考生注意事項：
一、考試時間 100 分鐘。
二、應考人不得自行攜帶電子計算器，一律由本校統一提供
三、本試題共八大題

試題一：〈每小題 3 分共 30 分〉

1. What volume is occupied by 19.6 g of methane (CH_4) at 27°C and 1.59 atm? a) 1.71L
   b)18.9 L   c)   27.7 L   d)   302 L

2. Which conditions of P, T, and n, respectively, are most ideal? a)   high P, high T, high n
   b) low P, low T, low n c)   high P, low T, high n d)   low P, high T, low n

3. Four identical 1.0-L flasks contain the gases He, Cl_2, CH_4, and NH_3, each at 0°C and 1 atm
   pressure. Which gas has the highest density? a) He   b) Cl_2 c) CH_4 d) NH_3

4. Four identical 1.0-L flasks contain the gases He, Cl_2, CH_4, and NH_3, each at 0°C and 1 atm
   pressure. For which gas do the molecules have the highest average velocity? a)He   b) Cl_2
   c) CH_4 d) NH_3

5. A gas absorbs 0.0 J of heat and then performs 15.2 J of work. The change in internal energy of
   the gas is a)   –24.8 J   b)   14.8 J   c)   55.2 J   d)   –15.2 J

6. Which of the following statements correctly describes the signs of q and w for the following
   exothermic process at P = 1 atm and T = 370 K?
   　　　　$H_2O(g) \rightarrow$　$H_2O(l)$
   a)q and w are negative.   b)q is positive, w is negative. c)q is negative, w is positive.
   d)q and w are both positive. e)q and w are both zero.

7. You take 200. g of a solid at 30.0°C and let it melt in 400. g of water. The water temperature
   decreases from 85.1°C to 30.0°C. Calculate the heat of fusion of this solid.   a)125 J/g
   b) 285 J/g   c)461 J/g   d)518 J/g

8. Which of the following concentration measures will change in value as the temperature of a solution changes?   a)   mass percent b)   molarity c)   molality d)   mole fraction

9. The solubility of O_2 in water is 0.590 g/L at an oxygen pressure of 15 atm. What is the Henry's law constant for O_2 (in units of L-atm/mol)?   a) 3.93×10^{-3} b)   1.23 $\times 10^{-3}$ c) 8.14×10^2 d)   1.26

10. Consider the reaction $X \rightarrow Y +$ Z Which of the following is a possible rate law?
    a)   Rate $= k[X]$ b)   Rate $= k[Y]$ c)   Rate $= k[Y][Z]$ d)   Rate $= k[X][Y]$

試題二：〈 10 分〉

For a system of 3.0 mol of argon (assumed ideal) compressed reversibly and isothermally at 298K from a volume of 200.0 L to 20.0 L. Calculate q, w, $\triangle U$, and $\triangle H$.

試題三：〈 10 分〉

Calculate the entropy of mixing per mole of air taking the composition by volume to be 79% N2, 20% O2, and 1% Ar.
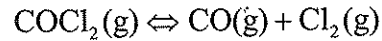
試題四：〈 10 分〉

Water is vaporized reversibly at 100°C and 1.013 bar. The heat of vaporization is 40.69 KJmol^{-1}

(a) What are values of q, $\triangle G$, and $\triangle S$ for the water?(5%)

(b) What is the value of $\triangle S$ for the water plus the heat reservoir at 100°C ?(5%)

試題五：〈 10 分 〉

At 100℃ and 2 bar pressure the degree of dissociation of phosgene is 6.30×10^{-5}. Calculate Kp,

Kc and Kx for the dissociation.

$$COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$$

試題六：〈 10 分 〉

The normal boiling temperature of ethanol is equal to 78.5℃ and the molar enthalpy change of

vaporization is equal to 40.5 KJ/mol. Estimate the vapor pressure of ethanol at 100.0℃.

試題七：〈 10 分 〉

At 373.15K and 1.0atm, the Gibbs energy change of vaporization of water is zero and the

enthalpy change is 40670J/mol. Find the Gibbs energy change of vaporization of water at

383.15K and 1.0atm.(If △H is constant).

試題八：〈 10 分 〉

a. Derive the general formula by definition $\mu = (\partial T / \partial P)_H$?(5%)

$\mu = -\dfrac{1}{C_P}(\dfrac{\partial H}{\partial P})_T$ μ is the Joule-Thomson coefficient.

b.The Helmholtz free energy given the symbol A, is defined by A=E-TS. Derive the formula

$\left[\dfrac{\partial}{\partial T}(\dfrac{\Delta A}{T})\right]_P = \dfrac{-\Delta E}{T^2}$? (5%)