

# 大同大學 102 學年度 轉學入學考試試題

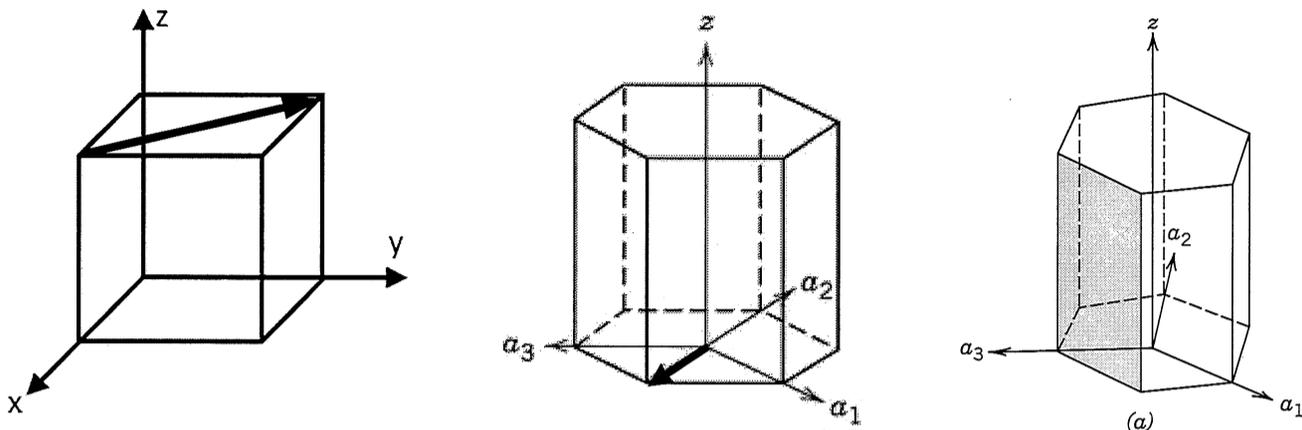
考試科目: 材料科學導論

所別: 材料工程學系

第 1 頁

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; 可以 使用計算器。

1. Determine the indices for the directions and planes shown in the following unit cell. (3\*4%)



2. For some applications, it is necessary to harden the surface of a steel (or iron-carbon alloy) above that of its interior. One way this may be accomplished is by increasing the surface concentration of carbon in a process termed carburizing; the steel piece is exposed, at an elevated temperature, to an atmosphere rich in a hydrocarbon gas, such as methane (CH<sub>4</sub>). Consider one such alloy that initially has a uniform carbon concentration of 0.25 wt% and is to be treated at 950°C (1750 °F). If the concentration of carbon at the surface is suddenly brought to and maintained at 1.20 wt%, **how long** will it take to achieve a carbon content of 0.80 wt% at a position 0.5 mm below the surface? The diffusion coefficient for carbon in iron at this temperature is  $1.6 \times 10^{-11} \text{ m}^2/\text{s}$ ; assume that the steel piece is semi-infinite. (8%)

**Table 5.1 Tabulation of Error Function Values**

$z$	$\text{erf}(z)$	$z$	$\text{erf}(z)$	$z$	$\text{erf}(z)$
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999

3. Briefly cite the **differences** (microstructure, mechanical characteristics....) between recovery, recrystallization and grain growth processes. (4, 4, 4%)
4. (a) Fig. I 請判斷 ABC 跟 AB'C' 分別屬於 ductile or brittle material? (1\*2%)  
 (b) Fig. II 請依照溫度高到低排列 A, B, C? (2%)  
 (c) Fig. III 請說明 A, B, C, D 分別代表的意義? yield point 為 E 或 F? (2\*5%)  
 (d) Fig. IV 請配對 A, B, C, D 與 1, 2, 3, 4? (1\*4%)

Fig. I

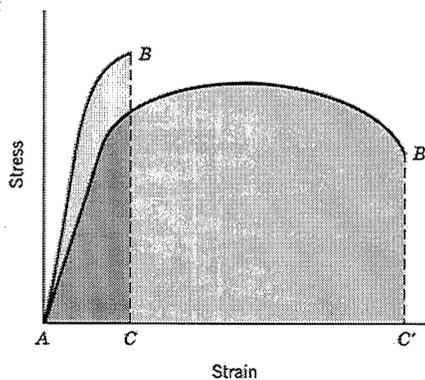


Fig. III

Fig. II

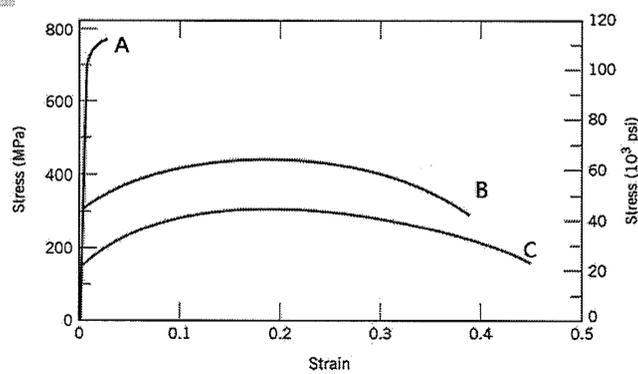


Fig. IV

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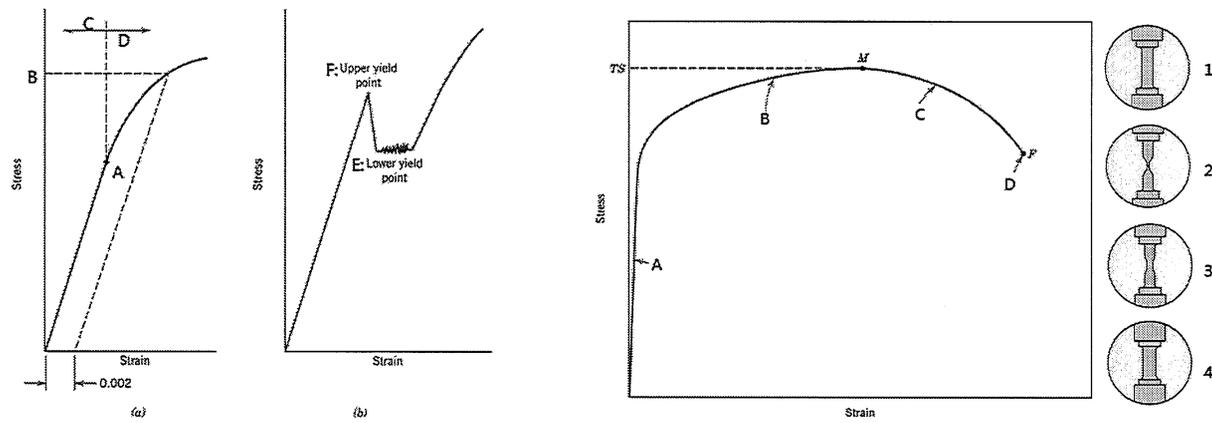
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第 2 頁

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5. What is(are) the difference(s) in physical concept between **mechanical strength** and **fracture toughness**? (10%)
6. What is "**fatigue**" for metals? (12%)
7. Draw a typical phase diagram with
  - (a) a **eutectoid** reaction,
  - (b) the formation of a complete solid solution (16%)
8. What is(are) the difference(s) in basic properties between metals formed by plastic deformation and casting? (12%)