

LECTURE TEST 1

September 30,1997

Please **read** each of the questions **carefully**. *Answer all portions of each question.* **Ionic radii** and **electronegativity** values are given on the last page. Partial credit makes a difference, so don't leave any blanks! Points given in (). **GOOD LUCK!** ↑.

1. Draw and label the crystallographic axes for each of the crystal systems. Give the relative lengths of each axis and the angles amongst the axes. Give the relationship of the axes to any symmetry elements. (18 pts).

2. What happens to the ionic radius of most cations as the coordination number increases?
(3)

increases *decreases*

3. What two changes occur in a mineral when subjected to increases in pressure? _____. (3)

4. Why is the SiO_4 tetrahedron preserved as an entity during melting of Fe_2SiO_4 ? (3)

5. What is the primary mineral that comprises the outer core? (3)

6. Color is one of the most recognizable properties of a mineral. However, color is only a reliable indicator of mineral ID in certain circumstances. (1) Describe the mechanisms that produce color in minerals and (2) describe when color **can** be used as an identifying characteristic. (12)

7. Give the definition of a **mineral**. Be sure to list all the attributes that are required for a substance to be considered a mineral. (10 pts)

8. The distance between two cations in different configurations are as follows: (5)

face-sharing = 0.43\AA edge-sharing = 0.47\AA corner-sharing = 0.97\AA

Circle the most stable configuration. State why _____

9. What is the bond strength of the following bonds? (9)

Ti^{4+} in octahedral coordination in ilmenite? _____

Li^{2+} in tetrahedral coordination in staurolite? _____

Which bond is stronger? _____

10. Draw a radial cross-section of the Earth's interior. Label the major divisions. (10)

11. What occurs in the transition zone that gives the zone its name? _____

12. Why does C typically occur in triangular coordination and K in twelve fold coordination?

13. How do we predict what types of polyhedra will exist in a crystal structure?

14. Why is gold so soft whereas corundum is so hard? State in terms of bonding.

Do either of these minerals conduct electricity? describe why or why not?

15. Does the polymorphic change from olivine - spinel structure - perovksite structure involve a change in chemistry? _____

16. There are two atoms: C^{4+} and Ba^{2+} . Space in the crystal structure won't allow both of them to share apices only with adjacent coordination polyhedra. Which one will share edges and which one will share apices? Why?

BONUS: What did Steno have in common with Mother Teresa?

BONUS: What did Steno have in common with Princess Diana?

BONUS: What has 8 legs, 6 eyes, 2 wings, and a tail?