※ 考生請注意：本試題 ☑可　□不可 使用計算機

1. Iron at 20°C is BCC with atoms of atomic radius 0.124nm. Calculate the lattice constant a for the cube edge of the iron unit cell . (20%)

2. Copper has an FCC crystal structure and an atomic radius of 0.1278nm. Assuming the atoms to be hard spheres that touch each other along the face diagonals of the FCC unit cell. Calculate a theoretical value for the density of copper. The atomic mass of copper is 63.54 g/mol. (20%)

3. Fig.(1) shows a hypothetical binary eutectic phase diagram on which we indicate an alloy of composition 0.27B. Calculate the following quantities (20%)

   a. The fraction of primary solid that forms under equilibrium cooling at the eutectic temperature .
   b. The fraction of liquid with the eutectic composition that will transform to two solid phases below the eutectic isotherm
   c. The amount of α and β that will form from the liquid just below the eutectic isotherm.
   d. The total amount of phase in the alloy at a temperature just below the eutectic temperature.

4. Please address the effect of temperature and impurity on the conductivity for metal, insulator and semiconductor, respectively.(20%)

5. Calculate the electrical resistivity of intrinsic silicon at 300K. For Si at 300 K n_i=1.5x10^{16} carriers/m^3,q=1.6x10^{-19}C, μn=0.135m^2/V.s,and , μp=0.038m^2/V.s,and (20%)

Fig.(1)