所別： 能源工程研究所 碩士班 不分組(一般生)　　　　　共 1 頁　第 1 頁

科目： 基礎熱力學

本科考試可使用計算器，廠牌、功能不拘

申論題及計算題　　*計算題需計算過程

請按題號順序作答，避免被漏改。若您要先做後面題目，請先在答案本預留空間。

1. (20 %) In an air-standard cycle, air at T_1=70 °F and p_1= 14.7 psia is initially heated at constant volume till the pressure is p_2=30 psia, and then heated at constant pressure till the temperature is T_3=1600 °F. The cycle is completed by first expanding isentropically to p_4=14.7 psia and then cooling at constant pressure. (a) draw the p-v diagram of the cycle, and determine (b) T_2, (c) T_4, (d) heat added per unit of mass, (e) heat rejected per unit of mass as well as thermal efficiency. (For air, c_v=0.171, c_p=0.24 Btu/(lbm·°F)) (4% each)

2. (10 %) Draw the p-v and T-s diagrams for the following cycles: (1) Otto, (2) Diesel, (3) Brayton, (4) Ericsson, and (5) Stirling cycles. (2 % each)

3. (10 %) State the conditions under which each of the following relations are valid:
(a) h=u+pv, (b) c_p-c_v=R, (c) h_2-h_1=c_p(T_2-T_1), (d) pv^k=constant, (e) c_p=kR/(k-1). (2 % each)

4. (10 %) Prove that c_p=c_v for an incompressible fluid.

5. (10 %) "內能"是由哪些能量所構成？

6. (10 %) 何謂"對應狀態原理"？

7. (10 %) The saturation pressure of water at 20°C is 2.34 kPa. Consider a rigid tank containing water at 3 kPa and 20°C. Does the water exist as compressed liquid, saturated liquid, saturated vapor, saturated mixture, or superheated vapor?

8. (20 %) Helium is to be compressed from 120 kPa and 310 K to 700 kPa and 430 K. A heat loss of 20 kJ/kg occurs during the compression process. Neglecting kinetic energy changes, determine the power input required for a mass flow rate of 90 kg/min. (c_p = 5.1926 kJ/kg·K)