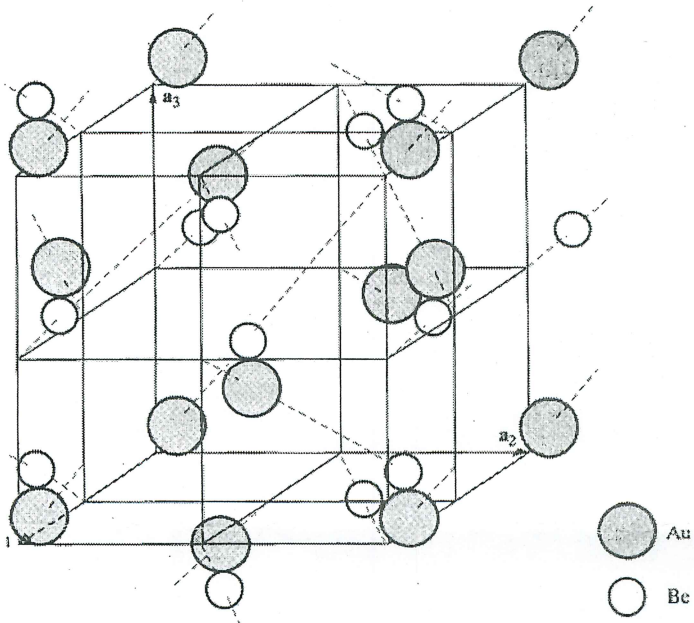
# 國立聯合大學 106 學年度

## 暑假轉學生招生考試試題紙

科目：材料科學導論　第 1 頁共 ___ 頁

選擇題：

1. Fig1 is called AuBe structure, what is the Bravais lattice of this structure: (a) Simple Cubic, (b) Face-Centered Cubic, (c) Body-Centered Cubic, (d) Hexagonal Close-Packed




4 Au at

$$u\ \ u\ \ u,\quad (\tfrac{1}{2}+u)(\tfrac{1}{2}-u)\overline{u},\quad \overline{u}(\tfrac{1}{2}+u)(\tfrac{1}{2}-u),\quad (\tfrac{1}{2}-u)\overline{u}(\tfrac{1}{2}+u),$$

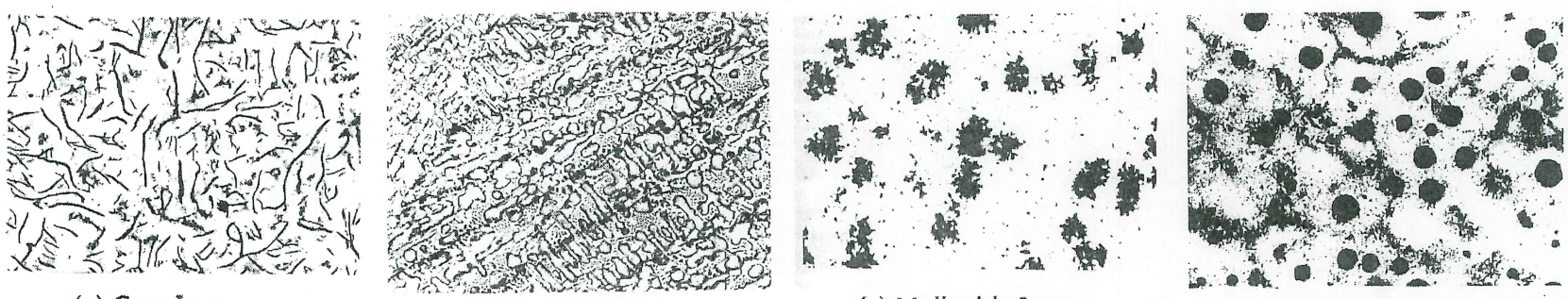
4 Be at

$$w\ \ w\ \ w,\quad (\tfrac{1}{2}+w)(\tfrac{1}{2}-w)\overline{w},\quad \overline{w}(\tfrac{1}{2}+w)(\tfrac{1}{2}-w),\quad (\tfrac{1}{2}-w)\overline{w}(\tfrac{1}{2}+w),$$

where $u = 0.100$ and $w = 0.406$, each $\pm 0.005$.

Fig1 Structure of AuBe

2. Which one of the following factors increases the plane strain fracture toughness ($K_{IC}$) of a metal material: (a) solution hardening, (b) increasing impact strain rate, (c) reducing grain size, (d) decreasing temperature.
3. Which one of the following explanations is not the hexagonal close-packed structure: (a) the coordination of number of 12, (b) the packing factor of 0.74, (c) having two lattice points per cell, (d) the basis of 2.
4. In the **C**ontinuous **C**ooling **T**ransformation (C.C.T.) diagram of 0.8wt% plain carbon steel, after various cooling rates of heat treatments which one of the following structures does not exist: (a) Martensite, (b) Bainite, (c)coarse pearlite,(d) fine pearlite.
5. Cast iron with carbon equivalent of 4.3% having the following microstructures; witch one of the following microstructure is needed to heat treat:

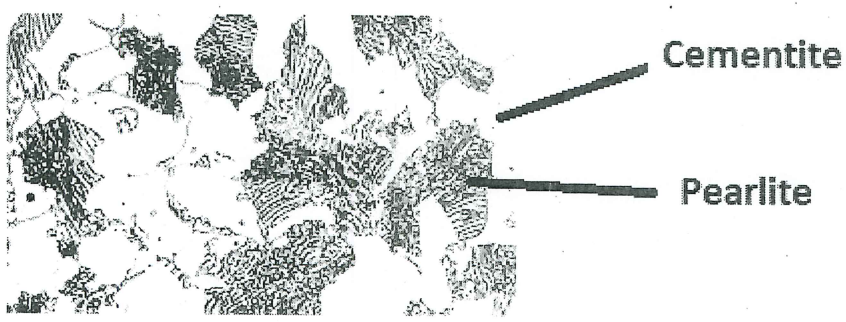


(a) Grey Iron　(b) White Iron　(c) Malleable Iron　(d) Ductile Iron

6. 90% of all metallic failures is caused by fatigue; which one of following is **NOT** fracture surfaces of a fatigue sample: (a) cup-and-cone (b)striations (c) beach-mark (d) concentric ridges.

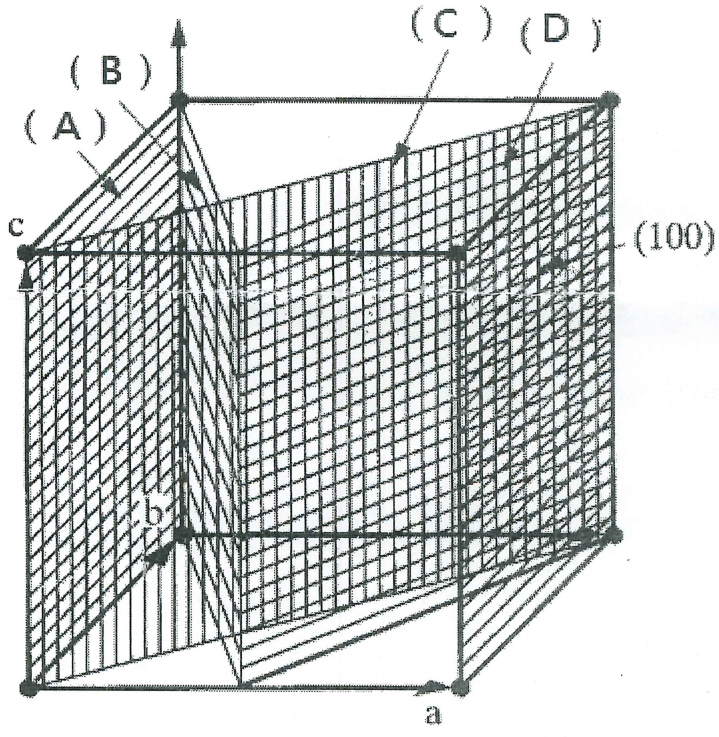
7. In Iron-Carbon equibrieum phase diagram which of the following three-phase reactions does not exist: (a)monotectic, (b) eutectioid, (c) eutectic, (d) peritectic reactions.

8. What is possible iron-carbon composition for the following optical microstructure: (a) 0.015 wt% C, (b) 0.4 wt% C, (c) 1.5 wt% C, (d) 3.5 wt% C.






9. Which flollowing plane is Millers index of $(\bar{2}10)$:




10. Which of of following phyical properties is detrimental for creep resistance: (a) high melting point (b) high Young's modulus, (c) small grain size, (d) dispersed phases.

非選擇題：

11. Draw the microstructures at various temperatures from liquid to solid states in the following compositions respectively: (a) hypo-peritectic composition, (b) hyper-eutectic composition, (10%)
12. (a) What is martensite structure in plain carbon steel? (b) Martensite transformation is highly dependent on carbon content and geometry size. How does the mechanical property of plain carbon steel change as cooling from austenite state in terms of carbon content and geometry size respectively. (10%)
13. Explain the following names in terms of dislocation: (a) work hardening, (b) dispersion hardening, (c) solution hardening, (d) dislocation climb. (10%)
14. (a) Using the following values, determine the theoretical density of BCC iron, which has a lattice parameter

of 0.2866nm. atomic mass = 55.847 g/mol, Avogadro's number Na = $6.02\times10^{23}$ atoms/ mol. (b) And explain why it is different from the measured density, which is 7.870 g/cm$^3$. (10%)

15. Compute the planar density values for (110) planes of aluminum, given that Al has a FCC crystal structure, a density of 2.70 g/cm$^3$, and an atomic weight of 26.982 g/mol. (Note: Avogadro's number= $6.02\times10^{23}$ atoms/mol). (10%)