

Name: \_\_\_\_\_

Geos 306, Mineralogy  
Midterm, Oct 16, 2006  
100 pts

1. (24 pts) In the table below, please fill in the empty cells with crystal systems and their unit cell parameter relations.

System	a	b	c	$\alpha$	$\beta$	$\gamma$

2. (10 pts) Draw and label an illustration of lattice planes in a crystal under diffraction conditions, showing the d-spacing and X-ray waves. Use this drawing to explain Bragg's equation.

3. (10 pts) Several point groups are listed below. Give the crystallographic symmetry associated with each.

a) 4

b)  $2/m$

c) 1

d)  $6/m\ 2/m\ 2/m$

e)  $3\bar{2}$

f)  $322$

g)  $2/m\ 2/m\ 2/m$

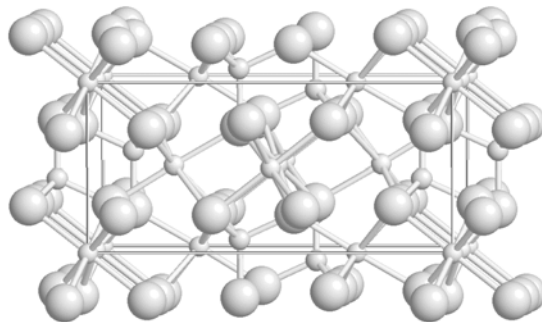
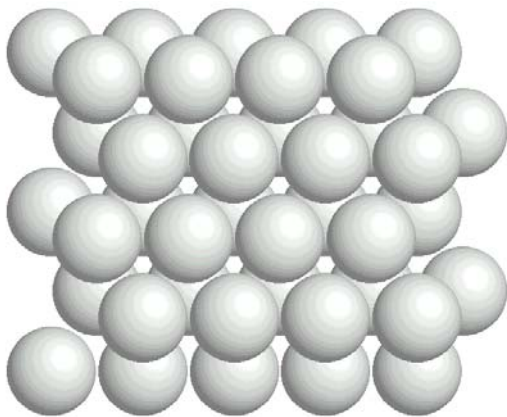
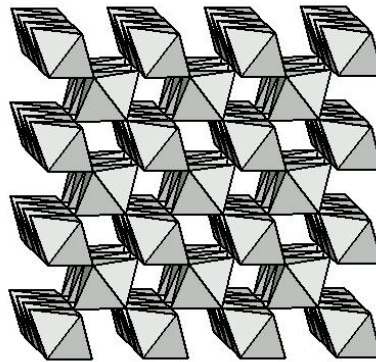
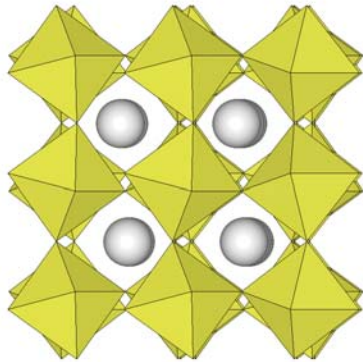
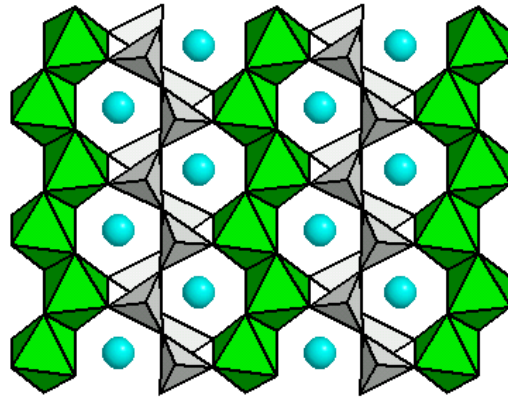
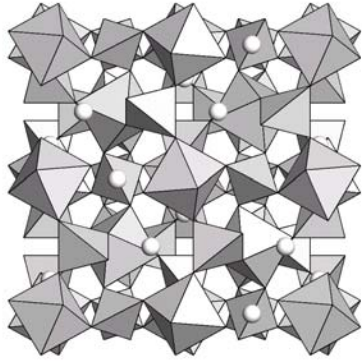
h)  $432$

i)  $4mm$

j)  $2mm$

4. (20 pts) Sketch a diagram showing the structure of the earth. Make a table and define the boundaries of each region by
- a. depth,
  - b. temperature, and
  - c. pressure.
- Include the surface and the center of the earth in your answer.  
List the important mineral phases that are found in each of the different regions.

5. (18 pts) For each illustration:
- Provide representative chemical formula for each, assuming composition is from Mg, Fe, Si, O space.
  - Name the minerals whose structures are illustrated and whose chemistry matches that given in part a).



6. (2 pts) What is the geotherm?

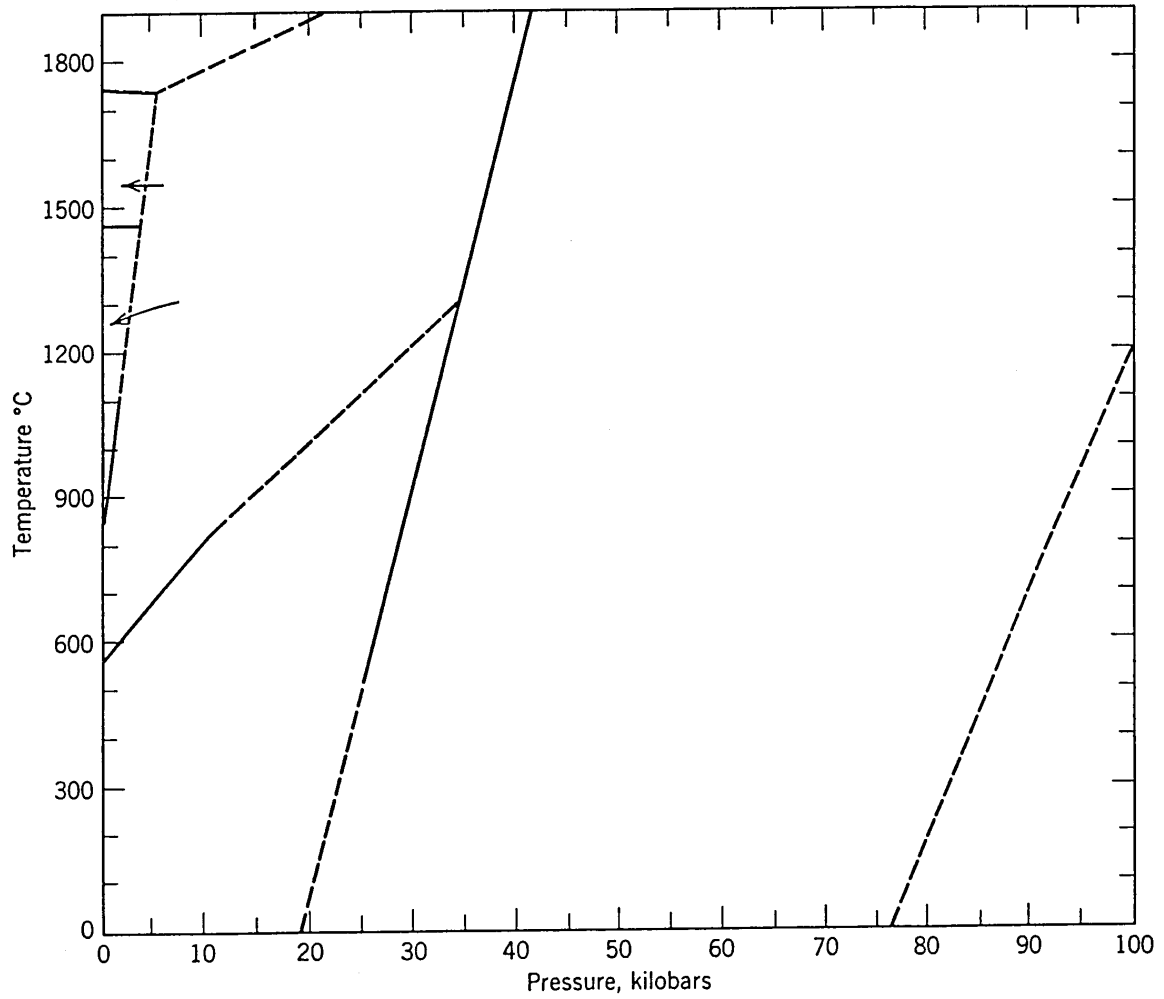
7. (3 pts)

a) What is the most common mineral phase in the Earth?

b) What is the most common mineral phase in the upper mantle?

c) What is the most common mineral phase in the crust?

8. (7 pts) Label the 7 regions of the phase diagram of the natural silica polymorphs with the name of the phase that is at equilibrium at those conditions.



9. (6 pts) The physical properties of crystals can often be described by quadratic functions whose variations are illustrated by ellipsoids. What crystal systems are consistent with ellipsoids with the following shapes:
- a) Spherical
  - b) Three different length axes all oriented parallel to crystallographic axes
  - c) Three different length axes with only one axes parallel to a crystallographic axis.
  - d) One axis that is parallel to a crystallographic axis, and with a perpendicular circular cross-section (2 answers here).
  - e) Three different length axes that have no orientational relationship to the crystallographic axes.