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

Geoscientists 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 geosciences is the ability to divide time between work in the field, the laboratory, and the office. Although the employment outlook within geosciences 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 geoscientists. Presently, planetary sciences are primarily the concern of Academia and national space agencies and their affiliates, however there are long-term prospects for industrial applications, as well.

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
Required Geology Courses		
GEOL100	Physical Geology	3
or GEOL120	Environmental Geology	
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 [1]		
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 Biogeochemistry	
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]		3-4
Supporting Courses		
CHEM131	Chemistry I - Fundamentals of General Chemistry	
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		**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.

Course	Title	Credits
Geology Courses		
GEOL100	Physical Geology	3
or GEOL120	Environmental Geology	
GEOL110	Physical Geology Laboratory	1
Select one of the following:		3
GEOL123	Causes and Consequences of Global Change [1]	
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	
GEOL212	Planetary Geology	
GEOL102	Historical Geology	4
GEOL322	Mineralogy	4
GEOL340	Geomorphology	4
GEOL341	Structural Geology	4
GEOL342	Sedimentation and Stratigraphy	4
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
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	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	
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	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.

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	
PHYS265	Introduction to Scientific Programming	3
PHYS272	Introductory Physics: Electricity and Magnetism	3
or PHYS260	General Physics: Electricity, Magnetism and Thermodynamics	
PHYS273	Intermediate Oscillations and Waves	3
or PHYS270	General Physics: Waves, Optics, Relativity and Modern Physics	
PHYS275	Experimental Physics I: Mechanics and Waves	2
PHYS276	Experimental Physics II: Analog Circuits	2
Select one of the following:		7
MATH243 & GEOL351	Introduction to Linear Algebra and Differential Equations and Statistics for Geoscientists	
MATH240 & MATH246	Introduction to Linear Algebra and Differential Equations for Scientists and Engineers	
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	Active 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 & CHEM132	Chemistry I - Fundamentals of General Chemistry 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