11:670:323 **How To Do Problem Sets**

Learning how to solve problems is an important part of this course. The techniques discussed here can be applied for the rest of your life when addressing the unknown, even in areas of your life far removed from meteorology. Learning how to think, how to skeptically consider information you receive and how to evaluate it, and learning how to create new knowledge and understanding, are the most important lessons in this class.

The problem sets you will be asked to do in this course serve several purposes. As discussed above, they teach you critical thinking and problem solving skills. They also serve to reinforce mathematical skills and familiarity with the metric system and the English units still pervasive in our science. And they reinforce the principles of atmospheric thermodynamics that are the subject of this course. Learning how to plug numbers into formulas and calculating the answers is a necessary final step in the solution of these problems. But figuring out what formulas to use is more difficult and more important. Learning how to set up the problems is the most important reason for doing them. Do them step by step as follows:

1. Restate the objective of the problem in your own words. Clearly state the final objective.

2. Identify the physical setting of the problem by drawing a figure.

3. Identify all the information given and assumptions to be made.

4. Determine the equations you will need to solve the problem, and how they will have to be manipulated to give you the answer in the requested units.

5. Solve the problem step by step. Clearly state all the additional assumptions you are making at each step and any additional information you may have added. Write down a brief running commentary to explain your thought processes. Do not skip any steps. Show all your work.

6. When doing the actual calculations, clearly write down all conversions of units. For example, if you were calculating the dry adiabatic lapse rate, you would do the calculation as follows:

$$\Gamma_d = \frac{g}{c_p} = \frac{9.8\ \mathrm{m\,s^{-2}}}{1004\ \mathrm{J\,kg^{-1}\,K^{-1}}} \times \frac{1\ \mathrm{J}}{1\ \mathrm{kg\,m^2\,s^{-2}}} \times \frac{1000\ \mathrm{m}}{1\ \mathrm{km}} = 9.8\ \frac{\mathrm{K}}{\mathrm{km}}$$

At each step, you multiply by a ratio that equals 1 to convert to the desired final units. Do not write down any numbers without including their units. Do not round intermediate solutions when doing the calculation, but present a justifiable number of significant figures in the final solution. Circle the answers and call attention to important intermediate results.

7. Examine your solution. Does it make sense? Is it the correct order of magnitude? Are the units correct?

8. Discuss the implications of the results. What general principle is illustrated?