Review Chapter 16

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1.

$$\begin{aligned} \Delta G &= \Delta H - T\Delta S \\ \sum \Delta H &= 3(-285.8) + 824.2 = -33.2[\text{kJ}] \\ T\sum \Delta S &= 308(3(.0699) + 2(.0273) - .0874 - 3(.1306)) = -66.19[\text{kJ}] \\ \Delta H - T\Delta S &= 33[\text{kJ}] \end{aligned} \tag{1}$$

2.

$$\begin{aligned} T &= \frac{\Delta H}{\Delta S} \\ \Delta H &= -635.1 - 393.5 + 1206.9 = 178.3[\text{kJ}] \\ \Delta S &= .0398 + .2136 - .0929 = .1605\left[\frac{\text{kJ}}{\text{K}}\right] \\ \frac{178.3}{.1605} &= 1110[\text{K}] \end{aligned} \tag{2}$$

3.

$$\begin{aligned} 10^{-3.12} &= .00076[\text{M}] \\ K &= \frac{[\text{Fe}^{3+}]^4}{[\text{H}^+]^4[\text{Fe}^{2+}]^4[\text{O}_2]} \\ \frac{(.25)^4}{(.00076)^4(.25)^4(.755)} &= 4 \cdot 10^{12} \\ -8.314 \cdot 298 \cdot \ln(4 \cdot 10^{12}) &= -71.9[\text{kJ}] \end{aligned} \tag{3}$$

4.

$$1000 = -8.314 \cdot 298 \cdot \ln\left(\frac{(.4)^2}{(.4)^2 \cdot x}\right) x = e^{\frac{1000}{8.314 \cdot 298}} = 1.5[\text{ATM}] \tag{4}$$

5.

$$\begin{aligned} \Delta G &= -RT\ln(K) \\ -8.314 \cdot 298 \cdot \ln(1 \cdot 10^{-37}) &= 91.7[\text{kJ}] \end{aligned} \tag{5}$$

6.

$$\begin{aligned} \Delta G &= -RT\ln(K) \\ -8.314 \cdot 296 \cdot \ln(3.5 \cdot 10^{-6}) &= 30.9[\text{kJ}] \end{aligned} \tag{6}$$

7.

$$\begin{aligned} \Delta G &= -RT\ln(K) \\ K &= \frac{[\text{H}^+][\text{F}^-]}{[\text{HF}]} \\ \frac{[10^{-1.89}]^2}{.12} &= .001383 \\ -8.314 \cdot 300 \cdot \ln(.001383) &= 16.4[\text{kJ}] \end{aligned} \tag{7}$$

8. (a) Entropy is negative in such a case because the entropy of the system is decreasing. The less moles of gas present, the less the disorder.

   (b) Entropy is taken separate from temperature because it is so small, that it is treated independently

   (c) A solid has lower entropy because they are extremely stable. The order of the molecules is much greater in a solid than a liquid.