**ACALANES UNION HIGH SCHOOL DISTRICT**
**COURSE OF STUDY: CURRICULAR AREA – SCIENCE**

| | |
|---|---|
| COURSE TITLE: | GEOLOGY |
| GRADE LEVEL: | 10-12 |
| COURSE LENGTH: | One Year |
| PREFERRED PREVIOUS COURSE OF STUDY: | The Living Earth |
| CREDIT: | 10 Credits |
| UC/CSU CREDIT: | Meets UC/CSU credit for Science requirement; subject area (“d”) |
| GRADUATION REQUIREMENT: | Fulfills one year of two-year science requirement for graduation |
| STANDARDS AND BENCHMARKS: | Next Generation Science Standards |
| ADOPTED: | 03.06.2019 |
| INSTRUCTIONAL MATERIALS: | TBD |

COURSE DESCRIPTION:

The Geology course offers a comprehensive study of the earth and space sciences. Topics include physical and historical geology, oceanography, weather, climate and astronomy which provides students with an understanding of Earth as a set of interconnected systems dynamically evolving through time. The course is lab and activity focused and allows students an opportunity to integrate science and engineering practices and concepts while learning about the processes that shape the earth and our environment.

DEFINITIONS:

**Instructional Segment**: Grouping elements or concepts from multiple PEs in lessons, units, and/or assessments that students can develop and use together to build toward proficiency on a set of PEs in a coherent manner.

**Performance Expectation:** The NGSS is not a set of daily standards, but a set of expectations for what students should be able to do by the end of instruction (years or grade-bands). The performance expectations set the learning goals for students, but do not describe how students get there.

.

**Disciplinary Core Ideas:** The fundamental ideas that are necessary for understanding a given science discipline. The core ideas all have broad importance within or across science or engineering disciplines, provide a key tool for understanding or investigating complex ideas and solving problems, relate to societal or personal concerns, and can be taught over multiple grade levels at progressive levels of depth and complexity.

CURRICULAR PRACTICES:

Within the Geology course, there are three distinct and equally important dimensions to learning science. These dimensions are combined to form each standard—or performance expectation—and each dimension works with the other two to help students build a cohesive understanding of science over time.

The Three Dimensions:

- The Science and Engineering Practices are what scientists/engineers DO.
- The Disciplinary Core Ideas are what scientists/engineers KNOW.
- The Crosscutting Concepts are HOW scientists/engineers THINK.

**Crosscutting Concepts:**

1. Patterns
2. Cause and effect
3. Scale, proportion and quantity
4. Systems and system models
5. Energy and matter: flows cycles and conservation
6. Structure and function
7. Stability and change of systems

**Science and Engineering Practices:**

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

COURSE INSTRUCTIONAL SEGMENTS:

1. Earth's Systems
2. Earth's Place in the Universe
3. Earth and Human Activity

ASSESSMENT:

Geology incorporates a variety of assessment activities that mirror the variety in NGSS-aligned instructional practices. The distinction between instructional activities and assessment activities may be blurred, particularly when the assessment purpose is formative.

Assessments will focus on:

1. Tasks that have multiple components so they can yield evidence of three-dimensional learning (and multiple performance expectations).
2. Explicit attention to the connections among scientific concepts.
3. Gathering of information about how far students have progressed along a defined sequence of learning.

GRADING GUIDELINES:

See AUHSD Grading Guidelines: Final Course Mark Determination

COURSE CONTENT:

| **Geology Instructional Segments** |
| --- |
| **Instructional Segment 1: Earth's Systems** |
| **Next Generation Science Standards - Disciplinary Core Ideas:**<br>ESS1.B: **Earth and the Solar System** Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes.<br><br>ESS2.A: **Earth Materials and Systems** Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.<br><br>ESS2.B: **Plate Tectonics and Large-Scale System Interactions** The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust.<br><br>ESS2.C: **The Roles of Water in Earth's Surface Processes** The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.<br><br>ESS2.D: **Weather and Climate** The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. |

PS4.A: **Wave Properties** Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet.

**Additional AUHSD Topics**

Matter, Minerals and Rocks:

- Characteristics of minerals, properties used in mineral identification
- The rock cycle, including how igneous, sedimentary and metamorphic rocks are formed and classified.
- Renewable vs nonrenewable resources

Volcanoes and Igneous Activity:

- Explosive vs quiet eruptions
- Shield, composite and cinder cone volcanoes
- Global distribution of volcanic activity in relation to plate tectonics

Physical Oceanography:

- Sea water and ocean currents
- Tides and their monthly cycles

California Geology:

- Natural Resources
- Seismic Hazards
- California river systems

Atmospheric Science:

- Composition and structure
- Moisture, clouds and precipitation
- Air pressure and winds
- El Nino and La Nina

World Climates and Global Climate Change

- Long, medium and short term climate cycles
- Factors that influence and force climate

**Geology Instructional Segments**

**Instructional Segment 2: Earth's Place in the Universe**

**Next Generation Science Standards - Disciplinary Core Ideas:**

ESS1.A : **The Universe and Its Stars** The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy . Heavier elements are produced when certain massive stars achieve a supernova stage and explode.

ESS1.B: **Earth and the Solar System** Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.

ESS1.C: **The History of Planet Earth** Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.

ESS2.B: **Plate Tectonics and Large-Scale System Interactions** Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history

PS1.C: **Nuclear Processes** Spontaneous radioactive decay s follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.

PS3.D: **Energy in Chemical Processes and Everyday Life** Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.

PS4.B **Electromagnetic Radiation** Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities.

**Additional AUHSD Topics**

Geologic Time:

- Numerical and relative dating principles and techniques.

Astronomy:

- Phases of the moon
- Lunar and solar eclipses
- Terrestrial and Jovian planets
- Stellar evolution
- Constellations

**Geology Instructional Segments**

**Instructional Segment 3: Earth and Human Activity**

**Next Generation Science Standards - Disciplinary Core Ideas:**

**ESS2.D: Weather and Climate** Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.

ESS3.A : **Natural Resources** Resource availability has guided the development of human society . All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.

ESS3.B: **Natural Hazards** Natural hazards and other geologic events have shaped the course of human history ; [they ] have significantly altered the sizes of human populations and have driven human migrations.

ESS3.D: **Global Climate Change** Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.