※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. A System which undergoes an adiabatic change and does work on surroundings has the following conditions. Which one is true? (10%)
(A)W<0,ΔU=0 (B) W>0,ΔU>0 (C)W>0,ΔU<0 (D)W<0,ΔU>0 (E)W<0,ΔU<0

2. At 25°C and 1 bar pressure, heat of combustion of butane is ΔH_1; Heat of formation of liquid water is ΔH_2; and heat of formation of carbon dioxide is ΔH_3; then the heat of formation of butane is: (choose correct one) (10%)
(A) $4\Delta H_3+\Delta H_2+\Delta H_1$ (B) $2\Delta H_3+5/2\Delta H_2-\Delta H_1$(C) $4\Delta H_1+5\Delta H_2-\Delta H_3$ (D) $4\Delta H_3+5\Delta H_2-\Delta H_1$ (E) none is correct

3. For a binary liquid mixture A-B, choose the correct one: (10%)
(A) Both the molar volume of the solution and partial molar volume for each component are always positive.
(B) The molar volume of mixing is always zero.
(C) The Gibbs energy of the solution is always increased with increasing the temperature.
(D) The Gibbs energy of the solution is always increased with increasing the pressure.
(E) None is correct.

4. Iodine crystals sublime at 25°C. Find the temperature at which solid iodine and gaseous iodine will exist in equilibrium. The enthalpy change for the reaction, $I_2(s) = I_2$ (g) is 9.41 kcal/mole and the change in entropy is 20.6 cal/mol-K. (10%)

5. What is the ionic strength of the solution containing both 0.05mol/kg Na_2SO_4 and 0.1 mol/kg NaCl. (10%)

6. The half-life of the first order reaction $2N_2O_5 \rightarrow 4NO_2+O_2$ is 5.7 hours at 25°C. Please calculate the rate coefficient for this reaction. (10%)

7. Given the following data： (10%)
(A) Cu^{2+} (aq) + e$^-$ $\rightarrow$ Cu^+(aq)　　$E_1°$ = 0.153 V
(B) Cu^{2+} (aq) +2 e$^-$ $\rightarrow$ Cu(s)　　$E_2°$ = 0.337 V
Please calculate the standard potential ($E°$)for the process?
Cu^+ (aq) + e$^-$ $\rightarrow$ Cu(s)

8. The free energy difference for the process C (graphite) → C (diamond) is $\Delta G°$ =2.90 kj/mol (at 25°C and 1 bar). The densities of these materials are: ρ(diamond) =3.51g/cm^3, ρ(graphite) =2.26g/cm^3. Estimate the pressure required to convert graphite to diamond at 25°C. (15%)

9. Helium is compressed isothermally and reversibly at 100°C from the pressure of 2 to 10 bar. Please calculate (a) heat Q, (b) work W, (c) ΔU (d) ΔH (e) ΔG per mole, assuming that helium is an ideal gas. (Gas constant R=8.31451 JK^{-1}mol^{-1}, ln5=1.609) (15%)