國　立　宜　蘭　大　學

110 學年度研究所碩士班考試入學

物理化學(含熱力學與動力學)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 7 題，共計 100 分。

4.請將答案寫在答案卷上。

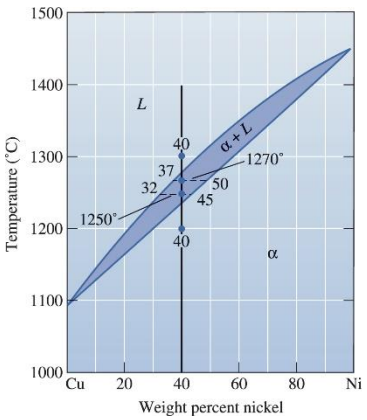
5.考試中禁止使用手機或其他通信設備。

6.考試後，請將試題卷及答案卷一併繳交。

7.本考科可使用電子計算機（廠牌、功能不拘）。

1. Calculate the work involved in expanding 20.0 L of an ideal gas to a final volume of 85.0 L against a constant external pressure of 2.50 bar. (10%)
2. What is the change in G for a process in which 0.022 mole of an ideal gas goes from 2505 psi (pounds per square inch) to 14.5 psi at 295K? (10%)
3. What are $\Delta_{mix}H$, $\Delta_{mix}U$, $\Delta_{mix}G$, and $\Delta_{mix}S$ for a system that mixes 1.00 mol of toluene and 3.00 mol of benzene? Assume ideal behavior and 298 K. (10%)
4. (a) Derive the Clausius-Clapeyron equation $\ln\frac{P_2}{P_1} = \frac{\Delta_{vap}H}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$. (10%)

   (b) The vapor pressure of mercury at 536 K is 103 torr. Estimate the normal boiling point of mercury, where the vapor pressure is 760 torr. The heat of vaporization of mercury is 58.7 kJ/mol. (10%)
5. Determine the amount and composition (in percentage) of each phase in a Cu-40% Ni alloy at 1300°C, 1270°C, 1250°C, and 1200°C. (20%)



6. One example of a first-order reaction is the isomerization of hydrogen isocyanide to hydrogen cyanide: $HNC_{(g)} \rightarrow HCN_{(g)}$. If the rate constant at a particular temperature is $4.403 \times 10^{-4}\ s^{-1}$, what mass of HCN remains after 1.50 hr if a 1.000-gram sample of HNC was present at the beginning of the reaction? (10%)
7. (a) Derive the second-order equation of 2A→Z. (10%)

   (b) Derive the second-order equation of A+B→Z. The initial concentrations of A and B are a_0 and b_0, respectively. (10%)