

國立臺北科技大學
九十八學年度研究所碩士在職專班入學考試

化學工程研究所
乙組：物理化學試題

填准考證號碼

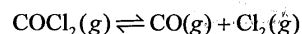
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注意事項：

- 本試題共 6 題，配分共 100 分。第 1 題 32 分，每小題 4 分；第 2~4 題各 14 分；第 5 題 14 分，每小題 7 分；第 6 題 12 分，每小題 6 分。
- 請按順序標明題號作答，不必抄題。
- 全部答案均須答在試卷答案欄內，否則不予計分。

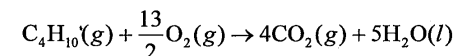
- For each of the following processes, state which of the quantities ΔU , ΔH , ΔS , ΔA , and ΔG are equal to zero:
 - Isothermal reversible expansion of an ideal gas.
 - Adiabatic reversible expansion of a nonideal gas.
 - Adiabatic expansion of an ideal gas through a throttling valve.
 - Adiabatic expansion of a nonideal gas through a throttling valve.
 - Vaporization of liquid water at 80°C and 1 bar pressure.
 - Vaporization of liquid water at 100°C and 1 bar pressure.
 - Reaction between H_2 and O_2 in a thermally insulated bomb.
 - Reaction between H_2SO_4 and $NaOH$ in dilute aqueous solution at constant temperature and pressure.
- At 100°C and 2 bar pressure the degree of dissociation of phosgene is 6.30×10^{-5} . Calculate K_p , K_c , and K_x for the dissociation



- Calculate Henry's law constant and the vapor pressure of pure liquid A (molar mass = 89.5 g mol⁻¹) and that of 75.0 g of liquid A in solution with 1000 g of liquid B. Liquid B (molar mass = 185 g mol⁻¹) has a pressure in this solution of 430 Torr and the total solution pressure is 520 Torr.
- A certain substance exists in two solid phases A and B and also in the liquid and gaseous states. Construct a P - T phase diagram indicating the regions of stable existence for each phase from the following triple-point data:

T/K	P/kPa	Phases in Equilibrium
100	100	A, B, gas
200	400	A, B, liquid
400	500	B, liquid, gas

- The following thermodynamic data apply to the complete oxidation of butane at 25°C.



Where $\Delta H^\circ = -2877 \text{ kJ mol}^{-1}$, $\Delta S^\circ = -432.7 \text{ J K}^{-1} \text{ mol}^{-1}$.

Suppose that a completely efficient fuel cell could be set up utilizing this reaction. Calculate (a) the maximum electrical work and (b) the maximum total work that could be obtained at 25°C.

- A sample of liquid acetone weighing 0.700 g was burned in a bomb calorimeter for which the heat capacity (including the sample) is 6937 J K⁻¹. The observed temperature rise was from 25.00°C to 26.69°C.
 - Calculate ΔU for the combustion of 1 mol of acetone.
 - Calculate ΔH for the combustion of 1 mol of acetone.