

國立臺北科技大學 106 學年度碩士班招生考試

系所組別：3720 分子科學與工程系有機高分子碩士班乙組

第二節 化工熱力學 試題

第一頁 共一頁

注意事項：

1. 本試題共六大題，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、1.2 kg of liquid water initially at 15°C is to be heated to 95°C in a teapot equipped with a 1200 W electric heating element inside. The teapot is 0.5 kg and has an average specific heat of 0.7 kJ/kg°C. Taking the specific heat of water to be 4.18 kJ/kg°C and disregarding any heat loss from the teapot, determine how long it will take for the water to be heated. (10 分)

二、The specific heat of a substance varies with the temperature according to the function $c=0.20+0.14T+0.023T^2$, with T in °C and c in cal/g·K. Find the energy required to raise the temperature of 1.0 g of this substance from 5.0 to 15°C. (5 分)

三、A thermodynamic system is taken from state A to state B to state C , and then back to A , as shown in the p - V diagram of **Fig 1(a)**. The vertical scale is set by $p_s = 40$ Pa, and the horizontal scale is set by $V_s = 4.0$ m³. (a)-(g) Complete the table in the **Fig 1(b)** by inserting a plus sign (+), a minus sign (-), or a zero (0) in each indicated cell. (每小題 5 分，共 35 分)

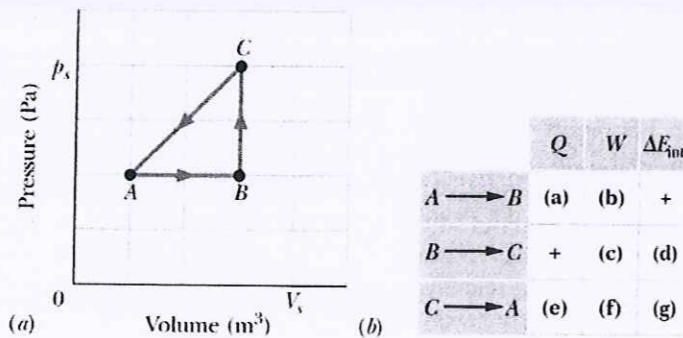


Fig 1

四、A 5-m-long section of an air heating system of a house passes through an unheated space in the basement. The cross-section of the rectangular duct of the heating system is 20 cm x 25 cm. Hot air enters the duct at 100 kPa and 60 °C at an average velocity of 5 m/s. The temperature of the air in the duct drops to 54 °C as a result of heat loss to the cool space in the basement. (a) Determine the rate of heat loss from the air in the duct to the basement under steady conditions. Also, (b) determine the cost of this heat loss per hour if the house is heated by a natural gas furnace that has an efficiency of 80 percent, and the cost of the natural gas in that area is \$0.60/therm (1 therm = 100000 Btu = 105500 kJ). (每小題 10 分，共 20 分)

五、A gas within a closed chamber undergoes the cycle show in the p - V diagram of **Fig 2**. The horizontal scale is set by $V_s = 4.0$ m³. Calculate the net energy added to the system as heat during one complete cycle. (10 分)

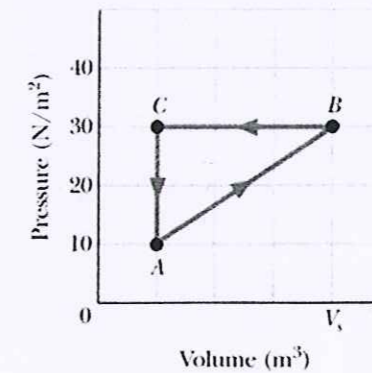


Fig 2

六、When a system is taken from state i to state f along path iaf in **Fig 3**, $Q = 50$ cal and $W = 20$ cal. Along path ibf , $Q = 36$ cal. (a) What is W along path ibf ? (b) If $W = -13$ cal for the return path fi , what is Q for this path? (c) If $E_{int,i} = 10$ cal, what is $E_{int,f}$? If $E_{int,b} = 22$ cal, what is Q for (d) path ib ? (每小題 5 分，共 20 分)

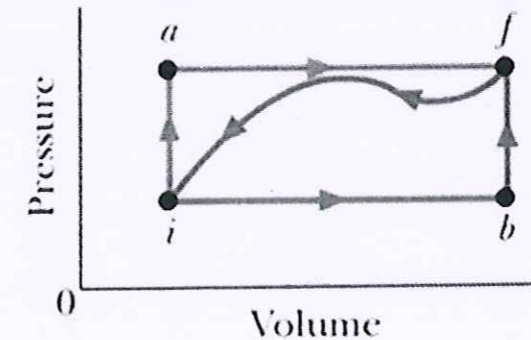


Fig 3