

國立聯合大學 104 學年度

理工學院材料科學工程系 (院)學系轉學生招生考試試題紙

科目： 材料科學導論 第 1 頁共 3 頁

A. There are four basic types of materials. Choose the best answer to fill in the blank (50%)

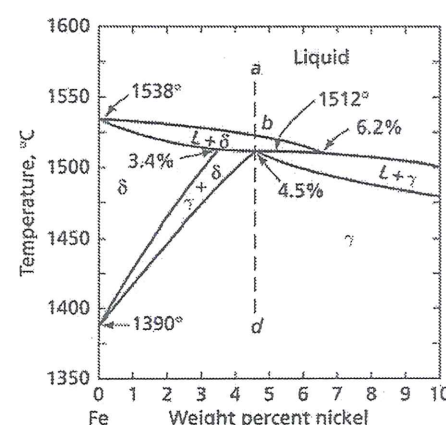
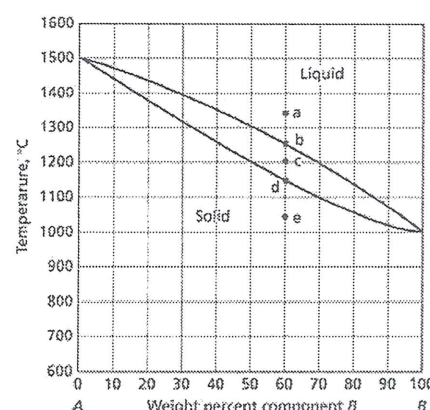
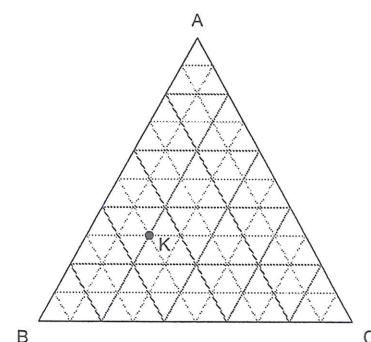
(a) Metal materials, (b) Ceramic materials, (c) Polymer materials, (d) Semiconductor materials

- Most _____ are lighter and flexible.
- _____ are strong in compression, weak in shearing and tension.
- For _____ the ions are surrounded by de-localized electrons, which are responsible for the conductivity.
- _____ are used to fabricate microelectronic and optoelectronic devices.
- _____ in general have high electrical and heat conductivity.
- The electrical conductivity of _____ increases significantly as the temperature increases.
- Most _____ are cheaper.
- _____ tend to be stiff, brittle, and hard.
- _____ reflect most of incident light.
- _____ generally can withstand very high temperatures.
- _____ are nominally small band gap insulators.
- Some _____ can bend and twist and get all tangled up elastically.
- _____ are usually ductile and shiny.
- _____ are inorganic, non-metallic materials made from compounds of a metal and a non metal.
- _____ are neither good conductors nor good insulators in their natural state.
- Most _____ are organic, employing carbon bonds as their backbone.
- _____ usually exhibit low melting temperature.
- If one fills the energy bands of a material with available electrons and ends up with a top band partly filled then the materials are _____.
- The electrical conductivity of _____ can be manipulated by doping.
- Some _____ possess high structural strength, making them useful materials for carrying large loads or resisting impact damage.
- _____ are large molecules (macromolecules) composed of repeating structural units.
- _____ are usually ionic or covalent bonded materials, and can be crystalline or amorphous.
- Elemental _____ crystallize in a diamond structure. Neighboring atoms are bound by covalent bonds.
- The electrical conductivity of _____ decreases as the temperature increases.
- Some inorganic _____ can be used as an insulator.

B. 單選題 (50%)

26. What is the atomic packing density of the body-centered-cubic crystal? (a) 0.34 (b) 0.52 (c) 0.68 (d) 0.74 (e) 0.78

27. The coordination number of the hexagonal structure is (a) 4 (b) 6 (c) 8 (d) 10 (e) 12.
28. What is the closest packed direction in the hexagonal structure? (a) $[\bar{1}\bar{1}23]$ (b) $[\bar{1}\bar{1}20]$ (c) $[\bar{1}010]$ (d) $[2\bar{2}43]$ (e) $[0\bar{1}11]$
29. Metallic bonds are formed by which of the process? (a) electron sharing (b) electron transfer (c) electron delocalization (d) electron localization (e) electron quantization
30. Which one of the bonding types is covalent? (a) NaCl (b) C (diamond) (c) Fe (d) Ar (e) CuZn
31. The first reflection plane for a BCC crystal is (a) $\{100\}$ (b) $\{110\}$ (c) $\{111\}$ (d) $\{200\}$ (e) $\{220\}$
32. For BCC iron, what is the diffraction angle for (220) set of planes? The lattice parameter for Fe is 0.2866 nm. Assume that monochromatic radiation having the wavelength of 0.1790 nm is used, and the order of reflection is 1. (a) 62.13° (b) 124.26° (c) 53.13° (d) 106.26° (e) 35.41°
33. What is the composition at point K in the ternary phase diagram in the right figure?
(a) A:30%, B:50%, C:20% (b) A:50%, B:30%, C:20% (c) A:20%, B:50%, C:30% (d) A:30%, B:20%, C:50% (e) A:50%, B:20%, C:30%
34. Which of the following statement is always correct (a) true strain < engineering strain (b) true stress < engineering stress (c) true strain > engineering strain (d) true stress > engineering stress (e) none of the above
35. For a BCC iron specimen under tensile testing, with the tensile loading direction parallel to its $[010]$ direction, what is the resolved shear stress on (110) along $[\bar{1}11]$ if the tensile normal stress is 52 MPa? (a) ~ 11 MPa (b) ~ 21 MPa (c) ~ 31 MPa (d) ~ 41 MPa (e) ~ 51 MPa.
36. Grain boundary is a (a) zero-dimensional (b) one-dimensional (c) two-dimensional (d) three-dimensional (e) four-dimensional defect.
37. A reaction is irreversible if (a) $\Delta G < 0$ (b) $\Delta G = 0$ (c) $\Delta G > 0$ (d) $\Delta S < 0$ (e) $\Delta S > 0$.
38. In the right figure, which points mean a state that is completely a solid phase? (a) only point b (b) points b, c and d (c) only point c (d) points d and e (e) only point e
39. Assuming pressure is a variable, the degree of freedom at point b is (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
40. Fe_3C is also called (a) cementite (b) pearlite (c) austenite (d) ferrite (e) banite
41. Calculate the weight percentage of the δ phase just above the peritectic point in the right figure. (a) 39.3% (b) 45.2% (c) 54.8% (d) 60.7% (e) 100%
42. Which of the following do you expect to have a large thermal conductivity? (a) glass (b) Al_2O_3 (c) SiO_2 (d) AlN (e) porous Al_2O_3
43. Which of the following is considered to be a glass network former? (a) Na_2O (b) CaO (c) P_2O_5 (d) PbO (e) ZnO
44. Which polarization gives rise to a resonance absorption peak in the optical range (visible light)? (a) electronic polarization (b) atomic polarization (c) ionic polarization (d) dipole polarization (e) interfacial polarization
45. BaTiO_3 is a (a) zinc blend (b) perovskite (c) rock salt (d) wurtzite (e) chalcopyrite structure, which exhibits



good ferroelectric properties.

46. Which of the following elements act as a donor when added to pure silicon? (a) boron (b) indium (c) germanium (d) gallium (e) antimony
47. The intrinsic carrier concentration of Si at 300 K is around (a) $1.5 \times 10^6 \text{ cm}^{-3}$ (b) $1.5 \times 10^8 \text{ cm}^{-3}$ (c) $1.5 \times 10^{10} \text{ cm}^{-3}$ (d) $1.5 \times 10^{12} \text{ cm}^{-3}$ (e) $1.5 \times 10^{14} \text{ cm}^{-3}$
48. A typical C = C double bond consists of (a) one σ bond, (b) one π bond, (c) one σ bond and one π bond, (d) two σ bonds, (e) two π bonds
49. The skeletal formula shown on the right is (a) benzene (b) naphthalene (c) anthracene (d) tetracene (e) pentacene
50. The large conjugated systems are not found in (a) graphene (b) graphite (c) conductive polymers (d) thermoplastic polymer (e) carbon nanotubes

