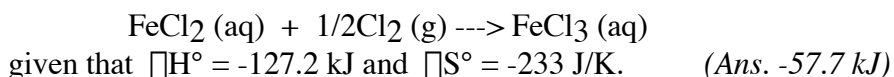


1. (Review) Use the data given in your Appendix to calculate the heats of reaction, at 25 °C, for the following reactions. For each, is the reaction exothermic or endothermic?
- $2\text{Fe}_3\text{O}_4 (\text{s}) + 1/2 \text{O}_2 (\text{g}) \rightarrow 3\text{Fe}_2\text{O}_3$
  - $\text{KCl} (\text{s}) + \text{Na} (\text{s}) \rightarrow \text{K} (\text{s}) + \text{NaCl} (\text{s})$
  - $\text{SO}_3 (\text{g}) + \text{H}_2\text{O} (\text{l}) \rightarrow \text{H}_2\text{SO}_4 (\text{l})$

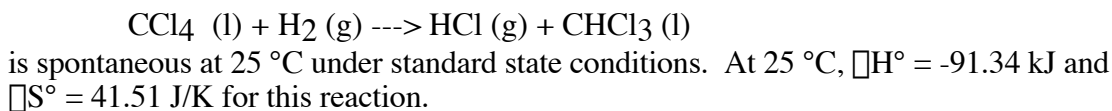
2. (Review) Ammonium nitrate dissolves in water according to the reaction:
- $$\text{NH}_4\text{NO}_3 (\text{s}) \rightarrow \text{NH}_4^+ (\text{aq}) + \text{NO}_3^- (\text{aq})$$
- Calculate the standard enthalpy change  $\Delta H^\circ$  for this reaction, using the following data: Enthalpy of formations for  $\text{NH}_4\text{NO}_3 (\text{s})$ ,  $\text{NH}_4^+ (\text{aq})$ ,  $\text{NO}_3^- (\text{aq})$  are -365.6, -132.5, and -205.0 KJ/mol respectively.
  - Suppose 15.0 grams of  $\text{NH}_4\text{NO}_3$  is dissolved in 0.100 L of water at 20.0°C. Calculate the temperature reached by the solution, assuming it to be an ideal solution with a heat capacity close to that of 100 grams of pure water (418 J/K).
  - What application would this reaction be useful?

3. Use the data given in your Appendix (or CRC handbook) to calculate the entropy change, at 25 °C, for the reactions in problem #1.

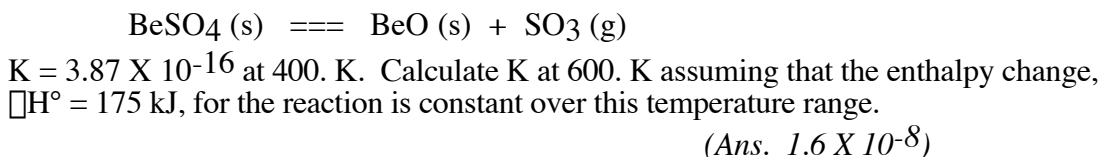
4. Calculate  $\Delta G^\circ$  at 25 °C for the reaction



5. Determine whether the reaction



6. Calculate the equilibrium constant at 25 °C for the reaction in question #5 given that  $\Delta G^\circ = -103.72 \text{ kJ}$  for this reaction. (Ans.  $1.5 \times 10^{18}$ )
7. How does the value of  $\Delta G$  change, for the reaction in question #5, if the reaction is carried out at 65 °C? (Ans. -105 kJ)
8. For the reaction,



### Chapter 10 Problems

As always, I recommend looking at the problems at the end of chapter.