Physics 008: The Quantum World Around Us
Spring 2007
Homework Assignment #7
Due Thursday 4/12/2007 **Name:**

In this week's assignment, you will practice writing based on a Scientific American article, *and the knowledge you have already gained in class.* The most important aspect of this, and the following assignments, is for you to express your ideas clearly (and in your own words), and for you to explain, using quantum-mechanical reasoning, the physical phenomenon described. Feel free to use figures if you find they will aid your essays. *Also, be sure to recognize that you will need to use other resources than just the current article in answering the questions.* These are important assignments to help you in writing your final paper.

1. Beginning on page 54 of the Scientific American article on C_{60}, the authors talk about searching for the elusive "yellow vial" of Buckyballs dissolved in benzene. The sought-after liquid was eventually discovered by other workers to be yellowish-red and transparent. Use quantum-mechanical reasoning to explain what the color of the liquid tells us about the energy level diagram for electrons in a molecule of C_{60}. (Hint: recall the sharp lines in the atomic spectroscope, and how we described them.)

2. On page 58, the authors state that NMR is used to verify the proposed soccer-ball structure of C_{60}. How does NMR provide this information? Be sure to describe what NMR is, and what it measures, and how one can conclude that all carbon atoms are in the same environment. (This last point implies that the molecule has the highly symmetric soccer-ball structure since it is the only arrangement of 60 atoms in which all atoms are in an identical environment.)