

本試題是否可以使用計算機:  可使用,  不可使用 (請命題老師勾選)

1. (25 分) Define or describe the following:

- (a) Critical state (5 分)
- (b) Generalize compressibility chart (5 分)
- (c) Clausius Inequality (5 分)
- (d) Isentropic nozzle efficiency (5 分)
- (e) Adiabatic flame temperature (5 分)

2. (25 分) Compare the thermal efficiency for the Otto cycle and Diesel cycle under the conditions of

- (a) same compression ratio and (13 分)
- (b) same maximum pressure and temperature (12 分)

You must give the theory in detail to support your conclusion.

3. (25 分) A freezer is maintained at  $-7^{\circ}\text{C}$  by removing heat from it at a rate of  $79\text{KJ}/\text{min}$ . The power input to the freezer is  $0.5\text{KW}$ , and the surrounding air is at  $24^{\circ}\text{C}$ . Determine

- (a) the reversible power in KW (8 分)
- (b) the irreversibility in KW (9 分)
- (c) Second-law efficiency (%) of this freezer. (8 分)

4. (25 分) A  $1.5\text{m}^3$  insulated rigid tank contains  $2.7\text{kg}$  of carbon dioxide at  $100\text{KPa}$ . Now paddle-wheel work is done on the system until the pressure in the tank rises to  $120\text{KPa}$ . Determine the entropy change of carbon dioxide during this process in  $\text{KJ}/\text{K}$ .

註: 1. for carbon dioxide  $C_p = 0.846\text{ KJ}/\text{Kg K}$ ,  $C_v = 0.657\text{ KJ}/\text{Kg K}$

2. universal gas constant  $R = 8.314\text{ KJ}/\text{mole K}$