CHEMISTRY 114

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Worksheet 3

1. One mole of supercooled water at -10°C, in a heat-insulated container, crystallizes resulting in a mixture of ice and water at 0°C. What fraction of the mixture is ice? The molar enthalpy of fusion of ice at 0°C is 6.02 kJ mol⁻¹, the molar heat capacity of supercooled water is 75.3 J mol⁻¹ K⁻¹.

$$\chi = \frac{0.105 \, \text{mol}}{1 \, \text{mol}} \frac{1}{8}$$

$$= \frac{1 \, \text{Cp DT}}{1 \, \text{mol}} = \frac{1}{8}$$

$$= \frac{1 \, \text{Cp DT}}{2 \, \text{LH}_{\text{fus}}} = \frac{1 \, \text{Cp DT}}{2 \, \text{LH}_{\text{fus}}} = \frac{1}{2 \, \text{Cp DT}} = \frac{1 \, \text{Cp DT}}{2 \, \text{LH}_{\text{fus}}} = \frac{1}{2 \, \text{Cp DT}} = \frac{1}{2 \, \text{Cp D$$

2. The enthalpy of vaporization of mercury is 58.51 kJ mol⁻¹ and the entropy of vaporization is 92.92 J K⁻¹ mol⁻¹. What is the normal boiling point of mercury?

$$\Delta S = \frac{8 \text{ now}}{T} = \frac{\Delta H}{T} \Rightarrow T = \frac{\Delta H}{\Delta S} = \frac{\left(58.51 \frac{kT}{mat}\right)}{\left(92.92 \frac{T}{mat}\right)} \times \frac{100015}{1/k5} = 629.68k$$

3. For the reaction FeO (s) + CO (g) \rightarrow Fe (s) + CO₂ (g), ΔG° is -5.8 kJ and ΔH° is -11 kJ. S° (J mol⁻¹ K⁻¹): Fe (27.3), CO (197.5), CO₂ (213.7)

a) What is
$$\Delta S_{surr}$$
?

b) Is the reaction spontaneous under standard conditions? Explain

c) To react as much FeO(s)temperatures? Explain

d) What is S° for FeO?

- 4. For ammonia the enthalpy of fusion is 5.65 kJ mol⁻¹ and the entropy of fusion is 28.9 J K⁻¹ mol⁻¹.
 - Will ammonia spontaneously melt at 200 K. Why or why not?

$$\Delta G = \Delta H - T\Delta S = \left(5.65 \frac{kT}{1 kT}\right) - \left(200k\right)\left(28.9 \frac{T}{malk}\right) = -130 \frac{T}{mal}$$

b) What is the normal melting point of ammonia?

$$\Delta S = \frac{8 \text{ nov}}{T} = \frac{\Delta H}{T} \Rightarrow T = \frac{\Delta H}{\Delta S} = \frac{(5.653 \frac{1}{100})}{28.9 \frac{1}{100}} \times \frac{1000 \text{ J}}{1107} = 195.5 \text{ K}$$

5. If you calculate a value for ΔG for a reaction using the values for ΔG_i^o in the appendix, is it correct to state that the reaction is always spontaneous if the calculated value for ΔG is negative? Explain.

6. Bromine melts at -7°C and the molar enthalpy of fusion is 10.8 kJ mol⁻¹. What is the molar entropy of fusion?

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