## Phase Changes

1. Silicon tetrachloride, SiCl4, has a melting point of −69.0 °C and a heat of fusion, $\Delta H_{fus}$, of 7.72 kJ/mol. What is the entropy of fusion, $\Delta S_{fus}$, in J/(K·mol) for $SiCl_4$?

$$\Delta S_{fus} = \frac{\Delta H_{fus}}{T} \qquad T = -69.0\ °C + 273.15\ K = 204.15\ K$$

$$\Delta S_{fus} = \frac{7.72 \frac{kJ}{mol}}{204.15\ K} = 0.0378\ \frac{kJ}{mol \cdot K} = \mathbf{37.8}\ \frac{J}{mol \cdot K}$$

2. Octane has an enthalpy of vaporization, $\Delta H_{fus}$, of 20.7 kJ/mol and an entropy of fusion, $\Delta S_{fus}$, of 95.7 J/(K·mol). What is the melting point, in °C, for octane?

$$T = \frac{\Delta H_{fus}}{\Delta S_{fus}} \qquad \Delta S_{fus} = 95.7\ J/(K \cdot mol) = 0.0957\ kJ/(K \cdot mol)$$

$$T = \frac{\Delta H_{fus}}{\Delta S_{fus}} = \frac{20.7\ kJ/mol}{0.0957\ kJ/(mol \cdot K)} = 216.3\ K = \mathbf{-56.8\ °C}$$

3. Name each of the following transitions. Indicate the sign of both $\Delta S$ and $\Delta H$.

    a) $H_2O\ (g) \rightarrow H_2O\ (l)$
        condensation $\Delta H < 0$ and $\Delta S < 0$

    b) $NH_3\ (l) \rightarrow NH_3\ (g)$
        vaporization $\Delta H > 0$ and $\Delta S > 0$

    c) $CH_3OH\ (s) \rightarrow CH_3OH\ (l)$
        melting $\Delta H > 0$ and $\Delta S > 0$

    d) $CH_3OH\ (l) \rightarrow CH_3OH\ (s)$
        solidification $\Delta H < 0$ and $\Delta S < 0$

    e) $C_4H_{10}\ (g) \rightarrow C_4H_{10}\ (l)$
        condensation $\Delta H < 0$ and $\Delta S < 0$