

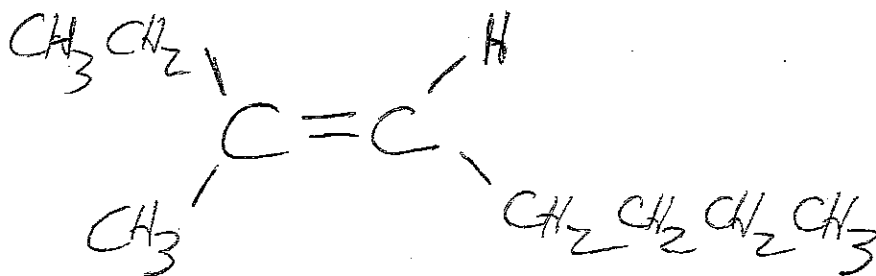
Last Name Answer  
First Name Key

General Instructions:

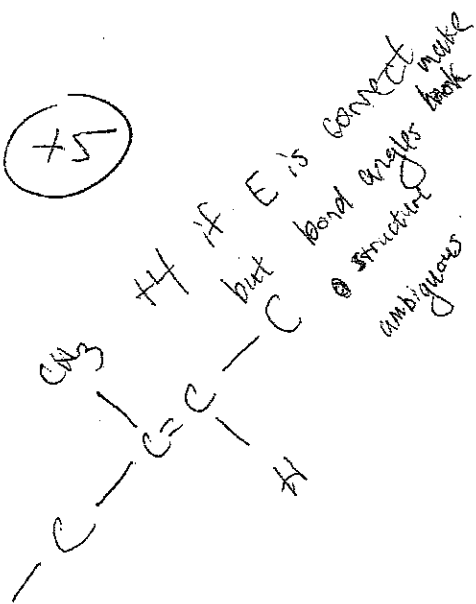
- (i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.
- (ii) Print your name on each page.
- (iii) Please keep your paper covered and your eyes on your own work. Misconduct will lead to failure in the course.

1. (10 points) Draw a structure that corresponds to each of the following names. Show all atoms in each structure, including hydrogen atoms.

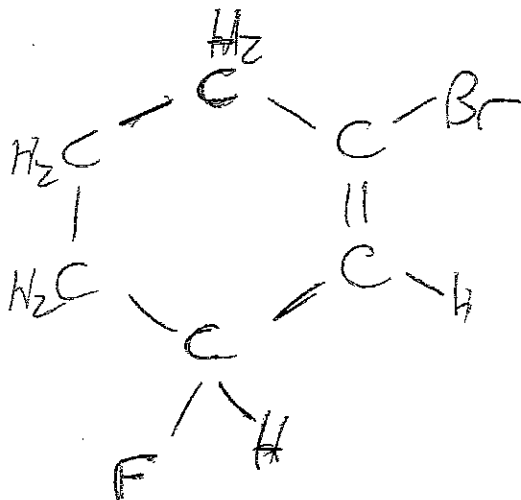
(a) *E*-3-methyl-3-octene



(+5)



(b) 1-bromo-3-fluorocyclohexene

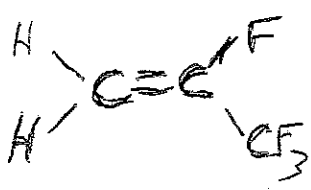


(+5)

+2 if H's not drawn in, but correct

2. (16 points)  $H_2C=CFCF_3$  is a relatively new refrigerant that has a smaller greenhouse effect (i.e., lower global warming effect) than currently popular refrigerants such as  $CHCl_2$ . Answer the following questions.

(a) Provide a drawing of  $H_2C=CFCF_3$  that indicates the three-dimensional structure.



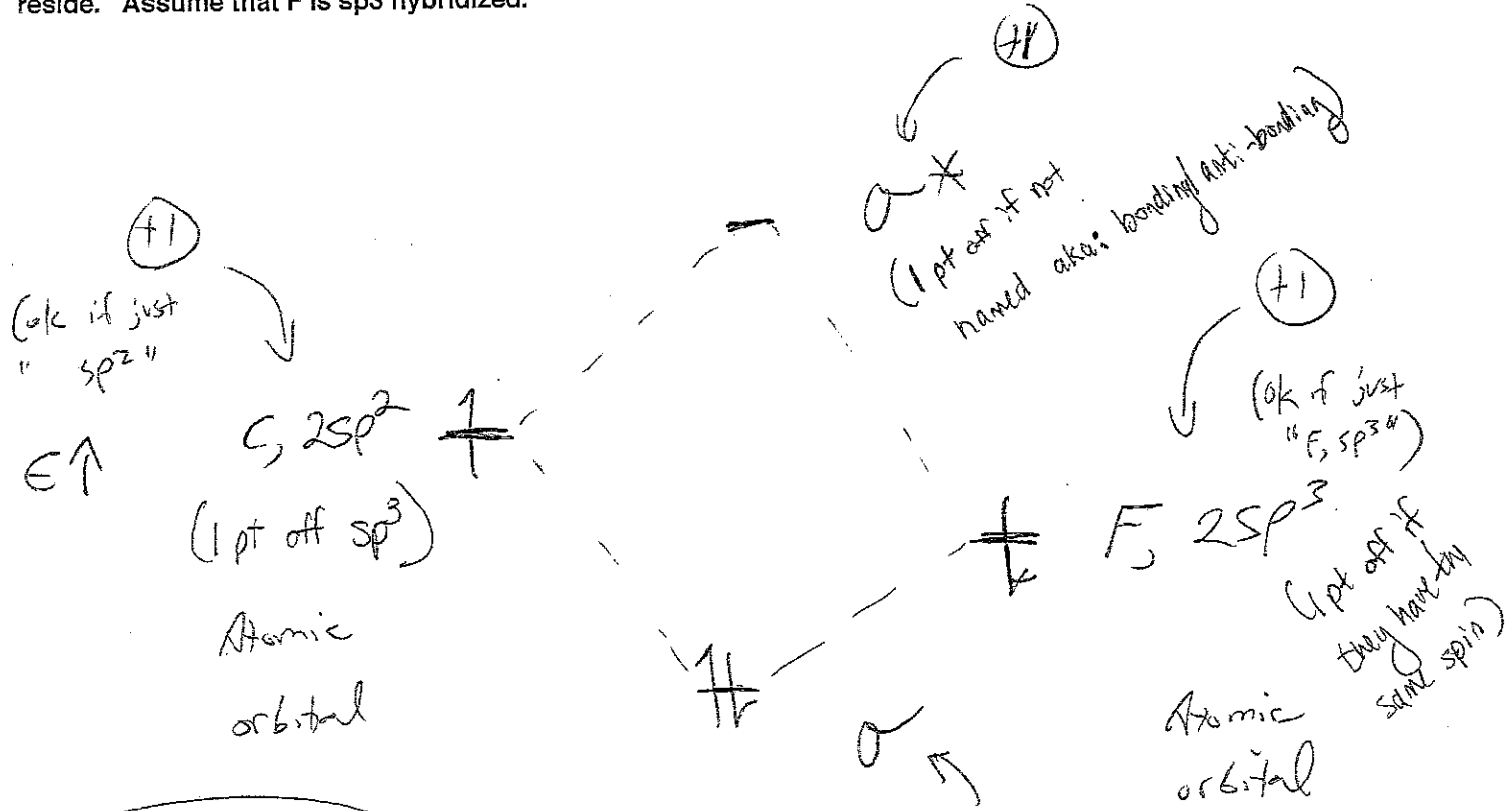
(+4) (no credit for anything that doesn't reflect planarity)

(b) Indicate the H-C-H bond angle (approximation) in the box.

~120°

(+4)

(c) Provide an energy diagram that shows how the relevant atomic orbitals combine to form the molecular orbitals of the C-F bond involving the central carbon, and where the bonding electrons are expected to reside. Assume that F is  $sp^3$  hybridized.



$\sigma$  is lowest  $\Rightarrow$  (+2)  
 $2e^-$  in  $\sigma \Rightarrow$  (+2)

Molecular orbitals

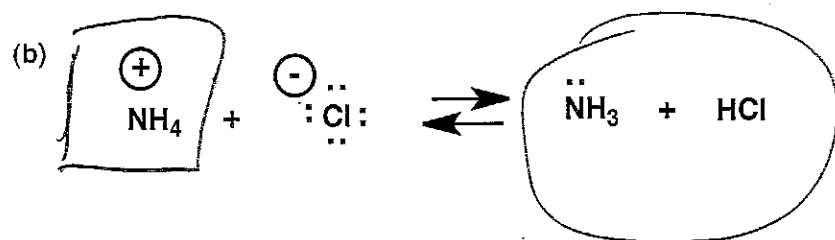
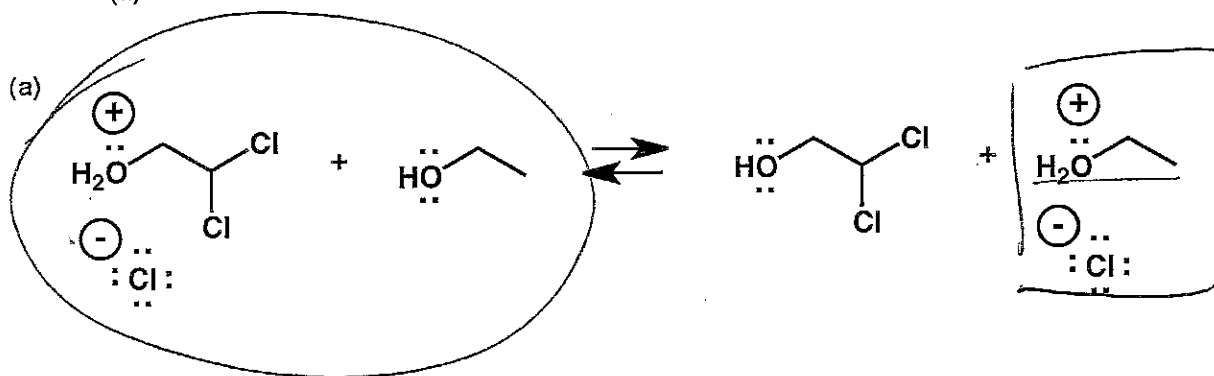
+8 total for 2c

Name MM

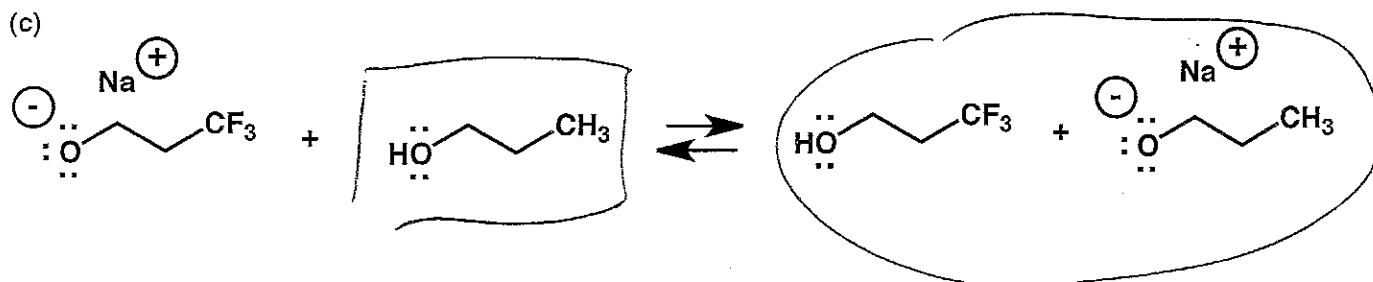
3. (12 points) For each equilibrium shown below, do two things:

(i) Put a SQUARE around the WEAKER ACID, of the two species that are serving as acids in the equilibrium.

(ii) Put a CIRCLE around the SIDE of the equilibrium that you expect to be LESS FAVORED.



+2 for each  
correct circle  
& square.



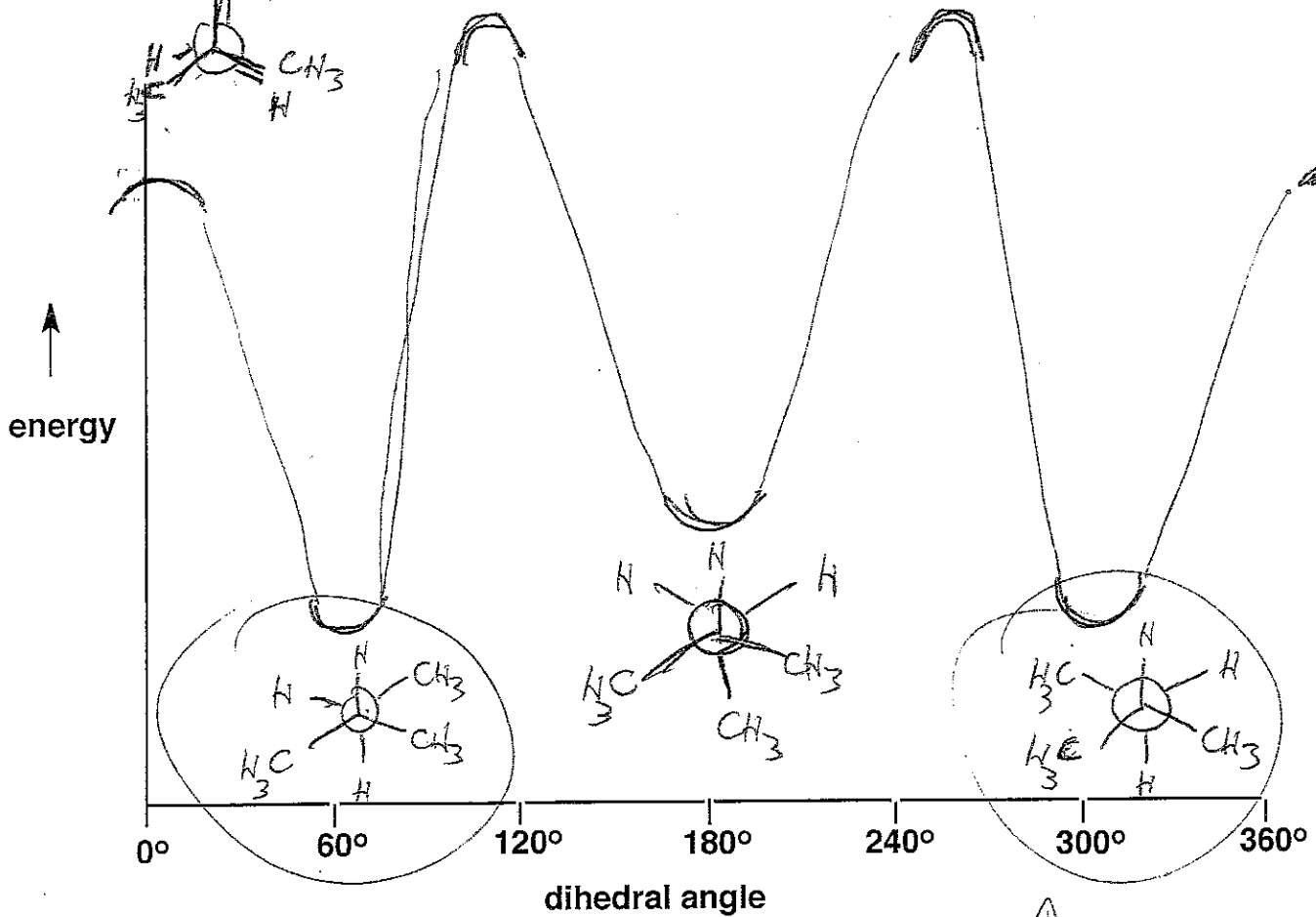
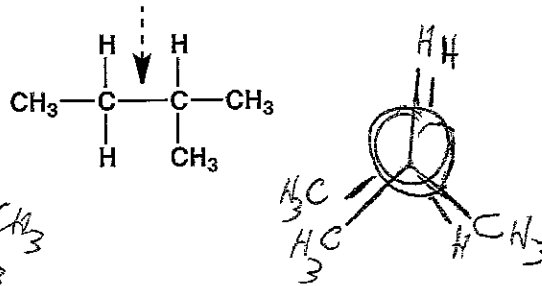
4. (25 points)

Draw an energy diagram for rotation about the indicated carbon-carbon bond (dotted arrow) of the molecule below. Show the structure for each energy minimum and each energy maximum.

CIRCLE the most stable structure(s).

+4 for each correct Newman projection

Must circle something to receive credit

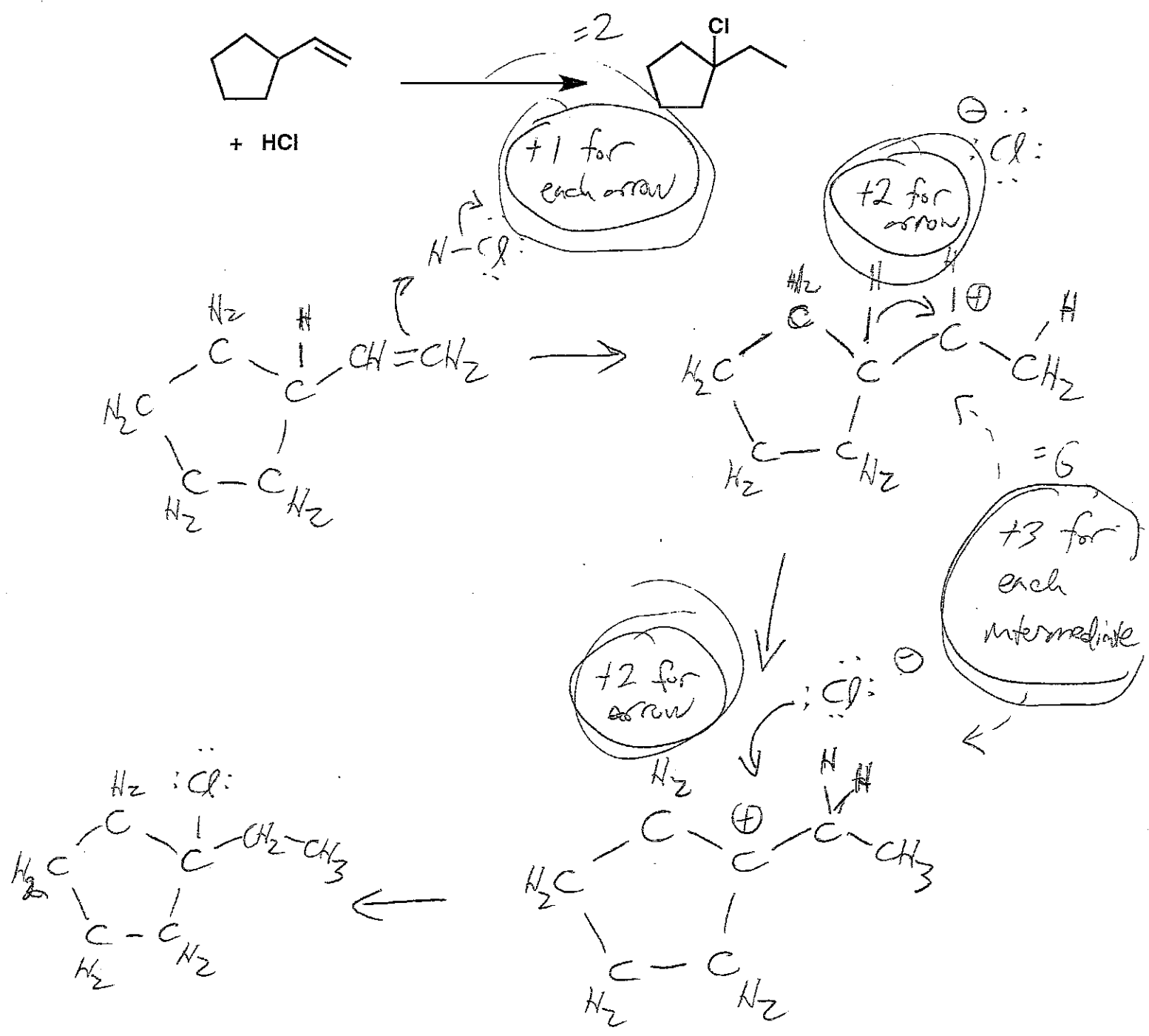


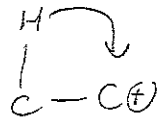
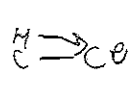
-2 if added additional (incorrect) structure

Most stable

+1 for 2 circles

5. (12 points) Provide a mechanism ("curved arrows") for the reaction shown below. Show every atom in each structure you draw.



- -1 pt 
- -2 pt 
- -2  $\oplus$  not shown in interm.

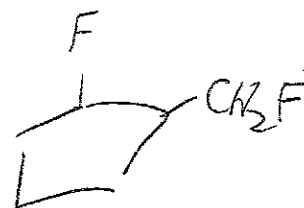
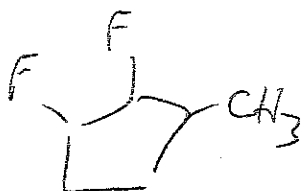
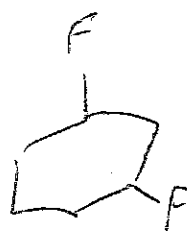
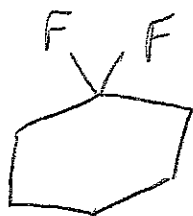
- -4: concerted attack/rearr.
- -6:  $\leftarrow$  (hydride shift) no rearr., or not showing
- didn't show all atoms: ~~2~~ -2

Name AM

6. (25 points)

A molecule with the formula  $C_6H_{10}F_2$  does not undergo any reaction when combined with  $H_2$  in the presence of the catalyst Pd/C. Propose FIVE possible structures for this molecule (via appropriate drawings).

MANY POSSIBILITIES! Some shown below...



5  
for  
each  
correct  
structure