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UNIVERSITY OF PRETORIA

GLY 251 - CRYSTAL CHEMISTRY AND OPTICS

1. Semester test

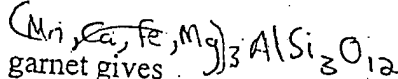
Answer all the questions and use sketches where applicable.

Theory questions [5 marks each]

- 1 Explain the difference between the generation of continuous X-rays and of characteristic X-rays. *fine when atoms decelerates*
fine when collage of electrons makes a space point (high intensity)
- 2 Explain why there is a finite number of specific wavelengths for a given element.
- 3 Discuss how solid solution and exsolution are related and what controls them.
- 4 What stacking order does cubic densest packing have?
- 5 What is the difference between the orthorhombic, monoclinic, and triclinic systems? *1 cell 3 fold axis*
- 6 Sketch a rough triangular diagram and label the apices as Na (bottom left), K (bottom right) and Ca (top). Plot the feldspar minerals in terms of their molar proportions.
- 7 If $\text{CuK}\alpha = 1.54178 \text{ \AA}$ and the 2θ angle is 45° , what d-spacing would be represented in an XRD pattern?
- 8 Explain the law on which question 7 is based.
- 9 Discuss whether a 2-fold rotation axis and a mirror plane can have the same effect in a crystal lattice.
- 10 What does (111) mean and what is described?

Practical questions

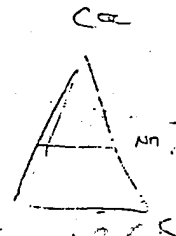
1 An analysis of a garnet gives



SiO ₂	37.233
TiO ₂	0.021
Al ₂ O ₃	20.877
FeO	25.277
MnO	6.663
MgO	2.186
CaO	7.334
TOTAL	99.591

MOLECULAR WEIGHTS

SiO ₂	60.08
TiO ₂	79.88
Al ₂ O ₃	101.96
FeO	71.85
MnO	70.94
MgO	40.3
CaO	56.08



50%

24
20
44

99

Pyrox
= $\text{Na}_3\text{Al}_2\text{Si}_3\text{O}_{12}$

silicate) and to what group garnet belongs [5]

An oxide mineral gives the analysis:

	Wt%
SiO ₂	0.345
TiO ₂	6.577
Cr ₂ O ₃	2.5
V ₂ O ₃	0.150
FeO	81.800
MgO	3.3
TOTAL	94.672

MOLECULAR WEIGHTS	
SiO ₂	60.08
TiO ₂	79.88
Cr ₂ O ₃	151.99
V ₂ O ₃	149.88
FeO	71.85
MgO	40.3

$FeTiO_3$ - limenite

$FeCr_2O_4$

Calculate the mineral chemical formula of this spinel [10] and give a revised analysis if necessary [10].

3. Is the following analysis an example of maucherite ($Ni_{11}As_8$) or of nickeline ($NiAs$)? Give your arguments [10]

Element	Mass %	Mass
Fe	29.4	55.847
As	69.8	74.922
S	0.21	32.066
Total	99.71	

	Mol. weight	Wt - %	cation equiv	Mol of O	To 4
* Cr_2O_3	151.99	2.5	0.032897	0.01645	0.1145
* FeO	71.81	81.800	1.13912	1.13912	3.964
				1.14957	4

factor = 1.1493605

$\therefore (Fe_{3.964} Cr_{0.1145}) O_4 = 3.48$