GEOL3010 Exam II Sample

I. (20) Define the following terms and give an example of how each might be used to distinguish various minerals:

A. Refraction

B. Dispersion

C. Pleochroism

D. Diffraction

E. Birefringence

Other terms

Optic axis, optic plane, optic normal, biaxial, uniaxial, b x a, b x o, Raman, Moessbauer, Indicatrix, Becke Line, Solidus, Liquidus, Solvus

II. (15) Last summer I synthesized a sample of ringwoodite at 20 GPa and 1400ºC using a 5000-ton multi-anvil press. Given below is a chemical analysis of the sample. Calculate the formula (Numbers of Si, Mg, and Fe cations per four oxygens).

Oxide	MolWt Oxide	Wt%
SiO_2	60.086	41.80
MgO	40.312	53.51
FeO	71.846	4.69

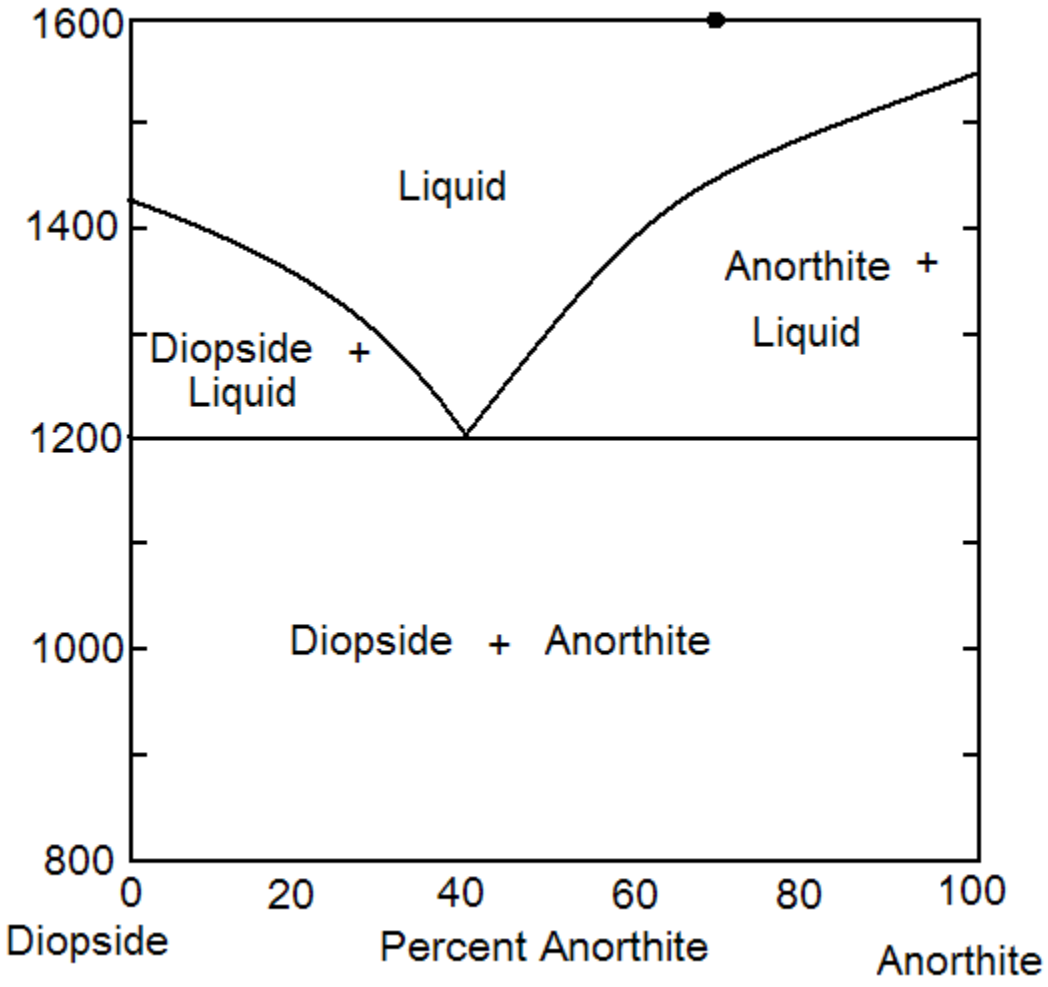
Atom	AtWt	Cations per 4 Oxygens
O	15.9994	
Si	28.087	
Mg	24.305	
Fe	55.847	

II. A. (10) Cuprite, Cu_2O, is a minor ore of copper and one of two hemi-oxide minerals. (The other one is ice.) The crystal structure of cuprite is cubic with a cell edge of 4.27Å and Z of 2. Cu_2O has a molecular weight of 143.09 g. Calculate the density of cuprite.

II. B. (10) The index of refraction of cuprite is 2.85, nearly the highest of any mineral and higher than diamond. What is the speed of light in cuprite?

III. (10) Calculate the 2θ angle for Cu Kα radiation (λ = 1.5405Å) for the (110) and (211) X-ray diffraction peaks of cuprite.

X (10) Below is a melting (T-X) diagram for diopside ($CaMgSi_2O_6$) – anorthite ($CaAl_2Si_2O_8$). Diopside is a pyroxene and anorthite is a feldspar so there is no solid solution between them. Starting with a liquid of composition 70% anorthite and 30 % diopside at 1600ºC (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. How many phases are present at 1300ºC? _____

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

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