

$$1. \quad W_{\max} = \int_{V_1}^{V_2} p_{\text{外}} dV = p_1 V_1 \ln \frac{V_2}{V_1} = 1519.9 \times 1 \times \ln \frac{10}{1} = 3500(\text{J})$$

$$\Delta H = \Delta U = 0$$

$$\Delta S = nR \ln \frac{V_2}{V_1} = \frac{W_{\max}}{T} = \frac{3500}{3000} = 1.17(\text{J/K})$$

$$2. \quad \Delta S = nR \ln \frac{V_2}{V_1} = 1 \times 8.314 \times \ln \frac{10}{1} = 19.14(\text{J/K})$$

$$3. \quad n_1 C_{p,m}(T-343) = n_2 C_{p,m}(T-303)$$

$$0.5 \times (T-343) + 0.1(T-303) = 0 \quad T = 336\text{K}$$

$$\Delta S = 75.4 \times \left( \frac{500}{18} \times \ln \frac{336}{343} + \frac{100}{18} \times \ln \frac{336}{303} \right) = 0.118\text{J/K}$$

4.

$$27. \quad \text{由} \left( p + \frac{a}{V^2} \right) (V - b) = nRT, \quad \text{得} \quad p = \frac{nRT}{V - b} - \frac{a}{V^2}$$

$$\text{由} \quad dU = TdS - pdV, \quad \text{得} \quad \left( \frac{\partial U}{\partial V} \right)_T = T \left( \frac{\partial S}{\partial V} \right)_T - p, \quad \left( \frac{\partial p}{\partial T} \right)_V = \left( \frac{\partial S}{\partial V} \right)_T$$

$$\left( \frac{\partial U}{\partial V} \right)_T = T \left( \frac{\partial p}{\partial T} \right)_V - p = T \left( \frac{nR}{V - b} \right) - p = \frac{nRT}{V - b} - p = \frac{a}{V^2}$$

28. 对于理想气体,  $pV = nRT$

$$\text{由} \quad dU = TdS - pdV, \quad \text{得} \quad \left( \frac{\partial U}{\partial V} \right)_S = -p, \quad \left( \frac{\partial U}{\partial S} \right)_V = T$$

$$\text{由} \quad dH = TdS + Vdp, \quad \text{得} \quad \left( \frac{\partial H}{\partial p} \right)_S = V$$

$$\frac{\left( \frac{\partial U}{\partial V} \right)_S \cdot \left( \frac{\partial H}{\partial p} \right)_S}{\left( \frac{\partial U}{\partial S} \right)_V} = \frac{-pV}{T} = -nR$$