UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF GEOLOGY

MODULE CODE	**GLG1B10**
MODULE NAME	**Optical and Analytical Mineralogy**
CAMPUS	**APK**
EXAM	**December 2014 (Supplementary Exam)**

Date	**December 2014**
Assessor(S)	**Mrs Lauren Blignaut & Mr Mike Knoper**
Internal Moderator	
External Moderator	
Duration	**3 hours**
Marks	**180**

Number of pages	**4 (including front page)**
Instructions	**Answer all the questions**

GLG1B10 Optical and Analytical Mineralogy
Supplementary exam questions 2014

Section A: Optical Mineralogy (90 marks)

Question 1

(a) Give the definition of a mineral **(5 marks)**
(b) Which crystal systems do fluorite, turquoise, apatite and amphibole come from? Graphically explain these systems and clearly state what the relationships are between the lengths of the axes and the angles in-between them **(20 marks)**

Question 2

(a) What is particle-wave dualism? **(5 marks)**
(b) Give the equation for the refractive index, and state what each symbol represents **(5 marks)**

Question 3

(a) With regards to bonding forces, how do isotropic and anisotropic minerals differ? **(2 marks)**
(b) What is double refraction? **(3 marks)**
(c) What is the gypsum plate? **(4 marks)**
(d) If the slow wave of the gypsum plate is parallel to the slow wave of the mineral, for a 1V- mineral, what is the slow wave? **(1 mark)**

Question 4

What are the steps for making an interference figure (must be in the correct order)? **(6 marks)**

Question 5

(a) Draw the indicatrix of a 2V+ mineral. Indicate all the axes and the refractive indices, as well as the 2V angle. Indicate what BXO and BXA is **(10 marks)**
(b) Mineral identification indicates that a mineral is 2V-. Draw the optic figure, indicating the 'quadrants', and respective colours and signs. Explain what is occurring in the figure in order for it to be a 2V+ mineral **(7 marks)**

Question 6

(a) What is Carlsbad twinning? Give 2 mineral examples (including their signs and angles) of this type of twinning **(7 marks)**
(b) What is feldspar zoning and list the 3 types **(7 marks)**

Question 7

(a) What is the main difference between pyroxenes and amphiboles? **(2 marks)**
(b) Which 2 pyroxene minerals have the highest pleochroism? **(2 marks)**
(c) Give the name of the amphibole minerals that have the optic sign and angle below **(4 marks)**

(1) 2V+; 70 - 90°
(2) 2V-; 52 – 85°
(3) 2V+; > 90°
(4) 2V-; 0 - 68°

Section B: Analytical Mineralogy (90 marks)

Question 1

(a) Give the definition of a mineraloid, and give an example **(4 marks)**
(b) Give an example of a polymorph **(1 mark)**

Question 2

Indicate to which Family and Group each of the following minerals come from. Give the chemical formula and Si:O ratio of each mineral, and provide one example of a rock where the mineral commonly occurs **(36 marks)**
(a) Forsterite
(b) Almandine
(c) Lawsonite
(d) Schorl
(e) Diopside
(f) Grunerite

Question 3

(a) Explain the formation and occurrence of olivine **(6 marks)**
(b) In the presence of CO_2, brucite reacts to form which mineral? Provide the chemical equation **(5 marks)**

Question 4

(a) What is zircon used for **(2 marks)**
(b) Give the occurrence of clinozoisite, and which minerals are associated with it **(5 marks)**

Question 5

Explain the difference between pyroxenes and pyroxenoids **(12 marks)**

Question 6

Give the trioctahedral schematic development of phyllosilicate structures, including mineral examples of each **(12 marks)**

Question 7

Two structural states of feldspars are common in igneous rocks. What are they? **(4 marks)**

Question 8

What determines the variety of mineral that forms in a natural environment **(3 marks)**