

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

Tier-One General Education Course

Tuesday and Thursday 09:30 AM–10:45 AM

Kuiper Space Sciences Building, Room 308

**Instructor:** Dr. Christopher Hamilton, [hamilton@lpl.arizona.edu](mailto:hamilton@lpl.arizona.edu)

**Office Hours:** Tuesdays 11:00 AM–Noon and Thursdays 11:00 AM–Noon (or by appointment)  
Kuiper Space Sciences Building, Room 430

## Teaching Assistants (TAs):

Ben Lew, [wplew@lpl.arizona.edu](mailto:wplew@lpl.arizona.edu), Office Hours: Wed./Fri. at 12:15 PM–1:15 PM, Kuiper 331

Kyle Pearson, [pearsonk@lpl.arizona.edu](mailto:pearsonk@lpl.arizona.edu), Office Hours Tue./Thu. 2:00 PM–3:00 PM, Kuiper 326

## Course website:

This course will use a Desire2Learn (D2L) website (<https://d2l.arizona.edu>) for assignments, lecture notes, and some communications. Homework and the final project will be submitted through the website so it is important to be able to access the site frequently.

## Course Objectives:

This course develops a planetary science perspective on the evolutionary processes that shaped Earth throughout its history. We will examine what makes Earth habitable and discuss the influences that physical, chemical, and biological systems can have on each other. We will explore some of the other potentially habitable worlds in our Solar System, investigate what factors contribute to habitability, discuss how Earth's climate has changed in the past, and show how humans are changing the climate today.

During the course, the students are expected to learn:

- Basic scientific tools necessary to explore planetary habitability and change
- How Earth's climate changed in the past and how it will change in the future
- What do we mean by habitability? How do we assess whether a planet is habitable?
- What physical and chemical processes lead to habitability?
- What does life require to survive and what are the causes of mass extinctions?
- Basics of how the Solar System and Earth evolved, including the origin of the Moon, changing of Earth's atmosphere through time, and plate tectonics
- How life originated on Earth and how forms of life have changed with time
- What we can learn about habitability by studying other bodies in the Solar System
- What are the factors may affect habitability on exoplanets beyond our Solar System

## Course Communications:

Communications will primarily be done with in-class announcements and through the course D2L website; however, attending class is the best way to receive information about the exams, final project, schedule etc. Homework and exams will also be returned in class.

**Required Texts or Readings:**

The course textbook is “Earth: Evolution of a Habitable World” (Second Edition) by Jonathan Lunine. The textbook provides text and figures that can help you study, understand and review course material. Some material presented in lectures is not in the textbook. Students are also expected to develop their own supplemental reading to develop their final written project.

**Lectures and Class Participation:**

Dr. Hamilton will present most lectures, 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. Lectures will include participation in the form of questions, class discussion, demonstrations, and/or short writing assignments.

**Writing Requirement:**

This is a Tier-One General Education course, and has a requirement of at least 10 pages of writing. Over the course of the semester, this writing will be distributed among homework, in-class writing, and the term project.

**Homework:**

There will be 6 homework assignments throughout the semester, and they will be posted in advance on the D2L website. The homeworks 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 work being flagged for plagiarism!

**Exams:**

There will be three exams, all cumulative. The exams will cover all aspects of the course: lectures, in-class questions, and homework. Exams dates are listed below. 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.

**Final Project:**

This course will have a final writing project that will involve researching material relating to the course and applying this information with what you learned in the course to produce a research paper. There will be two possible projects for you to choose from, all of which will require a 5-page written report. You are encouraged to start on this early, and a draft copy may be turned in to receive comments and allow a revision before final grading. The final project will also be turned in as a paper copy in class, and on D2L, and will be checked for plagiarism.

**Course Schedule and Important Due Dates:**

The course schedule is listed below. The particular lecture topics are subject to change (though any changes are expected to be minor), but the exam, homework, and project due dates are fixed. Check now to see if you have any conflicts!

Lecture	Date	Topic	Due in class	Textbook Readings
<b>Part 1: Introduction to Planetology, Climate, and Fundamental Scientific Tools for Discovery</b>				
1	Thursday August 24	Weather versus Climate	Homework 1 Assigned	–
2	Tuesday August 29	Climate Change Over the Past Few Hundred Thousand Years	–	Chapter 21
3	Thursday August 31	Human-Induced Global Warming	<b>Homework 1 Due</b>	Chapter 22
4	Tuesday September 5	Fundamental Scientific Tools 1: Excel and an Introduction to Linear and Non-Linear Systems	–	–
5	Thursday September 7	Fundamental Scientific Tools 2: Scales and Units	Homework 1 Returned Homework 2 Assigned	Chapter 2
6	Tuesday September 12	Fundamental Scientific Tools 3: Forces and Energy		Chapter 3
7	Thursday September 14	Fundamental Scientific Tools 4: Isotopes	<b>Homework 2 Due</b>	Chapters 5 and 6
8	Tuesday September 19	Fundamental Scientific Tools 5: Impact Events	–	Chapter 7
9	Thursday September 21	Relative age dating, rock stratigraphy, fossils and the geologic time scale	Homework 2 Returned	Chapter 8
10	Tuesday September 26	<b>In Class Exam 1 – Room 308</b>	–	–
<b>Part 2: The Origin and Evolution of the Solar System and the Development of Life on Earth</b>				
11	Thursday September 28	The Hadean Earth	Homework 3 Assigned	Chapter 11
12	Tuesday October 3	The Archean Eon and the Origin of Life 1	–	Chapter 12
13	Thursday October 5	The Archean Eon and the Origin of Life 2	<b>Homework 3 Due</b>	Chapter 13
14	Tuesday October 10	The First Greenhouse Crisis	–	Chapter 14
15	Thursday October 12	Plate Tectonics	Homework 3 Returned Homework 4 Assigned	Chapters 15 and 16

16	Tuesday October 17	The Oxygen Revolution	<b>Homework 4 Due</b>	Chapter 17
17	Thursday October 19	The Phanerozoic Eon 1	–	Chapter 18
18	Tuesday October 24	The Phanerozoic Eon 2	Homework 4 Returned	Chapter 19
19	Thursday October 25	<b>In Class Exam 2 – Room 308</b>	–	–
<b>Part 3: Comparative Climatology in a Planetary Context</b>				
20	Tuesday October 31	The Holocene Epoch	Homework 5 Assigned	Supplemental Reading
21	Thursday November 2	Guest Lecture 1	–	Supplemental Reading
22	Tuesday November 7	Guest Lecture 2	<b>Homework 5 Due</b>	Supplemental Reading
23	Thursday November 9	Guest Lecture 3	–	Supplemental Reading
24	Tuesday November 14	The 6 <sup>th</sup> Great Extinction	<b>Final Project Draft Due</b> Homework 5 Returned Homework 6 Assigned	Supplemental Reading
25	Thursday November 16	Climate Histories on Mars and Venus	–	Chapter 15
26	Tuesday November 21	Icy Satellites and Ocean Worlds	<b>Homework 6 Due</b> Final Project Draft Returned	Supplemental Reading
–	Thursday November 23	<b>No Class: Thanksgiving Break!</b>	–	–
27	Tuesday November 28	Deep Time: The Origins of the Universe and Formation of the Solar System	<b>Final Project Due</b> Homework 6 Returned	Chapter 10
28	Thursday November 30	Search for Other Earths	–	Supplemental Reading
29	Tuesday December 5	<b>In Class Exam 3 – Room 308</b>	Final Project Returned After the Exam is Submitted	–

**Grading Scale and Policies:**

The course components will have the following weights:

3 Exams:	3 × 20% = 60%
Homework:	15%
Final project	20%
In-class activities	5%
Total	100%

*Final letter grades will be assigned as follows:*

- A: >90.0%
- B: >80.0 to <90.0%
- C: >70.0 to <80.0%
- D: >55.0 to <70.0%
- E: <55.0%

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.

Dr. Hamilton reserves the right to scale the grades upwards, but there is no guarantee that this will be done.

Extra credit opportunities may also be provided. These will be worth at most 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.

**Late Homework/Missed Exams:**

Late homework will not be accepted. 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.

If you need to miss an exam for a University-approved reason, contact Dr. Hamilton as soon as possible. If you know that you will need to be absent or will miss a course deadline, 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.

**Regrades:**

All your work will be graded by a Teaching Assistant or by Dr. Hamilton. 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. Hamilton. We will look at your work again and return it to you with a written 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 Teaching Assistants know your concerns about any aspect of the class as soon as they arise. 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 (about anything!) and get help. Your time in office hours will be best spent if you come prepared with specific questions and have looked at the homework in advance. Some students find it useful to write questions in a notebook before coming, to be sure everything gets answered. You are also welcome to talk to me after class, or make an appointment to meet with me, or the Teaching Assistants, outside of office hours if that works better with your schedule.

We will also respond to emails. *Please use your university email and include PTYS 170A1 in the subject line so that we will recognize you as a student. Be sure to include your name.* Neither the instructor nor the TAs check email constantly, so please be patient waiting for a response. We will do our best to respond within a day.

My phone number is on the department website, but email is a better way to reach me. Plus, like many people nowadays, I never check my voicemail. Please email me instead of calling. We can always set up a time for a phone call by email; that will guarantee that I am in my office to receive your call.

If you feel shy about saying or asking something in person, we will also have a suggestion box that can be anonymous. I will do my best to address any constructive comments about the course and lectures, and will try to make time to explain any science questions that are dropped in there. You can ask about any of the course material by dropping a note in the suggestion box, without having to raise your hand in front of everyone.

**Required or Special Materials:**

No special materials are required for this class.

**Makeup Policy for students who register late:**

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.

**Honors Credit:**

Students wishing to contract this course for Honors Credit should email Dr. Hamilton to set up an appointment to discuss the terms of the contact. Information on Honors Contracts can be found at <https://www.honors.arizona.edu/honors-contracts>.

**Absence and Class Participation 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.

- The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>.
- The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.
- Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>.

**Classroom behavior policy:**

Department policy *forbids any outside 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. 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 include chatting, making phone calls, web surfing, watching movies, television or video clips, live streaming or video recording, reading a newspaper.

**Threatening Behavior Policy:**

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

**Accessibility and 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 let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

**Code of Academic Integrity:**

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/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. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

*The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>. Students who plagiarize will get a zero for the assignment, so if you have questions about plagiarism or how to cite sources, please talk to the Teaching Assistants or instructor.*

Please remember that when you turn in work, you are signing it with your name. This certifies that you are the author of the submitted work, and we will assume it is an expression of your original ideas. *Unless a task is specifically designated as group-work (e.g., in-class group participation), the coursework that is turned in must be yours, even if you have discussed the assignment with others.*

**UA Nondiscrimination and Anti-Harassment Policy:**

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>. Our classroom is a place where everyone is 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:**

All student records, including grades, will be handled according to FERPA guidelines. Please contact Dr. Hamilton yourself if you have questions about your grade. <http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>.

**Subject to Change Statement:**

Information contained 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.