



EARTH SCIENCE

Counselors are available to assist parents and students with course selections and career planning. Parents may arrange to meet with the counselor by calling the school's guidance department.

COURSE DESCRIPTION

Earth Science is the study of the features and forces of our planet. The course includes topics in astronomy, geology, meteorology, oceanography, and physical geography. Field trips, laboratory investigations, and other classroom activities permit the students to interrelate these topics and to gain personal experiences within their surroundings. Environmental concerns, energy, earth processes, and the influences of science, technology, and society are significant. Students will take the Standards of Learning (SOL) test for Earth Science. Specific dates for the SOL test will be announced by the school.

COURSE GOALS

- Develop a foundation of earth science concepts for understanding the forces and features of planet Earth, its place in the universe, and the interrelationships among the fields of earth science – geology, astronomy, meteorology, and oceanography.
- Develop investigative skills in order to solve real problems.
- Apply the processes of rational thought to make responsible decisions involving the interactions of science, technology, and society.
- Explore the application of earth science principles, in modern life, in careers, and in other areas of interest.

PREREQUISITE

Grade 8 - Advanced Science 7 and a teacher recommendation
High School - None

OPTIONS FOR NEXT COURSE

Biology
Chemistry (Algebra II prerequisite or co-requisite)
Oceanography (Earth Science prerequisite)

REQUIRED STUDENT TEXTBOOK

Earth Science: Geology, the Environment, and the Universe, Hess et al (Glencoe McGraw-Hill, 2002)

MINIMUM REQUIREMENTS

- Demonstrate knowledge and understanding of all core objectives through laboratory investigations, issue investigations, projects, oral and/or written tests, quizzes, and reports.
- Participate in the core laboratory experiences and adhere to all safety procedures.
- Prepare written reports for laboratory activities as directed.
- Investigate and report on science-related issues of local, regional, national, or global concern; suggest possible solutions; design a plan of action for solving them.
- Investigate career opportunities and areas of interest in earth science and prepare a brief report.
- Complete all assigned readings and homework.

The Instructional Objectives That Comprise the Earth Science Course are Listed as Follows From the Prescribed Curriculum:

- 1.1.1 Define earth science as a collection of studies including geology, meteorology, oceanography, and astronomy.
- 1.1.2 Explain how earth science incorporates knowledge of physical, biological, and environmental sciences.
- 1.2.1 Identify safety rules for the classroom and lab.
- 1.2.2 Point out the location and use of safety equipment in the room.
- 1.2.3 Discuss emergency procedures (fire drills, etc.) with emphasis on responsible behavior.
- 1.2.4 Demonstrate safe techniques when using science equipment.
- 1.3.1 Know the SI units of measurement and choices of equipment used for each.
- 1.3.2 Use appropriate tools and identify SI units of measurement to gather and analyze data in a scientific investigation.
- 1.3.3 Interpret data from a graph, diagram, or table.
- 1.3.4 List the steps of the scientific method and compare and contrast experimental variables and controls.
- 1.3.5 Use scientific methodology to design and test a hypothesis.
- 1.4.1 Investigate and understand how to read and interpret different types of maps, including bathymetric*, geologic, topographic, weather*, and star charts*.
[Note: * denotes maps that can be introduced in later units.]
- 1.5.1 Locate and identify points and directions on maps and globes using latitude and longitude, cardinal direction, and alphanumeric system.
- 1.6.1 Use the standard time zone system to calculate time and dates around the world.
- 1.7.1 Read and interpret maps, including legends with symbols and colors.
- 1.8.1 Relate scale on a map or globe to the actual distance it represents.
- 1.9.1 Identify features on a topographic map.
- 1.9.2 Determine elevation on a topographic map.
- 1.9.3 Construct profiles from topographic contours.
- 1.10.1 Relate air photos and satellite images to land features they represent.
- 1.10.2 Understand that technologies, including computers, satellites, and global positioning systems (GPS) are used to collect, analyze, and report data.
- 2.1.1 Explain the relationship of Earth's motions to day, night, rotations, and revolutions.
- 2.1.2 Explain the cause of the seasons due to Earth's tilt and the cause of equinoxes and solstices.
- 2.2.1 Describe the characteristics of the Earth's Moon (gravity, revolution, rotation, phases, distance from the earth, temperature) and surface features.
- 2.2.2 Diagram and explain the difference between a lunar and solar eclipse.
- 2.2.3 Relate the rise and fall of tides to the gravitational pull of the Sun and Moon.
- 2.3.1 Draw a diagram of the solar system and label all the planets as either terrestrial or gas giants.
- 2.3.2 Compare the structure, composition, and atmosphere of the inner planets to include: density, shape, size, and unusual characteristics.
- 2.3.3 Compare the structure, composition, and atmosphere of the outer planets to include: density, shape, size, and unusual characteristics.
- 2.3.4 Examine the orbital paths of planets and other astronomical bodies (comets and asteroids). Examine the theories of geocentric and heliocentric models and Kepler's laws of motion.
- 2.3.5 Examine and diagram the characteristics of meteors, meteorites, meteoroids, asteroids, and comets (including the development and direction of a comet's tail as it orbits the sun).
- 2.4.1 Describe the structure, composition, and features of the Sun. (Include flares, solar winds, sunspots, and solar prominences.)
- 2.4.2 Identify fusion of hydrogen to helium as the source of the Sun's energy.
- 2.5.1 Define and differentiate between seasonal and circumpolar constellations, using star charts.
- 2.5.2 Use the Hertzsprung-Russell (HR) diagram to explain the life cycle of stars. Use terms: nebula, protostar, main sequence, red giant/supergiant, white/black dwarf, supernova, neutron star, black hole.
- 2.5.3 Describe various methods for determining distance in the universe (light year, parallax, Cepheid variables).

- 2.6.1 Describe the Milky Way Galaxy.
- 2.6.2 Define galaxies and identify the three basic types.
- 2.7.1 Compare the theories of the origin of the solar system and the universe (to include the Big Bang theory, oscillating universe theory, steady state theory, and the solar nebula theory).
- 2.7.2 Explain how information gathered from telescopes, spectrosopes and other tools help us to understand the components of the universe.
- 2.8.1 Create a brief timeline of the highlights of the U.S. space program.
- 2.8.2 Describe the impact of space exploration on technology in daily life.
- 3.1.1 Describe how the Earth's atmosphere has changed over geologic time including the effects of early geologic and biological activities.
- 3.1.2 Describe the characteristics of each layer of the atmosphere (including temperature, unusual characteristics, and percentage of gases).
- 3.1.3 Explain the importance of ozone in the upper atmosphere and the cause and effect of its depletion (effects of chlorofluorocarbons).
- 3.2.1 Define the three methods of heat transfer in the atmosphere: conduction, convection, and radiation.
- 3.2.2 Explain the significance of the angle of isolation and the amount of energy reaching the Earth's surface.
- 3.2.3 Explain the greenhouse effect and its causes (compare Earth and Venus).
- 3.2.4 Relate air temperature to air pressure including high and low pressure systems.
- 3.2.5 Describe changes in the atmosphere and processes which cause the changes to occur including evaporation, condensation, transpiration and runoff.
- 3.2.6 Describe the factors that influence the amount of water vapor the air can hold.
- 3.3.1 Differentiate between forms of condensation including clouds, dew, frost, and fog and conditions necessary for their formation.
- 3.3.2 Relate the major types of precipitation to conditions under which they occur.
- 3.3.3 Explain that winds are created by uneven heat distribution at the Earth's surface and modified by the rotation of the Earth (include wind directions in high and low pressure systems, land and sea breezes, mountain and valley breezes, and monsoons).
- 3.3.4 Define the Coriolis effect and illustrate the effect that the earth's rotation has on global wind patterns.
- 3.3.5 Recognize the major global wind patterns.
- 3.4.1 Collect, read, and interpret data from a thermometer, a barometer, a psychrometer, an anemometer.
- 3.4.2 Read and interpret a weather map that includes station models, isobars, isotherms, fronts and high and low pressure systems.
- 3.4.3 Predict weather patterns.
- 3.4.4 Describe the role of satellites and other technologies in weather forecasting and reporting.
- 3.4.5 Describe the cause and effects of destructive storms such as severe thunderstorms, hurricanes, tornadoes, and winter storms including the proper precautionary steps to be taken.
- 3.5.1 Identify the major factors affecting climate: latitude, elevation, proximity to bodies of water, position relative to mountains, ocean currents and prevailing winds.
- 3.5.2 Identify the major climate zones of the world and relate them to temperature and rainfall.
- 3.5.3 Identify and describe the historical events that led to the Ice Ages.
- 3.6.1 Identify atmospheric pollutants resulting from human, biologic and geologic activity.
- 3.6.2 Describe the effects of air pollution on the Earth's atmosphere.
- 4.1.1 Relate atomic and molecular structure to the traits of minerals and include the major mineral groups.
- 4.1.2 Identify the major elements of the Earth's crust.
- 4.1.3 Define chemical and physical properties of minerals to include luster, hardness, cleavage, fracture, streak, color, specific gravity, and special traits.
- 4.1.4 Identify common minerals and ores and their uses. Include: quartz, calcite, talc, gypsum, fluorite, feldspar, biotite, muscovite, hematite, galena, halite, pyrite, magnetite, sulfur, and graphite.
- 4.2.1 Classify igneous rocks by mineral content and texture. Intrusive – granite; extrusive – pumice, obsidian, and basalt.
- 4.2.2 Classify sedimentary rocks by texture and composition. Clastic – sandstone, conglomerate, and shale; nonclastic – limestone and rock salt.
- 4.2.3 Classify metamorphic rocks by texture and composition. Foliated – slate, schist, and gneiss; unfoliated – marble and quartzite.

- 4.2.4 Identify Virginia's major rock and mineral resources and their uses.
- 4.2.5 Interpret a diagram of the rock cycle as it relates to the origin and transformation of rock types.
- 4.3.1 Summarize weathering as the process by which rocks are broken down by the action of water, air, and organisms.
- 4.3.2 Distinguish between physical (mechanical) and chemical weathering.
- 4.3.3 Recognize factors that affect the rate of weathering.
- 4.4.1 Define erosion as the process by which Earth materials are transported by moving water, ice, or wind.
- 4.4.2 Define deposition as the process by which Earth materials carried by wind, water, or ice settle out and are deposited.
- 4.4.3 Describe the agents of erosion: gravity, water (running water and waves), glaciers, and wind.
- 4.4.4 Explain the erosional and depositional results of gravity due to down-slope movement and mass movement (landslides, mudflows, and avalanches).
- 4.4.5 Explain that running water (rivers, streams, and runoff) is the major cause of erosion.
- 4.4.6 Describe the depositional and erosional features caused by waves (including deltas, beaches, and sandbars).
- 4.4.7 Describe the depositional and erosional features caused by glaciers (to include U-shaped valleys and lakes).
- 4.4.8 Explain how wind causes erosion and the results of deposition due to wind (such as dunes).
- 4.5.1 Explain the hydrologic cycle.
- 4.5.2 Identify the sources of fresh water on the Earth's surface.
- 4.5.3 Describe the process of stream development and the associated landforms.
- 4.5.4 Design and construct experiments using stream tables to infer relationships between gradient, slope, speed, and extent of weathering and erosion.
- 4.5.5 Explain the types of deposition specific to streams and rivers (such as alluvial fans and deltas).
- 4.5.6 Define a watershed.
- 4.5.7 Locate the major Virginia watershed systems on a map (Chesapeake Bay, Gulf of Mexico, and North Carolina sounds).
- 4.6.1 Interpret a simple groundwater diagram showing the zone of aeration, the zone of saturation, the water table, and an aquifer.
- 4.6.2 Describe underground water sources (such as aquifers and springs).
- 4.7.1 Explain the development of karst topography to include key terminology: joint, cavern, sinkhole, carbonation, stalactite, and stalagmite.
- 4.7.2 Locate the region of karst topography in Virginia as the Valley & Ridge Province where limestone/dolomite is common.
- 4.8.1 Explain how geologic processes such as erosion and human activities such as waste disposal can pollute water supplies.
- 4.8.2 Describe point source (e.g. sewers, waste pipes) and non-point source (e.g. sanitary landfills, runoff of pesticides) water pollution.
- 4.9.1 Explain the process of soil formation to include key terminology: soil horizon, soil profiles, humus and leaching.
- 4.9.2 Describe types of soil to include residual soil, transported soil, and humus.
- 4.9.3 Compare and contrast A, B, & C soil horizons found in mature and immature soils.
- 4.10.1 Compare and contrast the layers of the Earth (the core, mantle, and crust) focusing on mass, depth, physical characteristics, and any special features (such as convection currents in the mantle) for each layer.
- 4.10.2 Differentiate between the properties of continental crust and oceanic crust.
- 4.11.1 Outline the history of plate tectonics to include continental drift and sea-floor spreading.
- 4.11.2 Explain how the lithosphere is divided into plates that are in motion (compression, tension, and shearing) with respect to one another (because of convection currents in the mantle).
- 4.11.3 Describe the three plate boundaries: divergent (sea floor spreading), convergent (subduction and continental collision), and transform.
- 4.11.4 Identify and describe rock formations that have been folded due to continental collisions.
- 4.11.5 Identify the features of subduction zones (island arcs, trenches, and volcanic mountains).

- 4.12.1 Identify the major features of a divergent boundary with emphasis on mid-ocean ridges, rift valleys, and fissure volcanoes.
- 4.12.2 Identify the major features of a continental convergent boundary (with a focus on folded and thrust-faulted mountains).
- 4.12.3 Identify the major features of a transform boundary including strike slip faults.
- 4.12.4 Explain how a fault forms and identify the three types of faults to include: normal, reverse, and strike-slip.
- 4.12.5 Identify where most strike-slip faults are located and which plate boundaries they are associated with.
- 4.13.1 Define and illustrate the features that characterize a volcano and plutons.
- 4.13.2 Identify the three types of volcanoes and their associated characteristics.
- 4.13.3 Contrast the volcanism that occurs at each plate boundary including hot spot activity.
- 4.13.4 Compare and contrast P, S, and L (surface) waves.
- 4.13.5 Identify how scientists locate an epicenter using earthquake data.
- 4.13.6 Evaluate the impact of earthquakes on human activities.
- 4.13.7 Explain the formation of an anticline and syncline.
- 4.14.1 Summarize how the five physiographic provinces in Virginia were produced by a billion-year-long tectonic and geologic history.
- 4.14.2 Label a map of the physiographic provinces.
- 4.14.3 Describe the Coastal Plain and its connection to plate tectonics.
- 4.14.4 Identify the geologic features of the Piedmont as they pertain to plate tectonics.
- 4.14.5 Describe the Blue Ridge and its related geologic history.
- 4.14.6 Describe the Valley and Ridge province and relate its geology to plate tectonics.
- 4.14.7 Identify the Appalachian Plateau as a coal-rich province and describe its topography and geology.
- 4.15.1 Define what a fossil is, where they are found and how they can be preserved (molds, casts, and original bone or shell).
- 4.15.2 Identify the type of rocks in which fossils are found.
- 4.15.3 Identify in Virginia where most fossils are found and what type of fossils are found.
- 4.15.4 Identify that Paleozoic, Mesozoic, and Cenozoic fossils are found in Virginia.
- 4.16.1 Describe how life has changed and become more complex over geologic time.
- 4.16.2 Define superposition and crosscutting.
- 4.16.3 Identify how fossils, superposition, and crosscutting relations are used to determine the relative ages of rocks.
- 4.16.4 Differentiate between relative time and absolute time.
- 4.16.5 Identify how radioactive decay is used to determine the absolute age of rocks.
- 4.16.6 Interpret a simple geologic history diagram, using superposition and crosscutting relations.
- 4.16.7 Define the components of the geologic time scale.
- 5.1.1 Discuss the origin of the oceans and describe the distribution of oceans and seas.
- 5.2.1 Describe the composition of sea water and variations in salinity concentrations.
- 5.2.2 Explain ocean layering and effects of temperature differences.
- 5.2.3 Describe variations in sea level and ice caps.
- 5.3.1 Describe the physical properties of waves.
- 5.3.2 Explain the causes and effects of tides.
- 5.3.3 Explain the causes and effects of ocean currents.
- 5.4.1 Identify features of the sea floor to include continental margins, trenches, mid ocean ridges, and abyssal plains
- 5.4.2 Explain how sea floor topography reflects tectonic processes.
- 5.4.3 Describe the formation of major erosional and depositional shoreline features.
- 5.5.1 Identify and describe the categories of sea life: plankton, benthos, and nekton.
- 5.5.2 Give examples of the effects of chemical, physical, and geological changes in the ocean on living systems.
- 5.6.1 Evaluate impacts of cultural activities on the ocean environment.
- 5.6.2 Explain the relationships between geological evolution of shoreline features and coastal development.
- 5.6.3 Identify economic and public policy issues concerning the coastal zone including the Chesapeake Bay.

Core Areas For Laboratory Experiences

- Safety
- Latitude and longitude applications
- Time zones
- Map features
- Topographic maps
- Mineral characteristics and identification
- Igneous rock characteristics
- Sedimentary rock characteristics
- Metamorphic rock characteristics and rock cycle
- Natural resources
- Rate of erosion
- Weather, erosion, and deposition
- Identification of plate edges
- Epicenter
- Landforms related to uplift
- Geologic time line
- Methods of dating--relative and absolute
- Fossilization
- Spectroscope
- Stellar traits
- Celestial movement
- Heat transfer methods
- Relationship of evaporation to cooling
- Relative humidity and dew point
- Weather instruments--read and record
- Weather maps--interpretation and forecasting
- Climatic factors
- Chemical and physical properties of sea water
- Geological oceanography
- Tides
- Coastal processes



MISSION STATEMENT

The mission of the Virginia Beach City Public Schools, in partnership with our entire community, is to ensure that each student is empowered with the knowledge and skills necessary to meet the challenges of the future.

DEPARTMENT OF CURRICULUM AND INSTRUCTION
2512 George Mason Drive, P. O. Box 6038
Virginia Beach, Virginia 23456-0038

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Alternative formats of this publication which may include taped, Braille, or large print materials are available upon request for individuals with disabilities. Call or write The Department of Curriculum and Instruction, Director of Secondary Instructional Services, Virginia Beach City Public Schools, 2512 George Mason Drive, P.O. Box 6038, Virginia Beach, VA 23456-0038, Telephone (757) 263-1070 or (757) 263-1429, fax (757) 263-1412.