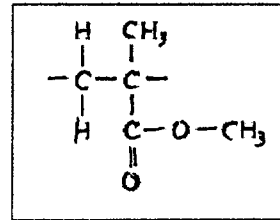


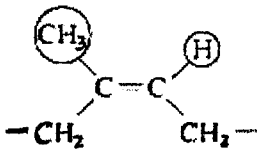
本試題是否可以計算機： 可使用， 不可使用。（請命題老師勾選）

1. 選擇題：共 20 題，每題 2 分（4 選 1：答錯不倒扣）

- (a) MgAl_2O_4 (b) Ba TiO_3 (c) Al_2O_3 (d) NaCl is piezoelectric material which is used in transducers
- Please select one property that might exist with a steel weld that was cooled rapidly. (a) very corrosive (b) very brittle (c) very ductile (d) very soft
- Derive from the equation of state of an ideal gas an equation for the density of an ideal gas in terms of pressure, temperature, and appropriate constants (a) $\rho = PR/MT$ (b) $\rho = PT/RM$ (c) $\rho = TR/PM$ (d) $\rho = PM/RT$
- The Bragg's law can be expressed on (a) $n\lambda = 2d \sin \theta$ (b) $n\lambda = 2d/\sin \theta$ (c) $2n\lambda = d \cos \theta$ (d) $n\lambda = 2d \cos \theta$
- The wavelength of visible light lies in (a) 0.4-0.7 m (b) 0.4-0.7 mm (c) 0.4-0.7 μm (d) 0.4-0.7 nm
- Which of the following bonding is not the primary bonding (A) Covalent (B) Metallic (C) van der Waals (D) ionic bonding
- Which of the following phenomenon caused the 2nd bonding of molecules (A) free electron (B) molecular dipole (C) bonding energy (D) atomic weight
- For unit cell geometry, which crystal system is $a = b \neq c$, and $\alpha = \beta = \gamma = 90^\circ$ (A) Tetragonal (B) Orthorhombic (C) Cubic (D) Rhombohedral



9. Which polymer has this monomer structure (A) Polytetrafluoroethylene (PTFE) (B) Poly (methyl methacrylate) (PMMA) (C) Polycarbonate (D) Poly(ethylene terephthalate) (PET)



10. (A) Geometrical isomerism- trans (B) Geometrical isomerism- cis (C) Stereoisomerism- trans (D) Stereoisomerism- cis
11. The surface energy of a single crystal depends on the planar density. As the planar density increases, it will (increase or decrease) the satisfied bonds in the plane, and (increase or decrease) the surface energy. (A) both increase (B) both decrease (C) increase and decrease (D) decrease and increase
12. Which factor will not affect the equilibrium number of vacancies N_v for a given material (A) total number of atomic sites (B) grain size (C) temperature (D) energy required to form a vacancy.

(背面仍有題目, 請繼續作答)

編號： 241
227

系所：醫學工程研究所甲組，丁

科目：材料導論

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

13. The difference between engineering stress and true stress is caused by (A) temperature (B) strain hardening (C) necking (D) slip system
14. Plastic deformation mostly involves the motion of (A) dislocations (B) vacancies (C) grains (D) solid solution
15. What is the driving force for the recovery and recrystallization (A) grain size (B) dislocations (C) internal strain energy (D) slip system
16. The reason for the fracture strength of most engineering materials normally lie between 10 and 1000 times below theoretical value is. (A) fatigue (B) corrosion (C) creep (D) stress concentration
17. What is K_{IC} in fracture mechanisms (A) Elastic modulus (B) yielding strength (C) plane strain fracture toughness (D) stress intensity factor
18. Which of the following is the slip system for the simple cubic crystal structure? (A) $\{100\}\langle 110\rangle$ (B) $\{110\}\langle 110\rangle$ (C) $\{100\}\langle 010\rangle$ (D) $\{110\}\langle 111\rangle$
19. What test does the S-N curve usually represent (A) fatigue (B) creep (C) stress relation (D) indentation test
20. Which material is usually used for bone cement (A) Teflon (B) PMMA (C) ceramic-glass (D) hydroxylapatite

II. 名詞解釋，每題 2 分，共 10 題

1. crystalline
2. brittle fracture
3. creep
4. dislocation
5. fatigue limit
6. Modulus of elasticity and yield strength
7. plane strain
8. Poisson's ratio (ν)
9. Schottky defect
10. strain hardening

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

III. 簡答題: (共 16 分)

1. 4 basic **structure of polymers** (2 points)
2. 2 basic atomic mechanisms for diffusion. (2 points)
3. What **ASTM** stands for? (2 points)
4. List 4 basic properties involved in the field of **fracture mechanics** (2 points)
5. 4 factors that determine the degree of solute dissolve in the solvent? (4 points)
6. Make a schematic plot showing the tensile engineering stress-strain behavior for a typical metal alloy to the point of fracture. Now superimpose on this plot a schematic compressive engineering stress-strain curve for the same alloy. Explain any differences between the two curves. (After plastic deformation) (4 points)

IV. 計算題: (6 points each) (共 24 分)

1. Show that the minimum cation-to-anion radius ratio for a coordination number of 6 is 0.414. Hint: Use the NaCl crystal structure, and assume that anions and cations are just touching along cube edges and across face diagonal.
2. Nickel has an atomic radius of 0.1246 nm, an FCC crystal structure, and an atomic weight 58.69 g/cm³. Compute its theoretical density. ($\rho = nA/V_c N_A$; n: number of atoms associated with each unit cell; A: atomic weight; V_c = volume of the unit cell; N_A = Avogadro's number 6.023×10^{23})
3. A plate of iron is exposed to a carburizing (carbon-rich) atmosphere on one side and a decarburizing (carbon-deficient) atmosphere on the other side at 723°C. If a condition of steady state is achieved, calculate the diffusion flux of carbon through the plate if the concentrations of carbon at positions of 2 and 10 mm beneath the carburizing surface are 1.6 and 0.8 kg/m³ respectively. Assume a diffusion coefficient of 3×10^{-11} m²/s at this temperature. (Fick's first law: $J = -D(dC/dx)$)
4. A 3-point bending test is performed on a silicon nitride (Si₃N₄) specimen having a rectangular cross section of height d 6 mm and width 8 mm; the distance between support points is 60 mm. Compute the flexural strength if load at fracture is 300 N. (E for Si₃N₄ is 300 GPa)