

Earth 351 - *Forming a Habitable Planet*

Earth & Planetary Sciences

Spring Quarter 2017

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Class Website: <http://lunar.earth.northwestern.edu/courses/351/>

Assigned readings, journal articles and handouts will be posted on this website.

Description::

We will investigate whether intelligent life is rare or common in the universe, exploring the conditions under which the formation and evolution of a planet allow it to develop and support intelligent life. Using our solar system and Earth as our only definite example of a planet supporting life, we will consider global geophysical and geochemical processes critical in developing our planet such that sentient beings evolved. The prospects for life elsewhere within our solar system and beyond will be discussed. The rapidly expanding database of exoplanets - those around other stars - identified, and specifically the discoveries by NASA's ongoing Kepler mission will be analyzed. Missions to Mars: rationale, past, planned, and possible, will be featured in the course.

Readings:

Ward, P. D. & D. Brownlee, *Rare Earth: Why Complex Life is Rare in the Universe*, Springer, 2004, paperback, ISBN 0387952896.

Langmuir, C. H. and W. Broecker, *How to Build a Habitable Planet*, Princeton Univ. Press, 2012. ISBN 9780691140063

(Reading assignments: RE# denotes chapters for *Rare Earth* and HP for *Habitable Planet*)

Both books on Reserve in the Main Library, as Mudd SEL not available for reserve.

Grades: 50% Homework; 10% Class Discussion; 10% Team Presentation; 30% Team Report

Course grades will be assigned on the basis of problem sets, class discussion exercises and participation as well as an independent team project presenting a facet of Mars exploration. This will be presented in class. A final paper will summarize the mission science goals with full documentation and citations. Opportunity will be given for revision.

Homework numerical answers require units and appropriate numbers of significant digits. All work must be shown.

Students may discuss homework with others, but are expected to work and do their write-ups independently: You cannot look at another student's work or show them yours.

Class Attendance: It's important to keep up, so attending class is required. In-class discussion questions cannot be made up. Homework due a week after being handed out, at the beginning of class. No credit will be given for late work without prior written approval from an instructor.

Make-ups ONLY allowed through advance arrangement with the WCAS Office of Studies, or Dean of Students, McCormick.

Note: No portable electronic devices, including laptop computers, may be used during class.

Earth 351 - Spring Quarter 2017 - Schedule

Date	Topics	Text, Homework
Mar 27	Fermi Question; Drake Equation: "Where is everybody?"	RE1,2; HP21; PS1
Mar 29	Our solar system; Definition of habitable zone	
Apr 3	Nucleosynthesis; Formation of the Solar System	RE3; HP3,5; PS2
Apr 5	Evolution of the Solar System	
Apr 10	Stellar Evolution	RE4,5; HP13; PS3
Apr 12	Starshot, Meteorites	
Apr 17	Impacts: Comets and Asteroids; Earth's Water	RE6,7; HP9,17; PS4
Apr 19	Early Earth; Origin of Life	
Apr 24	Evolution of Planetary Bodies	RE8; HP14; PS5
Apr 26	Cambrian Explosion, Extinctions & Theories for the events Mars Mission Team #1 -	
May 1	Life in the Solar System, Venus Mission Team #2 -	RE9;HP10;PS6
May 3	Viking and Life on Mars Mission Team #3 -	
May 8	Life in Outer Solar System Mission Team #4 -	RE10,11;HP12;PS7
May 10	Outer Solar System, Titan Mission Team #5 -	
May 15	Guest Lecture, Kepler Mission, Prof. Jason Steffen, UNLV	RE12,13; PS8
May 17	Exoplanets Mission Teams #6-, #7-	
May 22	The Moon *** NASA Moon Rocks *** Mission Team #8-, Mars Exploration Wrapup -	PS9
May 24	SETI, Course summary; Drake Equation Revisited Final Class, Final Team Report Paper Due	
May 29	Memorial Day, No Class	
May 30 - June 2	Wed - Sat WCAS Reading Period	

(Assignments: RE# denotes chapters to read in *Rare Earth*; HP# for *Habitable Planet*;
PS# refer to Problem Set #, #1-8 due at beginning of class a week later; PS9 due last class)
First paper draft due a week after presentation for comments.
Final paper due May 24th, last day of class.