

Fall 2008 CH301 Homework 13a—Problems for Statistical Thermodynamics Lecture

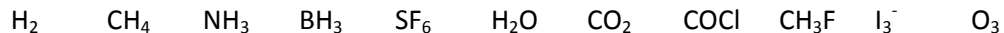
1. Two quick ideas that make math with statistical thermodynamics a lot simpler:

- What is the amount of energy for Avogadro's number multiplied by Boltzmann's constant? What is the famous name of this value?
- Use what you know about log functions to simplify  $S = k \ln W$ ?

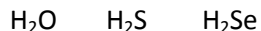
2. Answer the question asked about internal motional energy for each of the systems listed:

- The number of degrees of freedom in a H atom in benzene?
- The number of degrees of freedom in a benzene molecule?
- The number of translational modes of motion in a molecule of benzene?
- The number of rotational modes of motion in molecule of benzene?
- The number of vibrational modes of motion in a molecule of benzene?
- The number of degrees of freedom in 10 molecules of benzene?
- The total internal motional energy in 10 molecules of benzene?
- The total non-vibrational motional energy in 10 molecules of benzene?
- The total vibrational energy in 10 molecules of benzene?
- The total vibrational energy in a mole of benzene?
- The total translational energy in 10 moles of benzene?
- The number of degrees of freedom in 10 molecules of carbon monoxide?
- The number of degrees of freedom in a O atom in carbon monoxide?
- The number of translational modes of motion in a molecule of carbon monoxide?
- The number of rotational modes of motion in molecule of carbon monoxide?
- The number of vibrational modes of motion in a molecule of carbon monoxide?
- The total internal motional energy in 10 molecules of carbon monoxide?
- The total non-vibrational motional energy in 10 molecules of carbon monoxide?
- The total vibrational energy in 10 molecules of carbon monoxide?
- The total vibrational energy in a mole of carbon monoxide?
- The total translational energy in 10 moles of carbon monoxide?

3. Which of the following molecules would have no positional entropy at absolute zero?



4. Which of the following molecules would have a positional entropy closest to zero?



5. Write an expression describing the maximum positional entropy of each of the following systems at absolute zero:

- 1 molecule of ammonia
- 10 molecules of carbon monoxide
- a mole of chloromethane
- 50 molecules of  $\text{BH}_2\text{Cl}$
- 5 moles of  $\text{CO}_2$