2.8

(a) $Q = C_V \Delta T = \rho V c_V \Delta T = 4.92 \times 10^5\, J$,

(b) $Q = C_p \Delta T = \rho V c_p \Delta T = 6.94 \times 10^5\, J$,

(c) 某时间容器中有质量为m，温度为T的气体，由理想气体状态方程知

$$\frac{m_0}{M} R T_0 = n_0 R T_0 = nRT = \frac{m}{M} RT$$

即$m_0 T_0 = mT, m = m_0 \frac{T_0}{T}$

$$dQ = mC_p dT \Rightarrow Q = \int_{T_0}^{T_f} C_p m_0 \frac{T_0}{T} dT = m_0 C_p T_0 ln \frac{T_f}{T_0} = 6.70 \times 10^5\, J.$$

2.10

$$c_w m_w \Delta T_w = c_{Cu} m_{Cu} \Delta T_{Cu}$$

得到$c_{Cu} = 619.5\, J/(kg \cdot K)$.

2.11

$$\Delta Q = \Delta U - W' = u - u_0 - p_0 V_0 = 0$$

即$u - u_0 = p_0 V_0$.

2.21

$$Vdp + 2pdV = 0$$
$$d(pV) = nRdT = pdV + Vdp$$

得到$pdV = -nRdT$

$$dQ = dU + pdV = n(C_V - R)dT$$

即热容$C = C_V - R$

比热容为$c = \frac{C}{\mu} = \frac{C_V - R}{\mu}$.

2.22

绝热过程$dQ = dU + pdV = (\frac{\partial U}{\partial T})_V dT + [\left(\frac{\partial U}{\partial V}\right)_T + p]dV = C_{V,m} dT + \frac{RT}{V-b} dV = 0$

解微分方程得到$C_{V,m} lnT = -Rln(V - b) + const.$

两边取 e 指数得到$T(V - b)^{R/C_{V,m}} = const.$

2.23

与 2.22 相同，绝热过程满足$T(V - b)^{R/C_V} = const.$

2.24

$$dQ = C_V dT + pdV = CdT$$

两式除才能消dT.

即$pdV = (C - C_V)dT = d(pV) - Vdp = RdT - Vdp$

得到$Vdp = (C_V + R - C)dT = (C_p - C)dT$

二式相除得$\frac{p}{V}\frac{dV}{dp} = -\frac{C_V - C}{C_p - C}$

得到$pV^{\frac{C_V - C}{C_p - C}} = pV^n = const.$

C_V、C_p间差R.

指数含p、V.