Instructions: Read each question carefully before answering. Answers should be in either Chinese or English, not in both or others. Failure to follow this might result in fatal consequences.

1. Briefly explain the following terms: (3% each, total 15%)
   a. Jog (in dislocation)
   b. Shockley partial dislocation
   c. work hardening
   d. diffusional creep
   e. invariant plane strain

2. Structure determination is the most crucial role in materials science, please describe as many as possible the methods of structure determination with brief explanations.(16%)

3. Vacancy is necessary in some metallurgical/material processes, sometimes is the key point of that process, to name just one the fomation of dislocation loop. Please name the other processes related to vacancy and explain. (9%) How does vacancy form (be created) in a certain material (metals and nonmetals) ?(6%) How does vacancy vanish (be annihilated)? (6%)

4. How does the second phase exist in a grain structure (at what locations) of a material. Discuss the effect of surface tention on the above existence. (Please specify quantitatively if necessary). Give two examples of metallurgical application of your discussion. (8%, 12%, 6%, each; total 26%)

5. Grain size refinement is usually the most effiecient sometimes the only way to strengthen a material. Please give as many as possible the processes of refining grain size of a material. Remember to specify the process which is the only way of strengthening a certain material, and not to concentrate yourself on only metals. (22%)