1. In the table below is the thermodynamic data for ammonia (<http://en.wikipedia.org/wiki/Ammonia_%28data_page%29>) use this data to solve the following problems for mole of ammonia (state any assumptions you made):
   1. What is the melting point at standard conditions for ammonia? Boling point is given -33.4C.

Assume you have a sample of liquid ammonia that is somehow at 0C but has not changed phase. Do not include in your calculation how it got to 0C.

* 1. What is the enthalpy change for boiling ammonia at 0C?
  2. What is the entropy change for boiling ammonia at 0C?
  3. What is the free energy change for boiling ammonia at 0C?

|  |  |
| --- | --- |
| Property | Value in J/mole or J/moleK |
| ∆fus H | 5.7X103 |
| ∆vap H | 23.4 X 103 |
| ∆fus S | 28.9 |
| ∆vap S | 97.4 |
| Cp (lq) | 80.8 |
| Cp(gas) | 35.0 |

Note the standard heat capacity given is for 25C and you can solve the problem assuming it is constant between 0 and -33C. However if you go to the page referenced above you will see the heat capacity relationship with T could be better approximated in this range by a line.

Part 2 of question 1: Resolve the problem parts b-d using the following line (Cp=0.105T+78.68).

1. Derive the equation of state 
2. Assume you have gas that follows the equation of state p[(V/n)-b]=RT (b is a constant for the gas and n is the number of moles of gas). Determine the equation for α the thermal expansion coefficient.