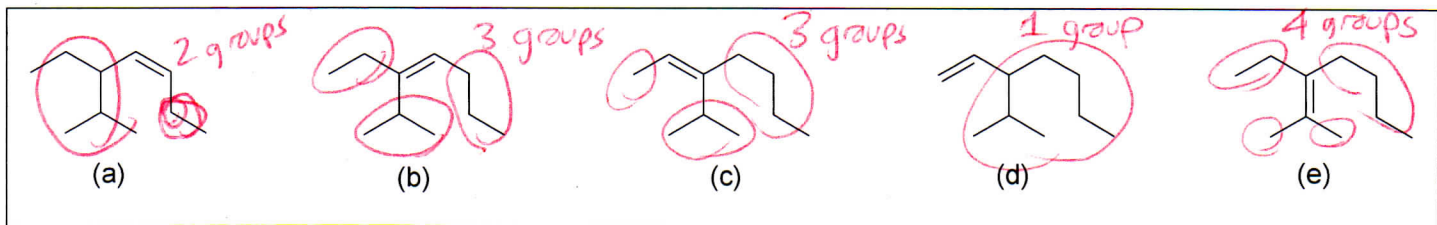


Section 1. Multiple Choice – 2 points each.

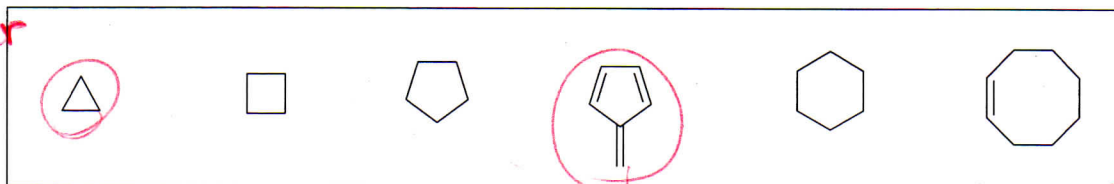
For Questions 1 – 4, kindly consider the compounds woefully trapped in the box below.



- The most stable compound would be e.
  - The second most stable compound would be c (less sterics).
  - The least stable compound would be d.
  - You could specify the stereochemistry of a of the compounds as cis or trans. *only a*  
(For partial credit, put an "X" through those you can't)
- (a) 1                      (b) 2                      (c) 3                      (d) 4                      (e) 5

- c of the cyclic compounds below would be completely planar (flat).  
(For partial credit circle those that will be flat)

(a) 0                      (b) 1                      (c) 2                      (d) 3                      (e) 4                      (f) 5                      (g) 6

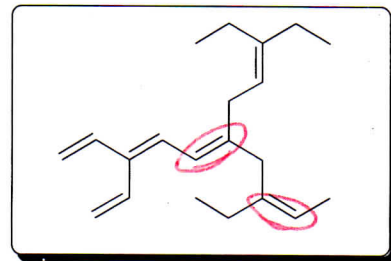


*all rings pucker if can*

*all sp<sup>2</sup>; flat (trigonal planar)*

- The compound on the right has a total of c double bonds that are stereocenters.  
(For partial credit, circle the ones that are stereocenters)

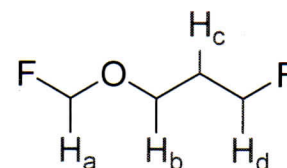
(a) no                      (b) 1                      (c) 2                      (d) 3                      (e) 4                      (f) 5



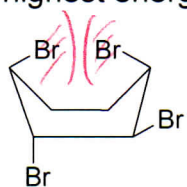
- A cyclic compound cannot have a *trans*-double bond unless it has more than 7 carbons. (this is a fill in the blank question)

- The weakest C-H bond in the structure on the right would be the C-a bond.

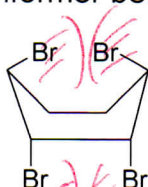
(a) H<sub>a</sub>                      (b) H<sub>b</sub>                      (c) H<sub>c</sub>                      (d) H<sub>d</sub>  
(e) they are all the same strength  
(f) you can't reliably predict this just from the structure



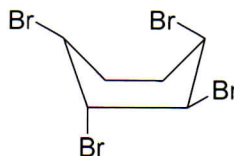
9. The highest energy boat conformer below is b.



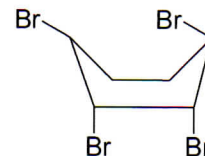
(a)



(b)



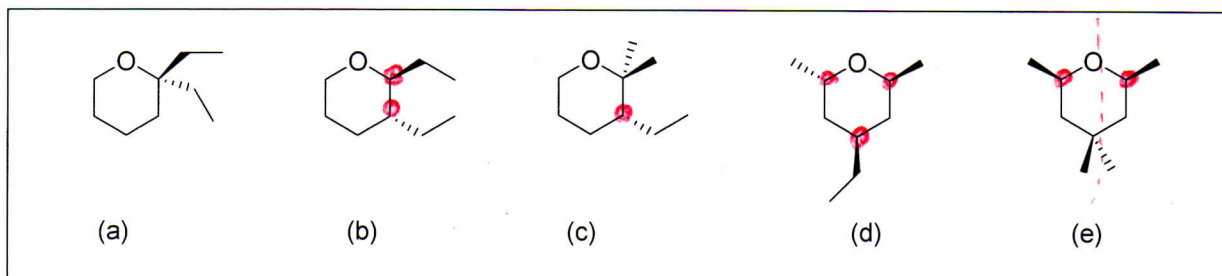
(c)



(d)

(e) they are all equal in energy

For Questions 10 – 13, kindly consider the compounds patiently waiting in the box below. First circle all the stereocenters in each compound, then answer questions 1-4. Note that for some of these questions, there are more than one answers – write them all in this case.



10. Compound(s) a has/have no stereocenters.

11. Compound(s) d has/have would have the most stereoisomers.

12. Compound(s) c is/are chiral but has no diastereomer.

*↳ diastereomer need at least 2 stereocenters*

13. Compound(s) e is/are meso.

14. Morphine has the absolute stereochemistry of  $5R, 6S, 9R, 13S, 14R$ , has a melting point of  $240^\circ\text{C}$ , an optical rotation of  $-132^\circ$ , and doesn't taste bad in a hollandaise sauce. A stereoisomer with the absolute stereochemistry of  $5S, 6R, 9R, 13R, 14S$  would have d.

(a) an optical rotation of  $+132^\circ$  and a melting point of  $240^\circ\text{C}$

(b) an optical rotation of  $+132^\circ$  and a melting point different than  $240^\circ\text{C}$

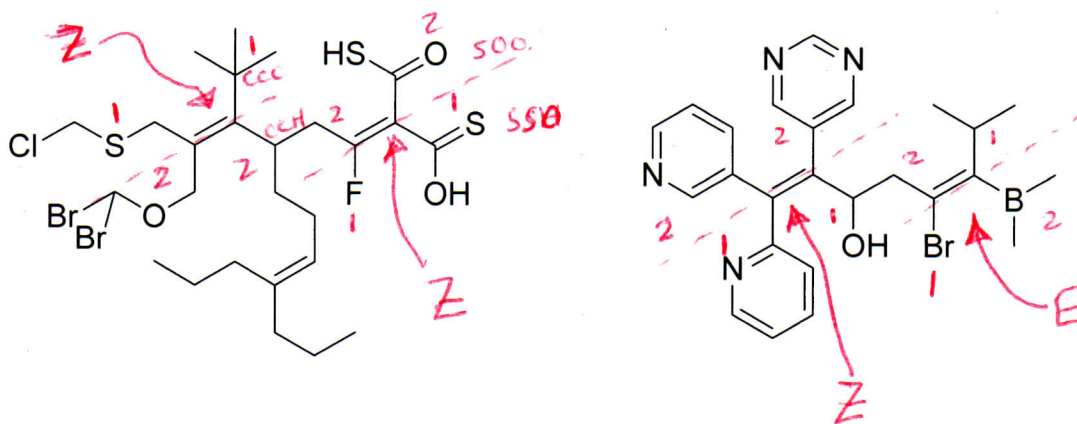
(c) a different optical rotation and a melting point of  $240^\circ\text{C}$

(d) a different optical rotation and a melting point different than  $240^\circ\text{C}$

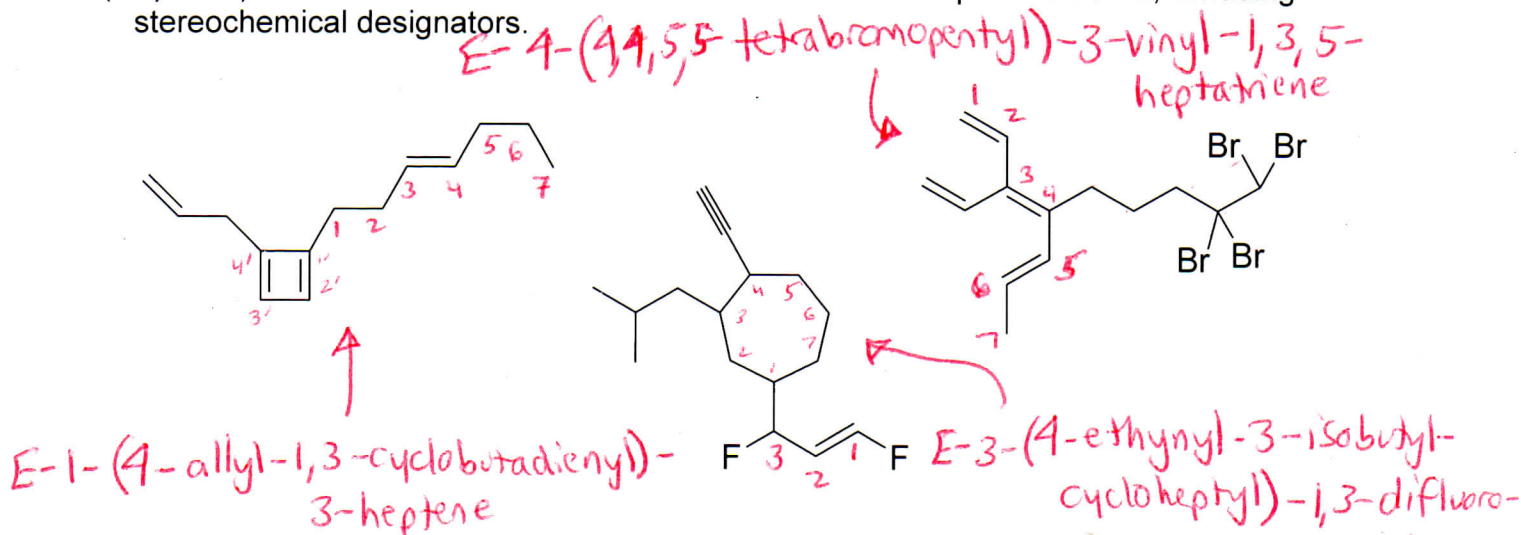
*diastereomer*

Section II. Nomenclature.

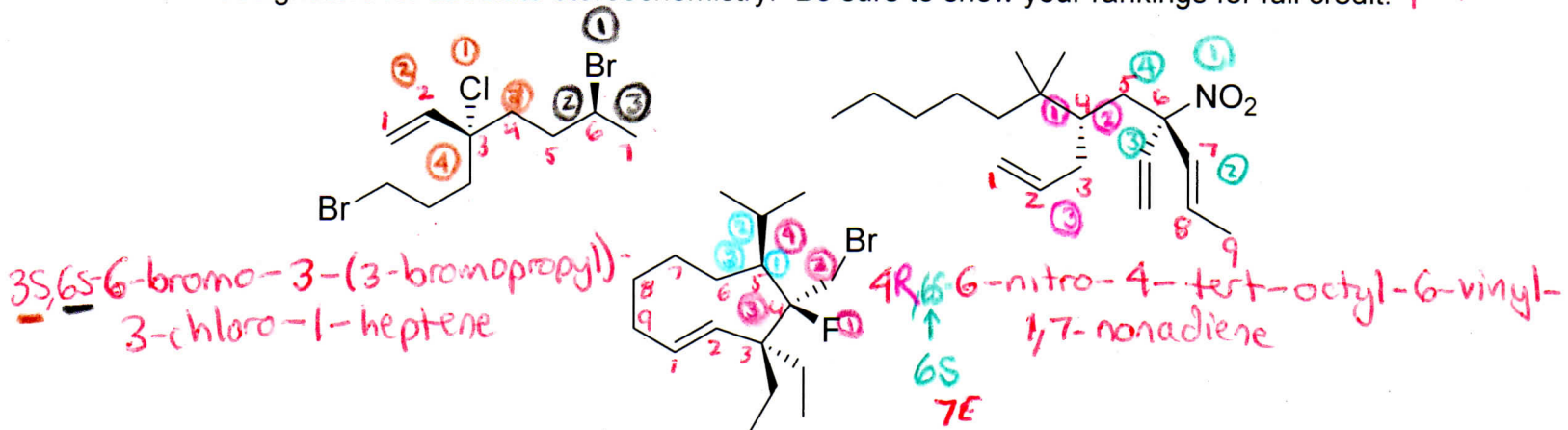
15. (7 points) Assign E/Z to **TWO** of the C=C double bonds below. **Note that you MUST show your rankings to receive ANY credit.** The double bonds can be in the same or different structures.



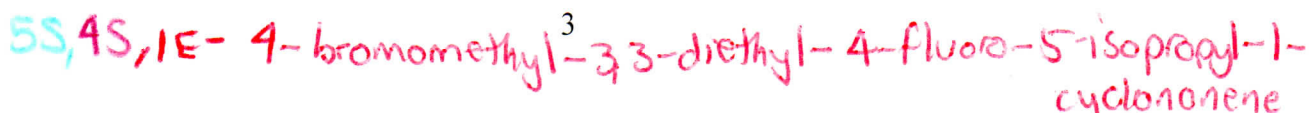
16. (11 points) Give an ACCEPTABLE name to ONE of the compounds below, including stereochemical designators.



17. (14 points) Give an acceptable name for ONE of the compounds below, including designators for absolute stereochemistry. Be sure to show your rankings for full credit.

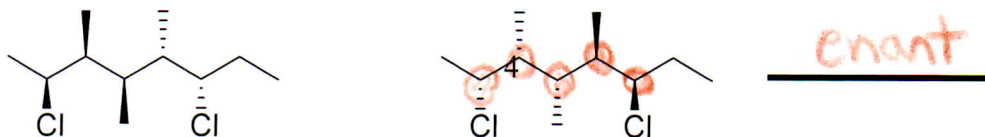
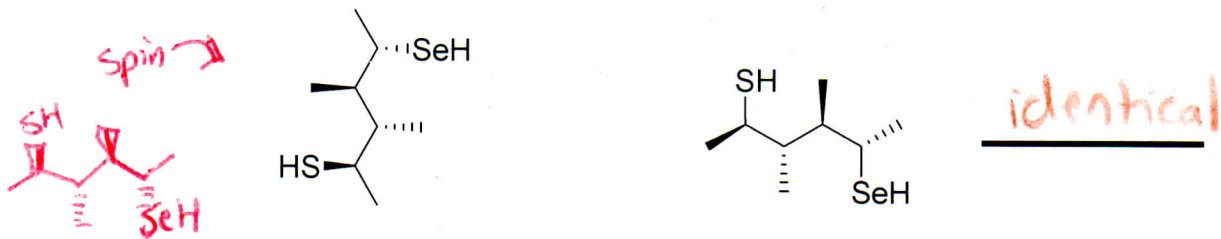
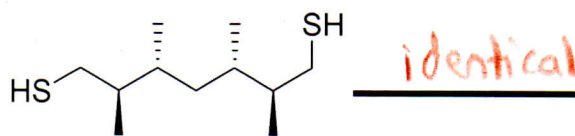
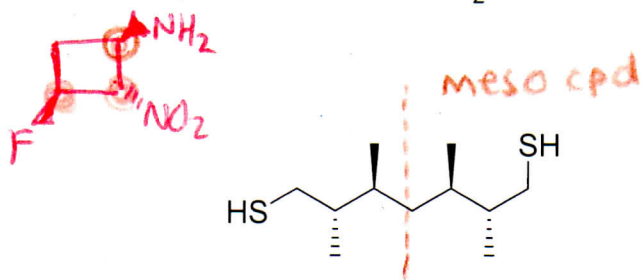
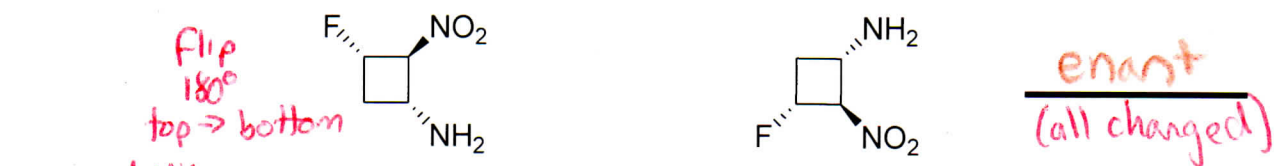
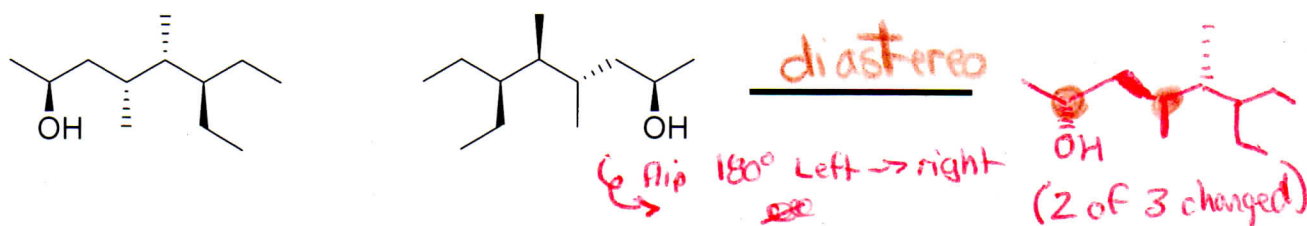
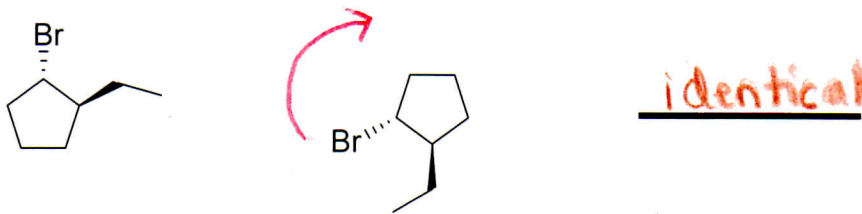
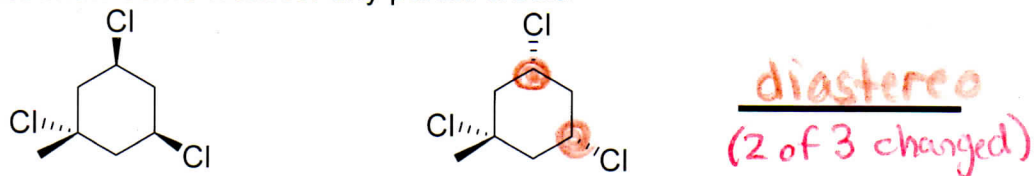


**DID YOU REMEMBER TO INCLUDE ABSOLUTE STEREOCHEMISTRY IN YOUR NAME?**

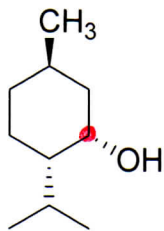
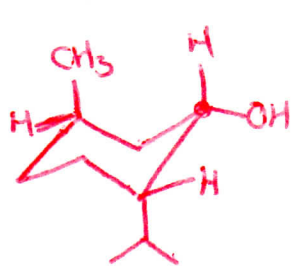


Section III. Short answer.

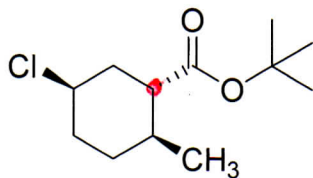
18. For **THREE** of the pair of compounds below, indicate their relationship to one another. You should be using terms like identical, constitutional isomer, diastereomer, and enantiomer. You must show some work for any partial credit.



19. (10 points) (a) Draw BOTH chair conformations for ONE of the compounds shown below.

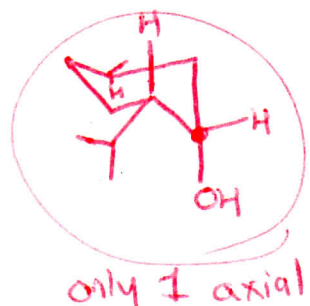
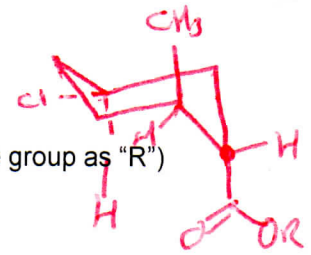
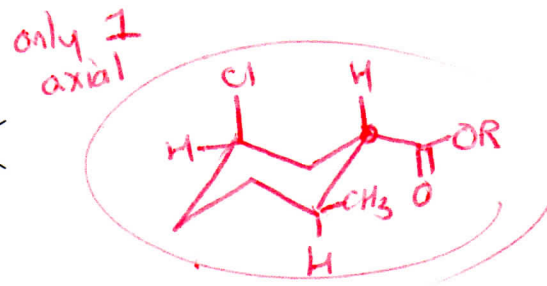


neomenthol  
(found in  
peppermint oil)



trimedlure  
(used to attract  
insects to trap boxes)

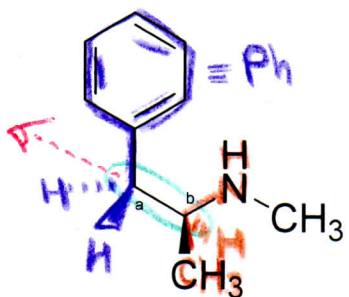
(note you can just abbreviate the one group as "R")



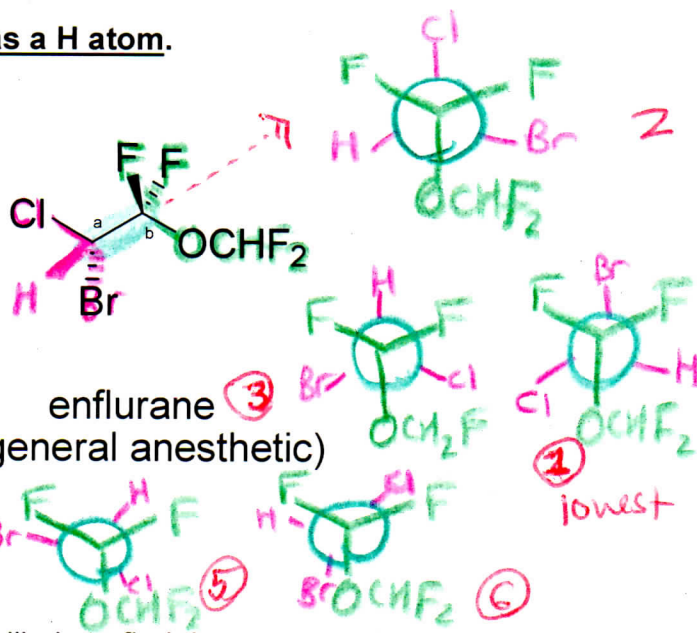
(b) Now circle the lower energy conformer.

20. (10 points) (a) Draw ONE staggered and TWO eclipsed conformers for ONE of the compounds below, looking down the a-b bond.

Please note that a F atom is THE SAME SIZE as a H atom.



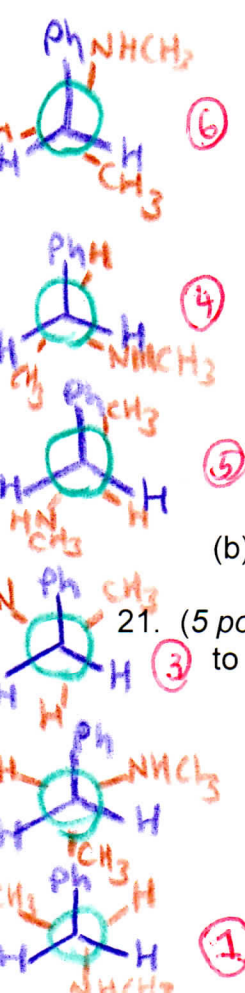
methamphetamine



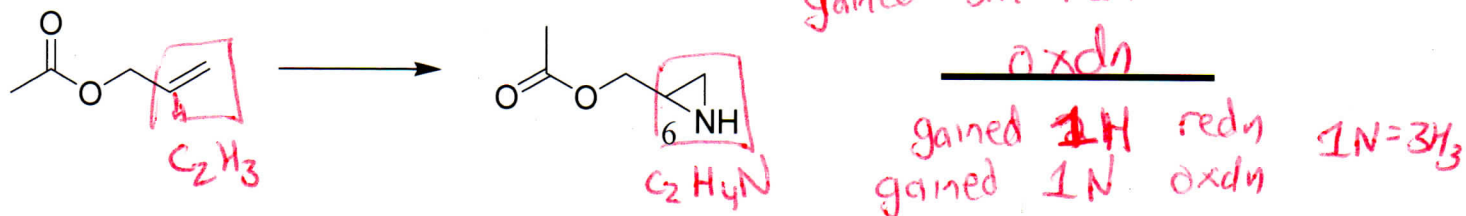
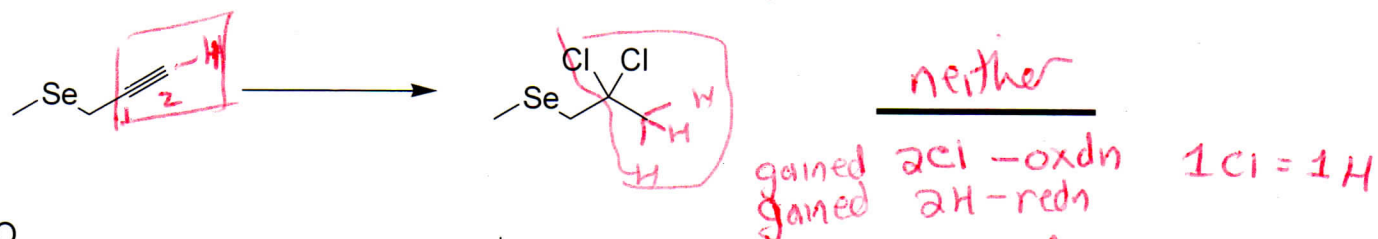
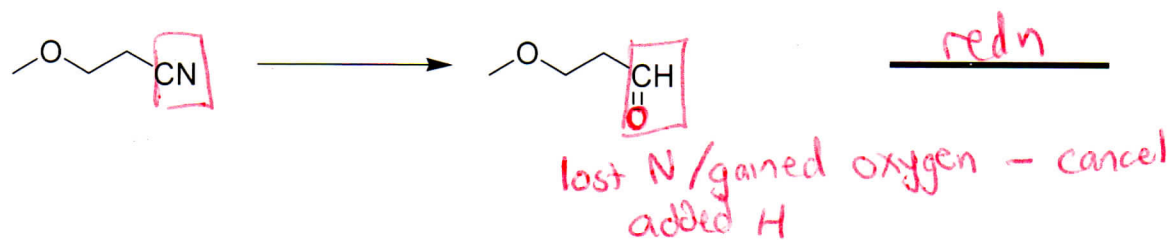
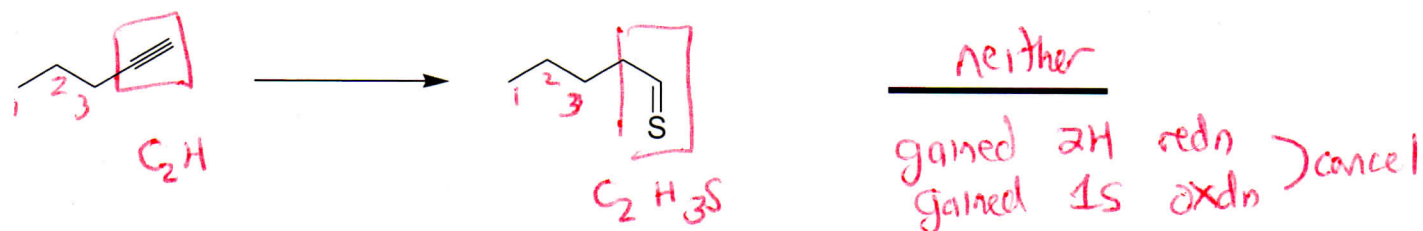
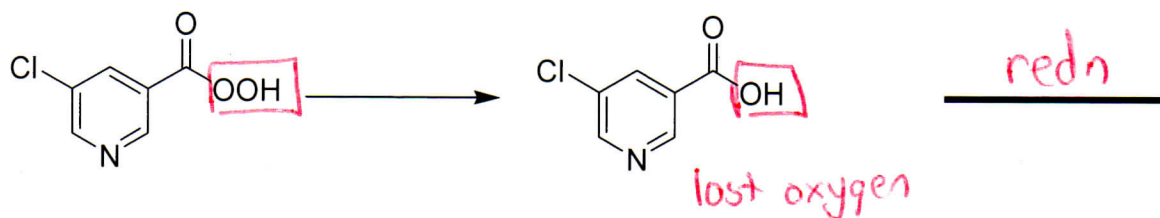
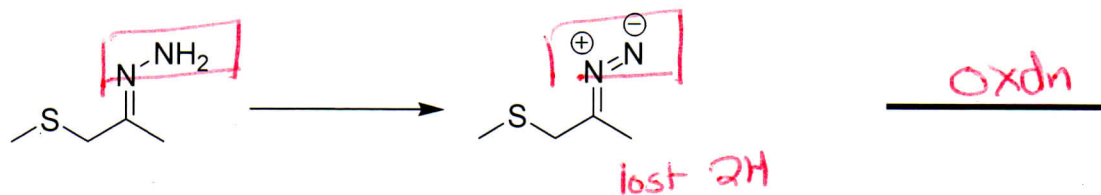
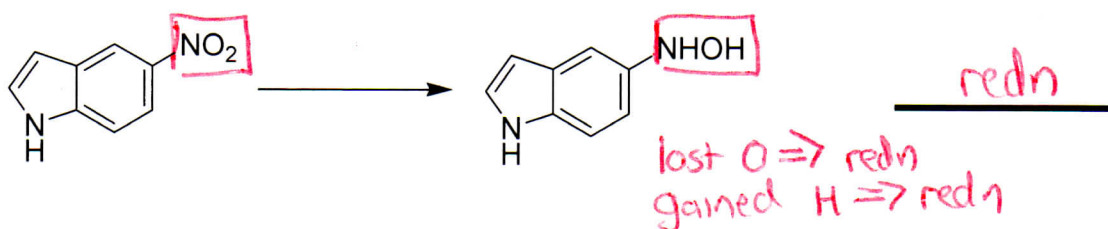
enflurane (a general anesthetic)

(b) Now circle the conformation that you are most likely to find the compound in.

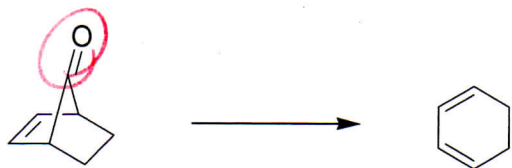
21. (5 points) Now briefly explain your reasoning in either question 14 or 15. Note that you need to actually explain in terms of interactions, not simply writing that "group x is ..."



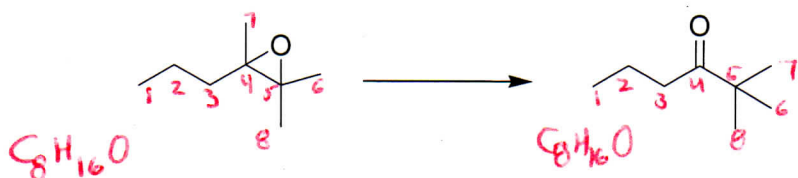
22. (6 points) For TWO of the reactions below, state if they are an oxidation, a reduction, or neither an oxidation or reduction. For any partial credit please jot down what led you to your choice.



23. (6 points) Correctly designate **TWO** of the reactions below as an addition, elimination, rearrangement, or substitution reaction.



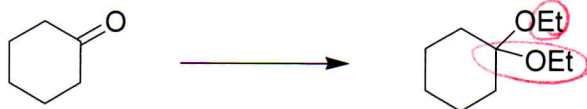
elimination



rearrangement



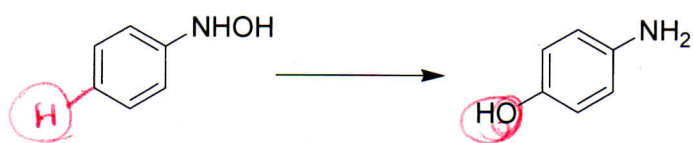
substitution



addition



substitution



substitution

24. For ONE of the reactions below,

(a) check and draw in any charges. Note that if one H is drawn off of a C, all the H's on that carbon are drawn. If NO H's are drawn on a carbon, assume it has enough H's to make a neutral compound.

(b) Now use curved arrow formalism to show the movement of electrons that occurs to make the products.

