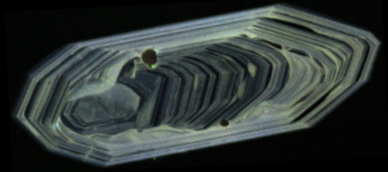


MINERALOGY

GEOS 280

Fall 2024



LECTURE: MWF (10:20 – 11:20am) **LAB:** Tues (A: 9:40-11:30pm) (B: 1:40-3:30pm) **Room:** JSC 226

Instructor: Dr. Ken Brown **Email:** kennethbrown@depauw.edu **Phone:** 765.658.6767

Office: Julian 213 **Office Hours:** MWF (11:30–12:30am) or by appointment

Textbook: **Introduction to Mineralogy;** *William D. Neese, 3rd ed.* **ISBN-10:** 0199827389

(optional) Introduction to Optical Mineralogy; *William D. Neese, 4th ed.* **ISBN-10:** 0199846278

COURSE DESCRIPTION:

Minerals and mineral resources are essential to modern society, impacting our way of life, our health, and the global economy. This course is an introduction to the scientific study of minerals and their physical, chemical, and optical properties. Throughout the course, we will also explore the ways in which minerals are relevant and important to everyday human activities and our health. This course emphasizes hands-on learning experiences. Students will explore three areas: 1) Crystallography & Chemistry; 2) Optical Mineralogy; and 3) Analytical & Systematic Mineralogy (see Syllabus Calendar, pgs. 5 & 6).

***PRIMARY COURSE OBJECTIVES:** At the end of this course, students will be able to:

1. Classify minerals based on their physical, chemical, and optical properties
2. Characterize and identify approximately 60 common rock-forming minerals (hand samples)
3. Characterize and identify common rock-forming minerals using a microscope
4. Discuss and use analytical methods commonly employed in the field of mineralogy & petrology
5. Evaluate and articulate the importance and impact of minerals on modern society (resources, uses, extraction/mining, health issues, etc).

**Course objectives are linked to specific student outcomes and performance indicators outlined in the Geoscience Assessment Plan.*

BASIC STUDENT RESPONSIBILITIES: It is your responsibility/expectation to....

- Enjoy the learning process and remain open-minded
- Read, understand, and abide by all of the policies established in this syllabus and the Student Handbook
- Know when all important assessments and exercises are due
- Complete assessment and assigned exercises by the *due dates/ deadlines*
- Attend class, participate in activities, and engage with materials inside & outside of the class
- Check your email daily for updates and relevant course announcements.
- Attend office hours and ask questions when you don't understand content or directions.

LAB FEE: You will be performing destructive tests on mineral specimens as well as using expensive analytical instruments in this course. That said, a small lab fee (\$25) will be charged to help offset costs associated with replacing minerals and lab consumables.

Letter Grade	Percent Range
A	100.00 - 93.00
A-	92.99 - 90.00
B+	89.99 - 87.00
B	86.99 - 84.00
B-	83.99 - 81.00
C+	80.99 - 78.00
C	77.99 - 75.00
C-	74.99 - 72.00
D+	71.99 - 69.00
D	68.99 - 66.00
D-	65.99 - 63.00
F	<62.99

GRADING

Lecture Component[†]

Exam 1	100 pts	(17%)
Exam 2	100 pts	(17%)
Exam 3	100 pts	(17%)

Lab Component

Lab Exercises	8 @ 25pts = 200pts (33%)	
Lab Practical #1	50 pts	(8%)
Lab Practical #2	50 pts	(8%)

Total points: 600 pts**

[†]Students will be given practice problems. Students are expected to attempt the practice problems as they are discussed in class and to ask questions about these problems. *Random Mineral ID Quizzes may occur at the start of any Lab Session. **It is the student's responsibility to regularly check with the instructor about their progress (grade).

STUDENT FEEDBACK: Timely and adequate feedback is essential to student learning. Thus, I will provide feedback on your submitted work, offering constructive comments and ways to improve.

ATTENDANCE: Regular attendance is required and is important to your success in this course. That said, students are expected to attend class sessions, and while in class, refrain from any activity that could interfere with the learning experience of others. During lecture, I will present material that is not in the textbook, but will be covered on Quizzes/Exams/Exercises. *If you miss /skip class, you will be held responsible for all of the content (and announcements) that you missed during your absence. Please email and/or visit my office hours if you have to miss class.*

EXAMS: Exams assess your understanding of lecture concepts and vocabulary. Although exams are not comprehensive, the concepts found in one section/chapter may require you to have a working knowledge of previous concepts and vocabulary from earlier sections/chapters. *If it is covered in the lecture (lecture slides/reading assignments/discussions), you are responsible for knowing it.* Make-up exams require instructor approval and are taken during office hours (by appointment).

LAB EXERCISES: Each week, we will work on a lab exercise that will explore the various areas of mineralogy (crystallography, mineral ID, optical mineralogy, analytical lab techniques, etc). These hands-on activities allow you to demonstrate your understanding of lecture/lab concepts and to help you gain appreciation for the field of mineralogy. Labs are due at the start of the next lab session. *Late submissions will be penalized 10% for each day submitted late. Lab exercises require effort outside of class time to complete* (e.g., looking at minerals, completing exercises, studying, etc.).

To help you become familiar with common rock-forming minerals, you will also make observations and identify ~60 mineral specimens in lab (during the semester). Each week, you will be given 5-6 new minerals to examine that will accompany your lab exercise. Examining these mineral and making observations is critical to this course and its objectives (page #1). You are strongly encouraged to make a set of mineral ID flashcards or keep a lab notebook to help you track your investigation of these minerals. Please note that you will be required to identify these minerals and their chemical formulas during lab practicals. Lab exercises are linked to course objectives #1 - #4.

LAB PRACTICALS: You will have two lab exams that will evaluate your understanding of lab topics and your ability to identify mineral specimens. Lab practical #1 will cover minerals 1-30; practical #2 will cover all mineral specimens (1-60 Make-up exams require approval and are taken during office hours (by appointment). These lab exams are linked to course objectives #1- #3.

ADDITIONAL COURSE POLICIES AND INFORMATION:

EMAIL: If you cannot meet during office hours, please email your instructor. *Emails sent after 5pm may not receive a response until the next business day. Emails sent over the weekend may not receive a response until the following weekday (Monday). Please respect this policy and plan accordingly.*

COPYRIGHT POLICY

All materials provided to you in this course are copyrighted. None of the course materials may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without prior written permission from the instructor.

INCLUSIVITY STATEMENT:

“A university is a place where the universality of the human experience manifests itself” – Albert Einstein. In keeping with Einstein’s viewpoint, the Geosciences program at DePauw is committed to providing an inclusive environment of learning and living that is open to all people and perspectives. It is the policy and practice of this course and its instructor to create a welcoming environment for all students as well as to address students in accordance with their personal identity. In this course, you will be encouraged to remain open to information, ideas, and experiences shared by others. For more information about diversity and inclusion at DePauw, please use the following link: <https://www.depauw.edu/studentacademiclife/cdi/>

INCLUSIVITY IN THE GEOSCIENCES:

Geoscientists address increasingly challenging problems that confront a growing human population: climate change, dwindling natural resources, earthquake prediction and natural hazard identification, human-environmental impact, and safe disposal of toxic and radioactive waste materials. Because the Earth is our only home, the geosciences promote stewardship of the environment and Earth’s finite natural resources, therein creating a deeper sense of social and civic responsibility that transcends all races, cultures, ages, and identities. As such, there are many professional societies and organizations that support the intersectionality of students within the geosciences (e.g., GeoLatinas, National Association of Black Geoscientists, Association of Women Geoscientists, 500 Queer Scientists; Geoscience Alliance; etc.). Please let me know if you are interested in joining one of these communities. I would be happy to connect you.

ADA ACCOMODATIONS:

It is the policy and practice of DePauw University to strive to support the student experience and to provide reasonable accommodations for students with properly documented disabilities. If you are eligible to receive an accommodation and would like to request it for this course, please contact student disability services. Allow one week advance notice to ensure enough time for reasonable accommodations to be made. Accommodations are not retroactive. Students who have questions about student disability services or who have, or think they may have, a disability (psychiatric, attentional, learning, vision, hearing, physical, medical, etc.) are invited to contact student disability services for a confidential discussion in union building suite 200 or by phone at 765-658-6267 (studentaccessibility@depauw.edu).

ACADEMIC INTERGRITY STATEMENT

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. Cheating, plagiarism, submission of the work of others, etc. violates DePauw’s policy on academic integrity. Lapses of academic integrity will be dealt with according to the policies set forth in the student handbook. If you are not sure what constitutes dishonest academic activities, please make sure you discuss any questions you may have with me. The policy is also available at: <http://www.depauw.edu/handbooks/academic/#Toc459018101>

As the instructor, I agree:	Your basic responsibilities as the student:
1. To begin and end class at its scheduled time. 2. To respectfully answer questions about the subject matter (i.e. to respect all questions and students). 3. To accept questions before/after the class period and to respond to these accordingly. 4. To promptly notify students of course changes. 5. To be approachable and respectful to students. 6. To provide timely and adequate feedback. 7. To meet with students that schedule office appointments. 8. To teach you fundamental geologic concepts and vocabulary relevant to a career in the Geosciences. 9. To have fun while teaching this course!	1. Remain open-minded about course content 2. Attend regular class meetings and be prepared for class/lab activities 3. Refrain from any disruptive behavior (talking, texting, phone calls, laptop use). 4. Email/visit your instructor if have questions. 5. Abide by all policies outlined in the syllabus. 6. Respect the opinions, ideas, and experiences shared by other students. 7. Complete all assignments and assessments by their respective due dates/ times. 8. Check email daily for class announcements. 9. Enjoy how cool science can be!

Teaching and Office Hours Schedule – Subject to Change*

Dr. Ken Brown					
Dept. of Geology & Env. Geoscience; Fall 2024 Teaching/ Office Hour Schedule					
	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00 AM					
9:10 AM 9:20 AM 9:30 AM 9:40 AM 9:50 AM		GEOS 280 LECTURE 9:40- 11:30 AM			
10:00 AM					
10:10 AM 10:20 AM 10:30 AM 10:40 AM 10:50 AM	GEOL 280 LECTURE 10:20 - 11:20 AM	GEOS 280 LECTURE 9:40- 11:30 AM	GEOL 280 LECTURE 10:20 - 11:20 AM		GEOL 280 LECTURE 10:20 - 11:20 AM
11:00 AM	OFFICE HOURS 11:30 - 12:30 PM (or by appointment)		OFFICE HOURS 11:30 - 12:30 PM (or by appointment)		OFFICE HOURS 11:30 - 12:30 PM (or by appointment)
11:10 AM 11:20 AM 11:30 AM 11:40 AM 11:50 AM					
12:00 PM	GEOS 125 LECTURE 12:30- 1:30 PM		GEOS 125 LECTURE 12:30- 1:30 PM		GEOS 125 LECTURE 12:30- 1:30 PM
12:10 PM 12:20 PM 12:30 PM 12:40 PM 12:50 PM					
1:00 PM		GEOS 280 LECTURE 1:40- 3:30 PM			
1:10 PM 1:20 PM 1:30 PM 1:40 PM 1:50 PM					
2:00 PM					
2:10 PM 2:20 PM 2:30 PM 2:40 PM 2:50 PM					
3:00 PM					
3:10 PM 3:20 PM 3:30 PM 3:40 PM 3:50 PM					
4:00 PM					

Lecture Schedule (subject to change)

MONTH	WEEK	DAY	TOPIC	Reading /Event				
AUGUST	Week 1	21-Aug	-	-				
		23-Aug	-	-				
	Week 2	26-Aug	Syllabus & Course Introduction		-			
28-Aug		Crystallography: Lattices & Crystal Systems		Nesse: pgs 14-19; Paper Models				
30-Aug		Crystallography: Symmetry Elements (Part I)		Nesse: pgs. 21-24; Paper Models				
SEPTEMBER	Week 3	2-Sep	Labor Day - No Class		-	CRYSTALLOGRAPHY & CHEMISTRY		
		4-Sep	Crystallography: Symmetry Elements (Part I) Continued		Nesse: pgs 21-24			
	6-Sep	Crystallography: Symmetry Elements (Part II)		Nesse: pgs. 24-29				
	Week 4	9-Sep	Crystallography: Indexing - Coordinate Systems		Nesse: pgs. 29-34			
		11-Sep	Crystallography: Indexing - Miller Indices		Nesse: pgs.29-34			
		13-Sep	Crystal Chemistry: Atoms, Ions, & Bonding		Nesse: pgs. 52-67			
	Week 5	16-Sep	Crystal Chemistry: Pauling's Rules (Part I)		Nesse: pgs. 52-67			
		18-Sep	Crystal Chemistry: Pauling's Rules (Part I) Continued)		Nesse: pgs. 73-83			
		20-Sep	Crystal Chemistry: Structures (Part II)		Nesse: pgs.83-86			
	Week 6	23-Sep	No Class- GSA MEETING					
		25-Sep						
27-Sep								
OCTOBER	Week 7	30-Sep	Crystal Chemistry: Structures (Part II) Continued		Nesse: pgs.83-86	OPTICAL MINERALOGY		
		2-Oct	Crystal Chemistry: Solid Solution		Nesse: pgs. 86-91			
		4-Oct	EXAM #1					
	Week 8	7-Oct	Optics: Common Optical Properties (PPL)		Nesse: 155-157			
		9-Oct	Optics: Common Optical Properties (XPL)		-			
		11-Oct	Optics: Intro to the Indicatrix		Nesse: pgs. 151-154			
	Week 9	14-Oct	FALL BREAK - NO CLASS					
		16-Oct						
		18-Oct						
	Week 10	21-Oct	Optics: Isotropic and Uniaxial Indicatrix		Nesse: pgs 157-170			
		23-Oct	Optics: Isotropic & Uniaxial Minerals		Nesse: pgs. 157-170			
25-Oct		Optics: Uniaxial Interference Figures & Optic Sign		Nesse: pgs. 175-180				
Week 11	28-Oct	Optics: Biaxial Indicatrix		Nesse: pgs 170-175				
	30-Oct	Optics: Biaxial Interference Figures & Optics Signs		Nesse: pgs. 180-189				
	1-Nov	Optics: Biaxial Interference Figures & Optics Signs (cont.)		Nesse: pgs. 180-189				
NOVEMBER	Week 12	4-Nov	Optics: Biaxial 2V angle		Nesse: pgs. 180-189	ANALYTICAL MINERALOGY & SILICATES		
		6-Nov	Finish Up & Review Session					
		8-Nov	EXAM #2					
	Week 13	11-Nov	Chemical Analyses: Electron Probe Micro-Analyses (EPMA)		Nesse: pgs. 214-227			
		13-Nov	Chemical Analyses: Mineral Formula Recalculations		Nesse: pgs. 200-203			
		15-Nov	Chemical Analyses: X-Ray Fluorescence		Nesse: pgs. 190-198			
	Week 14	18-Nov	Structural Analysis: X-Ray Diffraction (XRD)		Nesse: pgs. 190-198			
		20-Nov	Structural Analysis: X-Ray Diffraction (XRD)		Nesse: pgs. 190-198			
		22-Nov	Silicate Minerals: Intro to Silicates & Orthosilicates		Nesse: pgs. 350-370;			
	Week 15	25-Nov	Silicate Minerals: Sorosilicates & Cyclosilicates		Nesse: pgs. 335-343; 343-349			
		27-Nov	THANKSGIVING BREAK - NO CLASS					
29-Nov								
DEC.	Week 16	2-Dec	Silicate Minerals: Inosilicates & Phyllosilicates		Nesse: pgs. 306-334	ANALYTICAL MINERALOGY & SILICATES		
		4-Dec	Silicate Minerals: Tectosilicates		Nesse: pgs. 277-305			
		6-Dec	Finish Up & Review Session					
	Week 17	11-Dec	EXAM #3 (8:30 - 11:30am)					

LAB CALENDAR (subject to change)

MONTH	WEEK	DAY	TOPIC	LAB ASSIGNMENT	
AUG.	Week 2	27-Aug	Exploring Mineral Properties	Lab #1 & Minerals 1-5	STRUCTURE & CHEMISTRY
SEPTEMBER	Week 3	3-Sep	Exploring Mineral Properties	Lab #1(cont.) & Minerals 6-11	
	Week 4	10-Sep	Crystallographic Mineral Blocks #1	Lab #2 & Minerals 12-17	
	Week 5	17-Sep	Crystallographic Mineral Blocks #2	Lab #3 & Minerals 18-23	
	Week 6	24-Sep	NO CLASS - GSA MEETING		
	Week 7	1-Oct	Intro to Petrographic Microscopes	Lab #4 & Minerals 24-29	
OCTOBER	Week 8	8-Oct	Lab Practical #1 (Includes Minerals 1- 29)		OPTICAL MINERALOGY
	Week 9	15-Oct	FALL BREAK - NO CLASS		
	Week 10	22-Oct	Optical Properties of Minerals	Lab #5 & Minerals 30-35	
	Week 11	29-Oct	Uniaxial Minerals	Lab #6 & Minerals 36-41	
	Week 12	5-Nov	NO CLASS - ELECTION DAY		
NOVEMBER	Week 13	12-Nov	Biaxial Minerals	Lab #7 & Minerals 42-47	ANALYTICAL MINERALOGY
	Week 14	19-Nov	XRD Analysis of Minerals	Lab #8 & Minerals 48-53	
	Week 15	26-Nov	Lab Practical Review	Minerals 54-60	
	DEC.	Week 16	3-Dec	Lab Practical #2 (Includes All Minerals)	

SUCCESS IN THIS COURSE:

This course employs a variety of teaching approaches to maximize student learning. Specifically, my teaching approach blends traditional lectures, interactive demonstrations, qualitative and quantitative exercises, reflective observations/discussions, and guided interactive labs. Modern analytical techniques (e.g., XRD, EPMA, XRD) are also emphasized in this course, as these are fundamental tools used by professional geoscientists in the fields of mineralogy, petrology, environmental geology, and material science to solve real-world problems. To help you get the most out of this course and maximize your learning, I recommend that you consider the following tips for success:

- **TIP #1 - Attending Class and Taking Good Notes:** Regular attendance coupled with good note taking will serve you well in this course. To facilitate note taking, I have posted all of my lecture slides in Moodle for your convenience. I recommend coming to class prepared with these lecture slides printed out. This gives you an opportunity to annotate and supplement the lecture content presented during class with your own notes, ideas, and questions. At the start of many class lectures, I will often distribute an additional lecture handout. These handouts are designed to guide your notes and emphasize key content for your consideration. They also contain practice problems for you to complete on your own.
- **TIP #2 - Ask Questions:** Asking questions and seeking answers is fundamental to the scientific process. So, please don't hesitate to ask questions if you don't understand something or need clarification on instructions. The only "bad" question is one that is not asked. You can ask questions before/after class, during office hours, or via email.
- **TIP #3 – Study/Review Regularly:** As a life-long learner, you already know that your education doesn't end once you leave the classroom. So, be proactive about your learning inside and outside of the classroom space. That said, review the content regularly. Use this opportunity to interact with others. Waiting until the week of an exam (or night before) to cram is a serious mistake. This practice is not helping your ability to retain the content long-term and will only serve to hinder your learning in the future.
- **TIP #4 - Don't Procrastinate:** We are all guilty of this to varying degrees. However, waiting to work on something or putting it off entirely will often make it more challenging to complete in the future. Procrastination will only increase your anxiety and stress. Remember that a "lack of planning on your part does not constitute an emergency on [someone else's] part". So, prioritize your learning and continually make efforts to move forward.
- **TIP #5 – Learning Take Time:** Learning something new can be challenging and may require effort and time to get it right. So, keep putting forth an effort and seek help when you have questions. Science is like learning a new language – it takes time to learn how to speak it and use it correctly. But with practice, it gets easier!