

式

(i) ΔG°

$$\Delta \bar{f}^\circ = 6\bar{f}^\circ(\text{CO}_2(\text{g})) + 3\bar{f}^\circ(\text{H}_2\text{O}(\text{l})) - \bar{f}^\circ(\text{C}_6\text{H}_6(\text{l})) - \frac{7}{2}\bar{f}^\circ(\text{O}_2(\text{g}))$$

$$= 143.72$$

$$G = H - T\bar{f}^\circ$$

等温過程で

$$\Delta G^\circ = \Delta H^\circ - T\Delta \bar{f}^\circ$$

$$= -780980 - 298 \times 143.72$$

$$= -823808.56$$

$$\underline{-823808.56(\text{cal}) \dots (\text{答})}$$

(ii) Q

$$H = U + PV, \text{等温定圧過程より}$$

$$dH = PdV$$

$$\text{これと } Q = PdV \text{ より}$$

$$Q = dH = \Delta H^\circ$$

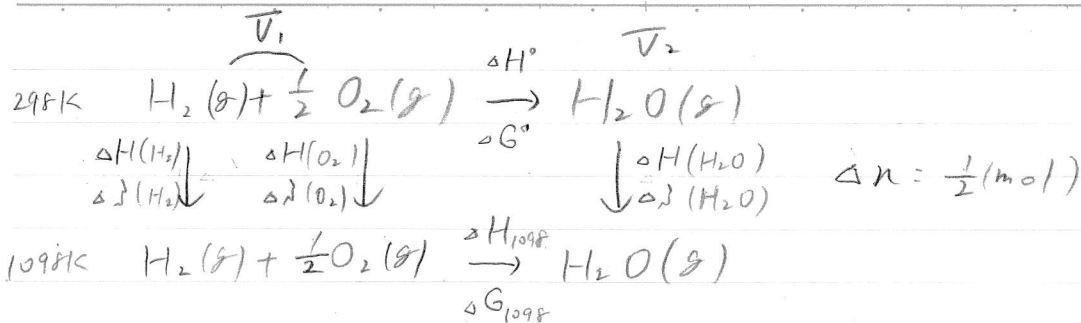
ただし $\Delta H^\circ < 0$ から

この反応は発熱反応なので

$$Q = 780980$$

$$\underline{780980(\text{cal}) \dots (\text{答})}$$

答



上図のように文字をおく

$$\begin{aligned}
 \textcircled{1} \quad \Delta H(\text{H}_2) &= C_p(\text{H}_2) \Delta T = 29.07 \times 800 \\
 \Delta H(\text{O}_2) &= \frac{1}{2} C_p(\text{O}_2) \Delta T = 12.81 \times 800 \\
 \Delta H(\text{H}_2\text{O}) &= C_p(\text{H}_2\text{O}) \Delta T = 30.36 \times 800
 \end{aligned}$$

$$\begin{aligned}
 \Delta H_{1098} &= \Delta H^\circ + \Delta H(\text{H}_2\text{O}) - \Delta H(\text{H}_2) - \Delta H(\text{O}_2) \\
 &= -251016
 \end{aligned}$$

$$\underline{-251016(\text{J}) \dots (\frac{\text{kJ}}{\text{g}})}$$

$$\begin{aligned}
 \textcircled{2} \quad \Delta S^\circ &= S^\circ(\text{H}_2\text{O}(\text{g})) - S^\circ(\text{H}_2(\text{g})) - \frac{1}{2} S^\circ(\text{O}_2(\text{g})) \\
 &= -44.395
 \end{aligned}$$

$G = H - TS$, 定温過程より

$$\begin{aligned}
 \Delta G^\circ &= \Delta H^\circ - T \Delta S^\circ \\
 &= -228570.29
 \end{aligned}$$

$$\underline{-228570.29(\text{J}) \dots (\frac{\text{kJ}}{\text{g}})}$$

$$\begin{aligned}
 \textcircled{3} \quad \Delta S(\text{H}_2) &= \int_{298}^{1098} \frac{C_p(\text{H}_2)}{T} dT = 29.07 \ln \frac{1098}{298} \\
 \Delta S(\text{O}_2) &= \int_{298}^{1098} \frac{\frac{1}{2} C_p(\text{O}_2)}{T} dT = 12.81 \ln \frac{1098}{298} \\
 \Delta S(\text{H}_2\text{O}) &= \int_{298}^{1098} \frac{C_p(\text{H}_2\text{O})}{T} dT = 30.36 \ln \frac{1098}{298}
 \end{aligned}$$

$$\begin{aligned}
 \Delta S_{1098} &= \Delta S^\circ + \Delta S(\text{H}_2\text{O}) - \Delta S(\text{H}_2) - \Delta S(\text{O}_2) \\
 &= -59.418 \dots
 \end{aligned}$$

$$\begin{aligned}
 \therefore \Delta G_{1098} &= \Delta H_{1098} - T \Delta S_{1098} \\
 &= -185774.12 \dots
 \end{aligned}$$

$$\underline{-1.86 \times 10^5(\text{J}) \dots (\frac{\text{kJ}}{\text{g}})}$$