

國立中山大學 109 學年度 碩士暨碩士專班招生考試試題

科目名稱：熱力學【材光乙組聯合招生碩士班、材光系碩士班乙組、材料前瞻應材碩士班乙組】

—作答注意事項—

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

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 題號：488002

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題） 共 2 頁第 1 頁

1. According to the following thermodynamic data, calculate the enthalpy (10%), entropy (10%) and Gibbs free energy (10%) of the reaction $\text{Pb} + 1/2 \text{O}_2 = \text{PbO}$ at 1000 K.

$$H_{\text{PbO}(298)} = -219,000 \text{ J/mole}$$

$$S_{\text{Pb}(298)} = 65 \text{ J/K mole}$$

$$S_{\text{PbO}(298)} = 66.3 \text{ J/K mole}$$

$$S_{\text{O}_2(298)} = 205 \text{ J/K mole}$$

$$C_{p, \text{Pb}(s)} = 23.6 + 9.75 \cdot 10^{-3} T \text{ J/K from } 298 \text{ K to } T_{m, \text{Pb}}$$

$$C_{p, \text{Pb}(l)} = 32.4 - 3.1 \cdot 10^{-3} T \text{ J/K from } T_{m, \text{Pb}} \text{ to } 1200 \text{ K}$$

$$C_{p, \text{PbO}(s)} = 37.9 + 26.8 \cdot 10^{-3} T \text{ J/K from } 298 \text{ K to } T_{m, \text{PbO}}$$

$$C_{p, \text{O}_2(g)} = 29.96 + 4.18 \cdot 10^{-3} T - 1.67 \cdot 10^5 T^{-2} \text{ J/K from } 298 \text{ K to } 3000 \text{ K}$$

$$H_{m, \text{Pb}} = 4810 \text{ J at } T_{m, \text{Pb}} = 600 \text{ K}$$

$$T_{m, \text{PbO}} = 1159 \text{ K}$$

2. According to the following figure, (a) describe the meaning of point d and e (10%); (b) write down the triple points of stable and metastable phase equilibria. (10%)

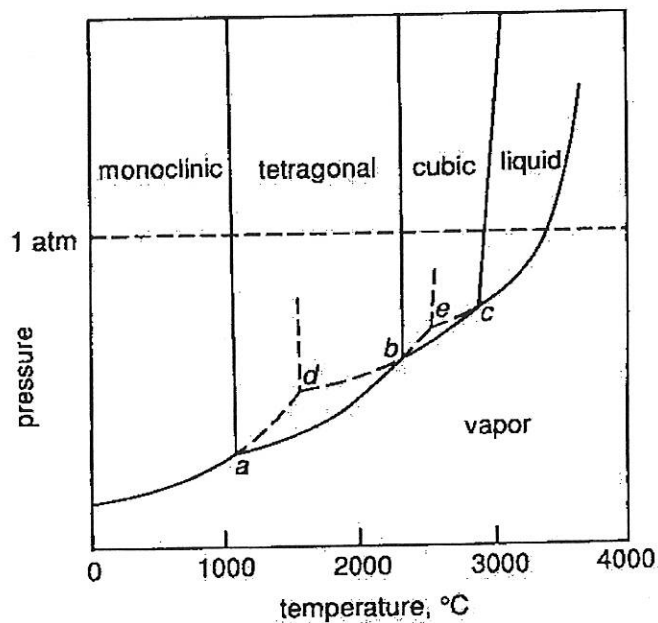


Figure 7.15 A schematic phase diagram for zirconia, ZrO_2 .

3. One mole of a monatomic ideal gas, in the initial state $T = 273 \text{ K}$, $P = 1 \text{ atm}$, is subjected to the following three processes, each of which is conducted reversibly:

a. a doubling of its volume at constant pressure, (10%)

b. then a doubling of its pressure at constant volume, (10%)

c. then a return to the initial state along the path $P = 6.643 \cdot 10^{-4} V^2 + 0.6667$. (10%)

Calculate the heat and work effects which occur during each of the three processes.

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4. There are four sets of regular solution parameters as (A) $\Omega_1 = 0.0 \text{ kJ}$, $\Omega_s = 0.0 \text{ kJ}$; (B) $\Omega_1 = 0.0 \text{ kJ}$, $\Omega_s = 15 \text{ kJ}$; (C) $\Omega_1 = -10 \text{ kJ}$, $\Omega_s = 0.0 \text{ kJ}$; (D) $\Omega_1 = 10 \text{ kJ}$, $\Omega_s = 0.0 \text{ kJ}$, The melting temperatures of A and B are, 800 and 1200 K, respectively, and the molar entropies of melting of both components are 10 J/K. Please mark these parameter sets to match the following four phase diagrams. (20%)

