

PTYS 407: Chemistry of the Solar System Fall 2019

Summary:

This is an introduction to the chemistry of the solar system and the bodies within it. It is designed with science and engineering majors in mind, but other students with a basic knowledge of chemistry should be able to understand the material.

Class:

Lectures will be MWF, 10-10:50 a.m., in Kuiper Space Sciences 312. Class attendance is expected. No formal roll will be taken, but class participation will be part of the grade, and homework and exams are likely to make more sense if you've been to class.

Textbook

The textbook is "Cosmochemistry", by McSween and Huss, published by Cambridge. The book was released in 2010, and has been used in PTYS 407 before, so there may be second-hand copies available.

Instructor:

Prof. Timothy D. Swindle 621-4128 Space Sciences 323
tswindle@lpl.arizona.edu
Office hours: MWF 9:30-10 a.m., 11-11:30 a.m. (i.e., before and after class)

In addition, I'll be happy to make an appointment to meet with you.
You can also contact me through the course page on D2L.

Course format and teaching methods:

The course will primarily be delivered in lecture format, with in-class discussion encouraged or sometimes required.

Required extracurricular activities:

Students will have to sign up to spend a block of four hours during one day working on an electron microprobe taking data, which they will then have to analyze.

Course objectives:

The course will provide basic information on how the elements in the Solar System are created, how elements and isotopes are measured in various objects, and what the variations in elemental and isotopic composition can signify, including the implications for chronology, Solar System formation, planetary evolution, and the origin of life.

Expected learning outcomes:

Upon completion of the course, students should be able to demonstrate their quantitative literacy by being able to interpret or construct relevant data displays such as reflectance spectra, three-isotope plots, isochrons, simple phase diagrams, and normalized elemental abundance patterns; should be able to interpret information in terms of the Chart of the Nuclides and the Periodic Table of the Elements; and should be able to explain the basic ideas about why the compositions of Solar System objects vary through the Solar System as they do.

Student expectations

Students will be required to complete about seven homework sets or activities, take two mid-term exams, and write a paper (incorporating and synthesizing the scientific literature) about some topic relating to the class. In addition, 3% of the grade will be for simply coming to meet with me at some point on or before October 18.

Grading: Class participation/attendance, meeting with instructor, etc. – 10%; Homeworks – 25% total; Paper – 25%; Mid-term exams – 20% each.

Homework

“Homework” covers a variety of things. It includes some calculations, some literature searches, some discussions of competing hypotheses, and one activity where you will use an electron microprobe to classify a meteorite. The current target is to have seven such assignments, but I reserve the right to make that number larger or smaller.

Exams

There will be two mid-term exams, which will include some definitions, some explanations of some pertinent equations, and some simple calculations.

Final paper

In lieu of a final exam, there will be a paper due (in the D2L dropbox) the day of the final exam. More details will be provided later, but the basic idea is for to look up some of the primary scientific literature on some topic that you find interesting, and synthesize and/or summarize it.

Schedule

The initial plan is to cover the whole book, roughly in order of the chapters, typically one chapter per week, but that is likely to change some. So I want to leave the schedule flexible, which is why I haven't given specific dates for specific topics, and I reserve the right to add, omit, or move topics. Topics are:

- Introduction to cosmochemistry
- Nuclides and elements
- Origin of the elements (nucleosynthesis)
- Solar system and cosmic abundances
- Presolar grains
- Meteorites
- Cosmochemical and geochemical fractionation
- Radioisotopes as chronometers
- Chronology of the Solar System
- Volatile elements and compounds
- Asteroids (focusing on the anhydrous)
- Comets and ice-bearing planetesimals
- Geochemistry of Mars and the Moon
- Cosmochemical models for the formation of the solar system

A schedule of due dates (tentative for homework, firm for other assignments) and other dates of importance is given below.

- Sept. 9: Homework #1 due
- Sept. 23: Homework #2 due
- Oct. 7: Homework #3 due
- Oct. 14: Exam #1
- Oct. 18: Last day for interview for full credit

Oct. 28: Homework #4 due
Nov. 13: Homework #5 (meteorite classification) due
Nov. 18: Exam #2
Dec. 2: Homework #6 due
Dec. 13: Final paper due

Due dates and late work:

All assignments except the final paper are due at the end of the day on the due date, in the D2L dropbox, in the drop box in Kuiper 330, or to me, personally, before or after class (please don't slide it under the office door or stick it in a mailbox, because you may get the wrong one). The final paper is due at the time the final exam would be complete, at 12:30 p.m. on Friday, December 13. I'd rather have late work than no work, although late work will receive reduced credit. Details are on individual assignments. My intent is to have assignments and exams graded and back to you within two weeks of the due date.

Absence and Class Participation Policy

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>

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is expected at all lectures. Absences may affect a student's final course grade. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class online activities, please contact me as soon as possible. *To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu.* If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

Other classroom issues:

We try to keep the classroom clean, and ask for your help. Please do not bring any food or drink (other than bottled water) into the classroom. If there are problems with a seat or with its writing table, please let me know, so that the problems can be addressed as soon as possible. Also, the standard rules of good conduct (including cell phones turned off or on vibrate) apply.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

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

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, <https://drc.arizona.edu/>) to establish reasonable accommodations.

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>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

Policies specific to this class: Collaboration is permitted, even encouraged, on most assignments. However, since the homeworks make up nearly half the grade, make sure that if you do work with someone, you write the final version yourself, and rephrase what you have concluded. If I get identical answers, I'll divide the credit evenly.

When using articles, web sites, etc., make sure that you put the material in quotes or rewrite things in your own words, and list the source of your information. The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

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 express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>
Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<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.