

P

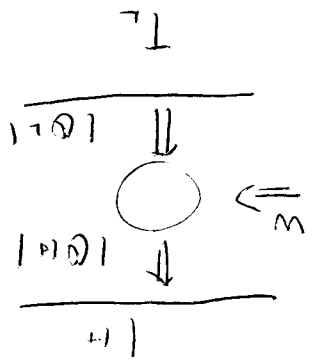
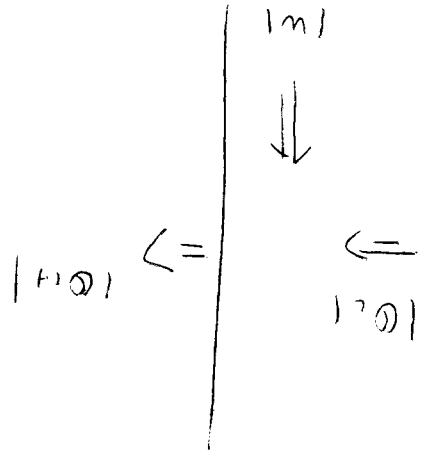
$$[Q_{23}] = 1 \cdot Q$$

$$[Q_{31}] = m \cdot Q$$

$$[Q_{12}] = 4 \cdot Q$$

$$P_{12} = m \cdot Q_{23} \Rightarrow m \cdot Q_{31} = m \cdot Q$$

$$c \cdot p = \frac{1 \cdot m}{1 \cdot 4} = 3 \cdot c$$



$$\frac{T_2 - T_1}{T_1} = \frac{1 \cdot Q_1 - |Q_2|}{|Q_2|} = \frac{1 \cdot m}{1 \cdot 4} = c \cdot p = 3 \cdot c$$

3 个状态

$$T_c \left(\frac{V_a}{V_c} \right)^{\gamma-1} = T_b \left(\frac{V_b}{V_c} \right)^{\gamma-1}$$

$$T_d - T_a$$

$$V_d = V_a$$

$$V_c = V_b$$

$$T_a V_a^{\gamma-1} = T_b V_b^{\gamma-1}$$

$$T_c V_c^{\gamma-1} = T_d V_d^{\gamma-1}$$

$$|Q_{12}| = C_V (T_c - T_b)$$

$$|Q_{12}| = C_V (T_c - T_b)$$

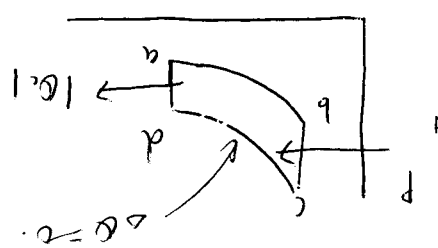
$$P_c V_c^\gamma = P_d V_d^\gamma$$

$$1 - \left(\frac{V_b}{V_c} \right)^{\gamma-1} =$$

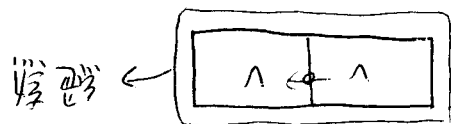
$$e = 1 - \frac{|Q_{12}|}{|Q_{23}|} = 1 - \frac{T_a - T_c}{T_b - T_c} = 1 - \frac{T_c - T_b}{T_c - T_b} \left(\frac{V_a}{V_b} \right)^{\gamma-1}$$

$$r = \frac{c_p}{c_v}$$

$$e = 1 - \left(\frac{V_b}{V_a} \right)^{\gamma-1}$$



物理



free expansion.

$$\Delta Q = 0.$$

$$dQ = dU + PdV.$$

$$dQ = dU(T) \quad U \text{ is a function of } T$$

$$\Delta S = \int_{V_1}^{V_2} \frac{P}{T} dV = \int_{V_1}^{V_2} \frac{nRT}{V} dV = nRT \ln \frac{V_2}{V_1}$$

20 kg Fe block, lake, $T_L = 280K$

$$C_{Fe} = 0.11 \text{ kcal/kg-K}$$

$$\Delta S_{Fe} = \int_{T_L}^{T_H} \frac{dT}{T} = mc \ln \frac{T_H}{T_L} = -0.25 \text{ kcal/K}$$

$$\Delta S_{lake} = \frac{\Delta Q}{T} = \frac{130 \text{ kcal}}{280K} = 0.46 \text{ kcal/K}$$

$$\Delta S = \Delta S_{Fe} + \Delta S_{lake} = +0.21 \text{ kcal/K}$$

$$S = \int k \ln \Omega$$

$$\Delta S = \int \frac{dQ}{T} = \int \frac{1}{C(T)} dT$$

③

$$\Delta S_{12} + \Delta S_2 + \Delta S_1 > 0$$

$$\Delta S_2 = \frac{296}{+100 \text{ kcal}}$$

$$\Delta S_1 = \int \frac{dQ}{T} = \frac{-100 \text{ kcal}}{298}$$

$$\boxed{240} < \boxed{260} + \boxed{220}$$

$$\Delta S = \Delta S_{1 \rightarrow 2} + \Delta S_{2 \rightarrow 1} = 0$$

$$= 1220 \text{ J/K}$$

$$\Delta S = \int_{T_1}^{T_2} \frac{dQ}{T} = \frac{296}{29.7 \text{ kcal}} = \frac{1}{T} = \frac{1}{T_1} \int_{T_1}^{T_2} dQ = 0.292 \text{ kcal/K}$$

$$29.7 \text{ kcal/kg} \cdot 29.7 \text{ kcal/K}$$

$$ds = \frac{1}{T} dQ$$

$$\int ds = 0 \Rightarrow \int \frac{1}{T} dQ = 0$$

$$\frac{Q_H}{T_H} = \frac{Q_C}{T_C} \Rightarrow \frac{Q_H}{T_H} - \frac{Q_C}{T_C} = 0 \quad (\text{可逆过程})$$

卡诺循环

Entropy S 代表系统混乱程度的量 $\Delta S \geq 0$