1. (25 分) 解釋及說明下列名詞:
   (a) Pitot tube   (5 分)
   (b) Bernoulli equation   (5 分)
   (c) Fuel cell   (5 分)
   (d) Newton's law of cooling   (5 分)
   (e) Lower and higher heating value   (5 分)

2. (25 分) Air enters an adiabatic nozzle steadily at 300 Kpa, 200 °C and leaves at 100 Kpa and 180 m/s. The inlet area of the nozzle is 80 cm^2. Determine
   (a) The mass flow rate through the nozzle in kg/s (7 分)
   (b) The exit temperature of the air in °C   (9 分)
   (C) The exit area of the nozzle in cm^2.   (9 分)

註: air 定壓比熱 $C_p = 1.004$ kJ/kg K，定容比熱 $C_v = 0.717$ kJ/kg K，氣體常數 $R = 0.287$ kJ/kg K

3. (25 分) An air-standard cycle is executed in a closed system with 0.003 kg of air and consists of the following three processes:
   1-2　Constant volume process with heat addition from 95 Kpa and 17 °C to 380 Kpa
   2-3　Isentropic expansion to 95 Kpa
   3-1　Constant pressure heat rejection to initial state

   (a) Show ht cycle on P-v and T-s diagram   (5 分)
   (b) Calculate the net work per cycle in KJ   (10 分)
   (c) Determine the thermal efficiency   (10 分)

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4. (25 分) Ethane (C_2H_6) is burned with 20% excess air during a combustion process. Assuming complete combustion and a total pressure of 100Kpa. Determine
   (a) air-fuel ratio (kg air/kg fuel)   (15 分)
   (b) partial pressure of the water vapor in the product in Kpa
       (10 分)