1. Once a total dislocation dissociated into a pair of separated partial dislocations, please explain what makes them repulsing apart from each other, also what causes them stay together and not separate very far away. (12%)

2. (a) Please write down the Hall-Petch equation, and identify the physical meaning of each term. (b) Why a much larger applied stress is needed to cause slip to pass through the grain boundary in fine-grained materials than is the case with coarse-grained materials? (13%)

3. The dislocation density in a cold deformed specimen would decrease as taking an annealing treatment. However, the vacancy density of a regular specimen would increase during a heating process. Both dislocation and vacancy are the commonly observed defects in material. Please explain why they behave with such a difference. (12%)

4. For each given temperature (T1, T2, T3) in the binary Ni-Au phase diagram, please draw the corresponding free energy curves vs. composition diagram, and label each curve. (13%)
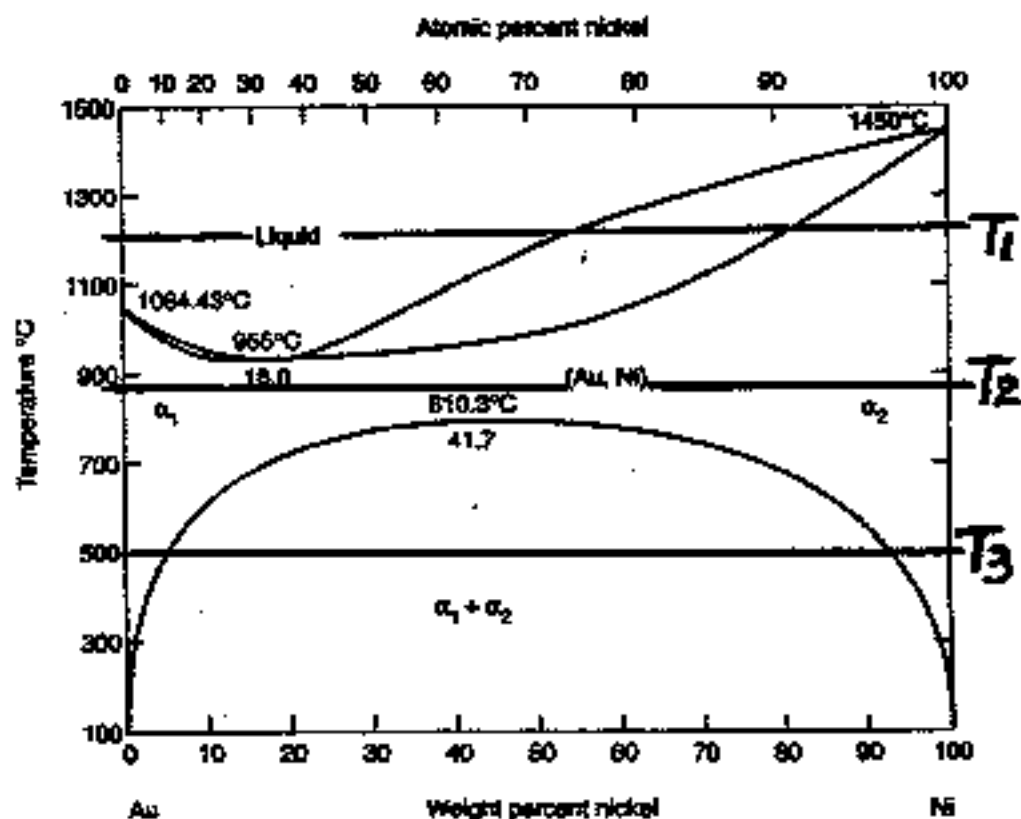
5. 試繪圖說明鑄錠的凝固過程 (Freezing of ingots). (10%)

6. 試說明擴散控制下的成長. (Diffusion controlled growth) (10%)

7. 試以 Vanadium Carbide 為例說明界面析出過程. (Interphase precipitation) (10%)

8. 試繪圖說明光學金相組織觀察辨別碳鋼緩慢冷卻的亞共析鋼和過共析鋼. (10%)

9. 試說明形成無析出物帶 (precipitate-free zone) 的機構. (10%)