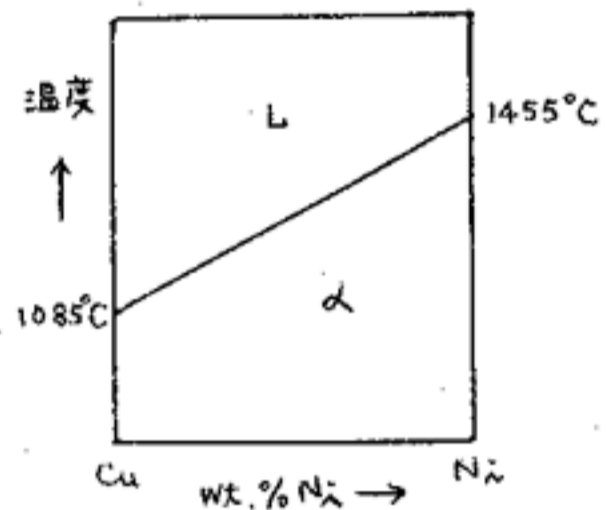


第一部份

1. 解釋 (1) 週期表中靠近左邊的第 IA 族元素 (例如 Na) 容易形成 Metallic Bond; (2) 週期表中靠近中間的第 IVA 族元素 (例如 C), 或 IIIA 與 VA 族元素 (例如 B 與 N) 容易形成 Covalent Bond; (3) 週期表中左邊的第 IA 族元素 (例如 Na) 容易與右邊 VIA 族元素 (例如 Cl) 形成 Ionic Bond。 (10%)
2. 你在山上檢到一塊岩石。解釋你如何著手研究此礦物的種類。 (10%)
3. 敘述 Ductile Fracture vs. Brittle Fracture 材料破斷面上所觀察到最大的差異。 (10%)

4. 右圖是某一學生所繪的 Binary Isomorphous System of Cu-Ni。你被要求證明此相平衡圖是錯誤的, 並且在你的答案紙上重繪正確的 Cu-Ni 相平衡圖 (定性即可, 無需十分正確)。
[注意: 祇繪出正確的相平衡圖但無法證明, 則此題得分為零]



5. 繪一個典型的 Binary Eutectic System 相平衡圖, 標示此相平衡圖的相, 並且解釋何謂 Eutectic Reaction? (10%)

第二部份：

1. A phase diagram of ternary system is shown in Fig. 1. Please calculate the percentages of (a) chemical composition and (b) phase constituents respectively for point X in this figure. (10%)

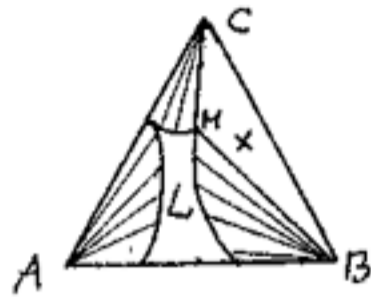


Fig. 1.

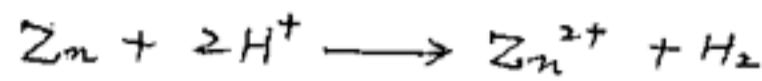
A, B, C = Chemical components
 L = Liquid phase

2. The density and associated percent crystallinity for two polytetrafluoroethylene materials are as follows: (10%)

ρ (g/cm ³)	Crystallinity (%)
2.144	51.3
2.215	74.2

- (a) Compute the densities of totally crystalline and totally amorphous polytetrafluoroethylene.
- (b) Determine the percent crystallinity of a specimen having a density of 2.26 g/cm³.
3. A brass rod is to be used in an application requiring its ends to be held rigid. If the rod is stress free at room temperature (20°C), what is the maximum temperature to which the rod may be heated without exceeding a compressive stress of 172 MPa? if
- $E_{\text{brass}} = 100 \text{ GPa}$
- $\alpha_{\text{brass}} = 20.0 \times 10^{-6} (\text{°C})^{-1}$ (10%)

4. Zinc experiences corrosion in an acid solution according to the reaction (10%)



The rates of both oxidation and reduction half-reactions are controlled by activation polarization.

(a) Compute the rate of oxidation of Zn (in mol/cm²-s) given the following activation polarization data:

Zn	Hydrogen
$V(\text{Zn}/\text{Zn}^{2+}) = -0.763\text{V}$	$V(\text{H}^+/\text{H}_2) = 0\text{V}$
$i_0 = 10^{-7}\text{ A/cm}^2$	$i_0 = 10^{-10}\text{ A/cm}^2$
$\beta = +0.09$	$\beta = -0.08$

(b) Compute the value of the corrosion potential
 1 Faraday = 96,500 C/mol.

5. Briefly describe the methods for measuring (10%)

(a) Hall Effect for majority charge carrier type, concentration and mobility.

(b) Hysteresis Effect for B-H behavior of a magnetic material