

**GEOS 3010 Minerals and Rocks
Spring 2009**

Exam 2 Info:

Thurs, Feb 26

Part 1: Multiple choice, T/F, fill-in, matching (20-25 questions)

Part 2: Short answer (a few) and calculations (lots)

The exam will cover lecture and homework activities for the Minerals unit, and reading materials from Chapters 3-7 of the M&RCP. Concentrate your study efforts on the material covered and discussed in lecture – you should be familiar with the material from the readings that we did not discuss in detail in class, but you do not need to know this in detail (examples: Pauling's rules from Chapter 4, methods of chemical analysis from Chapter 5). Specific important concepts are listed below.

For the calculation problems, you DO NOT need to memorize formulas (mathematical formulas or chemical formulas for minerals). Information critical to the problem (such as molecular weights or ionic radii of elements) will be provided for you. However, you should know the general procedure used to solve each of the in-class and homework problems.

Topics to be covered – be able to:

General

- Define a mineral
- Define a crystal
- Explain how minerals and crystals are related
- Explain controls on crystal formation (temp and time) and crystal shape (anhedral, subhedral, euhedral)

Periodic table & chemistry

- Know definitions of atomic mass, number, weight, valence, ionic radius
- Understand relationships in the periodic table – groups and periods (i.e., what does it mean to be a group IIIA element?)
- Bonding – explain why bonding occurs and know the types of bonding common in minerals
- Explain the origin and abundance of earth elements
- Know symbols and valences of common earth elements (O, Si, Al, Fe, Ca, Na, K, Mg, H, P, Ti, Mn)

Coordination polyhedron

- Understand atomic radii and explain importance
- Define coordination polyhedron, understand importance, know the types and how to determine coordination number by cation/anion ratio (CN)
- Know what anion groups are

Solid Solution

- Explain why, how, and under what conditions solid solution occurs
- Know P-T effects on solid solution
- Explain complete, partial, and coupled solid solution; be able to give example of each
- Define polymorph and give example
- Define isomorph, give example, and relate isomorphism to solid solution

Mineral classes

- Know the hierarchy of mineral classification (Class, subclass, group, species, variety) and criteria for each level
- Explain differences between levels

Unit Cell

- Define unit cell
- Explain how concept of unit cell relates to mineral formula and symmetry elements
- Relate unit cell to coordination polyhedron
- Z# - define and know how to determine
- Explain relationship between unit cell and macroscopic crystal forms
- Know names of 6 crystal systems and explain important symmetry elements of each (explain rotational and mirror plane symmetry)

Silicates

- Know importance
- Subclasses – define these, explain how and why silica tetrahedra form, know geometry of each subclass
- Relate subclasses to coordination polyhedron
- Know what a structural formula is (don't need to memorize these)
- Be familiar with major rock-forming silicate groups – names and classes (ones covered in lecture – olivine, garnet, pyroxene, etc.)

Calculations

- Convert between wt% of elements or oxides and atomic proportions
- Write a formula given atomic proportions
- Predict a formula based on element valence
- Read and plot mineral compositions on a ternary diagram
- Identify solid solution and miscibility gaps on a T-X binary phase diagram
- Determine temperature and/or composition of crystal formation on a T-X binary phase diagram
- Calculate Z# based on fractional ion contributions, given a diagram of the unit cell
- Calculate Z# and/or density for a unit cell of a mineral