

國立宜蘭大學

107 學年度研究所碩士班考試入學

材料科學試題

(化學工程與材料工程學系碩士班)

准考證號碼：

《作答注意事項》

- 1.請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
- 2.考試時間：100 分鐘。
- 3.本試卷共有七 題，共計 100 分。
- 4.請將答案寫在答案卷上。
- 5.考試中禁止使用手機或其他通信設備。
- 6.考試後，請將試題卷及答案卷一併繳交。
- 7.本試卷採雙面影印，請勿漏答。
- 8.本考科可使用非程式型（不具備儲存程式功能）之電子計算機。

1、(20%) A cylindrical metal specimen having an original diameter of 12.9 mm and gauge length of 50.9 mm is pulled in tension until fracture occurs. The diameter at the point of fracture is 6.7 mm, and the fractured gauge length is 72.1 mm. Calculate the ductility in terms of percent reduction in area and percent elongation.

2、(20%) The following table lists molecular weight data for a polypropylene material.

Compute (a) the weight-average molecular weight, and (b) the degree of polymerization.

<i>Molecular Weight</i>		
<i>Range (g/mol)</i>	x_i	w_i
8,000–16,000	0.05	0.02
16,000–24,000	0.16	0.10
24,000–32,000	0.24	0.20
32,000–40,000	0.28	0.30
40,000–48,000	0.20	0.27
48,000–56,000	0.07	0.11

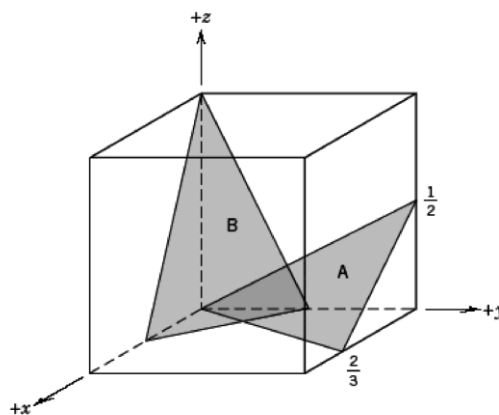
3、(20%) The diffusion coefficients for iron in nickel are given at two temperatures:

T (K)	D (m^2/s)
1273	9.4×10^{-16}
1473	2.4×10^{-14}

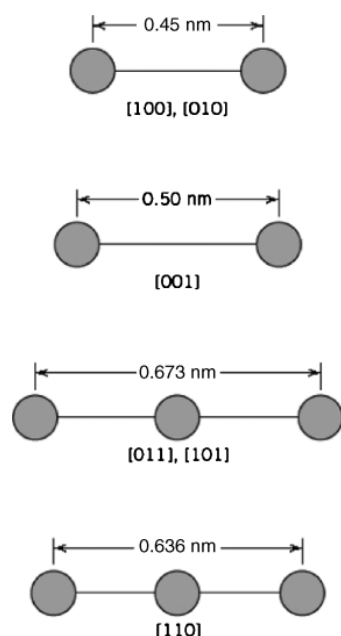
(a) Determine the values of D_0 and the activation energy Q_d .

(b) What is the magnitude of D at 1327 °C ? Hint: $\ln D = \ln D_0 - \frac{Q_d}{R} \left(\frac{1}{T} \right)$

4、(10%) Determine the Miller indices for the planes (A、B) shown in the following unit cell:



5、(10%) The accompanying figure shows the atomic packing schemes for several different crystallographic directions for some hypothetical metal. For each direction, the circles represent only those atoms contained within a unit cell; the circles are reduced from their actual size. (a) To what crystal system does the unit cell belong? (b) What would this crystal structure be called?



Sr. No.	Crystal System	Axial length of Unit Cell	Inter axial angles
1	Cubic	$a = b = c$	$\alpha = \beta = \gamma = 90^\circ$
2	Tetragonal	$a = b \neq c$	$\alpha = \beta = \gamma = 90^\circ$
3	Orthorhombic	$a \neq b \neq c$	$\alpha = \beta = \gamma = 90^\circ$
4	Monodinic	$a \neq b \neq c$	$\alpha = \beta = 90^\circ \neq \gamma$
5	Triclinic	$a \neq b \neq c$	$\alpha \neq \beta \neq \gamma \neq 90^\circ$
6	Trigonal	$a = b = c$	$\alpha = \beta = \gamma < 120^\circ, \neq 90^\circ$
7	Hexagonal	$a = b \neq c$	$\alpha = \beta = 90^\circ, \text{ and } \gamma = 120^\circ$

6、(10%) The value of R for iron is 0.1241 nm. For which set of crystallographic planes will a first-order diffraction peak occur at a diffraction angle of 46.21° for BCC iron when monochromatic radiation having a wavelength of 0.071 nm is used?

7、(10%) Compute the planar density value for the HCP (0001) plane for magnesium (the atomic radius for magnesium is 0.160 nm).