

# 淡江大學 97 學年度碩士班招生考試試題

系別：化學學系

科目：物理化學

A

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1. Consider a closed system that only P – V work is done on. Please show that

(a)  $\Delta H = q_p$   $q_p$ : the heat absorbed in a constant-pressure process (5%)

(b)  $C_P = \left( \frac{\partial H}{\partial T} \right)_P$   $C_P$ : the heat capacity in a constant-pressure process (5%)

(c)  $C_P - C_V = \left[ \left( \frac{\partial U}{\partial V} \right)_T + P \right] \left( \frac{\partial V}{\partial T} \right)_P$  (10%)

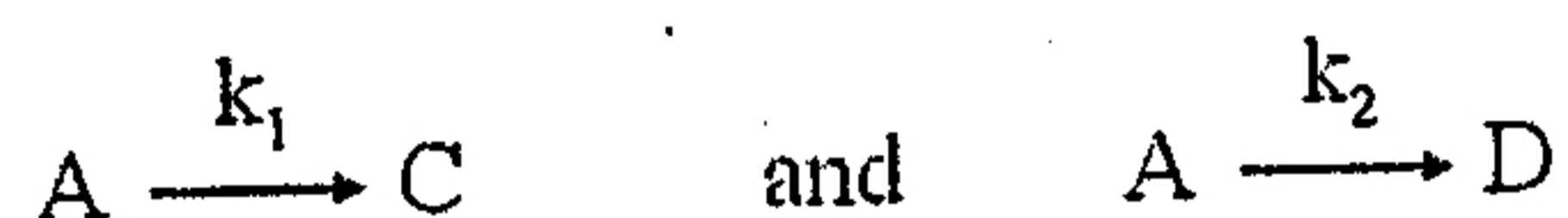
$C_V$ : the heat capacity in a constant-volume process

2. Find  $\Delta S$  and  $\Delta G$  for the conversion of 10 g of supercooled water at  $-10^\circ\text{C}$  and 1 atm to ice at  $-10^\circ\text{C}$  and 1 atm. Average  $C_P$  values for ice and supercooled water in the range 0 to  $-10^\circ\text{C}$  are 0.50 and 1.01 cal/(g  $^\circ\text{C}$ ), respectively. For ice, heat of melting = 79.7 cal/g at  $0^\circ\text{C}$ . (20%)

3. Please explain the following terms: (15%)

(a) critical micelle concentration (b) ideal solution (c) diffusion (d) effusion  
(e) Hess's Law

4. Consider two competing irreversible first-order reactions:



$k_1$  and  $k_2$  are the rate constants.

(a) Find all the concentrations of A, C, and D as functions of time, respectively.

Assume  $[A] = [A]_0$ ,  $[C] = 0$ , and  $[D] = 0$  at  $t = 0$ . (15%)

(b)  $[C] / [D] = ?$  (5%)

5. For a particle in one-dimensional-box stationary state, show that  $\langle p_x \rangle = 0$ . (10%)

6. Please explain the following terms: (15%)

(a) Hamiltonian operator (b) zero-point energy (c) Pauli exclusion principle  
(d) degenerate (e) stimulated emission