Name:_____

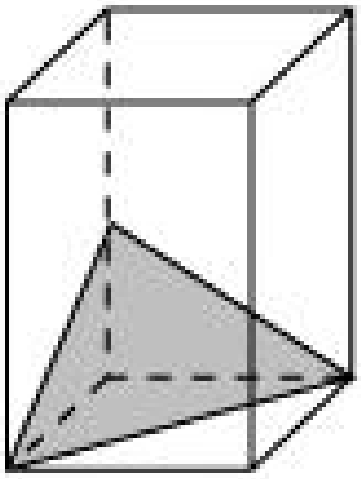
Geos 306
2nd 2008 Midterm (100 pts)

1) (12 pts) Fill in the table that defines the shape and constraints of the unit cell parameters.

System	a	b	c	α	β	γ
Cubic						
Hexagonal						
Tetragonal						
Orthorhombic						
Monoclinic						
Triclinic						

2) (3 pts) Draw a picture of a tetragonal lattice projected onto the *a*-*b* plane (i.e. you do not need to show the c-direction); indicate the origin and the cell edges. Then draw the vector [2 –1 0].

3) (5 pts) In the picture below is an image of a unit cell and a plane. Designate an origin, and label 3 edges as **a**, **b**, and **c**. What are the Miller indices of the indicated plane?



4) (30 pts) Fill in the missing point group symbols and indicate the crystal system for the point groups on a given row.

G	GUGi	HUG\Hi	System
1		n/a	
	2/m		
3		n/a	
	4/m		
		$\bar{6}$	
		2mm	
	$\bar{3}$2/m2/m		
		4mm and $\bar{4}$2m	
		6mm and $\bar{6}$2m	
332		n/a	
	4/m $\bar{3}$ 2/m		

5) (10 pts) Make a careful drawing and derive Bragg's law for X-ray diffraction.

6) (10 pts) Consider a crystal with tetragonal symmetry, a = 4.177 Å, c = 2.665 Å.
   (a) Draw a figure showing the plane (110).
   (b) Compute the d-spacing of (110)?
   (c) Using Cu radiation, λ = 1.54 Å, what position in 2θ would the (110) peak be found.

7) (15 pts) The density of SiO_2 quartz is 2.64 g/cm^3. Cristobalite is a high-temperature phase of silica, SiO_2, found in volcanic rocks. It is tetragonal with cell edges a = 4.9717 Å, c = 6.9223 Å and Z = 4 (i.e. 4 formula units per unit cell). Recall that Avogadro's number is 6.023×10^{23} mole^{-1} and that 10^8 Å = 1 cm.

   a) Determine the cell volume of cristobalite.
   b) Determine the molecular weight of SiO_2.
   c) Determine the density of cristobalite in units of gm/cm^3.
   d) Why should the density of cristobalite be greater or less than quartz?

8) (15 pts) From the microprobe analyses of a mineral, the following oxide weight percents were measured. Determine the chemical composition of this sample.

	Weight percent			
MgO	30.00			
Al_2O_3	25.29			
SiO_2	44.71			

Bonus point: name the mineral!