

系別：航空太空工程學系

科目：熱 力 學

准帶項目請打「V」

簡單型計算機

本試題共 / 頁，9 大題

簡答題：(每題 8 分)

1. 何謂空氣標準 Diesel Cycle? 其組成過程(Process)為何，請繪出其 P-V 狀態圖? 其效率為何?
2. 請問增加蒸汽動力 Rankine Cycle 熱效率的三種方法?
3. 請說明熱力學第一、二、三定律之內容
4. 節流過程為一穩態穩流(Steady State Steady Flow)通過一阻礙，使得本身壓力下降之過程，如流體流經部分開啟之閥門等。此過程通常在極小空間，極短時間內發生，因此常假設為何種過程?
5. 某物質之三相點壓力為 2.011kPa，請問在壓力為 1.5kPa 時，此物質是否有可能以液態存在，請說明理由?

計算題：(每題 15 分)

1. A mass of 0.8 kg of air at 100kPa and 25° C is contained in a gas-tight, frictionless piston-cylinder device. The air is now compressed to a final pressure of 500kPa. During the process heat is transferred from the air such that the temperature inside the cylinder remains constant. Calculate the work done during this process. (universal gas constant $R = 0.287 \text{ kJ/kg K}$)
2. Air at 100kPa and 280K (enthalpy $h = 280.13 \text{ kJ/kg}$) is compressed steadily to 600kPa and 400 K (enthalpy $h = 400.98 \text{ kJ/kg}$). The mass flow rate of the air is 0.02 kg/s, and a heat loss of 16 kJ/kg occurs during the process. Assuming the changes in kinetic and potential energies are negligible, determine the necessary power input to the compressor.
3. A car engine with a power output of 65 hp has a thermal efficiency of 24 percent. Determine the fuel consumption rate of this car if the fuel has a heating value of 19,000 Btu/lbm). (1hp = 2545 Btu/h)
4. A windmill with a 12m-diameter rotor is to be installed at a location where the wind is blowing steadily at an average velocity of 10 m/s. Determine the maximum power that can be generated by the windmill. Assume the air is at standard conditions of 1 atm and 25°C, and $\rho = 1.18 \text{ kg/m}^3$.