# **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.
- 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
<b>Required Geology</b>	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 Capstone	25	
GEOL393	Geology Senior Thesis I: Proposal	3
GEOL394	Geology Senior Thesis II: Research	3
GEOL490	Geology Field Camp	6
Geologic Core Dis	cipline Options <sup>1</sup>	
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 cre satisfy the above	dit 300 – 400 level GEOL course not taken to requirements <sup>1</sup>	3-4
Supporting Cours	es	

CHEM131 Chemistry I - Fundamentals of General Chemistry

or CHEM13	5 General Chemistry for Engineers	
CHEM132	General Chemistry I Laboratory	
or CHEM136	6 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

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 <sup>1</sup>	
GEOL124	Evolution of Life and Environment on Planet Ea	rth
GEOL200	Earth's Fury: Earthquakes, Volcanoes, and Tsun	nami
GEOL204	Dinosaurs, Early Humans, Ancestors, and Evolution; The Fossil Record of Vanished World the Prehistoric Past	ls of

GEOL212	Planetary Geology	
GEOL102	Historical Geology	4
GEOL322	Mineralogy	4
GEOL340	Geomorphology	4
GEOL341	Structural Geology	4
GEOL342	Sedimentation and Stratigraphy	4
Experiential Learn	ing in Earth Sciences	
Choose one cours	se from the following:	3-6
GEOL386	Experiential Learning <sup>1</sup>	
GEOL490	Geology Field Camp <sup>2</sup>	
GEOL499	Special Problems in Geology	
Earth Sciences Co	ore 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 Ge	osciences:	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 El	ectives	6-8
Any two 3 - 4 c satisfy the abo the approval of is taken as an f one Earth Scier	redit 300 - 400 level GEOL course not taken to ve requirements or appropriate substitution with the department. If GEOL490 – Geologic Field Camp Experiential Learning option, it additionally satisfies nees Elective requirement.	
Supporting Cours	es	
Select one of the	following:	3
AOSC123	Causes and Consequences of Global Change <sup>1</sup>	
AOSC200	Weather and Climate	
ASTR120	Introductory Astrophysics - Solar System	

Total Cred	lits		71-79
PHYS1 & PHYS	71 Ir 5261 a W	ntroductory Physics: Mechanics nd General Physics: Mechanics, Vibrations, /aves, Heat (Laboratory)	
PHYS1 & PHYS	61 G S261 D ai W	eneral Physics: Mechanics and Particle ynamics nd General Physics: Mechanics, Vibrations, /aves, Heat (Laboratory)	
Select one of the following:		4	
MATH141	С	alculus II	4
MATH140	) C	alculus I	4
or CHE	M136 G	eneral Chemistry Laboratory for Engineers	
CHEM132	G G	eneral Chemistry I Laboratory	1
or CHE	M135 G	eneral Chemistry for Engineers	Ū
CHEM131	С	hemistry I - Fundamentals of General Chemistry	3
TLPL10 & TLPL	01 Ir .102 ai	equiry Approach to Teaching STEM (Step 1) nd Inquiry Teaching of STEM in Middle School	

<sup>1</sup> AOSC123 and GEOL123 cannot both be taken for credit.

<sup>2</sup> 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 Introduc	ctory 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: Fields	3
or PHYS260	General Physics: Electricity, Magnetism and Thermodynamics	
PHYS273	Intermediate Oscillations and Waves	3
or PHYS270	General Physics: Waves, Optics, Relativity and Physics	Modern
PHYS275	Experimental Physics I: Mechanics and Waves	2

PHYS276	Experimental Physics II: Electricity and Magnetism	1 2
Select one of the	following:	7
MATH243	Introduction to Linear Algebra and Differential	
& GEOL351	Equations	
	and Statistics for Geoscientists	
MATH240	Introduction to Linear Algebra	
& MATH246	and Differential Equations for Scientists and	
Oceanity United	Engineers	
Geophysics Uppe	r Level Requirements	-
GEOL393	Geology Senior Thesis I: Proposal	3
GEOL394	Geology Senior Thesis II: Research	3
GEUL446	Geophysics	J
Depth Requireme	ints -	
Select three of th	e following:	9
GEOL447	Observational Geophysics	
GEOL455	Marine Geophysics	
GEOL456	Engineering Geology	
GEOL457	Seismology	
GEOL460	Field Geophysics	
GEOL472	Active Tectonics	
Context Requiren	nent '	
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 Bequiren	nent	
Select two of the	following	6-8
PHVS313	Electricity and Magnetism I	00
PHV\$371	Modern Physics	
	Introduction to Statistical Thermodynamics	
	Classical Machanica	
	Classical Mechanics	
PHIS413		
	following	
Select one of the	Obemietre L. Fundamentals of Open and Obemietre	
& CHEM131	and General Chemistry L aboratory	
CHEM135	General Chemistry for Engineers	
& CHEM136	and General Chemistry Laboratory for Engineers	
Total Credito	۵	0-72
iotal oreults	0	5-13

<sup>1</sup> 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-academicplanning/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-academicrequirements-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/.