

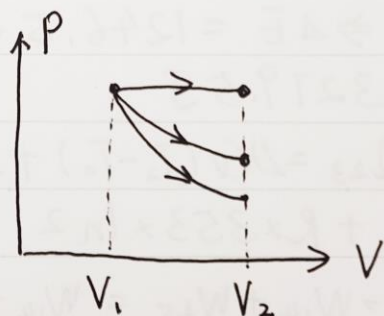
25. 热力学基础(-)

1. C.

2. C.

3. D: $Q = \nu C_p (T_2 - T_1) = \nu \cdot \frac{7}{2} R (T_2 - T_1)$
 $\Rightarrow Q = \frac{7}{2} (P_2 V_2 - P_1 V_1)$
 $W = P (V_2 - V_1) \Rightarrow \frac{W}{Q} = \frac{2}{7}$

5. 等压、绝热、等压、绝热、等压



6. $\nu = 1 \text{ mol}$, $i = 3$

由图: $W = \frac{1}{2} (P_1 + P_2) (V_2 - V_1)$

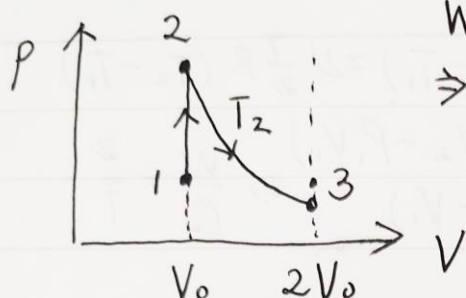
$\frac{P_1}{V_1} = \frac{P_2}{V_2} \Rightarrow W = \frac{1}{2} (P_2 V_2 - P_1 V_1)$

$\Delta E = \nu \cdot \frac{i}{2} R (T_2 - T_1) = \frac{3}{2} (P_2 V_2 - P_1 V_1)$

$Q = \Delta E + W = 2 (P_2 V_2 - P_1 V_1)$

7. $\nu = 1 \text{ mol}$, H_2 , $i = 5$

1) $T_0 = 273 + 20 = 293 \text{ K}$, $T_2 = 273 + 80 = 353 \text{ K}$



$$W = W_{12} + W_{23} = 0 + W_{23}$$

$$\Rightarrow W = W_{23} = \nu R T_2 \ln\left(\frac{2V_0}{V_0}\right)$$

$$\Rightarrow W = 2033 \text{ J}$$

$$\Delta E = \nu \frac{i}{2} R (T_2 - T_0)$$

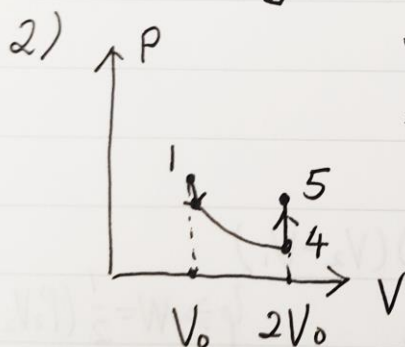
$$\Rightarrow \Delta E = \frac{5}{2} R (353 - 293)$$

$$\Rightarrow \Delta E = 1246.5 \text{ J}$$

$$Q = W + \Delta E = 3279.5 \text{ J}$$

或: $Q = Q_{12} + Q_{23} = \nu C_V (T_2 - T_0) + \nu R T_2 \ln\left(\frac{2V_0}{V_0}\right)$

$$\Rightarrow Q = \frac{5}{2} R \times 60 + R \times 353 \times \ln 2$$



$$W = W_{14} + W_{45} = W_{14} + 0 = W_{14}$$

$$\Rightarrow W = W_{14} = \nu R T_0 \ln\left(\frac{2V_0}{V_0}\right) = 1688 \text{ J}$$

$$\Delta E = \nu \frac{i}{2} R (T_5 - T_0)$$

$$= \frac{5}{2} R (353 - 293)$$

$$= 1246.5 \text{ J}$$

$$Q = \Delta E + W = 2934 \text{ J}$$

或: $Q = Q_{14} + Q_{45} = \nu R T_0 \ln\left(\frac{2V_0}{V_0}\right) + \nu C_V (T_5 - T_4)$

$$= R \times 293 \times \ln 2 + \frac{5}{2} R \times (353 - 293)$$

8. 注意: 是负中图错, V_B 未知

$$\gamma = 3, C_V = \frac{3}{2}R, C_P = \frac{5}{2}R, \gamma = \frac{C_P}{C_V} = \frac{5}{3}$$

$$\text{由 } P_A V_A = P_C V_C \Rightarrow T_A = T_C$$

$$\widehat{ABC} \text{ 过程中: } Q_{\widehat{ABC}} = \underbrace{4E}_0 + W_{\widehat{ABC}} = W_{\widehat{ABC}}$$

$$Q_{\widehat{ABC}} = Q_{\widehat{AB}} + Q_{\widehat{BC}} = Q_{\widehat{AB}} + 0 = Q_{\widehat{AB}}$$

$$Q_{\widehat{AB}} = \nu C_P (T_B - T_A) = \nu \cdot \frac{5}{2}R (T_B - T_A)$$

$$\Rightarrow Q_{\widehat{AB}} = \frac{5}{2} (P_B V_B - P_A V_A)$$

$$V_B = ?$$

$$\text{由 BC 过程: } P V^\gamma = \text{常}$$

$$P_B V_B^\gamma = P_C V_C^\gamma \Rightarrow V_B = \left(\frac{P_C}{P_B} \right)^{\frac{1}{\gamma}} V_C$$

$$\Rightarrow V_B = \left(\frac{1}{4} \right)^{\frac{3}{5}} \times 8 = 3.48 \text{ m}^3$$

$$W_{\widehat{ABC}} = Q_{\widehat{ABC}} = Q_{\widehat{AB}} = \frac{5}{2} (P_B V_B - P_A V_A)$$

$$= \frac{5}{2} \times (4 \times 3.48 - 4 \times 2) \times 1.013 \times 10^5$$

$$= \cancel{1.5 \times 10^6} 1.5 \times 10^6 \text{ J}$$

↑
太大3

9. $\nu = 1 \text{ mol}$, O_2 , $i = 5$

$$1) \widehat{Q_{AB}} = \widehat{W_{AB}} = \nu R T_A \ln\left(\frac{V_B}{V_A}\right)$$

$$\Rightarrow \widehat{Q_{AB}} = P_A V_A \ln\left(\frac{2V_0}{V_0}\right) = P_0 V_0 \ln 2$$

$$\widehat{Q_{AB}} = 3.11 \times 10^3 \text{ J}$$

$$2) \widehat{W_{ACB}} = W_{AC} + W_{CB} = 0 + W_{CB} = \frac{P_0}{2} V_0$$

$$\widehat{W_{ACB}} = 2.24 \times 10^3 \text{ J}$$

$$\widehat{Q_{ACB}} = \widehat{Q_{AC}} + \widehat{Q_{CB}}$$

$$= \nu C_V (T_C - T_A) + \nu C_P (T_B - T_C)$$

$$= \nu \cdot \frac{5}{2} R (T_C - T_A) + \nu \cdot \frac{7}{2} R (T_B - T_C)$$

$$= \frac{5}{2} (P_C V_C - P_A V_A) + \frac{7}{2} (P_B V_B - P_C V_C)$$

$$= \frac{1}{2} P_0 V_0 = 2.24 \times 10^3 \text{ J}$$

10、

解： 初态参量： p_0 、 V_0 、 T_0

末态参量： p_0 、 $5V_0$ 、 $T=5T_0$

等温过程： $\Delta E = 0$,

$$Q_T = W_T = \nu R T_0 \ln \frac{V_2}{V_1} = 3 R T_0 \ln 5 = 1.1 \times 10^4 \text{ J}$$

等体过程： $W = 0$,

$$Q_V = \nu C_V \Delta T = 3 C_V \cdot 4 T_0 = 3.28 \times 10^3 C_V$$

$$Q = Q_T + Q_V \Rightarrow Q_V = Q - Q_T$$

$$\Rightarrow C_V = \frac{Q - Q_T}{3.28 \times 10^3} = \frac{8 \times 10^4 - 1.1 \times 10^4}{3.28 \times 10^3} = 21.0 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$$

$$\gamma = \frac{C_P}{C_V} = \frac{C_V + R}{C_V} = 1.4$$