

Exam GLY 251 - CRYSTAL OPTICS AND CHEMISTRY

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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 plane? **[5]**
- 6 A garnet with Al as the only 3+ cation has  $\text{Fe}_{0.488}\text{Mn}_{2.512}$  as part of the mineral formula. What is the alumina content in weight % ? **[10]**

Molecular weights are:

SiO <sub>2</sub>	60.08
Al <sub>2</sub> O <sub>3</sub>	101.96
FeO	71.85
MnO	70.94
CaO	56.077
Na <sub>2</sub> O	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]**

SiO <sub>2</sub>	53.06	CaO	12.81
Al <sub>2</sub> O <sub>3</sub>	29.74	Na <sub>2</sub> O	4.06

8 A mineral analysis gives :

	Wt%
TiO <sub>2</sub>	1.300
Al <sub>2</sub> O <sub>3</sub>	14.810
Cr <sub>2</sub> O <sub>3</sub>	42.200
V <sub>2</sub> O <sub>3</sub>	0.500
FeO	31.000
MnO	0.300
MgO	8.500
NiO	0.400
TOTAL	99.010

MOLECULAR WEIGHTS	
TiO <sub>2</sub>	79.88
Al <sub>2</sub> O <sub>3</sub>	101.96
Cr <sub>2</sub> O <sub>3</sub>	151.99
V <sub>2</sub> O <sub>3</sub>	149.88
Fe <sub>2</sub> O <sub>3</sub>	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]**