Name _____

GEOL 3010 Hour Exam I Sample

I. (24) Define the following:

A. Mineral

A mineral is a naturally occurring homogeneous solid with a definite, but not fixed, chemical composition and ordered atomic arrangement that is formed by inorganic processes.

B. Polymorph

Two minerals or compounds with the same composition but different crystal structures.

C. Crystal form

A crystal form is a crystal face plus its symmetric equivalents

D. Vitreous

A term describing a glassy luster.

E. Chalcophile

Those chemical elements that form covalent bonds with sulfur and are enriched in the Earth's core but depleted in the crust and mantle relative to solar abundances

F. Atmophile

Those chemical elements that form weak Vander Waals bonds and are enriched in the atmosphere and outer planets but depleted in the Earth relative to solar abundances

II. (9) Give an example of a mineral with the following values of Mohs' hardness:

A. 1. **Talc**_____ D. 6. _**Orthoclase**_____

B. 3. **Calcite** _____ E. 8. ___**Topaz**_____

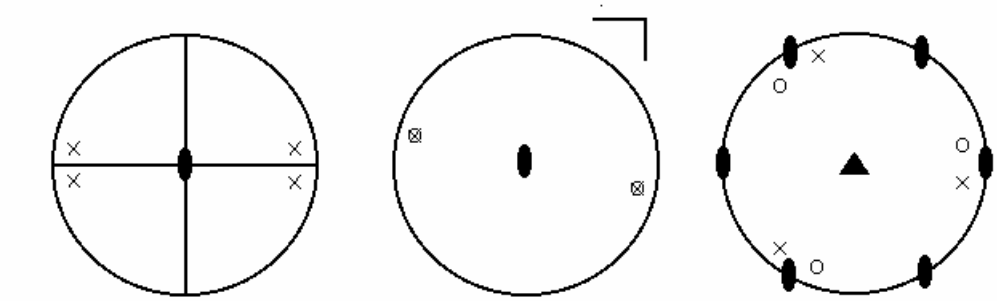
C. 4. **Fluorite**_____F. 10. ___**Diamond**_____

III. (15) Write the number of the appropriate mineral group (right column) next to the following minerals (left column):

a. ___**8**__ Celestine ($SrSO_4$)
b. ___**7**__ Galena (PbS)
c. ___**6**__ Sylvite (KCl)
d. ___**3**__ Biotite ($K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$)
e. ___**4**__ Sanidine (feldspar) $KAlSi_3O_8$
f. ___**2**__ Proto-enstatite ($MgSiO_3$)
g. ___**5**__ Graphite (C)
h. ___**1**__ Olivine (Mg2SiO4)
i. ____**10** Witherite ($BaCO_3$)
j. ___**9**__ Apatite ($Ca_5(PO_4)_3OH$

1. Orthosilicate
2. Chain Silicate
3. Layer Silicate
4. Framework Silicate
5. Native Element
6. Halide
7. Sulfide
8. Sulfate
9. Phosphate
10. Carbonate

IV. (12) For each of the following point-group symmetry diagrams, identify the point group (crystal class) and crystal system

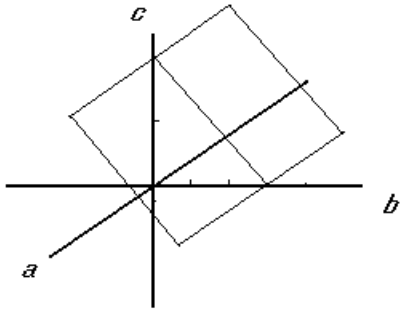


A B. C.

Point Group: _____**2mm**_____ _____**2/m**_____ _____**32**_____

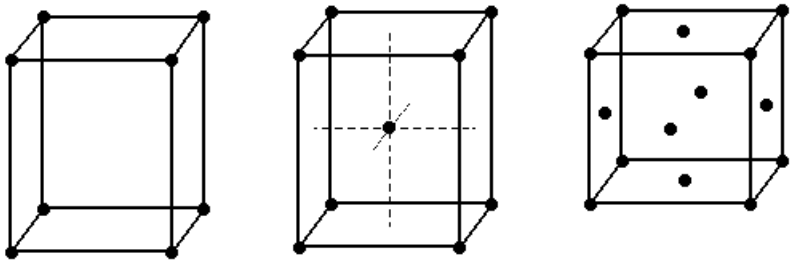
Crystal System:___**Orthorhombic**__ ____**Monoclinic**___ _____ **Trigonal**__

V. (6) As illustrated below, a lattice plane intercepts the *b*-axis at 3 units, the *c*-axis at 2 units, and is parallel to *a*. Give the Miller indices for the plane.



(∞,3,2) = (1/∞, 1/3, ½) = (0, 2, 3)

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



_____**P**____ ____**I**_____ ____F_____

VII. (12) Identify the crystal system:

A. $a = b = c$; $\alpha = \beta = \gamma = 90^\circ$ _____**cubic**_____

B. $a = b \neq c$; $\alpha = \beta = \gamma = 90^\circ$ _____**tetragonal**_____

C. $a \neq b \neq c$; $\alpha = \beta = \gamma = 90^\circ$ _____**Orthorhombic**_____

D. $a = b \neq c$; $\alpha = \beta = 90^\circ$, $\gamma = 120^\circ$_____**Hexagonal Trigonal**_____

E. $a \neq b \neq c$; $\alpha = \gamma = 90^\circ$ _____**Monoclinic**_____

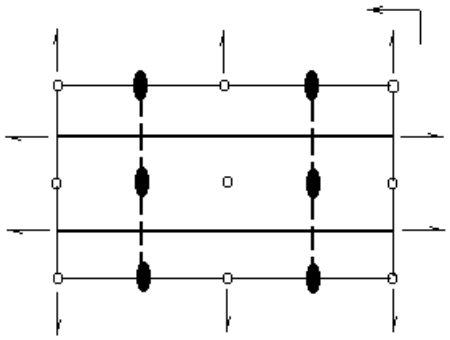
F. $a \neq b \neq c$; _____**Triclinic**_____

VIII. (8) Shown below are two symmetry diagrams for primitive orthorhombic space groups in standard orientation (a-vertical, b horizontal, and c normal to page). Give the Hermann-Mauguin symbol for thee space group and for the crystal class (point group) to which it belongs.

	axis	plane
a	_____	_____
b	_____	_____
c	_____	_____

H-Msymbol _____

Point Group _____



P 2_1/m 2_1/a 2/b = Pmab

IX. (10) Last year, some colleagues and I synthesized a sample of clinopyroxene at 120 kbar and 1400ºC using the 5000-ton press at the Bavarian Geological Institute at Bayreuth in Germany. Given below is a chemical analysis of the sample we made. Calculate the formula (Numbers of Si, Mg, and Fe cations per six oxygens).

Oxide	MolWt Oxide	Wt%	**Mols Oxide**	**Mols Cation**	**Mols Oxygen**
SiO_2	60.086	59.00	**0.9819**	**0.9819**	**1.9639**
MgO	40.312	37.77	**0.9369**	**0.9369**	**0.9369**
FeO	71.846	3.23	**0.0450**	**0.0450**	**0.0450**

6 / 2.9458 = 2.0368

Atom	AtWt	Cations per 6 Oxygens
O	15.9994	6.000
Si	28.087	**2.000**
Mg	24.305	**1.908**
Fe	55.847	**0.092**

___