GEOLOGY MAJOR

Program Director: John Merck, Ph.D.

The Department of Geology offers three major tracks addressing key aspects of Geology - the science of Earth. In its broadest sense, geology focuses on the formation and subsequent modification of the planets, emphasizing planet Earth. Geologists study Earth's internal and surface structure and materials, history, and the chemical and physical processes acting within and on it using the principles of mathematics, physics, chemistry, and biology.

Geological sciences encompass all the physical, chemical, and biological aspects of Earth. Increasingly, geologists are taking a holistic approach in the collection and interpretation of data about Earth, which means that the wider context of the geological sciences is broad and diverse. In studying Earth as a system, geologists address geology and geophysics, hydrology, oceanography and marine science, atmospheric science, planetary science, and soil science. A major in any relevant discipline can lead to a satisfying career within the geological sciences. In general, graduate training is expected for advancement to the most rewarding positions and for academic employment.

Geology offers three major tracks:

• The Geology Professional Track is intended for students seeking to enter geosciences careers in private industry or public service, and who intend to pursue graduate degrees in geosciences.
• The Geology Geophysics Track is similarly intended for students seeking to enter careers in private industry or public service emphasizing the applications of physics to geosciences issues, and who intend to pursue graduate degrees in geophysics and related disciplines.
• The Earth and Environmental Sciences Track prepares students who do not plan, specifically, to become geologists but who plan to enter careers in fields for which geological information is foundational, including but not limited to science education, science journalism, environmental science, environmental law, and public policy.

Program Objectives

Geologists are employed by governmental, industrial, and academic organizations. They work in exploration for new mineral and energy resources, as consultants on engineering and environmental projects, as teachers and researchers in universities, and in many other challenging positions. For many, the attraction of a career in geology is the ability to divide time between work in the field, the laboratory, and the office. Although the employment outlook within geology varies with the global economic climate, the long-range outlook is good. This is because our dwindling energy, mineral, and water resources, along with increasing concerns about natural hazards and environmental issues, present new challenges for geologists.

Program Learning Outcomes

1. Demonstrate mastery in the design and execution of geosciences research.
2. Demonstrate effective communication in oral and written geosciences presentations.
3. Demonstrate broad knowledge of subject material in the principal disciplines of geosciences and understanding of the connections between them.
4. Demonstrate understanding of the application of geosciences knowledge in broader societal contexts.

REQUIREMENTS

Professional Track

Courses required for the Professional Track B.S. in Geology are listed below. Some courses require field trips for which students are expected to pay for room (if required) and board. Field camp is taken during the summer at institutions other than the University of Maryland, College Park, that offer camps approved by the department.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>GEOL100</td>
<td>Physical Geology</td>
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<td>or GEOL120</td>
<td>Environmental Geology</td>
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<tr>
<td>GEOL110</td>
<td>Physical Geology Laboratory</td>
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<tr>
<td>GEOL102</td>
<td>Historical Geology</td>
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<tr>
<td>GEOL322</td>
<td>Mineralogy</td>
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<tr>
<td>GEOL341</td>
<td>Structural Geology</td>
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<td>GEOL342</td>
<td>Sedimentation and Stratigraphy</td>
<td>4</td>
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<tr>
<td>GEOL423</td>
<td>Optical Mineralogy</td>
<td>4</td>
</tr>
<tr>
<td>GEOL443</td>
<td>Petrology</td>
<td>4</td>
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<tr>
<td>GEOL393</td>
<td>Geology Senior Thesis I: Proposal</td>
<td>3</td>
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<tr>
<td>GEOL394</td>
<td>Geology Senior Thesis II: Research</td>
<td>3</td>
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<tr>
<td>GEOL490</td>
<td>Geology Field Camp</td>
<td>6</td>
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<tr>
<td>GEOL351</td>
<td>Statistics for Geoscientists</td>
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<tr>
<td>GEOL413</td>
<td>Geoscientific Modeling</td>
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<td>GEOL460</td>
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<td>GEOL435</td>
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<tr>
<td>GEOL436</td>
<td>Principles of Biogeochemistry</td>
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<tr>
<td>GEOL437</td>
<td>Global Climate Change: Past and Present</td>
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Geology Elective

Select any 3-4 credit 300 – 400 level GEOL course not taken to satisfy the above requirements 1

Supporting Courses

CHEM131 Chemistry I - Fundamentals of General Chemistry
courses in addition to completing GenEd and 120 credits overall.

In required geology courses, and a C- average or better in supporting
receive a degree in Geology, students must earn a grade of C- or better
Connecting Earth and Environmental Sciences Track can be completed in between 71 and 77 credits. To
Depending on course options selected, the Earth and Environmental Sciences Track leads
opportunities in geology are advised to pursue the Professional Track.

or for graduate study, students seeking advanced degrees or career
Consult with advisors in the College of Education. While this track may
opportunities in secondary education are urged, also, to
order to obtain Maryland State Teaching Certification. Students seeking
Background in fields
Such careers include but are not limited to science education, science
journalism, environmental law and public policy. Background in fields
connecting geology to related careers is provided by supporting options
in Atmospheric and Oceanic Sciences, Astronomy, and Education. Further coursework in Education (including student teaching) will be required in order to obtain Maryland State Teaching Certification. Students seeking professional opportunities in secondary education are urged, also, to consult with advisors in the College of Education. While this track may also prepare students for work as a geologists in government or industry or for graduate study, students seeking advanced degrees or career opportunities in geology are advised to pursue the Professional Track.

Depending on course options selected, the Earth and Environmental Sciences Track can be completed in between 71 and 77 credits. To receive a degree in Geology, students must earn a grade of C- or better in required geology courses, and a C- average or better in supporting courses in addition to completing GenEd and 120 credits overall.

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<tr>
<td>GEOL123</td>
<td>Causes and Consequences of Global Change¹</td>
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<tr>
<td>GEOL124</td>
<td>Evolution of Life and Environment on Planet Earth</td>
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<tr>
<td>GEOL200</td>
<td>Earth’s Fury: Earthquakes, Volcanoes, and Tsunami</td>
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<tr>
<td>GEOL204</td>
<td>Dinosaurs, Early Humans, Ancestors, and Evolution; The Fossil Record of Vanished Worlds of the Prehistoric Past</td>
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</table>

| GEOL212  | Planetary Geology                          |         |
| GEOL102  | Historical Geology                         | 4       |
| GEOL322  | Mineralogy                                 | 4       |
| GEOL340  | Geomorphology                              | 4       |
| GEOL341  | Structural Geology                         | 4       |
| GEOL342  | Sedimentation and Stratigraphy             | 4       |

**Earth Sciences Electives**

- GEOL386  Experiential Learning¹
- GEOL490  Geology Field Camp²
- GEOL499  Special Problems in Geology

**Earth Sciences Core Disciplines**

- GEOL375  Introduction to the Blue Ocean
- GEOL423  Optical Mineralogy
- GEOL437  Global Climate Change: Past and Present
- GEOL451  Groundwater
- GEOL452  Watershed and Wetland Hydrology
- GEOL453  Ecosystem Restoration

**Geophysics:**

- GEOL446  Geophysics
- GEOL455  Marine Geophysics
- GEOL456  Engineering Geology
- GEOL457  Seismology
- GEOL460  Field Geophysics

**Earth Materials:**

- GEOL443  Petrology
- GEOL444  Low Temperature Geochemistry
- GEOL445  High Temperature Geochemistry

**Geobiology:**

- GEOL331  Principles of Paleontology
- GEOL391  Biology of Extinct Animals
- GEOL431  Vertebrate Paleobiology
- GEOL435  Environmental Geochemistry
- GEOL436  Principles of Biogeochecmy
- GEOL437  Global Climate Change: Past and Present

**Analytic Methods in Earth Sciences:**

- GEOL373  Geographic Information Systems
- GEOL351  Statistics for Geoscientists
- GEOL413  Geoscientific Modeling
- GEOL447  Observational Geophysics

**Environmental Geosciences:**

- GEOL375  Introduction to the Blue Ocean
- GEOL423  Optical Mineralogy
- GEOL437  Global Climate Change: Past and Present
- GEOL451  Groundwater
- GEOL452  Watershed and Wetland Hydrology
- GEOL453  Ecosystem Restoration

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- GEOL437  Global Climate Change: Past and Present

Any two 3 - 4 credit 300 - 400 level GEOL course not taken to satisfy the above requirements or appropriate substitution with the approval of the department. If GEOL490 – Geologic Field Camp is taken as an Experiential Learning option, it additionally satisfies one Earth Sciences Elective requirement.

**Supporting Courses**

- AOSC123  Causes and Consequences of Global Change¹
- AOSC200  Weather and Climate
- ASTR120  Introductory Astrophysics - Solar System

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1 Or appropriate substitution with the approval of the department

Matriculated Geology majors are expected to take all courses on campus unless specific departmental permission is given.

**Earth and Environmental Sciences Track**

Courses required for the Professional Track B.S. in Earth and Environmental Sciences are listed below. Some courses require field trips for which students are expected to pay for room (if required) and board. The Geology Earth and Environmental Sciences Track leads to a B. S. degree in Geology with special emphasis on coursework that prepares the student for careers in fields other than professional geosciences but for which geological information is foundational. Such careers include but are not limited to science education, science journalism, environmental law and public policy. Background in fields connecting geology to related careers is provided by supporting options in Atmospheric and Oceanic Sciences, Astronomy, and Education. Further coursework in Education (including student teaching) will be required in order to obtain Maryland State Teaching Certification. Students seeking professional opportunities in secondary education are urged, also, to consult with advisors in the College of Education. While this track may also prepare students for work as a geologists in government or industry or for graduate study, students seeking advanced degrees or career opportunities in geology are advised to pursue the Professional Track.

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<tr>
<td>CHEM132</td>
<td>General Chemistry I Laboratory</td>
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<tr>
<td>or CHEM136</td>
<td>General Chemistry Laboratory for Engineers</td>
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<tr>
<td>MATH140</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>MATH141</td>
<td>Calculus II</td>
<td>4</td>
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<td>Select one of the following:</td>
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<tr>
<td>PHYS161</td>
<td>General Physics: Mechanics and Particle Dynamics</td>
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<tr>
<td>&amp; PHYS261</td>
<td>and General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)</td>
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</tr>
<tr>
<td>PHYS171</td>
<td>Introductory Physics: Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS261</td>
<td>and General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)</td>
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**Total Credits:** 70-74

1 Or appropriate substitution with the approval of the department
TLPL101 & TLPL102 Inquiry Approach to Teaching STEM (Step 1) and Inquiry Teaching of STEM in Middle School
CHEM131 Chemistry I - Fundamentals of General Chemistry 3 or CHEM135 General Chemistry for Engineers
CHEM132 General Chemistry I Laboratory or CHEM136 General Chemistry Laboratory for Engineers
MATH140 Calculus I 4 MATH141 Calculus II 4
Select one of the following: 4
PHYS161 & PHYS261 General Physics: Mechanics and Particle Dynamics and General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)
PHYS171 & PHYS261 Introductory Physics: Mechanics and General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)

Total Credits 71-79

1 AOSC123 and GEOL123 cannot both be taken for credit.
2 GEOL490 satisfies both the Experiential Learning in Earth Sciences requirement and one (of two) Earth Sciences Electives requirement.

Geophysics Track

The geophysics curriculum is designed to meet the requirements of industry, graduate school, and government. The B.S. degree requires students to complete introductory geology and physics requirements (39 credits) and upper-level requirements including depth options, context options, and breadth options (30 - 35 credits) in addition to the General Education Program requirements and the completion of at least 120 credits in total. In order to receive a degree in Geophysics, the department requires that students must have a grade of C- or better in the required geology courses.

Courses required for the B.S. in Geology are listed below. Some courses require field trips for which the students are expected to pay for room (if required) and board.

Course Title Credits

Required Introductory Physics and Geology
GEOL100 Physical Geology 3 or GEOL120 Environmental Geology
GEOL110 Physical Geology Laboratory 1
MATH140 Calculus I 4 MATH141 Calculus II 4 MATH241 Calculus III 4
PHYS161 General Physics: Mechanics and Particle Dynamics 3 or PHYS171 Introductory Physics: Mechanics
PHYS165 Introduction to Programming in the Physical Sciences 3
PHYS272 Introductory Physics: Fields 3 PHYS273 Introductory Physics: Waves 3
PHYS275 Experimental Physics I: Mechanics and Heat 2 PHYS276 Experimental Physics II: Electricity and Magnetism 2
Select one of the following: 6

Geophysics Upper Level Requirements
GEOL393 Geology Senior Thesis I: Proposal 3 GEOL394 Geology Senior Thesis II: Research 3 GEOL446 Geophysics 3

Depth Requirements
Select three of the following: 9
GEOL412 Geology of the Terrestrial Planets 6 GEOL447 Observational Geophysics 6
GEOL455 Marine Geophysics 3 GEOL456 Engineering Geology 3
GEOL457 Seismology 3 GEOL460 Field Geophysics 3

Context Requirement
Select two of the following: 6-8
AOSC400 Physical Meteorology 6 AOSC424 Remote Sensing of the Atmosphere and Ocean 6
AOSC431 Atmospheric Thermodynamics 6 AOSC432 Dynamics of the Atmosphere and Ocean 6
GEOL340 Mineralogy 6 GEOL341 Structural Geology 6
GEOL342 Sedimentation and Stratigraphy 6 GEOL423 Optical Mineralogy 6
GEOL443 Petrology 6 GEOL451 Groundwater 6
GEOL463 Economic Geology 6 GEOL472 Tectonics 6

Breadth Requirement
Select two of the following: 6-8
PHYS371 Modern Physics 6 PHYS373 Mathematical Methods for Physics II 6
PHYS401 Quantum Physics I 6 PHYS402 Quantum Physics II 6
PHYS410 Classical Mechanics 6 PHYS411 Intermediate Electricity and Magnetism 6

Recommended Courses
Select one of the following:
CHEM131 Chemistry I - Fundamentals of General Chemistry 3 or CHEM132 General Chemistry I Laboratory 3
CHEM135 General Chemistry for Engineers 3 or CHEM136 General Chemistry Laboratory for Engineers 3

Total Credits 68-72

Matriculated Geology majors are expected to take all courses on campus unless specific departmental permission is given.
FOUR-YEAR PLAN

Click here (https://cmns.umd.edu/undergraduate/advising-academic-planning/academic-planning/four-year-plans/four-year-plans-gened/) for roadmaps for four-year plans in the College of Computer, Mathematical, and Natural Sciences.

Additional information on developing a four-year academic plan can be found on the following pages:

- http://4yearplans.umd.edu
- the Student Academic Success-Degree Completion Policy (https://academiccatalog.umd.edu/undergraduate/registration-academic-requirements-regulations/academic-advising/#success) section of this catalog