Name_____

Exam #1

1. Name three intrusive igneous rocks and their extrusive counterparts. Are they mafic, felsic or intermediate? List two common minerals found in each type of rock.

2. Define each term listed below. Name one mineral, common in igneous rocks, that fits into each category.

Inosilicate (chain silicate):

Phyllosilicate (sheet silicate):

Tectosilicate (network silicate):

Nonsilicate:

3. Define the following terms and give a rock type for each.

Aphanitic:

Porphyritic:

Phaneritic:

4. Draw Bowen's reaction series. Label the high and low temperature parts of the diagram. Clearly show where the high-SiO_2 minerals plot. Supply one chemical formula for each mineral on the series. Use the back of this page, and be precise!

5. Define the following terms:

Isotropic:

Anisotropic:

Extinction:

Relief:

Retardation:

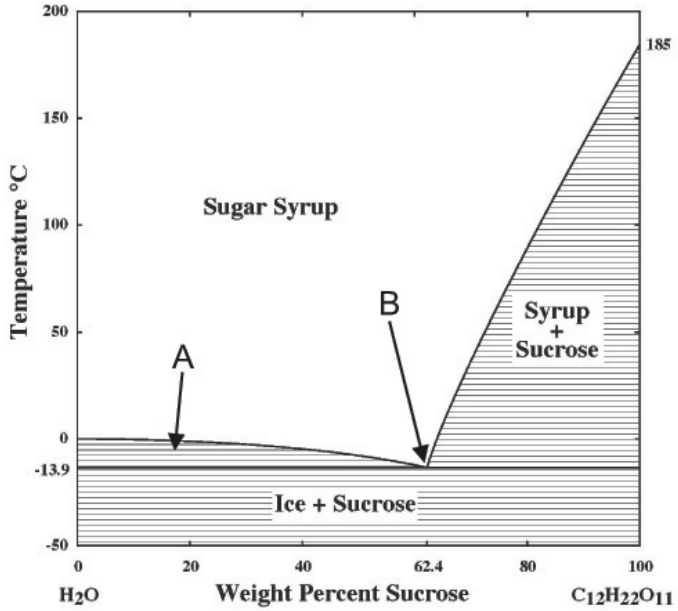
Pleochroism:

Opacity:

Euhedral:

6. Describe what twinning looks like in thin section. Name a type of mineral that exhibits twinning. What is that kind of twinning called. Draw an example. Why must you view a mineral in XP light to see twinning.

7. On the diagram shown at right, I forgot to label the field lettered A with phase names. What label should go in there?

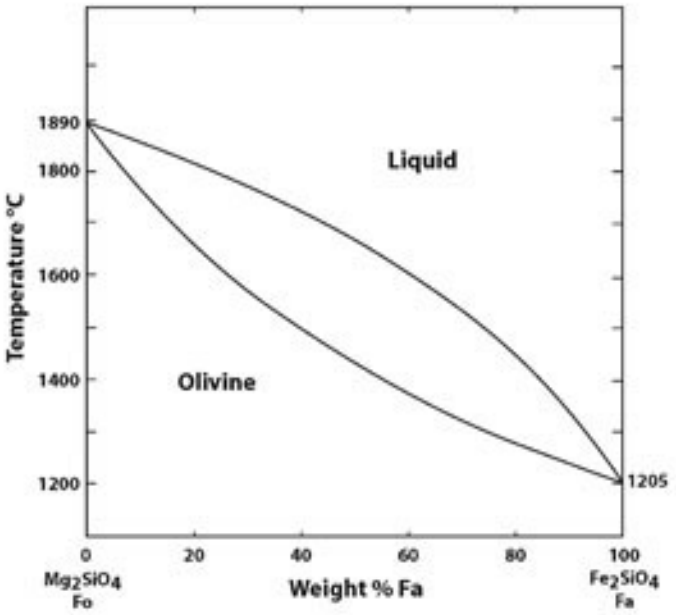


8. What is point B called? What does it represent? (i.e., What is its significance?)

9. This diagram does a good job of describing what happens when you put a popsicle in your mouth and it begins to melt. (Popsicles are almost entirely sugar, sucrose, and H_2O.)

Suppose you have a popsicle that is 80% ice and 20% sugar. At what temperature will it start to melt?

You put that popsicle in your mouth and taste all that yummy sugar with artificial sweetener. Eventually, if you wait long enough, all the flavor is gone and you just have a chunk of more or less pure H_2O ice left in your mouth. Explain this using the diagram above.



10. Label each of the following on the diagram shown at left, *if they are present*:

liquidus
solidus
solvus
miscibility gap
eutectic
peritectic

11. Which melts at a higher temperature, Fe-rich olivine or Mg-rich olivine?

12. Consider the olivine phase diagram above. Start with an olivine that is 30% forsterite. Heat it up. At what temperature will it begin to melt? What will be the composition of the melt?

Suppose it melts so that half of the original olivine is gone and there are now equal amounts of crystals and melt. Will the crystals still be 30% forsterite? If so, what will the composition of the melt be? If not, what will the composition of the crystals be?

13. Consider the diagram shown and a melt of composition A. If the melt cools, what will be the temperature at which the last drop of melt disappears?

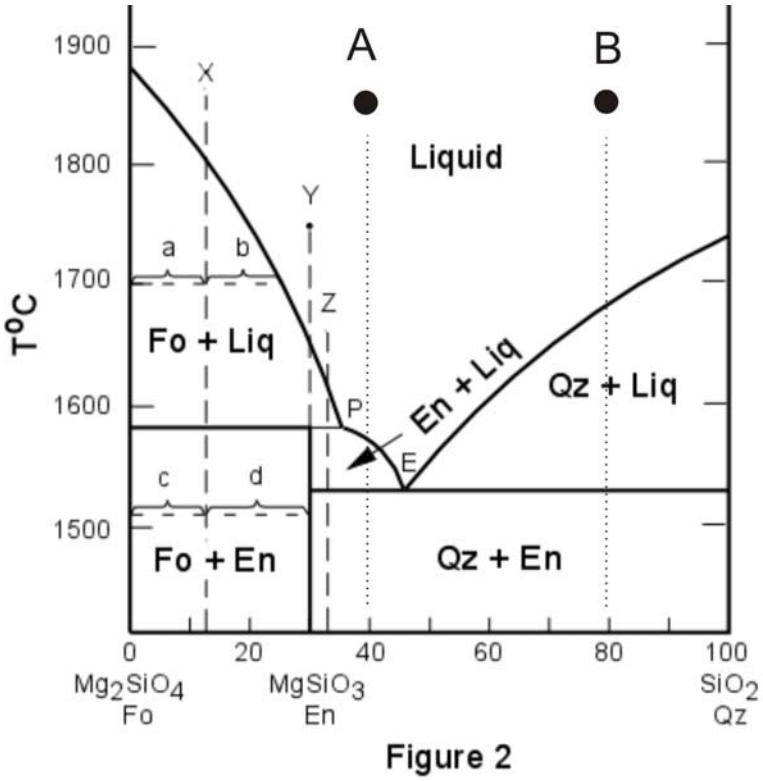


Figure 2

Consider a melt of composition B. If it cools, what will be the first mineral to form?

Suppose both melts cool completely so they are entirely crystalline. What minerals will they contain and in what proportions? (The answers will be different for A and B.)

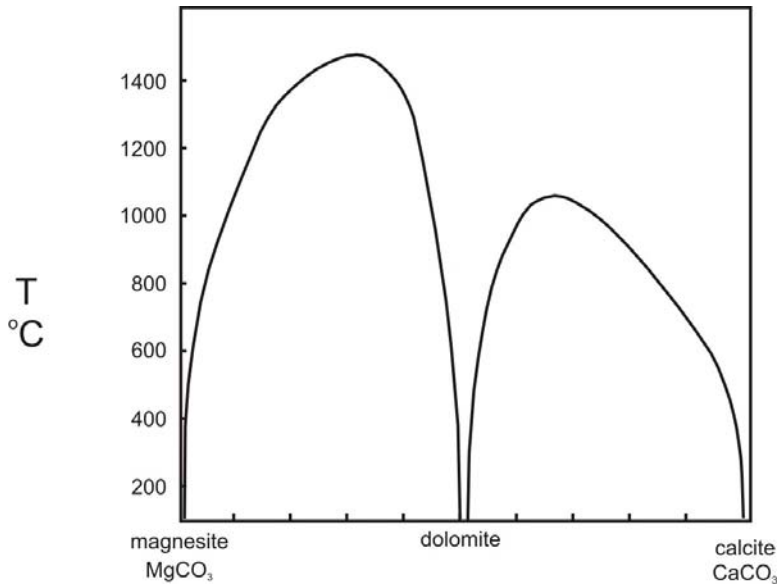
Make two sketches of "rocks" that show the difference in the textures when the two different melts crystallize.

14. Some igneous rocks that contain alkali feldspars, actually contain two different feldspars. One is albite (Na) rich and the other is orthoclase (K) rich. The two feldspars may or may not be exsolved. Other igneous rocks, similar in composition to the first, may contain only one alkali feldspar. Such feldspars are invariably exsolved.

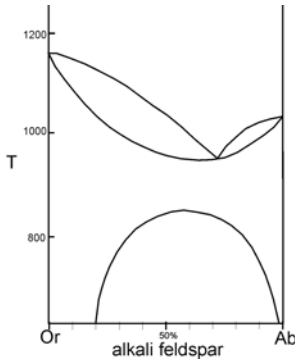
What does the term "exsolved" mean? How can you identify exsolution using a petrographic microscope?

Why do some rocks contain two alkali feldspars, while others contain only one?

15. The diagram shown at right shows relationships involving magnesite-dolomite-calcite. These are the subsolidus relationships. That is, the diagram describes what happens to the solid phases on cooling. (Melting temperatures are off the top of the diagram.)



In many ways, this diagram is like the alkali feldspar diagram you worked on in class. Except, here we have to "parabolic" curves whereas the alkali feldspars only had one.



What is the formula of dolomite?

What do you call the two "parabolic" shaped curves in the magnesite-calcite diagram?

What do you call the areas under the two curves?

Suppose you have a rock that has some composition between magnesite and calcite. Depending on the composition and temperature, different minerals may be present in the rock.

There may be more than one answer to the questions below. When answering the two questions, be sure you are specific as to the compositions of the minerals.

What mineral or mineral assemblages could be present at 1500 ^{o}C?

What mineral or mineral assemblage could be present at 600oC.

16. Name each of the following rocks, given the mineral assemblages:

a. A coarse grained rock contains 10% quartz, 20% biotite, 20% Na-rich plagioclase, and 50% K-rich alkali feldspar

b. A coarse grained rock contains 2% plagioclase, 70% augite, and 28% hypersthene.

c. A mostly fine grained rock contains large crystals of plagioclase (about 15% of the total volume), surrounded by a submicroscopic mix of alkali feldspar, plagioclase and hornblende in about equal proportions.