340. 9-14

$\eta_1 = \frac{A}{Q_1}$ ①, ~~$A_1+Q_1=\frac{3}{2}(P_1V_2-P_1V_1)$~~

$Q_1 = C_p\Delta T_1$, $Q_2 = C_p\Delta T_2$ ⇒ ~~Q~~ ~~$A=C_p(\Delta T_1-\Delta T_2)$~~ $A=-\int p\,dV=-S$

$\eta_1 = \frac{A}{Q_1} \propto \frac{1}{2}$

∴ $\eta_1 > \eta_2$

341. 9-15.

a→b: ~~$A=S_{\Delta}-\frac{3}{2}\Delta E$~~ $V_1 = 3000/200 = 10\,L$, $V_2 = 4000/200 = 20$

∴ $A_1 = -(V_2-V_1)\cdot 200 = -2000$ J. $A_1+Q_1=\Delta E \Rightarrow Q_1 = 5000$ J.

b→c: $E \propto P$, $E=\frac{3}{2}PV$ ∴ 等体, $A=0$, $Q_2=\Delta E=-3000$ J

c→a: $\Delta E=0$ ∴ $A=-Q$, $\frac{3}{2}\cdot PV=3000 \Rightarrow PV=2000 \Rightarrow P=\frac{2000}{V}$

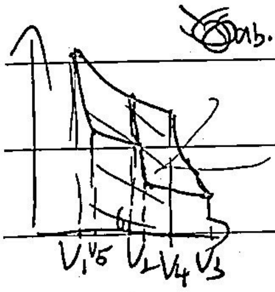
$V_3=20L$, $V_4=10L$ ∴ $A=-\int_{20}^{10}\frac{2000}{V}dV = 2000\ln 2$ J $Q=-2000\ln 2$ J.

∴ $W = 2000\text{J} - 2000\ln 2$ J, $Q=5000$ J ∴ $\eta=\frac{W}{Q}=\frac{2-2\ln 2}{5}=12.3\%$.

341. 9-16

$A=A_2$. $Q_{a\to b}=-A=S_{ab}\propto T\ln\frac{V_1}{V_2}$. 记 $Q=kT\ln\frac{V_1}{V_2}$.

~~Q_{ab}~~ ~~$Q_{c\to d}=$~~ ∴ $Q_{a\to b}=3T_0k\ln\frac{V_4}{V_1}$, $Q_{c\to d}=T_0k\ln\frac{V_2}{V_3}=-A_1$.



$Q_{e\to f}=2T_0k\ln\frac{V_5}{V_6}$

延长de交ab于H 则有两个卡诺循环.

∴ $\frac{V_5}{V_6}=\frac{V_1}{V_H}$, $\frac{V_H}{V_4}=\frac{V_2}{V_3}$ ∴ $\frac{V_2}{V_3}$ 且 $\frac{V_5}{V_6}=\frac{V_1}{V_4}$.

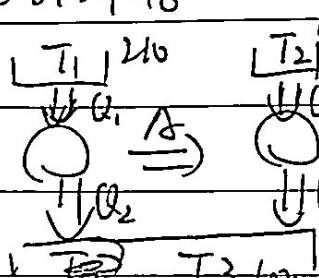
∴ $\begin{cases} \frac{1}{2}Q_{e\to f}+Q_{c\to d}=-\frac{1}{3}Q_{a\to b} \\ Q_{a\to b}+Q_{e\to f}+Q_{c\to d}=A_2 \\ Q_{c\to d}=-A_1 \end{cases}$ ∴ $\begin{cases} Q_{a\to b}=3A_2-3A_1 \\ A=A_2 \end{cases}$

∴ $\eta=\frac{A}{Q}=\frac{A_2}{3A_2-3A_1}$

341.9-17

$Q - Q_{cen} = A = 70 - 30 = 40$J ∴ $Q = 140$J

341.9-18



$A = 1 - \frac{300}{210}$

$\eta = 1 - \frac{60+273.15}{210+273.15} = 0.31$

∴ $A = \eta Q_1$

$W = \frac{T_2}{T_3 - T_2} \cdot A = \frac{Q_4 - Q_3}{A} \cdot \frac{Q_4}{A}$

∴ $Q_4 = A \cdot W$. $Q_2 = Q_1 - A$ ∴ $Q = Q_4 + Q_2 = \left(\frac{T_2}{T_1} + \frac{(T_1 - T_2) T_2}{(T_3 - T_2) T_1} \right) Q_1$

$= 5.62 \times 10^7$J