

※ 考生請注意：本試題可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Calculate the fractional concentration of vacancies in the aluminum crystal at 25°C and near the melting temperature (660°C), given that the energy of the formation of a vacancy in aluminum is about 0.75 eV. (1 eV=1.6x10⁻¹⁹ J) (10%)
2. What is the difference between the crystalline phase and amorphous phase? (5%) Please explain what heat treatment should be used to form coarse, fine crystalline materials and glassy phase from melt (5%) ?
3. ZnFe₂O₄ exhibits normal spinel structure. Please calculate the total tetrahedral and octahedral sites in the FCC of oxygen ions and explain the ratios of tetrahedral and octahedral sites occupied in the normal spinel structure. (20%)
4. Lead exhibits FCC structure and the atomic radius is 0.1750nm. Please calculate the volume of the unit cell. (10%)
5. Please plot the unit cell of P, C, F, I orthorhombic Bravais lattice, and explain what are the meanings of P, C, F, I. (10%)
6. Bonding in crystal
 - (1) Diamond and graphite have the same chemical formula yet exhibit very different properties (such as cleavage and hardness)? Explain why this is so. (5%)
 - (2) Write the sequence of the chemical bond from strongest to weakest (exclusive of H bonding).
 - (2-1) Bond strength (5%)
 - (2-2) Conductivity (5%)
 - (2-3) Which type of chemical bond owns directionality. (5%)
7. Using and plotting the electron band structures to explain the insulators, conductors, n-type semiconductors and p-type semiconductors. (10%)
8. Please explain and write the defect reaction equations of Schottky and Frenkel defects in term of alumina. (10%)