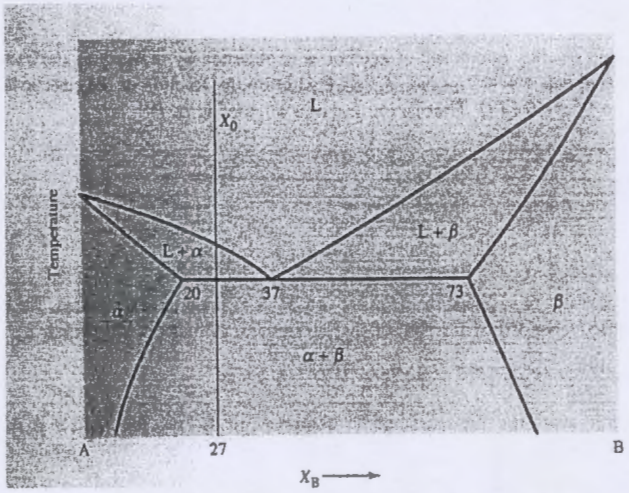
系所組別：電機工程學系甲組

考試科目：電子材料概論

考試日期：0222，節次：2

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

1. Iron at 20℃ is BCC with atoms of atomic radius 0.124nm. Calculate the lattice constant a for the cube edge of the iron unit cell.(10%)
2. Cooper has an FCC crystal structure and a unit cell with lattice constant of 0.361nm. What is its interplanar spacing d_{220} (10%)
3. Draw the following crystallographic planes in cubic unit cells.
   (a) (101) (b) (1-10) (c) (221) (d) Draw a (110) plane in a BCC atomic-site unit cell, and list the position coordinates of the atoms whose centers are intersected by this plane.(10%)
4. 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 αandβthat 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.



5. What is the lattice vibration scattering limited mobility and describe the temperature dependence of this mobility? And what is the ionized impurity scattering limited mobility and describe the temperature dependence of this mobility? (20%)
6. An n-type Si semiconductor containing 10^{16} phosphorus atom cm^{-3} has been doped with 10^{17} boron atom cm^{-3}. Calculate the electron and hole concentration in this semiconductor (14%)
7. Please prove the following laws (16%)
   a). Snell's law
   b). $n=\varepsilon_r^{1/2}$