CHEM441-001/002
College of Charleston
Fall 1999
Exam III

1(25). The molar mass of gaseous IO is 142.9 g mol^{-1}; the vibrational frequency of the ground state is 681.6004 cm^{-1}; and the moment of inertia is 8.228×10^{-46} kg m^2. At 25 °C and 1.00 bar, calculate the molar

a) translational partition function

b) rotational partition function

c) vibrational partition function

d) complete molecular partition function

2(15). The important energy levels of gaseous IO consist of a doubly degenerate ground level, a doubly degenerate first excited level at 25 014 J mol^{-1}, and a doubly degenerate second excited level at 257 889 J mol^{-1}. Calculate the partition function at

a) 25 °C

b) $T \rightarrow 0$

c) $T \rightarrow \infty$

3(10). Consider the reaction

$$A + B\text{-}B \rightarrow A\text{-}B\text{-}B$$

Excluding electronic and vibrational contributions, calculate ΔU assuming

a) A-B-B to be linear

b) A-B-B to be nonlinear

4(25). Calculate ΔH(thermal) at 1000 K for NH_3(g). The vibrational information is $\tilde{\nu}/(cm^{-1})$ = 3506, 1022, 3577 (doubly degenerate), and 1691 (doubly degenerate).

5(25). The heat capacity of NH_3(g) at 1000 K is C_p = 56.491 J K^{-1} mol^{-1} and can be considered to be constant over small temperature changes. A molar sample of ammonia was subjected to a process in which the sample released 265 J of heat to the surroundings and delivered 112 J of work to the surroundings. What temperature change occurred in the system?