements and composition of structures within the solar system and universe, and research and describe factors related to ecological, economical, and societal conflicts.	describe slow and rapid changes of the Earth's surface; use meteorological tools gather data and make weather forecasts; list factors that affect climate; and describe global climatic changes; use diagrams and models to identify structures within the solar system and universe, and list ecological, economical, and societal conflicts related to Earth Science.

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: • 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: • weathering • physical features of the ocean floor • 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: • 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: • ocean crust • sedimentation • active and passive continental margins.
SC.O.ES.2.17	examine the stratification of the oceans: • temperature • salinity zones • biological zones.
SC.O.ES.2.18	investigate to explain heat transfer in the atmosphere and its relationship to meteorological processes : • pressure • winds • evaporation • condensation • 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 to forecast weather:: • air masses

	• wind • barometric pressure • temperature data.
SC.O.ES.2.21	examine global change over time: • 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 • 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.

Environmental Science Content Standards and Objectives

Environmental Science is an elective, advanced level lab course which builds on foundational knowledge of the chemical, physical, biological, geological processes and focuses on the natural world. Through an inquiry-based program of study, all students will demonstrate environmental literacy as they explore the economic, social, political, and ecological interdependence in urban and rural areas. Students will synthesize information and experiences across disciplines as they acquire knowledge, values, and skills needed to protect and improve the environment. 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. 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 11	**Environmental Science**			
Standard: 1	Nature and Application of Science			
SC.S.ENV.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.ENV.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Environmental students at the distinguished level in the nature and application 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 relate science-technology-societal issues while using a variety of sources to construct solutions and	Environmental students at the above mastery level in the nature and application of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct and defend their	Environmental students at the mastery level in the nature and application of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct and defend their	Environmental students at the partial mastery level in the nature and application of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to construct their solutions,	Environmental students at the novice level in the nature and application of science: 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 construct their solutions,

defend their ideas to an authentic audience.	solutions.	solutions.		

Objectives	Students will
SC.O.ENV.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.ENV.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.ENV.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.ENV.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.ENV.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.ENV.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.ENV.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.ENV.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.ENV.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 11	Environmental Science
Standard: 2	Content of Science
SC.S.ENV.2	Students will • demonstrate knowledge understanding and applications of scientific facts, concepts, principles, theories, and models delineated in the objectives. • demonstrate an understanding of the interrelationships among physics, chemistry, biology, earth/environmental science, and astronomy; and apply knowledge, understanding and skills of science subject matter/concepts to daily life.

Performance Descriptors SC.PD.ENV.2

Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Environmental students at the distinguished level: analyze natural and human influences on the rate elements cycle through the ecosphere;	Environmental students at the above mastery level: compare and contrast the rate elements cycle through the ecosphere, explain how the chemical components fit biogeochemical cycling;	Environmental students at the mastery level: explain biogeochemical cycles describing influences on reaction rates between biological and physical processes;	Environmental students at the partial mastery level: describe biogeochemical cycles describing influences on reaction rates;	Environmental students at the novice level: diagram cycles of elements in the biogeochemical cycles;

predict how changes in the availability and use of natural resources will affect society- evaluate costs and benefits;	assess how changes in the availability and use of natural resources will affect human activities;	analyze and evaluate energy sources and energy generation and assess how natural resources can be sustained through technological advances;	determine the influence of energy production on the availability of renewable and nonrenewable energy sources;	describe the use of renewable and nonrenewable energy resources relative to energy production;
analyze population dynamics relative to biodiversity, invasive species, and population growth factors;	research and evaluate legislation protecting ecosystems;	explain factors effecting population dynamics, trace the flow of energy through living systems, assess the effect of invasive species, and compare legislation protecting ecosystems;	explain the effects of biotic and abiotic factors on population dynamics, trace the flow of energy through living systems, and compare legislation protecting ecosystems;	explain the effects of biotic and abiotic factors on population dynamics, trace the flow of energy through living systems;
evaluate impact of various treaties and laws on society and global systems;	be skeptical of climate change issues and arguments;	investigate and explain climate effects on biomes, and causes of air pollutants, acid rain, ozone layer, greenhouse gases;	describe climates in various biomes, and natural and anthropogenic causes of air pollutants, acid rain, ozone layer, greenhouse gases;	match biomes to corresponding climates and list causes of air pollutants, acid rain, ozone layer, greenhouse gases;
debate national and international clean water agreements; and	analyze cause and effect relationships of pollutants on surface and ground water resources; and	investigate water sources and pollutants, use GIS to analyze data and model local watersheds, describe wastewater treatment methods, and examine laws to maintain clean water; and	investigate water sources and pollutants, use GIS to gather data and diagram a local watershed, describe wastewater treatment methods, examine laws to maintain clean water; and	recognize water pollution, use maps to identify a local watershed, list wastewater treatment methods, examine national laws to maintain clean water; and
when given a scenario, determine the best solid waste management method, justify the selection.	classify soils by their characteristics and evaluate best practices for agriculture to minimize water pollution.	examine soil characteristics and determine best practices for agriculture and solid waste management.	describe soil characteristics and recommend practices for agriculture.	examine soil characteristics and determine best practices for agriculture and solid waste management.

Objectives	Students will
SC.O.ENV.2.1	compare and contrast the rate elements cycle through the ecosphere, describing natural and human influences on reaction rates: • carbon • nitrogen • phosphorus

	• oxygen • sulfur.
SC.O.ENV.2.2	explain how the chemical components of biological and physical processes fit in the overall process of biogeochemical cycling such as photosynthesis, respiration, nitrogen fixation, or decomposition.
SC.O.ENV.2.3	analyze and evaluate the use and availability of renewable and nonrenewable energy resources: • coal • solar • biomass • biofuels • hydropower • natural gas • wind • geothermal • nuclear.
SC.O.ENV.2.4	evaluate environmental and economic advantages and disadvantages of using nonrenewable and renewable energy.
SC.O.ENV.2.5	differentiate various means of generating electricity in terms of the transformation of energy among forms, the relationship of matter and energy, and efficiency/production of heat energy.
SC.O.ENV.2.6	explain how technology has influenced the sustainability of natural resources over time: • forestry practices • fossil fuels • farming.
SC.O.ENV.2.7	relate logistic, exponential, and irruptive population growth to population dynamics to: • natural selection • predator/prey relationships • reproductive strategies • carrying capacity • limiting factors.
SC.O.ENV.2.8	create food web diagrams to explain how adding a species to or removing species from an ecosystem may affect other organisms and the entire ecosystem.
SC.O.ENV.2.9	evaluate the leading causes of species decline and premature extinction: • habitat destruction and degradation • invasive species • pollution • human population growth • over exploitation.
SC.O.ENV.2.10	analyze biological diversity as it relates to the stability of an ecosystem.
SC.O.ENV.2.11	relate habitat changes to plant and animal populations and climate influences: • variations in habitat size

	• fragmentation • fluctuation in conditions of abiotic factors • albedo • surface temperature.
SC.O.ENV.2.12	compare and contrast legislation and international agreements associated with protecting habitats, ecosystems, and species: • superfund • surface Mining Control and Reclamation Act • wilderness Act • endangered Species Act • marine Mammals Act.
SC.O.ENV.2.13	illustrate how changes in wind patterns or ocean temperatures can affect weather in different parts of the world: • El Nino • La Nina • Santa Ana winds.
SC.O.ENV.2.14	identify natural and anthropogenic sources of primary, secondary, and indoor air pollutants and the resulting environmental and health effects.
SC.O.ENV.2.15	explain the formation of acid rain and describe the resulting effect on soil, plants, water, statues, etc.
SC.O.ENV.2.16	identify causes for the thinning of the ozone layer and evaluate the effectiveness of the Montreal Protocol for reducing ozone depletion.
SC.O.ENV.2.17	debate climate changes as it relates to greenhouse gases, human changes in atmospheric concentrations of greenhouse gases, and relevant laws and treaties.
SC.O.ENV.2.18	identify sources, uses, quality, conservation, and global distribution of water.
SC.O.ENV.2.19	create models to show surface and groundwater flows in a local drainage and explain how surface and ground water are related.
SC.O.ENV.2.20	contrast point source and non-point source water pollutants.
SC.O.ENV.2.21	use GIS data to analyze the parameters of a watershed and interpret physical, chemical and biological data as a means of assessing environmental quality.
SC.O.ENV.2.22	examine legislation associated with the protection of water: • Clean Water Act • London Dumping Convention of 1972.
SC.O.ENV.2.23	describe the processes involved and compare different methods of wastewater treatment.
SC.O.ENV.2.24	classify and analyze characteristics of different soil types: • texture • pH • nitrogen • phosphorus • potassium.
SC.O.ENV.2.25	analyze best management practices of the agriculture business: • fertilizers

	• integrated pest management • associated water pollution • irrigation practices.
SC.O.ENV.2.26	research and describe how communities have restored or protected ecosystems: • remediation • mitigation • rehabilitation • reclamation • preservation.
SC.O.ENV.2.27	evaluate solid waste management practices: • recycling • incineration • sanitary landfills • hazardous waste disposal.

Human Anatomy and Physiology Content Standards and Objectives

Human Anatomy and Physiology is an advanced course that is an elective designed for those students wanting a deeper understanding of the structure and function of the human body. The body will be viewed as a whole using anatomical terminology necessary to describe location. Focus will be at both micro and macro levels reviewing cellular functions, biochemical processes, tissue interactions, organ systems and the interaction of those systems as it relates to the human organism. Systems covered include integumentary, skeletal, muscular, respiratory, circulatory, digestive, excretory, reproductive immunological, nervous and endocrine. This course will develop 21st century skills and be appropriate for college bound students as well as those choosing a health services career cluster. Students will engage in active inquiries, investigation, and hands-on activities for a minimum of 50% of the instructional time to develop conceptual understanding and research/laboratory skills as they evaluate the academic requirements and prepare for occupational opportunities in health and medical fields. 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	Human Anatomy and Physiology			
Standard: 1	Nature and Application of Science			
SC.S.HAP.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.HAP.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Human Anatomy and Physiology students at the distinguished 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	Human Anatomy and Physiology students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and	Human Anatomy and Physiology students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-	Human Anatomy and Physiology students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and	Human Anatomy and Physiology students at the novice level in the nature and applications of science: implement safe practices as they conduct experiments and base conclusions on observations and experimental evidence, and relate science-technology-

relate science-technology-societal issues while using a variety of sources to construct solutions and defend their ideas to an authentic audience.	relate science-technology-societal issues while using a variety of sources to construct and defend their solutions.	societal issues while using a variety of sources to construct and defend their solutions.	relate science-technology-societal issues while using a variety of sources to construct their solutions.	societal issues while using a variety of sources to construct their solutions.

Objectives	Students will
SC.O.HAP.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.HAP.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.HAP.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.HAP.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.HAP.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.HAP.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.HAP.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.HAP.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.HAP.1.9	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).

High School	Human Anatomy and Physiology
Standard: 2	Content of Science
SC.S.HAP.2	Students will • 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.HAP.2				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Human Anatomy and Physiology students at the distingished level will:	Human Anatomy and Physiology students at the above mastery level will:	Human Anatomy and Physiology students at the mastery level:	Human Anatomy and Physiology students at the partial mastery level:	Human Anatomy and Physiology students at the novice level:

integrate anatomical terms; sequence hierarchal organizational levels; assess interdependency interaction; investigate and explain tissues; integrate form and function within systems and effects of aging and disease; compare/contrast system structure and function and system integration; analyze systems in maintaining homeostasis; evaluate models replicating muscular contraction; analyze neural control; evaluate models demonstrating nerve impulses; apply physics concepts to ear and eye structure and function; compare enzyme action; describe feedback loops in endocrine functioning;	utilize anatomical terms; compare hierarchal organizational levels; distinguish interdependency and interaction; examine tissues; determine form and function relationship within systems and effects of aging and disease; compare system structure and function and investigate system integration; examine systems in maintaining homeostasis; design and build a model of muscle cell contraction; illustrate neural control; design a model demonstrating nerve impulses; critique effectiveness of ear and eye structures; examine enzyme action;	apply anatomical terms; describe hierarchal organizational levels; examine interdependency and interaction; compare/contrast tissues; analyze form and function relationship within systems and effects of aging and disease; describe system structure and function and summarize system integration; explain systems in maintaining homeostasis; model muscle contraction; integrate neural control and model nerve impulses, relate ear and eye structures to function/dysfunction; apply enzyme action to function;	recall anatomical terms; summarize hierarchal organizational levels; discuss interdependency and interaction; classify tissues; determine form and function relationship within systems and effects of aging and disease;, recall system structure and function and recognize system integration; identify system functions in maintaining homeostasis; illustrate muscle contractions; summarize neural control and model nerve impulses, relate ear and eye structures to function/dysfunction; describe lock and key enzyme model to action; match endocrine glands to	define anatomical terms; identify hierarchal organizational levels; define interdependency and interaction; identify tissues; identify form and function relationship within systems and effects of aging and disease; describe system structure and function and identify system integration; recognize systems in maintaining homeostasis; describe muscle contractions; list the neuron types; describe nerve impulses, define ear and eye structures; recite specific enzyme functions; match endocrine glands to

research effects of synthetic hormones, and research use of stem cells and predict how this may affect disease treatment.	research endocrine functions and dysfunctions; explain hormones in reproductive control, and examine stress effects on immunity and research history of disease treatment.	incorporate hormones to functions/dysfunctions; outline gametogenesis, fertilization, and development, and assess immune components and research disease progression.	hormones and functions; describe oogenesis and spermatogenesis, and diagram immune response and classify factors in disease progression.	functions; define mitosis/meiosis; describe immune defenses and match specific disease factors to prevention and treatments.

Objectives	Students will
SC.O.HAP.2.1	apply directional terminology to locate human body structures: • proximal • dorsal • medial • visceral • superficial • deep.
SC.O.HAP.2.2	describe the organizational levels, interdependency and the interaction of • cells • tissues • organs • organ systems.
SC.O.HAP.2.3	categorize, by structure and function, the various types of human tissue: • muscle • epithelial • connective • nervous.
SC.O.HAP.2.4	relate the structure of the integumentary system to its function as a/an: • sensory organ • environmental barrier • temperature regulator.
SC.O.HAP.2.5	relate how bone tissue is important to the development of the human skeleton.
SC.O.HAP.2.6	correlate the structure and function of the elements of the skeletal system: • bone • articulations • insertions.
SC.O.HAP.2.7	model the mechanisms of muscular contraction on the cellular and molecular levels.

SC.O.HAP.2.8	integrate the skeletal, muscular and nervous systems to the functioning of the organism.
SC.O.HAP.2.9	model the muscular system including: • locations • origins • insertions • muscle groups • types of muscles.
SC.O.HAP.2.10	classify the various types of neurons emphasizing the relationship of structure and function.
SC.O.HAP.2.11	model the mechanism of a nerve impulse at the cellular and molecular levels.
SC.O.HAP.2.12	compare and contrast the parts and functions of the central and peripheral nervous system including the autonomic portions.
SC.O.HAP.2.13	apply the structure of the ear and eye to their function/dysfunction in relation to environmental perception.
SC.O.HAP.2.14	apply the action of specific enzymes to their roles in bodily functions.
SC.O.HAP.2.15	incorporate the role of endocrine glands and their hormones into the overall functions and dysfunctions of the body.
SC.O.HAP.2.16	analyze the role of components and processes of the digestive system in supplying essential nutrients.
SC.O.HAP.2.17	explain how structures of the respiratory system are essential to cellular respiration, gas exchange and communication.
SC.O.HAP.2.18	illustrate the structures of the circulatory and lymphatic systems and the function of blood to the role of: • transportation • cellular support • defense.
SC.O.HAP.2.19	compare the compatibility of blood types and assess the molecular basis for blood functions.
SC.O.HAP.2.20	integrate the functions of the excretory system to the maintenance of the other body systems.
SC.O.HAP.2.21	compare and contrast the structure and function of male and female reproductive systems.
SC.O.HAP.2.22	outline the events of reproduction for the formation of gametes through fertilizations and embryological development.
SC.O.HAP.2.23	assess the role of components of the immune system in defending the body.
SC.O.HAP.2.24	research disease causative factors, symptoms, prevention and treatment.

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 as they evaluate the academic requirements and prepare for occupational opportunities in biology, engineering and technology. 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 and Applications of Science
SC.S.P.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions

Performance Descriptors SC.PD.P.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics students at the distinguished 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 relate science-technology-societal issues while using a	Physics students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a	Physics students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Physics students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a	Physics students at the novice level in the nature and applications of science: 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 construct solutions and defend their ideas to an authentic audience.	variety of sources to construct and defend their solutions.	construct and defend their solutions.	variety of sources to construct their solutions.	variety of sources to construct their solutions.

Objectives	Students will
SC.O.P.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.P.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.P.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.P.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.P.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.P.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.P.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.P.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.P.1.9	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).

High School	Physics
Standard: 2	The Content of Science
SC.S.P.2	Students will • 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: derive formula of best-fit for representation of motion	Physics students at the above mastery level: test the theoretical basis of mathematical methods for	Physics students at the mastery level: analyze data, construct and interpret graphs, and	Physics students at the partial mastery level: construct graphs and perform calculations for	Physics students at the novice level: collect data for motion in one- or two-dimensions;

and evaluate methods to solve problems for motion in one and/or two dimensions;	motion in one and/or two dimensions;	perform calculations for motion in one and/or two dimensions	motion in one and/or two dimensions	
create graphical, algebraic and/or trigonometric solutions problems involving vector components and resultants;	create graphical, algebraic and/or trigonometric solutions problems involving vector components and resultants;	interpret graphical, algebraic and/or trigonometric solutions to prove the values for vector components and resultants;	draw vector solutions;	define vectors;
experimentally verify Newton's Laws of Motion in terms of equilibrium and net force situations with an increasing number of variables;	experimentally verify Newton's Laws of Motion in terms of equilibrium and net force situations;	experimentally verify Newton's Laws of Motion in terms of equilibrium and net forces situations;	state Newton's Laws of Motion and perform calculations involving equilibrium and net force situations;	state Newton's Laws of Motion and express the difference between weight and mass;
experimentally verify the conservation of energy and momentum and deduce solutions for elastic and inelastic collisions;	predict the energy and momentum outcomes for elastic and inelastic collisions;	evaluate the conversation of energy and momentum and deduce solutions for elastic and inelastic collisions;	describe elastic and inelastic collisions;	define the law of conservation of energy;
experimentally and mathematically determine the behavior of fluids in terms of buoyant force, pressure and velocity and apply to everyday object;	experimentally and mathematically determine the behavior of fluids in terms of buoyant force, pressure and velocity;	describe the behavior of fluids in terms of buoyant force, pressure and velocity;	demonstrate the behavior of fluids in terms of buoyant force, pressure and velocity;	define buoyant force, pressure and velocity of fluids;
calculate the apparent frequency caused by Doppler shift and interpret the results;	calculate the apparent frequency caused by Doppler shift;	perform calculations to determine the properties of mechanical and transverse waves in order to research applications of Doppler shift;	define/ label the properties of mechanical and transverse waves and interpret a diagram showing the Doppler effect;	define/ label the properties of mechanical and transverse waves and the Doppler effect;
predict image placement and prove mathematically based upon the properties	predict image placement based upon the properties concave or convex mirrors	apply ray optics diagrams and the lens/mirror equation to solve and justify optics	experimentally find the image of a lens or mirror using an optics bench	define focal point, image, image distance and object distance;

concave or convex mirrors or lenses, and construct and analyze electrical circuits and calculate Ohm's law problems for complex circuits and find kilowatt-hours for an alternating current to determine the cost of using that current.	or lenses, and construct and analyze electrical circuits and calculate Ohm's law problems for complex circuit, and power of direct and alternating current using resistance, current and voltage.	problems, and construct and analyze electrical circuits, calculate Ohm's law problems for series and parallel circuits and distinguish between direct and alternating current.	and/or a ray diagram, and calculate Ohm's law problems for series circuits and distinguish between direct and alternating current.	 state Ohm's law and define direct current.

Objectives	Students will
SC.O.P.2.1	construct and interpret graphs of: • position versus time • velocity versus time • 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 • 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 wave properties: • wavelength • frequency • velocity • energy.
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.

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 as they evaluate the academic requirements and prepare for occupational opportunities in biology, engineering and technology. 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 and Application of Science
SC.S.CP.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions

Performance Descriptors SC.PD.CP.1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Conceptual Physics students at the distinguished 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 relate science-technology-societal issues while using a	Conceptual Physics students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a	Conceptual Physics students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and. relate science-technology-societal issues while using a variety of sources to	Conceptual Physics students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a	Conceptual Physics students at the novice level in the nature and applications of science: 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

variety of sources to construct solutions and defend their ideas to an authentic audience.	variety of sources to construct and defend their solutions.	construct and defend their solutions.	variety of sources to construct their solutions.	construct their solutions.

Objectives	Students will
SC.O.CP.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.CP.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.CP.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.CP.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.CP.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.CP.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.CP.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.CP.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.CP.1.9	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).

High School	**Conceptual Physics**
Standard: 2	Content of Science
SC.S.CP.2	Students will • 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: interpret graphs relating	Conceptual Physics students at the above mastery level: draw graphs relating	Conceptual Physics students at the mastery level: compare and contrast	Conceptual Physics students at the partial mastery level: define the units distance,	Conceptual Physics students at the novice level: define distance, velocity

distance, velocity and acceleration to time;	distance, velocity and acceleration to time;	distance, velocity and acceleration of moving objects to describe accelerated and non-accelerated motions;	velocity and acceleration;	and acceleration;
solve vector problems both graphically and algebraically; apply knowledge of projectile motion to determine horizontal and vertical velocities and/or distances;	solve vector problems graphically or algebraically; determine the horizontal and vertical distances of projectile motion;	solve right triangle vector problems both graphically and algebraically to analyze the motion of a projectile ;	solve right triangle vector problems graphically or algebraically and recognize a projectile moves in both horizontal and vertical direction;	draw a right triangle and recognize projectile motion;
calculate the net force acting on a two body system and determine the net force acting on the system;	illustrate forces acting on a two body system with a free body diagram and apply Newton's Laws as a system to explain natural phenomena;	illustrate forces acting on objects with free body diagrams and interpret Newton's Laws in terms of natural phenomena;	identify forces acting on an object and state Newton's Laws;	identify force as a vector and state one of Newton's Laws;
mathematically verify that mechanical energy is conserved and experimentally determine mechanical advantage of a mechanical system;	calculate kinetic and potential energy and experimentally determine mechanical advantage of a mechanical system;	compare and contrast kinetic and potential energies, deduce work, energy, power and efficiency, and recognize situations where mechanical energy is conserved;	define and give examples of kinetic and potential energies, efficiency in a mechanical system and state the formulas for work, energy and power;	define work, energy and power, stating that energy is conserved within a system;
solve equations for Archimedes' and/or Pascal's principles and apply Bernoulli's principle to everyday object (for example, paint sprayer or perfume bottle);	test Archimede's and Pascal's principles involving floating systems and apply Bernoulli's principle to everyday object (for example, paint sprayer or perfume bottle);	analyze Archimedes' and Pascal's principles to solve problems involving floating systems and recognize the effects of Bernoulli's principle on fluid motion;	demonstrate Archimede's, Pascal's, and Bernoulli's principles;	recognize that a floating object displaces fluid and state Bernoulli's principle;
interpret a phrase change diagram;	experimentally determine the melting point of a	compare and contrast the common temperature	distinguish between heat and temperature;	identify the common temperature scales and

	substance and graph the results;	scales, convert from one temperature scale to another and evaluate temperature in terms of kinetic energy;		their units;
appraise the role of heat transfer and the first law of thermodynamics involved in environmental and energy conservation issues and predict ways to eliminating the heat transfer;	examine the role of heat transfer and the first law of thermodynamics involved in environmental and energy conservation issues and predict ways of eliminating the heat transfer;	apply the mechanism of heat transfer and the first law of thermodynamics to environmental and energy conservation issues;	compare and contrast the three methods of heat transfer and state the first law of thermodynamics;	list the three methods of heat transfer and state the Law of Energy Conservation;
given wavelength calculate the energy of a wave, predict the effect of changing the frequency of a standing wave and calculate the apparent change in frequency that occurs with either a moving source or a moving detector;	given wavelength, calculate the energy of a wave, identify the nodes and antinodes of a standing wave and investigate the uses of Doppler shift in astronomy and cosmology;	perform calculations to determine the properties of sound and light waves, compare the Doppler shift effect for sound and light waves, and model the production of a standing wave, proposing the applications and examples of each;	label a transverse and longitudinal wave with the parts of the wave, construct a standing wave and identify examples of Doppler shift for either sound or light waves;	label a transverse wave with the parts of the wave, define a standing wave, and define the Doppler shift;
evaluate sound and light waves using the concepts of reflection, refraction, diffraction, and interference to predict, illustrate, and calculate image location involving plane and spherical mirrors, concave and convex lenses;	analyze sound and light waves using the concepts of reflection, refraction, diffraction and interference, calculating image location involving plane and spherical mirrors, concave and convex lenses;	compare and contrast sound and light waves using the concepts of reflection, refraction, diffraction and interference and diagram image location involving plane and spherical mirrors, concave and convex lenses;	compare sound and light waves using the concepts of reflection, refraction, diffraction and interference to find the image location involving plane and spherical mirrors, concave and convex lenses on an optical bench;	define reflection, refraction, diffraction and interference and find the image location involving plane and spherical mirrors on an optical bench;
analyze the applications of colored lights and pigments and relate the concept of polarization to three dimensional viewing, and	compare and contrast the applications of colored lights and pigments and analyze the concept of polarization, and	illustrate the applications of colored lights and pigments and examine the concept of polarization, and	compare primary and secondary colors of light and pigment and sketch the concept of polarization, and	list primary and secondary colors of light and pigment and define polarization, and

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.	calculate any variable in a simple circuit using Ohm's Law and distinguish between the flow of electrons in AC and DC circuits.	analyze simple direct current circuits using Ohm's Law and distinguish between AC and DC circuits, describing how AC is converted to DC.	relate Ohm's Law to simple circuits; distinguish between direct and alternating current.	list and define the variables of Ohm's Law.

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: • 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.

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 as they evaluate the academic requirements and prepare for occupational opportunities in engineering and technology. 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 Kills 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	Nature and Application of Science			
SC.S.PII.1	Students will • demonstrate an understanding of history and nature of science as a human endeavor encompassing the contributions of diverse cultures and scientists. • demonstrate the ability to use the inquiry process to solve problems. • relate science-technology-societal issues while using a variety of sources to construct and defend their solutions			
Performance Descriptors SC.PD.PII,1				
Distinguished	Above Mastery	Mastery	Partial Mastery	Novice
Physics II students at the distinguished 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 relate science-technology-societal issues while using a	Physics II students at the above mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments, analyze data for errors, and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a	Physics II students at the mastery level in the nature and applications of science: implement safe practices as they design, conduct, and revise experiments and base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a variety of sources to	Physics II students at the partial mastery level in the nature and applications of science: implement safe practices as they conduct and revise experiments, then base conclusions on observations and experimental evidence, and relate science-technology-societal issues while using a	Physics II students at the novice level in the nature and applications of science: 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

variety of sources to construct solutions and defend their ideas to an authentic audience.	variety of sources to construct and defend their solutions.	construct and defend their solutions.	variety of sources to construct their solutions.	construct their solutions.

Objectives	Students will
SC.O.PII.1.1	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.
SC.O.PII.1.2	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.
SC.O.PII.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.PII.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.PII.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.PII.1.6	investigate, compare and design scientific and technological solutions to address personal and societal problems.
SC.O.PII.1.7	given current science-technology-societal issues, construct and defend potential solutions.
SC.O.PII.1.8	relate societal, cultural and economic issues to key scientific innovations.
SC.O.PII.1.9	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, systems, or change over time).

High School	Physics
Standard: 2	Content of Science
SC.S.PII.2	Students will • 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
Physics II students at the distinguished level: differentiate among linear, quadratic, and inverse	Physics II students at the above mastery level: compose equations to express the relationships	Physics II students at the mastery level: apply graphical analysis to interpret motion in terms of	Physics II students at the partial mastery level: will draw motion graphs to show motion in terms of	Physics II students at the novice level: measure distance and time to calculate velocity and

relationships found in graphs of motion in terms of position, velocity, acceleration, and time and evaluate data to deduce mathematical relationships involving one and two dimensional motion;	found in graphs of motion in terms of position, velocity, acceleration, and time and summarize data to deduce mathematical relationships involving one and two dimensional motion;	position, velocity, acceleration, and time and use data to deduce mathematical relationships involving one and two dimensional motion;	position, velocity, acceleration, and time and use data to deduce mathematical relationships involving one dimensional motion;	acceleration and describe mathematical relationships involving one dimensional motion;
critique experiments to verify laws of motion including Newton's Laws, Conservation of Momentum, Conservation of Energy, and rotational motion;	design experiments to verify laws of motion including Newton's Laws, Conservation of Momentum, Conservation of Energy, and rotational motion;	experimentally verify laws of motion including Newton's Laws, Conservation of Momentum, and Conservation of Energy and synthesize concepts of rotational motion from linear motion equations;	recognize that laws of motion including Newton's Laws, Conservation of Momentum, and Conservation of Energy can be verified experimentally and contrast the concepts of linear and rotational motion;	perform experiments on motion topics including Newton's Laws, Conservation of Momentum, and Conservation of Energy and define the concepts of rotational motion;
design experiments to verify the effect of variables on the properties and dynamics of fluids;	evaluate the effect of variables to the properties and dynamics of fluids;	predict and verify the effect of variables on the properties and dynamics of fluids;	apply Pascal's Archimedes', and Bernoulli's, principles in everyday situations;	define the properties and dynamics of fluids;
justify experimental results using concepts of thermal physics;	relate experimental results using concepts of thermal physics;	interpret and apply concepts of thermal physics;	apply concepts of thermal physics;	state 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;	summarize the relative values of electric force and field strength based on the magnitude of and the distance from the point charge;	deduce the relative values of electric force and field strength based on the magnitude of and the distance from the point charge;	relate electric fields to electric forces and distinguish between them;	calculate the field strength using Coulomb's Law;
design, construct, diagram and evaluate complex electrical circuits, adding various components;	design, construct, diagram and evaluate complex electrical circuits;	construct, diagram and evaluate complex electrical circuits;	construct, diagram and evaluate simple electrical circuits;	construct and diagram simple electrical circuits;

justify 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;	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;	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;	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;	relate magnetism to electric charge and electricity;
critique electromagnetic induction and justify its application to particular electric circuits and various devices;	critique electromagnetic induction and evaluate its application to electric circuits and various devices;	critique electromagnetic induction and evaluate its application to electric circuits and various devices;	apply electromagnetic induction to electric circuits and various devices;	describe electromagnetic induction;
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;	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;	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;	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;	investigate the applications of semiconductors and superconductors in the advancement of electronics through the development of diodes, transistors, and integrated circuits;
assess the kinetic and potential energies and energy transformations of different oscillating systems;	compare and contrast the kinetic and potential energies and energy transformations of different oscillating systems;	apply knowledge of simple harmonic motion to calculate the kinetic and potential energies of the oscillating system;	calculate the kinetic and potential energies of the oscillating system;	calculate the kinetic and/or potential energies of the oscillating system;
evaluate wave properties and their interactions, predicting how optical and acoustical devices will incorporate new materials to improve their effectiveness;	analyze optical and acoustical devices for their effective application of wave properties and their interactions;	examine wave properties and their interactions to evaluate their application in the development of optical and acoustical devices;	review wave properties and their interactions while researching their application to the development of optical and acoustical devices;	list optical and acoustical devices and identify the property that is the basis of the device;
appraise the role of	analyze the role of technology in the	examine and critique the role of technology in the	research the development of historical models of the	arrange the models of the atom historically and list

technology in the development of historical models of the atom 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, and categorize nuclei based on their placement on the periodic table and proton to neutron ratio to demonstrate different types of decay processes.	development of historical models of the atom and 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, and using the proton to neutron ratio, predict the type of nuclear decay that could occur for nuclei.	development of historical models of the atom and evidence 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, and differentiate between stable and nuclear nuclei, and if the nucleus is unstable predict the type(s) of nuclear decay.	atom and 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, and differentiate between stable and unstable nuclei and list types of decay that the unstable nuclei could display.	evidence for the historical development of the quantum mechanical theory; calculate an atom's binding energy, and define stable and unstable nuclei and list types of decay that the unstable nuclei could display.

Objectives	Students will
SC.O.PII.2.1	apply graphical analysis to interpret motion in terms of: • position • velocity • acceleration • 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) • Conservation of Energy.
SC.O.PII.2.4	using knowledge of linear motion equations, synthesize concepts of rotational motion: • 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:

	• distinction of heat and temperature • thermal expansion • properties of Ideal Gases • Kinetic Theory • specific heat • 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: • Coulomb's Law • 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 - to calculate the kinetic and potential energies of the oscillating system: • springs • pendulums • other oscillating objects.
SC.O.PII.2.13	examine wave properties and their interactions: • reflection • refraction • dispersion • total internal deflection • interference • diffraction • Doppler Shift • beats • 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: • radioactivity • atomic spectra • particle accelerators, etc.).
SC.O.PII.2.16	examine evidence for the historical development of the quantum mechanical theory: • 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.

FISCAL NOTE FOR PROPOSED RULES

Rule Title: **W. Va. 126CSSR44C, Policy 2520.35 Science 9-12 Content Standards and Objectives for West Virginia High Schools**

Type of Rule: **X** Legislative ☐ Interpretive ☐ Procedural

Agency: West Virginia Department of Education

Address: Capitol Building 6, Room 608

1900 Kanawha Boulevard, East

Charleston, WV 25305

Phone Number: 304.558.5325 Email: cljwilli@access.k12.wv.us

Fiscal Note Summary

Summarize in a clear and concise manner what impact this measure will have on costs and revenues of state government.

Fiscal Note Detail

Show over-all effect in Item 1 and 2 and, in Item 3, give an explanation of Breakdown by fiscal year, including long-range effect.

	FISCAL YEAR		
Effect of Proposal	Current Increase/Decrease (use"-")	Next Increase/Decrease (use"-")	Fiscal Year (Upon Full Implementation)
1. Estimated Total Cost	0	0	0
Personal Services	0	0	0
Current Expenses	0	0	0
Repairs & Alterations	0	0	0
Assets	0	0	0
Other	0	0	0
2. Estimated Total Revenues	0	0	0

Rule Title: **W. Va. 126CSSR44C, Policy 2520.35 Science 9-12 Content Standards and Objectives for West Virginia High Schools**

Rule Title: **W. Va. 126CSSR44C, Policy 2520.35 Science 9-12 Content Standards and Objectives for West Virginia High Schools**

3. **Explanation of above estimates (including long-range effect);**
Please include any increase or decrease in fees in your estimated total revenues.

MEMORANDUM

Please identify any areas of vagueness, technical defects, reasons the proposed rule **would not** have a fiscal impact, and/or any special issues **not** captured elsewhere on this form.

No costs or revenues will be impacted by the proposed amendment of W. Va. 126CSR44C, Policy 2520.35 Science 9-12 Content Standards and Objectives.

Signature of Agency Head or Authorized Representative

Date

1-14-10

126CSR44R

POLICY 2520.35: 21st Century Science 9-12 Content Standards and Objectives for West Virginia Schools

COMMENT PERIOD ENDS: March 15, 2010

COMMENT RESPONSE FORM

The following form is provided to assist those who choose to comment on the Environmental Science content standards and objectives section of Policy 2520.35: 21st Century Science 9-12 Content Standards and Objectives for West Virginia Schools. Additional sheets may be attached, if necessary.

Name : _____ Organization: _____

Title: _____

Street Address: _____

City: _____ State: _____ Zip: _____

Please check the box below that best describes your role.

☐ School System Superintendent	☐ School System Staff	☐ Parent/Family
☐ Principal	☐ Teacher	☐ Business/Industry
☐ Professional Support Staff	☐ Service Personnel	☐ Community Member

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COMMENTS/SUGGESTIONS
§126-44R-1. General.

§126-44R. Environmental Science Content Standards and Objectives.

Please direct all comments to:
Robin Anglin
Office of Instruction
West Virginia Department of Education
Capitol Building 6, Room 608
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0330
E-Mail Address: ranglin@access.k12.wv.us
Fax No.: (304) 558-1834