

# SAN DIEGO STATE UNIVERSITY

## Geol 324: *Petrology*

Lecture: Mondays and Wednesdays from 10:00-10:50 AM in CSL-425

Lab: Mondays and Wednesdays from 12:00-2:40 PM in CSL-425

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Dept. of Geological Sciences

**OFFICE:** GMCS-228K

**OFFICE HOURS:** MTWTh 11:00-11:50 AM

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**PETROLOGY** is defined as the study of rocks, and especially, the study of the geological processes that create igneous, sedimentary, and metamorphic rocks. The goal of this course is to introduce undergraduate students to the fundamental principles of modern petrology. Although sedimentary petrology will be discussed in this course, we will focus primarily on *igneous and metamorphic petrology* (you will learn much more about sedimentary petrology in Geol 536: Sedimentology and Lithostratigraphy!). Unlike sedimentary rocks, the formation of both igneous and metamorphic rocks is governed by geological processes that occur at relatively high temperature and pressure within the Earth. These processes cannot be directly observed. The origin of these rocks must be deciphered through indirect observations: their structure and texture, mineralogy, and chemical compositions. Because of this, chemical equilibrium and thermodynamics are the “rules” that govern the igneous and metamorphic petrology “game”. Thus, you will need a firm background in chemistry, preferably at the college level, to be successful in this course. The course has one broad goal and two content objectives from the “Student Learning Outcomes” expected of all students in the Department of Geological Sciences:

**Goal 3:** Understand Earth materials and composition in all parts of the geosphere.

**Objective 3.1:** Identify and understand the relationships between the basic chemical building blocks that make up minerals and rocks.

**Objective 3.2:** Integrate chemical data to understand active and past Earth processes using compositional clues.

### **REQUIRED TEXT:**

**Assigned reading** will come primarily from the textbook “*An Introduction to Igneous and Metamorphic Petrology*” by Winter, which is available for purchase at the SDSU Bookstore. You are expected to complete each reading assignment by the next class meeting (i.e., reading assigned on Monday should be completed by Wednesday). I may ask questions or lead discussions in class assuming that you have done the reading. *You will be responsible for understanding all material in the assigned reading from Winter’s book, as well as all lecture material even if it is not mentioned in Winter’s book.* The lecture material will be summarized in a series of pdf files that will be periodically posted on the Blackboard site.

### **LAB SUPPLIES:**

The textbook “*Minerals in Thin Section*” by Perkins and Henke or any other useful lab manual can be used as a reference for the laboratory portion of this course. A hand lens is not required, but would be useful in the lab.

### **FORMAT and POLICIES:**

We will meet twice per week. Attendance is mandatory and **class participation** is an important component of the final grade (see below). **Lectures** will provide the necessary background material and an opportunity for active discussion of the reading assignments. **Laboratory exercises** will be used to supplement the lecture portion of the course. These exercises will focus on the identification, classification, and interpretation of igneous, sedimentary, and metamorphic rocks in hand specimen and thin section (using the petrographic microscope). You may have to spend several hours per week in the lab outside of normal class time in order to perfect your lab exercises and

observational skills. No lab write-ups will be assigned. Instead, all laboratory exercises will be self-graded using answer keys that I provide after the lab is completed (if appropriate based on the exercise).

**Three multiple-choice “knowledge” exams** based on *BOTH the lecture and laboratory portions of the course will be given*. The knowledge exams are “*closed notes*”. Your mastery of the laboratory portion of the course will also be tested with **two multiple-choice “practical” exams**. The practical exams are “*open notes*”. You *do not need to memorize any of the equations* that we discuss in class and lab, but you need to understand how to use them!

**\*\*\*No make-up exams will be allowed except under extraordinary circumstances!\*\*\***

Your work will be weighted as follows:	Class participation:	10%
	Knowledge Exams:	60% (20% points each)
	Practical Exam:	30% (15% each)

Your final grade will be based on a percentage of the total available points:

**A** (90% or above), **B** (89-80%), **C** (79-70%), **D** (69-60%), **F** (59% or below). Of course, +/- grades will be given!

### **LECTURE SCHEDULE:**

Fundamental Concepts (Chapter 1)  
Classification and Nomenclature of Igneous Rocks (Chapter 2)  
Igneous Textures (Chapter 3)  
Physical Properties and Igneous Textures (Chapter 4)  
Intro to Thermodynamics (Chapter 5)  
Phase Rule and Binary Phase Diagrams (Chapters 6 and 7)  
Chemical Petrology I: Major and Minor Elements (Chapter 8)  
Chemical Petrology II: Trace Elements and Isotopes (Chapter 9)  
Mantle Melting and the Generation of Basaltic Magma (Chapter 10)  
? Layered Mafic Intrusions (Chapter 12) ?  
Mid-ocean Ridge Volcanism (Chapter 13)  
Intraplate Volcanism (Chapters 14 and 15)  
Subduction Zone Volcanism (Chapters 16 and 17)  
Intro to Metamorphism (Chapters 21 and 22)  
Chemographics (Chapter 24)  
Metamorphic Facies (Chapter 25)

### **LAB SCHEDULE:**

*Jan. 23:* Rock Identification and Description  
*Jan. 28 & 30:* Classification of Sedimentary Rocks  
*Feb. 4 & 6:* Classification of Metamorphic Rocks  
*Feb. 11 & 13:* Classification of Igneous Rocks  
*Feb. 18 & 20:* Review of Igneous Minerals in Thin Section (2 weeks)  
*Feb. 25 & 27:* Review of Igneous Minerals in Thin Section (continued)  
*March 4 & 6:* Petrography of Igneous Rocks  
*March 11 & 13:* Petrography of Igneous Rocks (continued)  
*March 18 & 20:* **PRACTICAL EXAM #1**  
*March 25 & 27:* Tuolomne or Stillwater lab  
*April 1-5 (Spring Break)*  
*April 8 & 10:* Tuolomne lab (continued)  
*April 15 & 17:* Identification of Metamorphic Minerals (three weeks)  
*April 22 & 24:* Identification of Metamorphic Minerals (continued)  
*April 29 & May 1:* Identification of Metamorphic Minerals (continued)  
*May 6:* **PRACTICAL EXAM #2** (12:00 PM in CLS-425)