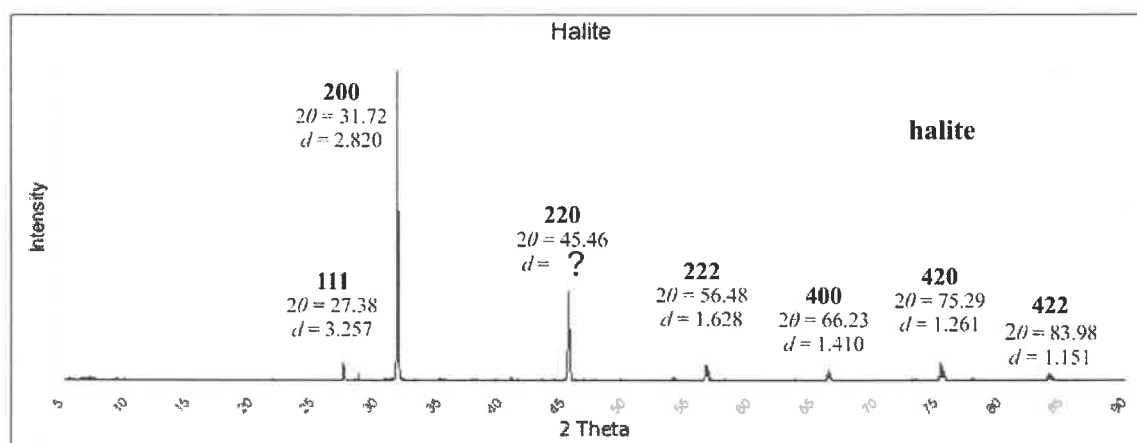


1. Give the definition of a mineral. (10 pt)
2. Explain and plot the Bowen's Reaction series. Please also explain the relationship between Bowen's Reaction series and the crystal structure of silicate minerals. (15 pt)
3. Make spin diagrams that describe the electronic structures of Cr^{2+} and Fe^{2+} . (^{24}Cr , ^{26}Fe) (10 pt)
4. What is polymorph? Explain it and have one example. (10 pt)
5. (a) Using two parallel planes (periodic atomic arrangement) to explain Bragg's law by plotting the relationship among x-ray wavelength, interatomic spacing, and diffraction angle. (10 pt) (b) Write down the equation and use it to calculate the missing d value in the below figure. (5 pt)



(題目將用本張複印製版請以黑色正楷書寫或打字並請勿超出此線)

命題人
簽章

高立誠

6. Read the following description about SANIDINE and answer the questions

SANIDINE—(K,Na)AlSi₃O₈

IV

Crystallography. Monoclinic; $2/m$. Crystals are often tabular parallel to {010}; also elongated on a with square cross section as in Fig. 19.78a. Carlsbad twins common.

$C2/m$; for high sanidine, $a = 8.56$, $b = 13.03$, $c = 7.17$ Å; $\beta = 115^\circ 59'$; $Z = 4$. d_s : 4.22(6), 3.78(8), 3.31(10), 3.278(6), 3.225(8).

Physical Properties. *Cleavage* {001} perfect, {010} good. $H = 6$. $G = 2.56$ – 2.62 . *Luster* vitreous. *Color* colorless and commonly transparent. *Streak* white. *Optics*: (–); $\alpha = 1.518$ – 1.525 ; $\beta = 1.523$ – 1.530 , $\gamma = 1.525$ – 1.531 . Occurs in two orientations with optic plane parallel with {010} and $2V = 0^\circ$ – 60° , and with optic plane normal to {010} and $2V = 0^\circ$ – 25° .

Composition and Structure. A complete solid solution exists at high temperature between sanidine and high albite; part of the intermediate region is known as *anorthoclase* (see Fig. 18.47). The structure of sanidine shows a disordered (random) distribution of Al and Si in the tetrahedral framework (see Fig. 18.48). The Al and Si distribution in orthoclase is more ordered (see Fig. 12.9 and related text).

- What does the symbol “G” in Physical Properties mean? Please write down its definition. (5 pt)
- Which of the following minerals is harder than SANIDINE? “gypsum, calcite, corundum, apatite” (5 pt)
- Why are the color and streak different? (5 pt)
- Which crystal system does this mineral belong to? Plot the unit cell geometries for this crystal system and list lattice parameters. (10 pt)
- Name the point group and corresponding crystal system of the below figure. Identify which belongs to the SANIDINE. (15 pt)

