

Earth— Evolution of a Habitable World
Planetary Sciences 170A1-001 (PTYS/ASTR 170A1-001)
Tier-One General Education Course
Kuiper 308, TTh 11:00-12:15

Instructor:

Dr. Kristopher G. Klein, Kuiper Space Sciences 431; kgklein@lpl.arizona.edu

Office Hours: Tuesday: 2-3pm; Wednesday: 1 - 2pm (or by arrangement)

This class is scheduled to be taught in the in person modality.

Teaching Assistants:

Rowan Huang, Kuiper Space Sciences 519D; rihuang@lpl.arizona.edu

Office Hours: Thursday: 2-3 pm

Patrick O'Brien, Kuiper Space Sciences 528; pob@lpl.arizona.edu

Office Hours: Tuesday & Thursday: 12:30-1:30pm

This course will use a D2L website for assignments, lecture notes, and communications. Homework and projects 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:

- fundamental physical forces and their impact on the formation of planets.
- 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 text "How to Build a Habitable Planet" by Langmuir and Broecker contains useful reading material to complement the information presented in this course. An e-book version of Langmuir & Broecker can be found [here](#). 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 paper.

Homework

There will be six homework assignments throughout the semester. These assignments will be posted at least one week in advance of their due date 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 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 will be flagged for plagiarism, and **you will receive 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, associated with the three topical sections of the course, 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 during the examination.

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 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 lecture notes 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.

Grading Scale & Policies

The Course Components will have the following weights:

3 Exams: 45% total	Homework: 30%	Final Project : 25%
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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 and will be posted on D2L. 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.

Classroom Attendance

If you feel sick, or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel. Notify your instructor if you will be missing a course meeting or an assignment deadline. Non-attendance for any reason does not guarantee an automatic extension of due date or rescheduling of examinations/assessments. Please communicate and coordinate any request directly with your instructor. If you must miss the equivalent of more than one week of class, you should contact the Dean of Students Office (DOS-deanofstudents@email.arizona.edu) to share documentation about the challenges you are facing.

Academic Advising

If you have questions about your academic progress this semester, please reach out to your academic advisor (<https://advising.arizona.edu/advisors/major>). Contact the Advising Resource Center (<https://advising.arizona.edu/>) for all general advising questions and referral assistance. Call 520-626-8667 or email to advising@arizona.edu

Life Challenges

If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at (520) 621-2057 or DOS-deanofstudents@email.arizona.edu.

Physical and mental-health challenges

If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520) 621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

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](#).

COVID-19

Please consult the University's [COVID-19 website](#) for the latest information. Any changes to this course's schedule, modality, or meeting location will be communicated through D2L.

Voluntary, free, and convenient COVID-19 testing is available for students on Main Campus and the COVID-19 vaccine is available for all students at Campus Health.

0.1 Class Recordings

For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies (Code of Academic Integrity and the Student Code of Conduct) are also subject to civil action.

Course Schedule & Due Dates

Lec	Date	Topic	Due	Returned
1	08/24/2021	A Rapid Tour of Our Solar System		
Part One: Physical Forces and Scientific Tools				
2	08/26/2021	Distances, Units, and Motion	HW#1	
3	08/31/2021	Motion and Forces		
4	09/02/2021	Gravity: The Waltz of Planets		
5	09/07/2021	Light: Messenger Between Worlds		
6	09/09/2021	Nuclear Forces: The Ties that Bind	HW#2	HW#1
7	09/14/2021	Fission and Fusion		
8	09/16/2021	Telescopes and Missions of Exploration		HW#2
	09/21/2021	Exam #1		
Part Two: The Formation of Worlds				
9	09/23/2021	Our Sun	Project Proposal	
10	09/28/2021	Other Stars		
11	09/30/2021	The Birth of Stars	HW# 3	
12	10/05/2021	The Big Bang!		Project Proposal
13	10/07/2021	Exoplanets	HW#4	HW# 3
14	10/12/2021	Measuring Exoplanets		
15	10/14/2021	The Birth of Planets & Planetary Migration		HW# 4
	10/19/2021	Exam #2		
Part Three: The Evolution of Life				
16	10/21/2021	The Structure and Formation of the Earth	Project Draft	
17	10/26/2021	The Cooling Earth & Plate Tectonics		
18	10/28/2021	What is Life?	HW#5	
19	11/02/2021	Chemistry to (Astro)Biology		
20	11/04/2021	The Faint Young Sun & the Greenhouse Effect		HW#5
21	11/09/2021	The Habitable Zone & The Carbon-Silicate Cycle	HW#6	Project Draft
22	11/16/2021	The Oxygen Revolution & Cambrian Explosion		
23	11/18/2021	Mass Extinctions		HW#6
	11/23/2021	Exam #3		
24	11/30/2021	Our Nearest Neighbors: Mars & Venus	Final Project	
25	12/02/2021	Our Nearest Neighbors: Ocean Worlds		
26	12/07/2021	The Anthropocene Earth		Final Project