

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 are the crystallographic systems related to the optical character (I am not asking for positive or negative!) of minerals and why is there a maximum number of optical axes? [10]
- 2 Discuss the difference in the requirements for the unit cell of mineral X (take your pick) for the case that it is euhedral or anhedral [5]
- 3 Sketch an octahedral coordination. [5]
- 4 There are reasons why thin sections have a certain thickness. Please discuss the physical background why that has to be. [10]
- 5 If you consider Goldschmidt's rules, the sizes of ions and their charges, coordination numbers, and symmetry elements: should there be an infinite number of minerals? [10]
- 6 Describe how characteristic X-rays are generated, derive Bragg's law and discuss how this is used to identify minerals. [10]
- 7 Write down the general formulae (i.e., taking all possible substitutions into account) of clinopyroxene, olivine, and feldspar. [10]

Atomic weights are: O = 15.999, Al = 26.982, Fe = 55.847, Ti = 47.88, Mn = 54.938, S = 32.066, Cu = 63.546, Ni = 58.6934, Co = 58.9332, Si = 28.0855, Ca = 40.078

- 8 An electron micro probe analysis gives:

S	Fe	Cu	Ni	Co	Total
33.58	31.97	0.00	28.56	6.09	100.20

- a) Discuss whether this mineral can be a derivative of a pyrite-type mineral. [5]
  - b) Derive the likely mineral formula (explain your approach!) and give the correct name to this mineral. [10]
- 9 In this garnet, assume that Fe is in the 2+ state. Please calculate the mineral formula [15]

Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	CaO	TiO <sub>2</sub>	MnO	FeO	Total
20.72	35.63	0.41	0.17	41.5	1.06	99.53