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.

Course | Title | Credits
--- | --- | ---
GEOL100 | Physical Geology | 3
or GEOL120 | Environmental Geology | 3
GEOL110 | Physical Geology Laboratory | 1
GEOL102 | Historical Geology | 4
GEOL322 | Mineralogy | 4
GEOL341 | Structural Geology | 4
GEOL342 | Sedimentation and Stratigraphy | 4
GEOL423 | Optical Mineralogy | 4
GEOL443 | Petrology | 4

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 | 3
GEOL413 | Geoscientific Modeling | 3
GEOL447 | Observational Geophysics | 3

Select one of the following Surface Processes courses: | 3-4
--- | ---
GEOL340 | Geomorphology | 3
GEOL451 | Groundwater | 3

Select one of the following Geophysics courses: | 3
--- | ---
GEOL446 | Geophysics | 3
GEOL455 | Marine Geophysics | 3
GEOL457 | Seismology | 3
GEOL460 | Field Geophysics | 3

Select one of the following Geochemistry courses: | 3-4
--- | ---
GEOL444 | Low Temperature Geochemistry | 3-4
GEOL445 | High Temperature Geochemistry | 3-4
GEOL463 | Petrology | 3-4

Select one of the following Geobiology courses: | 3
--- | ---
GEOL331 | Principles of Paleontology | 3
GEOL435 | Environmental Geochemistry | 3
GEOL436 | Principles of Biogeochemistry | 3
GEOL437 | Global Climate Change: Past and Present | 3

Geology Elective

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

Supporting Courses

CHEM131 | Chemistry I - Fundamentals of General Chemistry | 3-4
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 Dynamics
- PHYS261 General Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)

- PHYS171 Introductory Physics: Mechanics
- PHYS261 Introductory Physics: Mechanics, Vibrations, Waves, Heat (Laboratory)

Total Credits: 70-74

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.

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 Gen Ed and 120 credits overall.

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<thead>
<tr>
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<td>GEOL110</td>
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Select one of the following: 3

- GEOL123 Causes and Consequences of Global Change
- GEOL124 Evolution of Life and Environment on Planet Earth
- GEOL200 Earth's Fury: Earthquakes, Volcanoes, and Tsunami
- GEOL204 Dinosaurs, Early Humans, Ancestors, and Evolution; The Fossil Record of Vanished Worlds of the Prehistoric Past

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<td>Structural Geology</td>
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<tr>
<td>GEOL342</td>
<td>Sedimentation and Stratigraphy</td>
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Experiential Learning in Earth Sciences

Choose one course from the following: 3-6

- GEOL386 Experiential Learning
- GEOL490 Geology Field Camp
- GEOL499 Special Problems in Geology

Earth Sciences Core Disciplines

Choose one from each of the following groups.

Analytic Methods in Earth Sciences: 3

- GEOG373 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 Geology
- 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
- AOSC200 Weather and Climate
- ASTR120 Introductory Astrophysics - Solar System
Geology Major

TLPL101 & TLPL102 Inquiry Approach to Teaching STEM (Step 1) and Inquiry Teaching of STEM in Middle School 3

CHEM131 Chemistry I - Fundamentals of General Chemistry 3
or CHEM135 General Chemistry for Engineers

CHEM132 General Chemistry I Laboratory 1
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.

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<tr>
<td>MATH141</td>
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<td>4</td>
</tr>
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<td>Calculus III</td>
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<tr>
<td>PHYS265</td>
<td>Introduction to Scientific Programming</td>
<td>3</td>
</tr>
<tr>
<td>PHYS272</td>
<td>Introductory Physics: Fields</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS260</td>
<td>General Physics: Electricity, Magnetism and Thermodynamics</td>
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</tr>
<tr>
<td>PHYS273</td>
<td>Introductory Physics: Oscillations and Waves</td>
<td>3</td>
</tr>
<tr>
<td>or PHYS270</td>
<td>General Physics: Waves, Optics, Relativity and Modern Physics</td>
<td></td>
</tr>
<tr>
<td>PHYS275</td>
<td>Experimental Physics I: Mechanics and Waves</td>
<td>2</td>
</tr>
<tr>
<td>PHYS276</td>
<td>Experimental Physics II: Electricity and Magnetism</td>
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</tr>
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Select one of the following: 7

MATH243 Introduction to Linear Algebra and Differential Equations for Scientists and Engineers 3
GEOL351 Statistics for Geoscientists 3

Geophysics Upper Level Requirements

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

Depth Requirements 1

Select three of the following: 9

GEOL447 Observational Geophysics
GEOL455 Marine Geophysics
GEOL456 Engineering Geology
GEOL457 Seismology
GEOL460 Field Geophysics
GEOL472 Tectonics

Context Requirement 1

Select two of the following: 6-8

AOSC400 Physical Meteorology
AOSC424 Remote Sensing of the Atmosphere and Ocean
AOSC431 Atmospheric Thermodynamics
AOSC432 Dynamics of the Atmosphere and Ocean
ASTR415 Computational Astrophysics
ASTR430 The Solar System
ASTR435 Astrophysics of Exoplanets
GEOL322 Mineralogy
GEOL340 Geomorphology
GEOL341 Structural Geology
GEOL342 Sedimentation and Stratigraphy
GEOL412 Geology of the Terrestrial Planets
GEOL423 Optical Mineralogy
GEOL443 Petrology
GEOL451 Groundwater

Breadth Requirement

Select two of the following: 6-8

PHYS313 Electricity and Magnetism I
PHYS371 Modern Physics
PHYS401 Quantum Physics I
PHYS404 Introduction to Statistical Thermodynamics
PHYS410 Classical Mechanics
PHYS413 Electricity and Magnetism II

Recommended Courses

Select one of the following:

CHEM131 Chemistry I - Fundamentals of General Chemistry & CHEM132 and General Chemistry I Laboratory
CHEM135 General Chemistry for Engineers & CHEM136 and General Chemistry Laboratory for Engineers

Total Credits 69-73
1 Or any upper level (300 or higher) Geology course with the approval of the undergraduate director not used to satisfy above requirements. Matriculated Geology majors are expected to take all courses on campus unless specific departmental permission is given.

GRADUATION PLANS

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

Additional information on developing a graduation 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

ADVISING

Semesterly advising is mandatory for Geology majors in all tracks. Advising is performed by the Director of Undergraduate Studies or designees. To schedule an advising appointment, please follow the instructions at http://geol.umd.edu/undergraduate/advising/.