ORDRE DES INGÉNIEURS DU QUÉBEC

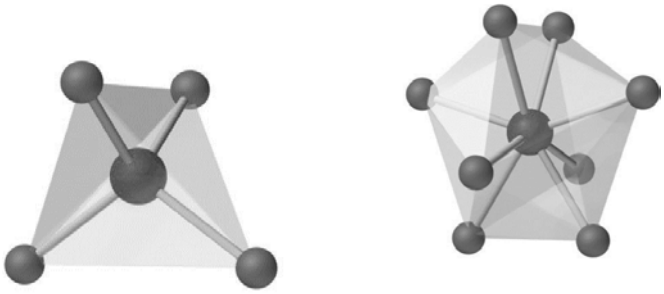
MAY 2018 SESSION

Open Book Exam Only approved calculators are permitted Time: 3 hours

14-GE-A1
Mineralogy and Petrology

Question 1 (20 marks)

Scheelite is a mineral species of general chemical ABX_4, often of composition $CaWO_4$. The structure of scheelite has two sites (polyhedra) A et B shown below.



a) What are the coordination numbers of these two polyhedra? (5 marks)

b) The ionic radii of Ca^{2+} and W^{6+} are 1.00 Å and 0.42Å, respectively. In which polyhedral do Ca and W fit? (5 marks)

c) The following ionic radii are given: Tc^{7+} = 0.37Å; Ba^{2+} = 1.42Å; Mo^{6+} = 0.41Å; Pb^{2+} = 1.29Å; Mg^{2+} = 0.89Å. In which polyhedron fits each of these ions? (5 marks)

d) A chemical analysis of a scheelite sample gives the following results, in % mass of oxides: WO_3 = 80.17%; MoO_3 = 0.07%; MgO = 0.21% and CaO = 19.49%.
Calculate the structural formula of the scheelite knowing that the molecular weights are: WO_3 = 231.85; MoO_3 = 143.94; MgO = 40.31; CaO = 56.07. (5 marks)

Question 2 (10 marks)

Quartz is a very abundant mineral in several types of rocks. The structure od quartz is built exclusively of SiO_4 units. How do you justify that the chemical formula of quartz is SiO_2?

Question 3 (10 marks)

A thin section of anorthosite observed in plane-polarised light contains many different grains of the same mineral (plagioclase feldspar). No boundaries can be seen between grains. Explain why?

In crossed polars, can you distinguish between different grains? If so, what is the explanation for this?

Question 4 (20 marks)

A complex ore contains quartz (SiO_2), galena (PbS), pyrite (FeS_2) and chalcopyrite ($CuFeS_2$).

The chemical analysis of the ore is:
SiO_2: 71%
Pb: 6.06%
Cu: 3.46%
Fe: 8.63%
S: 10.85%

Calculate the mass % of each mineralogical species.

Question 5 (20 marks)

Describe each of the following rocks, specifying the main characteristics that allow us to distinguish between them.

a) Quartzitic sandstone

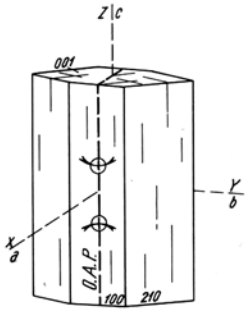
b) Rhyolite

c) Granitic gneiss

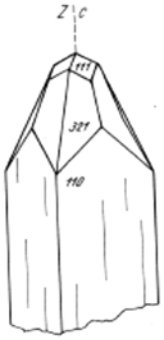
d) Quartzite

Question 6 (20 marks)

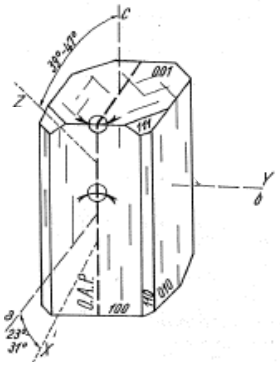
From the block diagram describing the optical properties of minerals, complete the following table.



A



B



C

Block	Crystal System	Cleavage	Optic Sign	Extinction Angle
A				
B				
C				