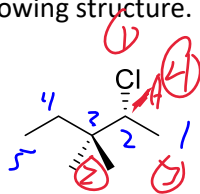


Name: _____

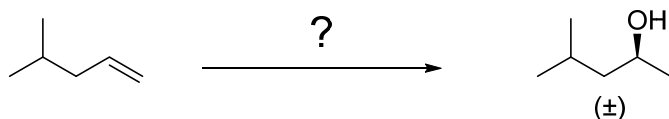
Select the correct solution for each multiple-choice question. (2 points each)

1. Identify the correct IUPAC name for the following structure.

- a. (S)-4-chloro-3,3-dimethylpentane
 b. (R)-3,3-dimethyl-2-chloro-pentane
 c. (S)-2-chloro-3,3-dimethylpentane
 d. (R)-2-chloro-3,3-dimethylpentane



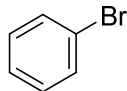
2. Circle the reagents required for the given reaction.



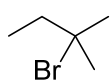
a. NaOH, heat

c. 1. $\text{BH}_3 \cdot \text{THF}$
2. NaOH, H_2O_2 b. 1. $\text{Hg}(\text{OAc})_2, \text{H}_2\text{O}$
2. NaBH_4 d. OsO_4, NMO 3. Circle the starting bromide which would react fastest in an $\text{S}_{\text{N}}2$ reaction.

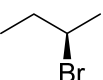
a.



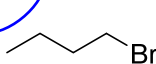
b.



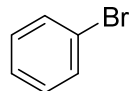
c.



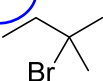
d.

4. Circle the starting bromide which would react fastest in an $\text{E}2$ reaction.

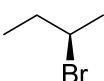
a.



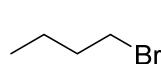
b.



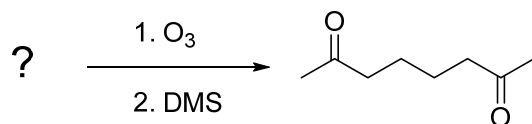
c.



d.



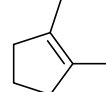
5. Circle the starting material to yield the following diketone via an ozonolysis reaction.



a.



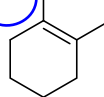
b.



c.

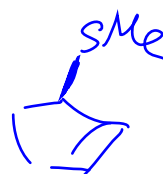
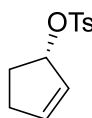
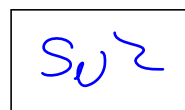
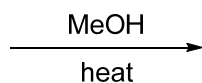
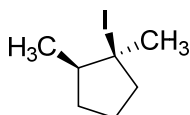
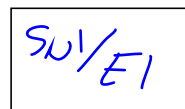
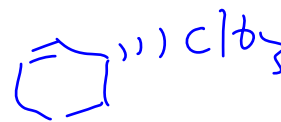
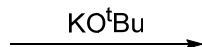
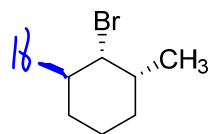
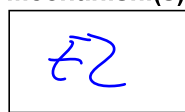


d.



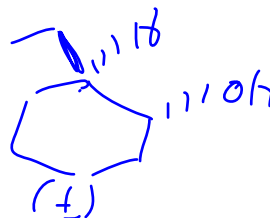
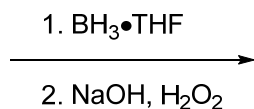
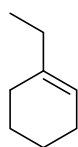
6. a. Predict the mechanism(s) for following reactions. If you do not expect a reaction to occur write "no rxn".
 b. Provide the expected major product(s). If there is one than one possible mechanism, draw the expected **major** product for **each** mechanism. (9 points)

Mechanism(s):

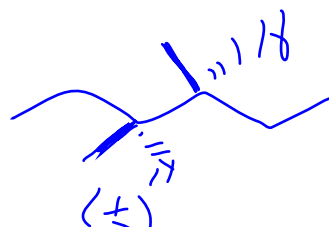
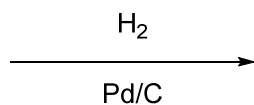
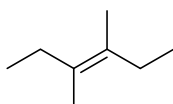


7. Provide the product for the following reactions. Be sure to **clearly indicate stereochemistry** where appropriate. You do not need to draw mechanisms for these problems. (8 points)

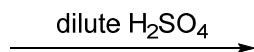
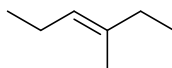
a.



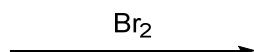
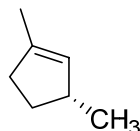
b.



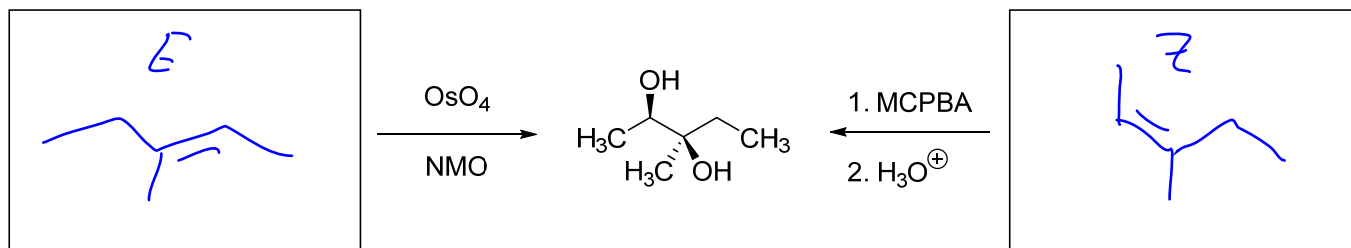
c.



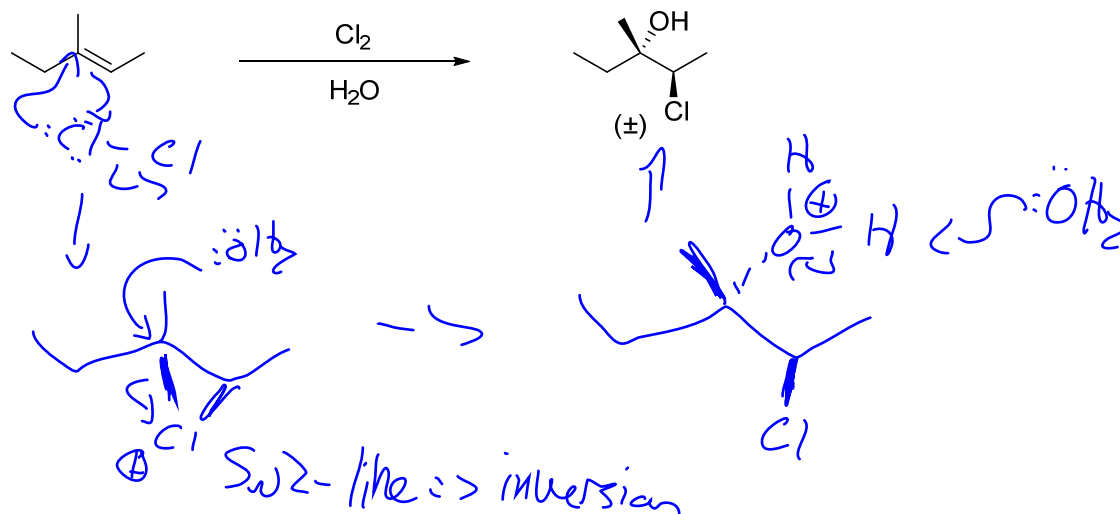
d.



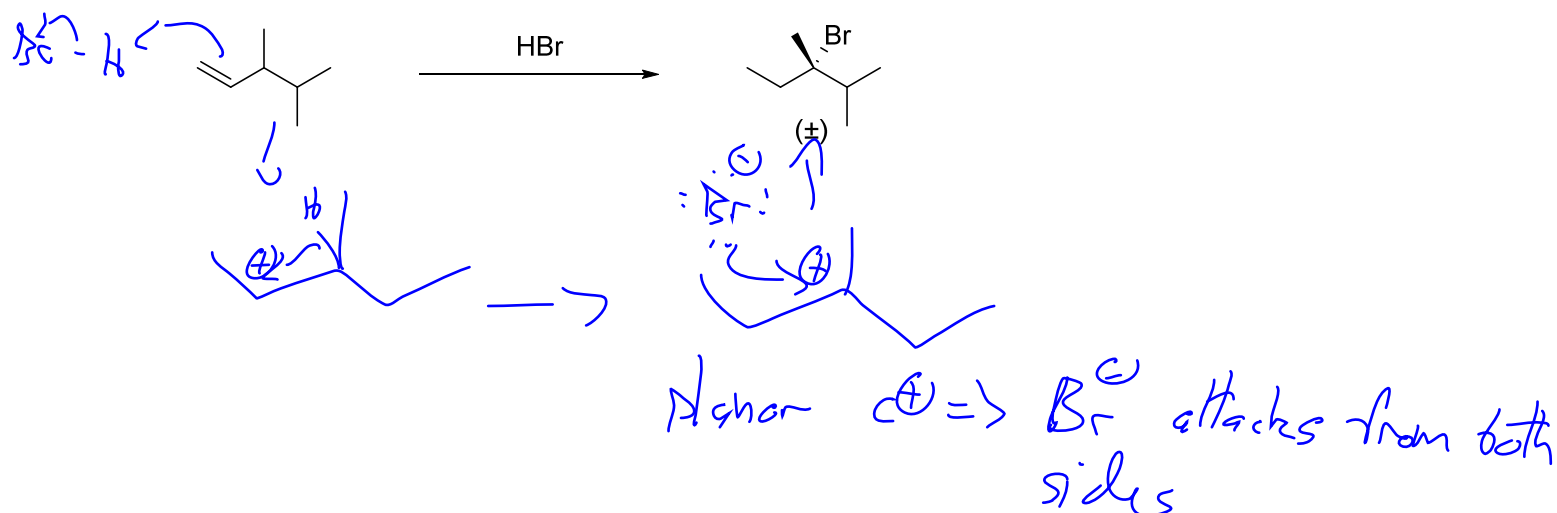
8. Provide the starting material for both of the following reactions. Be sure to **clearly indicate stereochemistry** (4 points)



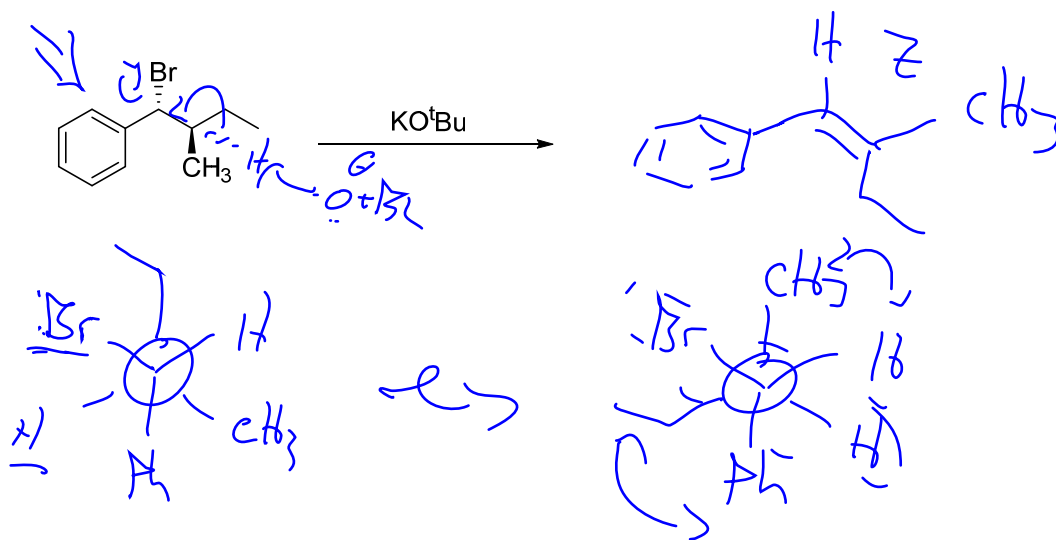
9. a. Draw a mechanism to account for the following reaction.
b. Use this mechanism to briefly explain the **anti-stereoselectivity**. (5 points)



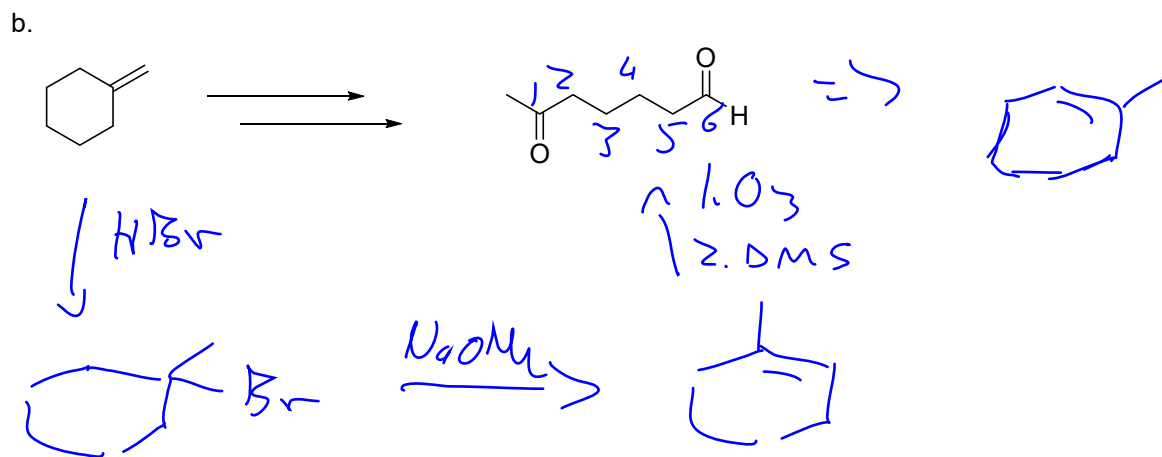
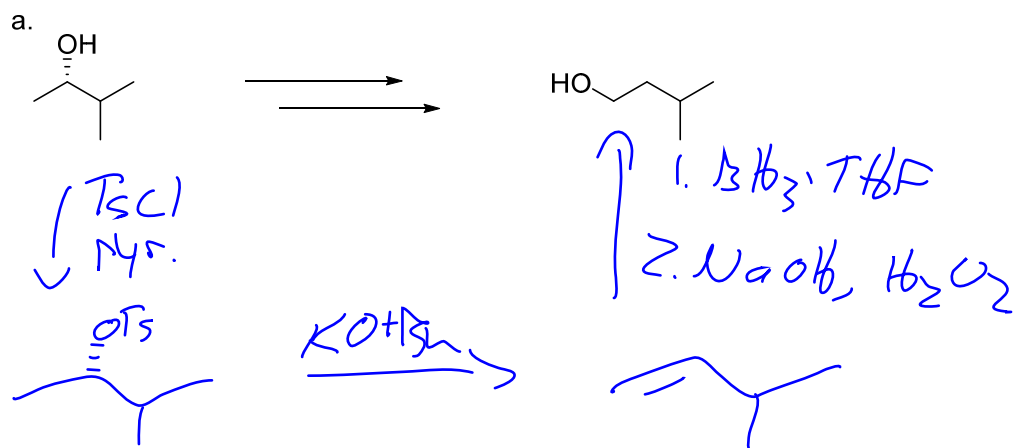
10. a. Draw a mechanism to account for the following reaction.
b. Use this mechanism to briefly explain why this reaction gives racemic products. (4 points)



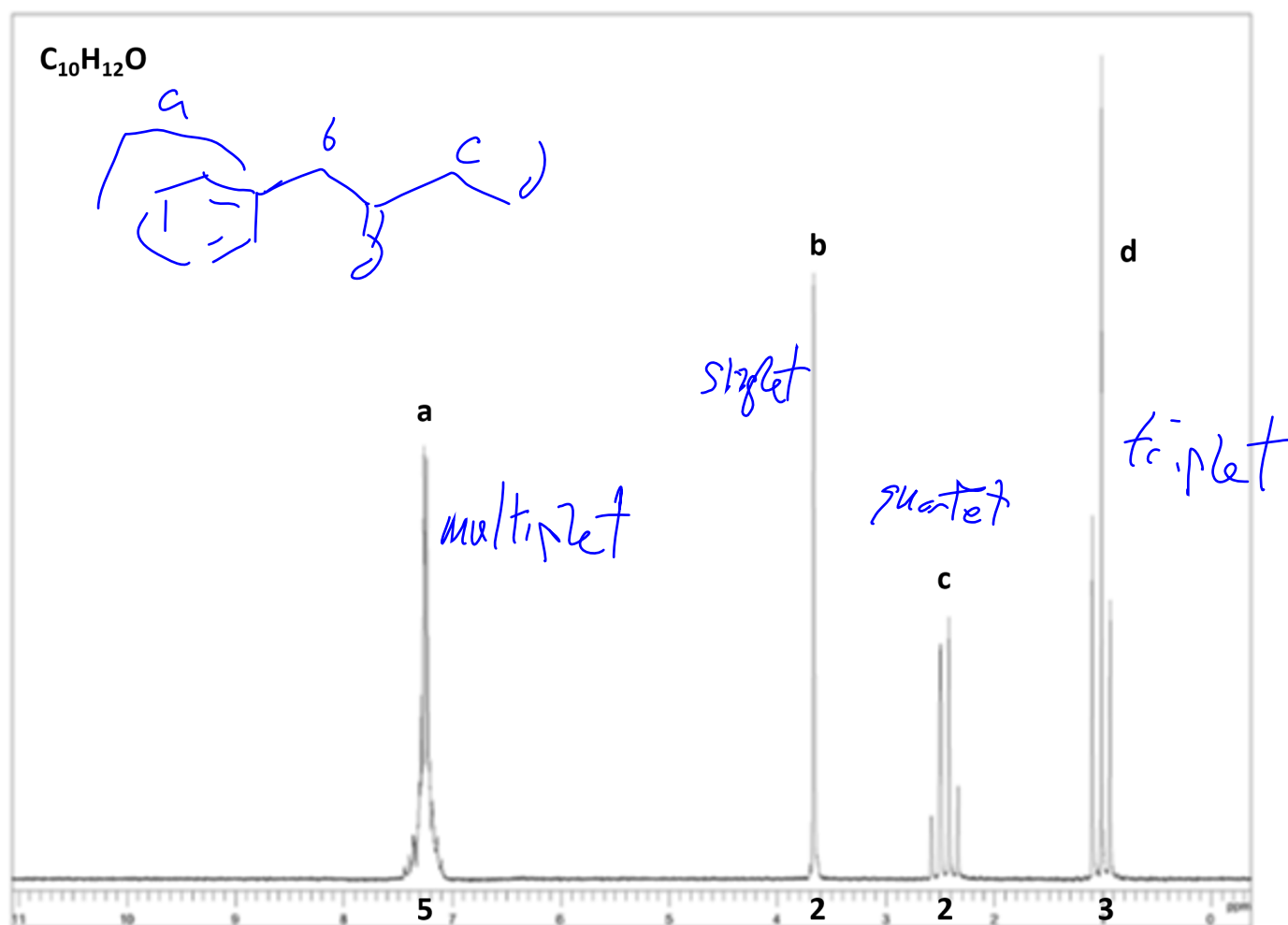
11. a. Use a Newman projection to help predict the major **E2 elimination** product for the following reaction.
 b. Provide an arrow pushing mechanism to account for your predicted product. (5 points)



12. Provide synthesis for the following transformations. You do not need to draw mechanisms for these problems. (8 points)



13. Propose a structure based on the ^1H NMR spectrum below. Clearly label each set of protons on your proposed structure (a,b,c...). The molecular formula is $\text{C}_{10}\text{H}_{12}\text{O}$ and possible functional groups include alcohol, aromatic, ether, aldehyde and ketone. (5 points)



BONUS:

Mustard gas is hydrolyzed to a diol much more rapidly than the analogous 1,5-dichloropentane lacking the sulfur atom. Propose a mechanism for the hydrolysis of mustard gas shown below! (4 bonus points)

