(1) Two schematic Laue patterns are given below, showing how polygonization breaks up asterated X-ray reflections into a series of discrete spots. Explain the reason for this.　　8 points

(A)　　　　　　　　(B)
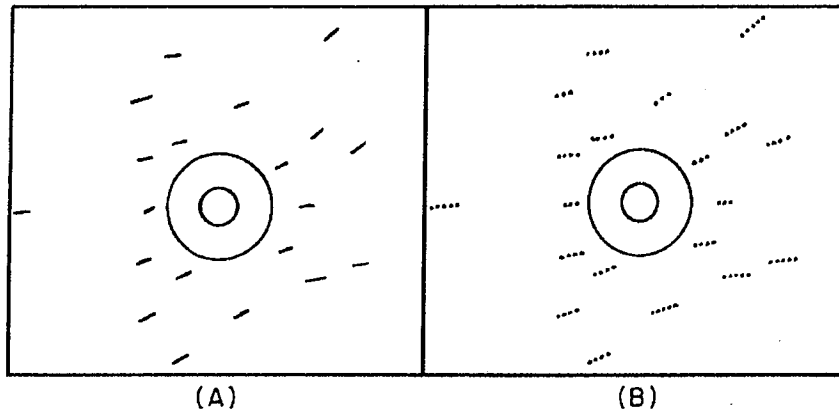
(2) For a material to be deformed plastically, dislocations need to be generated and slipped in the material. Shear stress is required to let dislocations slip in a material. Dislocations can slip in some materials under a relatively low shear stress, however, there are methods which can let dislocations need a higher shear stress to slip in the material. Give the methods that you know can make dislocations more difficult to slip in a material. Explain the mechanisms of these methods.
　　10 points

(3) The figure shown below is the unit cell of a hexagonal close-packed crystal. What is the Miller-Bravais indices of plane A? And what is the angle between the (0001) basal plane and plane A? The c/a ratio of this crystal is 1.624.　　8 points
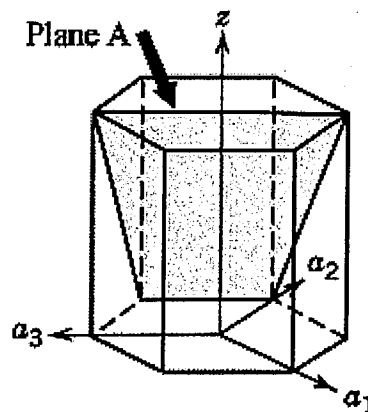
(4) Derive the Fick's first law of diffusion in interstitial solid solutions.　　10 points

(5) Give a schematic drawing of the morphology of grains after secondary recrystallization.　　8 points

(6) What is the function of a p-n junction? Explain how does it work?　　10 points

(7) Some alloy steels can be hardened by quenching the steels from the austenite phase temperature to room temperature to obtain martensite structure. Martensite is a very strong phase, it has very high strength, but it does not have good toughness and ductility. What method you can do to improve the toughness and ductility of the martensite? What is the change of the microstructure after your method?　　　　　　10 points

(8) Draw a hypothetic (假定) binary phase diagram which consists of a eutectic and a peritectic reaction. In this diagram mark (a) solidus line, (b) liquidus line, (c) eutectic temperature, (d) peritectic composition, and (e) solvus line.　　　　　　10 points

(9) Explain the following terms. (a) semicoherent phase boundary, (b) jog, (c) creep, (d) fatigue limit, (e) refractory metals, (f) coring, (g) interface-controlled growth, (h) soft magnetic materials.
　　　　　　16 points

(10) Metals are known to be good electric conductors. The resistivity of a metal is very low, however, several factors may cause the resistivity of a metal to be increased. What are these factors? Why these factors can increase the resistivity of the metal?　　　　　　10 points