

國立聯合大學 104 學年度碩士班考試招生

材料科學工程學系 入學考試試題

科目：材料科學導論 第 1 頁共 2 頁

A. 選擇題(單選)，每題5分，共80分

1. The ductile-to-brittle transitions are generally observed in (a) FCC alloy (b) BCC alloy (c) high strength alloy (d) ceramics
2. What type of the diffusion do you think will be easier: (a) Fe in FCC iron (b) H in BCC iron (c) H in FCC iron (d) C in BCC iron
3. (a) Tetragonal (b) Rhombohedral (c) Orthorhombic (d) Monoclinic crystal system shows  $a = b \neq c ; \alpha = \gamma = \beta = 90^\circ$
4. For FCC metal, the number of slip system is (a) 3 (b) 6 (c) 9 (d) 12
5. In Hall-Petch equation,  $\sigma_y = \sigma_0 + k_y d^{-1/2}$ , d means (a) grain size (b) yield strength (c) thickness (d) constant
6. What is the Schottky defect ? (a) edge dislocation (b) cation vacancy (c) vacancy-interstitial pair (d) cation-anion vacancy pair.
7. The number of tetrahedral site are (a) 2 (b) 4 (c) 6 (d) 8
8. Austenite, or  $\gamma$ -iron, has (a) BCC (b) FCC (d) HCP (e) simple cubic crystal structure
9. In Cu/Zn cell, Cu act as (a) anode (d) cathode (c) negative electrode (d) electrolyte
10. An electromagnetic radiation having a wavelength of 500 nm is (a) X-ray (b) visible light (c) infrared ray (d) microwave
11. The minimum wavelength for visible light is about 400 nm, so that the maximum band gap energy for which absorption of visible light is possible is (a) 1.1 (b) 3.1 (c) 4.2 (d) 6.3 eV
12. The group of dielectric materials exhibiting spontaneous polarization is called (a) insulator (b) paraelectric materials (c) ferroelectric materials (d) transistor
13. For binary temperature–composition phase diagrams, the number of degrees of freedom in the single-phase fields is (a) 0 (b) 1 (c) 2 (d) 3
14. Which of the following statements is false?  
Creep deformation is (a) a thermally activated process (b) interface-controlled process (c) diffusion-controlled process (d) involving dislocation climb
15. Thermal energy can be conducted through a material by two mechanisms: one is the motion of free electrons and the other is (a) cations (b) phonons (C) photons (d) anions
16. Which one is typically more brittle than others? (a) HCP, (b) FCC, (c) BCC

B. 簡答計算題，每題20分，共120分

17. Planar density is the number of atoms per unit area on a plane within one unit cell. Determine the planar density of (110) in an FCC crystal.
18. (a) Construct a cubic structure and show (110) and (111) planes  
(b) What is the angle between (110) and (111) in a cubic crystal?
19. Using the lever rule to calculate the maximum amount of proeutectoid ferrite phase that can form in a plain carbon steel containing 0.4 wt% C.
20. Describe the strengthening mechanisms in material systems
21. MgO has NaCl-type crystal structure. Determine the theoretical density of MgO. (the atomic mass: Mg = 24.3 ; O = 16; and the ion radius :  $R_{O^{2-}} = 1.32\text{\AA}$ ;  $R_{Mg^{+2}} = 0.78\text{\AA}$ )
22. The standard reduction half-cell potentials for Zn and Cu are  $E_{Cu}^{\circ} = +0.34V$  and  $E_{Zn}^{\circ} = -0.76V$ , respectively. Determine the total reaction potential of Cu-Zn electrochemical cell.