GEOL 333 (Earth Materials and the Environment) - Lab Overview and Policies-Student Notes

Lab Overview

First five Labs involve study of minerals (two on physical properties, two on identification of mineral unknowns, one on using petrographic microscope to examine thin sections (slices) of pure minerals)

Five Labs involve rock characterization using hand samples and petrographic microscope study of thin sections

One soil Lab with student presentations of different soil categories

One geology field trip to coal-bearing outcrop (cyclothem)

Two Labs involve environmental application (building stones) and powerful technique of mineral analysis (X-ray diffraction)

Lab final exam during last Lab period of semester

Lab Policies

Arrive on time, except for the field trip, when you should arrive 5 minutes early.

Absences - Contact TA (cabanis2@illinois.edu) before Lab with valid excuse and you can make it up. Otherwise, you need note from Emergency Dean to make up missed Lab.

Bring to all mineral and rock Labs (Labs #1 - 10): Klein and Philpotts - Earth Materials (main class textbook). Bring MacKenzie and Adams book to six Labs involving petrographic microscope (Labs #5 - 10).
Bring to every Lab the Lab Exercise and either the Powerpoint Lab notes or Summary Lab Notes available on the Class Web site.

All Labs involve an exercise, which must be completed by 11:50 am unless authorized by TA. Some Labs involving petrographic microscope will require completion outside of scheduled Lab time. In next week or two you will be able to enter 69 CAB using card-swipe lock. **Never leave Lab room unlocked; petrographic microscopes are very expensive**. Don't bring food or drinks into 69 CAB and don't leave it as a mess. Don't use Lab room when a class is in session. There is class in 69 CAB on Tuesday late morning and afternoon and Thursday morning and afternoon.

Today's Lab begins with 5-minute pretest on chemical principles; it does not count towards your grade. Labs #2 - 7 begin with 5-minute Quiz, which does count towards your grade. Quizzes cover key concepts from previous week and reading assignment for current week.

GEOL 333 - Lab 1 (Physical Properties of Minerals I) - Student Notes

Introduction

Mineral =

Importance =

Mineral Identification =

Selected Physical Properties

1) Hardness (H):

Mohs Hardness Scale
(Table 3.6, p. 56, Perkins, 2011, Mineralogy)

Mineral	Hardness	Non-mineral	Hardness
Talc (used for talcum powder)	1		
Gypsum	2	Fingernail	2.5
Calcite	3	Penny, brass	3.5
Fluorite	4	Iron	4.5
Apatite	5	Knife blade, glass	5.5
Feldspar	6	Metal file, streak plate	6.5
Quartz	7		
Topaz + beryl (includes emerald)	8		
Corundum (includes ruby + sapphire)	9		
Diamond	10		

How is mineral hardness related to chemical bonding within the mineral?

Practical Information for Hardness Determinations: Make sure to look for an actual scratch by brushing off tested surface. Sometimes powder of softer mineral is left on harder mineral, giving only appearance of a scratch. **Do not scratch a mineral by holding glass plate because glass plates can break and cause a serious cut**. Instead, rub mineral on glass plate to see if glass surface is scratched.

2) Cleavage:

Why does a mineral cleave in only certain directions?

Common Mineral Cleavage Shapes
(see examples in Fig. 3.9 on last page and in Fig. 3.13 - 3.17, p. 49 - 50, Klein + Philpotts)

- **Basal** (platy) = one direction, e.g., mica
- **Prismatic** = 2 directions at 90°, e.g., feldspar and pyroxene or 2 directions not at 90°, e.g., amphibole
- **Cubic** = three directions at 90°, e.g., galena
- **Rhombohedral** = three directions not at 90°, e.g., calcite
- **Octahedral** = four directions, produces 8-sided figure (octahedron), e.g., fluorite

Practical Information for Cleavage Determinations: Look for shiny flat surfaces; often as series of surfaces parallel to each other but at different elevations; turn sample and look where shiny planes come from many parts of sample at same time. Parallel cleavage faces on opposite sides of sample count as one cleavage plane. Examine only one crystal at a time; if there are multiple individual crystals, there will be many differently oriented cleavage faces. DON'T BREAK SAMPLES WITHOUT YOUR INSTRUCTOR'S APPROVAL.

Minerals with fracture =

Quartz has conchoidal fracture =

Why does a mineral fracture rather than cleave?

3) Crystal Shape (Form, Habit):

crystal =

crystal faces =

Fig. 2.3 on last page and Fig. 3.1 on p. 41 in Klein + Philpotts textbook shows some of many possible crystal shapes (also called crystal form and crystal habit). Some minerals have single, diagnostic crystal shape, e.g., quartz (hexagonal or 6-sided prisms with pyramid-like faces at end). Most minerals have variety of crystal shapes.

What controls crystal shape?

Practical Information for Crystal Shape Determinations: Crystal faces can be confused with cleavage faces; crystal face can also be a cleavage face. Crystal faces are usually continuous and smooth (or have fine-scale grooves or ridges) whereas cleavage faces usually are broken in a step-like manner. Unfortunately, minerals with well-developed crystal shapes are relatively rare.

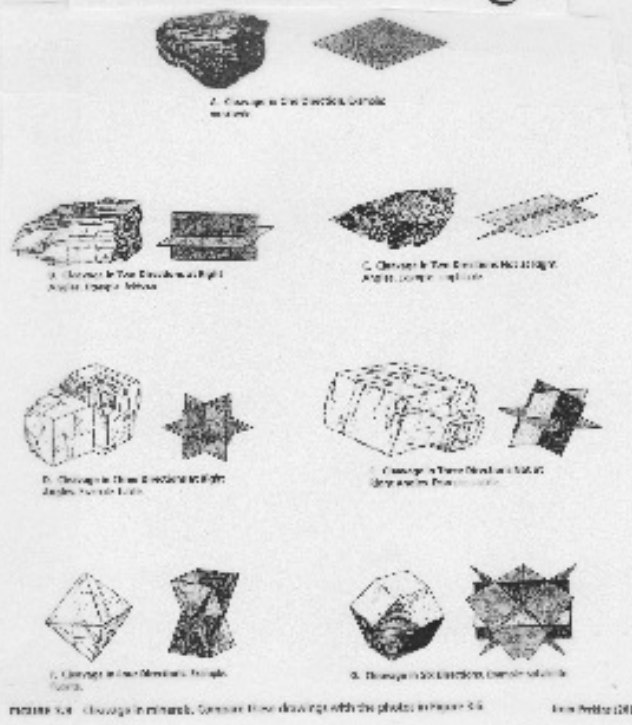
4) Specific Gravity (G):

Related property of density =

What factors should affect a mineral's G value?

Most minerals have G value between 2 and 10.

Mineral Cleavage



Measuring Crystal Facial Angles

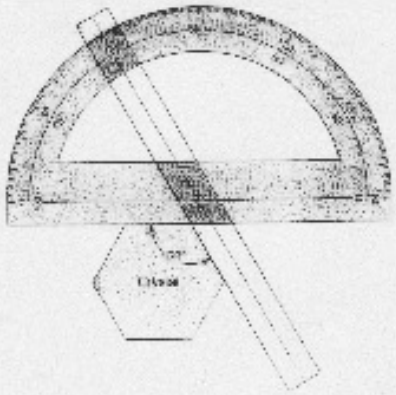


FIGURE 1.23
A simple contact goniometer consists of a protractor and a rotatable arm. The angle between adjacent crystal faces is measured as shown.

from Jones (1998) Lab Manual for Physical Geology

Crystal Forms (Shapes)

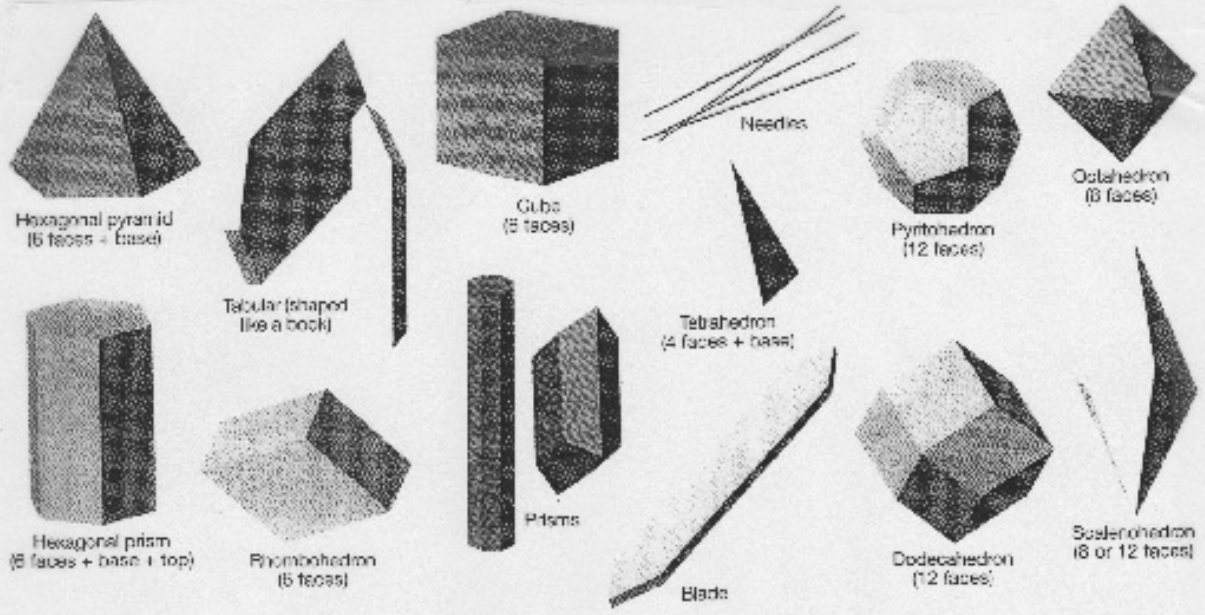


FIGURE 2.3 Some *crystal forms* (geometric shapes). The flat surfaces of these forms are called *crystal faces*.

from Busch, ed. (2000) Lab Manual in Physical Geology