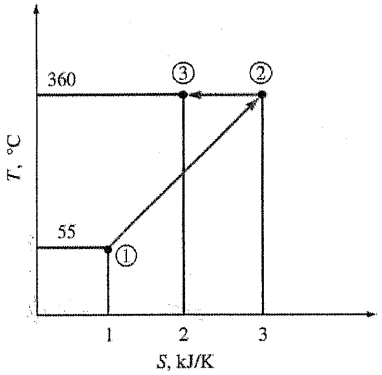
逢甲大學101學年度碩士班招生考試試題 編號：005 科目代碼：

科目	熱流學（含熱力學、流體力學）	適用系所	機械與電腦輔助工程學系機械工程碩士班熱流組	時間	120 分鐘

※請務必在答案卷作答區內作答。

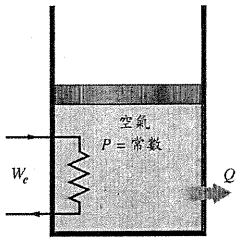
1. 簡答或推導下列問題(每題 15 分，共 45 分)
   A. 在一個絕熱的活塞－汽缸裝置內，是否有可能將理想氣體等溫壓縮？試解釋之。
   B. 試證明理想氣體 $\bar{c}_p = \bar{c}_v + R_u$ 。
   C. 畫出卡諾循環的 T-S 圖（需標示出功和熱的流向），並證其效率為 1-TL/TH。

2. 試求下圖此可逆過程 1-3 的總熱傳量。(15 分)



3. 一個活塞－汽缸裝置裝有 1.2 kg、120 kPa、27°C 的氮氣， 氮氣以 Pν^1.3 = 常數的多變過程緩慢壓縮。在過程結束時，其體積減為一半，試求氮氣在此過程中的熵變化量。(Cp = 1.005 kJ/kg·K) (15 分)

4. 令電流流經汽缸內的電熱器，將活塞－汽缸內 15 kg 的空氣從 25ºC 加熱至 77ºC。過程中汽缸內的壓力維持固定於 300 kPa，並產生 60 kJ 的損失，試求供應的電能，以 kWh 表示。(ps: Cp=1.005kJ/kgK, Cv=0.718kJ/kgK) (25 分)



5. The velocity for a steady, incompressible flow in the xy plane is given by $\vec{V} = \frac{A}{x}\vec{i} + \frac{Ay}{x^2}\vec{j}$, where A=2 m^2/s, and the coordinates are measured in meters. Obtain an equation for the streamlines that passes through the point (x,y)=(1,3). Calculate the time required for a fluid particle to move from x=1 m to x=3 m in this flow field. (25 分)

6. If ρ is the density and $\vec{V}$ is the velocity of a flow field, ∇ is the del operator, $\bullet$ is the dot product and $\times$ is the cross product, please list the flow conditions of the following equations : (a). $\nabla \times \vec{V} = 0$ (b). $\nabla \bullet \vec{V} = 0$ (c). $(\vec{V} \bullet \nabla)\vec{V} > 0$. (24 分)

7. Consider the pressure-driven flow between stationary parallel plates separated by distance 2b. Coordinate y is measured from the channel centerline. The velocity field is given by $u = u_{max}[1-(y/b)^2]$. Evaluate the rates of linear and angular deformation. Obtain an expression for the vorticity vector, $\vec{\zeta}$. Find the location where the vorticity is a maximum. (25 分)

8. Consider the cylindrical weir of diameter D and length L. If both of the fluids on the left and on the right have a density of ρ, find the magnitude and direction of the resultant force. (26分)