**GEOLGY 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.

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<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>GEOL100</td>
<td>Physical Geology</td>
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<tr>
<td>GEOL443</td>
<td>Petrology</td>
<td>4</td>
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</tbody>
</table>

**Geology Capstones**

- GEOL393: Geology Senior Thesis I: Proposal 3
- GEOL394: Geology Senior Thesis II: Research 3
- GEOL490: Geology Field Camp 6

**Geologic Core Discipline Options**

Select one of the following Quantitative Reasoning courses: 3

- GEOL351: Statistics for Geoscientists
- GEOL413: Geoscientific Modeling
- GEOL447: Observational Geophysics

Select one of the following Surface Processes courses: 3-4

- GEOL340: Geomorphology
- GEOL451: Groundwater

Select one of the following Geophysics courses: 3

- GEOL446: Geophysics
- GEOL455: Marine Geophysics
- GEOL457: Seismology
- GEOL460: Field Geophysics

Select one of the following Geochemistry courses: 3-4

- GEOL444: Low Temperature Geochemistry
- GEOL445: High Temperature Geochemistry
- GEOL463: Economic Geology

Select one of the following Geobiology courses: 3-4

- GEOL331: Principles of Paleontology
- GEOL435: Environmental Geochemistry
- GEOL436: Principles of Biogeochmistry
- GEOL437: Global Climate Change: Past and Present

**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.

receive a degree in Geology, students must earn a grade of C- or better

Sciences Track can be completed in between 71 and 77 credits. To

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

professional opportunities in secondary education are urged, also, to

in Atmospheric and Oceanic Sciences, Astronomy, and Education. Further

Such careers include but are not limited to science education, science

journals in fields connecting geology to related careers is provided by supporting options

in fields other than professional geosciences but for which geological information is foundational.

such careers include but are not limited to science education, science

Matriculated Geology majors are expected to take all courses on campus

for which students are expected to pay for room (if required) and

Depending on course options selected, the Earth and Environmental

and a C- average or better in supporting courses in addition to completing GenEd and 120 credits overall.

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 General Physics: Mechanics and Particle

& PHYS261 Dynamics and General Physics: Mechanics, Vibrations,

Waves, Heat (Laboratory)

PHYS171 Introductory Physics: Mechanics

& PHYS261 and General Physics: Mechanics, Vibrations,

Waves, Heat (Laboratory)

Total Credits 70-74

1 Or appropriate substitution with the approval of the department

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

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

journals in fields connecting geology to related careers is provided by supporting options

in Atmospheric and Oceanic Sciences, Astronomy, and Education. Further

work 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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<td>GEOL123</td>
<td>Causes and Consequences of Global Change 1</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>

Experiential Learning in Earth Sciences

Choose one course from the following: 3-6

GEOL386 Experiential Learning 1
GEOL490 Geology Field Camp 2
GEOL499 Special Problems in Geology

Earth Sciences Core Disciplines

Choose one from each of the following groups.

Analytic Methods in Earth Sciences: 3

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

Environmental Geosciences: 3-4

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: 3-4

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

Earth Materials: 4

GEOL443 Petrology
GEOL444 Low Temperature Geochemistry
GEOL445 High Temperature Geochemistry

Geobiology: 3-4

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

Earth Sciences Electives 6-8

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

Select one of the following: 3

AOSC123 Causes and Consequences of Global Change 1
AOSC200 Weather and Climate
ASTR120 Introductory Astrophysics - Solar System
Inquiry Approach to Teaching STEM (Step 1) and Inquiry Teaching of STEM in Middle School

Chemistry I - Fundamentals of General Chemistry
General Chemistry for Engineers

General Chemistry I Laboratory
General Chemistry Laboratory for Engineers

Calculus I
Calculus II

Calculus III

General Physics: Mechanics and Particle Dynamics
General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)

Introductory Physics: Mechanics and General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)

Geological 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.

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<td>MATH241</td>
<td>Calculus III</td>
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<tr>
<td>PHYS161</td>
<td>General Physics: Mechanics and Particle Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS171</td>
<td>Introductory Physics: Mechanics</td>
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<tr>
<td>PHYS165</td>
<td>Introduction to Programming in the Physical Sciences</td>
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<tr>
<td>PHYS272</td>
<td>Introductory Physics: Fields</td>
<td>3</td>
</tr>
<tr>
<td>PHYS273</td>
<td>Introductory Physics: Waves</td>
<td>3</td>
</tr>
<tr>
<td>PHYS275</td>
<td>Experimental Physics I: Mechanics and Heat</td>
<td>2</td>
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<tr>
<td>PHYS276</td>
<td>Experimental Physics II: Electricity and Magnetism</td>
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Mathematical Methods for Physics I and Statistics for Geoscientists
Introduction to Linear Algebra and Differential Equations for Scientists and Engineers

Geophysics Upper Level Requirements

Geology Senior Thesis I: Proposal
Geology Senior Thesis II: Research
Geophysics

Depth Requirements

Select three of the following:

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<thead>
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<tr>
<td>GEOL412</td>
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<tr>
<td>GEOL447</td>
<td>Observational Geophysics</td>
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<tr>
<td>GEOL455</td>
<td>Marine Geophysics</td>
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<td>GEOL456</td>
<td>Engineering Geology</td>
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<tr>
<td>GEOL457</td>
<td>Seismology</td>
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<tr>
<td>GEOL460</td>
<td>Field Geophysics</td>
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Context Requirement

Select two of the following:

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<tr>
<td>AOSC400</td>
<td>Physical Meteorology</td>
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<tr>
<td>AOSC424</td>
<td>Remote Sensing of the Atmosphere and Ocean</td>
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<tr>
<td>AOSC431</td>
<td>Atmospheric Thermodynamics</td>
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<tr>
<td>AOSC432</td>
<td>Dynamics of the Atmosphere and Ocean</td>
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<tr>
<td>GEOL322</td>
<td>Mineralogy</td>
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<tr>
<td>GEOL340</td>
<td>Geomorphology</td>
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<td>GEOL341</td>
<td>Structural Geology</td>
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<tr>
<td>GEOL342</td>
<td>Sedimentation and Stratigraphy</td>
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<td>GEOL451</td>
<td>Groundwater</td>
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<tr>
<td>GEOL463</td>
<td>Economic Geology</td>
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<tr>
<td>GEOL472</td>
<td>Tectonics</td>
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Breadth Requirement

Select two of the following:

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Modern Physics
Mathematical Methods for Physics II
Quantum Physics I
Quantum Physics II
Classical Mechanics
Intermediate Electricity and Magnetism

Recommended Courses

Select one of the following:

<table>
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Chemistry I - Fundamentals of General Chemistry and General Chemistry I Laboratory
General Chemistry for Engineers and General Chemistry Laboratory for Engineers

Total Credits

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