In practice, scientists often work collaboratively. We encourage you to work on the problem sets in groups, but you must answer the questions in your own words. Acknowledge your group members by noting their names on your problem set when you hand it in.

1) Send an email to a classmate with an electronic copy (cc:) to Professor Ellis and Cindy. Use this opportunity to give us feedback on the course and identify topics that you would like to study. This is also a good opportunity to make suggestions for the website.

2) Ammonia belongs to the point group $C_{3v}$ which includes the operations $E, C_3, C_3^2, \sigma_w, \sigma_v, \sigma'_v,$ and $\sigma''_v$. These operations are set out in the stereographic projection below. Generate the $C_{3v}$ group multiplication table. For consistency, rotate in a clockwise direction for $C_n$ operations.

3) Find all of the symmetry elements and the point group in the following species. Clearly label each symmetry element.

   a) SF$_4$

   b) PtCl$_4^{-2}$ (square planar)

   c) Allen

   d) Chair conformation of cyclohexane

   e) Boat conformation of cyclohexane

For d and e, if you took an NMR of the molecule, which of the protons would be chemically equivalent?

---OVER---
4) Assign the point group for each of the following structures and explain your reasoning.

a) IF\textsubscript{7} (pentagonal bipyramid)

b) I\textsubscript{2}Cl\textsubscript{6} (planar)

c) [Cl\textsubscript{2}PN\textsubscript{3}] (P and N atoms all lie in the same plane)