

LECTURE TEST 3

Please **read** each of the questions **carefully**. *Answer all portions of each question.* Here's your next chance to tell me all that you know! Remember that partial credit makes a difference, so don't leave any blanks! Remember spelling counts. Points given in (). **GOOD LUCK!** ↑.

1. Draw a P-T diagram showing the fields of the Al-silicate polymorphs. Be sure to label each field and the axes. (15 pts total)

What are the structural similarities and differences of these polymorphs?
How does this relate to the specific P-T regime where each is stable?

If your rock contained all three polymorphs, what P-T conditions would you decipher?
(plot on diagram)

Why are these minerals important for metamorphic petrologists?

2. Fluorite, pyrite and calcite are derivatives of the *halite structure*. Beginning with the halite structure, describe the structure of the others. Draw the halite structure. Why are they termed derivatives? (8)
3. Phyllosilicates can be structurally classified based on the number of T-O units and the occupancy of the octahedral sheet. Describe the four different structural types of phyllosilicates and give a mineralogical example of each. What is different about chlorite? (12 pts)
4. Excluding the monocline hydrous carbonates,
(a) why do carbonates form two different solid solution series? (9)
- (b) Is there solid solution **between** the series? Why or why not.
- (c) Describe the general physical characteristics of the two different series. Give a mineralogical example in each series.

5. What differentiates the serpentine polymorphs? (5)

6. Minerals provide evidence to the geologic history of an area, be it Pressure, Temperature, Bulk or fluid composition, oxidation conditions, protolith composition, etc. If your rock contained the following mineral, what could you discern about the environment of formation using each of the following minerals? (e.g. chemistry, P, T, and/or fluid composition). (15 pts)

(a) Apatite _____

(b) Staurolite _____

(c) Glaucophane _____

(d) Beryl _____

(e) Topaz _____

(f) Aragonite _____

(g) Rhodonite _____

(h) Wollastonite _____

(i) Anhydrite _____

(j) Tourmaline _____

(k) Zircon _____

(l) Titanite _____

(m) Stibnite _____

7. You have two minerals, smithsonite and calcite. Mineral "B" feels lighter than mineral "A". Which mineral is A and which is B?

A = _____ B = _____

8. You are given the task to correlate ore deposits in the Tri-State mining region based on the **color** of fluorite that occurs as a gangue mineral with the ores. Do you tell your manager that this is a good or poor idea? Why? (3)

9. What is the general cause of color in the following minerals? State if you can or can not use color as an identifying feature. (YES, NO) Why or why not? (3)

(a) tourmaline _____

(b) beryl _____

(c) rhodonite _____

10. For each of the following mineral pairs, state whether or not they commonly exist together. If they do exist together, give an example of the environment in which they would be found. If they do not exist together, state why not. (10 pts)

(a) cordierite-andalusite _____

(b) grossularite-wollastonite _____

(c) quartz-corundum _____

(d) kyanite-staurolite _____

(e) actinolite-epidote _____

(f) kaolinite-chlorite _____

(g) illite-sillimanite _____

11. You are sure that your crystal is aragonite, yet it appears to have hexagonal symmetry. Explain this apparent discrepancy and tell how you know it is not hexagonal. (5)

12. In general, describe the zeolite structure. What is unique about zeolites? What two properties do they exhibit that make them extremely useful for industry? (9)

13. Compare and contrast epitaxis and twinning. Give an example of each. (5)

14. Match the mineral formula to the mineral. Write the letter which corresponds to the correct formula in the space to the left of the minerals. Each formula can ONLY be used ONCE. *This information may be helpful elsewhere in the test.* (10 pts)

- | | | |
|-------|---------------------|--|
| | 1. cordierite | a. $Mg_3Al_2Si_3O_{12}$ |
| _____ | 2. epidote | b. $Na_2Mg_3Al_2Si_8O_{22}(OH)_2$ |
| _____ | 3. wollastonite | c. $(Na, Ca)_xAl_2(Si, Al)_4O_{10}(OH)_2 \cdot nH_2O$ |
| _____ | 4. glaucophane | d. $Ca_2(Mg, Fe)_5Si_8O_{22}(OH)_2$ |
| _____ | 5. biotite | e. $Al_2Si_2O_5(OH)_4$ |
| _____ | 6. illite | f. $(Mg, Fe)_2Al_4Si_5O_{18} \cdot nH_2O$ |
| _____ | 7. staurolite | g. $Na(Mg, Fe, Al, Li)_6(Si, Al)_6O_{18}(OH)$ |
| _____ | 8. chlorite | h. $(Na, K)_{0-1}Ca_2(Mg, Fe, Al)_5(Si, Al)_8O_{22}(OH)_2$ |
| _____ | 9. kaolinite | i. $Ca_2(Al, Fe)_3Si_3O_{12}(OH)$ |
| _____ | 10. montmorillonite | j. $CaSiO_3$ |
| | | k. $KMg_3AlSi_3O_{10}(OH)_2$ |
| | | l. $Al_2Si_4O_{10}(OH)_2$ |
| | | m. $Fe_{\sim 4}Al_{18}Si_8O_{48}H_{2-4}$ |
| | | n. $K(Mg, Fe)_3AlSi_3O_{10}(OH)_2$ |
| | | o. $Ca_3Al_2Si_3O_{12}$ |
| | | p. $K_xAl_2(Si, Al)_4O_{10}(OH)_2 \cdot nH_2O$ |
| | | q. $(Fe, Mg)_5Al_3Si_3O_{10}(OH)_8$ |

Short Answer (3 pts each):

15. Why do phyllosilicates have one excellent direction of cleavage?
16. Why are sulfides important?
17. You have illite in your sample rather than montmorillonite, what will you infer about a marine vs. non-marine origin for the rock? (2)
18. Why is the term "clay mineral" a non-precise term?
19. What differentiates **True** micas from **Brittle** micas?
20. What is a pyroxenoid?
21. What is a biopyribole?
22. Why does the moon have a face?
23. Tourmaline exhibits piezoelectric properties. What does this mean and what crystallographic feature must be present (or absent) for this to occur? (4)

BONUS:

1. The Israeli's have a new web search engine. What is it called?

2. Describe three primary occurrences of ore minerals. Also include the minerals that you would expect to find.

3. If you placed a piece of pyrite and a piece of marcasite on your metallic bookshelf here in Louisiana, what might you expect to happen to each of these minerals after a few years on the shelf?

Happy Thanksgiving!!!