Earth— Evolution of a Habitable World
Planetary Sciences 170A1-001 (PTYS/ASTR 170A1-001)
Tier-One General Education Course
Kuiper Space Science 308, TTh 9:30-10:45

Instructor:
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Office Hours: Tuesdays, noon-1pm; Wednesday, 11am-noon (or by arrangement)
Teaching Assistants:
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Office Hours: Monday & Friday; 11am-noon
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Office Hours: Tuesday & Thursday; 11am-noon

This course will use a D2L website for assignments, lecture notes, and some communications. Homework and the final project will be submitted through the website. Email communications with instructors should include **PTYS 170A1** and the student's name in the subject line and be from your UA email address; we will endeavor to respond to emails within one business day.

Course Objectives

This course develops a planetary science perspective on the processes that shaped Earth through its history. We will examine how stars and solar systems are formed, what makes Earth habitable, and how physical, chemical and biological systems influence each other. We will explore the concept of habitability, and how it can be applied to worlds in our Solar System and around other stars. We will discuss how Earth's climate has changed in the past and how humans are changing the climate today. Habitability and the search for life in the universe are exciting research fields, and this course will expose students to this interdisciplinary field, including discussion of current and future spacecraft missions and exoplanet studies.

During the course, students are expected to learn:

- Scientific techniques for studying the Earth and other planets, the Sun and other Stars, and the Universe at large.
- To describe the fundamental forces and their impact on the formation of planets such as Earth.
- Basics of how stars, the Solar System, and the Earth evolved, including the origin of the Moon, changing of Earth's atmosphere through time, and plate tectonics.
- How to communicate science topics covered during the course, especially through writing.
- How the Earth's climate changed in the past and how it is likely to change in the future.
- What physical and chemical factors influence habitability, and how they differ within our solar system and around other stars.

Texts and Course Materials

You will need a Turning Point clicker and will need to register it in D2L. Information about registering your clicker can be found here.

The text "Earth: Evolution of a Habitable World" by Lunine is recommended but not required for this course. Additional suggested reading will be provided throughout the semester.

Writing Requirement

This is a Tier-One General Education course which has a requirement of at least ten pages of writing over the course of the semester. This writing will be distributed between homework, in-class writing, and the final project.

Homework

There will be six homework assignments throughout the semester, and they will be posted in advance on the D2L website. The homework will be a combination of multiple choice, written short response and short essay. Each homework will have at least one week for completion, then they will be graded over the next week and returned to you. Homework must be turned in as a paper copy in class, as well as on D2L, where it will automatically be checked for plagiarism. You may discuss the homework with other students, but be sure the final work is yours. Do not let others copy your homework; it could result in your getting flagged for plagiarism.

Late Homework

No late homework will be accepted (except in very exceptional cases). For scheduled absences like religious holidays and university travel, the homework can be downloaded from D2L in advance so that it can be turned in early, and there is no reason for a due-date extension. In rare cases of a sudden family or medical emergency, late homework may be accepted with documentation, but only before the graded homework is returned.

Exams

There will be three exams, all cumulative, covering all aspects of the course including lectures, in-class questions, and homework. The dates of the exams are listed below; please check to see if you have an approved conflict.

Exhibiting suspicious behavior during an exam may result in confiscation of your exam and/or a zero grade. No cellphones, laptops, or notes are allowed. You will not need a calculator.

There will be no final exam for this course, but rather a final project.

Missed Exams

If you need to miss an exam for a University-approved reason, contact Dr. Klein as soon as possible. If you know that you will need to be absent or will miss course deadlines, you are expected to make every effort to inform us before it occurs so that we can make arrangements in advance. Note that illness will require documentation as described in the Absence and Class Participation Policy below. Makeup exams may take a different format and have different questions than the in-class exam, so please make every effort to be present. Skipping the exam without a University-approved excuse or proper documentation of your absence will result in a zero grade.

Final Project

This course will have a final writing project that will involve researching material related to the course and applying this information to produce an at least four page research paper.

There will be due dates throughout the semester for selecting and proposing a topic, optionally turning in a draft for feedback and the opportunity to revise and resubmit, and final submission of the report.

The final project will be turned in as a paper copy in class, and on D2L, and will be checked for plagiarism.

Lectures and Class Participation

Most lectures will be presented by Dr. Klein, although occasionally a guest lecturer may lead the class. The lectures will be placed on D2L before the class so they can be downloaded in advance. Some students like to use the course notes as study guides, other students like to bring a copy to class and annotate them during the lecture. Lectures will include participation in the form of questions, class discussion, demonstrations, and/or short writing assignments.

The lectures will use Turning Technology clickers for in-class participation responses. The purpose of these in class clicker questions is to encourage students to think about and use the course material. The in-class questions will provide practice for exam-type questions, sort of like an exam review session during normal class. Correct answers are not required for in-class work, but your participation will be recorded and will comprise part of the final grade, so it is important that you bring your clicker to class each day. This grade component reflects your efforts in coming to class and proactively thinking about the course material. The Code of Academic Integrity applies to clickers as well — people caught using multiple clickers to record answers for their friends may receive a zero for this grade component.

The in class participation grade will simply be the number of lectures with recorded answered divided by 24, with a maximum of 100%, e.g. attending and answering questions in 27 lectures will yield 100%, 16 lectures 66.7%, and one lecture 0.04%.

Grading Scale & Policies

The Course Components will have the following weights:

3 Exams: $3 \times 20\% = 60\%$	Homework: 20%	Final Project : 20%	In-Class: 5%

Final Letter Grades will be assigned as follows, and will be calculated to the nearest 0.1%.

A: $\geq 90\%$	B: $\geq 80\%$	C: $\geq 70\%$	D: $\geq 60\%$	E: $< 60\%$

Extra-credit opportunities worth up to 2% of the final grade will be offered throughout the semester; see the extra credit handout on D2L for details.

University policy regarding grades and grading systems is available here.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available here and here respectively.

Makeup Policy for Late Registering Students

Students who register by the end of the second week of class may be given an opportunity to make up missed assignments within a reasonable amount of time, to be mutually agreed upon by the student and instructor.

Regrades

All your work will be graded by a teaching assistant or by Dr. Klein. Although we will make every effort to evaluate your work thoroughly and fairly, we are only human. If you think there is an error in grading your homework, please contact the TAs first. If you have a question about an exam or final project grade, or cannot resolve a homework grade with the TAs, please contact Dr. Klein. We will look at your work again and return it to you with a response, usually within a week. **You must report any grading errors within a week of the return of your assignment/exam to receive a regrade**

Questions & Concerns

It is very important that you let the instructor and/or TAs know your concerns about any aspect of the class as soon as they arise, and we are happy to help you. There are many ways to contact us about questions or concerns about the course material and your grade. Weekly office hours are the best place to ask questions and get help. You are also welcome to talk to me after class, or you can make an appointment to meet with me or the TAs outside of office hours if that works better.

Honors Credit

Students wishing to contract this course for Honors Credit should email Dr. Klein to set up an appointment to discuss the terms of the contact.

Class Participation and Absence Policy

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is encouraged at all lectures, and in-class activities will be a small part of the final grade. Students who miss in-class participation credits, homework/project due dates, or exams due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences and/or a zero on the coursework.

- We follow the UA's policy on Class Attendance, Participation, and Administrative Drops.
- We follow the UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable.
- Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored.

Classroom Behavior Policy

We all have a shared responsibility to create a positive learning environment free from distractions. If you arrive late to class or need to leave early, please choose a seat on the aisle and enter/exit quietly. Please silence your phone during class. If you need to accept an emergency phone call, exit the lecture hall fully before talking on the phone. Behaviors that could be disruptive to other students are not acceptable and disruptive students will be asked to leave. Examples of potentially disruptive behaviors making phone calls, web surfing, watching videos, or reading a newspaper.

Department policy *forbids any outside food or drink, except water, in the lecture hall.*

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself.

UA Academic policies and procedures are available here. Student Assistance and Advocacy information is available here.

Accessibility & Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please contact Dr. Klein and the Disability Resource Center (520-621-3268) so that reasonable accommodations can be arranged. Additional information on reasonable accommodations can be found at the Disability Resource Center.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work and exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog.

Student who plagiarize will get a zero for the assignment. If you have questions about how to cite sources or plagiarism, please talk to the TAs or the instructor. The UA libraries also provide references on the distinction between citation and plagiarism.

UA Nondiscrimination and Anti-Harassment Policy

The University is committed to creating and maintaining an environment free of discrimination. The classroom is a place all are encouraged to ask questions and express well-formed opinions and their reasons for those opinions. We want to create a tolerant and open environment where comments and questions can be expressed without resorting to bullying or discrimination of others.

Confidentiality of Student Records

Student records, including grades, will be handled according to FERPA guidelines. Please contact Dr. Klein yourself if you have questions about grades.

Subject to Change Statement

All information presented in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

University-Wide Policies

Policies established by UA regarding *Absence and Class Participation*, *Threatening Behavior*, *Accessibility and Accommodations*, *Code of Academic Integrity*, and *Nondiscrimination and Anti-Harassment* can be found at the Academic Affairs website.

Course Schedule & Due Dates

Lec	Date	Topic	Due	Returned
1	8/27/2019	A Tour of Our Solar System		
		Part One: Forces and Scientific Tools		
2	8/29/2019	Distances, Units, and some Math		
3	9/3/2019	Ancient Observation, Motion, and Newton's Laws		
4	9/5/2019	Fundamental Forces: Gravity	HW#1	
5	9/10/2019	Fundamental Forces: Electromagnetism		
6	9/12/2019	Fundamental Forces: Strong and Weak Nuclear	HW#2	HW#1
7	9/17/2019	Kinds of Energy throughout the Universe		
8	9/19/2019	Measuring Time:		
		Isotopes, Red Shifts, and Cratering		HW#2
	9/24/2019	**Exam #1**		
		Part Two: The Formation of Worlds		
9	9/26/2019	Missions to Explore the Solar System		
10	10/1/2019	The Birth of Stars	HW# 3	
11	10/3/2019	The Formation of Planets		
12	10/8/2019	The Formation of the Moon	Project Proposal	HW#3
13	10/10/2019	The Habitable Zone	HW# 4	
14	10/15/2019	Observing Exoplanets		Project Proposal
15	10/17/2019	Life on Other Worlds		HW#4
	10/22/2019	**Exam #2**		
		Part Three: The Evolution of Life		
16	10/24/2019	The Hadean Earth		
17	10/29/2019	Origins of Life	Project Draft	
18	10/31/2019	The Greenhouse Effect and the Faint Young Sun		
19	11/5/2019	The Archean Earth	HW#5	
20	11/7/2019	The Proterozoic Earth		Project Draft
21	11/12/2019	Plate Tectonics		HW#5
22	11/14/2019	The Oxygen Revolution		
23	11/19/2019	The Cambrian Explosion/Mass Extinctions	HW#6	
24	11/21/2019	Our Nearest Neighbors: Mars & Venus		
25	11/26/2019	Our Nearest Neighbors: Icy Worlds	Final Project	HW#6
26	12/3/2019	Climate Change		
27	12/5/2019	Looking Forward: Future Explorations		
	12/10/2019	**Exam #3**		Final Project