Name _____

GEOL 3010 Sample Final Exam

I. (15) Define the following:

A. Mineral

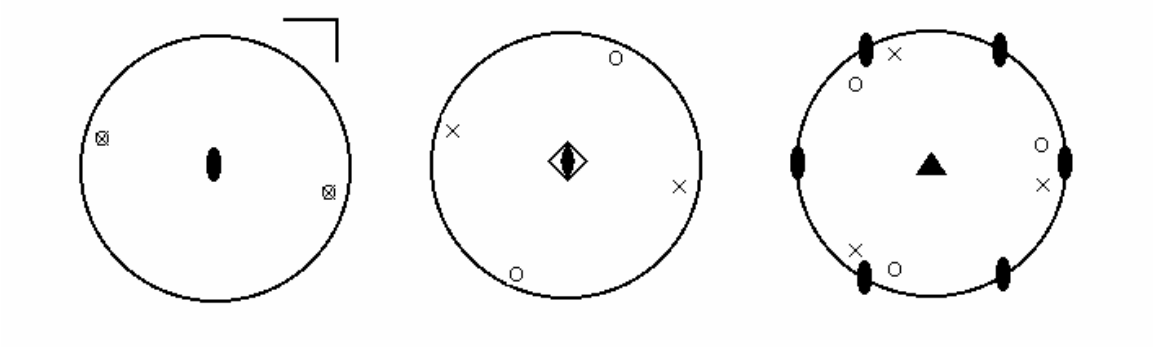
B. Glide plane

C. Siderophile

D. Birefringence

E. Optic normal

II. (6) For each of the following point-group symmetry diagrams, identify the point group (crystal class) and crystal system

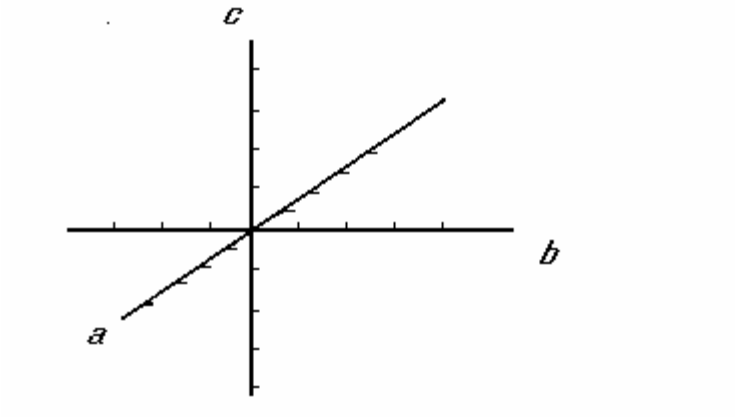


A B. C.

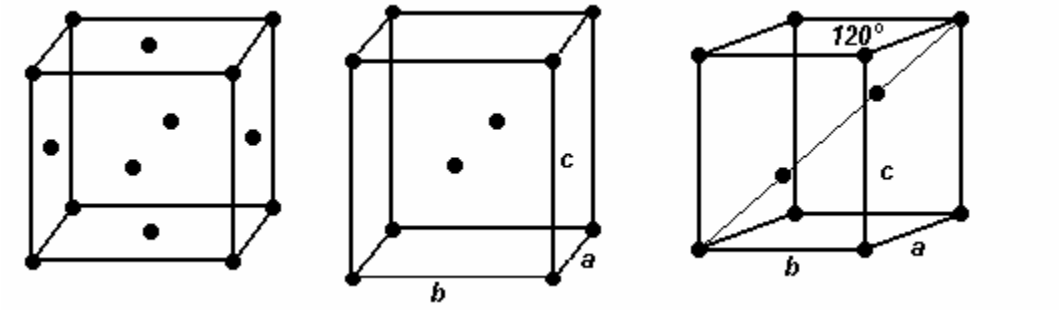
Point Group: _____ _____ _____

Crystal System:_____ _____ _____

III.(6) Illustrated below are a set of orthogonal crystallographic axes with unit-cell tic marks. Draw on the diagram the axial intercepts of a lattice plane with Miller indices (2 0 3).



IV. (6) Identify the lattice type (P, A. B, C, I, F, or R) and give the multiplicity for each of the following:



_____ _____ _____

_____ _____ _____

V. (12) Name the crystal system for each of the following sets of axial constraints. For each, give also the optic class (Isotropic (I), Uniaxial(U), or Biaxial (B).

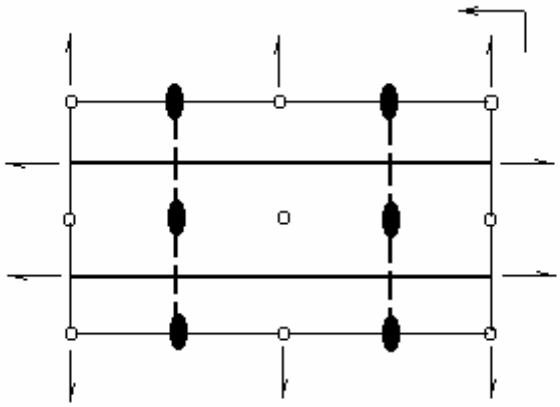
	Constraints	Optic Class
A. $a = b = c$; $\alpha = \beta = \gamma = 90^\circ$	_____	_____
B. $a = b$; $\alpha = \beta = 90^\circ$ $\gamma = 120^\circ$	_____	_____
C. No axial or angle constraints	_____	_____
D. $\alpha = \gamma = 90^\circ$	_____	_____
E. $\alpha = \beta = \gamma = 90^\circ$	_____	_____
F. $a = b$; $\alpha = \beta = \gamma = 90^\circ$	_____	_____

VI. (8) Shown below is a symmetry diagram for a primitive orthorhombic space group in standard orientation (*a*-vertical, *b* horizontal, and *c* normal to page). Give the Hermann-Mauguin symbol for the space group and for the crystal class (point group) to which it belongs.

	axis	plane
a	_____	_____
b	_____	_____
c	_____	_____

H-Msymbol _____

Point Group _____



VII. (12) Last July, some colleagues and I synthesized a sample of the mineral ringwoodite using the 5000-ton press at the Bavarian Geological Institute at Bayreuth in Germany. Ringwoodite is the high pressure form of olivine $(Mg,Fe)_2SiO_4$ but unlike olivine, it can accept significant amounts of hydrogen. It is thought to be a major component of the mantle between depths of 525 and 670 km. Given below is a chemical analysis of the sample we made. Calculate the formula (Numbers of Si, Mg, Fe, and H cations per four oxygens) and its formula weight.

Oxide	MolWt Oxide	Wt%
SiO_2	60.086	39.82
MgO	40.312	45.89
FeO	71.846	11.46
H_2O	18.015	2.83

	AtWt	Cations per 4 Oxygens
Si	28.087	
Mg	24.305	
Fe	55.847	
H	1.008	

Formula Weight:

VIII. (10) Ringwoodite is a spinel, and I measured its cubic (Z=8) cell parameter as 8.0924Å. Calculate the density of this sample.

IX. (5) Ringwoodite has an index of refraction of 1.710. What is the speed of light in ringwoodite?

X. (10) Name a mineral and give the formula in each of the following groups:

A. Phosphate _____ _____

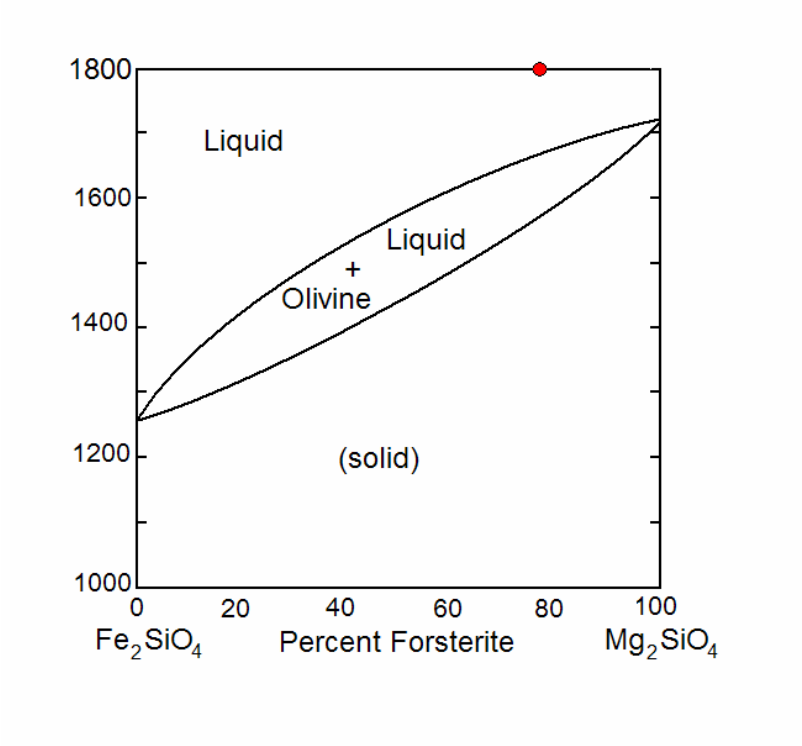
B. Oxide_____ _____

C. Carbonate _____ _____

D. Sulfide _____ _____

E. Sulfate _____ _____

XI (10) Below is a melting (T-X) diagram for forsterite (Mg_2SiO_4) – fayalite (Fe_2SiO_4). Starting with a liquid of composition 80% Fo and 20 % Fa at 1800ºC (dot) answer the following questions based on the diagram assuming perfect equilibrium between crystals and solid:



A. At what temperature do the first crystals form? _____

B. What is the composition of the first crystals to form? _____

C. How many phases are present at 1600ºC? _____

D. At what temperature does the last liquid disappear? _____

E. What is the composition of the last liquid to crystallize? _____

XII. (2 extra) Circle the correct spelling:

A. Mineralogy, Minerology, Minorology

B. Occurance, Occurrence, Occurrance, Occurence, Ocurense, Occurrense