F16t02

University of Pretoria
Department of Geology

Time: 1.5 hours

Exam GLY 251 - CRYSTAL OPTICS AND CHEMISTRY

29 May 2008   Internal examiner: Prof R.K.W. Merkle
                           External examiner: Dr. M. Rigby

Answer all questions. Write legibly. No creative spelling permitted. Use sketches where applicable. Points for each question are given in brackets.

1   How is uniaxial and biaxial character related to the crystallographic systems? [10]

2   What is the Becke line, how is it generated, and what is its use? [10]

3   Strontium can substitute for Ca in some pyroxenes. Explain why and when you reckon such a substitution is possible. [6] In which group of pyroxenes can you expect higher Sr contents? [4]

4   What is densest packing, in which crystal systems can that happen, and how do the packings differ? [10]

5   Explain and calculate a Miller index of your choice. [5] How do you write the direction perpendicular to your chosen plain? [5]

6   A garnet with Al as the only 3+ cation has $Fe_{0.488}Mn_{2.512}$ as part of the mineral formula. What is the alumina content in weight % ? [10]

Molecular weights are:

SiO2   60.08
Al2O3   101.96
FeO   71.85
MnO   70.94
CaO   56.077
Na2O   61.979

7   The analysis below (in weight-%) is suspected to be a feldspar. Give the mineral formula [10] and discuss whether the crystal chemical rules for feldspar are fulfilled. [10] How can you be sure that this is not a pyroxene? [5]

SiO2   53.06   CaO   12.81
Al2O3   29.74   Na2O   4.06

8   A mineral analysis gives :

	Wt%
TiO2	1.300
Al2O3	14.810
Cr2O3	42.200
V2O3	0.500
FeO	31.000
MnO	0.300
MgO	8.500
NiO	0.400
TOTAL	99.010

MOLECULAR WEIGHTS

TiO2	79.88
Al2O3	101.96
Cr2O3	151.99
V2O3	149.88
Fe2O3	159.69
FeO	71.85
MnO	70.94
MgO	40.3
NiO	74.693

Calculate the mineral formula [10] and argue your reasons for naming this mineral. [10]