VALWOOD

GO BEYOND

Sixth Grade Science Curriculum

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 (ERB)

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.