Discussion of answers

Entropy and equilibrium

Alternative question 11.

Tin pest

Answers

a) $\Delta_r H^{\ominus} = -2.09$ kJ mol^{-1}

b) $\Delta_r S^{\ominus} = 44.1 - 51.4$
$= -7.30$ J K^{-1} mol^{-1}

c) 25 °C = 298 K
$\Delta_r G = \Delta_r H - T\,\Delta_r S$
$= -2090 - (298 \times -7.3)$
$= 85.4$ J mol^{-1}

d) White, because $\Delta_r G > 0$ at room temperature.

e) $T = (\Delta_r H - \Delta_r G) / \Delta_r S$
$= (-2090 - 0) / -7.3$
$= 286$ K (13 °C)

f) Volume of 1 g white tin = 1 / 7.31 = 0.137 cm^3
Volume of 1 g grey tin = 1 / 5.75 = 0.174 cm^3
Percentage volume increase
$= [(0.174 - 0.137) / 0.137] \times 100 = 27.0$ %

g) White tin has a greater coordination number because it is denser so the atoms are more tightly packed. There is a larger distance to its nearer neighbours which implies it has more neighbours (especially since it is more dense).

This question was taken from the *UK Olympiad selection competition 2004*, Round 1, question 5.