CH302H – Principles of Chemistry II: Honors
Fall 2014, Unique 51880

Homework, Week 5

1. For each of the following processes determine whether ΔS_{sys} is greater than zero, less than zero, or equal to zero. Explain your reasoning.

a) An adiabatic process

b) An isothermal expansion of an ideal gas

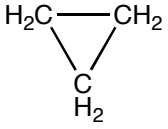
c) An isobaric (i.e constant pressure) cooling of an ideal gas

d) Isobaric evaporation of a liquid.

2. Vaporization at the normal boiling point of a substance (the boiling point at 1 atm, T_{vap}) is a reversible process. If ΔH_{vap} of water is 40.65 kJ mol^{-1}, determine ΔS_{vap} when 2.0 moles of water are vaporized at 100˚C. Comment on the sign of ΔS_{vap}.

3. For each of the following pairs of molecules, predict which has the greater molar entropy, assuming all are gaseous species under the same conditions. Briefly discuss your reasoning.

a. CO CO_2

b. $CH_3CH_2CH_3$ 

c. $CH_3CH_2CH_2CH_2CH_3$ $C(CH_3)_4$

4. Without referring to reference tables, arrange the following reactions according to increasing values of ΔS_{rxn}, and briefly discuss your reasoning.

a. $S(s) + O_2(g) \rightarrow SO_2(g)$
b. $H_2(g) + O_2(g) \rightarrow H_2O_2(l)$
c. $CO(g) + 3\ H_2(g) \rightarrow CH_4(g) + H_2O(l)$
d. $C(s) + H_2O(g) \rightarrow CO(g) + H_2(g)$

5. A couple weeks ago we discussed colligative properties, which are properties of a solution that result only from dissolving a solute in a solvent, not from the chemical identity of either species. Let's think about this observation again in light of our new understanding of entropy.

a) When two pure species are mixed, is the entropy of the mixture greater than, less than, or equal to the entropy of the pure species? Justify your answer.

b) Use your answer in part a) to explain i) boiling point elevation and ii) freezing point depression in terms of entropy.

6. 3.0 mole of an ideal gas ($C_{v,m} = 3/2R$) is compressed from an initial pressure of 1.0 atm to a final pressure of 5.0 atm. During this compression, the temperature of the system increases from 25˚C to 125˚C. Determine ΔS_{sys} and be sure to justify the sign of your answer.