Directions. Please solve the problem below. Your solution must begin with a clear statement (or re-statement in your own words) of the problem. You solutions should be clear, legible, and demonstrate at minimum partial progress towards a complete solution to the problem. Please refer to the syllabus for the policy on grading (communication, completeness, and correctness). Homework is due at the start of class, and late homework is not accepted.

Collaboration. You may either solve this problem on your own or as part of a group of students. (I prefer that you work in a group.) In either case, I encourage you to discuss the homework with your classmates.

Each individual or group must write and submit their own solution to the problem below. If you reference any external sources, please give a proper citation. If you use the ideas of another, you should also acknowledge this assistance.

Calculators. You may use calculators to determine a numerical approximation to an answer to an application question, but you should use exact values until the very last step in the problem. Calculators are not, however, permitted on any quizzes or exams.

1. The bond angle of the methane molecule. Please solve this problem with a partner (group size has a maximum of 2). You will both receive the same grade.

The methane molecule consists of four hydrogen atoms and a single carbon atom. The hydrogen atoms can be regarded as positioned at the four vertices of a regular tetrahedron. In this case, the carbon atom lies at the centroid of the tetrahedron. Determine the bond angle between the two bonds between the carbon atom and two hydrogen atoms. You are required to use vectors to solve this problem. Show all of your work and include at least one sketch of the molecule and clearly indicate the angle mentioned in the problem. If you use any references, be certain to give proper credit and to cite any resources used.