

PTYS 170A1 – Planet Earth: Evolution of a Habitable World

Tier-One General Education Course

Kuiper Space Sciences Rm 308 Tues/Thurs 2:00-3:15 pm

Instructor: Dr. Lynn Carter, lmcarter@arizona.edu

Office Hours: Tuesdays 1:00 pm to ~1:45 pm (before class), or by appointment. Office is currently 533A Kuiper Building, but will change to Kuiper 540 during the semester at some point, please check D2L. Any other changes to office hours will be announced on D2L/Brightspace.

Teaching Assistants:

Namya Baijal, namyabaijal@arizona.edu, Office hours Wednesdays, 1:00-2:00 pm in Kuiper 409

Claire Cook, clairec@arizona.edu, Office hours Thursdays, 3:15-4:15 pm (after class) in Kuiper 409

Any changes to TA office hours will be announced on D2L/Brightspace

Part 1: Course summary and logistics

Course Description:

Thousands of planets have been discovered orbiting nearby stars. How many of these worlds can we expect to be Earth-like? We explore this question from the perspective of astronomers, geologists, and historians. We look back at Earth's geologic history to periods when our planet itself would appear very alien to us today. We study the nearby planets Venus and Mars, which were once more Earth-like than today. We discuss not only the evolution of Earth, Venus, and Mars as habitable worlds but also how human understanding of these planets has evolved. Finally, we apply these perspectives to the search for alien Earths in our galaxy. This interdisciplinary treatment of Earth, its neighboring planets, and planets being discovered around nearby stars allows us to consider the potentially unique position of Earth as a habitable world not only in space but in time.

Course Objectives:

During the course, students will:

1. Demonstrate the methodologies and knowledge that characterize the perspective of astronomers in the context of searching for planets orbiting around other stars in our galaxy – including how this astronomical perspective has changed over time.
2. Demonstrate the methodologies and knowledge that characterize the perspective of geologists in the context of exploring Earth's geologic record as well as those of Venus and Mars – including how this geological perspective has changed over many generations of geologists.
3. Synthesize the perspectives of astronomers and geologists to describe the importance of both space and time in finding truly Earth-like planets around other stars.
4. Obtain their own data – such as images from observations, measurements from scale models, quantitative information from demonstrations, etc.
5. Critically analyze and interpret their observations, measurements, and quantitative data in the context of understanding Earth as a habitable planet.
6. Communicate with educated non-experts – through written essays and/or recorded video presentations – their analysis and interpretation of their own images and data as well as data provided from primary sources.
7. Discuss the past and current contributions of astronomers and geologists with diverse backgrounds.

Expected Student Learning Outcomes:

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

1. Students will demonstrate the ability to utilize multiple perspectives and make meaningful connections across disciplines and social positions, think conceptually and critically, and solve problems.
2. Students will demonstrate rhetorical awareness and writing proficiency by writing for a variety of contexts and executing disciplinary genre conventions of organization, design, style, mechanics and citation format while reflecting on their writing development.
3. Students will demonstrate competency in working with numerical information by critically analyzing quantitative information, generating ideas that are supported by quantitative evidence, assessing the relevance of data and its associated implications in a variety of contexts, and communicating those ideas and/or associated interpretations using a variety of formats (graphs, data tables, equations, oral presentations, or written reflections).
4. Communicate a broad understanding of the evolution of Earth, Venus, and Mars over their 4.5-billion-year histories, as well as the techniques geologists and astronomers employ to develop our understanding of this evolution.
5. Use perspectives of time and space to apply our understanding of Earth/Venus/Mars to terrestrial planets orbiting distant stars to determine the likelihood of these planets being alien Earths (i.e., Earth-like).

Course website: This course will use D2L/Brightspace for assignments, lecture notes, and communications. Assignments will also be submitted through D2L/Brightspace unless otherwise noted.

Course Communications: Course announcements will be posted on D2L/Brightspace and announced in class. If we need to contact you for any reason we will use your university email, so please check it regularly. Please email Dr. Carter or the T.A.s, or talk to us before or after class, or come to office hours, if you have any questions, comments or concerns.

Required Texts and Materials: There is no textbook. You will need a device capable of internet access (phone, tablet, laptop) to get credit for in-class participation via Top Hat. You will also need pens/pencils to complete the in-class labs. A calculator or calculator program on your phone or laptop may also be useful.

Honors Credit: As this is a GenEd course, it is available for Honors credit. Honors contract information is available at frankehonors.arizona.edu. See the instructor to discuss your ideas for an honor contract.

Part 2: Course Assessment and Grading

This class involves multiple components: lecture participation, in-class labs, homework, and a Signature Assignment. There is no final exam in this class. Grades will be available in D2L.

The grade distribution for the course will be as follows:

PTYS 170 A1 Grade Distribution	
Lecture Participation	5%
In-Class Labs	25%
Homework	35%
Signature Assignment	35%

Lectures and Participation

The lectures will use Top Hat for in-class participation responses. The purpose of these in-class questions is to encourage students to think about and use the course material. This grade component reflects your efforts in coming to class and proactively thinking about the course material. The Code of Academic Integrity applies to Top Hat as well.

In-class Labs

The class will have in class activities (labs) that will require work in small groups. The labs will involve elements of quantitative analysis and/or group discussion and must be turned in by the end of class. If you will miss class due to illness or university-approved activity and need to make up a lab, please email Dr. Carter and/or the TAs *in advance* and arrange a make-up time. These make-ups will occur during office hours (with the TAs or Dr. Carter) or during a pre-arranged meeting time. We need to know about lab make-ups in advance so that the lab materials will be available during the office hour. *Lab make-ups must occur within 3 weeks of the initial lab (for labs 1-4) - after this you will receive a zero grade. Lab make-ups for labs 5 and 6 must occur by 5 pm on Friday, May 8th (shorter than the usual 3 week cutoff) so that we can complete the grades for the class. You are responsible for making sure your full name is on the lab sheet when it is turned in, otherwise you may not receive credit.*

Homework and Late Policy

There will be 6 homework assignments throughout the semester, and they will be posted in advance on D2L/Brightspace. The homework will be written short response or short (one page) essays. Each homework will have at least one week for completion, then they will be graded over the next week and returned to you. You may discuss the homework with other students but be sure the final work is yours, written using your own words. *You may not use AI, or copy answers from work you submitted to another course. Late homework will incur a 5% penalty for up to 24 hours late, and a 10% penalty after that. No homework will be accepted more than 1 week late without the approval of Dr. Carter.* The first two homeworks will be eligible for revisions to receive a better grade; more details on this process will be provided in class. Revisions will not be offered in cases of violation of the Code of Academic Integrity.

Signature Assignment:

This GenEd course will have a Signature Assignment “final project” that will involve researching material relating to the course and applying this information to produce a final project report. There will be multiple possible projects for you to choose from, which will be discussed early in the class. As with homework, AI use is not allowed, and students are expected to do their own work. In the case of these projects, if a student has a specific reason to use AI or “machine learning” for purposes not related to the primary academic content, they can discuss with Dr. Carter and get explicit written permission, and document the use in the project. Lack of this permission, or any other use of AI, will be considered a violation of academic integrity rules. *Late Signature Assignments will incur a 5% penalty for up to 24 hours late, and a 10% late penalty after that. We will not accept any Signature Assignments after Friday May 8th due to our needing to complete the class grades.*

Final letter grades will be assigned as follows.

- A: 90% or higher
- B: 80 – 89%
- C: 70 – 79%
- D: 60 – 69%
- E: Below 60%

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively. Students may be dropped from the class using Administrative Drop if there has been no engagement with the class (attendance, email, assignments).

Extra Credit

Extra credit opportunities may also be provided. These will be worth at most 3-5% of the grade and will be fairly challenging and/or require extra time. The extra credit should not be seen as a potential substitute for the regular course work.

Regrades

All your work will be graded by a teaching assistant or by Dr. Carter. 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. Contact Dr. Carter if you have concerns about a lab grade. If you have a question about the Signature Assignment grade, or if you cannot resolve a homework grade with the TAs, please contact Dr. Carter. We will look at your work again and return it to you with a response, usually within a week. If you notice that you are lacking a grade for an assignment, let us know ASAP! *You must report any grading errors within a week of the return of your assignment to receive a regrade!*

Course schedule/Due Dates

A detailed course schedule and due dates will be available on D2L. A rough schedule of topics is listed here. Details are subject to change and D2L/Brightspace will always have the most current information. In-class lab dates will be posted on D2L/Brightspace.

Week	Topic	Assignment	Due Date (11:59 pm)
1	Intro to the Solar System		
2	The Sun and Stars		
3	Light, energy and gravity	Homework 1	Jan. 29
4	Early evolution of the Solar System		
5	Studying Early Earth, Age Dating	Homework 2	Feb. 12
6	The Hadean Earth and Origin of Life		
7	Early life on Earth	Homework 3	Feb 26
8	Snowball Earth and the first continents	Signature Project Proposal	Mar. 17
9	Plate tectonics and the oxygen revolution	Homework 4	Mar. 26
10	Mass extinctions		
11	Climate change through history	Homework 5	Apr. 9
12	Venus: The exoplanet next door		
13	Mars: Early habitability?		
14	Exoplanets		
15	Icy Ocean Worlds	Homework 6	Apr. 28
16	Life in the Universe	Signature Assignment	May 5

Part 3: Course policies

Classroom behavior policy

Department policy forbids food or drink, except water, in the lecture hall. 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. Behaviors that could be disruptive to other students are not acceptable, and disruptive students will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave the lecture, may lose participation points for that class, and may be reported to the Dean of Students in cases of particularly egregious behavior. Examples of disruptive behaviors include chatting, talking on the phone, watching movies, tv or video clips, and live streaming or video recording.

Use of AI tools

We will not use AI in this class, and it is not allowed for homework or the signature assignment. Inappropriate use of AI tools will be considered a violation of the Code of Academic Integrity, specifically the prohibition against submitting work that is not your own.

Safety on campus and in the classroom

- For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): <https://cirt.arizona.edu/case-emergency/overview>
- Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/common/learningeventdetail/crtfy00000000003560

University wide policies

Links to the following UA policies are provided here, <http://catalog.arizona.edu/syllabus-policies>:

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement