Mineral Identification III

Lab groups (as requested):

Topic	1	2	3	4	5	6
A	Ault	Lembrick	Wheeler	Carlile	Kaemingk	Benedetti
B	Walter	Messer	Henrichs	Bowerman	Marshall	Bratz
C	Marrs	Sayler	Youngquist	Montgomery	Lykken	Isaacson
D	Leighton	Darst	Williams	"Brady"	Futch	Johnson

Instructions for this exercise

The main goal of this lab is introducing you to the second set of minerals you will learn about in detail. In this lab, you will continue to make a catalog of minerals from which you can study.

Your task is to learn the important features of each mineral. One important feature of every mineral is its chemical composition. Most geologists, in identifying a mineral, will ask what other minerals it was found with, or what rock type it was found in. This is because minerals that form together frequently share aspects of their chemistry.

→ For each mineral, you should therefore record:

1. Name
2. Chemical formula (if the formula is complex, then only the elements, not their proportions - see below)
3. Geologic occurrence (not locations, but environments. e.g., Pyrite - sulfide ore deposits)
4. Identifying Characteristics. This is the key. What is it important to know about this mineral to be able to identify it? To distinguish it from most minerals is easy, but what about minerals that share many features? (i.e., for pyrite, the important features are not those that distinguish it from quartz, but those that distinguish it from chalcopyrite and pyrrhotite - see Plate II in your text)

Cooperative strategy:

We will be doing the same type of exercise as in the previous labs. You are a member of a team (1-6), and you must become an expert on a topic (A-D). You will develop answers to your topic material first on your own (**before** the lab session), then you will share your answers with the other experts on that topic from the other 5 teams. Finally, we will go through four rotations in which each expert will teach their topic to the other members of their team.

Each team will turn in a single lab report, but you are responsible for knowing all the material in this lab. In addition, you must **critically review** the results of the other experts on your team while they are teaching.

What you should have done when you come into lab:

When you arrive at lab, you should have written-down answers for your topic. These **will be collected** briefly, then returned in the first part of the lab session, and will form part of your individual lab score. They need not be terribly neat, but should be legible.

Topic A, Mineral Identification - Isolated Tetrahedra Silicates

Using your text and any other reference materials you wish, learn to identify the following minerals and distinguish them from similar ones. Turn in a sheet with the four items mentioned above for each mineral, and answer the following questions about the minerals as well.

→ Titanite	→ Andradite	→ Zircon
→ Almandine	→ Grossular	

→ Zircon can, in some cases be metamict. Explain what this means, and why some (rather than all) zircons would be metamict

→ What is the solid solution that relates Almandine to Grossular? Grossular to Andradite?

→ What is the most common use for almandine garnet?

→ What is titanite's old name?

Note: Only perform destructive tests (hardness, acid) on mineral samples if your professor says it is okay to do so!

Topic B, Mineral Identification - Isolated Tetrahedra Silicates

Using your text and any other reference materials you wish, learn to identify the following minerals and distinguish them from similar ones. Turn in a sheet with the four items mentioned above for each mineral, and answer the following questions about the minerals as well.

→ Topaz	→ Andalusite	→ Staurolite
→ Forsterite	→ Kyanite	

→ Topaz crystals have a distinctive cleavage perpendicular to the columns. See if you can find it, and note the unusual asymmetric shape that results.

→ Andalusite and Kyanite are ***polymorphs***, minerals with the same composition and differing structure. As a result, they can be transformed from one to another easily. Sillimanite is the third polymorph in the group. What is the maximum pressure at which andalusite could form?

→ The large sample shows large crystal-like shapes that are really aggregates of tiny sillimanite crystals. The shapes are similar to the crystal form of andalusite. How could this happen? Illustrate with a sketch of Fig. 12.12.

Note: Only perform destructive tests on mineral samples if your professor says it is okay to do so!

Topic C, Mineral Identification - Bowtie & Ring Silicates

Using your text and any other reference materials you wish, learn to identify the following minerals and distinguish them from similar ones. Turn in a sheet with the four items mentioned above for each mineral, and answer the following questions about the minerals as well.

→ Epidote	→ Vesuvianite	→ Tourmaline
→ Allanite	→ Beryl	

→ Allanite is a mineral with an unusual composition. What is the unusual element? What is it's ionic charge? What set of other elements might easily substitute for this element, based on similarity of size and charge?

→ Allanite can be metamict. What does this mean, and how does it relate to the compositional questions above?

→ Epidote is both the name of an end-member, and the intermediate compositions. Give the solid solution (arrows or vector form). How does the mineral's color change across the range of compositions?

→ Piemontite is a member of the epidote group, and tends to be pink or red. What other mineral with a related composition and similar color have you recently seen?

→ What is vesuvianite's old name?

Note: Only perform destructive tests on mineral samples if your professor says it is okay to do so!

Topic D, Mineral Identification - Pyroxenes & Pyroxenoids

Using your text and any other reference materials you wish, learn to identify the following minerals and distinguish them from similar ones. Turn in a sheet with the four items mentioned above for each mineral, and answer the following questions about the minerals as well.

→ Enstatite	→ Augite	→ Spodumene
→ Diopside	→ Jadeite	→ Wollastonite

→ How can you best tell augite from hornblende?

→ How can you best tell augite from enstatite?

→ There is a solid solution ($FeMg_{-1}$) between diopside and it's Fe-rich end-member, hedenbergite. What is the solid solution between these and augite?

→ Enstatite and the Fe-version, ferrosilite are called "orthopyroxenes;" diopside, hedenbergite, and augite are called "clinopyroxenes", based on their differing structure. What differentiates these groups compositionally?

→ Imagine there is a solid solution (in reality, there isn't much of one) between diopside and jadeite. What would it be?

→ Think about the Ca site in the diopside structure, how big that site should be. Given the solid solution just above, and the size of the ion trying to get in there, is there a problem? Does this explain why there is little of this solid solution that goes on in real rocks?

→ Would that situation change at high pressure perhaps? Note the stability limit of jadeite (Fig 12.39, p. 519). How high a pressure is needed to stabilize jadeite if quartz is present? How can this pressure-related stability range shed light on the problem illustrated in the question above?

Note: Only perform destructive tests on mineral samples if your professor says it is okay to do so!