

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：1330 車輛工程系碩士班丙組

第一節 熱力學 試題

第一頁 共一頁

注意事項：

1. 本試題共 5 題，配分共 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。

1. Describe the operating principles and practical applications of: (1) gasoline engine, (2) diesel engine, (3) gas turbine, (4) rocket engine, (5) steam engine. (20%)
2. (1) Draw the pressure-temperature diagram of water, and explain what is triple point. The triple point of water is at 0.01°C and 0.6113kPa . (4%)
(2) The boiling temperature of water at sea level is 100°C , does it become higher or lower at high mountain? Why? (4%)
(3) Draw the temperature-entropy diagram of Carnot cycle, and describe the four processes of Carnot cycle. (4%)
(4) What is thermal efficiency? Derive the thermal efficiency of Carnot cycle in terms of high temperature T_H and low temperature T_L . (4%)
(5) Is it possible to use Carnot cycle for a practical internal combustion engine? (A guess without explanation is only worth zero point.) (4%)
3. Identify each of the following imaginary processes, (a) does it satisfy or violate the first law of thermodynamics? (b) does it satisfy or violate the second law of thermodynamics? You should give the reason for each one. (A guess without explanation is only worth minimal points.)
 - (1) Transferring 5kWh of heat to an electric resistance wire and producing 5kWh of electricity. (4%)
 - (2) Transferring 5kWh of heat to an electric resistance wire and producing 6kWh of electricity. (4%)

(3) An electric resistance heater which consumes 5kWh of electricity and supplies 6kWh of heat to a room. (4%)

(4) Raising the temperature of a small amount of water to 150°C by transferring heat from high-pressure steam at 120°C without any heat pump. (4%)

(5) A kind of heat engine uses sun-shine to produce work without any other energy input. (4%)

4. 1 liter of air at 100kPa of pressure and 25°C of temperature is compressed to 0.1 liter in a closed chamber under the following processes: (1) isentropic, (2) constant temperature. Calculate: (a) the final temperature in $^{\circ}\text{C}$, (b) the final pressure in kPa . (Assume the heat capacity is constant, the properties of air: $R=0.287\text{kJ/kg-K}$, $C_p=1.005\text{kJ/kg-K}$, $C_v=0.718\text{kJ/kg-K}$) (20%)
5. 1kg/s of air enters the compressor of a gas-turbine plant at ambient conditions of 100kPa and 25°C with a low velocity and exits at 1MPa and 350°C with a velocity of 90m/s . The compressor is cooled at a rate of 35kJ/s . Determine the power input to the compressor in kW . (Assume the heat capacity is constant, the properties of air: $R=0.287\text{kJ/kg-K}$, $C_p=1.005\text{kJ/kg-K}$, $C_v=0.718\text{kJ/kg-K}$) (20%)