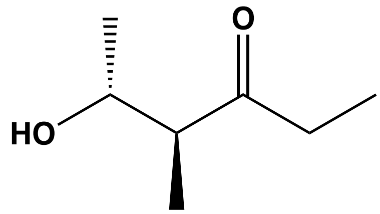
NAME (Print): ______________________________

SIGNATURE: ______________________________

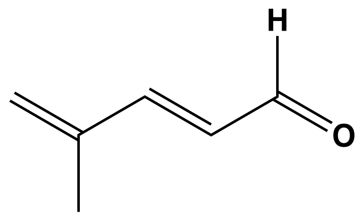
Chemistry 320N
Dr. Brent Iverson
2nd Homework
January 21, 2026

Please print the first three letters of your last name in the three boxes

(3 pts each) Write an accurate IUPAC name for the following molecules.



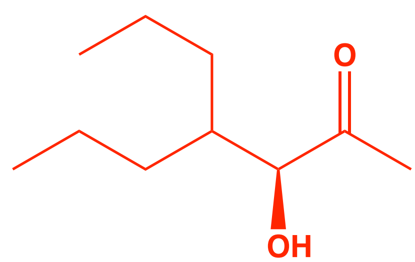
(4*S*,5*R*)-5-hydroxy-4-methyl-3-hexanone
or (4*S*,5*R*)-5-hydroxy-4-methylhexan-3-one



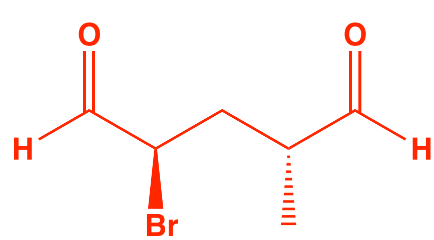
(*E*)-4-methyl-2,4-pentadienal
or (*E*)-4-methylpenta-2,4-dienal

(3 pts each) Draw the correct structure for the given IUPAC name. Use wedges and dashes to show the appropriate stereochemistry where appropriate.

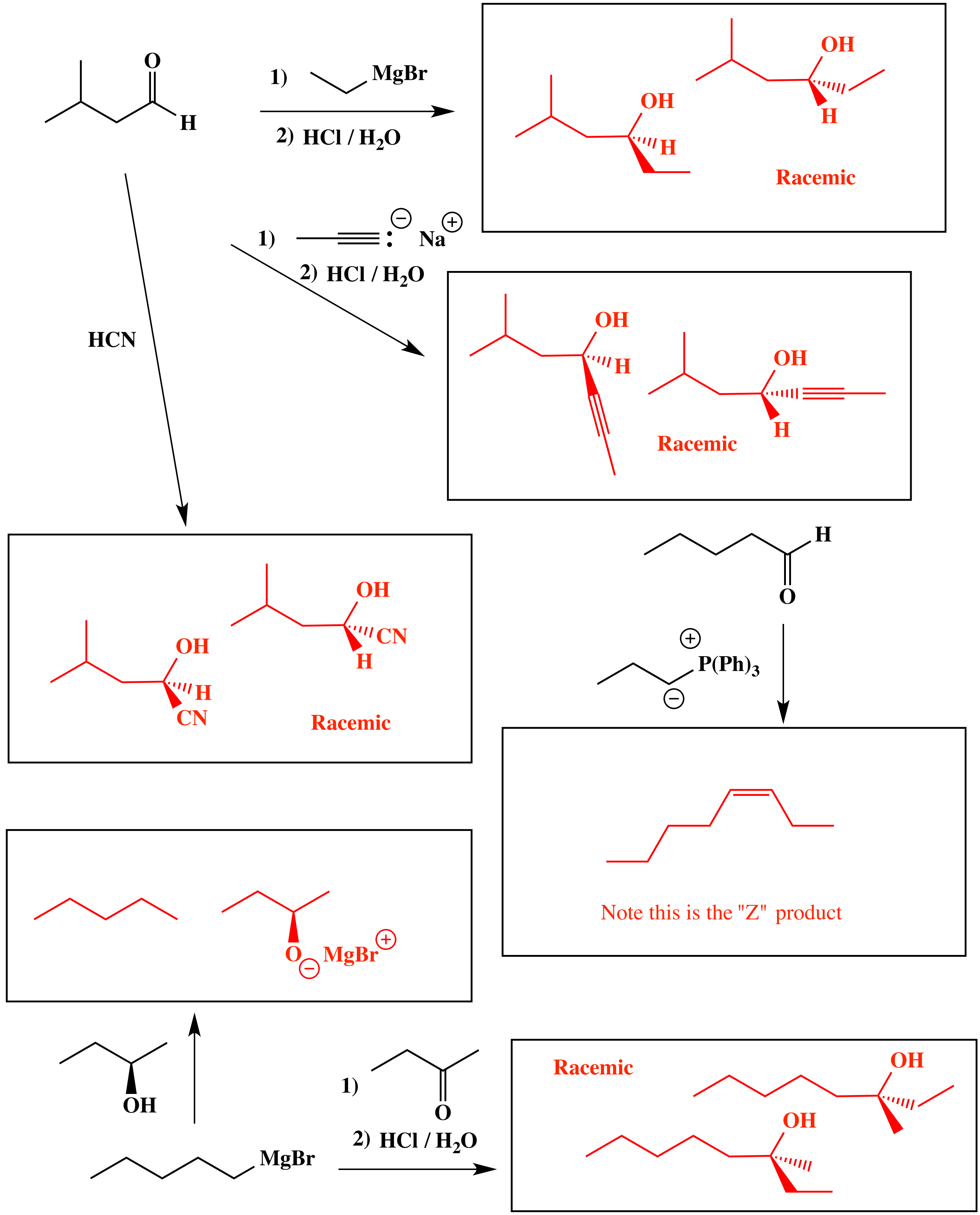
(*S*)-3-hydroxy-4-propyl-2-heptanone



(2*R*,4*R*)-2-bromo-4-methylpentanedial



(3 or 5 pts each) Fill in the boxes with the structures that complete the reactions. Use wedges and dashes to indicate stereochemistry when appropriate. If a racemic mixture is formed, you must draw both enantiomers and write "racemic" next to the two structures.



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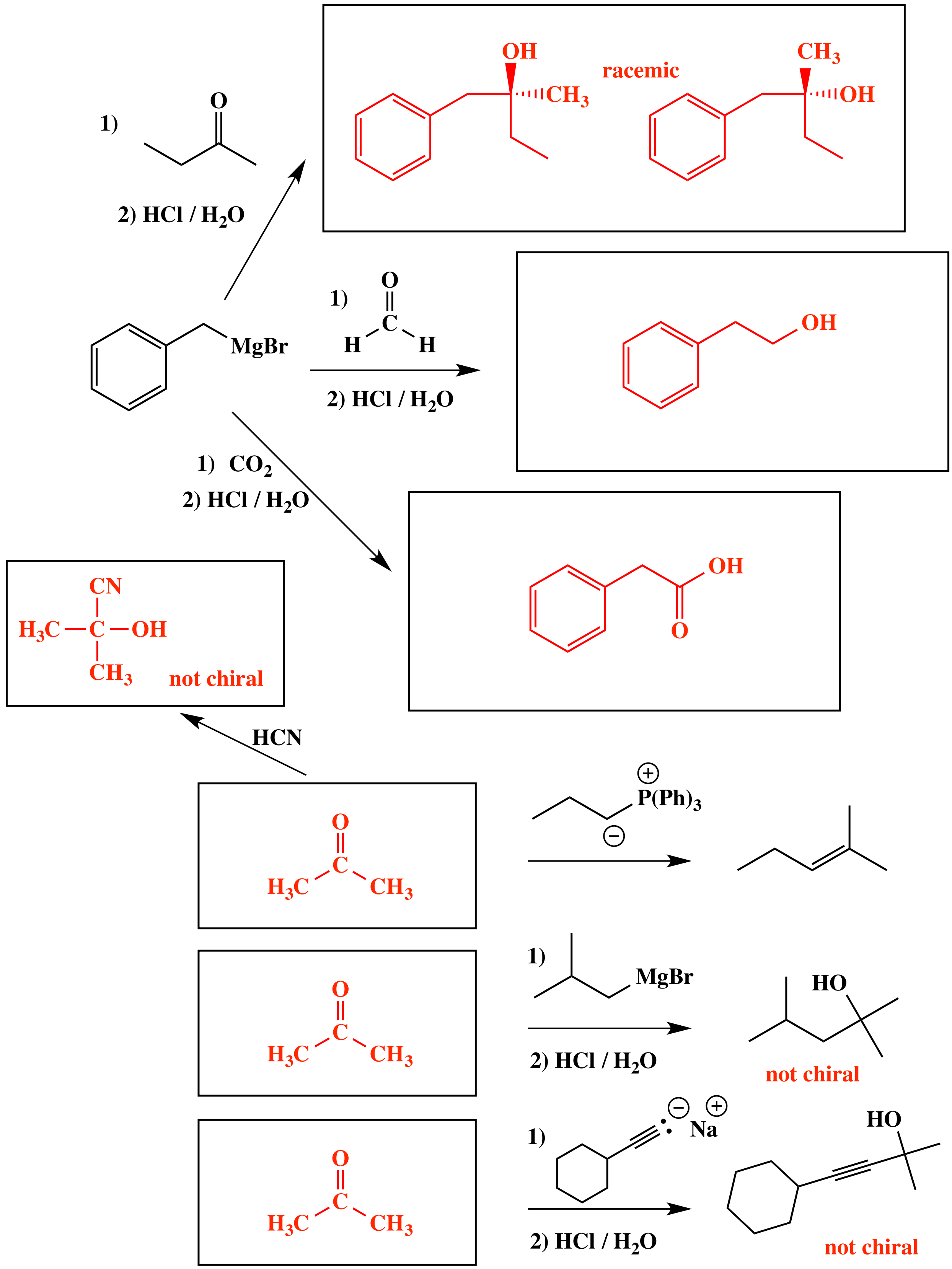

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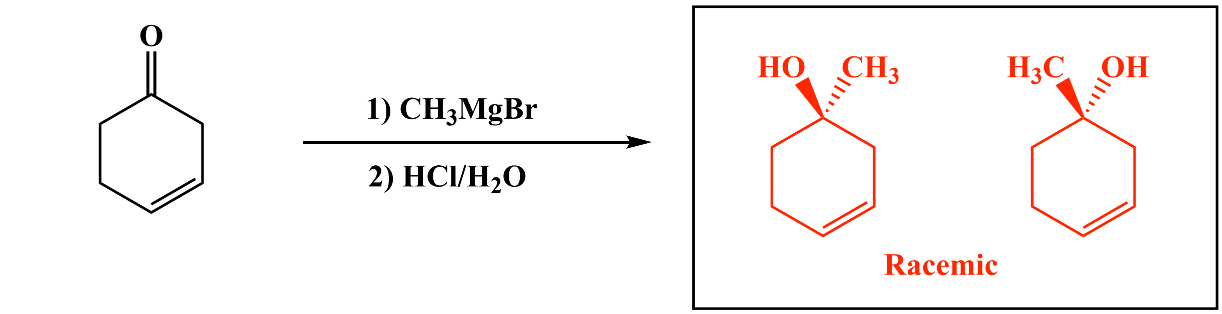
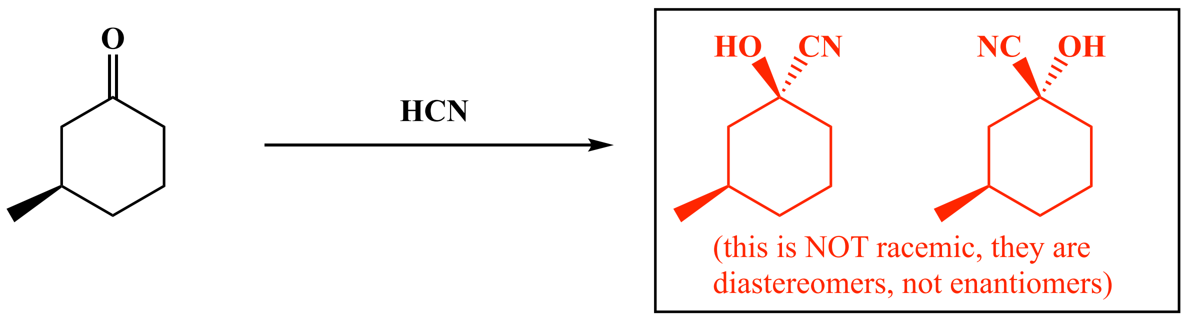
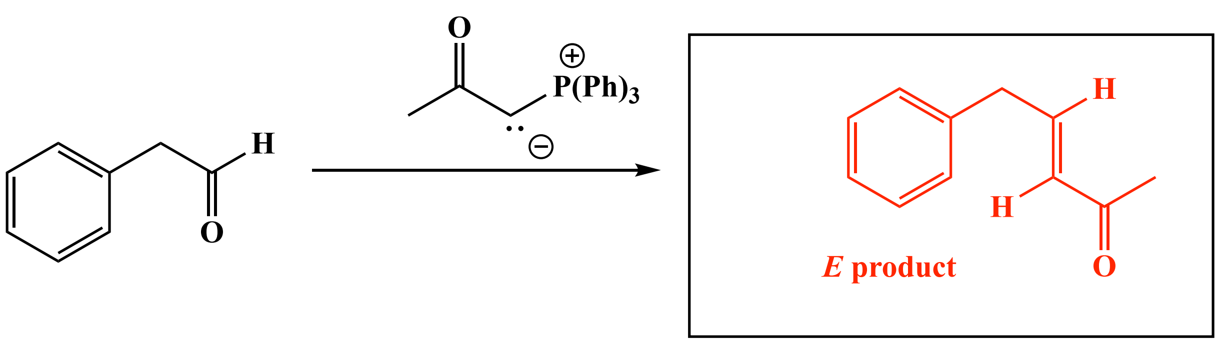
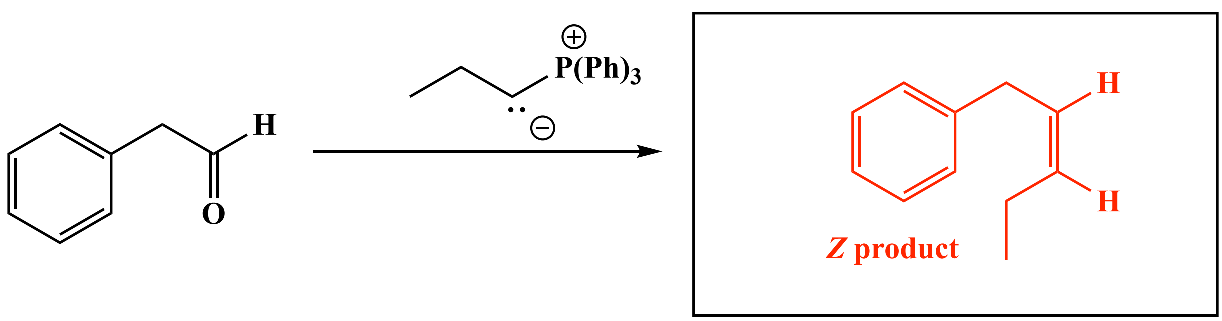
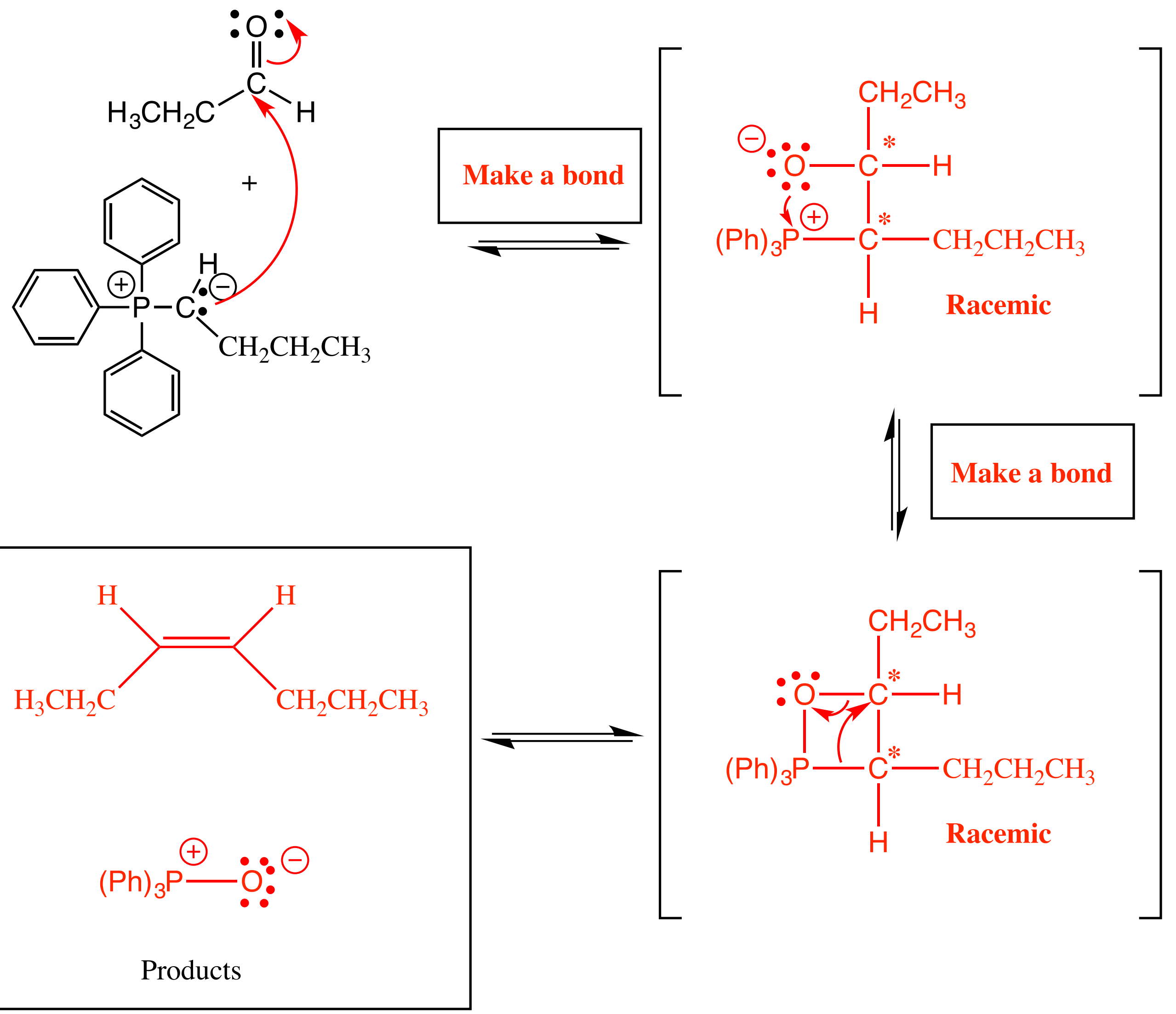








(18 pts. total) Complete the mechanism for the following Wittig reaction. **Be sure to show arrows to indicate movement of <u>all</u> electrons, write <u>all</u> lone pairs, <u>all</u> formal charges, and <u>all</u> the products for each step.** Remember, I said <u>all</u> the products for each step. **IF A RACEMIC MIXTURE IS CREATED IN AN INTERMEDIATE, MARK ALL CHIRAL CENTERS WITH AN ASTERISK AND WRITE RACEMIC. IF A RACEMIC MIXTURE IS CREATED IN THE FINAL PRODUCTS, YOU NEED TO DRAW BOTH ENANTIONMERS, AND WRITE RACEMIC.** I realize these directions are complex, so please read them again to make sure you know what we want.



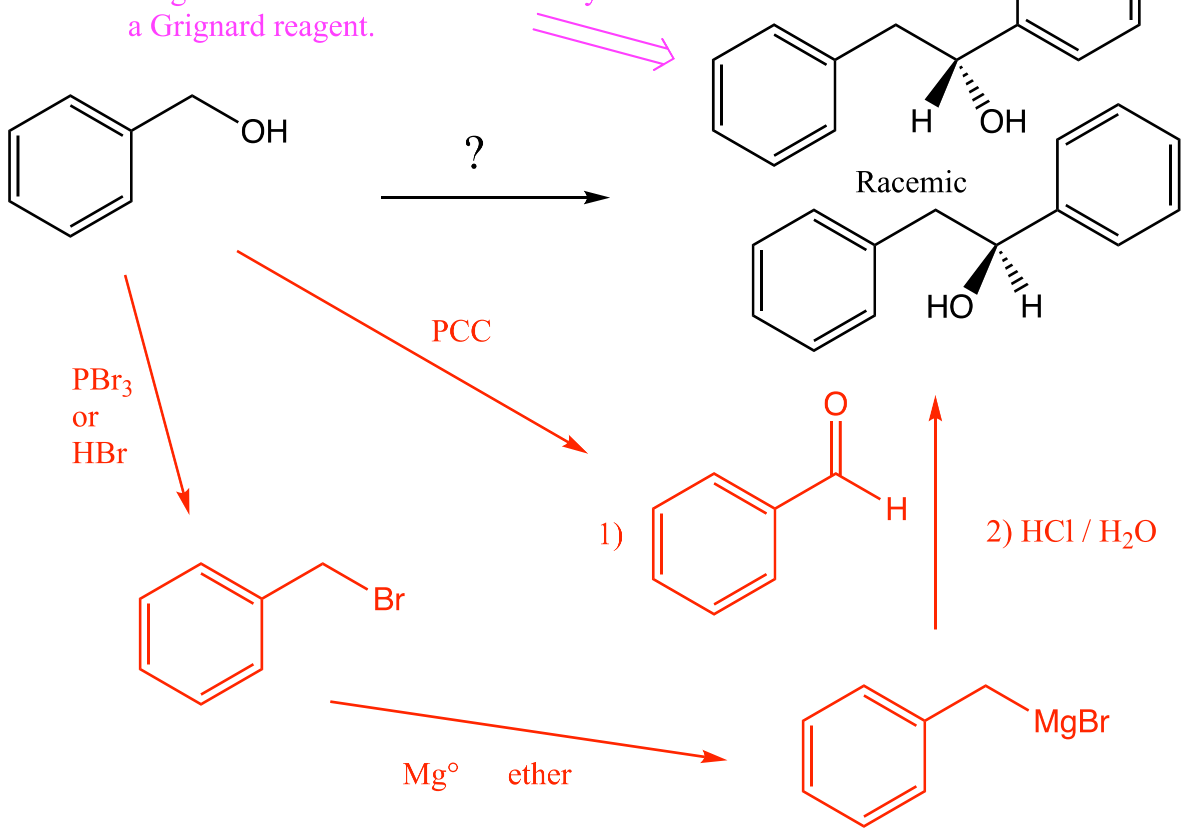
2 pts In the boxes provided adjacent to the first two sets of arrows, write which of the four basic mechanistic elements are involved (i.e. "Make a bond", "Add a proton", etc.

NOTICE THIS

These are synthesis questions. You need to show how the starting material can be converted into the product(s) shown. You may use any reactions we have learned. Show all the reagents you need. Show each molecule synthesized along the way and be sure to pay attention to the regiochemistry and stereochemistry preferences for each reaction.

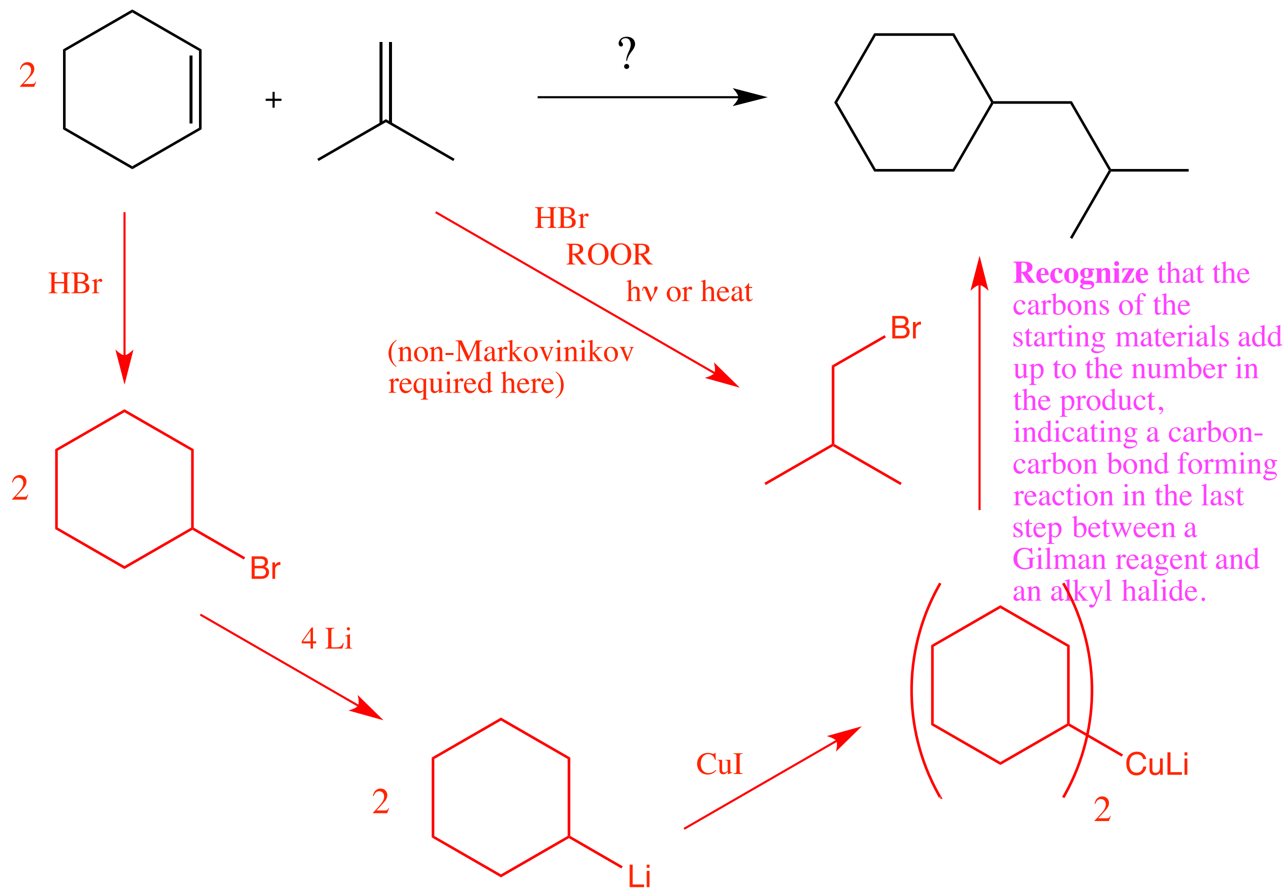
(10 pts) **All of the carbon atoms of the products must come from the starting material for this one!**

Recognize the product as a secondary alcohol, the **Key Recognition Element** of a Grignard reaction between an aldehyde and a Grignard reagent.

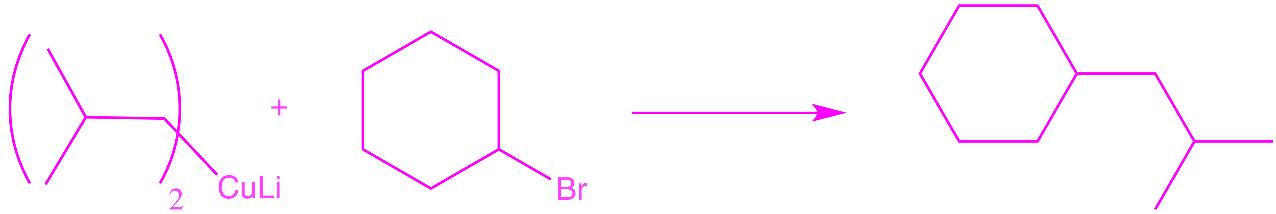


The aldehyde can be made from the starting alcohol using PCC, and the Grignard reagent can be made from the corresponding alkyl halide derived from the starting alcohol. Note, the bromide was used, but it is also fine if you used the chloride derived from reaction with either $SOCl_2$ or HCl.

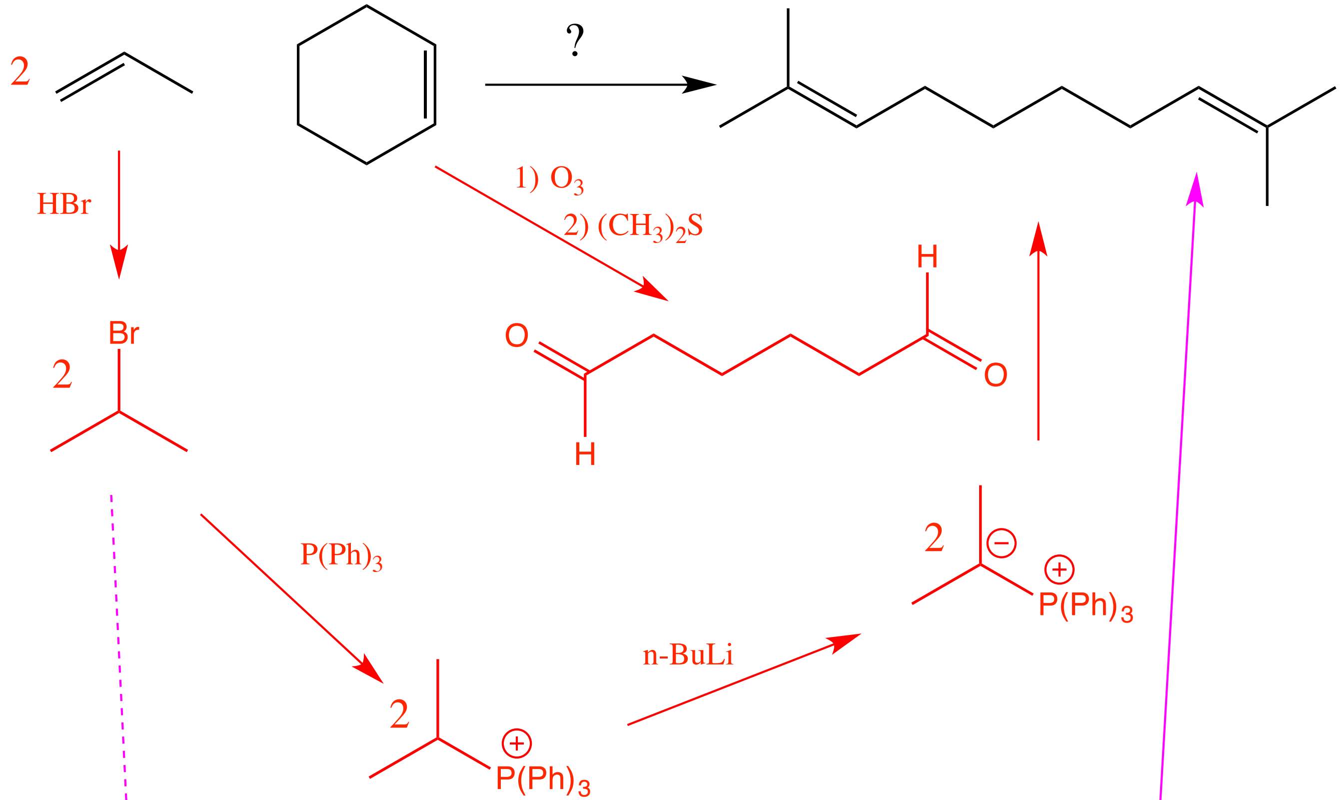
(12 pts) **All of the carbon atoms of the products must come from the starting materials for this one!**



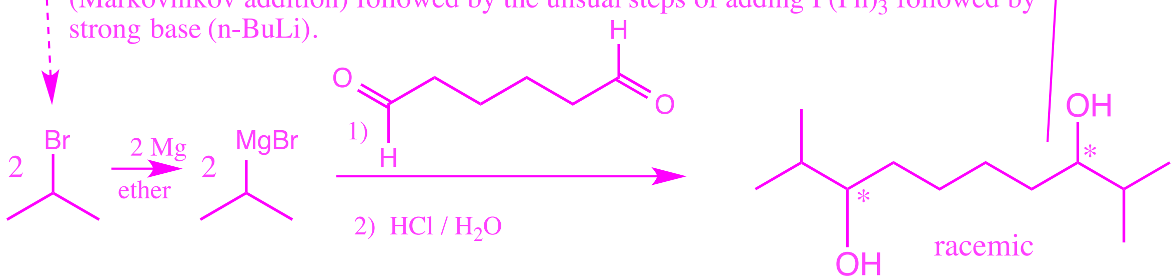
Notice that this scheme could be reversed in that the 2-methylpropene could have been converted to the Gilman reagent and reacted with cylcohexylbromide in the final carbon-carbon bond forming step. Although this is an acceptable answer (you will get credit), the fact that a secondary bromoalkane is being used, it would probably give a lower yield compared with the route above that uses a primary alkyl bromide.



(12 pts) **All of the carbon atoms of the products must come from the starting material for this one!**



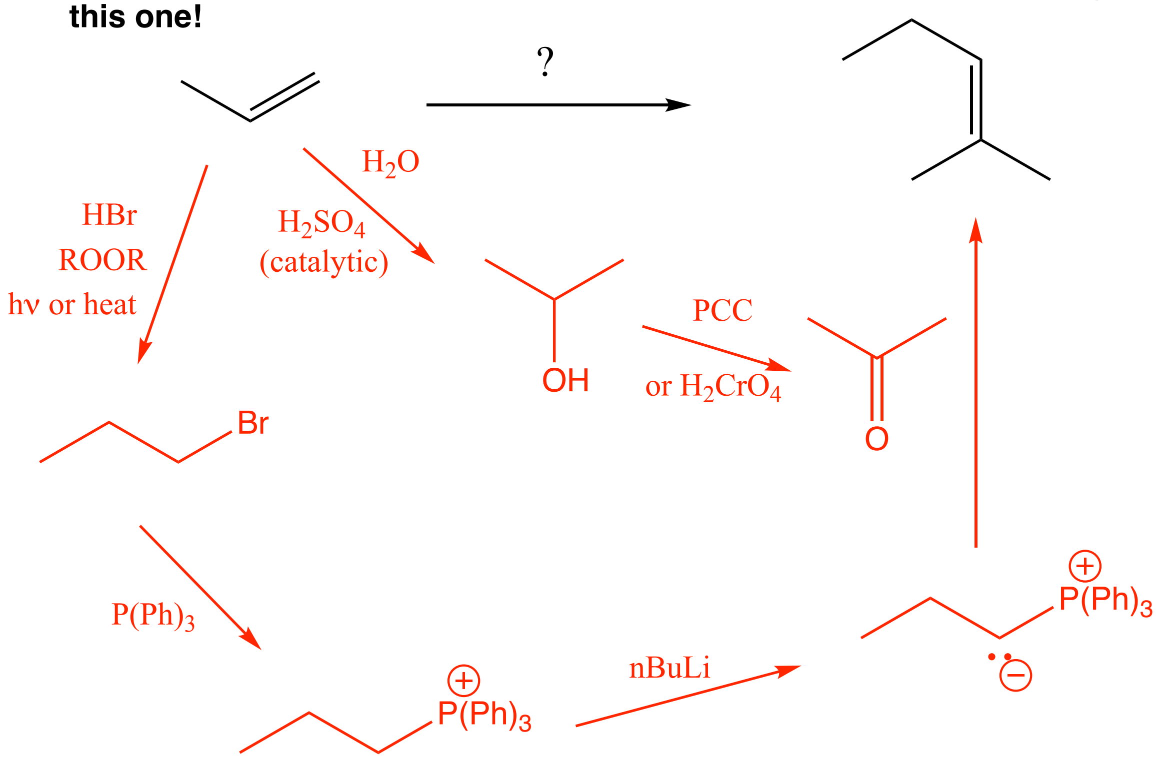
Count carbons in the product (12) and realize that two molecules of the 3-carbon unit need to be added to one of the 6-carbon unit. **Recognize** that the last step makes alkenes in the locations required for carbon-carbon bond formation, indicating a Wittig reaction as the last step. **Recognize** that the ring can be opened to give the required dialdehyde by an ozonolysis. **Recognize** that the required Wittig ylide can be derived from the starting alkene via reaction with HBr (Markovnikov addition) followed by the unsual steps of adding $P(Ph)_3$ followed by strong base (n-BuLi).



Alternative route: Above we have illustrated the most efficient synthetic route involving a Wittig reaction. A reasonable alterntive utilizes a Grignard reagent made from the same 2-bromopropane that is used to react with the same hexanedial to give a diol, that is then dehydrated in anhydrous acid (H_2SO_4) to give the product diene. This works because the desired product happens to be the so-called "Zaitsev" product favored in the dehydration reaction.

This example underscores the idea that there are often more than one route to the synthesis of molecules, and we will accept any of these as long as they provide the desired product, based on the predominant products of each of the reactions you use along the way.

(15 pts) **All of the carbon atoms of the products must come from the starting material for this one!**



Recognize that the product is an alkene, indicating a Wittig reaction as the last step. This makes sense because the product has six carbon atoms, indicating that two molecules of the starting material were needed to create the product. **Recognize** that the acetone could be derived from propene through a combination of Markovnikov addition of water followed by oxidation. The Wittig reagent is available from non-Markovnikov addition of HBr in the presence of peroxides followed by the usual reaction with $P(Ph)_3$ and n-BuLi.

Note, there are actually two sets of reagents that would give this Wittig product.