

Homework 1 Key (Stowell)

- 1) (15pts) Molecules are held together by a variety of chemical bonds/forces listed below. An answer can be used once, multiple times or not at all.:
- A. Covalent bonds
 - B. Hydrogen bonds (Dipole-Dipole)
 - C. Ionic bonds
 - D. Van der Waals forces or bonds (e.g. Induced Dipole/Induced Dipole)

Match these bonds with the appropriate description given below

Weak bonds between polar molecules. **B,C**

Bonds formed between positive and negative charged atoms. **C**

Bonds important in biology because they allow flexibility. **ABCD**

Bonds formed through the sharing of electrons to form "full" orbits. **A**

The strongest bonds of the four are. **A**

Order these types of interactions based on strength.

A>B>C>D

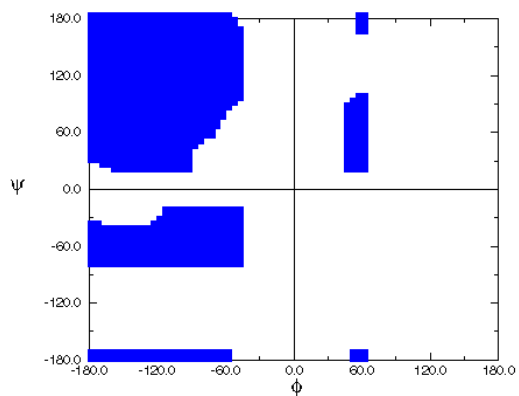
- 2) (15pts) Download and install the Chimera program (<http://www.cgl.ucsf.edu/chimera/>) Go to the PDB (<http://www.rcsb.org/pdb/>) and download a protein of interest. Load the molecule into Chimera and explore the various functions of the program. Measure a distance and print out a picture of the molecule with the distance measurement.

- 3) (5pts) Why is proline considered a "helix breaker".

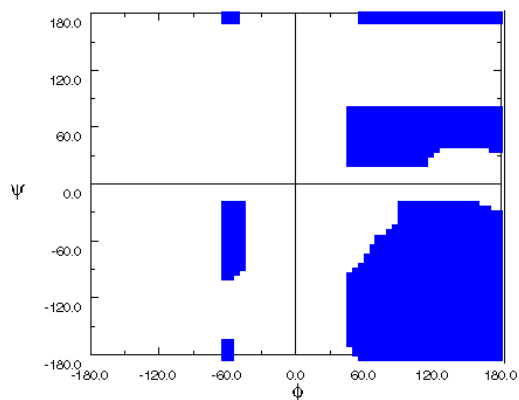
It does not have an amide bond hydrogen and therefore cannot make the H-bond normally found in a helix

- 4) (10 pts) Below is the ramachandran plot for L-alanine. Draw the ramachandran plot for D-alanine and a-amino isobutyric acid (L-alanine with a second methyl group replacing the hydrogen on the alpha carbon).

Hard Sphere Ramachandran Map L-alanine



Hard Sphere Ramachandran Map D-alanine



Hard Sphere Ramachandran Map isobutyric acid

