

E 3, 1a)

$$\Delta S = \int_i^f \frac{dq_{rev}}{T} = \frac{1}{T} \int_i^f dq \text{ (constant temp)} = \frac{q_{rev}}{T}$$

$$a) \Delta S = \frac{25.3 \times 10^3 \text{ J}}{273.15 \text{ K}} = 92 \text{ J/K}$$

$$b) \Delta S = \frac{25 \times 10^3 \text{ J}}{373.15 \text{ K}} = 67 \text{ J/K}$$

E 3, 7a) a) $\Delta_{vap} S_m = \frac{\Delta_{vap} H}{T_b} = \frac{29.4 \times 10^3 \text{ J/mol}}{334.86 \text{ K}} = 87.8 \text{ J/K}\cdot\text{mol}$

b) Vaporization occurs reversibly: $\Delta S_{tot} = 0$
 $\Delta S_{surr} = -87.8 \text{ J/K}\cdot\text{mol}$

E 3, 8a) a) $2\text{CH}_3\text{CHO}(g) + \text{O}_2(g) \rightarrow 2\text{CH}_3\text{COOH}(l)$ @ 298K

$$\Delta_r S^\ominus = \sum_{\text{products}} \nu S_m^\ominus - \sum_{\text{reactants}} \nu S_m^\ominus$$

Table 2.5 + 2.7:

$$\begin{aligned} \Delta_r S^\ominus &= 2 S_m^\ominus(\text{CH}_3\text{COOH}(l)) - 2 S_m^\ominus(\text{CH}_3\text{CHO}(g)) - S_m^\ominus(\text{O}_2) \\ &= 2 \cdot (159.8) - (2 \times 250.3) - 205.14 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} \\ &= \boxed{-386.1 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}} \end{aligned}$$

b) $2\text{AgCl}(s) + \text{Br}_2(l) \rightarrow 2\text{AgBr}(s) + \text{Cl}_2(g)$

$$\begin{aligned} \Delta_r S_m^\ominus &= 2 S_m^\ominus(\text{AgBr}, s) + S_m^\ominus(\text{Cl}_2, g) - 2 S_m^\ominus(\text{AgCl}, s) - S_m^\ominus(\text{Br}_2, l) \\ &= [2 \times 107.1 + 223.07 - 2 \times 96.2 - 152.23] \text{ J/K}\cdot\text{mol} \\ &= \boxed{92.6 \text{ J/K}\cdot\text{mol}} \end{aligned}$$

c) $\text{Hg}(l) + \text{Cl}_2(g) \rightarrow \text{HgCl}_2(s)$

$$\begin{aligned} \Delta_r S_m^\ominus &= S_m^\ominus(\text{HgCl}_2, s) - S_m^\ominus(\text{Hg}, l) - S_m^\ominus(\text{Cl}_2, g) \\ &= (146.0 - 76.02 - 223.07) \text{ J/K}\cdot\text{mol} = \boxed{-153.1 \text{ J/K}\cdot\text{mol}} \end{aligned}$$

