

# EARTH SCIENCE

## EARTH SCIENCE

The **Earth Science major** is a program leading to the bachelor of arts (B.A.) or bachelor of science (B.S.).

The B.A. emphasizes an interdisciplinary field and prepares the student primarily for a career in secondary education. The B.S. program provides a broad overview of geology and supporting sciences. This degree pathway is also suitable for students who may want to pursue a career in secondary education or continue on to graduate school. If a student chooses this option and is interested in secondary education, they should contact Dr. Cinzia Cervato for additional guidance.

### Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate the ability to think critically;
- Exhibit a broad understanding of Earth systems and processes;
- Demonstrate scientific literacy and its application to scientific inquiry and societal concerns;
- Demonstrate proficiency in data collection, management, and analysis including understanding sources of error and/or uncertainty;
- Demonstrate competency with geoscience-specific techniques and field methods.
- Read and critically evaluate relevant literature and information;
- Use appropriate tools from chemistry, physics, biology, mathematics, and data science to solve discipline-specific problems;
- Present information effectively in written and oral forms;
- Work in a team environment in alignment with the ISU principles of community;
- Work independently;
- Attain employment in the geosciences or related fields, or pursue graduate studies.

## EARTH SCIENCE

Students can pursue either the Bachelor of Arts (B.A.) or the Bachelor of Science (B.S.) degree with a major in Earth Science. They can also prepare to teach Earth Science.

### Required courses for the B.A. include:

GEOL 100	How the Earth Works	3
or GEOL 101	Environmental Geology: Earth in Crisis	
or GEOL 201	Geology for Engineers and Environmental Scientists	
GEOL 100L	How the Earth Works: Laboratory	1
GEOL 102	History of the Earth	3
GEOL 102L	History of the Earth: Laboratory	1

GEOL 302	Summer Field Studies	6
GEOL 315	Mineralogy and Earth Materials	3
GEOL 315L	Laboratory in Mineralogy and Earth Materials	1
GEOL 316	Optical Mineralogy	1
GEOL 356	Structural Geology and Tectonics	4
GEOL 357	Geological Mapping and Field Methods	1
GEOL 365	Igneous and Metamorphic Petrology	3
GEOL 368	Sedimentary Geology	4
MTEOR 206	Introduction to Weather and Climate	3
ASTRO 120	The Sky and the Solar System	3
ASTRO 150	Stars, Galaxies, and Cosmology	3
And 3 credits of geology electives		3
<b>Total Credits</b>		<b>43</b>

Required supporting courses for the B.A. include:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
PHYS 131	General Physics I	4
PHYS 131L	General Physics I Laboratory	1
PHYS 132	General Physics II	4
PHYS 132L	General Physics II Laboratory	1

One of the following

MATH 151	Calculus for Business and Social Sciences	3
or MATH 160	Survey of Calculus	
or MATH 165	Calculus I	

One of the following

STAT 101	Principles of Statistics	4
or STAT 104	Introduction to Statistics	

And one course in Biology 3

**Total Credits 29**

**Communication Proficiency requirement:** According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 250. The department requires a grade of C or better in ENGL 309 or ENGL 314.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	

One of the following:

ENGL 309	Proposal and Report Writing	3
or ENGL 314	Technical Communication	

**Total Credits** 9

### Required courses for the B.S. include:

GEOL 100	How the Earth Works	3
or GEOL 101	Environmental Geology: Earth in Crisis	
or GEOL 201	Geology for Engineers and Environmental Scientists	

GEOL 100L	How the Earth Works: Laboratory	1
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GEOL 102	History of the Earth	3
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GEOL 102L	History of the Earth: Laboratory	1
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GEOL 302	Summer Field Studies	6
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GEOL 315	Mineralogy and Earth Materials	3
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GEOL 315L	Laboratory in Mineralogy and Earth Materials	1
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GEOL 316	Optical Mineralogy	1
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GEOL 356	Structural Geology and Tectonics	4
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GEOL 357	Geological Mapping and Field Methods	1
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GEOL 365	Igneous and Metamorphic Petrology	3
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GEOL 368	Sedimentary Geology	4
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GEOL 479	Surficial Processes	3
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MTEOR 206	Introduction to Weather and Climate	3
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And 8 credits of electives in agronomy, astronomy, environmental science, or other approved areas.

**Total Credits** 45

Required supporting courses for the B.S. include:

CHEM 177	General Chemistry I	4
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CHEM 177L	Laboratory in General Chemistry I	1
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CHEM 178	General Chemistry II	3
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CHEM 178L	Laboratory in College Chemistry II	1
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MATH 165	Calculus I	4
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MATH 166	Calculus II	4
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PHYS 131	General Physics I	4
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PHYS 131L	General Physics I Laboratory	1
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PHYS 132	General Physics II	4
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PHYS 132L	General Physics II Laboratory	1
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STAT 101	Principles of Statistics	3-4
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or STAT 104	Introduction to Statistics	
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**Total Credits** 30-31

**Communication Proficiency requirement:** According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or

better in ENGL 250. The department requires a grade of C or better in the below communication courses.

ENGL 150	Critical Thinking and Communication	3
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ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	

ENGL 309	Proposal and Report Writing	3
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or ENGL 314	Technical Communication	
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or ENGL 302	Business Communication	
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or JL MC 347	Science Communication	
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**Total Credits** 9

### Required for B.A. and B.S.

As majors in the College of Liberal Arts and Sciences, Earth Science students must meet College of Liberal Arts and Sciences (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofliberalartsandsciences/#lascollegerequirementstext>) and University-wide requirements (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegescurricula/>) for graduation in addition to those stated above for the major.

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (<http://www.registrar.iastate.edu/courses/div-ip-guide.html>) for a list of approved courses.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level in addition to the LAS world language and cultures and career preparation requirement (LAS 203 Professional Career Preparation). At least 8 credits in the major from 300+ courses must earn grade C or better. The average grade of all courses in the major must be 2.0 or higher.

### Teacher Preparation Focus

Earth Science majors seeking certification to teach Earth Science in secondary schools can follow the requirements of either the B.A. or the B.S. degree in Earth Science. In addition they must take the complementary coursework listed below and meet all of the requirements of the Secondary Major in Education. (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofhumansciences/educationsecondary/#curriculumtext>) Some of these courses, and some of the required coursework for the Secondary Major in Education (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofhumansciences/educationsecondary/#curriculumtext>), may also apply to LAS general education requirements.

Complementary Coursework

PSYCH 230	Developmental Psychology	3
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EDUC 418	Secondary Science Methods I	3
EDUC 419	Secondary Science Methods II	3

One course in American History or Government

*Notes:* Teacher license requirements are established by the Iowa Department of Education and the Iowa Board of Educational Examiners and are subject to change. Recent changes may not be reflected in this catalog, but advisers and faculty will be aware. Some students pursuing the Earth Science decide to complete the Earth Science major and continue their studies as graduate students in Iowa State's Science Education, Masters of Teaching (M.A.T.) program (<https://education.iastate.edu/graduate-students/graduate-programs/division-of-teaching-learning-leadership-and-policy/educator-prep-programs-for-licensure-recommendation/science-education-m-a-t/endorsements/>).

## Earth Science, B.A.

NOTE: Course plan, sequence and credit amounts will vary depending upon which endorsement area(s) a student chooses to pursue. In addition, this plan is solely an example of one possible academic layout. This plan can and likely will be modified based on transfer credit, advanced placement (AP) credit, dual enrollment credit, "test out" credit, course offerings, schedule conflicts and entry term. *It is our expectation that students know the requirements of their academic program and develop and follow an academic plan based on their academic catalog and degree audit using their individual academic advisor as a resource in this process.*

Potential pathway for the B.A. major in Earth Science with the Secondary Major in Education:

### Freshman

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 150		3 EDUC 204		3 PSYCH 230 (social science)	3
LIB 160		1 GEOL 102		3 Social Science Option <sup>1</sup>	3
GEOL 100		3 GEOL 102L		1	
GEOL 100L		1 GEOL 113		1	
CHEM 177		4 CHEM 178		3	
CHEM 177L		1 CHEM 178L		1	
MATH 151, 160, or 165		3-4 ASTRO 120		3	
GEOL 112		1 MTEOR 206		3	
		<b>17-18</b>		<b>18</b>	<b>6</b>

### Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 250		3 GEOL 365		3 Humanities Option <sup>1</sup>	3
PHYS 131		4 PHYS 132		4	
PHYS 131L		1 PHYS 132L		1	
GEOL 315		3 EDUC 333 (social science)		3	
GEOL 315L		1 Humanities Option <sup>1</sup>		3	
GEOL 316		1 ASTRO 150		3	
LAS 203		1			
EDUC 202		3			
EDUC 280L		0.5			
EDUC 219		1			
Apply/ Accepted to Educator Preparation Program					
			<b>18.5</b>	<b>17</b>	<b>3</b>

### Junior

Fall	Credits	Spring	Credits	Summer	Credits
EDUC 347		3 ENGL 302, 309, 314, or JL MC 347		3 GEOL 302	6
EDUC 418		3 EDUC 419		3	
EDUC 280A		1-2 EDUC 480J		2	
GEOL 357		1 COMST 211, SP CM 212, or THRE 358		3	
GEOL 368		4 STAT 101 or 104		3-4	
HIST 280 or 281 (humanities)		3 GEOL 356		4	
			<b>15-16</b>	<b>18-19</b>	<b>6</b>

### Senior

Fall	Credits	Spring	Credits
Geology Option <sup>1</sup>		3 EDUC 417J	16

Humanities Option <sup>1</sup>	3	PPAT	
SP ED 401	3		
EDUC 406	3		
Social Science Option <sup>1</sup>	3		
Biology Option <sup>1</sup>	3		
Apply to student teach			
Apply for graduation			
	<b>18</b>		<b>16</b>

Students must take an American History (counts as humanities) or American Government (counts as social science).

<sup>1</sup> Choose from list of approved courses available from an advisor.

## EARTH SCIENCE, B.S.

Potential pathway for the B.S. in Earth Science degree:

### Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	GEOL 102	3
GEOL 100 or 101	3	GEOL 102L	1
GEOL 100L	1	CHEM 178	3
CHEM 177	4	CHEM 178L	1
CHEM 177L	1	MATH 166	4
MATH 165	4	Arts-and-Humanities Choice	3
LIB 160	1		
	<b>17</b>		<b>15</b>

### Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	GEOL 365	3
GEOL 315	3	Arts-and-Humanities Choice	3
GEOL 315L	1	PHYS 132	4
GEOL 316	1	PHYS 132L	1

PHYS 131	4	STAT 101 or 104	3-4		
PHYS 131L	1	MTEOR 206	3		
LAS 203	1				
	<b>14</b>		<b>17-18</b>		
<b>Junior</b>					
Fall	Credits	Spring	Credits	Summer	Credits
GEOL 479	3	GEOL 356	4	GEOL 302	6
GEOL 368	4	World Language	3-4		
Agron/Astronomy/EnSci Choice <sup>1</sup>	3	Agron/Astronomy/EnSci Choice <sup>1</sup>	3		
World Language	3-4	Social-Science Choice	3		
GEOL 357	1				
	<b>14-15</b>		<b>13-14</b>		<b>6</b>

### Senior

Fall	Credits	Spring	Credits
Agron/Astronomy/EnSci Choice <sup>1</sup>	2	Electives	9
Arts-and-Humanities Choice	3	Arts-and-Humanities Choice	3
Social Science Choice	3	Social-Science Choice	3
ENGL 309, 302, 314, or JL MC 347	3		
Elective	3-4		
	<b>14-15</b>		<b>15</b>

<sup>1</sup> Choose from list of approved courses available from an advisor or departmental office.

## Graduate Programs

The department offers programs leading to the master of science and doctor of philosophy with majors in Geology, Earth Science, and Meteorology. Students desiring a major in the above fields normally will have a strong undergraduate background in the physical and

mathematical sciences. Individuals desiring to enter a graduate program are evaluated by considering their undergraduate preparation and performance along with their expressed goals in the statement of purpose. All prospective students should reach out to individual faculty members who they wish to work with prior to applying.

Programs of study are designed on an individual basis in accordance with requirements of the Graduate College and established requirements for each departmental major. Additional coursework is normally taken in complementary areas such as aerospace engineering, agronomy (soil science), chemistry, civil and construction engineering, computer engineering, computer science, engineering mechanics, environmental science, materials engineering, mathematics, mechanical engineering, microbiology, physics, or statistics. Departmental requirements provide a strong, broad background in the major and allow considerable flexibility in the program of each individual.

A dissertation is required of all Ph.D. candidates.

M.S. students in Geology are required to complete a thesis. The M.S. in Earth Science is available to students electing the non-thesis (Creative Component) option in Geology or Meteorology.

Graduates in Geology specialize in a sub-discipline, but they comprehend and can communicate the basic principles of geology and supporting sciences. They possess the capacity for critical and independent thinking. They are able to write a fundable research proposal, evaluate current relevant literature, carry out the proposed research, and communicate the results of their research to peers at national meetings and to the general public. They work as consultants on engineering and environmental problems, explorers for new minerals and hydrocarbon resources, researchers, teachers, writers, editors, and museum curators.