

PTYS-407 Chemistry of the Solar System

Kuiper Space Sciences Bldg

MWF 11:00 – 11:50 AM

Description of Course

The general characteristics and diversity of the solar system are reviewed and investigated with undergraduate-level physics and mathematics.

Course Prerequisites or Co-requisites

Students should have a good understanding of Newtonian physics, thermodynamics, and introductory chemistry as well as facility with calculus, including vector calculus and experience with elementary computer programming.

Instructor and Contact Information

Professor Roger Yelle, Space Sciences Bldg rogeryelle@gmail.com

Office hours.

D2L Page: <https://d2l.arizona.edu/d2l/home/XXXXX>

Course Format and Teaching Methods

The course consists of lectures, homework assignments, and two exams.

Course Objectives

This course presents investigations of the properties of the solar system in terms of basic physical processes. We study the orbits and rotation of planets and moons in response to gravity and tides, examine surface temperatures on solar system bodies in terms of radiative energy balance, study the internal structure of terrestrial planets, and examine the generation of magnetic fields and their role in protecting planets from harmful radiation. As part of these investigations, the course provides an overview of the characteristics of our solar system and extra-solar planetary systems.

Expected Learning Outcomes

The successful student will be able to:

- 1) Describe the components of the solar system (Sun, planets, moons, comets, asteroids, ring systems) and their properties.
- 2) Apply Newtonian physics to the calculation of orbital motion
- 3) Calculate the energy balance and temperature on surfaces throughout the solar system and their relationship to the solar energy distribution.
- 4) Explain the greenhouse effect, how it modifies atmospheric temperatures throughout the solar system, and perform simple calculations of greenhouse warming.
- 5) Describe the interior structures of the terrestrial planets.
- 6) Explain the generation of planetary magnetic fields and how these protect planets from harmful radiation.

Makeup Policy for Students Who Register Late

Students who register after the first class meeting may complete the first assignment but it will still be due at the specified time and date. It is not recommended to register if more than one assignment has been missed.

Course Communications

Students should monitor D2L for class information including lectures and homework assignments. Other communications will be through email. The class course number (PTYS407) should be included in the subject line of all emails.

Required Texts or Readings

There is no required text for this class. References will be provided throughout the course.

Assignments and Examinations: Schedule/Due Dates

The course will include roughly 10 homework assignments and with one mid-term exam and one final exam.

Final Examination or Project

The date and time of the final exam or project, along with links to the Final Exam Regulations, <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information> , and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

Grading Scale and Policies

Specify the grade distribution for the course. University policy regarding grades and grading systems is available at <http://catalog.arizona.edu/policy/grades-and-grading-system>

Grades will be based on homework and exams with equal weighting (50% each). The exams are weighted equally so each is worth 25%.

If the course is a 400/500:

Include a grading scale (as per above) that is specific to graduate students. Also include a description of how the experiences of undergraduate and graduate students will be differentiated in addition to information on how this requirement/experience figures in the grading scheme.

Incomplete (I) or Withdrawal (W):

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.

Dispute of Grade Policy

Disputation a grade on homework or exams must be made within 2 days of the return of the homework or exam to the student.

Scheduled Topics/Activities **required**

List topics in logical units in a weekly/daily schedule, including assignment due dates and exam dates.

Week 1: Aug 25	Course Introduction & Overview
Week 2: Sep 1	Formation of the Elements
Week 3: Sep 8	Chemical Equilibrium Principles
Week 4: Sep 15	Condensation, Sublimation, Evaporation
Week 5: Sep 22	Jovian Planet Chemistry
Week 6: Sep 29	Exam 1 Administered & Reviewed

Week 7: Oct 6	Formation of Minerals, Theory
Week 8: Oct 13	Formation of Minerals, Theory
Week 9: Oct 20	Geochemistry of Terrestrial Planets
Week 10: Oct 27	Geochemistry of Terrestrial Planets
Week 11: Nov 3	Chemistry and Climate Change on Earth
Week 12: Nov 10	Photochemistry
Week 13: Nov 17	Photochemistry
Week 14: Nov 24	Astrobiology and Prebiotic Chemistry
Week 15: Dec 1	Astrobiology and Prebiotic Chemistry
Week 16: Dec 8	Exam 2 administered

Bibliography

Cosmochemistry, 2nd Edition, McSween & Huss
 Physics and Chemistry of the Solar System, Lewis
 Geochemistry: Pathways and Processes, 2nd Edition, McSween, Richardson, Uhle

Classroom Behavior Policy

Recommended language:

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.).

Additional recommendations depending on instructor preferences:

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Campus Health

<http://www.health.arizona.edu/>

Campus Health provides quality medical and mental health care services through virtual and in-person care.

Phone: 520-621-9202

Counseling and Psych Services (CAPS)

<https://health.arizona.edu/counseling-psych-services>

CAPS provides mental health care, including short-term counseling services.

Phone: 520-621-3334

The Dean of Students Office's Student Assistance Program

<http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Student Assistance helps students manage crises, life traumas, and other barriers that impede success. The staff addresses the needs of students who experience issues related to social adjustment, academic challenges, psychological health, physical health, victimization, and relationship issues, through a variety of interventions, referrals, and follow up services.

Email: DOS-deanofstudents@email.arizona.edu

Phone: 520-621-7057

Survivor Advocacy Program

<https://survivoradvocacy.arizona.edu/>

The Survivor Advocacy Program provides confidential support and advocacy services to student survivors of sexual and gender-based violence. The Program can also advise students about relevant non-UA resources available within the local community for support.

Email: survivoradvocacy@email.arizona.edu

Phone: 520-621-5767

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

University-wide Policies link

Links to the following UA policies are provided here, <https://academicaffairs.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