Mineralogy Exam 2 – 1997 **NDSU Dept. of Geosciences**

Answer in the blue book provided. Show work for partial credit.

1. Name and draw the regular coordination polyhedra for a 3-, 4-, and 6-coordinated ion. [6 pts]

2. For an element with multiple valence states, does ionic radius increase or decrease with increasing positive charge. Why? [4 pts]

4. You analyzed an olivine from the metamorphosed Gunflint iron formation in Minnesota and found it contains 0.08 wt.% TiO_2. How many ppm Ti is this?
(FW Ti = 47.90 g/mol; FW O = 16.00 g/mol). [5 pts]

3. Describe how an electron microprobe generates information about the chemical composition of a mineral. Include information on how the sample is excited, what is being measured and how it is measured. You may draw a clearly labeled diagram if you wish. [15 pts]

5. Bauxite ore can be heated to produce aluminum. The first step of heating results in thermal decomposition of AlOOH into Al_2O_3 (FW = 101.96 g/mol) and H_2O (FW = 18.02 g/mol).
a) Write a balanced chemical reaction for this decomposition.
b) What would be the percent weight loss?
c) What geologic process forms bauxite ore deposits? [15 pts]

6. a) Draw a (001) projection of the unit cell of a cubic mineral structure with :

Cu on sites:	$^1/_4,^1/_4,^1/_4$	O on sites:	0,0,0
	$^3/_4,^3/_4,^1/_4$		$^1/_2,^1/_2,^1/_2$
	$^3/_4,^1/_4,^3/_4$		
	$^1/_4,^3/_4,^3/_4$		

b) What is the ratio of Cu to O atoms in this mineral?
c) Therefore, what is its reduced chemical formula? [15 pts]

7. What is the Bragg equation? Draw a diagram showing the geometry of X-ray "reflection" from a crystal and relate it to the Bragg equation. Label your diagram clearly. [20 pts]

8. Relate physical properties of the following minerals to type of chemical bonding. For example, why is graphite so soft, but why does it have such a high melting point (3600 °C)?
a) graphite; b) diamond; c) copper; d) halite [20 pts]