

Earth— Evolution of a Habitable World
Planetary Sciences 170A1-001 (PTYS/ASTR 170A1-001)
Tier-One General Education Course
Flandrau 219B, MW 12:30-1:45

Instructor:

Dr. Kristopher G. Klein, Kuiper Space Sciences 431; kgklein@lpl.arizona.edu
Office Hours: Monday: 2-3pm; Wednesday: 11am - noon (or by arrangement)

Teaching Assistants:

Teddy Kareta, Kuiper Space Sciences 324; tkareta@lpl.arizona.edu
Office Hours: Tuesday & Thursday; 10-11am
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Office Hours: Monday & Friday; 10-11am

This course will use a D2L website for assignments, lecture notes, and 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.

As this is a three credit course, there is an expectation of 90 hours of reading, homework, and other studies to be done by the student outside of lecture.

Course and Learning 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 will learn about:

- the fundamental forces and their impact on the formation of planets such as Earth.
- 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.
- what physical and chemical factors influence habitability, and how they differ within our solar system and around other stars.

Upon the completion of this course, students will be able to:

- Apply scientific techniques for studying the Earth and other planets, the Sun and other Stars, and the Universe at large.
- Clearly communicate planetary science concepts, especially through writing.
- Describe how the Earth's climate changed in the past and how it is likely to change in the future.

Texts and Course Materials

The texts “How to Build a Habitable Planet” by Langmuir and Broecker and “Universe” by Geller, Freedman, and Kaufman are recommended for this course; they can be acquired from the UArizona bookstore. Used copies are sufficient. 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. There will be due dates throughout the semester for selecting and proposing a topic for the final project, turning in a draft for feedback and the opportunity to revise and resubmit, and final submission of the report.

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 mathematical manipulations, written short responses and short essays. Each homework will have at least one week for completion from posting, then they will be graded and returned to you within a week. Homework must be turned in as a paper copy in class, as well as on D2L **in pdf format**, 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, and **you receiving a zero for the assignment**.

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.

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. Skipping the exam without a University-approved excuse or proper documentation of your absence will result in a zero grade.

Makeup exams will have different questions than the in-class exam, and take a different format, specifically an oral examination with Dr. Klein.

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 a four-page research paper.

There will be due dates throughout the semester for selecting and proposing a topic, 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 **in pdf format**, where it 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.

In-class participation in problem solving and discussions is expected. To facilitate this participation, we will be using lettered response cards, which will be distributed on the first day in class; please bring these cards to each class.

Grading Scale & Policies

The Course Components will have the following weights:

3 Exams: 60% total	Homework: 20%	Final Project : 20%
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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: $< 60\%$
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Extra-credit opportunities 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. Students who miss in-class 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	1/15/2020	Distances, Units, & A Tour of Our Solar System		
Part One: Physical Forces and Scientific Tools				
2	1/22/2020	Energy & Newton's Laws of Motion	HW#1	
3	1/27/2020	Kepler and Gravity		
4	1/29/2020	Electromagnetism & Light		
5	2/3/2020	Measuring Time		
6	2/5/2020	Optics & Missions to Explore the Universe	HW#2	HW#1
7	2/10/2020	The Big Bang		
8	2/12/2020	Nuclear Processes		HW#2
	2/17/2020	Exam #1		
Part Two: The Formation of Worlds				
9	2/24/2020	Our Sun	HW# 3	
10	2/26/2020	Other Stars		
11	3/2/2020	The Birth of Stars		
12	3/4/2020	Comparative Planetology		
13	3/16/2020	The Birth of Planets		
14	3/18/2020	Planetary Structures	HW#4	HW# 3
15	3/23/2020	Exoplanets	Project Proposal	HW# 4
	3/25/2020	Exam #2		Project Proposal
Part Three: The Evolution of Life				
16	3/30/2020	Plate Tectonics	Project Draft	
17	4/1/2020	Circulation on Earth		
18	4/6/2020	What is Life?		
19	4/8/2020	Chemistry to Biology	HW#5	Project Draft
20	4/13/2020	The Faint Young Sun & the Greenhouse Effect		
21	4/15/2020	The Habitable Zone		
22	4/20/2020	The Oxygen Revolution and Cambrian Explosion		
23	4/22/2020	Mass Extinctions		
24	4/27/2020	Our Nearest Neighbors: Mars & Venus	HW#6	
25	4/29/2020	Our Nearest Neighbors: Ocean Worlds		
	5/4/2020	Exam #3		
27	5/6/2020	The Ever-Changing Earth		Final Project