Mineralogy 2081 **Name** _____

LECTURE TEST 2
October 23, 1997

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! Points given in (). **GOOD LUCK!** ⇑.

1. As pressure is increased from the upper mantle to the lower mantle, minerals change structure, primarily in the transition zone. (1) Draw the layers of the transition zone and note which structures are prevalent in each zone. Beginning with olivine, (2) briefly describe the structural changes that occur from the olivine structure, to the perovskite structure. Include C.N. of major sites, general structure, any intermediate structures. (18 pts)

2. Why do Mg and Fe exhibit good solid solution, whereas K and Na exhibit only limited solid solution? (5)

3. Diamond and graphite have the same chemical formula yet exhibit very different properties (such as cleavage and hardness)? Explain why this is so. (Hint: Describe using crystal structures.) (10 pts)

4. We find diamonds at the Earth's surface, are they stable? Why or why not? _____

5. What rock type is the primary transport agent for getting diamonds to the surface? ___

6. Compare and contrast the polymorphic transition for stishovite to coesite, Orthoclase to Microcline, and α to β quartz.

7. Describe the two different solid solution series for garnets. Give the endmembers in each group and their chemical formulas, and the groups name. Note which ions substitute within each group.

   Why do garnets form two solid solution series? _____

   Is their solid solution between groups? Why or why not. _____

8. Beginning with the appropriate feldspar, add or subtract components to produce: analcime, sodalite, leucite, and nepheline.

9. Each of the following mineral pairs may or may NOT exist together. If they do occur together, give an example of the environment in which they would be found. If they do not exist together, state why not. (14 pts)

   (a) quartz-nepheline _____

   (b) olivine - diopside _____

   (c) albite - microcline _____

   (d) olivine - sanadine _____

   (e) magnetite - plagioclase _____

   (f) hematite - chert _____

   (g) almandine - olivine _____

10. Feldspars are important rock-forming minerals. (a) Draw a ternary diagram which illustrates the compositional relationships in the two solid-solution series. Label each field clearly. (b) Briefly describe each solid- solution series, including temperature dependence, extent of solid solution,what occurs upon cooling. Illustrate your discussion with mineralogical examples where applicable. Indicate how this applies to Ca vs.K igneous rocks. (15 pts)

    a.

    b.

11. (a) Cleavage is one of the best properties to distinguish amphiboles and pyroxenes. Draw the crystal structure of each (cross section down c). Label the major crystallographic sites, note C.N. , and indicate on your diagram where the mineral cleaves.

(b) What is the cleavage angle for an amphibole _____, for pyroxene _____ .

(c) Why are the cleavage angles different? _____

Short Answer (3-5 pts each):

12. Explain the difference between "normal" and "inverse" spinels. Give a mineralogical example of each. (5)

13. Does symmetry of a crystal **decrease** or **increase** with increase in ordering? (circle one)

14. What is the chemical formula of stishovite? _____

What is unusual about the crystal structure? _____

Where does it form? Why? _____

15. If you find coesite in your metamorphic rock, what does it tell you about the rocks formation?

16. Why does Ca prefer the M2 site in olivine? _____

BONUS:

October 14, 1997 was a notable anniversary in technological achievements in air flight and aerospace design. This date was the (fill in) anniversary of breaking the sound barrier.

Who was the first person to fly faster than the speed of sound? _____

Describe exsolution and its relationship to a miscibility gap?
What can this tell us about the history of the rock?

What did the fly say when he hit the windsheild?