

1. Defines the following terms: (總分 40 分; 每小題 5 分)
  - a. Second Law of thermodynamic.
  - b. Third Law of thermodynamic.
  - c. Henry's Law
  - d. Raoult's Law
  - e. Heisenberg's "Uncertain Principle".
  - f. Pauli's "Exclusion Principle"
  - g. Hund's rule.
  - h. Arrhenius equation.
  
2. Derive the rate law for decomposition of  $N_2O_5$  generating  $NO_2$  and  $O_2$  by the mechanisms: (20 分)
 

$N_2O_5$	$\longrightarrow$	$NO_2 + NO_3$	.....	$k_a$
$NO_2 + NO_3$	$\longrightarrow$	$N_2O_5$	.....	$k_a'$
$NO_2 + NO_3$	$\longrightarrow$	$NO_2 + NO + O_2$		$k_b$
$NO + N_2O_5$	$\longrightarrow$	$3 NO_2$		$k_c$
  
3. Two moles of an ideal gas is allowed to expand isothermally from 10 to 50 L at 298 K: (總分 20 分; 每小題 5 分)
  - a. What is the change in entropy of the ideal gas?
  - b. How much work has been done of the ideal gas?
  - c. What is the change in heat of the surrounding?
  - d. What is the change in entropy of the surrounding?
  
4. For the simplest assumption used in quantum mechanics is that of a particle of mass  $m$  was constrained to move in one dimensional box of length  $a$ . The potential energy of the  $V(x)$  is taken to be 0 for  $0 < x < a$  (when particle was move within the box) and is infinite when situated outside the limited region. The potential energy confines the particle to move in the region between 0 and  $a$  on the  $x$  axis. (總分 20 分; 每小題 5 分)
  - a. What is the Hamiltonian operator?
  - b. What is the time-independent Schrodinger equation?
  - c. What is the total energy of ground state?
  - d. What is time-independent wave function of ground state?