VALWOOD

GO BEYOND

Middle School Science Curriculum
Three Year Rotation

Earth Science Overview

Course Description

Earth science allows students to investigate their home planet, Earth. They study its composition as well as the forces that act on it and within it. Main studies of Science include geology, oceanography, volcanism, meteorology, and astronomy. Erosion, how minerals and rocks are formed, how minerals and rocks are classified, weather, earthquakes, and volcanoes are some of the subtopics covered in this course. This investigation of Earth is accomplished through group learning, paired activities, class discussions, project based assignments, labs, lecture, and hands on learning. Students will take over ownership of parts of their learning through proper research. Astronomy will be a project based unit at the end of the year.

Topics at a Glance

- Introduction to Earth
- The Lithosphere
- The Hydrosphere
- Planet Earth
- Earth and Space

Assessments

- Teacher-created assessments
- Lab Reports
- Standardized Test

Effective Components

- Organizes data into graphs, tables, and charts
- Analyzes scientific data via calculations and inference
- Recognizes the importance of explaining data with precision and accuracy
- Uses models
- Asks quality questions
- Uses technology

Grade Level Expectations

1. The history of the universe, Solar system and Earth can be inferred from evidence left from past events.
2. As part of the Solar System, Earth interacts with various extraterrestrial forces and energies such as gravity, solar phenomena, electromagnetic radiation, and impact events that influence the planet's geosphere, atmosphere, and biosphere in a variety of ways.
3. The theory of plate tectonics helps explain geological, physical, and geographical features of Earth.
4. Climate is the result of energy transfer among interactions of the atmosphere, hydrosphere, geosphere, and biosphere.
5. There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources.
6. The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes.
7. Natural hazards have local, national and global impacts such as volcanoes, earthquakes, tsunamis, hurricanes, and thunderstorms.

3. Earth Systems Science

Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.

Valwood Graduates:
The preschool through twelfth-grade concepts and skills that all students must master to ensure their success in a postsecondary and workforce setting.

Valwood Graduate Competencies in the Earth Systems Science standard:

- Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet
- Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system
- Describe how humans are dependent on the diversity of resources provided by Earth and Sun

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Weather is a result of complex interactions of Earth's atmosphere, land and water, that are driven by energy from the Sun, and can be predicted and described through complex models

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Differentiate between basic and severe weather conditions, evaluate and assess criteria for severe weather watches and warnings, and develop an appropriate action plan for personal safety and the safety of others b. Observe, gather, and analyze data for various weather conditions and compare to historical data for that date and location; identify and explain long term patterns and trends in the data c. Gather numerical weather data and use models to develop and communicate an authentic local weather prediction d. Identify the properties and composition of the atmosphere (layers and components) e. Demonstrate that air is matter, having mass and taking up space (relationships among mass, weight, volume, and density) f. Describe or illustrate the processes by which energy from the Sun drives atmospheric circulation; g. Extension: enumerate and evaluate Earth's atmospheric energy budget	**Inquiry Questions:** 1. Why does weather vary from day to day? 2. What are the strengths and limitations of different types of weather models? 3. What are the variables that make predicting weather challenging? 4. How do weather patterns relate to climate? **Relevance and Application:** 1. Weather stations, buoys, satellites, radar, and computer modeling are examples of technology used to help forecast weather. 2. Weather prediction is based on the interaction of many variables. 3. Weather prediction can save lives, protect property, and conserve resources. **Nature of Discipline:** 1. Evaluate of the accuracy of various tools used in forecasting weather. 2. Use the historical context and impact of early weather research and consider the potential implications for current weather studies on science and our society.

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate and justify an evidence-based scientific explanation to account for Earth's different climates b. Research and evaluate direct and indirect evidence to explain how climates vary from one location to another on Earth c. Examine, evaluate, and question information from a variety of sources and media to investigate how climates vary from one location to another on Earth; Extension: Identify and appraise biases found within climate change news and information d. Extension: Analyze peer-reviewed and research-based data and evidence to evaluate the current state of global climate change e. Identify natural and human processes that cycle carbon through the earth system, the relative speed of these processes, and the impacts of changes to these processes f. Extension: Collect data and use carbon calculators to calculate and analyze carbon footprints	**Inquiry Questions:** 1. How does the climate in one area compare and contrast with another area? 2. Why are there different climates on Earth? 3. How has Earth's climate changed over time? 4. What evidence supports and/or contradicts human influence on climate change? 5. What is the difference between weather and climate? **Relevance and Application:** 1. Data tables, charts, and graphs allow people to compare and contrast various climates around the globe. 2. Computer models help people understand past, present, and future climates. *3. Changes in climate conditions can affect the health and function of ecosystems and the survival of entire species.* *4. Carbon calculators allow people to calculate carbon footprints.* **Nature of Discipline:** 1. Ask testable questions and make a falsifiable hypothesis about Earth's climate and use an inquiry-based approach to find an answer. 2. Describe various techniques that scientists use to study climate,and suggest ways that each technique can be used to better understand various climates and changes in climate. *3. Recognize that people in different cultures and at different times in history have made contributions to the advancement of science.*

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

GRADE LEVEL EXPECTATION

Concepts and skills students master:

3. The Solar System is comprised of various objects that orbit the Sun and are classified based on their characteristics

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Calculate scale factors and construct a scale model of the Solar System; use it to explain the motion of objects in the system such a planets, Sun, moons, asteroids, comets, and dwarf planets b. Describe methods and equipment used to explore the Solar System and beyond; Extension: identify and evaluate challenges and limitations of space exploration; analyze and debate the merits of space exploration c. Design an investigation that involves direct observation of objects in the sky, and analyze and explain results d. Research, critique, and communicate scientific theories that explain how the Solar System was formed e. Use computer data sets and simulations to explore objects in the Solar System f. Recognize that mathematical models are used to predict orbital paths and events g. Use mathematical expressions to describe the movement of an object (e.g. speed/velocity, force, acceleration, kinetic energy); Extension: design and conduct an investigation that simulates movement of objects in space (e.g., impact craters, rocket launches, etc.)	**Inquiry Questions:** 1. How are the various bodies in the Solar System similar and different? 2. How does investigating characteristics of the various bodies in the Solar System provide clues to Earth's origin and evolution? 3. Why do objects such as satellites, moons and planets stay in orbit? 4. How is the life cycle of a star such as the Sun similar to the cycle of life on Earth? **Relevance and Application:** 1. Various technological methods and equipment such as telescopes are used to investigate far-away objects in the Solar System and beyond. 2. By representing galaxies and solar systems, planetariums allow people to simulate the experience of outer space. **Nature of Discipline:** 1. Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that planets follow the same rules about forces as other objects. 2. Recognize that our current understanding of the Solar System has developed over centuries of studies by many scientists, and that through continued scientific investigations and advances in data collection, we will continue to refine our understanding of the solar system. *3. Recognizes that people in different cultures and at different times in history have made contributions to the advancement of science.*

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

GRADE LEVEL EXPECTATION

Concepts and skills students master:

5. Major geologic events such as earthquakes, volcanic eruptions, mid-ocean ridges, and mountain formation are associated with plate boundaries and attributed to plate motions

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather, analyze, and communicate data that explains Earth's plates, plate motions, and the results of plate motions b. Identify, interpret, and explain models of plate motions on Earth, Extension: and analyze differences in rates of plate motions for explanation of the differences c. Use maps to locate likely geologic "hot spots", using evidence of earthquakes and volcanic activity d. Use web-based or other technology tools to show connections and patterns in data about tectonic plate boundaries and earthquakes, volcanic eruptions, and mountain formation e. Compare mountain formation on other planets/moons to how formation occurs on Earth, speculating on how plate motions fit in those locations	**Inquiry Questions:** 1. How can major geologic events be attributed to plate movement? 2. What evidence supports the theory of plate tectonics? 3. What are the effects of plate movement along plate boundaries? **Relevance and Application:** 1. Computer models and simulations help us understand and make informed decisions about major geologic events. 2. Building codes and emergency plans often reflect natural threats in an area. **Nature of Discipline:** 1. Construct a model to demonstrate how plate movement results in geologic events. 2. Trace the development of a scientific theory using the theory of plate tectonics. 3. Describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others. *4. Recognize that people in different cultures and at different times in history have made contributions to the advancement of science.*

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Describe and interpret how Earth's geologic history and place in space are relevant to our understanding of the processes that have shaped our planet

GRADE LEVEL EXPECTATION

Concepts and skills students master:

6. Geologic time, history, and changing life forms are indicated by fossils and successive sedimentation, folding, faulting, and uplifting of layers of sedimentary rock

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Extension: Create a scale model of the geologic time scale, explain why it is divided the way it is, and why it is used b. Identify and describe the impact of major geologic events on life on Earth c. Identify and describe major events in Earth's geologic history d. Extension: Correlate the major events in Earth's geologic history, the type of life on Earth, and the geologic time scale divisions e. Use direct and indirect evidence to determine the sequence of events in geologic time	**Inquiry Questions:** 1. How can we interpret data from layers of rock? 2. What is geologic time? **Relevance and Application:** 1. Knowledge of Earth's structure such as knowing where to mine for gold or drill for oil helps humans locate and extract resources. 2. Dating fossils absolutely and relatively helps assemble the story of the evolution of life on Earth. **Nature of Discipline:** 1. Ask testable questions and make falsifiable hypotheses about the history of the earth and design a method to find an answer. 2. Describe how scientists study fossils, and suggest ways that understanding fossil evidence contributed to our knowledge about life on Earth over geologic time.

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

GRADE LEVEL EXPECTATION: Middle SchoolScience

Concepts and skills students master:

7. Complex interrelationships exist between Earth's structure and natural processes that over time are both constructive and destructive

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather, analyze, and communicate an evidence-based explanation for the complex interaction between Earth's constructive and destructive forces b. Gather, analyze and communicate evidence from text and other sources that explains the formation of Earth's surface features Extension: and the rates at which these occur c. Use a computer simulation for Earth's changing crust d. Identify and explain the processes that create minerals, rocks (igneous, metamorphic, and sedimentary), and soils Extension: and the variations in each process that produce a variety of types of minerals, rocks, or soils e. Identify and discuss evidence that conservation of mass applies to the materials that make up the crust of the earth f. Extension: Analyze models of erosion and deposition for accuracy relative to real event	**Inquiry Questions:** 1. How do forces inside Earth and on the surface build, destroy, and change Earth's crust? *(rock cycle, weathering, erosion and deposition).* 2. How does Earth's surface change over time? *(landforms, soil formation and soil profiles).* **Relevance and Application:** 1. There are costs and benefits to building in areas that are prone to constructive and destructive forces such as earthquakes and landslides. 2. Harbors, glaciers, and geysers change over time based on geologic and natural events. **Nature of Discipline:** 1. Practice the collaborative inquiry process that scientists use to identify local evidence of Earth's constructive and destructive processes. 2. Create and compare models that show how natural processes affect Earth's structures.

Content Area: Science - Middle School

Standard: 3. Earth Systems Science

Valwood Graduates:

Evaluate evidence that Earth's geosphere, atmosphere, hydrosphere, and biosphere interact as a complex system

GRADE LEVEL EXPECTATION

Concepts and skills students master:

8. Water on Earth is distributed and circulated through oceans, glaciers, rivers, ground water, and the atmosphere

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather and analyze data from a variety of print resources and investigations to account for local and world-wide water circulation and distribution patterns; Extension: infer how these patterns will change with global climate changes (salinity and temperature affect density and circulation – a pattern which requires understanding of the relationships among mass, weight, volume, and density) b. Use evidence to model how water is transferred throughout the Earth (water cycle) c. Identify problems, and debate solutions related to water quality, circulation, and distribution – both locally and worldwide d. Identify the various causes and effects of water pollution in local and world water distributions Extension: and make recommendations for solutions e. Describe where water goes after it is used in houses or buildings Extension: and create a timeline for when it will be available to use again (conservation of mass – water is constantly recycled through the water cycle) f. Compare and contrast different types of waves (wind, tsunamis, tides) g. Describe and compare for various waves the amplitude, frequency, wavelength, and speed	**Inquiry Questions:** 1. How is water cycled on Earth? 2. How does the lack or abundance of water impact human civilizations and populations? 3. How do your daily decisions impact the quality of water in the water cycle? **Relevance and Application:** 1. Home water quality and consumption affects for health and conservation policies. 2. Water systems affect local, regional, and world population development. 3. Water-use irrigation patterns in Colorado affect economic development in the state. **Nature of Discipline:** 1. Ask testable questions and make falsifiable hypotheses to research about water distribution. 2. Create and evaluate models; identifying the strengths and weaknesses of the model in representing water circulation and distribution.

Content Area: Science

Standard: 3. Earth Systems Science - Middle School Science

Valwood Graduates:

Describe how humans are dependent on the diversity of resources provided by Earth and Sun

GRADE LEVEL EXPECTATION

Concepts and skills students master:

9. Earth's natural resources provide the foundation for human society's physical needs. Many natural resources are nonrenewable on human timescales, while others can be renewed or recycled

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Research and evaluate data and information to learn about the types and availability of various natural resources, and use this knowledge to make evidence-based decisions b. Identify and evaluate types and availability of renewable and nonrenewable resources *Extension: (including mineral, rock, soil, plant, water and energy resources)* c. Use direct and indirect evidence to determine the types of resources and their applications used in communities d. Research and critically evaluate data and information *(including biases)* about the advantages and disadvantages of using fossil fuels and alternative energy sources e. *Evaluate how energy is transformed from one form to another, but that the total energy is in a closed system does not change (chemical, mechanical, electrical, thermal, radiant, Conservation of Energy)* f. *Extension: Analyze peer-reviewed and research-based data and evidence to evaluate the current state of Earth's natural resources and long term sustainability*	**Inquiry Questions:** 1. What resources are found and used in our community? 2. How can natural resources be identified and classified? 3. How can we make responsible choices about the resources we use on a daily basis? **Relevance and Application:** 1. Natural resources come from a variety of locations and have to be mined or harvested, depending on the type. 2. A resource can be used in a variety of ways, depending on the product being made. For example, plastics, textiles, medications, and fertilizers are produced from petroleum. 3. Resources in Colorado directly affect the state economy and society by providing employment and sources of revenue. **Nature of Discipline:** 1. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others.

Life Science

Course Description

Life Science seeks to give students an overview of the great diversity of living organisms. This is accomplished by group learning, paired activities, class discussions, project based assignments, labs, lecture, and hands on learning. The class is largely a taxonomic review of life, beginning with the basic make up of living organisms. Each kingdom will be discussed, with the similarities and differences between the kingdoms being learned. Students will distinguish the difference in prokaryotic and eukaryotic organisms. Students do simple lab activities and are introduced to dissection of simple invertebrate organisms. Human anatomy and the function of body systems are introduced at the end of this class.

Topics at a Glance

- Life: Structure and Function
- From Bacteria to Plants
- Animals
- Human Body Systems
- Interactions of Life

Assessments

- Teacher generated assessments
- Lab Reports
- Standardized test assessment

Grade Level Expectations

- Obtain, evaluate, and communicate information to investigate the diversity of living organisms and how they can be compared scientifically.
- Obtain, evaluate, and communicate information to describe how cell structures, cells, tissues, organs, and organ systems interact to maintain the basic needs of organisms.
- Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.
- Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.
- Obtain, evaluate, and communicate information from multiple sources to explain the theory of evolution of living organisms through inherited characteristics.

Effective Components of a Life Science Program

- Maintains an inquiry-based learning environment
- Addresses a limited number of concepts, but does so in depth
- Provides students with multiple opportunities to learn and timely feedback to help students know what they need to improve upon
- Explains concepts and problems in multiple ways
- Uses assessment to guide instruction
- Differentiates instruction to meet student needs
- Draws out and actively engages the preexisting understandings about the natural world that students bring with them
- Assists students in developing metacognitive skills within the context of learning about science
- Provides opportunities and support to apply writing, reading, and mathematics skills in the context of investigating scientific concepts, including hand-graphing data
- Provides a safe, equitable and engaging learning environment for all students

Grade Level Expectations

Standard	Big Ideas
2. Life Science	1. Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment. 2. The human body is composed of atoms, molecules, cells, tissues, organs, and organ systems that have specific functions and interactions. 3. Cells are the smallest unit of life that can function independently and perform all the necessary functions of life. 4. Photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms. 5. Multiple lines of evidence show the evolution of organisms over geologic time. 6. Human activities can deliberately or inadvertently alter ecosystems and their resiliency. 7. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation. 8. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species. 9. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem.

stating hypotheses, identifying variables, identifying constants, and collecting data accurately.
- Use appropriate tools, technology and measurement units to gather and organize data and to report results.
- Interpret data and recognize bias in order to formulate logical conclusions.
- Communicate the design and results of scientific investigations in appropriate ways (written, oral, graphical, pictorial, digital).
- Follow lab and safety procedures when conducting scientific investigations.
- Explain that a controlled experiment must have comparable results when repeated.
- Create and use physical and conceptual models for explanations and predictions.
- Recognize that people from different cultures and from different times in history make contributions to the advancement of science.
- Recognize that the interrelationship of science and technology has implications for the social, cultural, and ecological systems within which we live.
- Use technology responsibly for communication and transfer of ideas.
- Use technology to gather, organize, analyze, and communicate about data.
- Collaborate with others to identify information problems and to seek solutions.
- Create a labeled diagram that supports information being shared.
- Organize and report information in a variety of complex ways including tables, graphs, charts, and reports.
- Identify different information sources and assess reliability of sources.
- Present information in a variety of formats including written paragraphs, posters, illustrations, oral reports, etc.

2. Life Science

Students know and understand the characteristics and structure of living things, the processes of life and how living things interact with each other and their environment.

Valwood Graduates
The preschool through twelfth-grade concepts and skills that all students must master to ensure their success in a postsecondary and workforce setting.

Valwood Graduate Competencies in the Life Science standard:

- Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection
- Explain and illustrate with examples how living systems interact with the biotic and abiotic environment
- Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment
- Explain how biological evolution accounts for the unity and diversity of living organisms

Content Area: Science – Middle School

Standard: 2. Life Science

Valwood Graduates:

Explain and illustrate with examples how living systems interact with the biotic and abiotic environment

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Human activities can deliberately or inadvertently alter ecosystems and their resiliency

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate, and justify an evidence-based scientific example of how humans can alter ecosystems b. Analyze and interpret data about human impact on local ecosystems c. Recognize and infer bias in print and digital resources while researching an environmental issue d. Use technology resources such as online encyclopedias, online databases, and credible websites to locate, organize, analyze, evaluate, and synthesize information about human impact on local ecosystems e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate an environmental issue *f. Compare and contrast food webs within and between different ecosystems*	**Inquiry Questions:** 1. Do humans have a unique responsibility to the ecosystems in which they live? *2. What does it mean to be a steward of an ecosystem?* 3. How can a young person be a steward of an ecosystem? *4. How have human activities influenced climate patterns in a way that precipitates change in ecosystems?* ***5. EXTENSION: What are biotic and abiotic factors of the ecosystems in Boulder County?*** **Relevance and Application:** 1. Human activities such as cutting down forests and polluting water or covering deserts with fields of solar panels are constantly changing various cycles and habitats in the natural world. 2. There are laws that preserve and protect wilderness areas such as national parks and other natural areas but such laws also limit the utilization of the natural resources in those areas. *3. Ecosystems exist in populated areas such as on school grounds or in parks. These ecosystems can be studied through direct observation.* **Nature of Discipline:** 1. Critically evaluate scientific claims in popular media and peer generated explanations regarding interactions in ecosystems, and determine if the evidence presented is appropriate and sufficient to support the claims.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment

Explain how biological evolution accounts for the unity and diversity of living organisms

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. Organisms reproduce and transmit genetic information (genes) to offspring, which influences individuals' traits in the next generation

Evidence Outcomes	**21st Century Skills and Readiness Competencies**
Students can: a. Develop, communicate, and justify an evidence-based scientific explanation for how genetic information is passed to the next generation b. Use direct and indirect observations, evidence, and data to support claims about genetic reproduction and traits of individuals c. Gather, analyze, and interpret data on transmitting genetic information d. Use models and diagrams to predict the phenotype and genotype of offspring based on the genotype of the parents e. Use computer simulations to model and predict phenotype and genotype of offspring based on the genotype of the parents *f. Infer the traits of offspring based on genes of parents (including dominant and recessive traits by using Punnett square diagrams)*	**Inquiry Questions:** 1. How are traits passed from one generation to the next? 2. What traits can be passed to the next generation and what traits cannot? 3. How can patterns in the inheritance of traits be used to predict how frequently they appear in offspring? *4. What is the relationship between DNA, genes and chromosomes?* ***5. EXTENSION: How does gene expression influence the way that traits are revealed and conveyed through a population?*** **Relevance and Application:** 1. There are benefits and risks to genetic engineering such as cloning, genetically modifying organisms, and replacing genes for therapy. 2. Genome sequencing has many potential applications to the field of medicine. **Nature of Discipline:** 1. Understand the interconnected nature of math and science by utilizing math in the prediction of future generations. 2. Recognize that current understanding of genetics has developed over time and become more sophisticated as new technologies have lead to new evidence. 3. Critically evaluate models used to represent deoxyribonucleic acid (DNA) and genes; identify strengths and weaknesses of these models for representing complex natural phenomena.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Explain how biological evolution accounts for the unity and diversity of living organisms

Analyze how various organisms grow, develop, and differentiate during their lifetimes based on an interplay between genetics and their environment

GRADE LEVEL EXPECTATION

Concepts and skills students master:

3. Individual organisms with certain traits are more likely than others to survive and have offspring in a specific environment

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate, and justify an evidence-based explanation for why a given organism with specific traits will or will not survive to have offspring in a given environment b. Analyze and interpret data about specific adaptations to provide evidence and develop claims about differential survival and reproductive success c. Use information and communication technology tools to gather information from credible sources, analyze findings, and draw conclusions to create and justify an evidence-based scientific explanation d. Use computer simulations to model differential survival and reproductive success associated with specific traits in a given environment *e. Compare and contrast ways that various organisms transport nutrients and wastes (plant vascular vs. animal circulatory system, etc.)*	**Inquiry Questions:** 1. What is the relationship between an organism's traits and its potential for survival and reproduction? 2. *How do adaptations affect an organism's potential to survive and reproduce?* 3. How is the use of the word "adaptation" different in everyday usage than in biology? **Relevance and Application:** 1. Bacteria have evolved to survive in the presence of the environmental pressure of antibiotics – giving rise to antibiotic resistance. 2. Species that can live with humans –such as rats and pigeons – are more common around towns and cities. **Nature of Discipline:** 1. Create and use sound experimental designs to collect data around survival and genetic traits. 2. Describe several ways in which scientists would study genetics, and suggest ways that this has contributed to our understanding of survival and populations.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

GRADE LEVEL EXPECTATION

Concepts and skills students master:

4. The human body is composed of atoms, molecules, cells, tissues, organs, and organ systems that have specific functions and interactions

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop and design a scientific investigation about human body systems b. Develop, communicate, and justify an evidence-based scientific explanation regarding the functions and interactions of the human body c. Gather, analyze, and interpret data and models on the functions and interactions of the human body	**Inquiry Questions:** 1. How does each body system contribute to supporting the life of the organism? 2. How do organs and organ systems in the human body interact to perform specific functions? ***3. EXTENSION: How can environmental factors affect body systems?*** ***4. EXTENSION: How does disease affect body systems?***
	Relevance and Application: 1. There are technologies such as magnetic resonance imaging (MRI), computed tomography (CT) scans, and chemical lab tests that are related to the diagnosis and treatment of the human body's diseases. *2. Personal wellness choices and practices such as exercise and diet can have an effect on body systems.*
	Nature of Discipline: 1. Critically evaluate models, and identify the strengths and weaknesses of the model in representing our understanding of the human body.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

GRADE LEVEL EXPECTATION

Concepts and skills students master:

5. Cells are the smallest unit of life that can function independently and perform all the necessary functions of life

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather, analyze, and interpret data and models on the different types of cells, their structures, components and functions b. Develop, communicate, and justify an evidence-based scientific explanation regarding cell structures, components, and their specific functions c. Compare and contrast the basic structures and functions of plant cells, animal cells, and single-celled organisms d. Employ tools to gather, view, analyze, and report results for the scientific investigations of cells *e. Differentiate between mitosis and meiosiz*	**Inquiry Questions:** 1. How is the basic structure of a cell related to its function? 2. How are the components – or organelles – of a cell related to the cell's function? 3. How are various cells unique, and what do they have in common with other cells? ***4. EXTENSION: How are differences in cells used to classify organisms?*** **Relevance and Application:** 1. Stem cells are undifferentiated cells that have potential use in medicine. 2. Cancer is caused by a cell that isn't functioning correctly. 3. Cells can be cultured to benefit humanity. *4. There is ethical debate surrounding stem cell research.* **Nature of Discipline:** 1. Recognize that our current understanding of cells has developed over centuries of studies by many scientists, and that through continued scientific investigations and advances in data collection, we will continue to refine our understanding of cells.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Analyze the relationship between structure and function in living systems at a variety of organizational levels, and recognize living systems' dependence on natural selection

GRADE LEVEL EXPECTATION

Concepts and skills students master:

6. Photosynthesis and cellular respiration are important processes by which energy is acquired and utilized by organisms

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather, analyze, and interpret data regarding the basic functions of photosynthesis and cellular respiration b. Use direct and indirect evidence to describe the relationship between photosynthesis and cellular respiration within plants – and between plants and animals c. Use computer simulations to model the relationship between photosynthesis and cellular respiration within plants – and between plants and animals *d. Identify and manipulate the raw materials and products of respiration and photosynthesis*	**Inquiry Questions:** 1. What is the relationship between photosynthesis and cellular respiration? 2. What energy transformations occur in both the processes of photosynthesis and cellular respiration? ***3. EXTENSION: What is the relationship between photosynthesis and atmospheric O_2 and CO_2?*** **Relevance and Application:** 1. Plants are essential for human health and the health and survival of Earth's ecosystems. 2. The energy in food comes from sunlight via photosynthesis and is the basis for most ecosystems on earth. 3. Fossil fuels come from the photosynthesis of organisms that lived millions of years ago. ***4. EXTENSION: In addition to photosynthesis, there are other processes by which organisms acquire energy, such as chemosynthesis.*** **Nature of Discipline:** 1. Ask a testable question and make a falsifiable hypothesis about photosynthesis or respiration and design an inquiry based method to find an answer. 2. Design an experiment to observe photosynthesis or respiration, and clearly define controls and variables. 3. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Explain how biological evolution accounts for the unity and diversity of living organisms

GRADE LEVEL EXPECTATION

Concepts and skills students master:

7. Multiple lines of evidence show the evolution of organisms over geologic time

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Interpret and analyze data from the fossil record to support a claim that organisms and environments have evolved over time b. Analyze and critique the evidence regarding the causes and effects of a mass extinction event c. Analyze and interpret data that show human evolution d. Use technology to share research findings about the evidence regarding the causes and effects of a mass extinction event	**Inquiry Questions:** 1. What might life on Earth have been like in the distant past, and what evidence is there for this? 2. How does the evidence about the way life has evolved on Earth from long ago tell us about Earth today? *3. How do we know that organisms have evolved over time?* ***4. EXTENSION: How do new techniques of classification utilizing DNA sequencing provide evidence regarding the evolution of life on earth?***
	Relevance and Application: 1. There is growing concern over the current extinction of organisms around the world – and the consequences of these extinctions. ***2. EXTENSION: Coevolution occurs in many species and can take on varying forms such as parasitism, mutualism and symbiosis.***
	Nature of Discipline: 1. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists. 2. Cite various scientific arguments regarding the causes and effects of mass extinctions.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Explain and illustrate with examples how living systems interact with the biotic and abiotic environment

GRADE LEVEL EXPECTATION

Concepts and skills students master:

8. Changes in environmental conditions can affect the survival of individual organisms, populations, and entire species

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Interpret and analyze data about changes in environmental conditions – such as climate change – and populations that support a claim describing why a specific population might be increasing or decreasing b. Develop, communicate, and justify an evidence-based explanation about how ecosystems interact with and impact the global environment c. Model equilibrium in an ecosystem, including basic inputs and outputs, to predict how a change to that ecosystem such as climate change might impact the organisms, populations, and species within it such as the removal of a top predator or introduction of a new species d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate how environmental conditions affect the survival of individual organisms	**Inquiry Questions:** 1. How do ecosystem changes affect biodiversity? 2. How does biodiversity contribute to an ecosystem's equilibrium? *3. How does climate change precipitate changes in ecosystems?* **Relevance and Application:** 1. The development and application of technologies are intended to aid some populations and ecosystems. *(Modern scientists are developing and applying technologies that are intended to preserve biodiversity and manage ecosystems).* **Nature of Discipline:** 1. Ask testable questions and make a falsifiable hypothesis about how environmental conditions affect organisms, populations, or entire species and design a method to find the answer. 2. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others. 3. Use models and technology tools to show what might happen to individuals, populations, and species as environmental conditions change.

Content Area: Science - Middle School

Standard: 2. Life Science

Valwood Graduates:

Explain and illustrate with examples how living systems interact with the biotic and abiotic environment

GRADE LEVEL EXPECTATION

Concepts and skills students master:

9. Organisms interact with each other and their environment in various ways that create a flow of energy and cycling of matter in an ecosystem

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Develop, communicate, and justify an evidence-based explanation about why there generally are more producers than consumers in an ecosystem b. Design a food web diagram to show the flow of energy through an ecosystem c. Compare and contrast the flow of energy with the cycling of matter in ecosystems	**Inquiry Questions:** *1. How are food webs and trophic levels ways of describing the flow of energy between organisms in an ecosystem?* *2. How do trophic levels illustrate transfers in biomass?* 3. How do different ecosystems cycle matter differently? 4. What "jobs" do organisms do to facilitate the flow of energy and cycling of matter?
	Relevance and Application: 1. Humans use an understanding of the cycling of matter and energy to help mitigate environmental problems. For example, they treat waste water and clean up oil spills.
	Nature of Discipline: 1. Scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere – that energy follows the same rules in an ecosystem as it does in physics experiments. 2. Generate solutions to help mitigate environmental problems based on an understanding of the cycling of matter and energy. 3. Create and evaluate models that show how interactions create a flow of energy and a cycling of matter in an ecosystem.

Physical Science Overview

Course Description	Topics at a Glance
Students are introduced to chemistry and physics through the investigation of the basic structure of matter. In the first part of this course, students will explore the nature of atoms and chemical reactions. In the second part, students create models exploring motion, acceleration, force, work and energy which is applied to concepts involving sound, light, electricity and magnetism. Emphasis is placed on developing such skills as critical thinking, problem solving, drawing conclusions, working cooperatively with others, following written and oral directions, writing, mathematics calculations, use of the scientific method, generating and interpreting graphs, and creating and manipulating models.	• Matter and Energy • Chemical Interactions • Motions and Forces • Wave, Sound, and Light • Electricity and Magnetism
Assessments	**Effective Components**
• Teacher created assessments • Lab reports • Standardized Test	• keep records of their observations, use those records to analyze the data they collect • recognize patterns in the data, use simple charts and graphs to represent the relationships they see • find more than one way to interpret their findings. • develop conceptual understanding of the laws of conservation of matter and conservation of energy • plan and carry out investigations, describe observations, and show information in graphical form.

Grade Level Expectations

1. Newton's laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion – but have limitations
2. Matter has definite structure that determines characteristic physical and chemical properties
3. Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy
4. Atoms bond in different ways to form molecules and compounds that have definite properties
5. Energy exists in many forms such as mechanical, chemical, electrical, radiant, thermal, and nuclear, that can be quantified and experimentally determined
6. When energy changes form, it is neither created nor destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases
7. *Scientists use the tools of math to solve problems, analyze data, and evaluate the validity of results.*
8. *Scientists ask questions and state hypotheses using prior knowledge to help design and guide scientific investigations, using appropriate technology and safe laboratory practices.*

1. Physical Science

Students know and understand common properties, forms and changes in matter and energy.

Valwood Graduate Competencies
The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

Valwood Graduate Competencies in the Physical Science standard:

- Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects
- Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions
- Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable
- *Engage in scientific inquiry by asking or responding to scientifically oriented questions, collecting and analyzing data, giving priority to evidence, formulating explanations based on evidence, connecting explanations to scientific knowledge, and communicating and justifying explanations.*

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Observe, explain, and predict natural phenomena governed by Newton's laws of motion, acknowledging the limitations of their application to very small or very fast objects

GRADE LEVEL EXPECTATION

Concepts and skills students master:

1. Identify and calculate the direction and magnitude of forces that act on an object, and explain the results in the object's change of motion

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Predict and evaluate the movement of an object by examining the forces applied to it • Identify the forces acting on a moving object and explain the effects of changes in both magnitude and direction b. Use mathematical expressions to describe the movement of an object • Calculate velocity given distance and time • Extension: Define and calculate acceleration given velocity and time • Extension: manipulate mathematical expressions to describe the movement (for example: solve for distance when given velocity and time) c. Develop and design a scientific investigation to collect and analyze speed and acceleration data to determine the net forces acting on a moving object • Based on the size and direction of a force applied, determine the direction an object will move	**Inquiry Questions:** 1. What relationships exist among force, mass, speed, and acceleration? 2. What evidence indicates a force has acted on a system? Is it possible for a force to act on a system without having an effect? **Relevance and Application:** 1. Engineers take forces into account when designing moving objects such as car tires, roller coasters, and rockets. 2. Vehicles and their propulsion systems are designed by analyzing the forces that act on the vehicle. For example, the designs of propellers and jet engines are based on the aerodynamics of airplanes. **Nature of Discipline:** 1. Recognize that our current understanding of forces has developed over centuries of studies by many scientists, and that we will continue to refine our understanding of forces through continued scientific investigations and advances in data collection. 2. Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases to answer scientific questions about motion and acceleration.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. There are different forms of energy, and those forms of energy can be changed from one form to another – but total energy is conserved

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Gather, analyze, and interpret data to describe the different forms of energy and energy transfer b. Develop a research-based analysis of different forms of energy and energy transfer c. Use research-based models to describe energy transfer mechanisms, and predict amounts of energy transferred	**Inquiry Questions:** 1. Which forms of energy can be directly observed, and which forms of energy must be inferred? 2. What evidence supports the existence of potential and kinetic energy? 3. Is there a limit to how many times energy can be transferred? Explain your answer.
	Relevance and Application: 1. Photos and measurements of accident investigations provide evidence of energy transfers during such events. 2. Kinetic energy often is turned into heat such as when brakes are applied to a vehicle or when space vehicles re-enter Earth's atmosphere. 3. Energy transfers convert electricity to light, heat, or kinetic energy in motors. 4. There are ways of producing electricity using both nonrenewable resources such as coal or natural gas and renewable sources such as hydroelectricity or solar, wind, and nuclear power.
	Nature of Discipline: 1. Share experimental data, and respectfully discuss conflicting results. 2. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others. 3. Use tools to gather, view, analyze, and report results for scientific investigations designed to answer questions about energy transformations.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

3. Distinguish between physical and chemical changes, noting that mass is conserved during any change

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Identify the distinguishing characteristics between a chemical and a physical change • Define chemical change as a change in which existing substances react to form new substances with different properties b. Gather, analyze, and interpret data on physical and chemical changes c. Gather, analyze, and interpret data that show mass is conserved in a given chemical or physical change d. Identify evidence that suggests that matter is always conserved in physical and chemical changes • Explain that mass will remain the same in a closed system even if changes take place within the system e. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate physical and chemical changes f. Extension: Understand that a chemical equation describes a chemical change g. Extension: Count the atoms of different elements on both the reactant and product side of a chemical equation h. Extension: Balance a chemical equation using coefficients	**Inquiry Questions:** 1. What evidence can indicate whether a change is physical or chemical? 2. Is it easier to observe the conservation of mass in physical or chemical changes? Why? 3. What would happen if mass were not conserved? **Relevance and Application:** 1. The freezing, thawing, and vaporization of Earth's water provide examples of physical changes. 2. An understanding of chemical changes has resulted in the design of various products such as refrigerants in air conditioners and refrigerators. 3. Physical and chemical changes are involved in the collection and refinement of natural resources such as using arsenic in gold mining. 4. Living systems conserve mass when waste products from some organisms are nutrients for others. **Nature of Discipline:** 1. Evaluate the reproducibility of an experiment, and critically examine conflicts in experimental results. 2. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding that energy exists in various forms, and its transformation and conservation occur in processes that are predictable and measurable

GRADE LEVEL EXPECTATION

Concepts and skills students master:

4. Recognize that waves such as electromagnetic, sound, seismic, and water have common characteristics and unique properties

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Compare and contrast different types of waves b. Describe for various waves the amplitude, frequency, wavelength, and speed c. Describe the relationship between pitch and frequency in sound d. Develop and design a scientific investigation regarding absorption, reflection, and refraction of light	**Inquiry Questions:** 1. What are some different ways to describe waves?
	Relevance and Application: 1. Different vibrations create waves with different characteristics. For example, a vibrating low-pitch guitar string feels different to the touch than a high-pitch guitar string. 2. Dealing with different types of waves presents design challenges. For example, higher frequency waves have shorter wavelengths, which affect ships, buildings, and antenna design. 3. Energy from different types of waves can affect the environment. For example, natural waves cause different beach erosion than boat wakes. 4. There are many applications of light and lasers such as using fiber optics in high speed communication and lasers in surgery. 5. Living organisms collect and use light and sound waves – such as for hearing and vision – to gather information about their surroundings.
	Nature of Discipline: 1. Evaluate models used to explain and predict wave phenomena that cannot be directly measured. 2. Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere. For example, the speed of light in a vacuum is constant across space and time. 3. Select and use technology tools to gather, view, analyze, and report results for scientific investigations about the characteristics and properties of waves.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

5. Mixtures of substances can be separated based on their properties such as solubility, boiling points, magnetic properties, and densities

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Identify properties of substances in a mixture that could be used to separate those substances from each other b. Develop and design a scientific investigation to separate the components of a mixture	**Inquiry Questions:** 1. What techniques can be used to separate mixtures of substances based their properties? 2. Which properties are the most useful in trying to separate mixtures of substances? 3. How much difference must there be among the properties of substances for the properties to be useful in separating the substances?
	Relevance and Application: 1. Materials are sorted based on their properties in a variety of applications. For example, water filtration systems rely on the solubility, density, and physical sizes of substances, and recycling facilities use the properties of materials to separate substances in single-stream recycling systems. 2. Mining and oil refining processes use properties to separate materials. 3. The kidneys use properties to filter wastes from the blood.
	Nature of Discipline: 1. Ask testable questions and make a falsifiable hypothesis about using properties to perform separations, and design a method to find an answer. 2. Evaluate and critique experimental procedures designed to separate mixtures.

	3. Share experimental data, and respectfully discuss inconsistent results. 4. Describe several ways in which scientists would study mixtures, and suggest ways that this has contributed to our understanding of materials.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

6. All matter is made of atoms, which are far too small to see directly through a light microscope. Elements have unique atoms and thus, unique properties. Atoms themselves are made of even smaller particles

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Identify evidence that suggests there is a fundamental building block of matter • Explain all matter is comprised of atoms b. Use the particle model of matter to illustrate characteristics of different substances • Describe the relative location, charge, and mass of subatomic particles (protons, neutrons, and electrons) • Explain how number of protons in an atom determines what element it is • Predict how the atomic structure affects properties of elements • Identify the basic parts of an entry in the Periodic Table • Collect and apply information from the Periodic Table to elements (determine number of protons, electrons, and neutrons and atomic mass) c. Develop an evidence based scientific explanation of the atomic model as the foundation for all chemistry d. Find and evaluate appropriate information from reference books, journals, magazines, online references, and databases to compare and contrast historical explanations for the nature of matter • Understand people of different times and places contributed to the development of modern atomic theory (Dalton, Rutherford, Thomson, Bohr, etc) e. Extension: Explain atoms of the same element that have the same number of protons but different numbers of neutrons are called isotopes.	**Inquiry Questions:** 1. In the world of science what makes something a building block? **Relevance and Application:** 1. Living things consist of the same matter as the rest of the universe. **Nature of Discipline:** 1. Work in groups using the writing process to effectively communicate an understanding of the particle model of matter. 2. Use technology to share research findings about historical explanations for the nature of matter and to publish information to various audiences. 3. Create models that explain the particle theory of matter. 4. Recognize and describe the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing others work.

f. Extension: Calculate average atomic mass using isotopic masses and abundances g. Extension: Use Bohr models to show electron configuration h. Extension: Apply classification systems to other groups of objects by making new Periodic Tables i. Extension: Describe periodic trends on the Periodic Table	

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

7. Atoms may stick together in well-defined molecules or be packed together in large arrays. Different arrangements of atoms into groups compose all substances

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Explain the similarities and differences between elements and compounds • Two or more atoms chemically combine to form a molecule • Molecules are represented by a chemical formula that show the ratio of each element in the molecule b. Identify evidence suggesting that atoms form into molecules with different properties than their components • The smallest unit of a compound that still retains the properties of the compound is a molecule • A compound is chemically bonded while a mixture is physically mixed c. Find and evaluate information from a variety of resources about molecules d. Extension: Count the number of atoms in a molecule using subscripts and coefficients ***e.*** Extension: Recognize the shape and chemical formula for common compounds on Earth and in the atmosphere (water, carbon dioxide, ozone, carbon monoxide, nitrogen, oxygen, etc.)	**Inquiry Questions:** 1. Why do substances behave differently? For example, why does water pour rapidly while syrup pours slowly? **Relevance and Application:** 1. Different arrangements of atoms provide different properties. 2. Very small devices consist of large numbers of arranged groups of atoms that perform a specific function. **Nature of Discipline:** 1. Use models and/or electronic media to show and understand how molecules are made of atoms. 2. Investigate how our current understanding of matter has developed through centuries of scientific investigations.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

8. The physical characteristics and changes of solid, liquid, and gas states can be explained using the particulate model

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Explain how the arrangement and motion of particles in a substance, such as water, determine its state • Describe and identify the properties of solids, liquids, and gases • Describe the arrangement, motion, and energy of particles in different states b. Distinguish between changes in temperature and changes of state using the particle model of matter • Identify the names and processes of changes in state • Predict how changes in temperature affect behavior of particles • Use the particulate model to explain the changes in energy and molecular motion in transitions between solids, liquids, and gases • Measure temperature using a thermometer and appropriate units c. Extension: Explore additional states of matter, such as plasma, Bose-Einstein Condensate, etc. d. Extension: Investigate Ideal Gas Law and use mathematical expressions to predict changes in pressure, volume, and temperature. e. Extension: Interpret phase diagrams for different types of matter f. Extension: Design experiments to test hypotheses about changes in state for different types of matter	**Inquiry Questions:** 1. What determines whether matter is in the form of a solid, liquid, or gas? 2. What is the kinetic molecular theory, and how does temperature affect the behavior of particles in a gas? **Relevance and Application:** 1. Solids, liquids, and gasses all have unique properties that make them useful in different situations. For example, solids are useful building materials. **Nature of Discipline:** 1. Use models and technology tools to help visualize what is happening at the molecular level during phase changes. 2. Understand and apply the difference between scientific laws, theories and hypotheses. 3. Work in groups using the writing process to communicate an understanding how the particle model of matter explains various states of matter.

Content Area: Science

Standard: 1. Physical Science

Valwood Graduates:

Apply an understanding of atomic and molecular structure to explain the properties of matter, and predict outcomes of chemical and nuclear reactions

GRADE LEVEL EXPECTATION

Concepts and skills students master:

9. Distinguish among, explain, and apply the relationships among mass, weight, volume, and density

Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: a. Explain that the mass of an object does not change, but its weight changes based on the gravitational forces acting upon it • Define mass, volume, weight, density, and gravity • Distinguish between mass and weight b. Predict how changes in acceleration due to gravity will affect the mass and weight of an object c. Predict how mass, weight, and volume affect density d. Measure mass and volume, and use these quantities to calculate density • Use appropriate units for listed quantities • Predict how relative density affects the ability of a sample to float or sink in a liquid of known density e. Use tools to gather, view, analyze, and report results for scientific investigations about the relationships among mass, weight, volume, and density • Use a balance, graduated cylinder, scale, and metric ruler f. Extension: Calculate force of gravity on objects using acceleration and mass g. Extension: Explore Newton's Law of Universal Gravitation and explain how mass and distance affect gravitational pull between two objects h. Extension: Describe inertia and how inertia relates to mass	**Inquiry Questions:** 1. Which of the following is the best recommendation for a person trying to lose weight and why? o Reduce the number of calories he or she eats. o Exercise more. o Go to the Moon. 2. If weight and mass are not the same thing, why might people use the words interchangeably? 3. Describe a situation in which mass would be the most useful information to know about an object? Do the same for weight, volume, and density. **Relevance and Application:** 1. Mass, weight, and gravitational forces are critical for space travel, future visits to outer space, and possibly the colonization of places like the Moon or Mars. **Nature of Discipline:** 1. Calculate the density of a sample, predict its ability to float or sink in a liquid of known density, design and perform the experiment, and justify discrepancies in the experimental outcome. 2. Ask testable questions, make a falsifiable hypothesis about density and design an inquiry based method to find an answer. 3. Select proper tools to measure the mass and volume of an object and use appropriate units.