Geology

Overview

Geology is the study of the origin and evolution of the Earth, using the principles of mathematics, chemistry, physics, and biology. Geologists study rocks, minerals, and fossils in an effort to draw conclusions about the Earth’s observable surface processes, as well as those processes taking place inside the Earth. They attempt to determine how the Earth was formed and how it is being changed by natural and man-made activities. Geologists are often involved in remediating environmental problems caused by mining, construction, and manufacturing.

Roadmaps

Road maps lay out all of the courses you need to take for a given degree or certificate. 

Get a Road map! Explore Ways to Complete These Programs (/academics/arc-program-road-maps)

Associate Degrees for Transfer

A.S.-T. in Geology

Geology is an interdisciplinary science that combines geological observations and concepts with those of biology, chemistry, physics, and mathematics. Its goals are to study rocks, minerals, fossils, energy and water resources, and to understand geologic principles and processes that shape Earth and its environments.

The Associate in Science in Geology for Transfer provides students with a major that fulfills the general requirements of the California State University for transfer. Students with this degree will receive priority admission with junior status to the California State University system.

The Associate in Science in Geology for Transfer (A.S.-T.) may be obtained by the completion of 60 transferable, semester units with a minimum of a 2.0 GPA, including (a) the major or area of emphasis described in the Required Program outlined below (earning a C or better in these courses), and (b) the Intersegmental General Education Transfer Curriculum (IGETC).

Catalog Date: June 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
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<td>MATH 401</td>
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Total Units: 28

The Associate in Science in Geology for Transfer (A.S.-T) degree may be obtained by completion of 60 transferable, semester units with a minimum 2.0 GPA, including (a) the major or area of emphasis described in the Required Program, and (b) the Intersegmental General Education Transfer Curriculum (IGETC).

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate new and accepted ideas about the natural universe using testable methodology.
- articulate orally and/or in writing the importance of continuous examination and modification of accepted ideas as a fundamental element in the progress of science.
- sort, arrange, and quantify objects using the international system of measurement (metric) as the standard.
- analyze a wide variety of natural phenomena using basic definitions and fundamental theories of natural science.
- compare the scales at which geologic processes work.
- apply knowledge of current geologic processes to the understanding of Earth's past geologic history.

Career Information

The Geology transfer degree is designed to facilitate students’ successful transfer to four-year colleges that prepare them for advanced study in a variety of graduate programs as well as a variety of career opportunities in the fields of environmental monitoring, protection and remediation, energy and mineral exploration, paleontology, vulcanology, seismology, climatology, teaching, and research.

Associate Degrees

A.S. in General Science
This program provides a broad study in the fields of biological and physical sciences in preparation for transfer to a four-year program and continuation of studies in upper division science courses.

**Catalog Date:** June 1, 2020

### Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<td>Stars, Galaxies, and Cosmology (3)</td>
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<td>ASTR 330</td>
<td>Introduction to Astrobiology (3)</td>
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<td>Weather and Climate (3)</td>
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<td>GEOG 394</td>
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<td>Electricity and Magnetism (4)</td>
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# Geology (GEOL) Courses

**COURSE CODE** | **COURSE TITLE** | **UNITS**
--- | --- | ---
GEOL 300 | Physical Geology | 3

## BIOL Courses

**COURSE CODE** | **COURSE TITLE** | **UNITS**
--- | --- | ---
BIOL 300 | The Foundations of Biology | 3
BIOL 301 | Evolution | 3
BIOL 303 | Survey of Biology | 4
BIOL 305 | Natural History | 4
BIOL 310 | General Biology | 4
BIOL 322 | Ethnobotany | 3
BIOL 332 | Introduction to Ornithology | 4
BIOL 342 | The New Plagues: New and Ancient Infectious Diseases Threatening World Health | 3
BIOL 352 | Conservation Biology | 3
BIOL 370 | Marine Biology | 4
BIOL 375 | Marine Ecology | 3
BIOL 390 | Natural History Field Study | (0.5 - 4)
BIOL 400 | Principles of Biology | 5
BIOL 411 | Principles of Botany | 5
BIOL 415 | Introduction to Biology: Biodiversity, Evolution, and Ecology | 5
BIOL 420 | Principles of Zoology | 5
BIOL 430 | Anatomy and Physiology | 5
BIOL 431 | Anatomy and Physiology | 5
BIOL 440 | General Microbiology | 4
BIOL 442 | General Microbiology and Public Health | 5
BIOL 482 | Honors Marine Biology | 4
BIOL 495 | Independent Studies in Biology | (1 - 3)
BIOL 499 | Experimental Offering in Biology | (0.5 - 4)
BIOT 301 | Biotechnology and Human Health | 3
BIOT 305 | Introduction to Bioinformatics | 1
BIOT 307 | Biotechnology and Society | 3
BIOT 311 | Biotechnology Laboratory Methods - Molecular Techniques | 3
BIOT 312 | Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques | 2
BIOT 499 | Experimental Offering in Biology | (0.5 - 4)
NATR 300 | Introduction to Natural Resource Conservation and Policy | 4
NATR 302 | Introduction to Wildlife Biology | 4
NATR 303 | Energy and Sustainability | 3
NATR 304 | The Forest Environment | 3
NATR 305 | Fisheries Ecology and Management | 4
NATR 306 | Introduction to Rangeland Ecology and Management | 3
NATR 307 | Principles of Sustainability | 4
NATR 310 | Study Design and Field Methods | 4
NATR 320 | Principles of Ecology | 4
NATR 322 | Environmental Restoration | 2
NATR 324 | Field Studies: Birds and Plants of the High Sierra | (1.5)
NATR 330 | Native Trees and Shrubs of California | 4
NATR 332 | Wildflowers of California | 3
NATR 346 | Water Resources and Conservation | 3
NATR 495 | Independent Studies in Natural Resources | (1 - 3)
NATR 499 | Experimental Offering in Natural Resources | (0.5 - 4)
PSYC 315 | Biological Psychology | 3
PSYC 311 | Biological Psychology Laboratory | 1
PSYC 495 | Independent Studies in Psychology | (1 - 3)
PSYC 499 | Experimental Offering in Psychology | (0.5 - 4)

**Total Units:** 18

1 must be transfer-level and must include one laboratory course in a physical science and one laboratory course in a biological science

The General Science Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate new and accepted ideas about the natural universe using scientific methods.
- analyze a wide variety of natural phenomena using basic definitions and fundamental theories of biological or physical sciences.
- apply appropriate quantitative and qualitative methods to interpret and analyze pertinent data.
- outline the basic concepts and fundamental theories of a natural science.
- articulate orally and/or in writing the importance of continuous examination and modification of accepted ideas as a fundamental element in the progress of science.
- discuss ethical components of scientific decision making and apply personal and social values within the process of decision making in scientific endeavors.

## Geology (GEOL) Courses

**GEOL 300 Physical Geology**

**Units:** 3
**Hours:** 54 hours LEC
This course provides an understanding of the dynamic nature of the Earth through the study of Earth processes. Topics include global plate tectonics and related processes such as seismic and volcanic activity. It also covers mineral and rock formation, and those processes related to the development of fluvial, glacial, desert, and coastal environments. The occurrence, use, and abuse of renewable and non-renewable resources such as air, ground and surface water, and fossil fuels are also covered. Field trips may be required.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- explain the origins and characteristics of igneous, sedimentary, and metamorphic rock types.
- compare divergent, convergent, and transform plate tectonic boundaries in terms of the geologic processes and landforms found at each.
- recognize the dynamic nature of geologic processes and their rates as they relate to Earth's great age.
- analyze problems affecting daily life such as earthquake risks, volcanic hazards, mass wasting problems, rising sea levels, global warming, and use/abuse of natural resources.

**GEOL 301 Physical Geology Laboratory**

Units: 1  
Hours: 54 hours LAB

Prerequisite: None.  
Corequisite: GEOL 300  
Transferable: CSU; UC

General Education: CSU Area B3; IGETC Area 5C  
C-ID: C-ID GEOL 100L

Catalog Date: June 1, 2020

This course is a laboratory study of the basic principles of geology and their applications to everyday life. It encompasses the study and identification of common rocks and minerals, the interpretation and recognition of geologic structures and landforms, interpretation of maps, aerial photographs, remote sensing images, seismic information, and analysis of geologic hazards. Field trips may be required.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify and classify minerals by their physical properties.
- evaluate rock samples and differentiate between igneous, sedimentary, and metamorphic rocks.
- appraise major types of aerial photographs, remote sensing imagery, and topographic and geologic maps and interpret geologic information from them.
- interpret ancient geologic, geographic, and environmental settings by using sedimentary rocks.
- formulate views of Earth's interior based on analyzing seismic information.
- explain major Earth features to demonstrate understanding of plate tectonic processes.

**GEOL 305 Earth Science**

Units: 3  
Hours: 54 hours LEC

Prerequisite: None.  
Advisory: MATH 32 or 42; and eligible for ENGRD 310 or ENGRD 312 AND ENGRWR 300, OR ESLR 340 AND ESLW 340.

Transferable: CSU; UC (UC Credit Limitation: No credit if taken after a college level course in Astronomy, Geology, Oceanography or Meteorology)

General Education: AA/AS Area IV; CSU Area B1; IGETC Area 5A

Catalog Date: June 1, 2020

This is an introductory science course covering major topics in geology, oceanography, meteorology, and astronomy. It focuses on Earth as a dynamic and continually evolving planet and emphasizes the relationships between human-Earth interactions. Field trips may be required.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe the Big Bang origin theory of the universe and explain the importance of stellar fusion to the formation of elements that make up the known universe.
- classify the planets in our solar system as terrestrial and Jovian and list the characteristics of each category.
- outline the processes and features associated with running water, ground water, glaciers, wind, and waves that impact Earth's surface.
• cite the factors/processes that are responsible for producing Earth's seasons, weather, and climate.
• describe divergent, convergent, and transform plate tectonic boundaries in terms of the geologic processes (seismic activity, subduction, volcanism) and landforms found at each.
• illustrate, with real-world examples, issues affecting daily life, such as earthquake risks, volcanic hazards, mass wasting, rising sea levels, climate change, and use-abuse of natural resources.
• classify rocks by their visible characteristics as igneous, sedimentary, and metamorphic rock types.

GEOL 306 Earth Science Laboratory

Units: 1
Hours: 54 hours LAB
Prerequisite: None.
Corequisite: GEOL 305
Advisory: MATH 32 and 42; Eligible for ENGRD 310 or ENGRD 312 AND ENGRWR 340; OR ESLR 340 AND ESLW 340.
Transferable: CSU: UC (UC credit limitation: No credit if taken after GEOL 300 or 301)
General Education: CSU Area B3; IGETC Area 5C
C-ID: C-ID GEOI 120L
Catalog Date: June 1, 2020

This course emphasizes scientific methods, critical thinking skills, and systematic Earth science laboratory procedures. Topics include weather analysis, rock and mineral identification, study of topographic and geologic maps, and exercises in astronomy and oceanography.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
• apply the scientific method to evaluate Earth science processes.
• distinguish between specimens of rocks and minerals and their modes of formation.
• differentiate between various geological processes that work to shape the topography of Earth.
• analyze atmospheric observations (temperature, pressure, humidity, cloud cover) to make basic weather forecasts.
• examine astronomical patterns and phenomena including planetary motion, solar and lunar eclipses, lunar phases, sun angle, and constellations.
• survey Earth's basic marine processes and describe seafloor topography.
• interpret and analyze various types of maps and satellite imagery used in the Earth sciences.

GEOL 310 Historical Geology

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Corequisite: GEOL 300, GEOL 305, MATH 100, or MATH 132; AND eligible for ENGRD 310 or ENGRD 312 AND ENGRWR 300; OR ESLR 340 AND ESLW 340.
Advisory: CSU: UC
Transferable: AA/AS Area IV; CSU Area B1; IGETC Area 5A
C-ID: C-ID GEOI 110
Catalog Date: June 1, 2020

This course covers geologic history of the Earth as shown by the rock record and by the succession of fauna and flora through the processes of evolution and extinction. Plate tectonics and its driving mechanisms are used to understand the assembly and breakup of supercontinents, growth and erosion of mountains and changing sea levels. The evolution of species, ecosystems, climates, and landscapes is placed in a plate tectonics context. Stratigraphic, mineralogic, geochemical, and petrographical techniques for interpreting the sequence of past geological events are studied. Field trips may be required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
• evaluate the history of the Earth in its 4.6 billion-year history in the context of the geological timescale, and the relative and numerical methods used to construct the timescale.
• describe the mechanisms of evolution and extinction and how they have shaped the history of life and affected geological processes in the past
• describe how the rock cycle has changed over geological time in terms of minerals, igneous, metamorphic and sedimentary rocks
• explain the mechanisms and features of plate tectonics and geological change and how they have shaped the Earth's history
• analyze the assembly, movement, and growth of the continents, and formation and breakup of supercontinents, with special regard for the North American continent
• analyze the factors that have determined the state of Earth's climate system in the past

GEOL 311 Historical Geology Laboratory

Units: 1
Hours: 54 hours LAB
Prerequisite: None.
Corequisite: GEOL 310
Advisory: GEOL 300 and 301
Transferable: CSU: UC
General Education: CSU Area B3; IGETC Area 5C
C-ID: C-ID GEOI 110L
Catalog Date: June 1, 2020

This course is a laboratory study in historical geology. It applies principles of physical geology and paleontology in the reconstruction of the history of the earth. Exercises in stratigraphy, paleontology, and interpretation of geologic maps are utilized. Field trips are required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
• compare the evolution of major fossil phyla
• analyze examples of stratigraphic sequences to determine depositional environments
• analyze rock specimens to infer the processes involved in their origins
• analyze fossil assemblages to infer geologic ages

GEOL 320 Global Climate Change
This course explores the history and mechanisms of climate change in Earth’s past, as well as the methods that scientists use to investigate climate change. It also focuses on climate change in Earth’s recent history (the past few million years) and the role that humans have had in climate change, especially since the industrial revolution. Additionally, it investigates the effects of climate change in today’s world and discusses possible technological and political solutions to this vast and increasingly important problem, and how societies may adapt to the changes. Field trips may be required. This course is not open to students who have completed GEOG 305.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe the scientific tools used to study global climate change in the past and present.
- explain the components, processes, and dynamics of the global heat budget, as they pertain to the ocean/atmosphere system.
- identify and describe the various lines of evidence that scientists use to investigate climate change in Earth’s deep past.
- explain the conditions that led to extensive climate change over the past 2.5 million years.
- evaluate the human causes of climate change, the evidence surrounding that, and the possible consequences of anthropogenically driven climate change.
- discriminate between and evaluate mechanisms of climate mitigation and adaptation at international, national, state, and local levels.

### GEOL 325 Environmental Hazards and Natural Disasters

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<td>Prerequisite:</td>
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<td>Transferable:</td>
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<td>General Education:</td>
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This course covers the environmental effects and applications of Earth-related processes. It focuses on earthquakes, volcanic eruptions, landslides, flooding, hurricanes, as well as covering related current events. Topics also include the availability and exploitation of natural resources, waste disposal, and global climate change. Humans as a force in environmental change are emphasized. This course addresses geology, engineering, environmental studies, natural resources, geography, and science education. One field trip is required. This course is not open to students who have completed GEOG 307.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- identify and describe potential environmental hazards associated with different geomorphic settings.
- describe short- and long-term consequences of environmental hazards on human activities.
- compare and contrast renewable and non-renewable natural resources.
- analyze the impact of human activity on natural resources.
- distinguish between short- and long-term global climate trends.
- evaluate current environmental issues that involve Earth system processes.

### GEOL 330 Introduction to Oceanography

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<tr>
<td>Units:</td>
<td>3</td>
</tr>
<tr>
<td>Hours:</td>
<td>54 hours LEC</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Advisory:</td>
<td>GEOG 300 or GEOG 300</td>
</tr>
<tr>
<td>Transferable:</td>
<td>CSU; UC</td>
</tr>
<tr>
<td>General Education:</td>
<td>AA/AS Area IV; CSU Area B1; IGETC Area 5A</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>June 1, 2020</td>
</tr>
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</table>

This course is an integrated study of the world’s oceans, including the physical, chemical, biological and human-made processes that affect the oceans. Topics include plate tectonics, ocean basins and sediments, water chemistry, waves, tides, shoreline processes, ocean currents and its biosystems. Humans have impacted nearly all aspects of the oceans, which are critical to our species. Regional oceanographic features are emphasized and a field trip to gain familiarity with regional physical shoreline features is required. This course is not open to students who have completed GEOG 308.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- describe and evaluate the relationships between marine processes and plate tectonics
- assess the impact of human activities on ocean chemistry, biosystems and global climate
- examine common coastal features and processes
- evaluate the impacts of shoreline processes on human activities and structures
- analyze the relationships between weather patterns and oceanic circulation
- assess and interpret the gross chemical composition of the ocean
- evaluate and measure the impacts of resource extraction on marine environmental concerns
- describe the distribution of sediment in the oceans and the processes that move sediment

### GEOL 331 Introduction to Oceanography Lab

<table>
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<tr>
<th>Same As:</th>
<th>GEOG 309</th>
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<tbody>
<tr>
<td>Units:</td>
<td>1</td>
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<tr>
<td>Hours:</td>
<td>54 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
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<td>Corequisite:</td>
<td>GEOG 308 or GEOG 330</td>
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<td>Advisory:</td>
<td>GEOG 301 or GEOG 301</td>
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<tr>
<td>Transferable:</td>
<td>CSU; UC</td>
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</tbody>
</table>

This course is not open to students who have completed GEOG 308.
This course is a laboratory investigation of Earth's oceans, emphasizing coastal processes of California. Most laboratory exercises are incorporated into field studies of California's coast, which involves visiting and comparing several distinct coastal environments. Camping is required, and a small fee is to be paid by the student. This course is not open to students who have completed GEOG 309.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- assess the physical and chemical similarities and differences of distinct coastal environments
- analyze the changing physical and chemical conditions on biological patterns
- analyze the relationships between sea floor morphology and plate tectonics

GEOL 345 Geology of California

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Transferable: CSU; UC
General Education: AA/AS Area IV; CSU Area B1; IGETC Area 5A
C-ID: C-ID GEOL 200
Catalog Date: June 1, 2020

This course provides a survey of the physical and historical aspects of California geology, emphasizing the linkage of geology and people through economic and social impacts. It is recommended for non-majors and majors in geology and is of particular value to science, engineering, environmental studies, education, and economics majors. Field trips may be required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- interpret the formation of California's geologic provinces within the framework of plate tectonics.
- describe California's geologic resources, their distribution, use, and conservation.
- analyze California's geologic hazards and assess their prediction, prevention, and mitigation.
- evaluate the continuing interaction between geology and humans in California.
- locate California's geologic provinces on a map.

GEOL 390 Field Studies in Geology

Units: 1 - 4
Hours: 6 - 24 hours LEC; 36 - 144 hours LAB
Prerequisite: None.
Transferable: CSU; UC
Catalog Date: June 1, 2020

This course involves field study of selected locations of geologic interest. Course content varies according to field trip destination but may include topics in physical geology, environmental geology, economic geology, and/or introduction to tools and techniques used for geosciences field research (e.g. map and compass, the Global Positioning System (GPS), Geographic Information Systems (GIS), etc.). Field excursions are required and field trip expense fees may be required. A portion of this course may be offered in a TBA component of 18-144 hours which may include composing field notes, making field sketches, collecting various forms of field data, analysis of field data, and use of maps, compass, and/or the Global Positioning System.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- relate geologic concepts and processes to actual locations and situations.
- compose field notes.
- describe and explain geologic phenomena related to the specific examples under study.
- integrate student-observed geologic information to interpret and explain patterns and processes.
- analyze collected field data.

GEOL 495 Independent Studies in Geology

Units: 1 - 3
Hours: 54 - 162 hours LAB
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

GEOL 499 Experimental Offering in Geology

Units: 0.5 - 4
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

Field trips to selected locations of geologic interest in California and bordering areas. This course provides a general geologic understanding of a particular region of California and/or bordering areas. Course content may include plate tectonics, earthquakes and seismicity, geomorphology, recent volcanic activity, glacial features, ore deposits, mining, regional geology, and structural geology (faulting). Intended for those with a general interest in geology, earth science, environmental studies, civil engineering, science education, or the outdoors. Field trip(s) required.

Faculty
Major topics of geology include mineral and rock formation, earthquakes and plate tectonics.