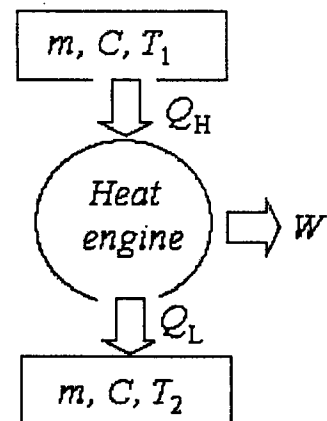


E 224
編號：E 234

系所：工程科學系己組、丁組

科目：熱力學

1. What does the Joule-Thomson coefficient represent? Show that the Joule-Thomson coefficient of an ideal gas is zero. (10%)
2. Would you expect the temperature of air to drop as it undergoes a steady-flow throttling process? (10%)
3. How do the values of the integral $\int_1^2 \delta Q/T$ compare for a reversible and irreversible process between the same end states? (10%)
4. Can a system have a higher second-law efficiency than the first-law efficiency during a process? Give examples. (10%)
5. Consider two bodies of identical mass m and specific heat C used as thermal reservoirs (source and sink) for a heat engine. The first body is initially at an absolute temperature T_1 while the second one is at a lower absolute temperature T_2 . Heat is transferred from the first body to the heat engine, which rejects the waste heat to the second body. The process continues until the final temperatures of the two bodies T_f become equal. Show that $T_f = \sqrt{T_1 T_2}$ when the heat engine produces the maximum possible work. (20%)



6. Show that

$$C_v = -T \left(\frac{\partial v}{\partial T} \right)_s \left(\frac{\partial p}{\partial T} \right)_v \quad \text{and} \quad C_p = T \left(\frac{\partial p}{\partial T} \right)_s \left(\frac{\partial v}{\partial T} \right)_p \quad (20\%)$$

7. Air as an ideal gas is stored in a closed system of volume V at temperature T_0 and pressure p . (a) Ignoring motion and gravity, obtain the following expression for the availability (or exergy), A , of the air. (Environment : temperature = T_0 and pressure = p_0)

$$A = p_0 V \left(1 - \frac{p}{p_0} + \frac{p}{p_0} \ln \frac{p}{p_0} \right) \quad (20\%)$$