國立勤益科技大學 102 學年度研究所碩士班招生筆試試題卷

所別： 化工與材料工程系碩士班　　組別：化工科技

科目： 化工動力學及化工熱力學

准考證號碼：□□□□□□□□（考生自填）

考生注意事項：
一、考試時間 80 分鐘。
二、
三、

試題一：〈 10 分〉

Derive a relation for the change of internal energy of a pure substance as a function of volume and temperature. What is the result of application of this equation to a van der Waals gas?

試題二：〈 15 分〉

A reversible cycle executed by 1mole of an ideal gas for which $C_p = 7R/2$ and $C_v = 5R/2$ consists of the following: (a) Starting at 800 K and 2.0 bar, the gas is cooled at constant pressure to 400 K. (b) From 400 K and 2.0 bar, the gas is compressed isothermally to a pressure. (c) The gas returns to its initial state along a path for which PT = constant. What is the thermal efficiency of the cycle?

試題三：〈 10 分〉

A refrigeration system cools brine from 320 K to 260 K at the rate 20 kg/sec. Heat is discarded to the atmosphere at a temperature of 300 K. What is the power requirement if the thermodynamic efficiency of the system is 0.3? The specific heat of the brine is 3.5kJ/(kg-K).

## 試題四：〈 10 分〉

What is the pressure in a 0.8-m3 vessel when it is charged with 15 kg of ethane (MW=30, $T_C$=305.3K, $P_C$=48.72bar, ω=0.1) at 70 °C? (Calculate the pressure by the Redlich / Kwong equation)

$$P=\frac{RT}{V-b}-\frac{a}{V(V+b)}\ ;\ a=0.42748\frac{T_r^{-1/2}R^2T_C^2}{P_C}\ ;\quad b=0.08664\frac{RT_C}{P_C}\ 。$$

## 試題五：〈 10 分〉

One mole of an ideal gas, $C_p$ = 5R/2 and $C_v$ = 3R/2, is compressed isothermally in a piston/cylinder device from 2 bar 400 K to 8 bar. The process is irreversible and requires 35% more work than a reversible, isothermal compression. The heat transferred from the gas during compression flow to a heat reservoir at 300 K. Calculate the $S_G$.

## 試題六：〈 15 分〉

Derivative the first-order reaction of the vary-volume batch reactor ：$-\ln\left(1-\frac{\Delta V}{\varepsilon_A V_\circ}\right)=kt$.

## 試題七：〈 10 分〉

A reaction has the stoichiometric equation $A+B\xrightarrow{k_2}C$. What is the order of reaction?

## 試題八：〈 10 分〉

The series reaction $A\xrightarrow{K_1}B\xrightarrow{K_2}C$ , If$C_B=C_{A\circ}k_1\left(\frac{e^{-k_1t}}{k_2-k_1}+\frac{e^{-k_2t}}{k_1-k_2}\right)$, derive $t_{\max}=\frac{\ln\left(k_2/k_1\right)}{k_2-k_1}$

## 試題九：〈 10 分〉

A chemical reaction rate is independent on the initial concentration of reactant, and in a batch reactor 50% of reactant is converted in a 15 min run. How much longer would it take to reach 85% conversion?