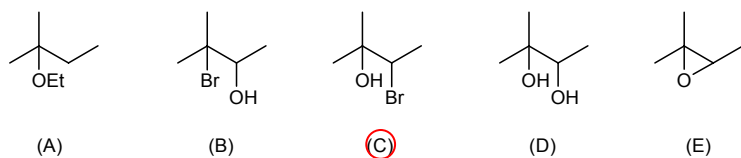
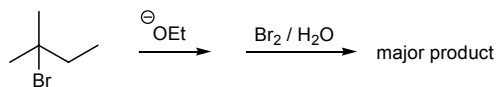


1. Choose the major product of the following reaction sequence.

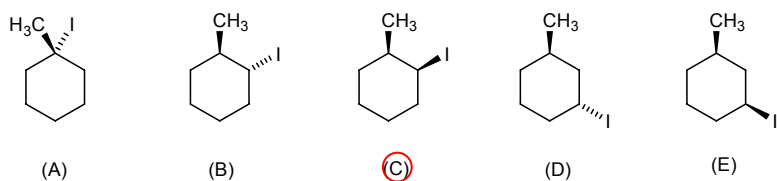
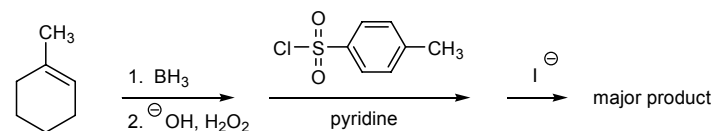


2. Choose the incorrect statement about the following reactions.

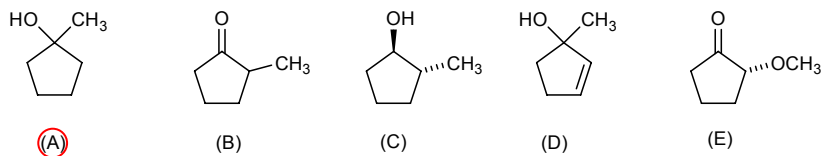
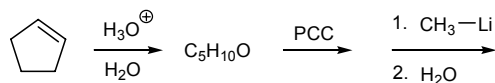


- (A) Both reactions proceed through a carbocation intermediate.
 (B) The same mixture of products would be anticipated for both reactions.
 (C) The equatorial chloride is more stable than the axial chloride.
 (D) The rates of both reactions must be identical.
 (E) The addition of iodide ion (I^-) to the above reaction mixtures will not affect the rate of these reactions.

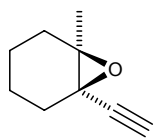
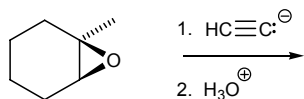
3. Choose the major product of the following reaction sequence.



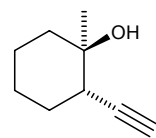
4. Choose the major product of the following reaction sequence.



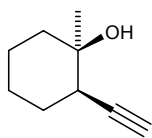
5. Choose the major product of the following reaction.



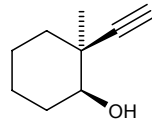
(A)



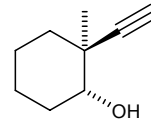
(B)



(C)

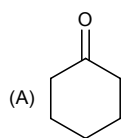
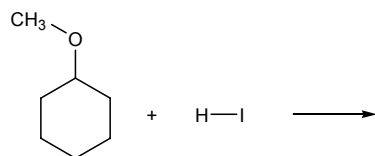


(D)

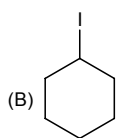


(E)

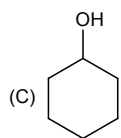
6. Choose the major product of the following reaction.



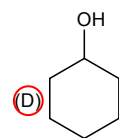
(A) + $\text{CH}_3\text{-OH}$



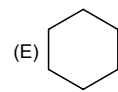
(B) + $\text{CH}_3\text{-OH}$



(C) + $\text{CH}_3\text{-OH}$

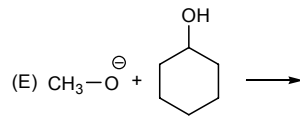
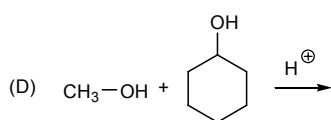
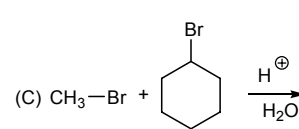
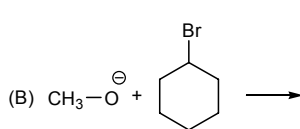
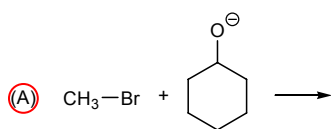
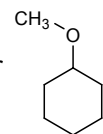


(D) + $\text{CH}_3\text{-I}$

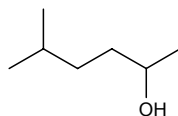


(E) + $\text{CH}_3\text{-OH}$

7. Choose the best reaction sequence for the preparation of methylcyclohexyl ether



8. Choose the correct name for the following structure.



(A) 2-methyl-2-hexanol

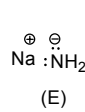
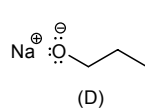
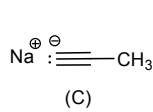
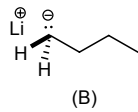
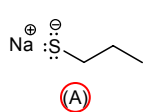
(B) 2-methyl-5-hexanol

(C) 5-methyl-2-hexanol

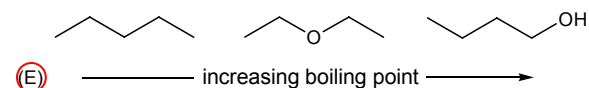
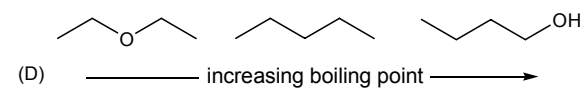
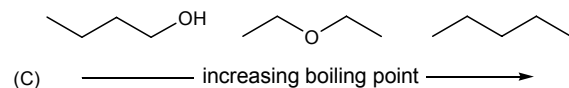
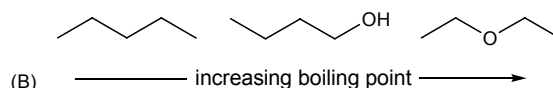
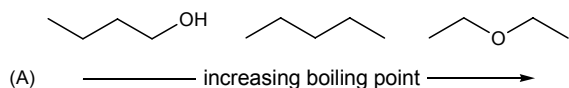
(D) 5-methyl-5-hexanol

(E) 2-methyl-5-heptanol

9. Choose the weakest base.



10. Choose the order that has the following compounds correctly arranged with respect to increasing boiling point.



11. Choose the incorrect statement about reactions of haloalkanes proceeding by S_N2 mechanisms.

(A) The order of reactivity of the haloalkane is the following: methyl (fastest) $>$ $1^\circ >$ $2^\circ >$ 3°

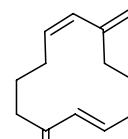
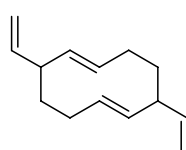
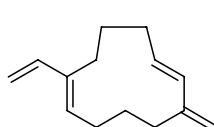
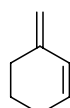
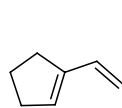
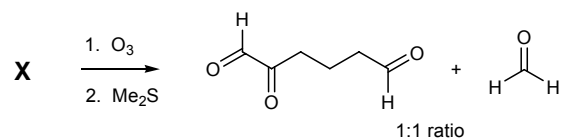
(B) Rearrangements are common.

(C) Inversion of configuration occurs at the site of substitution.

(D) The reaction rate depends upon the concentration of the nucleophile and haloalkane.

(E) The reaction rate is generally faster in polar aprotic solvents.

12. Choose a structure for compound X that cannot be a reactant of the following ozonolysis sequence.



(A)

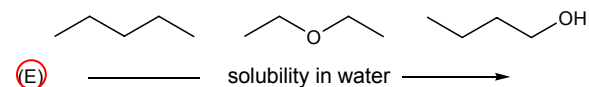
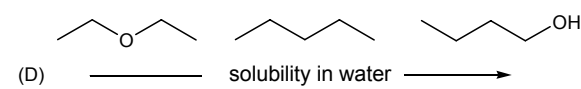
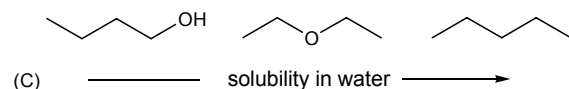
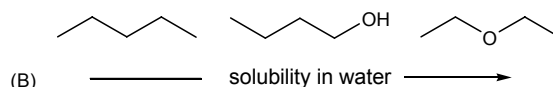
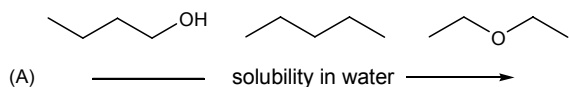
(B)

(C)

(D)

(E)

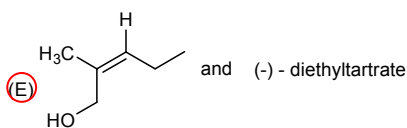
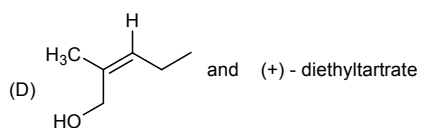
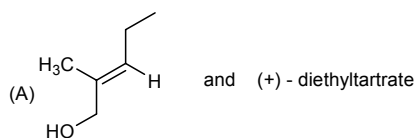
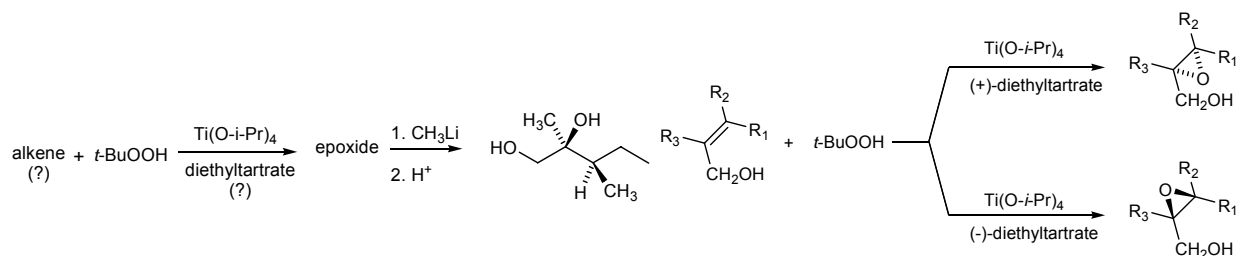
13. Choose the order that has the following compounds correctly arranged with respect to increasing solubility in water.



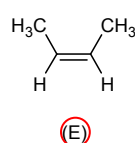
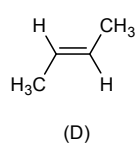
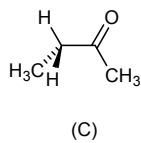
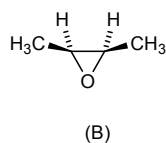
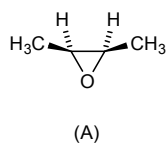
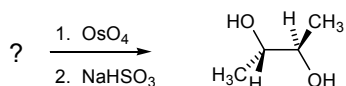
14. Using the general scheme for the Sharpless epoxidation choose the correct reagents for performing the asymmetric epoxidation used in the following reaction scheme.

Reaction Scheme:

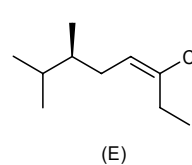
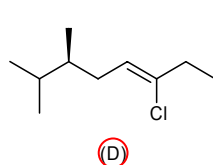
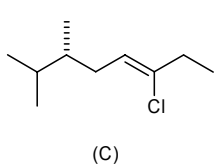
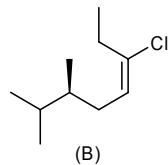
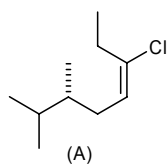
Sharpless Epoxidation:



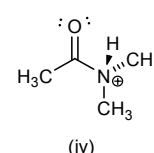
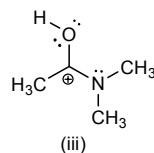
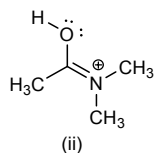
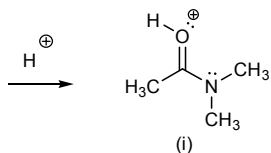
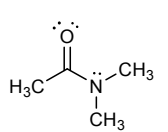
15. Choose the reactant that would give the product shown in the following reaction sequence.



16. Choose the compound with the (S) chiral carbon and the (Z) double bond configuration.



17. Shown below are three representations of protonated N,N-dimethylacetamide. Identify the incorrect statement.



(A) Structure (ii) is the most important of the resonance structures shown.

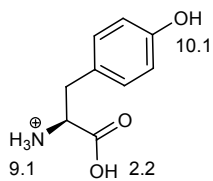
(B) The C—O bond in protonated N,N-dimethylacetamide would be shorter than the C—O in N,N-dimethylacetamide.

(C) Structure (iv) is not a resonance form of the others.

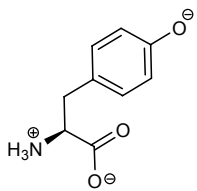
(D) The structure at the N atom is predicted to be trigonal planar.

(E) Structure (iii) is the least important of the resonance structures shown.

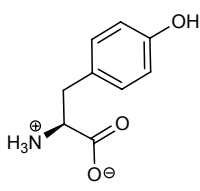
18. Shown below are five representations of the amino acid tyrosine. Which one best represents the structure of tyrosine as found in the blood stream (pH \approx 7.3)? Hint: use the acid base table at the front of the exam.



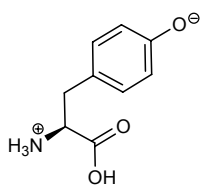
pK_as for tyrosine



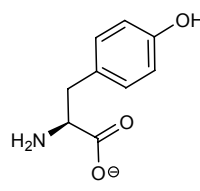
(A)



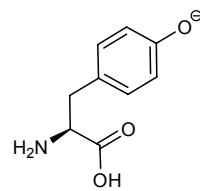
(B)



(C)

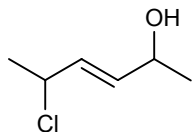


(D)



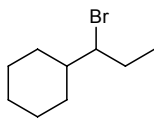
(E)

19. What is the total number of stereoisomers that can exist for the molecule 2,5-dichlorohex-3-ene?

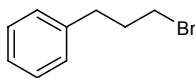


(A) 2 (B) 3 (C) 4 (D) 6 (E) 8

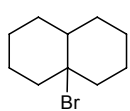
20. Which of the following compounds can be prepared in high yield by regioselective bromination of a hydrocarbon?



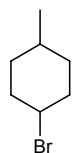
(A)



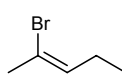
(B)



(C)



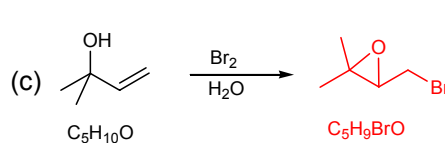
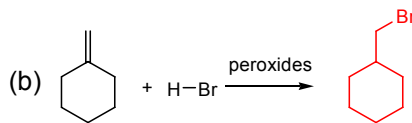
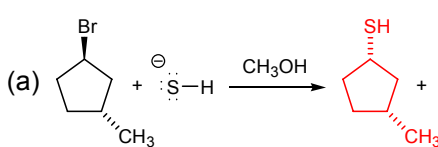
(D)



(E)

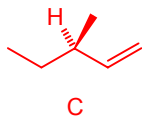
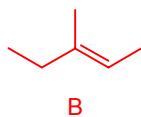
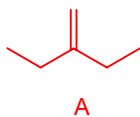
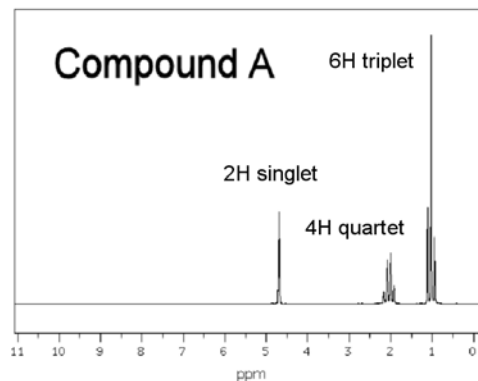
Short Answer Questions. 80 points.

21. Predict the major product of the following reactions. 15 pts



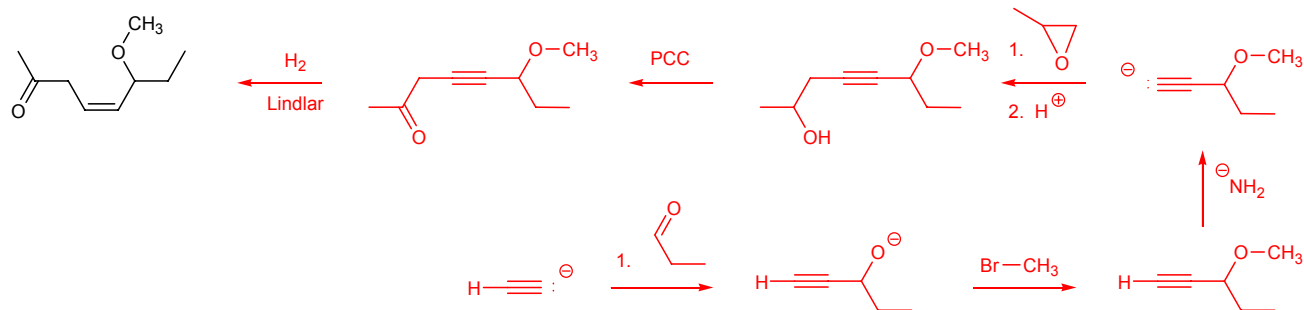
22. Give structures for compounds A, B and C consistent with the following information. 15 pts

- Three compounds, A, B, and C, have the formula C₆H₁₂.
- A and B are achiral and C is chiral.
- All three compounds (A, B, and C) react with H₂ to give the same compound D.
- All three compounds (A, B, and C) react with HBr to give the same major product E.
- The NMR spectrum of Compound A.

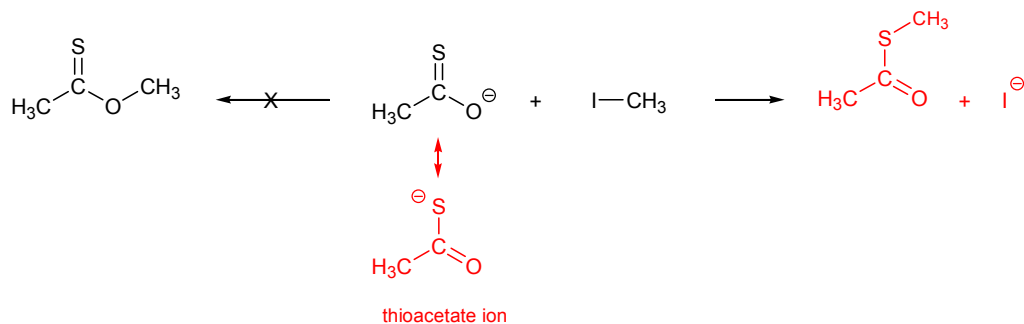


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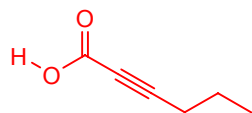
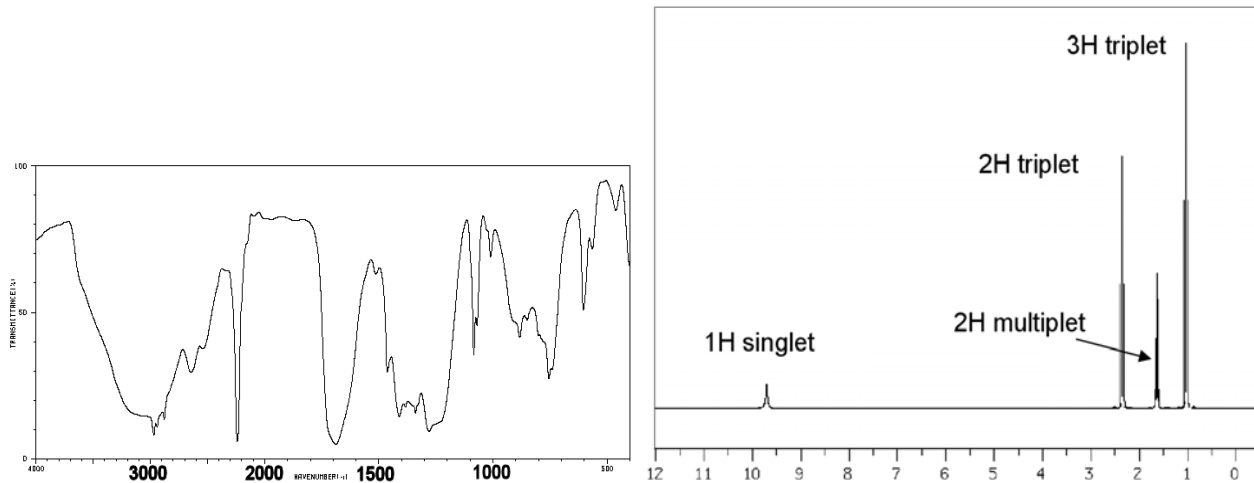
Propose a synthesis of the following compound from compounds containing four carbon atoms or less and any other necessary reagents. 10 pts



23. The thioacetate ion reacts with methyl iodide to give a product with the formula C_3H_6OS . Give the structure of this product. 10 pts



24. Propose a structure for a compound with the molecular formula $C_6H_8O_2$ that is consistent with the following data. 10 pts



25. Using the curved arrow formalism to show the bond breaking and bond making give a reaction mechanism for the following transformation. 20 pts

