



The American University of Beirut
Final Examination



Optical Mineralogy (212)
Department of Geology
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Feb. 1, 2000
Time: 2 hours
Exam rules apply

Part I

Answer all 3 questions of Part I

(MARKS)
(20)

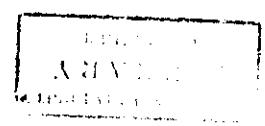
1. a) A uniaxial mineral has two refractive indices; $n_1 = 1.54$ and $n_2 = 1.66$
Which one is that of the fast ray? Why?
- b) A biaxial mineral has the following refractive indices: $n_\alpha = 1.604$, $n_\beta = 1.621$, $n_\gamma = 1.711$
i) Use the proper formula to calculate δ .
ii) Is this mineral B+ or B-?
iii) What is the numerical value of n_α ?
iv) What is the numerical value of n of the oil that would produce a minimum relief for a grain of this mineral that gives an optic axis figure?
- c) In a comparative table format show how do you distinguish (under a polarizing microscope) between the following pairs of minerals (make use of at least three optical properties for each pair):
i) talc and tremolite
ii) forsterite and diopside
iii) zircon and sphene

(15)

2. Concisely define or describe the following terms:
a) Brewster's angle b) Indicatrix
c) BXA d) Snell's law
e) Apparent optic angle F) Retardation
g) Fraunhofer lines

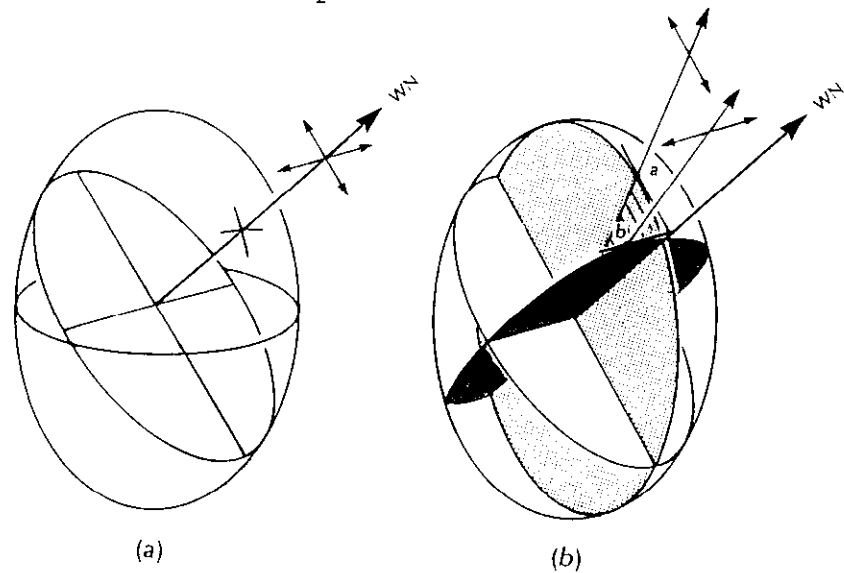
(15)

3. a) Neatly sketch a fully labelled ZX plane (or principal section) of a biaxial, positive indicatrix.
- b) Describe one common method to determine plagioclase composition (use the appropriate diagrams to support your answer).
- c) The diagram (Fig.1) given below is generally used to determine n , vibration directions, and ray directions, given a wave normal (WN) direction



within a biaxial mineral. Fully label this diagram, and describe the procedure used to determine these parameters.

Figure 1

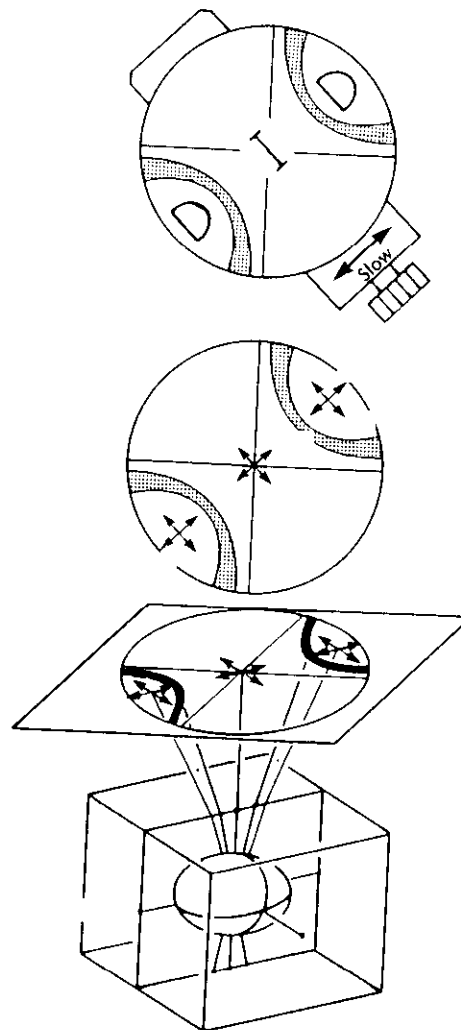


Part II

Answer only two of the following three questions.

- (15) 4. List the methods of determining the optic angle ($2V$) of a mineral. Describe in detail the fundamental operations for both Wright's method and Kamb's method (use diagrams along with text to illustrate your answer).
- (15) 5. a) Using grain mounts, describe in detail the method of determining the colour of n_{γ} of a biaxial mineral.
- b) Isogyres of an interference figure of a mineral found to completely leave the field of view with less than 5-degrees of stage rotation from the 90-degree position:
- i) Indicate the type of the interference figure that conforms with the above information.
 - ii) would such a mineral grain produce (in orthoscopic illumination) a low, a high, or an intermediate birefringence?
 - iii) Use a diagram (say an orthorhombic crystal) to show the orientation (and other features as axes) along which the section was cut to give such an interference figure.
- c) Use the diagram given below to explain the method of determining the optic sign of a biaxial mineral (Label the missing information on the

diagram).



6. a) You are given a thin section containing one unknown mineral and another known mineral. Using the interference colour chart, explain how do you determine the thickness of the thin section, and the numerical birefringence of the unknown mineral (use diagrams when applicable).
- b) Use the diagram given below to explain the formation of colored Becke lines and discuss the way these colored Becke lines move with respect to the mineral and the oil upon increasing the distance between the sample and the objective lense in case (a) indices of mineral and oil matched for light whose wavelength is 589 nm, (b) indices of mineral and oil matched near the red end of the spectrum, and (c) indices of mineral and oil matched near the blue end of the spectrum.

Diagram for question # 6b

