

**Mineralogy Exam 3 – sample  
2009**
**Name** \_\_\_\_\_  
**NDSU Dept of Geosciences**

 1. Matching (**note:** there may be more than one answer!):

[9 pts]

|       |                       |  |
|-------|-----------------------|--|
| _____ | magnetite             | A. $[\text{SiO}_4]^{4-}$                   |
| _____ | ilmenite              | B. $[\text{Si}_2\text{O}_7]^{6-}$          |
| _____ | phyllosilicate        | C. $[\text{Si}_2\text{O}_5]^{2-}$          |
| _____ | double chain silicate | D. $[\text{Si}_2\text{O}_6]^{4-}$          |
| _____ | mica                  | E. $[\text{Si}_4\text{O}_{11}]^{6-}$       |
| _____ | tectosilicate         | F. $[\text{Si}_6\text{O}_{18}]^{12-}$      |
| _____ | sorosilicate          | G. $[\text{SiO}_2]^0$                      |
| _____ | inosilicate           | H. pyroxene                                |
| _____ | fayalite              | I. olivine                                 |
| _____ | garnet                | J. amphibole                               |
| _____ | tectosilicate         | K. spinel structure group                  |
| _____ | cyclosilicate         | L. an ore of titanium                      |
| _____ | bauxite               | M. weathering/alteration product of pyrite |
| _____ | cassiterite           | N. hematite structure group                |
| _____ | beryl                 | O. rutile structure group                  |
| _____ | goethite              | P. diaspora, boehmite, gibbsite            |
| _____ | corundum              | Q. epidote                                 |
| _____ | nesosilicate          |  |

 2. Locate ilmenite on a a) weight percent and b) molecular % FeO –  $\text{TiO}_2$  binary diagram. [8 pts]

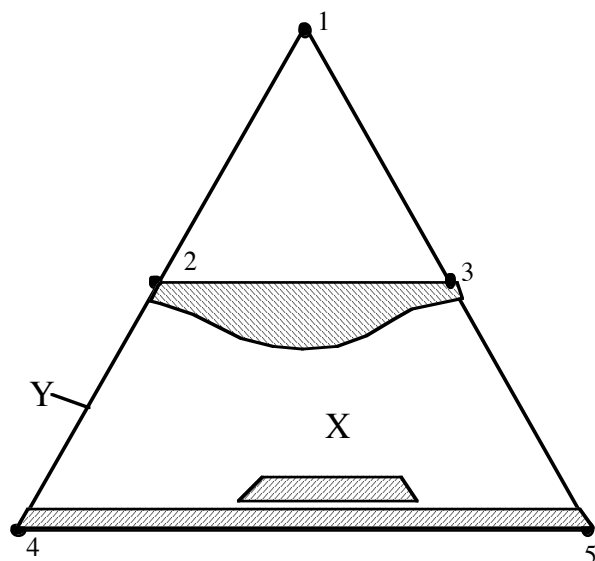
Molecular weights: Fe = 55.86; O = 16.0; Ti = 47.90

3. Two of the principle factors that determine the degree of solid solution in a mineral are: [6 pts]  
a.

b.

4. A prospector brings in a sample for analysis, which from field evidence she suspects is chromium-bearing. The common chromium ore mineral is \_\_\_\_\_ (name, formula). After confirming its identity, you need to determine if it also contains Mg, which might make it unsatisfactory as an ore. What steps would you take to prepare a bulk sample and measure its Mg-content using X-ray Fluorescence spectroscopy (XRF)? How does XRF work? [18 pts]

5. On the diagram at the places with numbers, write in the NAME, the FORMULA and the SHORTHAND SYMBOL for each number on the diagram. What minerals coexist at: [17 pts]  
 X \_\_\_\_\_, Y \_\_\_\_\_.



6. Someone from the local rock club brings you a pale brown mineral. You perform an XRD analysis and cannot distinguish any good peaks. Puzzled, you then perform an XRF analysis and determine the following chemistry: (no calculations necessary, just answer by inspection)

|                                | wt%   |
|--------------------------------|-------|
| SiO <sub>2</sub>               | 32.50 |
| ZrO <sub>2</sub>               | 65.03 |
| Fe <sub>2</sub> O <sub>3</sub> | 0.05  |
| Al <sub>2</sub> O <sub>3</sub> | 1.10  |
| UO <sub>2</sub>                | 1.32  |

[8 pts]

Based on its composition, this mineral would appear to be an impure specimen of (formula, name) \_\_\_\_\_.

Why did your XRD analysis provide no good peaks?

7. List all the major mineral groups we studied this semester (example: elements, sulfides, etc.)  
Include the subgroups of the silicates. [18 pts]
8. The ancient Romans smelted a sulfide mineral to make lead pipes for transporting drinking water.  
(By the way, they extracted all the silver that was in solid solution in this mineral). What  
mineral was that? (name, formula) \_\_\_\_\_ In southern Illinois, that  
mineral is found in association with a zinc sulfide (name, formula) \_\_\_\_\_ and  
a calcium fluoride called (name, formula) \_\_\_\_\_? [6 pts]
10. Questions about garnet: [10 pts]
- a) What is the general formula for garnet?
  - b) of what silicate group is it a member?
  - c) what is garnet's crystallography?
  - d) what are typical forms or habits of garnet crystals?