General Chemistry II
Problem Set 4
Due Monday, February 27, 2006 (at 5 p.m)

- This problem set will not be returned before your test on this material on Wednesday, March 1. However, the key for this assignment will be posted on the course web page on the 27th after 5 p.m.
- Total points for this assignment = 68.
- No points off for use of significant figures on this assignment.

1. (24 points) Introduction to Molecular Thermodynamics (IMT) Problems 7.4 and 7.23. Note that in 7.23, you should calculate $\Delta S$, not $S$, for each change of state.

2. (9 points) IMT Problem 7.6. Note that in all cases, you are comparing standard molar entropies at 298 K ($S^o_{298}$).

3. (3 points) IMT Problem 7.25. You do not need to justify your answers.

4. (9 points) IMT Problem 7.27

5. (5 points) IMT Problem 8.1

6. (2 points) IMT Problem 8.9(a). Assume that the ionization of acetic acid is negligible.

7. (7 points) IMT Problem 8.14. Hints: (1) The standard entropies you are correcting are listed in Table 7.1. (2) Use the pressure conversion factors on the inside back cover of IMT. (3) Tutors: The answer to part (b) in the key is wrong.

8. (9 points) IMT Problem 8.20. Again, you will need to use Table 7.1.

Here is the very correct way to treat the units when calculating energy changes for a reaction (cf. Chapter 5):

For example, for the reaction $2 \text{NI}_3 \rightarrow \text{N}_2 + 3 \text{I}_2$,

$$\Delta, U = \left( \frac{6 \text{ mol bond}}{\text{mol rxn}} \right) \text{BDE(N} - \text{I)} - \left( \frac{1 \text{ mol bond}}{\text{mol rxn}} \right) \text{BDE(N} \equiv \text{N)} - \left( \frac{3 \text{ mol bond}}{\text{mol rxn}} \right) \text{BDE(I} - \text{I)}$$

$$\Delta, U = \left( \frac{6 \text{ mol bond}}{\text{mol rxn}} \right) \left( \frac{159 \text{ kJ}}{\text{mol bond}} \right) - \left( \frac{1 \text{ mol bond}}{\text{mol rxn}} \right) \left( \frac{945 \text{ kJ}}{\text{mol bond}} \right) - \left( \frac{3 \text{ mol bond}}{\text{mol rxn}} \right) \left( \frac{151 \text{ kJ}}{\text{mol bond}} \right)$$

$$\Delta, U = -444 \text{ kJ/mol rxn}$$