CHEM442-001/002 Name ______________________________
College of Charleston
Fall 2000
Exam III Score ___________ /100

1(5). The molecule OFO(g) is of interest to atmospheric chemists. For this ideal gas, the *JANAF Tables* give the singly degenerate vibrational "frequencies" as $\tilde{\nu}/(\mathrm{cm}^{-1})$ = 1050, 600, and 1200.
Is OFO a linear molecule or is it a nonlinear molecule? _______________
How many degrees of rotational freedom? ______________
How many degrees of translational freedom? _______________
What is the value of the rotational symmetry factor (σ)? ______________

2(20). Using the data given in #1, calculate *E*(thermal) for OFO at 298 K.

3(10). Using your results of #2, calculate *H*(thermal) for OFO at 298 K.

4(15). A molar sample of OFO underwent a reversible, isothermal expansion from 1.00 L to 10.00 L at 298 K. Calculate the work involved. Is the system doing work on the surroundings? ______________

5(10). If 565 of heat are absorbed by the system described in #4 from the thermal reservoir in the surroundings, calculate the change in internal energy of the system.

6(10). The complete process of #4 and #5 resulted in a temperature change of the gas. Neglecting vibrational contributions, calculate the temperature change of the OFO as a result of the complete process.

7(5). Is the temperature change calculated in #6 (which neglects vibrational contributions) too large or too small compared to what would actually be observed (which includes vibrational contributions)? _______________
Would the temperature change be greater or smaller if the expansion described in #4 was done isobarically and isothermally against an external pressure of 0.1 bar instead of reversibly? ______________

8(25). Most of us know that $\overline{v^2} - \bar{v}^2 \neq 0$. For the three-dimensional speed of an ideal gas, derive the equation (showing all work) for $\overline{v^3}$ and evaluate $\overline{v^3} - \bar{v}^3$. Is this equal to zero? _______________