EARTH AND PLANETARY SCIENCES MAJOR

The academic program aims to cover the breadth of geologic sub-disciplines, hone the skills necessary to succeed in Earth Science careers, and allow for choice based on student interests. Courses may include theory, descriptive studies, data analysis, computer modeling, laboratory exercises, and field training.

Students are encouraged to take the 200-level foundation courses as early as possible, but they need not be taken in sequence.

Students planning to attend graduate school are strongly encouraged to conduct independent study (EARTH 399-0 Independent Study).

Major Requirements: Department Courses (12 Units)

4 200-level Core Courses (4 units)

Course	Title
EARTH 201-0	Earth Systems Revealed
EARTH 202-0	Earth's Interior
EARTH 203-0	Earth System History
EARTH 204-0	Communication for Geoscientists

8 300-level Advanced Studies Courses (8 units)

At least one course must be from 4 of the 8 Sub-Discipline Requirement lists (see list below), and at least one course must be from each of the 3 Skills Requirement lists (see list below). Additional Advanced Studies courses to the required total of 8 may be any EARTH 300 or 400 level, but only one EARTH 399-0 Independent Study may be counted toward the major.

Sub-Discipline Requirement (4 courses)

At least one course from 4 of the 8 sub-disciplines.

Earth Materials

Course	Title
EARTH 300-0	Earth and Planetary Materials
EARTH 301-0	Petrology: Evolution of Crustal and Mantle Rocks
EARTH 302-0	Geological Thermodynamics

Geochemistry

Course	Title
EARTH 310-0	Aqueous Geochemistry
EARTH 312-0	Stable Isotope Geochemistry
EARTH 313-0	Radiogenic Isotope Geochemistry
EARTH 314-0	Organic Geochemistry

Seismology

Course	Title
EARTH 323-0	Seismology and Earth Structure
EARTH 324-0	Earthquakes and Tectonics
EARTH 327-0	Geophysical Time Series Analysis

Geology

Course	Title
EARTH 330-0	Sedimentary Geology
EARTH 331-0	Field Problems in Sedimentary Geology
EARTH 335-0	Tectonics and Structural Geology

Climate/Paleoclimate

Course	Title
EARTH 340-0	Atmospheric Physics & Weather
EARTH 341-0	Quaternary Climate Change: Ice Ages to the Age of Oil
EARTH 342-0	Contemporary Energy and Climate Change
EARTH 343-0	Earth System Modeling

Geophysics

Course	Title
EARTH 350-0	Physics of the Earth
EARTH 352-0	Global Tectonics
EARTH 353-0	Mathematical Inverse Methods in Earth and Environmental Sciences

Geobiology

Course	Title
EARTH 370-0	Geobiology
EARTH 371-0	Biogeochemistry
EARTH 373-0	Microbial Ecology

Planetary

Course	Title
EARTH 380-0	Forming a Habitable Planet
EARTH 381-0	Planet Formation and Evolution
EARTH 382-0	Cosmochemistry
EARTH 383-0	Planetary Physics

Skills Requirement (3 courses)

At least one course from each of the 3 categories. No course may be counted in more than one skills category.

Quantitative

Course	Title
EARTH 302-0	Geological Thermodynamics
EARTH 310-0	Aqueous Geochemistry
EARTH 327-0	Geophysical Time Series Analysis
EARTH 343-0	Earth System Modeling
EARTH 353-0	Mathematical Inverse Methods in Earth and Environmental Sciences
EARTH 362-0	Data Analysis for Earth and Planetary Sciences

Spatial Reasoning

Course	Title
EARTH 300-0	Earth and Planetary Materials
EARTH 330-0	Sedimentary Geology
EARTH 335-0	Tectonics and Structural Geology
EARTH 361-0	Introduction to Scientific Programming in Python

Analytical/Instrumentation/Field

Course	Title
EARTH 331-0	Field Problems in Sedimentary Geology
EARTH 343-0	Earth System Modeling
EARTH 360-0	Instrumentation and Field Methods
EARTH 361-0	Introduction to Scientific Programming in Python

In certain cases, the Director of Undergraduate Studies may approve additional eligible courses for the Sub-Discipline and Skills Requirement course lists.

Major Requirements: Related Courses (9.34-12.04 Units)

Math Courses (3-4 depending on sequence)

Course	Title
MATH 220-0 & MATH 224-0	Differential Calculus of One-Variable Functions and Integral Calculus of One-Variable Functions
or MATH 212-0 & MATH 213-0 & MATH 214-0	Single Variable Calculus I and Single Variable Calculus II and Single Variable Calculus III
MATH 230-0	Differential Calculus of Multivariable Functions
or equivalent	

6 Additional Related Math and Science Courses

Any 6 of the following math and science lectures or lecture/lab combinations may count toward this requirement.[1]

Course	Title
CHEM 131-0 & CHEM 141-0	General Chemistry 1 and General Chemistry Laboratory 1
CHEM 132-0 & CHEM 142-0	General Chemistry 2 and General Chemistry Laboratory 2
CHEM 151-0 & CHEM 161-0	Accelerated General Chemistry 1 and Accelerated General Chemistry Laboratory 1
CHEM 152-0 & CHEM 162-0	Accelerated General Chemistry 2 and Accelerated General Chemistry Laboratory 2
CHEM 171-0 & CHEM 181-0	Advanced General Inorganic Chemistry and Advanced General Inorganic Chemistry Laboratory
CHEM 172-0 & CHEM 182-0	Advanced General Physical Chemistry and Advanced General Physical Chemistry Laboratory
PHYSICS 135-1 & PHYSICS 136-1	General Physics and General Physics Laboratory
PHYSICS 135-2 & PHYSICS 136-2	General Physics and General Physics Laboratory
PHYSICS 135-3 & PHYSICS 136-3	General Physics and General Physics Laboratory
BIOL_SCI 215-0 & BIOL_SCI 220-0	Genetics and Molecular Biology and Genetics and Molecular Processes Laboratory [2]
BIOL_SCI 219-0 & BIOL_SCI 221-0	Cell Biology and Cellular Processes Laboratory [2]
MATH 234-0	Multiple Integration and Vector Calculus
MATH 240-0	Linear Algebra
MATH 250-0	Elementary Differential Equations

1 Note: Introductory Chemistry, Physics, Biology, and Math courses may be offered in parallel tracks. Consistent with restrictions at the University level, a student cannot receive credit for some course sequences if credit has already been awarded for an equivalent course. See Chemistry, Physics, Biology, and Math sections of this Catalog for details.

2 Though the courses may be completed separately (they are not co-requisites for enrollment) BIOL_SCI 215-0 counts as a related course only if BIOL_SCI 220-0 is also completed; BIOL_SCI 219-0 counts as a related course only if BIOL_SCI 221-0 is also completed.

Honors in Earth and Planetary Sciences

Majors with strong academic records and an interest in pursuing honors should discuss possible projects with an appropriate faculty member or the director of undergraduate studies as early as possible, but no later than fall of senior year. After a proposed project is approved by the undergraduate adviser, the research is conducted as 2 quarters of EARTH 399-0 Independent Study or as 1 quarter of EARTH 399-0 and 1 quarter of a 400-level course; the student prepares a thesis based on this research. One quarter of EARTH 399-0 counts toward the major requirements; the second quarter of thesis work (EARTH 399-0 or a 400-level course) does not.

Students whose projects and grades meet department criteria are recommended to the college for graduation with honors. For more information, students should contact the director of undergraduate studies or their research advisers and see Honors in the Major (https://catalogs.northwestern.edu/undergraduate/arts-sciences/#academicoptionstext).