

**NAME (Print):** \_\_\_\_\_

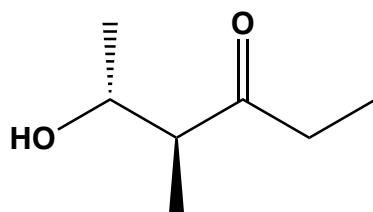
**SIGNATURE:** \_\_\_\_\_

**Chemistry 320N  
Dr. Brent Iverson  
2nd Homework  
January 23, 2024**

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

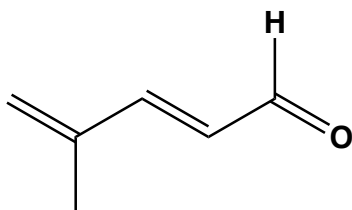
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(3 pts each) Write an accurate IUPAC name for the following molecules.



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

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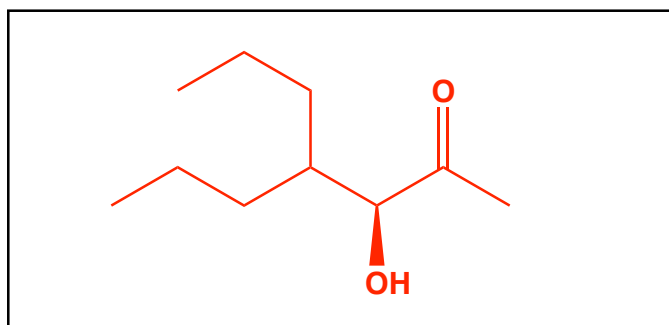


**(*E*)-4-methyl-2,4-pentadienal**  
**or (*E*)-4-methylpenta-2,4-dienal**

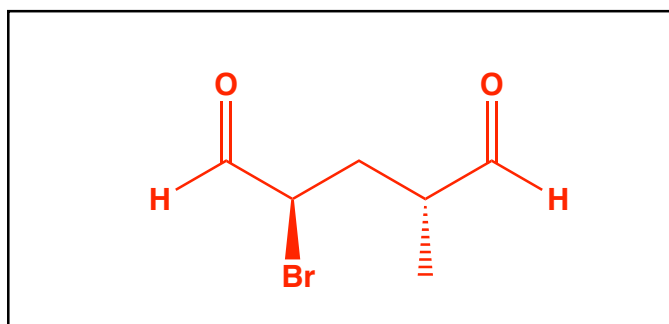
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(3 pts each) Draw the correct structure for the given IUPAC name. Use wedges and dashes to show the appropriate stereochemistry where appropriate.

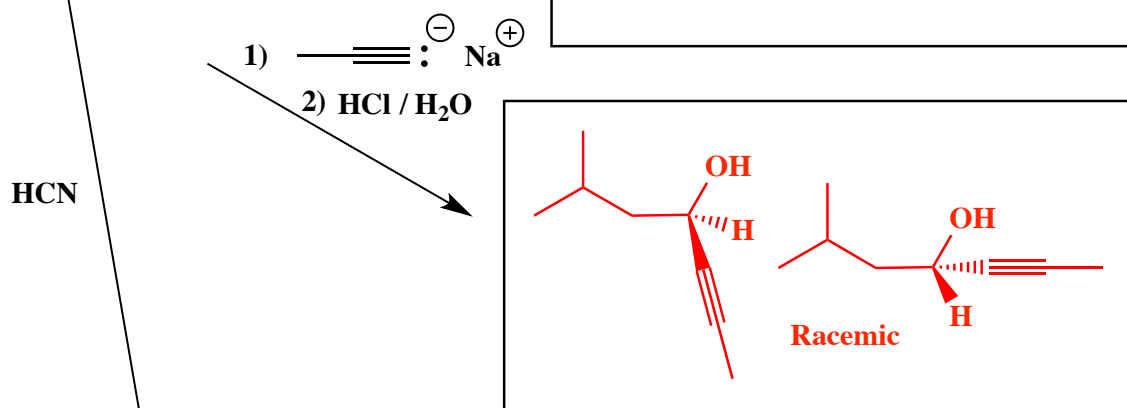
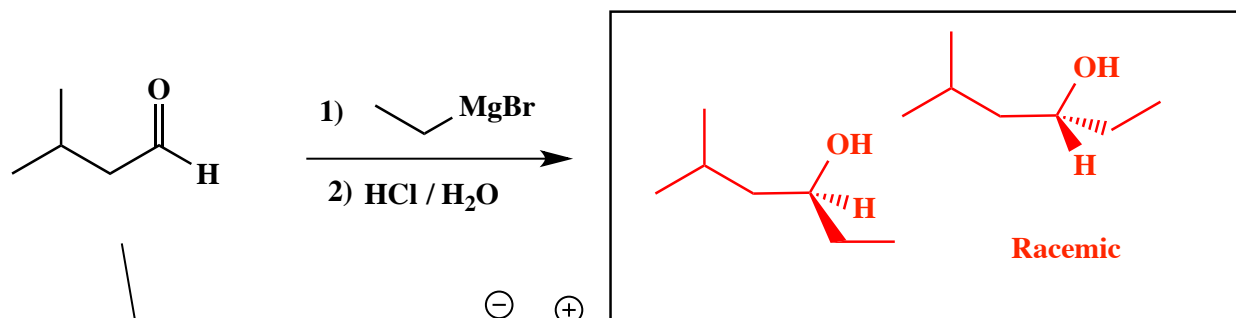
**(*S*)-3-hydroxy-4-propyl-2-heptanone**



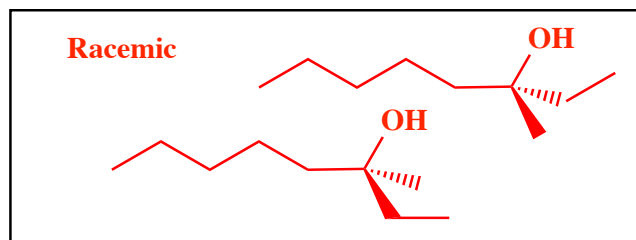
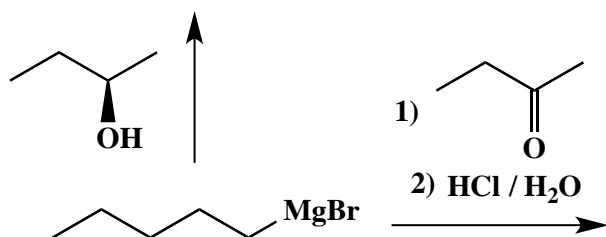
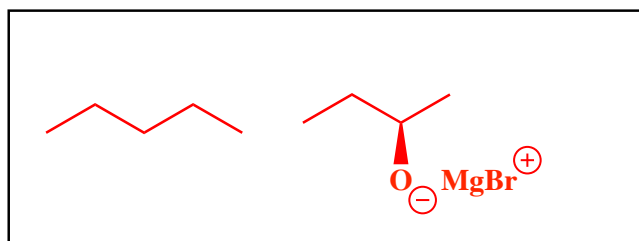
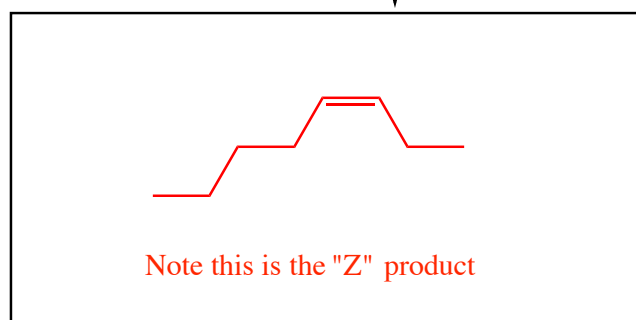
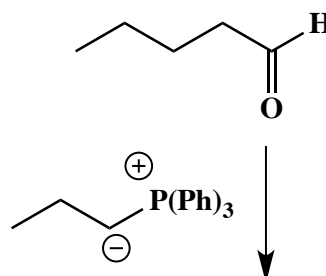
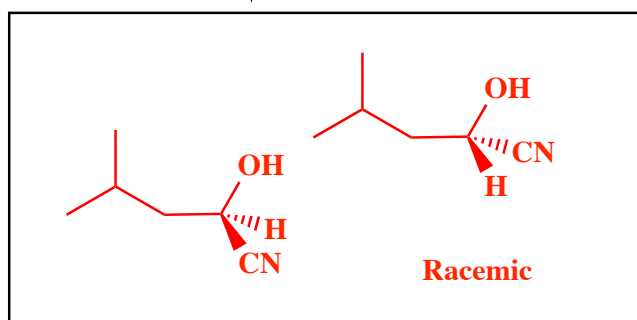
**(2*R*,4*R*)-2-bromo-4-methylpentanedial**



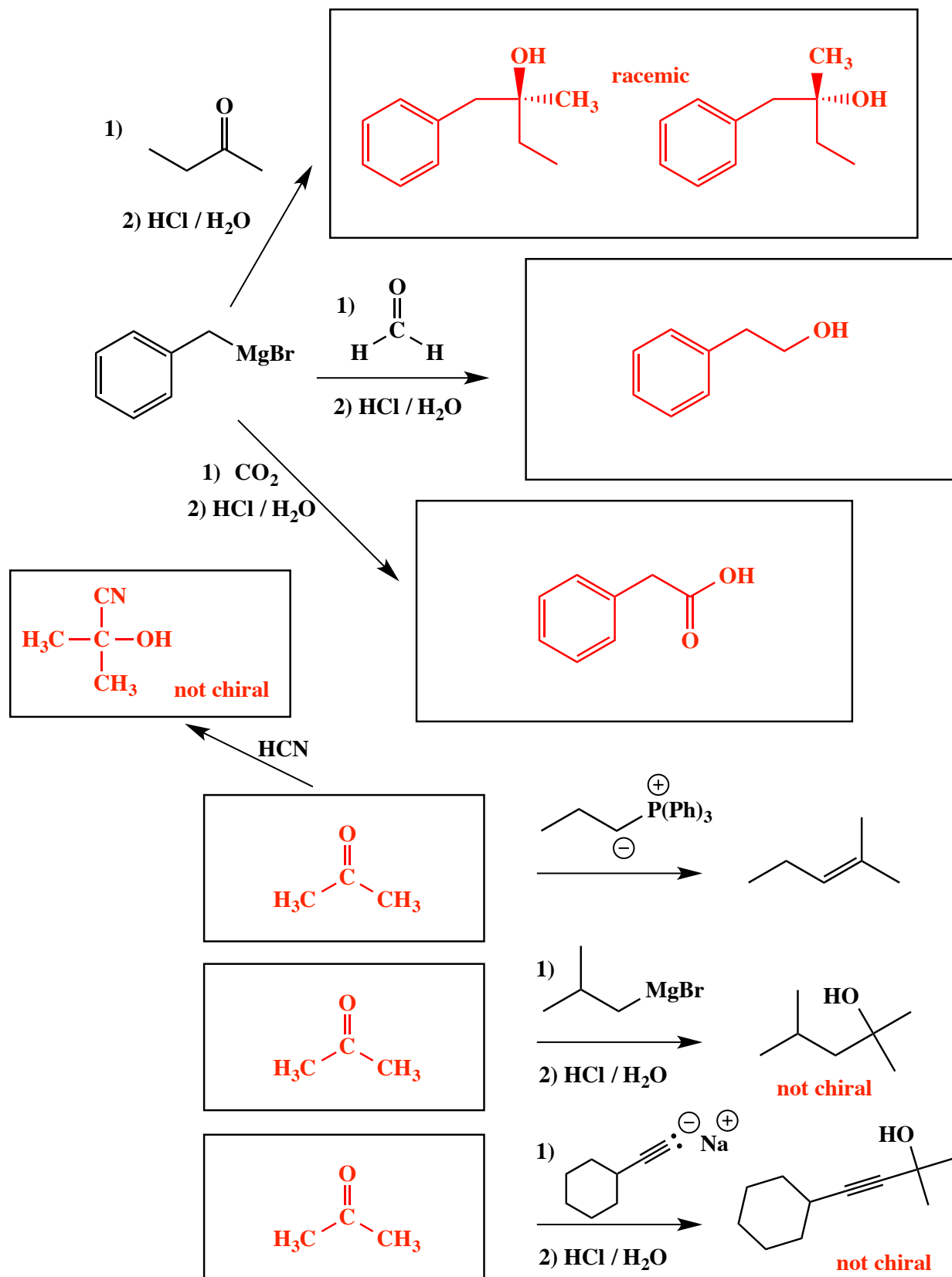
(3 or 5 pts each) Fill in the boxes with the structures that complete the reactions. Use wedges and dashes to indicate stereochemistry when appropriate. If a racemic mixture is formed, you must draw both enantiomers and write "racemic" next to the two structures.



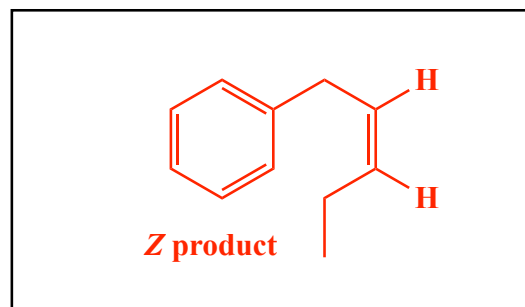
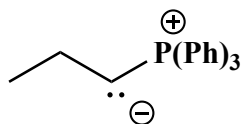
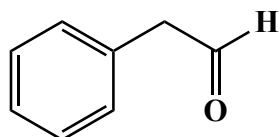
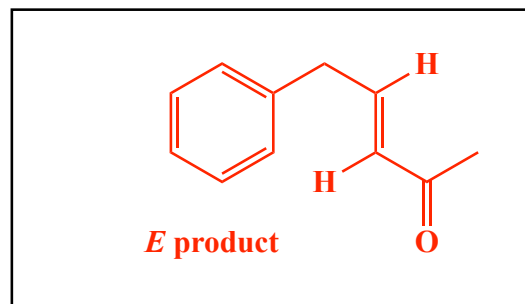
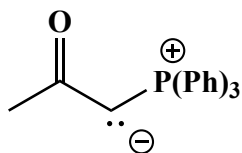
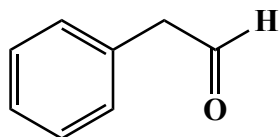
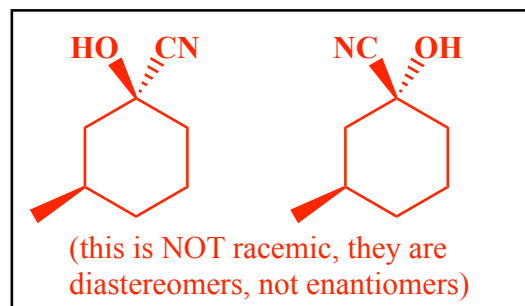
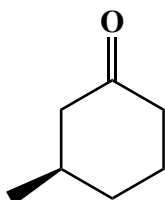
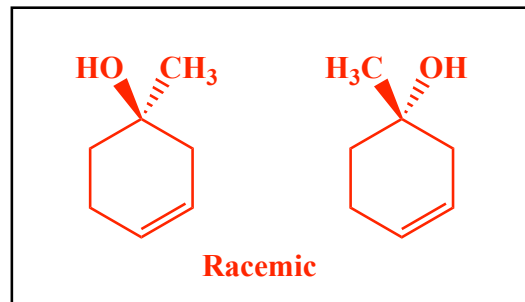
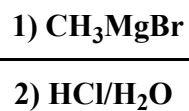
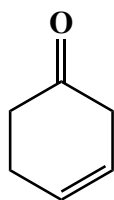
HCN



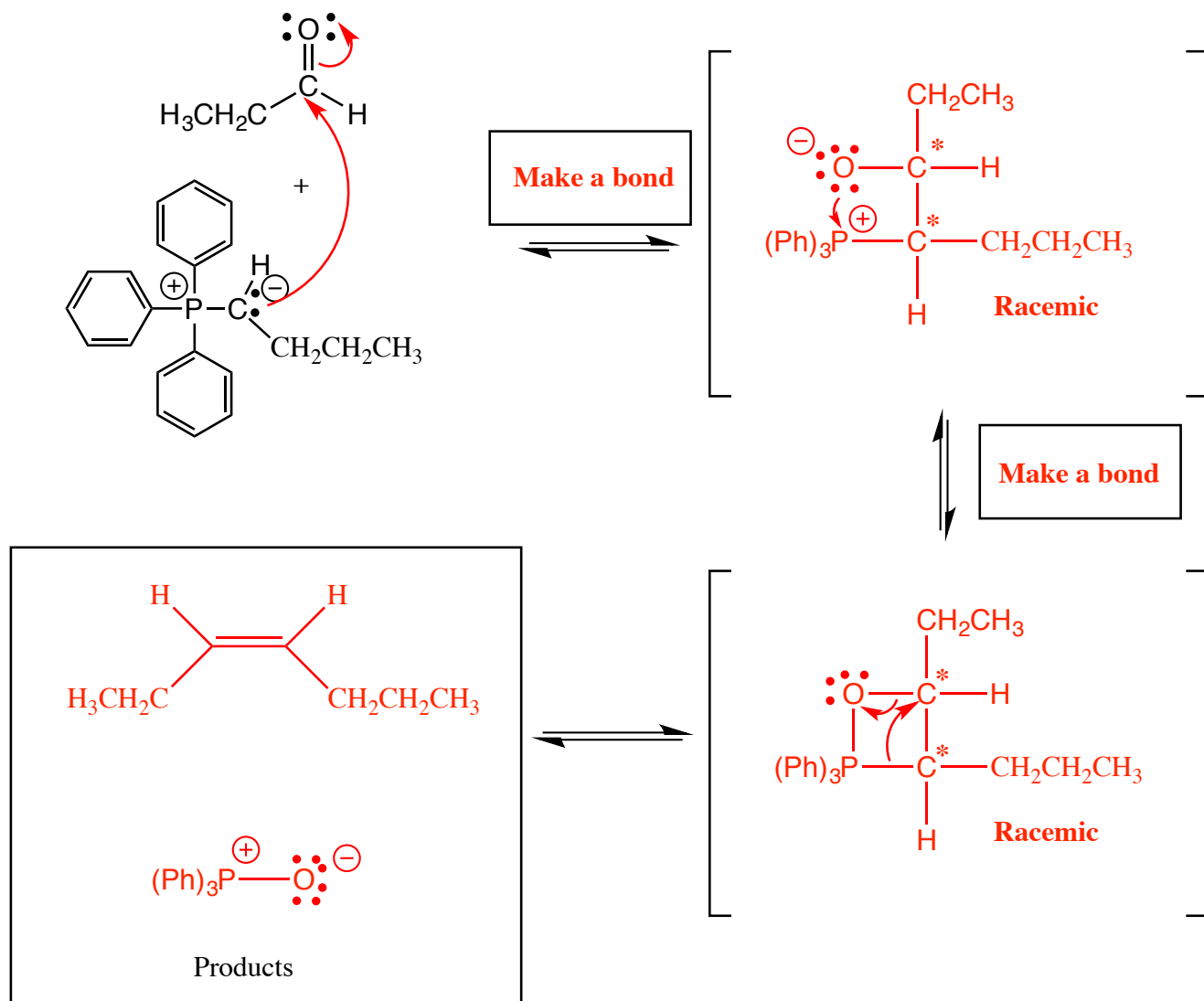
(3 or 5 pts each) Fill in the boxes with the structures that complete the reactions. Use wedges and dashes to indicate stereochemistry when appropriate. If a racemic mixture is formed, you must draw both enantiomers and write "racemic" next to the two structures.



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(18 pts. total) Complete the mechanism for the following Wittig reaction. **Be sure to show arrows to indicate movement of all electrons, write all lone pairs, all formal charges, and all the products for each step.** Remember, I said all 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 ENANTIOMERS, AND WRITE RACEMIC.** I realize these directions are complex, so please read them again to make sure you know what we want.

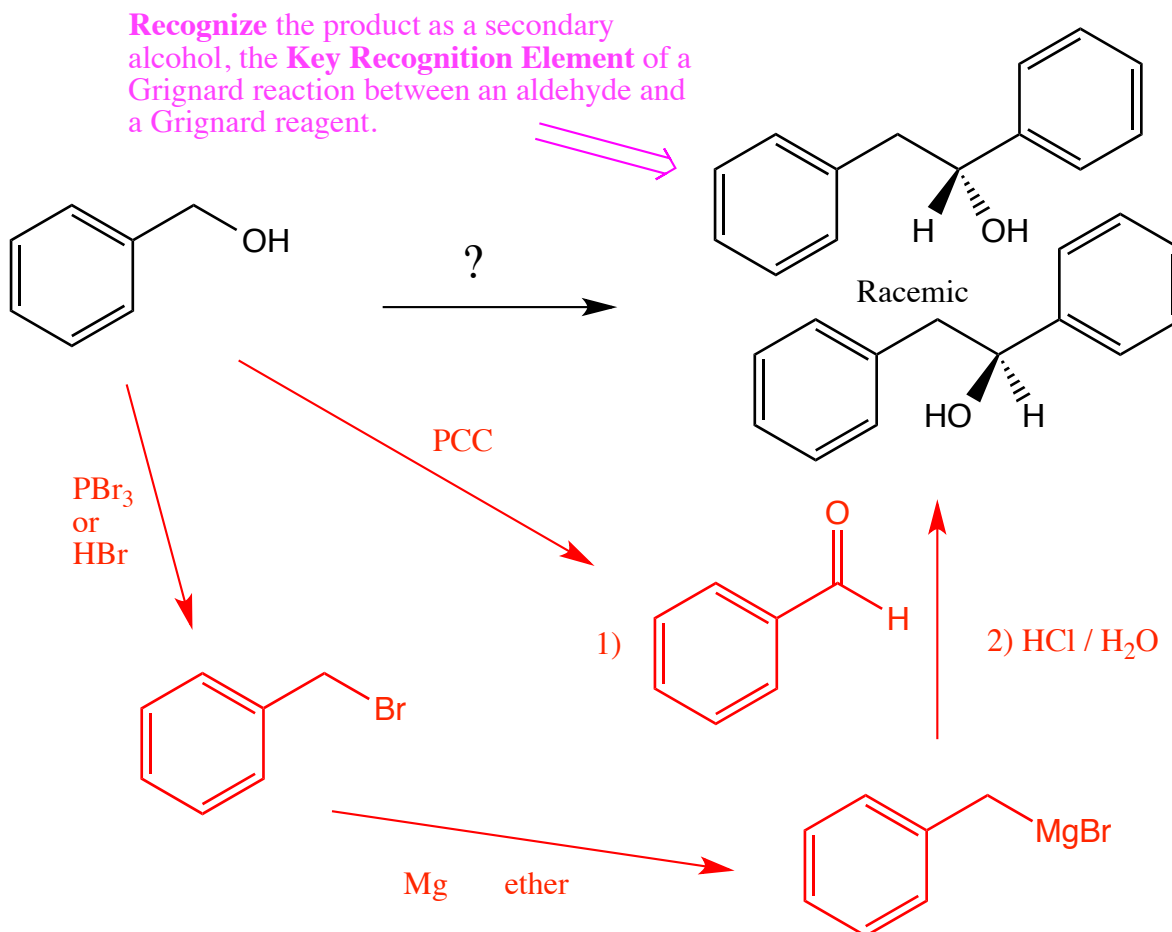


**2 pts** In the boxes provided adjacent to the first two sets of arrows, write which of the four basic mechanistic elements are involved (i.e. "Make a bond", "Add a proton", etc.

↑↑  
NOTICE THIS

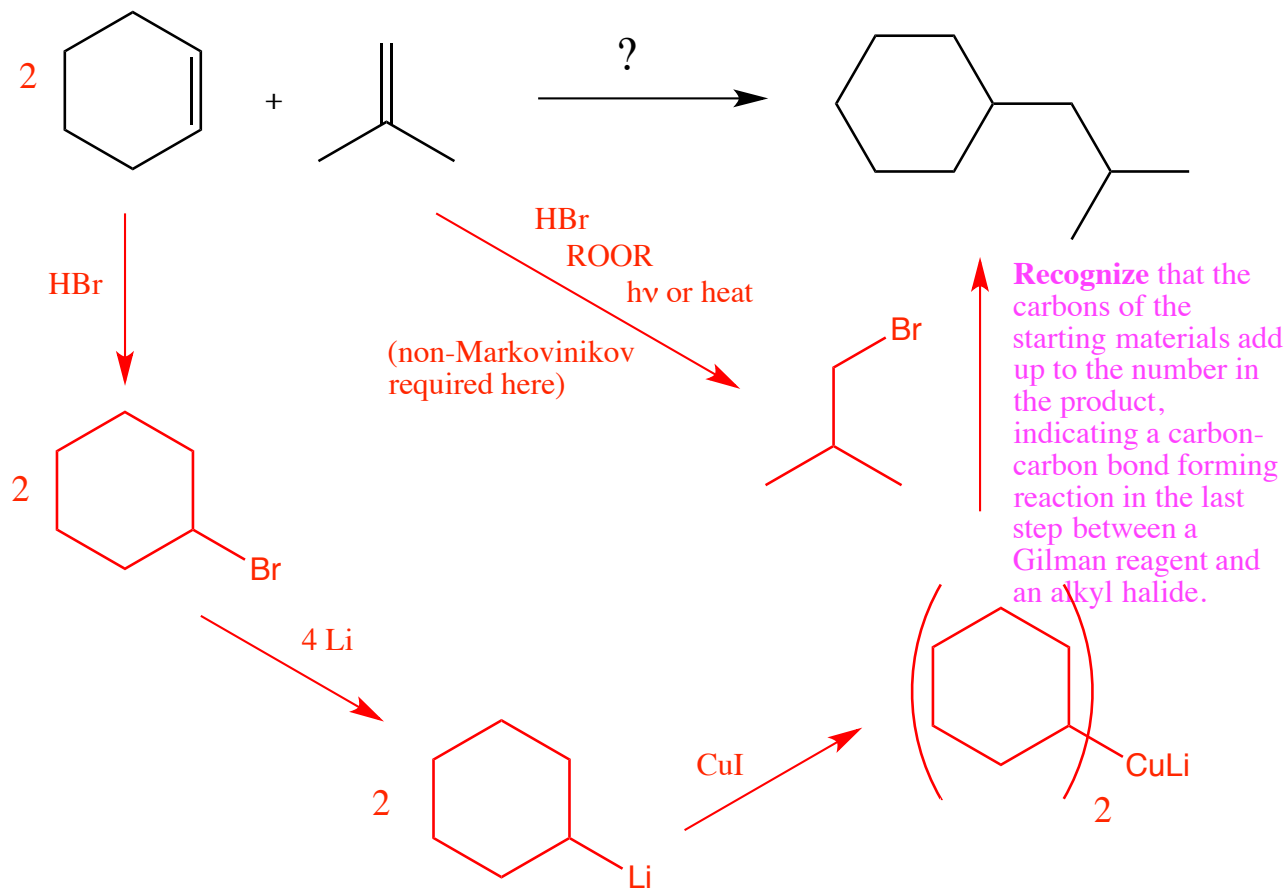
These are synthesis questions. You need to show how the starting material can be converted into the product(s) shown. You may use any reactions we have learned. Show all the reagents you need. Show each molecule synthesized along the way and be sure to pay attention to the regiochemistry and stereochemistry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

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

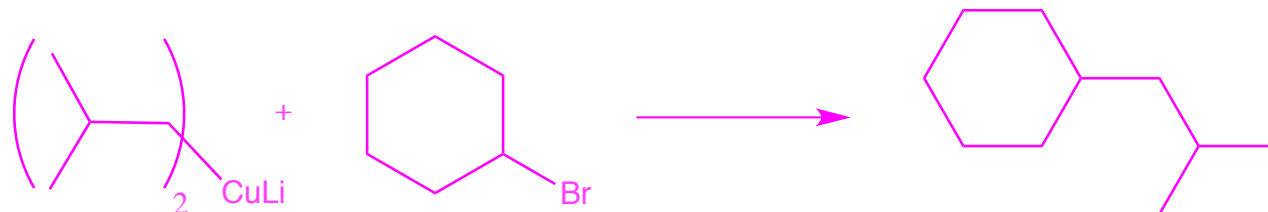


The aldehyde can be made from the starting alcohol using PCC, and the Grignard reagent can be made from the corresponding alkyl halide derived from the starting alcohol. Note, the bromide was used, but it is also fine if you used the chloride derived from reaction with either  $\text{SOCl}_2$  or  $\text{HCl}$ .

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

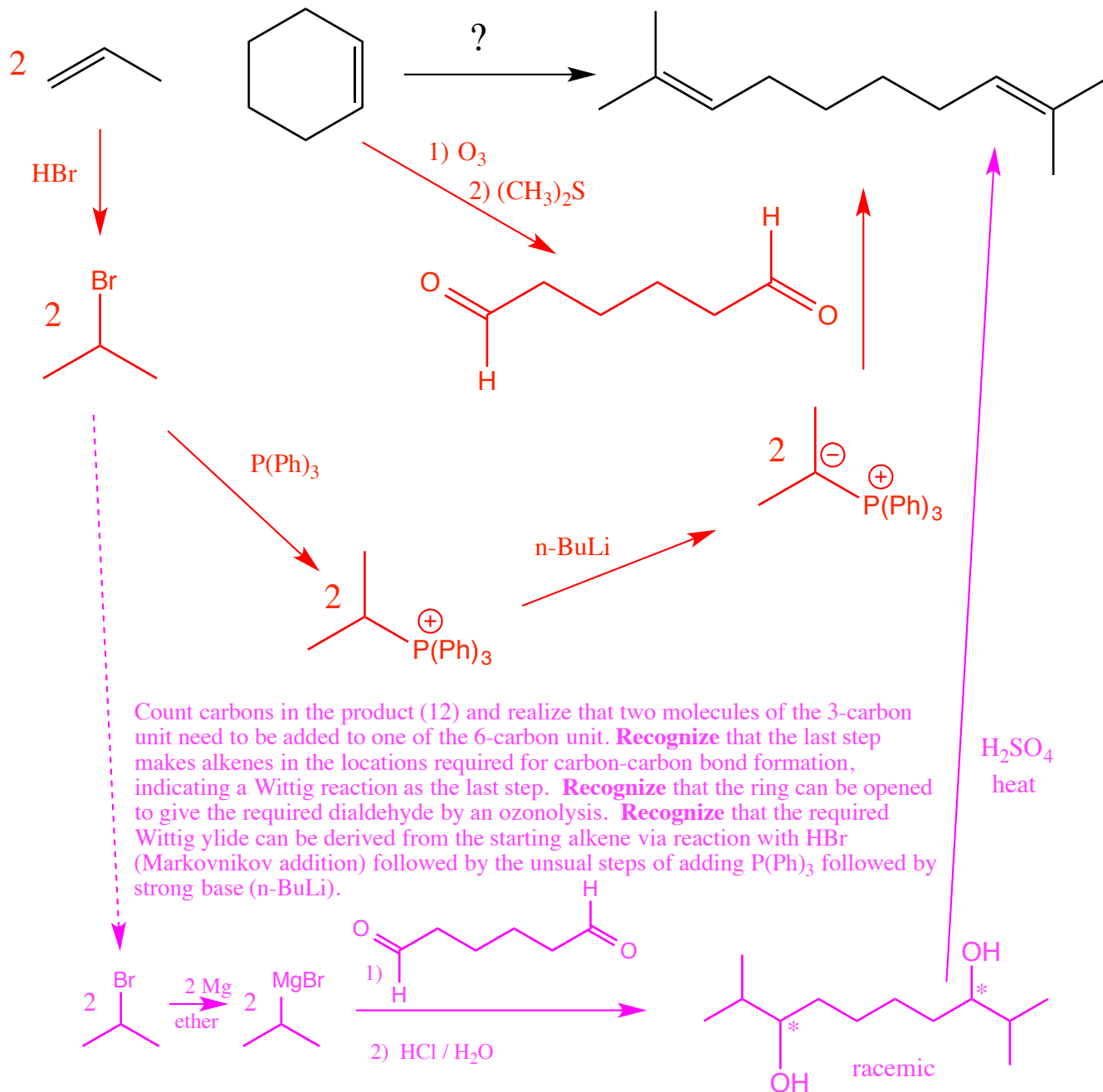


Notice that this scheme could be reversed in that the 2-methylpropene could have been converted to the Gilman reagent and reacted with cyclohexylbromide in the final carbon-carbon bond forming step. Although this is an acceptable answer (you will get credit), the fact that a secondary bromoalkane is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





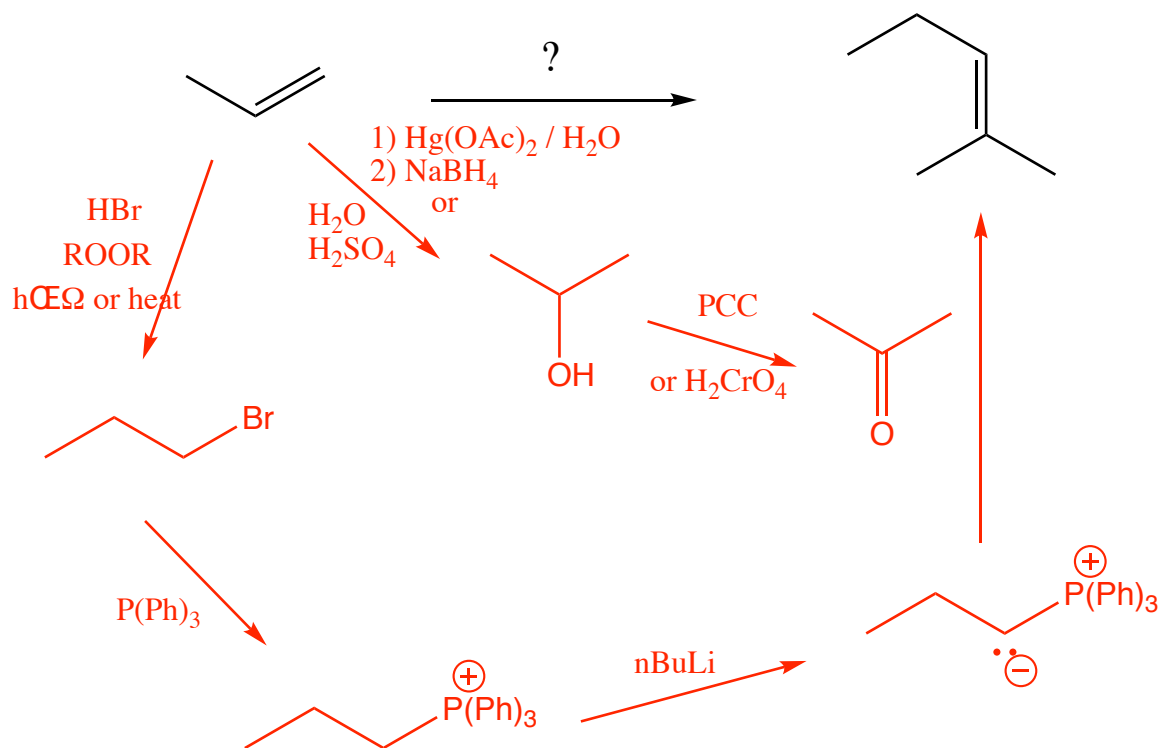
(12 pts) All of the carbon atoms of the products must come from the starting material for this one!



**Alternative route:** Above we have illustrated the most efficient synthetic route involving a Wittig reaction. A reasonable alternative 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 ( $\text{H}_2\text{SO}_4$ ) 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  $\text{P(Ph)}_3$  and  $n\text{-BuLi}$ .

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

