

**University of Arkansas
Department of Geosciences**

**GEOS 4063 / 5273 – Principles of Geochemistry
Fall 2021 Tentative Syllabus
Gearhart Hall 0017 MoWe 3:05 pm – 4:20 pm**

Professor: Dr. Adriana Potra
Office: Gearhart Hall 22
Office hours: Tu/Th 3:00 pm – 5:00 pm
E-mail: potra@uark.edu
Required textbooks: I. Geochemistry by White
II. Geochemistry – Pathways and Processes (2nd edition) by McSween, Richardson,
and Uhle (2003)
Optional textbooks: Mineral Equilibria by Garrels (1960)
Thermodynamics for Geologists by Kern and Weisbrod (1967)

Welcome to Principles of Geochemistry! The objectives of this course are to introduce you to:

- The formation of the solar system, the Earth, and the Elements
- Composition of the Earth
- The behavior of trace elements in magmatic systems
- Radiogenic and stable isotope geochemistry
- The basic principles and techniques of modern geochemistry, including thermodynamics and kinetics
- Understanding processes in aqueous systems

EVALUATION:

1) Exams: There are three exams, with dates marked in the syllabus. The format for the exams will be a mix of multiple choice, fill in the blank, short answer, and problem solving.

2) Homework assignments: They emphasize the application of principles learned in class to geologic processes.

3) Term paper: Details about the term paper will be available by September 13th.

Exams	3X 20%	=	60% of grade
Homework assignments		=	20% of grade
Term paper		=	20% of grade

A = 10-9, B = 8.9-7.9, C = 7.8-6.5, D = 6.4-5.5, F = fewer than 5.5 points.

Lecture Outline and Reading Assignments

<u>Class date</u>	<u>Lecture topic/exams</u>	<u>Assigned reading</u>
Aug 23 – Aug 25	<i>Geochemical aspects of systems of planetary scale</i> Why Cosmochemistry? Origin and abundance of the elements Meteorites: Essential Clues to the Beginning Cosmochemical behavior of elements Condensation of the elements	10 (I); 15 (II)

Aug 30 – Sept 1	<i>Controls on elemental behavior in the Earth</i> Elements, atoms, and the structure of matter Bonding	1 (I); 2 (II)
Sept 6	Labor Day holiday	
Sept 8 – Sept 13	<i>Trace Elements in Igneous Processes</i> The geochemical periodic table Distribution of trace elements between co-existing phases Factors governing the value of partition coefficients Trace element distribution during melting and crystallization	7 (I); 12 (II)
Sept 15 – Sept 20	<i>Radioactive isotopes</i> Principles of radioactivity Geochronology Geologic applications	8 (I); 14 (II)
Sept 22	<i>Stable isotopes</i> Basic principles Mass fractionation and bond strength Geologic applications	9 (I); 13 (II)
Sept 27	Exam one	
Sept 29	<i>The solid Earth as a geochemical system</i> Composition of the mantle and core Composition of the crust	11 (I); 12 (II) 12 (I); 12 (II)
Oct 4	<i>The oceans and atmosphere as a geochemical system</i> Composition of the Oceans Composition of the Atmosphere Carbonate and the great marine balancing act Global mass balance and steady state in the Oceans	15 (I); 8 (II)
Oct 6	<i>Fundamental thermodynamic concepts I</i> Thermodynamic systems and equilibrium Temperature and the zeroth law of thermodynamics	2 (I); 3 (II)
Oct 11 – Oct 13	Geological Society of America Annual Meeting No class this week	
Oct 18 – Oct 20	<i>Fundamental thermodynamic concepts II</i> Energy and First law of thermodynamics The second law and entropy	2 (I); 3 (II)
Oct 25 – 26	Fall Break	
Oct 27	<i>Fundamental thermodynamic concepts III</i> Enthalpy Heat capacity The third law and absolute entropy Free energy The Maxwell relations	2 (I); 3 (II)

Nov 1	Exam two (not cumulative)	
Nov 3 – Nov 8	<i>Solutions and thermodynamics of multicomponent systems I</i> Phase equilibria Solutions Chemical potential Ideal and real solutions	3 (I); 4 (II); 9 (II)
Nov 10 – Nov 15	<i>Solutions and thermodynamics of multicomponent systems II</i> Electrolyte solutions Equilibrium constants Oxidation-Reduction Processes Redox in aqueous solutions	3 (I); 4 (II); 9 (II) 3 (I); 7 (II)
Nov 17 – Nov 22	<i>Applications of thermodynamics</i> Thermodynamics and phase diagrams Problem solving	4 (I); 10 (II)
Nov 24	Thanksgiving Break	
Nov 25 – 26	Thanksgiving Holiday	
Nov 29 – Dec 1	<i>Aquatic Chemistry</i> Acid-base reactions Complexation Dissolution and precipitation reactions	6 (I); 7 (II)
Dec 6 – Dec 8	Term paper presentations	
TBA	Final Exam (not cumulative)	

POLICIES

COVID-19 PROTOCOLS: In the light of the recent surge of COVID-19 cases, the University of Arkansas has established guidelines to achieve safe and effective learning this Fall 2021. Health and safety are our #1 priority, followed by facilitating effective learning. While not mandatory, vaccination is our primary means for preventing the spread of COVID-19 and the development of variants.

Masks:

- Masks must be worn at all times
- Face shields are not substitutes for masks
- Student non-compliance with mask rules:
 - Encourage student to comply
 - Report student to Office of Dean of Students <https://report.uark.edu>

Attendance:

- Students expected to attend all classes in-person
- Students may request excused absence (details below) via email. Instructor chooses to approve / deny
- Students may seek CEA accommodation(s)
- Outside an official CEA accommodation, students may not (self) choose to “go remote”
- Students tested positive for COVID-19 should report to:
 - <https://health.uark.edu/coronavirus/self-reporting.php>

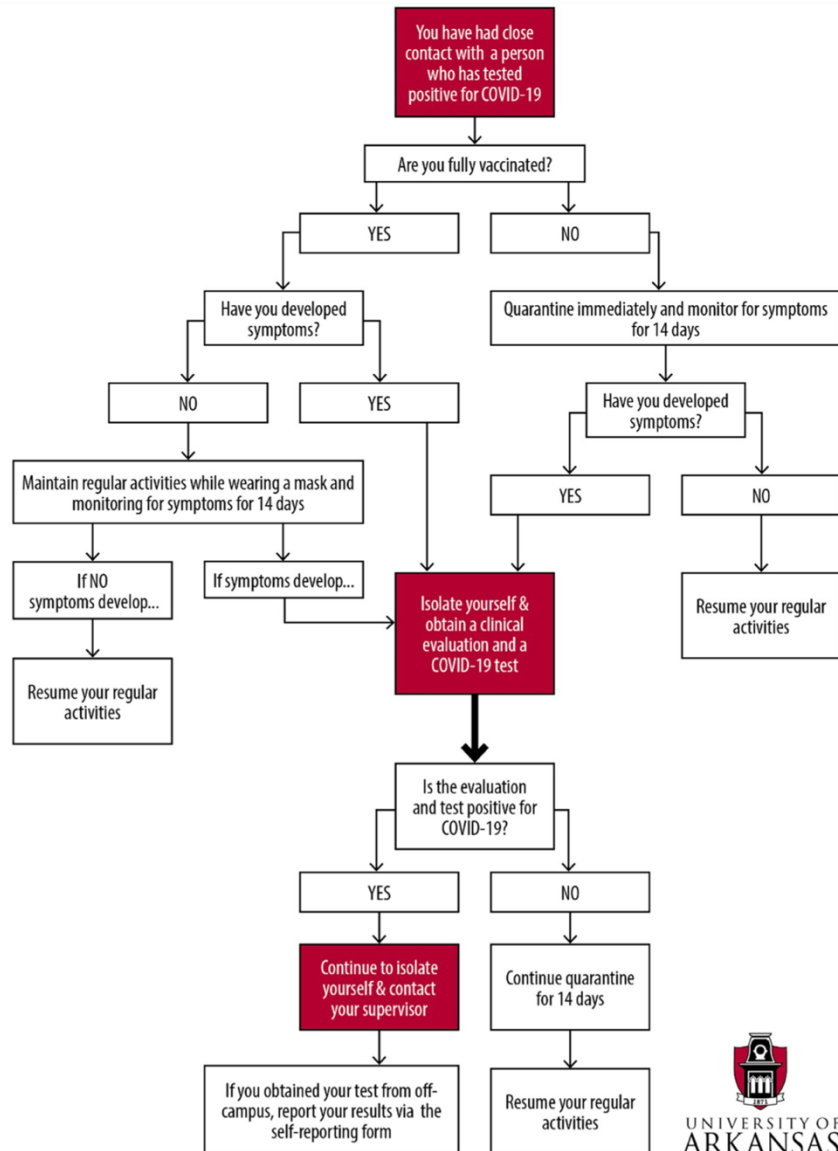
Isolation and Quarantine:

- For students required to isolate or quarantine:
 - Instructor provides class materials on Blackboard as PowerPoint presentations
 - Instructor encourages student to contact peers for notes / other class-related info
 - Student provides evidence of completing appropriate isolation / quarantine period
 - To obtain a release from quarantine / isolation letter
 - Contact ADH or medical provider who conducted your test
 - Call ADH COVID-19 Hotline at 1-800-803-7847

Recording and Streaming:

- Instructor provides all class materials presented during class on Blackboard as PowerPoint presentations
- Instructors are not required to record and/or live-stream lectures
 - CEA accommodations may require recording
 - Instructors will share recording to students with CEA accommodations

For more information: <https://health.uark.edu/coronavirus/index.php>



STUDENT SUPPORT: U of A Cares offers a supportive and encouraging partnership with students by linking them with appropriate resources that will allow them the opportunities to overcome barriers on their path to success; both personal and educational at uofacares.uark.edu

EXCUSED UNIVERSITY ABSENCES are: (1) illness of the student, (2) serious illness or death of a member of the student's immediate family or other family crisis, (3) University-sponsored activities for which the student's attendance is required by virtue of scholarship or leadership/participation responsibilities, (4) religious observances, (5) jury duty or subpoena for court appearance, and (6) military duty. The instructor has the right to require that the student provide appropriate documentation for any absence for which the student wishes to be excused.

INCLEMENT WEATHER: If the University is open, class will be in-session. Call the Weather Hotline when in doubt at (479) 575-7000. I will follow-up with a class-wide email notifying you of the situation. The University's inclement weather policy is available at emergency.uark.edu

ACADEMIC HONESTY STATEMENT: "As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail. Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' which is found at <https://honesty.uark.edu/policy/index.php> Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor." **No cheating or plagiarism will be tolerated.**

SEXUAL ASSAULT AND DOMESTIC/DATING VIOLENCE: If you are in danger, dial 9-1-1. For confidential help, call the University Victim Advocate at (479) 575-7252. The University of Arkansas prohibits sexual harassment or acts of sexual assault, domestic violence, dating violence and stalking committed against students, employees, campus visitors, and other persons who use University facilities. Sexual assault is any form of sexual activity where consent is not consciously and voluntarily given. Anyone can be a victim of sexual assault. Sexual harassment is prohibited by University policy and is a form of sex discrimination prohibited by Title VII of the Civil Rights Act of 1964 and by Title IX of the Education Amendments of 1972. Sexual assault is a crime, as defined by the Arkansas criminal code. Important sexual assault information and guidance is available at: <https://report.uark.edu/sexual-assault-or-domestic-dating-violence/index.php> and respect.uark.edu. File a formal report at report.uark.edu

TECHNOLOGY POLICY: The use of cell phones, smart phones, tablets, laptops, etc., for purposes other than note taking or learning geology is not allowed during class. You are in class to learn, not socialize with your media! **Flagrant violation of this policy will result in you being dismissed from class for the day!**

STUDENTS WITH DISABILITIES: It is the student's responsibility to request accommodations each term from the Center for Educational Access (ada@uark.edu or 479-575-3104). Please provide me with the proper paperwork at the beginning of the semester and I will help coordinate accommodations for examinations and class materials.

EMERGENCY PROCEDURES: Many types of emergencies can occur on campus. Instructions for specific emergencies such as severe weather, an active shooter, or fire can be found on the web at emergency.uark.edu

SEVERE WEATHER (e.g., Tornado Warning):

- Follow the directions of the instructor or emergency personnel.
- Seek shelter in the basement or an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside.
- In a multi-story building, if you cannot get to the lowest floor, go to a hallway in the center of the building.
- Stay in the center of the room, away from exterior walls, windows, and doors.

VIOLENCE or ACTIVE SHOOTER (C.A.D.D.):

- **CALL.** 9-1-1
- **AVOID.** If possible, evacuate to a safe area outside the building. Follow directions of police officers.
- **DENY.** Barricade the door with desks, chairs, bookcases, or any items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it is safe.

- **DEFEND.** Use desks, chairs, cell phones, or whatever is immediately available to distract and/or defend yourself and others from attack.

CONCEALED CARRY ON CAMPUS: Handguns are only allowed on campus (including all classrooms) to the extent specifically authorized by state law. Everyone who lawfully possesses a handgun and an enhanced carry permit is always required to keep the handgun concealed from public view and is responsible for carrying the handgun in a safe manner. If an individual carries a concealed handgun in a personal carrier such as a backpack, purse, or handbag, the carrier must remain within the individual's immediate vicinity (within arm's reach). During this class, you may be required to engage in activities that require you to be physically separate from your belongings and you should plan accordingly. Any student who violates the concealed carry laws while on campus may be subject to criminal prosecution and/or discipline by the University, up to and including dismissal. If you observe someone displaying a handgun or other weapon on campus, it should be reported to the University of Arkansas Police Department (uapd.uark.edu). For more information: safety.uark.edu.