GE 11a: Physical Geology

GE 11a is a 9-unit course introducing the fundamentals of Earth sciences with an emphasis on the physical and chemical processes controlling major features of the Earth’s surface, as well as some of what is know of the surfaces of the ‘Earth-like’ planets and moons. This class is intended to provide GPS undergraduate majors with a foundation for advanced course work in one of several sub-disciplines. However, the subject matter is of general interest and non-majors are welcome.

Who are you?
This course is taught by Dr. John Eiler, professor of Geochemistry. You can reach him at:
Office: 105 N. Mudd
Phone: x6942
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Your TA is Grace Leishma, an undergraduate student. You can reach her at: gleishma@caltech.edu, MSC 641. She might also elect to give you her phone number and/or campus address, on your request.

What am I supposed to know already?
You are assumed to have a good working knowledge of elementary calculus, algebra and geometry, classical physics, and chemistry (all at the level of a well-educated high school graduate). If you encounter any problems that you believe stem from a need for more background of this type, please raise questions as we go along or contact me during office hours. I have to look up this sort of fundamental material on an almost daily basis for my own research, so there is no shame in asking for help.

Some of you likely took GE 1(Earth and Environment) and will find that approximately half of the subject matter from that course is touched upon here, although the treatments differ. The goal of GE 11A is to give you a working knowledge of the Earth sciences—e.g., the ability to recognize and understand the significance of major types of rocks. This is particularly true in the first 3 weeks of class, which aim to prepare you for our field trip on October 17th – 19th. In addition, GE 11A reviews in detail the string of discoveries and arguments that led to fundamental theories and models that you might have heard of previously. For example, all educated people know that the earth’s outer 10’s of kilometers consist of brittle plates that move with respect to each other. Few people understand how we know this or
why it happens. You will by the end of class. Those of you who did not take GE 1 are at no disadvantage assuming that you do your assigned reading and pay attention to the introductory material given for each subject, which will be presented assuming no prior knowledge of Earth science.

**How is this class structured?**

This course has four main components:

**Lectures:** Three 1-hour lectures per week. This is the source of most information you will be expected to understand in exams and weekly homework. Many subjects are covered in detail only once and most contain some element of specialized vocabulary or facts that will be hard for you to reproduce by reading alone. It is therefore key that you try to attend all (or most…) lectures. Your text provides a useful review of vocabulary and general concepts. It contains only a portion of the material I will present in class.

**Homeworks:** Six homework assignments will be given out over the course of the term. Each will be handed out on a Friday and be due back at the beginning of class on the following Friday. Homeworks may be turned in late only with permission from the instructor, obtained before the due date.

**Labs:** One 3-hour laboratory session per week, for a total of 8 weeks (i.e., no lab will be assigned on two weeks). These labs will be the main source of your ‘hands-on’ experience with minerals, rocks, and maps and are where you will learn the skills needed to get the most out of our field trip (described below). Laboratory exercises also make up a significant fraction of your grade. Labs consist of a short introduction given by the TA, a set of exercises to be conducted during the lab with assistance of the TA and/or the professor, and a small number of related exercises to be conducted on your own, either during lab or at any time during the following week. Labs may be turned in late only with permission from the instructor, obtained before the due date.

**Field trip:** Perhaps the best reason to take this class is a field trip, which goes through Owens valley and Long Valley caldera. This year it will take place on October 17th-19th. We will leave Pasadena around noon on Friday, October 17th, spend all of Saturday and Sunday in the field, and return around dinner time on Sunday the 19th. Lodgings and food have
been arranged. You will need a sleeping bag, change of clothes, a notebook and pens. During the field trip, most of our time will be spent exploring lava domes, and crawling around in fossil waterfalls. Presumably little more incentive is needed to get you to attend, but, in addition, your field notes will be the basis of a portion of your grade. If you cannot attend the field trip, you will be assigned a short (5 page) literature research paper instead.

Textbooks
There are two books used this class, one of which I recommend you purchase (Understanding Earth by Grotzinger et al.) and one of which will be made available in lab (Exercises in Physical Geology by Hamblin and Howard). Some of the concepts and computational tools that form the core of this class can only be learned from the lectures, but the text is a useful reference, particularly for technical vocabulary. If you don’t like it, feel free to complain — its first author is chair of our department, so we should be able to do something about it!

What are the grading criteria?
Mid term exam: 15%
Lab exercises: 35% (4% each x 8, + 3% if you turn them all in)
Homework: 25% (4% each x 6, + 1% if you turn them all in).
Field notes: 5%
Final exam: 20%

Both the midterm and final exam are closed-book, take-home exams. They have no time limit but are written to be doable in roughly 2 hours. Labs, homework, and field notes cannot be turned in late without prior permission from the instructor. Exceptions will be made for clearly extenuating circumstances (e.g., serious illness). The class is graded on a curve.

'Honor code' policies:
You may freely discuss homeworks, labs, and field notes with other students. Advice verbally given to you by another student can be used in your own work, but each student must turn in their own written work, composed in their own words and containing calculations they have completed themselves. Verbatim copying or close paraphrasing from another student’s written work, even with their knowledge, is not allowed. No information of any sort may be taken from another student’s written work without their knowledge, regardless of where you might stumble
across it. Communication of any sort regarding exams is not allowed. Please keep in mind the difference between learning from your fellow students (very good!) and copying them (very bad!).

**Office Hours:**
I will keep open office hours in 105 N. Mudd one afternoon per week (between 1pm and 5 pm). You should feel free to stop by during this time for help with problems or simply to discuss other questions that come up during class. The day on which I will be available will be decided in the first lecture; unless you decide otherwise, assume it will be Thursdays. In addition, you are always welcome to hunt me down at other times in my office or laboratories (basement of N. Mudd and sub-basement of Arms), though I move around often and quickly so it might take some effort. It is a good idea to send an e-mail requesting a time when I will be around.

**When should I come back?**
This class is pre-scheduled to meet MWF 2-3 pm. The lab time must be decided; an evening in the middle of the week, 7-10 pm, is traditional. We will begin by trying to make that work. Any of these times can be changed with a complete consensus of the students, instructor and TA.