Earth and Space Science

5 credits - Level: I (This course fulfills the graduation requirement for earth and space science.)
Grade: 9-12
Prerequisite: Minimum grade of B in 8th grade science, score proficient on both the science and the language arts literacy sections of the NJ ASK 8.

This laboratory course provides students with the opportunity to develop scientific and problem-solving skills and to employ those skills in conjunction with appropriate technology to study the Earth and changes in the Earth caused by human activity and natural events. The scope of this course will range from an in-depth examination of the movement of the Earth's plates to how man has adapted to changes in his environment caused by himself or natural events.

PROFICIENCIES

Foundations of Earth Science

- differentiate among the following sciences: chemistry, physics, biology and earth science
- identify the topics studied in earth science
- describe some problem-solving strategies
- list steps commonly used as scientific methods
- distinguish among hypotheses, theories and laws
- list the SI units for the following measurements: length, mass, weight, area, volume, density and temperature.
- differentiate between the terms mass and weight and the terms area and volume

Rocks and Minerals

- differentiate between a rock and a mineral
- describe the rock cycle and the changes that a rock may undergo
- recognize magma and lava as the materials that cool to form igneous rock
- contrast the formation of intrusive and extrusive igneous rock
- contrast granitic and basaltic igneous rocks
- describe conditions that cause metamorphic rocks to form
- classify metamorphic rock as foliated or non-foliated
- explain how sedimentary rocks form from sediments
- classify sedimentary rocks as clastic, chemical or organic in origin
- list five characteristics all minerals share
- describe the structure of minerals
- give examples of two ways minerals form

The Changing Surface of Earth

- contrast mechanical weathering and chemical weathering
- explain the effects of climate on weathering
- explain how soil evolves from rock
- describe soil by comparing three soil horizons
- describe how environmental conditions affect the evolution of soil
- define erosion and deposition
- compare and contrast slumps, creeps, rock slides and mud slides
- compare rill, gully and sheet erosion
- describe how alluvial fans and deltas form
- describe how plucking occurs
- explain how striations are created
- compare and contrast till and out wash
- explain how wind causes deflation and abrasion
- discuss how loess and dunes form

- describe the water cycle
- explain what happens to water that does not soak into the ground or evaporate
- list three factors that affect runoff
- describe how a river system is like a tree
- explain what a drainage basin is
- discuss the three different stages of river development
- explain what happens to water when it soaks into the ground
- describe the relationship between water table and springs
- explain the causes of geysers and how caves form
- differentiate between plains and plateaus
- compare and contrast folded, upwarped, fault-block and volcanic mountains
- differentiate between latitude and longitude
- describe how latitude and longitude are used to identify locations
- calculate the time and date in different time zones

Earth's Air and Water
- name the common gases in the Earth's atmosphere
- describe the structure of the Earth's atmosphere
- explain what causes air pressure
- describe three things that happen to the energy Earth receives from the sun
- contrast radiation, conduction and convection
- explain why different latitudes receive different amounts of solar energy
- describe causes of the Coriolis Effect, sea breezes and land breezes
- locate the positions of the doldrums, trade winds, prevailing westerlies and polar easterlies
- learn the origin of water in the earth's oceans
- explain how dissolved salts and other substances get into seawater
- describe the composition of seawater
- determine how surface currents are influenced by winds, the Coriolis Effect and continents
- explain hwy water of the western coasts of continents are usually colder than waters off the eastern coast
- describe how density currents cause ocean water below the surface to circulate
- differential among the continental shelf, the continental slope and the abyssal plain
- describe the rift zones, mid-ocean ridges and ocean trenches

Earth's Internal Process
- diagram the earth’s structure
- describe each layer inside the earth
- discuss four pieces of evidence for the idea of continental drift
- describe sea floor spreading
- compare and contrast divergent, convergent and transform plate boundaries
- describe how convection currents might be the cause of plate tectonics
- explain how earthquakes result from the build up of stress in the earth’s crust
- contrast normal, reverse and strike-slip faults
- compare and contrast primary, secondary and surface waves
- explain how an earthquake epicenter is located using sonic wave information
- describe how seismic wave studies indicate the structure of earth’s interior
- define magnitude and the Richter Scale
- list ways to make your classroom and home more earthquake safe
- describe how volcanoes affect people
- describe conditions that cause volcanoes
- describe the relationship between volcanoes and plate tectonics
- describe three forms of volcanoes
- give examples of intrusive igneous feature sand how they form
- explain how a volcanic neck and caldera form

Change and Earth's History
- list the conditions necessary for fossils to form
- describe processes of fossil formation
- explain how fossil correlation is used to determine rock ages
- describe several method used to date rock layers relative to other rock layers
- interpret gaps in the rock record
- give an example of how rock layers may be correlated with other rock layers
- explain how geological time is divided into units
- relate organic evolution to divisions on the geologic time scale
- describe how plate tectonics affect organic evolution

The Solar System
- describe Earth's shape and list physical data about Earth
- compare and contrast rotation and revolution of Earth
- demonstrate how Earth's revolution and tit cause season to change on Earth
- compare and contrast the sun-centered and earth-centered models of the solar system
- describe the theory for the formation of the solar system

Science and Society
- list the ways technology helps you
- discuss ways the use of technology could be harmful
- contrast strip mines and underground coal mines
- list several environmental effects associated with coal min9ing
- explain the importance of soil
- identify and describe activities that lead to soil loss
- explain why problems develop when people live in places where land is prone to excessive erosion
- describe ways erosion can be reduced in some high risk areas
- give examples of ways people use water
- explain why some communities must rely on water diversion methods for their water supply
- identify a problem caused by water diversion
- explain why expose to ultraviolet radiation can be a problem for plants and animals
- describe how chlorofluorocarbons destroy ozone molecules
- describe the Greenhouse Effect
- list the causes of global warming
- list seven human activities that pollute the ocean
- explain how ocean pollution affects the entire world
- determine how we can live on this planet without destroying the oceans
- recognize that most loss of life in an earthquake is caused by the destruction of human-made structures
- decide who should pay for making structures seismic safe
- list the pros and cons of using geothermal energy to produce electricity
- form an opinion as to whether geothermal energy under the Hawaiian Islands should be used to generate electricity
- recognize how humans have caused extinctions
- predict what might happen to the diversity of life on Earth if land is developed without protection of natural habitats
- decide what can be done to stop or slow down the rate of species extinctions
- list the advantages of recycling
- describe ways to promote recycling
- express your feelings about government control of recycling
- describe the effects of acid rain on people, plants, water and animals
- describe activities that help reduce acid rain
- relate ways you can help reduce water pollution
- describe the evolution of fossil fuels - coal, oil and natural gas
- explain why fossil fuels are called non-renewable energy sources
- discuss how you can help conserve fossil fuels

- list the advantages of using solar power, wind power and hydroelectric power
- list the disadvantages of using solar power, wind power and hydroelectric power

You and the Environment
- interpret data from a graph that shows human population growth
- list reasons for Earth's rapid increase in population
- list several ways each person in an industrialized nation affects the environment
- list ways that we use land
- discuss environmental problems created because of land use
- list things you can do to help protect the environment
- identify the sources of pollutants that cause photochemical smog, sulfurous smog, holes in the ozone layer and acid rain
- describe how air pollution affects people and the environment
- explain how air pollution can be reduced
- list five water pollutants and their source
- describe ways that international agreements and U.S. laws are designed to reduce water pollution
- relate ways you can help to reduce water pollution

The Environment
- identify the components of an ecosystem
- discuss the flow of energy through ecosystems
- identity the different trophic levels in an ecosystem
- explain why ecosystems can only contain a few trophic levels
- recognize that nutrients, water and carbon cycle within ecosystems
- describe how nitrogen and water are recycled within ecosystems
- understand the role of plants in the cycling of materials within an ecosystem
- trace the path of carbon between living organisms and the environments
- identify the characteristics of fresh water ecosystems
- identify the factors that determine the ecosystem type found in a particular area
- contrast the seven major terrestrial ecosystems
- identify the major ocean ecosystems
- recognize the role of co-evolution in shaping the structure of ecosystems
- relate the characteristics of flowers to their co-evolution with insects
- describe how plants and their herbivores have co-evolved
- contrast parasitism, mutualism and commensalism
- describe the components of an organism’s niche
- describe the process of succession
- relate the stability of an ecosystem to its diversity
- recognize the roles of ecosystem size and latitude in determining diversity