Review Question for Thermodynamics Quiz

$$CH_{4(g)} + 3Cl_{2\,(g)} \rightarrow CHCl_{3(g)} + 3HCl_{(g)}$$
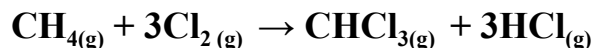
a) Explain what is meant by the term Average Bond Enthalpy
b) Using the Table of average bond enthalpies calculate the enthalpy change for this reaction
c) Comment on the value you obtain in b)
d) Enthalpy of this reaction can also be calculated by using the enthalpy of formation ($\Delta H^\circ_f$). Explain why the two values differ for the same reaction.
e) Explain the term $\Delta S^\circ$
f) Predict the entropy change without calculations for the above reaction and justify your answer
g) Using the Table of values of entropy $S^\circ$ under standard conditions, calculate the entropy change $\Delta S^\circ$ for this reaction
h) Comment upon the value value of $\Delta S^\circ$ obtained in g)
i) Explain with justification if this reaction will become more or less spontaneous as the temperature increases.
j) Calculate the Gibbs Free Energy at 298K
k) What may be deduced from the value $\Delta G^\circ$ calculated in j)
l) Calculate the Temperature at which this reaction becomes spontaneous