國　立　宜　蘭　大　學

104 學年度轉學招生考試

（考生填寫）
准考證號碼：

物　理　化　學　試　題

《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：80 分鐘。

3.本試卷共有　6 題，共計 100 分。

4.請將答案寫在答案卷上（於本試題上作答者，不予計分）。

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。

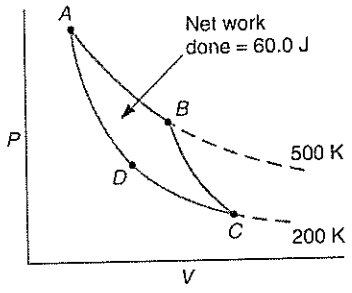
7.本考科可自行攜帶使用非程式型(不具備儲存程式功能)之電子計算機。

1. Explain the following items: (a) Ideal gas, (b) First law of thermodynamics, (c) Equilibrium, (d) Phase rule, (e) Raoult's law. (20%)

2. (a) An ideal gas occupies a volume of 0.300 dm^3 at a pressure of 1.80×10^5 Pa. What is the new volume of the gas maintained at the same temperature if the pressure is reduced to 1.15×10^5 Pa?
(b) If the gas were initially at 330 K, what will be the final volume if the temperature were raised to 550 K at constant pressure? (20%)

3. Calculate the average molar mass of air at sea level and 0 °C of the density of air is 1.29 kg m^{-3}. (10%)

4. The accompanying diagram represents a reversible Carnot cycle for an ideal gas.
(a) What is the thermodynamic efficiency of the engine?
(b) How much heat is absorbed at 500 K?
(c) How much heat is rejected at 200 K?
(d) In order for the engine to perform 1.00 kJ of work, how much heat must be absorbed? (20%)



5. (a) Derive the van't Hoff equation $\frac{d \ln K_p^o}{d(1/T)} = -\frac{\Delta H^o}{R}$ from Gibbs-Helmholtz equation.

(b) The equilibrium constant for an associate reaction

$$A + B \leftrightarrow AB$$

is 1.80×10^3 dm^3 mol^{-1} at 25°C and 3.45×10^3 dm^3 mol^{-1} at 40°C. Assuming ΔH^o to be independent of temperature, calculate ΔH^o and ΔS^o. (20%)

6. (a) Derive the half-life of a first-order reaction is $t_{1/2} = \frac{\ln 2}{k}$.

The half-life of radium, $^{226}_{88}Ra$, is 1600 years. How many disintegrations per second would be undergone by 1 g of radium? (10%)