

# 大大同大學 102 學年度(寒)轉學入學考試試題

考試科目:材料科學導論

所別:材料工程學系

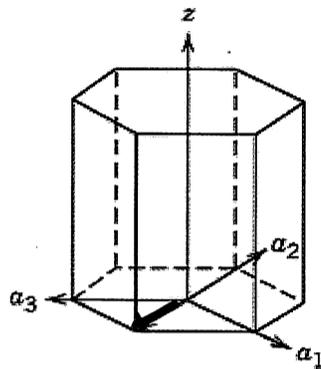
第 1/2 頁

註:本次考試 不可以參考自己的書籍及筆記; 不可以使用字典; 不可以使用計算器。

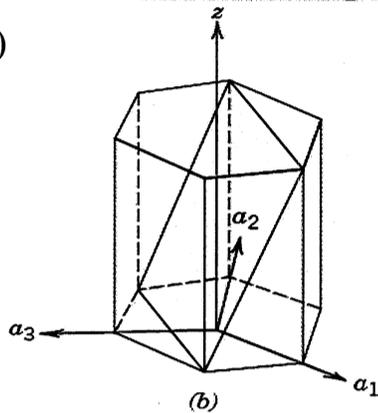
1. The close-packed crystal structure for stacking sequence, close-packed plane, close-packed direction  
 (a) HCP (2, 2, 2%),  
 (b) FCC (2, 2, 2%)

2. Determine the indices for (a) the directions and (b) the planes shown in the following unit cell. (3, 3%)

(a)



(b)



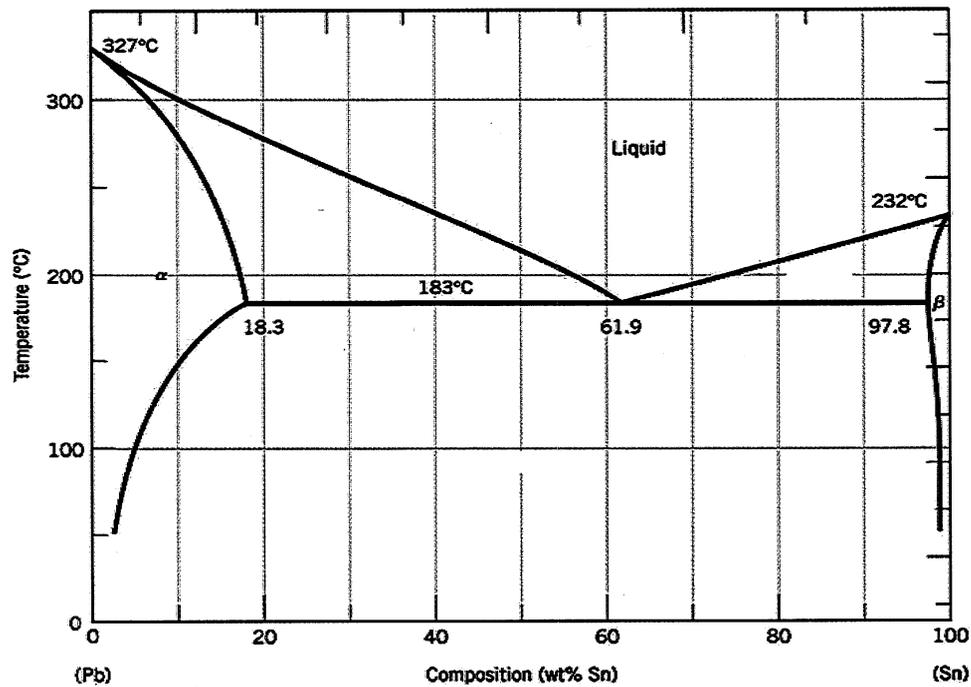
3. Of those metals listed in below Table. (2, 2, 2, 2%)  
 (1) Which is the hardest?  
 (2) Which is the stiffest?  
 (3) Which is the strongest?  
 (4) Which will experience the greatest percent reduction in area?

Material	Yield strength (MPa)	Tensile strength (MPa)	Strain at fracture	Fracture strength (MPa)	Elastic modulus (GPa)
A	700	850	0.14	720	210
B	415	550	0.15	500	310
C	100	230	0.40	105	150
D	310	340	0.23	265	210
E	Fractures before yielding			650	350

4. (1) Plastic deformation of a metal **above** its recrystallization temperature is (2%).  
 (2) ( ) (3%)  
 steel **increase** in (a) modulus of elasticity, (b) elongation, (c) tensile strength, (d) yield strength, (e) ductility with **increasing cold work**.  
 (3) ( ) (3%)  
Recrystallization temperature diminishes with \_\_\_\_\_ (a) increasing or (b) decreasing percent cold work.
5. Consider a single crystal of BCC iron oriented such that a tensile stress is applied along a [010] direction.  
 (a) **Compute** the resolved shear stress along a (110) plane and in [111] a direction when a tensile stress of 52 MPa is applied. (5%)  
 (b) If slip occurs on a (110) plane and in a [111] direction, and the critical resolved shear stress is 30 MPa, calculate the magnitude of the applied tensile stress necessary to initiate yielding. (5%)
6. **List 1 samples** of each classifications (1) point (2) linear (3) planar in solid materials, and then cite the distinctive instance of each. (2, 2, 2%)

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- 7. Define fracture toughness in terms of (a) a brief statement and (b) an equation; define all parameters in this equation. (5%, 5%)
- 8. According to the following figure, cite (a) the phases that are present and (b) the phase compositions for the alloy: 30 Sn – 70 Pb (wt%) at 250°C. (5%, 5%)



- 9. (a) Make a schematic fraction transformation vs. log(time) plot for a typical solid-solid transformation (7%);  
(b) Cite the equation that describes this behavior. (3%)
- 10. Describe the heat treatments that are used to precipitation harden a metal alloy. (10%)
- 11. Describe the major differences in processing between metals and ceramics. (10%)