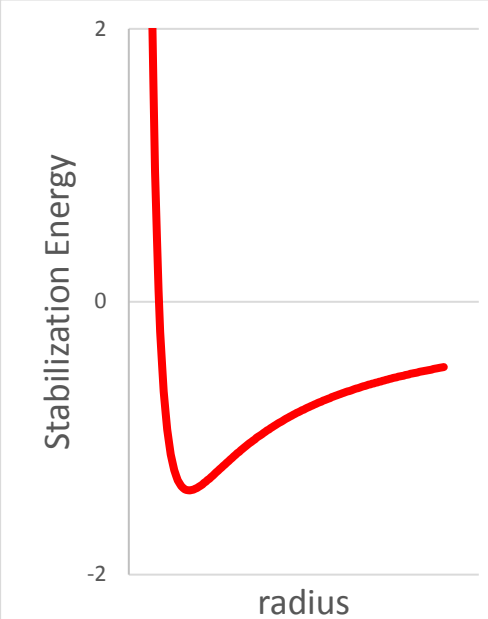
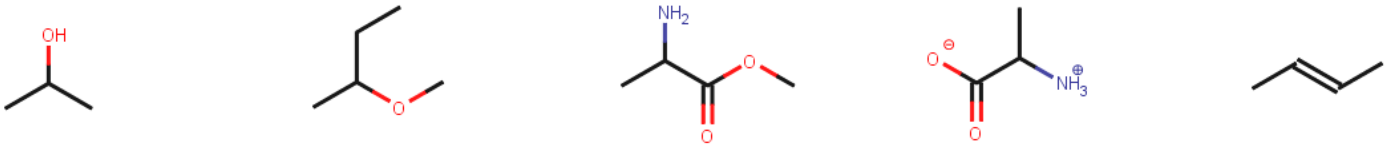
Problem Set 1 (**Due January 18th**)

1. Examine the image to the right and answer each of the following questions:
    a. What does this image represent?
    b. Units are missing for the x and y axes. Based on what you know about the meaning of this image, propose units for each axis.
    c. There is a very important physical law that is used to understand this figure. Name it and discuss how each variable influences the stabilization energy.
    d. The law that was just mentioned fails to completely describe the image. Why?
    e. Which intermolecular force(s) can be explained by the trend seen in this image? For any IMF that is not governed by the trend, clearly explain why.



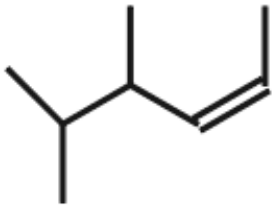
2. Use the image below to answer each of the following questions.



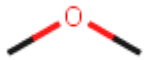
A B C D E

    a. Draw the complete Lewis structure for each compound.
    b. Identify all intermolecular forces that each compound can participate in.
    c. Which compound (if any) can be an H-bond acceptor but not a donor?
    d. Identify all functional groups that are present in each molecule.
    e. Is compound E a cis or trans alkene?
    f. Rank these compounds based on their solubility in water. Lowest solubility is 1 and the highest solubility is 5.
    g. Which compound do you expect to have the lowest melting point?
    h. Which compound do you expect to have the highest melting point?
    i. Determine the hybridization on each atom in compound C.

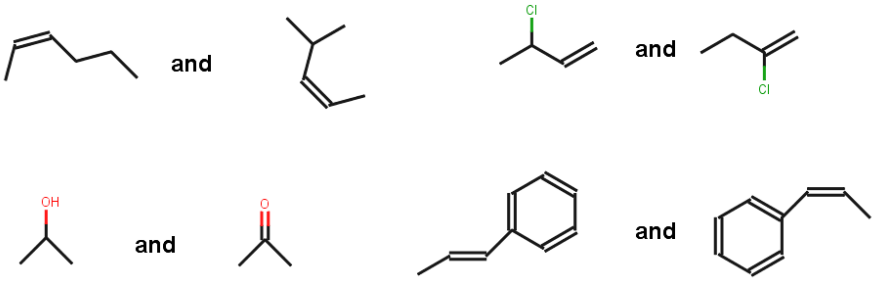
3. Draw 3 possible isomers of each of the compound shown below.



4. How many hydrogen bonds can this compound form with water? Clearly explain your answer.



5. Determine if each pair are structural isomers, stereoisomers, or neither.



6. The effectiveness of a drug is influenced by its ability to "partition" between aqueous solutions and non-polar solutions. The equilibrium below represents this reaction where the reactant is a compound dissolved in water and the products is the same compound dissolved in octane.

$$X\ (H_2O) \rightleftharpoons X\ (Octane)$$

Consider the two compounds below. Which would have a more negative ΔG^0 for this reaction? Which would have a smaller K?

7. Name each compound using the common organic name.