

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).

Students must also complete the Undergraduate Registration Requirement (<https://catalogs.northwestern.edu/undergraduate/requirements-policies/undergraduate-registration-requirement/>) and the degree requirements of their home school.

NOTE: This Catalog describes Weinberg College BA requirements that pertain to students who matriculated at Northwestern after spring quarter 2023. Refer to the Archives (<https://catalogs.northwestern.edu/archives/>) if you are following BA requirements described in the 2018-2019 through 2022-2023 editions.

Major Requirements: Department Courses (12 Units)

4 200-level Core EARTH 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 EARTH Courses (8 units)

Advanced studies courses are divided into seven sub-disciplines and three skill areas, as listed below. Students must take at least one course from four of the seven Sub-Discipline Requirement lists below, and at least one course from each of the three Skills Requirement lists below. Additional advanced studies courses to the required total of eight may be any EARTH 300- or 400-level course, but only one EARTH 399-0 Independent Study may be counted toward the major. Consult with the Director of Undergraduate Studies (DUS) regarding EARTH 399-0 Special Topics in Earth and Planetary Science courses that may meet Sub-Discipline or Skills requirements. In certain cases, the DUS may approve additional eligible courses for the Sub-Discipline and Skills Requirement course lists.

Sub-Discipline Requirement (4 courses)

Students must take at least one course from four of the following seven sub-disciplines.

Earth Materials

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

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	Physics of Weather & Climate
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 for ISP
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

Skills Requirement (3 courses)

Students must take at least one course from each of the following three skill areas. No course may be counted in more than one skills category. Some topic offerings of EARTH 390-0 may be applied to a skill area with department approval; see department website for updates.

Quantitative

Course	Title
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 361-0	Scientific Programming in Python
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	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	Scientific Programming in Python
EARTH 373-0	Microbial Ecology

Major Requirements: Related Courses (9.34-12.04 Units)

Math Courses (3-4 courses)

Students must take the following math requirements, for a total of three units if the MATH 220 sequence is selected, or a total of four units if the MATH 218 sequence is selected.

Course	Title
MATH 220-1 & MATH 220-2 or MATH 218-1 & MATH 218-2 & MATH 218-3	Single-Variable Differential Calculus and Single-Variable Integral Calculus Single-Variable Calculus with Precalculus and Single-Variable Calculus with Precalculus and Single-Variable Calculus with Precalculus
MATH 226-0 or MATH 230-1 or MATH 240-0	Sequences and Series Multivariable Differential Calculus Linear Algebra

or equivalent

6 Additional Related Math and Science Courses

Students must take six courses (and their associated lab, if applicable) from the following options, with maximum three in any one subject.¹

Course	Title
CHEM 131-0 & CHEM 141-0	Fundamentals of Chemistry I and Fundamentals of Chemistry Laboratory I
CHEM 132-0 & CHEM 142-0	Fundamentals of Chemistry II and Fundamentals of Chemistry Laboratory II
CHEM 151-0 & CHEM 161-0	General Chemistry I and General Chemistry Laboratory I
CHEM 152-0 & CHEM 162-0	General Chemistry II and General Chemistry Laboratory II
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
CHEM 215-1 & CHEM 235-1	Organic Chemistry I and Organic Chemistry Lab I
CHEM 215-2 & CHEM 235-2	Organic Chemistry II and Organic Chemistry Lab II
CHEM 215-3 & CHEM 235-3	Organic Chemistry III and Organic Chemistry Lab III
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 201-0	Molecular Biology
BIOL_SCI 202-0 & BIOL_SCI 232-0	Cell Biology and Molecular and Cellular Processes Laboratory
BIOL_SCI 203-0 & BIOL_SCI 233-0	Genetics and Evolution and Genetics and Molecular Processes Laboratory
MATH 226-0	Sequences and Series
MATH 230-2 or MATH 228-2	Multivariable Integral Calculus Multivariable Integral Calculus for Engineering
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.

Honors in Earth and Planetary Sciences

Majors with strong academic records and an interest in pursuing honors should discuss possible research projects with a faculty member and/or the director of undergraduate studies (DUS) early in their undergraduate career, but no later than spring quarter of their junior year. After the chosen faculty mentor approves a proposed project, research is conducted and students must complete at least two quarters of EARTH 399-0 Independent Study; only one quarter may count towards major requirements. To earn the honors distinction, students must complete a thesis following the guidance provided in guidelines published on the department webpage.

Students whose grades, research, and written thesis meet departmental criteria are recommended to the college for graduation with honors. For more information, students should consult the director of undergraduate studies and see Honors in the Major (<https://catalogs.northwestern.edu/undergraduate/arts-sciences/#academicoptionstext>).