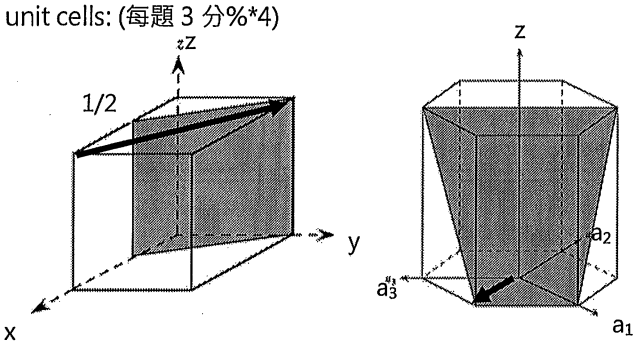
大同大學 103 學年度(暑)轉學入學考試試題

考試科目：材料科學導論　　所別：材料工程學系　　

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。

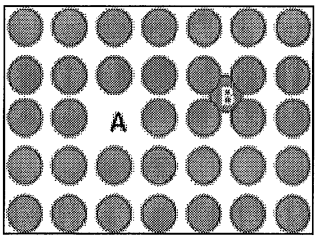
1. Determine the indices for the direction and plane shown in the following cubic unit cell and hexagonal unit cells: (每題 3 分%*4)



2. Identify the three crystal structure: Body-Centered Cubic (BCC), Face-Centered Cubic (FCC), Hexagonal Close-Packed (HCP). (*r*: radius of sphere and *a*: length of cube side) (每題 2 分%*5)

Crystal Structure	Atom/ unit cell	The relation between *r* and *a*	Coordination number	Atomic packing factor (APF)	Close-packed planes (Miller indices)
BCC	(1)	(2)	(3)	(4)	(5)

3. (　　) In below figure, A or B indicate self-intersitial. (3%)



4. (　　) Match how FCC crystal structure may be generated by the stacking sequence of close-packed plane of atoms (1) ABAB... (2) ACAC... (3) ABCABC... (3%)

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

Table. I　**Tensile Stress–Strain Data for Several Hypothetical Metals to be Used with Concept Checks 6.2 and 6.4**

Material	*Yield Strength (MPa)*	*Tensile Strength (MPa)*	*Strain at Fracture*	*Fracture Strength (MPa)*	*Elastic Modulus (GPa)*
A	310	340	0.23	265	210
B	100	120	0.40	105	150
C	415	550	0.15	500	310
D	700	850	0.14	720	210
E	Fractures before yielding			650	350

6. Write **Fick' s first 1st** and **second 2nd law** in equation form (公式) (每題 3 分%*2)

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7. The self-diffusion of iron atoms in BCC iron is significantly higher than in FCC iron. **Explain** why. (2, 4%)
8. (a)Mark **(A) propotional limit, (B) yield strength, (C) (ultimate) tensile strength, (D) necking, (E) fracture** in Fig. 1. (每題 2 分%*5) (請畫圖並標示於答案卷上)

   (b) Compare **(A) strength** and **(B) ductility (C) toughness** betweem curve X and Y in Fig.2. (每題 2 分%*3)

Fig. 1

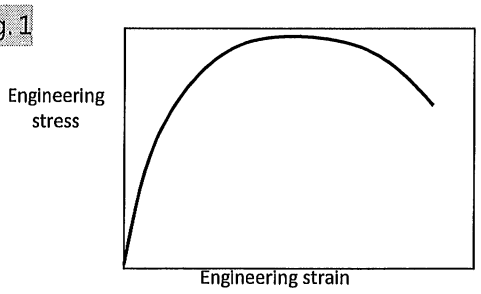
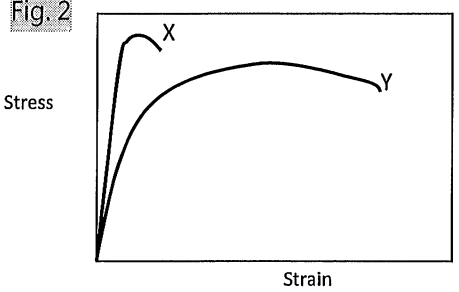


Fig. 2



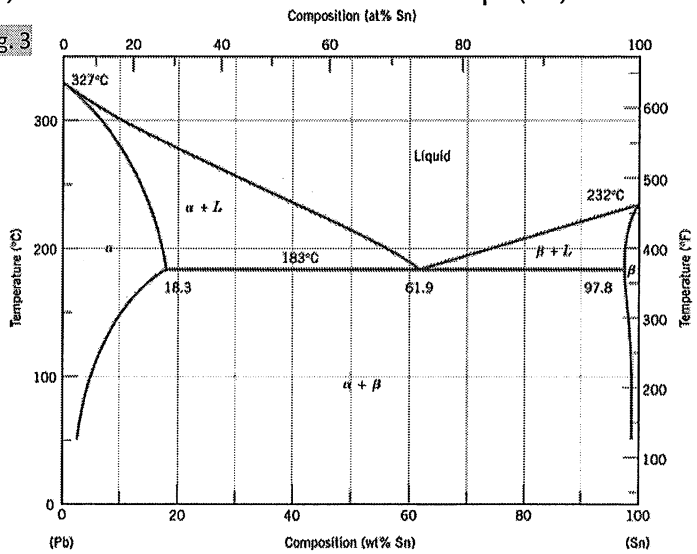
9. In Fig. 3, for a lead– tin (Pb-Sn) alloy of composition 80 wt% Sn– 20 wt% Pb and at 180°C(355°F) do the following:

   (a) Determine the **mass fractions of and phases.** (2, 3, 3%)

   (b) Determine the **mass fractions of primary and eutectic microconstituents.** (3, 3%)

   (c) Determine the **mass fraction of eutectic**β . (4%)

Fig. 3



10. **Name** the 5 cast iron types and **match** from the Fig. 4 (1-5) below (每題 2 分%*5)

Fig.4

1.	2.	3.	4.	5.