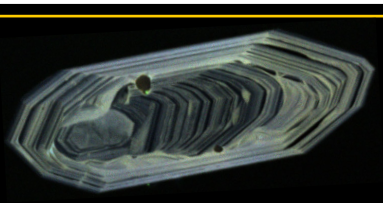
MINERALOGY
GEOS 280
Fall 2021



LECTURE: MWF (9:10 – 10:10) **LAB:** Tues (12:40 – 3:30pm) **Room:** JSC 226

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

Office: Julian 213 **Office Hours**: MWF (10:30–11:30am) 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 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.

***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).

**These 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 DePauw 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 announcements.
- Attend office hours and ask questions when you don't understand content or directions.

Q-CERTIFICATION:

Students must successfully satisfy *both* of the following criteria to receive Q-certification:

1. Earn an average of 75% (or better) on the Lab Exams & Lab Assignments.
2. Earn a final course grade of 70% or better

Practice problems will be given, but answers will not be posted. Students are expected to attempt the problems as they are discussed in class and ask questions/check their answers during office hours.

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.

GRADING*

Lecture Component

Exam 1	100 pts	(15%)
Exam 2	100 pts	(15%)
Exam 3	100 pts	(15%)

Lab Component

Lab Exercises	8 @ 25pts = 200 pts (31%)	
Mineral ID Quizzes**	50 pts	(8%)
Lab Practical #1	50 pts	(8%)
Lab Practical #2	50 pts	(8%)
Total points:	**650 pts***	

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

** It is your responsibility to regularly check with your instructor about your progress in the course*
*** Random Mineral ID Quizzes may occur at the start of any Lab Session*

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 in-person 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 in 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 your instructor 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 (or by appointment).

LAB EXERCICES: 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 25% for each day submitted late*. *Lab exercises require effort outside of class time to complete* (e.g., looking at minerals, completing exercises, studying, etc.). Lab exercises are linked to course objectives #1 - #4.

MINERAL ID QUIZZES: To help you become familiar with common rock-forming minerals, you will make observations and identify 60 mineral specimens in lab. Each week, you will be given 5 new minerals to examine. Examining these mineral and making observations is critical to this course and its objectives (see page #1). That said, you will have random mineral ID quizzes that will evaluate your ability to identify these mineral specimens (and their chemical formulas). You are strongly encouraged to make a set of mineral ID flashcards to prepare for these quizzes. These quizzes are linked to course objectives #1- #3.

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). No make-up exams will be given without proper approval by the instructor. Approved make-up exams are taken during office hours (or 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 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.

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 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 other students. For more information about diversity and inclusion at DePauw, please use the following link: https://www.depauw.edu/studentacademiclife/cdi/

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).

RESOURCES FOR STUDENTS OF COLOR IN STEM:

Students of Color in STEM (SoCiS) is a student organization aimed at supporting STEM students who identify as students of color and members of diverse underrepresented identities on campus. This organization provides these students with a network of students in or interested in a similar major that could be a support system for them academically (tutoring) and socially (mentoring). Please let me know if you would like more information about SoCiS. Join their e-mail list at: (SoCiS_list@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 our 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; Fall 2021 Teaching/ Office Hour Schedule

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
9:00 AM					
9:15 AM	GEOS 280 LECTURE 9:10-10:10		GEOS 280 LECTURE 9:10-10:10		GEOS 280 LECTURE 9:10-10:10
9:30 AM					
9:45 AM					
10:00 AM					
10:15 AM					
10:30 AM	OFFICE HOURS 10:30 - 11:30 (or by appointment)		OFFICE HOURS 10:30 - 11:30 (or by appointment)		OFFICE HOURS 10:30 - 11:30 (or by appointment)
10:45 AM					
11:00 AM					
11:15 AM					
11:30 AM					
11:45 AM					
12:00 PM					
12:15 PM					
12:30 PM	GEOS 125A LECTURE 12:30 - 1:30		GEOS 125A LECTURE 12:30 - 1:30	RESEARCH & SERVICE	GEOS 125A LECTURE 12:30 - 1:30
12:45 PM					
1:00 PM					
1:15 PM		GEOS 280 LAB 12:40 - 3:30			
1:30 PM					
1:45 PM					
2:00 PM					
2:15 PM					
2:30 PM					
2:45 PM					
3:00 PM					
3:15 PM					
3:30 PM					
3:45 PM					
4:00 PM	DEPT MEETINGS				
4:15 PM					
4:30 PM					
4:45 PM					
5:00 PM					
5:15 PM					
5:30 PM					
5:45 PM					
6:00 PM					

LECTURE CALENDAR (subject to change)

MONTH	WEEK	DAY	TOPIC	Reading /Event	
AUGUST	Week 1	25-Aug	Course Intro	Syllabus	MINERAL STRUCTURE & CHEMISTRY
		27-Aug	Intro to Mineralogy	Nesse pgs. 3-10	
	Week 2	30-Aug	Physical Properties	Nesse: pgs 123-141	
		1-Sep	Crystallography: Lattices & Crystal Systems	Nesse: pgs. 12-18	
		3-Sep	Crystallography: Symmetry Elements (Part I)	Nesse: pgs 19-22	
SEPTEMBER	Week 3	6-Sep	-	-	
		8-Sep	Crystallography: Symmetry Elements (Part II)	Nesse: pgs. 22-26	
		10-Sep	Crystallography: Indexing (Part I)	Nesse pgs. 27-32	
	Week 4	13-Sep	Crystallography: Indexing (Part II)	Nesse: pgs. 32-33	
		15-Sep	Crystal Chemistry: Atoms and Ions	Nesse: pgs. 50-59	
		17-Sep	Crystal Chemistry: Bonding	Nesse: pgs. 59-66	
	Week 5	20-Sep	Crystal Chemistry: Structures (Part I)	Nesse: pgs. 66-80	
		22-Sep	Crystal Chemistry: Structures (Part II)	Nesse: pgs. 81-84	
		24-Sep	Crystal Chemistry: Solid Solution	Nesse: pgs. 85-89	
	Week 6	27-Sep	**REVIEW SESSION**		
		29-Sep	**EXAM #1**		
		1-Oct	**LAB PRACTICAL REVIEW**		
OCTOBER	Week 7	4-Oct	Petrogrpaphic Microscopes	-	OPTICAL MINERALOGY
		6-Oct	Common Optical Properties (PPL)	Nesse: pgs. 142 -158	
		8-Oct	Common Optical Properties (XPL)	-	
	Week 8	11-Oct	Optics: Intro to the Indicatrix	Nesse: pgs. 158 - 163	
		13-Oct	Optics: Isotropic and Uniaxial Indicatrix	Nesse: pgs 158-162	
		15-Oct	Optics: Isotropic & Unaxial Minerals	Nesse: pgs. 160-161	
	Week 9	18-Oct 20-Oct 22-Oct	**FALL BREAK - NO CLASS**		
	Week 10	25-Oct	Optics: Uniaxial Interference Figures & Optic Sign	Nesse: pgs. 168-172	
		27-Oct	Optics: Biaxial Indicatrix	Nesse: pgs 162-164	
		29-Oct	Optics: Biaxial Interference Figures & Optics Signs	Nesse: pgs. 172-180	
	Week 11	1-Nov	Optics: Biaxial 2V angles	Nesse: pgs. 178-180	
		3-Nov	**REVIEW SESSION**		
		5-Nov	**EXAM #2**		
NOVEMBER	Week 12	8-Nov	Mineral Analyses: Scanning Electron Microscopy (SEM)	Nesse: pgs. 203-205	ANALYTICAL & SYSTEMATIC MINERALOGY
		10-Nov	Mineral Analyses: Electron Probe Micro-Analyses (EPMA)	Nesse: pgs. 200-203	
		12-Nov	Mineral Analyses: X-ray Diffraction (XRD)	Nesse: pgs. 190-198	
	Week 13	15-Nov	Non-Silicates: Native Elements, Carbonates, Phosphates	Nesse: pgs. 434-441; 371-387; 393-398	
		17-Nov	Non-Silicates: Oxides, Hydroxides, Halides, Sulfides, Sulfates	Nesse: pgs. 402-444; 387-393	
		19-Nov	Silicate Minerals: Intro to Silicates & Orthosilicates	Nesse: pgs. 350-370	
	Week 14	22-Nov 24-Nov 26-Nov	**THANKSGIVING BREAK - NO CLASS**		
	Week 15	29-Nov	Silicate Minerals: Sorosilicates & Cyclosilicates	Nesse: pgs. 335-343; 343-349	
		1-Dec	Silicate Minerals: Inosilicates & Phyllosilicates	Nesse: pgs. 306-334	
		3-Dec	Silicate Minerals: Tectosilicates	Nesse: pgs. 277-305	
DEC.	Week 16	6-Dec	**LAB PRACTICAL REVIEW**		
		8-Dec	Mineral Resources (Uses & Society)	-	
		10-Dec	Mineral Resources (Uses & Society)	-	
	Week 17	17-Dec	**EXAM #3 (TBA)**		

LAB CALENDAR (subject to change)

Note – Random Mineral ID Quizzes can happen at the start of any Lab Session

MONTH	WEEK	DAY	TOPIC	LAB ASSIGNMENT	
AUG.	Week 2	31-Aug	Exploring Mineral Properties	Minerals 1-5	MINERAL STRUCTURE & CHEMISTRY
SEPTEMBER	Week 3	7-Sep	Exploring Mineral Properties	Minerals 6-11	
	Week 4	14-Sep	Crystallographic Mineral Blocks #1	Lab #1 & Minerals 12-17	
	Week 5	21-Sep	Crystallographic Mineral Blocks #2	Lab #2 & Minerals 18-23	
	Week 6	28-Sep	XRF Analyses of Minerals	Lab #3 & Minerals 24-29	
OCTOBER	Week 7	5-Oct	**Lab Practical #1 (Includes Minerals 1- 29)**		
	Week 8	12-Oct	Optical Properties of Minerals	Lab #4 & Minerals 30-35	OPTICAL MINERALOGY
	Week 9	19-Oct	**FALL BREAK - NO CLASS**		
	Week 10	26-Oct	Refractive Index and Isotropic Minerals	Lab #5 & Minerals 36-41	
	Week 11	2-Nov	Uniaxial Minerals	Lab #6 & Minerals 42-47	
NOVEMBER	Week 12	9-Nov	Biaxial Minerals	Lab #7 & Minerals 48-53	
	Week 13	16-Nov	Scanning Electron Microscopy (SEM/EDS)	Lab #8 & Minerals 54-60	ANALYTICAL MINERALOGY
	Week 14	23-Nov	**THANKSGIVING BREAK - NO CLASS**		
	Week 15	30-Nov	Scanning Electron Microscopy (SEM/EDS) Continued	-	
DEC.	Week 16	7-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 of out this course and maximize your learning, I recommend that you consider the following tips for success:

- **PRO 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.

- **PRO 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.

- **PRO 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.

- **PRO 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.

- **PRO 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!