Chemistry 2000 answers for review problems on thermodynamics

1. $2C_3H_7NO_2S + HgO \rightarrow Hg + C_6H_{12}N_2O_4S_2 + H_2O$

2. 11.28. Note the temperature in bold, and look at the data at the back of the paper.

3. (a) $-79\,\mathrm{kJ\,mol^{-1}}$
   (b) $1.3 \times 10^{-8}\,\mathrm{atm}$

4. $p_{HCONH_2} = 0.07\,\mathrm{bar}$, $p_{NH_3} = p_{CO} = 3.43\,\mathrm{bar}$

5. (a) $PbFCl_{(s)} \rightleftharpoons Pb^{2+}_{(aq)} + F^-_{(aq)} + Cl^-_{(aq)}$
   (b) 2.0×10^{-8}
   (c) $-480.92\,\mathrm{kJ\,mol^{-1}}$

6. The formation reaction for $FeCl_2$ has a negative free energy of formation under these conditions. The formation of $FeCl_2$ is therefore allowed. I then looked at the reaction

$$FeCl_{2(s)} + \frac{1}{2}Cl_{2(g)} \rightleftharpoons FeCl_{3(s)}.$$

   For this reaction, $\Delta_r G_m = -30.93\,\mathrm{kJ\,mol^{-1}}$. This means that under these conditions, $FeCl_3$ is the more stable compound. Therefore, assuming that kinetic effects do not prevent it, we would expect to make $FeCl_3$.

   Note: You can analyze this system using different reactions, but fundamentally you need to answer two questions:

   (a) Will you make at least one of the iron chlorides?
   (b) If the answer to the first question is yes, then which one is more stable?

7. 0.39 V

8. (a) See figure 1.

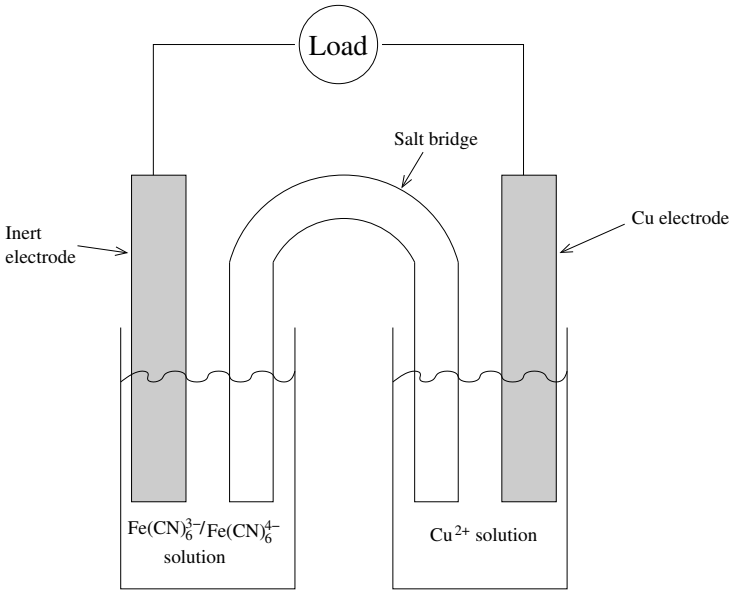

Figure 1: Electrochemical cell for question 8.

(b) $2Fe(CN)^{4-}_{6(aq)} + Cu^{2+}_{(aq)} \rightarrow 2Fe(CN)^{3-}_{6(aq)} + Cu_{(s)}$, $E = 0.059\,V$

9. (a) 4×10^{44}

   (b) $1.3\,kg$