

GEO101 – Introduction to Physical Geology – Fall, 2019

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This course is designed to provide an introduction to Earth as a solid planet, its internal structure, physical processes, and the relationships among the solid Earth, Earth's water, its atmosphere, and its living organisms. This course will provide you with a basic working knowledge of Earth, its materials, structures, and processes. The course is designed to provide a broad introduction to Earth's resources on which we depend and the interactions between humans as inhabitants of Earth and Earth's natural geologic processes.

Below is a list of the main **learning objectives** of this course:

- 1) Understand and be able to describe the materials that make up the solid Earth, including common rock-forming minerals, common rock types, their basic characteristics and geologic settings.
- 2) Develop an appreciation for and basic working knowledge of geologic time, fossilization, and the tools geologists use to date geologic events.
- 3) List the major geologic resources, including metallic and non-metallic mineral resources and energy resources. Describe the geologic setting of each and some of the hazards associated with certain mineral resources such as asbestos and mercury.
- 4) Describe the basic elements of Earth's plate tectonic system. Outline the history of plate tectonic theory; describe the three main plate boundary types.
- 5) Develop an understanding of Earth's interior structure and the evidence used to infer this structure.
- 6) Describe how earthquakes occur, what waveforms are involved, and how each waveform travel. Describe how earthquake epicenters are located and how tsunamis form.
- 7) Understand how volcanoes work and how they differ among different plate tectonic settings in terms of morphology, magma composition, and explosivity.
- 8) Describe basic geologic structures such as folds and faults and relate each to the type of stress involved. Describe the major tectonic settings and ways in which mountains are formed.
- 9) Describe how rocks weather and how soils form. Recognize the basic elements of a soil profile and the eleven major soil orders.
- 10) Understand Earth's fresh water resources, including groundwater, streams, lakes, and wetlands and how these interact. Develop an appreciation for water as a finite resource and some of the socio-political issues surrounding water use today.
- 11) Describe how glaciers are formed; recognize different glacial erosional landforms and deposits.
- 12) Describe how deserts are formed; recognize basic desert landforms and understand basic desert processes.
- 13) Understand how the oceans formed, describe the basic features and sediments of the seafloor, and describe the difference between active and passive continental margins.
- 14) Describe the composition of ocean water, understand how seawater circulates both at the surface and at depth, recognize emergent vs. submergent coastlines and the basic characteristics of each.
- 15) Understand the basic structure and composition of Earth's atmosphere, and how both moisture and energy move through and are transformed in the atmosphere.
- 16) Become familiar with Earth's climate and basic climate zones.
- 17) Understand the scientific evidence behind climate change; how climate has changed in the geologic past; and what major controls cause climate to change.

Why is this class important and why should you take it? (hint: jobs, jobs, jobs)

We all depend on Earth for the air we breathe, water we drink, and food we eat. We also depend on Earth as the ultimate source for building materials, our energy needs, and physical space in which to live. As the global human population continues to increase and place greater demands on Earth's resources, it is critically important that we as humans adopt sustainable means of using those resources. This path towards sustainability starts with a basic understanding of Earth's physical, chemical, and biological systems and how these interact. The search for sustainable energy production, water resources, soil, and mineral resources depends on understanding Earth's dynamics as a planet that has evolved over 4.5 billion years. Similarly, mitigating the effects of climate change depends on a basic understanding of Earth's atmosphere and oceans, and the interactions of these with the solid Earth and its living organisms (including humans). Geoscientists are responsible for finding and supplying the world with water, developing most of the world's energy resources and all of the world's mineral resources, mitigating and cleaning up surface and groundwater pollution, and developing a detailed understanding of the solid Earth beneath our feet so that the effects of natural hazards such as earthquakes, volcanoes, large storms, and mass wasting events such as landslides can be minimized. In short, it's a good time to be a geoscientist, and the demand for competent, professional geoscientists is certain to grow as our planet becomes more crowded and the pressure on Earth's limited resources intensifies. This course is designed to provide an introduction to this fascinating field of study.

Your part in this class:

This course will utilize the book *Earth2* by Marc S. Hendrix (me) and Graham Thompson. The book is available from the UM bookstore and also is available hard-copy form via Amazon or cengage.com. The e-book can be purchased directly from cengage.com.

To succeed in this class, you must acquire a copy of the book *Earth2* and study it carefully; you must come to all class lectures and take good notes, and you must participate in the class discussion hosted by Packback. I recommend that you purchase the book immediately and get started right away. The book is organized into chapters with relatively short sections. Each chapter has a review section, a series of key terms that you will need to become familiar with, and a set of review questions that you should use to help assimilate the information. The lectures will cover many of the course highlights, but you will be tested on material covered by both the lectures and the book.

Course Grading: Your grade for this class will be determined by two midterm exams (25% each), one final exam (35%), your participation in the on-line class discussion hosted by Packback (10%), and your participation in the all-day field trip (5%). One extra credit option is also available, described below.

Each of the two midterm exams will consist of 50 multiple choice questions. The final exam will consist of 75 multiple choice questions. Examples of prior GEO 101 exams by Hendrix will be made available on the course moodle website. In addition, Hendrix will hold one optional evening review prior to each exam in order to answer any outstanding questions or review any course material that is unclear.

One optional extra credit assignment is available. To earn up to a possible 5% percentage points, you must read the two articles posted at the links below and write a two page (maximum, single-spaced) paper describing your thoughts on these articles, what you learned, and new perspectives gained. Your paper will be scored based on its thoughtfulness, creativity, and quality of writing. The optional extra credit assignment will be due on Friday, November 25 by 11:59 pm and must be emailed to Hendrix [as a pdf file](#). No late assignments will be accepted for this extra credit, so make sure you complete it in time.

Read first: <https://www.newyorker.com/magazine/2019/04/08/the-day-the-dinosaurs-died>

Read second: <https://www.pnas.org/content/116/17/8190>

Course Discussion Board hosted by Packback: A course discussion board will serve as the main go-to spot for basic questions that you have regarding either the course content or about any of the course logistics. The course discussion board is hosted by Packback and requires that you register in order to participate. You will receive an email from Packback describing how to register and get started. The discussion board will be monitored by me on a regular basis and will serve as a way to keep the class discussion focused while responding directly to your posts.

Required Field Trip: This course has a required field trip that will be held on Saturday, October 5. We will leave campus at 9am via school bus and be out in the field until about 4pm. More information on the field trip will be forthcoming, but please reserve the date now.

Contacting Hendrix: Please email me directly at marc.hendrix@umontana.edu with any questions or concerns you have about the class. I will respond to each email within 24 hours. If there is an emergency or you need to contact me urgently, you may use my cell number, 406-544-0780; otherwise please contact me via email.

Course Schedule:

Here is the day-to-day schedule for the class, including the basic topics covered and Earth2 chapters that you will need to read and study for each exam:

Monday, August 26:	Course introduction, Earth Systems; Rates of change, threshold and feedback effects	Chapter 1 - Introduction
Wednesday, August 28	Mineral definition, chemistry, crystalline structures	Chapter 2 - Minerals
Friday, August 30	Mineral physical properties, classes, beneficial and harmful minerals	Chapter 2, cont.
Monday, September 2	NO CLASS – Labor Day Holiday	
Wednesday, September 4	Rock Cycle, Igneous rocks,	Chapter 3 - Rocks
Friday, September 6	Sedimentary Rocks	Chapter 3 cont.
Monday, September 9	Metamorphic Rocks	Chapter 3 cont.
Wednesday, September 11	Geologic Time, unconformities	Chapter 4 – Geologic Time
Friday, September 13	Relative vs. absolute geologic time	Chapter 4 cont.
Monday, September 16	Minerals and mining	Chapter 5 – Geologic Resources
Wednesday, September 18	Fossil Fuels	Chapter 5 cont.
Friday, September 20	Alternative Energy Resources	Chapter 5 cont.
Monday, September 23	Alfred Wegener, continental drift, tectonic plate anatomy	Chapter 6 – Plate Tectonics
Wednesday, September 25	why plates move, plate movement and surface topography and climate	Chapter 6 cont.
Friday, September 27	Earthquakes	Chapter 7 - Earthquakes

Monday, September 30	Midterm I	Chapters 1-6
Wednesday, October 2	Magma formation and behavior; Plutons and other igneous bodies	Chapter 8 – Plutons and volcanoes
Friday, October 4	Volcanoes and volcanic eruptions	Chapter 8 cont.
Saturday, October 5	Field Trip	9am – 4pm
Monday, October 7	Geologic structures	Chapter 9 - Mountains
Wednesday, October 9	Tectonic settings of mountains	Chapter 9 cont.
Friday, October 11	Mechanical vs. chemical weathering;	Chapter 10 – Weathering and Soils
Monday, October 14	Soils and soil formation	Chapter 10 cont.
Wednesday, October 16	Mass wasting	Chapter 10 cont.
Friday, October 18	Lakes, wetlands;	Chapter 11 - Freshwater
Monday, October 21	Groundwater; Hot springs and geysers;	Chapter 11 cont.
Wednesday, October 23	Dams, diversions, and water politics;	Chapter 12 – Water Resources
Friday, October 25	Water Resources; Water pollution	Chapter 12 cont.
Monday, October 28	Glacial Dynamics; Glacial Erosion;	Chapter 13 - Glaciers
Wednesday, October 30	Glacial Deposition; Earth's glaciations	Chapter 13 cont.
Friday, November 1	How deserts form; wind erosion; landforms associated with deserts; desertification	Chapter 14 - Deserts
Monday, November 4	Seafloor; Earth's oceans and their origin;	Chapter 15 – Ocean Basins
Wednesday, November 6	Seafloor features; Continental margins	Chapter 15 cont.
Friday, November 8	Midterm 2	Chapters 1-14, with emphasis on Chapters 8-14.
Monday, November 11	NO CLASS – Veteran’s Day Holiday	
Wednesday, November 13	Seawater, tides, and ocean currents;	Chapter 16: Oceans and Coastlines
Friday, November 15	Emergent and submergent coastlines	Chapter 16 cont.
Monday November 18	The Atmosphere	Chapter 17: Atmosphere
Wednesday, November 20	continued	Chapter 17 cont.
Friday, November 22	Atmospheric Dynamics	Chapter 18: Energy Balance in the Atmosphere
Monday, November 25	continued	Chapter 18 cont.
Friday, November 29	Atmospheric moisture and weather	Chapter 19 Moisture, Clouds, Weather
Monday, November 25	continued	Chapter 19 cont.

Wednesday, November 27	NO CLASS - Student Travel Day	
Friday, November 29	NO CLASS – Thanksgiving Holiday	
Monday, December 2	Climate	Chapter 20
Wednesday, December 4	Climate Change	Chapter 21
Friday, December 6	continued	Chapter 21 cont.
Friday, December 13	Final Exam	8am-10am

STUDENT CONDUCT CODE: Please be familiar with the UM Student Conduct Code. The Student Conduct Code can be found at: <http://www.umt.edu/student-affairs/community-standards/Student%20Conduct%20Code%20-%20FINAL%20-%208-24-18.pdf>.

Course Accommodations (DSS): Students with disabilities will receive reasonable accommodations in this course. To request course modifications, please contact me as soon as possible. I will work with Disability Services in the accommodation process. For more information, visit the Disability Services website (<https://www.umt.edu/dss/>) or call 406.243.2243 (Voice/Text).