※ 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. Calculate the atomic packing factor (AFP) for the BCC unit, assuming the atoms to be hard spheres.(10%)

2. Draw the following direction vectors in cubic unit cells. (10%)
   [100]，　[110]，[112]，[-110]，[-32-1]

3. Please compare the effect of temperature and impurity respectively on the conductivity for metal, inorganic semiconductor, organic semiconductor and insulator. (20%)

4. a). What is polarization ? please describe all possible the polarization mechanisms .(10%)

   b).What is Magnetization ? please describe all possible the magnetization mechanisms. (10%)

5. Calculate the number of silicon atoms per cubic meter. The density of silicon is 2.33 g/cm^3, and its atomic mass is 28.08 g/mol.(10%)

6. Calculate the electrical resistivity of intrinsic silicon at 300K. For Si at 300K, $n_i = 1.5 \times 10^{16}$ carriers/m^3, q=1.6×10^{-19}C, μ_n=0.135m^2/Vs, and　μ_p=0.048m^2/Vs(10%)

7. 6 Please explain following noun: (20%)
   a). Fermi energy
   b). Schottky effect
   c). Mean free path
   d). Fick's first law
   e). Fick's second law
   f). Gibbs phase rule
   g). Seebeck effect
   h). Matthiessen's rule
   i). Nordheim's rule
   j). Skin depth