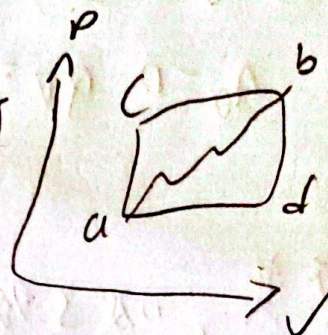


物理作业3

6-1

a 沿 acb 到 b 吸收了热量 350J
同时对外做功 126J



(1) 沿 adb 进行时, 系统
做功 42J, 问这过程吸收了多少热量

$$\Delta E_{ab} = E_b - E_a = Q_{acb} - A_{acb} = (350 - 126) = 224 \text{ J}$$

对 adb

$$Q_{adb} = \Delta E_{ab} + A_{adb} = (224 + 42) = 266 \text{ J}$$

(2) 当系统由状态 b 沿曲线 ba 返回状态 a 时, 外界对系统做功 84J, 问这过程系统吸热还是放热? 量值是多少

$$\text{对 ba 过程有 } Q_{ba} = \Delta E_{ba} + A_{ba} = -\Delta E_{ab} + A_{ba} = (-224 - 84) \text{ J}$$

放出热量

$$= -308 \text{ J}$$



6-2 1 mol 单原子理想气体从 300K 加热至 350K.

(1) 容积保持不变, 升温过程

$$A_V = 0 \quad Q_V = \Delta E = \frac{3}{2} V R \Delta T (T_2 - T_1) = V C_{Vm} \Delta T \\ \Rightarrow 1.5 \times 8.31 \times 50 = 6.23 \times 10^2 \text{ J}$$

(2) P 不变, 吸了多少热量? 增加了多少内能? 对外做了多少功

$$\Delta E = V C_{Vm} (T_2 - T_1) = 6.23 \times 10^2 \text{ J}$$

$$A_P = P(V_2 - V_1) = R(T_2 - T_1) = 4.16 \times 10^2 \text{ J} \\ \Rightarrow 8.31 \times 50 \rightarrow$$

$$Q_P = C_{Pm} \Delta T = \left(\frac{3}{2} + 1\right) R (T_2 - T_1) = \\ \Rightarrow 2.5 \cdot 8.31 \cdot 50 = 1.039 \times 10^3 \text{ J}$$

6-3 $1.0 \times 10^5 \text{ Pa}$ $V = 0.0082 \text{ m}^3$ 从 300K \rightarrow 400K 氦气
(氦气 $i=5$) $C_{Vm} = \frac{5}{2} R$ $C_{Pm} = \frac{7}{2} R$

(1) 等体过程中 $A_V = 0$, 由热力学第一定律和理想气体物态方程

$$Q_V = \Delta E = \frac{m}{M} C_{Vm} \Delta T = \frac{P_1 V_1}{R T_1} C_{Vm} (T_2 - T_1) = 6.83 \times 10^2 \text{ J}$$

(2) 等压过程 $Q_P = \frac{m}{M} C_{Pm} \Delta T = \frac{P_1 V_1}{R T_1} C_{Pm} (T_2 - T_1) = 9.57 \times 10^2 \text{ J}$

$$A_P = Q_P - \Delta E = 2.74 \times 10^2 \text{ J} \quad \text{可见 } Q_P > Q_V$$

