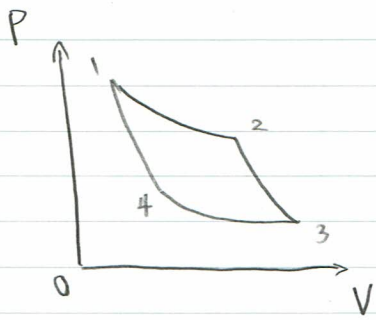
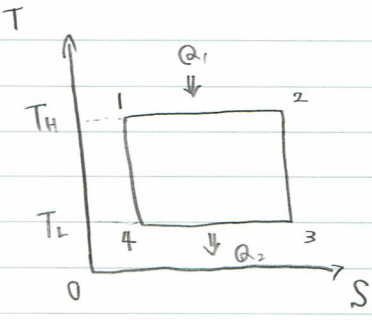
No.

Date ・ ・

熱力学 H29

[1] (1)





(2) 供給される熱量を Q_{12}，排出される熱量を Q_{34} とする
どちらも等温変化なので

$$Q_{12} = \int P\,dt = mRT_H \ln\frac{V_2}{V_1}$$
$$Q_{34} = -\int P\,dt = -mRT_L \ln\frac{V_4}{V_3}$$

(3) S_{23} と S_{41} は断熱変化なので

$$\Delta S_{23} = \Delta S_{41} = 0$$

また $dS = \frac{dQ}{T} = \frac{mR}{V}dV$ より

$$\Delta S_{12} = S_2 - S_1 = mR\ln\frac{V_2}{V_1}$$
$$\Delta S_{34} = S_4 - S_3 = mR\ln\frac{V_4}{V_3}$$

(4) $$\eta_{th} = 1 - \frac{Q_2}{Q_1} = 1 - \frac{T_L}{T_H}$$

[2] CH_4 : $C + 4H = 12 + 4\times 1 = 16$

CO_2 : $C + 2O = 12 + 2\times 16 = 44$

O_2 : $2O = 2\times 16 = 32$

N_2 : $2N = 2\times 14 = 28$

(1)

$$m_0 = 16\times 0.1 + 32\times 0.2 + 44\times 0.3 + 28\times 0.4$$
$$= 32.4$$

(2) $$R_0 = \frac{R}{m_0} = \frac{8.314}{32.4} = 0.256605$$
$$\fallingdotseq 0.257 \text{ kJ/kgK}$$

(3) $PV = mRT$ より

$$m = \frac{PV}{RT} = \frac{0.1\times 10^3 \times 10}{0.257\times 300} = 12.97017$$
$$= 13.0 \text{ kg}$$

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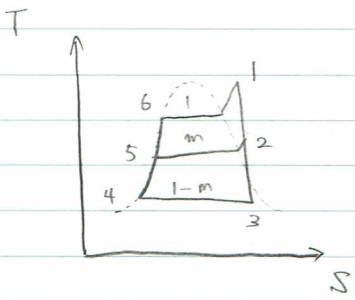
[3] $h_1 \sim h_5$, W_P は無視



(1) エネルギー保存の法則より

$$m h_2 + (1-m) h_4 = h_5$$

$$\therefore m = \frac{h_5 - h_4}{h_2 - h_4}$$

(2)

タービン仕事 $w_t = (h_1 - h_2) + (1-m)(h_2 - h_3)$

加熱量 $Q_1 = h_1 - h_5$

よって

$$\eta_{th} = \frac{(h_1 - h_2) + (1-m)(h_2 - h_3)}{h_1 - h_5}$$

(3)