

# EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

## Course 12

### Department Contact

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### Description

With an emphasis on personal attention, the Earth, Atmospheric and Planetary Sciences program provides students with a challenging course of study, applying physics, chemistry, and mathematics to the study of the geophysical sciences. Students and faculty solve real-world problems and processes related to the Earth's interior, oceans, and atmosphere, as well as the interiors and atmospheres of other planets. The department also explores the past history of the Earth and planets. Students work to develop an understanding of the dynamics of systems as diverse as the global climate system, regional tectonics and deformation, petroleum and geothermal reservoirs, exoplanets, and geobiology.

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### Introductory Classes

12.001 **Introduction to Geology**

Major minerals and rock types, rock-forming processes, and time scales. Temperatures, pressures, compositions, structure of the Earth, and measurement techniques. Geologic structures and relationships observable in the field. Sediment movement and landform development by moving water, wind, and ice. Crustal processes and planetary evolution in terms of global plate tectonics with an emphasis on ductile and brittle processes. Includes laboratory exercises on minerals, rocks, mapping, plate tectonics, rheology, glaciers. Two one-day field trips (optional).

12.002 **Introduction to Geophysics and Planetary Science**

Study of the structure, composition, and physical processes governing the terrestrial planets, including their formation and basic orbital properties. Topics include plate tectonics, earthquakes, seismic waves, rheology, impact cratering, gravity and magnetic fields, heat flux, thermal structure, mantle convection, deep interiors, planetary magnetism, and core dynamics. Suitable for majors and non-majors seeking general background in geophysics and planetary structure.

12.003 **Introduction to Atmosphere, Ocean, and Climate Dynamics**

Introduces the dynamical processes that govern the atmosphere, oceans, and climate. Topics include Earth's radiation budget, convection and clouds, the circulation of the atmosphere and ocean, and climate change. Illustrates underlying mechanisms

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through laboratory demonstrations with a rotating table, and through analysis of atmospheric and oceanic data.

### 12.004 Introduction to Chemistry of Habitable Environments

Introduction to the central roles of chemistry and biology on Earth that underlie modern climate, climate history, and global elemental cycles. Topics include the interactions of chemistry and biology in atmospheric, aquatic, and terrestrial systems. Fundamental principles of redox, equilibria, and acid/base reactions are explored via their links in the Earth system and with respect to climate feedbacks and ecosystem dynamics, providing perspectives for the future of our planet.

### Course 12-Friendly UROP Areas

- Center for Global Change Science
- Earth Resources Laboratory
- Wallace and Haystack Observatories
- Joint Program on the Science and Policy of Global Change
- Earth Signals & Systems Group

### Get Involved with Course 12

- Terrascope
- MIT Weather and Climate Club (WCC)
- Women+ in Course XII (WIXII)
- MIT Energy Club
- Departmental Lecture Series

### Skills

- Ability to design and conduct research
- Data analysis, typically utilizing computer software
- Strong technical writing and research proposal ability
- Ability to work in interdisciplinary teams
- Preparation for graduate school

### Possible Future Jobs

- **Environmental Geologist:** Study the interaction between the geosphere, hydrosphere, atmosphere, biosphere, and human activities to solve problems associated with pollution, waste management, urbanization, and natural hazards.
- **Climate Analyst:** Analyzes existing climate or environmental management legislation, regulations, policies, and practices to determine actual and potential environmental

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impacts. Communicates research findings to legislators, regulatory agencies, or other stakeholders through written reports, presentations, and academic papers.

- **Planetary Scientist:** Study the atmosphere, and physical objects beyond our atmosphere to improve our understanding of planets, satellites, and smaller bodies in the solar system.

### Career Industry Examples

Climate Risk Analyst	Government
Oceanographer	Research Scientist
Environmental Science Consultant	Geomechanics Specialist
Aerospace and defense	Environmental Marketing and Communications
Oil and Gas Industry	

### Sample Employers

Booz Allen Hamilton	National Science Foundation
Jet Propulsion Laboratory	Frontier Group
National Parks Service	Observatory of the Code d'Azur
National Center for Atmospheric Research	NASA
Environmental Protection Agency	Corning Incorporated