

淡江大學八十八學年度碩士班招生考試試題

系別：機械工程學系

科目：熱力學

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本試題雙面印製

1. Please give definitions of the following: (20%)

- (1) Adiabatic process
- (2) Carnot cycle
- (3) Clapeyron equation
- (4) Dry-bulb temperature
- (5) Principle of increase of entropy
- (6) Gibbs function
- (7) Inequality of Clausius
- (8) Joule-Thomson coefficient
- (9) Polytropic process
- (10) Third law of thermodynamics

2. A water cooled compressor has refrigerant entering as saturated vapor at -30°C . The refrigerant leaves the compressor at 800 kPa. The refrigerant flow rate is 0.9 kg/min and the cooling water results in a heat transfer rate of 140 kJ/min from the refrigerant. The power input to the compressor is 3kW. Determine the exit temperature of the refrigerant. (15%)

For refrigerant: $T = -30^{\circ}\text{C}$, $h_g = 174.076 \text{ kJ/kg}$

Superheated refrigerant table: 800 kPa : Temp. ($^{\circ}\text{C}$) h (kJ/kg)

40	205.924
50	213.290
60	220.558
70	227.766

3. Nitrogen is compressed in a reversible process in a cylinder from 100 kPa, 20°C , to 500 kPa. During the compression process the relation between pressure and volume is $PV^{1.3} = \text{constant}$. Calculate the work and heat transfer per kilogram, and show this process on P-v and T-s diagrams. (15%) ($R = 0.2968 \text{ kJ/kg K}$)

◀ 注意背面尚有試題 ▶

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4. Express dS in terms of dT and dP . (10%)

Hint: Maxwell Relation: $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$

5. In a Carnot engine, using 0.05 kg of air as the working fluid, the maximum cycle temperature and pressure are 940 °K and 8.4 MPa respectively. What is the maximum cylinder volume if the minimum temperature during the cycle is 300 °K and the addition of heat to the air is 4.2 kJ? Assume ideal gas behavior. ($R = 0.287$ kJ/ kg K) (15%)

6. A coal sample has the following composition:

- 0.14 moles H_2 / mole fuel
- 0.27 moles CO / mole fuel
- 0.03 moles CH_4 / mole fuel
- 0.006 moles O_2 / mole fuel
- 0.509 moles N_2 / mole fuel
- 0.045 moles CO_2 / mole fuel

Determine the air-fuel ratio if producer gas from this sample is burned with 50 percent excess air. (15%)

7. Please show the relations of Heat Transfer to Thermodynamics. (10%)

◀ 注意背面尚有試題 ▶