BIOLOGY

The student will investigate and understand that chemical and biochemical processes are essential for life. Key ideas include:

- water (chemistry) has an influence on life processes.
- protein synthesis is the process of forming proteins which influences inheritance and evolution.

The student will investigate and understand that cells have structure and function. Key ideas include:

- cell structures and processes are involved in cell growth and division
- the structure and function of the cell membrane support cell transport.
- structures in unicellular and multicellular organisms work interdependently to carry out life processes.

The student will investigate and understand that chemical and biochemical processes are essential for life. Key ideas include:

- enzymes have a role in biochemical processes.
- the processes of photosynthesis and respiration include the capture, storage, transformation, and flow of energy.

The student will demonstrate an understanding of scientific and engineering practices by:

- analyze data using tools, technologies, and/or models to make valid and reliable scientific claims or determine an optimal design solution.

The student will investigate and understand that there are common mechanisms for inheritance. Key ideas include:

- DNA has structure and is the foundation for protein synthesis.
- the variety of traits in an organism are the result of the expression of various combinations of alleles.
- meiosis has a role in genetic variation between generations.

The student will investigate and understand that bacteria and viruses have an effect on living systems. Key ideas include:

- viruses depend on a host for metabolic processes.
- the modes of reproduction/replication can be compared.
- bacteria and viruses have a role in other organisms and the environment.

The student will investigate and understand that modern classification systems can be used as organizational tools for scientists in the study of organisms. Key ideas include:

- organisms have structural and biochemical similarities and differences.
- the functions and processes of protists, fungi, plants, and animals allow for comparisons and differentiation within the Eukarya kingdoms.
- developmental stages in different organisms can be used to classify organisms.

The student will investigate and understand that populations change through time. Key ideas include:

- evidence is found in fossil records and through DNA analysis.
- genetic variation, reproductive strategies, and environmental pressures affect the survival of populations.
- biological evolution has scientific evidence and explanations.
- natural selection is a mechanism that leads to adaptations and may lead to the emergence of new species.

The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems. Key ideas include:

- interactions within and among populations include carrying capacities, limiting factors, and growth curves.
- nutrients cycle with energy flow through ecosystems.
- natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia.

CHEMISTRY

The student will investigate and understand that elements have properties based on their atomic structure. The periodic table is an organizational tool for elements based on these properties. Key information pertaining to the periodic table includes:

- average atomic mass, isotopes, mass number, and atomic number.
- electron configurations, valence electrons, excited electrons, and ions.
- trends within groups and periods including atomic radii, electronegativity, shielding effect, and ionization energy.
- electron configurations, valence electrons, excited electrons, and ions

The student will investigate and understand that atoms are conserved in chemical reactions. Knowledge of chemical properties of the elements can be used to describe and predict chemical interactions. Key ideas include:

- chemical formulas are models used to represent the number of each type of atom in a substance.
- substances are named based on the number of atoms and the type of interactions between atoms.
- balanced chemical equations model rearrangement of atoms in chemical reactions.
- reaction types can be predicted and classified.

The student will investigate and understand that molar relationships compare and predict chemical quantities. Key ideas include:

- Avogadro's principle is the basis for molar relationships.
- stoichiometry mathematically describes quantities in chemical composition and in chemical reactions.

The student will investigate and understand that solutions behave in predictable and quantifiable ways. Key ideas include:

- molar relationships determine solution concentration.
- changes in temperature can affect solubility.
- pH and pOH quantify acid and base dissociation.

The student will investigate and understand that the phases of matter are explained by the kinetic molecular theory. Key ideas include:

- pressure and temperature define the phase of a substance.
- intermolecular forces affect physical properties.

The student will investigate and understand that thermodynamics explains the relationship between matter and energy. Key ideas include:

- heat energy affects matter and interactions of matter.
- heating curves provide information about a substance.
- reactions are endothermic or exothermic.
- rates of reactions depend on catalysts and activation energy.

EARTH SCIENCE

The student will demonstrate an understanding that there are scientific concepts related to the origin and evolution of the universe. Key ideas include:

- the big bang theory explains the origin of universe.
- stars, star systems, and galaxies change over long periods of time.

The student will investigate and understand that Earth is unique in our solar system. Key ideas include:

- Earth supports life because of its relative proximity to the sun and other factor.
- the dynamics of the sun-Earth-moon system cause seasons, tides, and eclipses.

The student will investigate and understand that there are major rock-forming and ore minerals. Key ideas include:

- analysis of physical and chemical properties supports mineral identification.
- minerals originate and are formed in specific ways.
- characteristics of the sun, planets and their moons, comets, meteors, asteroids, and dwarf planets are determined by materials found in each body.

The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include:

- water influences geologic processes including soil development and karst topography.
- the nature of materials in the subsurface affect the water table and future availability of fresh water.
- weather and human usage affect freshwater resources, including water locations, quality, and supply.

The student will investigate and understand that plate tectonic theory explains Earth's internal and external geologic processes. Key ideas include:

- convection currents in Earth's interior lead to the movement of plates and influence the distribution of materials in Earth's layers, and may impact the magnetic field.
- interaction between tectonic plates causes the development of mountain ranges and ocean basins.

The student will investigate and understand that freshwater resources influence and are influenced by geologic processes and human activity. Key ideas include:

- water influences geologic processes including soil development and karst topography.
- the nature of materials in the subsurface affect the water table and future availability of fresh water

The student will investigate and understand that many aspects of the history and evolution of Earth and life can be inferred by studying rocks and fossils. Key ideas include:

- traces and remains of ancient, often extinct, life are preserved by various means in sedimentary rocks.
- superposition, cross-cutting relationships, index fossils, and radioactive decay are methods of dating rocks and Earth events and processes.

The student will investigate and understand that oceans are complex, dynamic systems and are subject to long- and short-term variations. Key ideas include:

- chemical, biological, and physical changes affect the oceans.
- environmental and geologic occurrences affect ocean dynamics.
- unevenly distributed heat in the oceans drives much of Earth's weather.

The student will investigate and understand that the atmosphere is a complex, dynamic system and is subject to long-and short-term variations. Key ideas include:

- the composition of the atmosphere is critical to most forms of life.
- biologic and geologic interactions over long and short time spans change the atmospheric composition.
- natural events and human actions may stress atmospheric regulation mechanisms.
- human actions, including economic and policy decisions, affect the atmosphere.

The student will investigate and understand that Earth's weather and climate are the result of the interaction of the sun's energy with the atmosphere, oceans, and the land. Key ideas include:

- weather involves the reflection, absorption, storage, and redistribution of energy over short to medium time spans.
- extreme imbalances in energy distribution in the oceans, atmosphere, and the land may lead to severe weather conditions.
- changes in the atmosphere and the oceans due to natural and human activity affect global climate.

ALGEBRA I

Expressions and Operations:

The student will:

- represent verbal quantitative situations algebraically.
- evaluate algebraic expressions for given replacement values of the variables.

The student will perform operations on polynomials including:

- applying the laws of exponents to perform operations on expressions.
- adding, subtracting, multiplying, and dividing polynomials.
- factoring completely first- and second-degree binomials and trinomials in one variable.

The student will simplify:

- square roots of whole numbers and monomial algebraic expressions.
- cube roots of integers.
- numerical expressions containing square or cube roots.

Equations and Inequalities:

The student will solve:

- multistep linear equations in one variable algebraically.
- quadratic equations in one variable algebraically.
- literal equations for a specified variable.
- systems of two linear equations in two variables algebraically and graphically.
- practical problems involving equations and systems of equations.

The student will:

- solve multistep linear inequalities in one variable algebraically and represent the solution graphically.
- represent the solution of linear inequalities in two variables graphically.
- solve practical problems involving inequalities.
- represent the solution to a system of inequalities graphically.
- determine the slope of a line when given an equation of the line, the graph of the line, or two points on the line.
- write the equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.
- graph linear equations in two variables.

Functions:

The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including:

- determining whether a relation is a function; domain and range, zeros, intercepts.
- values of a function for elements in its domain.
- connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs.

Statistics:

The student, given a data set or practical situation, will analyze a relation to determine whether a direct or inverse variation exists, and represent a direct variation algebraically and graphically and an inverse variation algebraically.

The student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems, using mathematical models of linear and quadratic functions.

GEOMETRY

Reasoning, Lines, and Transformations:

The student will use deductive reasoning to construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include;

- identifying the converse, inverse, and contrapositive of a conditional statement.
- translating a short verbal argument into symbolic form.
- determining the validity of a logical argument.

The student will use the relationships between angles formed by two lines intersected by a transversal to:

- prove two or more lines are parallel.
- solve problems, including practical problems, involving angles formed when parallel lines are intersected by a transversal.

The student will solve problems involving symmetry and transformation. This will include:

- investigating and using formulas for determining distance, midpoint, and slope.
- applying slope to verify and determine whether lines are parallel or perpendicular.
- investigating symmetry and determining whether a figure is symmetric with respect to a line or a point.
- determining whether a figure has been translated, reflected, rotated, or dilated, using coordinate methods.

The student will construct and justify the constructions of:

- a line segment congruent to a given line segment.
- the perpendicular bisector of a line segment.
- a perpendicular to a given line from a point not on the line.
- a perpendicular to a given line at a given point on the line.
- the bisector of a given angle.
- an angle congruent to a given angle.
- a line parallel to a given line through a point not on the line.
- an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Triangles:

The student, given information concerning the lengths of sides and/or measures of angles in triangles, will solve problems, including practical problems. This will include:

- ordering the sides by length, given angle measures.
- ordering the angles by degree measure, given side lengths.

- determining whether a triangle exists.
- determining the range in which the length of the third side must lie.

The student, given information in the form of a figure or statement, will prove two triangles are congruent.

The student, given information in the form of a figure or statement, will prove two triangles are similar.

The student will solve problems, including practical problems, involving right triangles. This will include applying:

- the Pythagorean Theorem and its converse.
- properties of special right triangles.
- trigonometric ratios.

Polygons and Circles:

The student will verify and use properties of quadrilaterals to solve problems, including practical problems.

The student will solve problems, including practical problems, involving angles of convex polygons. This will include determining the:

- sum of the interior and/or exterior angles.
- measure of an interior and/or exterior angle.
- number of sides of a regular polygon.

The student will solve problems, including practical problems, by applying properties ofcircles. This will include determining:

- angle measures formed by intersecting chords, secants, and/or tangents.
- lengths of segments formed by intersecting chords, secants, and/or tangents; arc length, and area of a sector.

The student will solve problems involving equations of circles.

Three-Dimensional Figures:

The student will use surface area and volume of three-dimensional objects to solve practical problems.

SOCIAL STUDIES – WORLD HISTORY & GEOGRAPHY TO 1500

These standards will enable students to explore the historical development of people, places, and patterns of life from ancient times until 1500 A.D. (C.E.) in terms of the impact on Western civilization.

Human Origins and Early Civilizations, Prehistory to 1000 B.C. (B.C.E.):

The student will apply social science skills to understand the period from the Paleolithic Era to the agricultural revolution by:

- explaining the impact of geographic environment on hunter-gatherer societies
- describing characteristics of hunter-gatherer societies, including their use of tools and fire.
- analyzing how technological and social developments gave rise to sedentary communities.
- analyzing how archaeological discoveries are changing current understanding of early societies.

The student will apply social science skills to understand the ancient river valley civilizations, including those of Mesopotamia, Egypt, the Indus River Valley, and China and the civilizations of the Hebrews and Phoenicians, by:

- locating these civilizations in time and place and describing their major geographic features.
- describing the development of social, political, and economic patterns, including slavery.
- explaining the development and interactions of religious traditions.
- describing the origins, beliefs, traditions, customs, and spread of Judaism.
- explaining the development of language and writing.

Classical Civilizations and Rise of Religious Traditions, 1000 B.C. (B.C.E.) to 500 A.D. (C.E.):

The student will apply social science skills to understand the civilizations of Persia, India, and China in terms of chronology, geography, social structures, government, economy, religion, and contributions to later civilizations by:

- locating Persia in time and place, including Zoroastrianism and the development of an imperial bureaucracy.
- locating India in time and place, including its origins, early development, and the debate over the Aryan migrations.
- describing the origins, beliefs, traditions, customs, and spread of Hinduism.
- describing the origins, beliefs, traditions, customs, and spread of Buddhism.

- locating China in time and place, including the development of an empire and the construction of the Great Wall
- describing the impact of Confucianism, Taoism, and Buddhism.

The student will apply social science skills to understand ancient Greece in terms of its impact on Western civilization by:

- locating Greek civilizations in time and place and describing their major geographic features.
- describing the cultural development of Athens and Sparta, with emphasis on the significance of citizenship and the development of democracy.
- evaluating the significance of the conquest of Greece by Macedonia and the formation and spread of Hellenistic culture by Alexander the Great.
- citing and explaining contributions in drama, poetry, history, sculpture, architecture, science, mathematics, and philosophy, with emphasis on Socrates, Plato, and Aristotle.

The student will apply social science skills to understand ancient Rome from about 700 B.C. (B.C.E.) to 500 A.D. (C.E.) in terms of its impact on Western civilization by:

- locating Roman civilizations in time and place and describing their major geographic features.
- describing the social and religious structure of ancient Rome.
- describing and evaluating the political and military structure of the Roman Republic under the rule of Julius Caesar.
- describing and evaluating the political structure of the Roman Empire under the rule of Augustus Caesar.
- evaluating the fall of the Western Roman Empire and the Germanic invasions.

The student will apply social science skills to understand the development of Christianity by:

- describing the origins, beliefs, traditions, customs, and spread of Christianity in time and place.
- explaining the unifying role of the Church in Europe after the collapse of Rome.
- sequencing events related to the spread and influence of Christianity and the Catholic Church throughout Europe.

Postclassical Civilizations, 300 to 1000 A.D. (C.E.):

The student will apply social science skills to understand the Byzantine Empire and Eastern Europe from about 300 to 1000 A.D. (C.E.) by:

- explaining the influence of geography on the establishment of Constantinople as the capital of the Eastern Roman Empire and describing the Byzantine Empire in time and place.
- describing Justinian and his contributions, including the codification of Roman law, and the expansion of the Byzantine Empire and economy.
- characterizing the role Byzantine art and architecture played in the preservation of Greek and Roman traditions.
- explaining the disputes that led to the split between the Roman Catholic Church and the Greek Orthodox Church.

The student will apply social science skills to understand the Islamic civilization from about 600 to 1000 A.D. (C.E.) by:

- describing the origin, location, beliefs, traditions, customs, and spread of Islam, with emphasis on the Sunni-Shi'a division and the Battle of Tours.
- assessing the influence of geography on Islamic economic, social, and political development, including the impact of conquest and trade.
- explaining the cultural and scientific contributions and achievements of Islamic civilization.

The student will apply social science skills to understand Western Europe during the Middle Ages from about 500 to 1000 A.D. (C.E.) in terms of its impact on Western civilization by:

- locating and describing the societies of Western Europe during the Middle Ages in time and place.
- describing the social, religious, and cultural patterns of the Vikings.
- evaluating and explaining the development of feudalism and the manor system.

Regional Interactions, 1000 to 1500 A.D. (C.E.):

The student will apply social science skills to understand the civilizations and empires of Asia, with emphasis on Japan and China, by:

- locating and explaining major global and regional trade routes.
- explaining technological advances and transfers, networks of economic interdependence, and cultural interactions.
- explaining the impact of Shinto and Buddhist traditions and the influence of Chinese culture on the region.

The student will apply social science skills to understand the civilizations and empires of Africa, with emphasis on the African kingdoms of Axum and Zimbabwe and the West African civilizations of Ghana, Mali, and Songhai, by:

- locating early civilizations and kingdoms in time and place and describing major geographic features.
- explaining the development of social, political, economic, religious, and cultural patterns in each region.

The student will apply social science skills to understand the major civilizations of the Western Hemisphere, including the Mayan, Aztec, and Incan, by:

- locating early civilizations in time and place and describing major geographic features.
- explaining the development of social, political, economic, religious, and cultural patterns in the civilizations of the Americas.
- evaluating and explaining the European interactions with these societies, with emphasis on trading and economic interdependence.

The student will apply social science skills to understand the social, economic, and political changes and cultural achievements in the high and late medieval periods by:

- describing the emergence of centralized monarchies (England, France, Spain, and Russia) and distinctive political developments in each.
- evaluating and explaining the preservation and transfer to Western Europe of Greek, Roman, and Arabic philosophy, medicine, and science.

The student will apply social science skills to understand the developments leading to the Renaissance in Europe in terms of its impact on Western civilization by:

- determining the economic and cultural foundations of the Italian Renaissance.
- citing the contributions of artists and philosophers of the Renaissance, as contrasted with the medieval period, including Leonardo da Vinci, Michelangelo, and Petrarch.