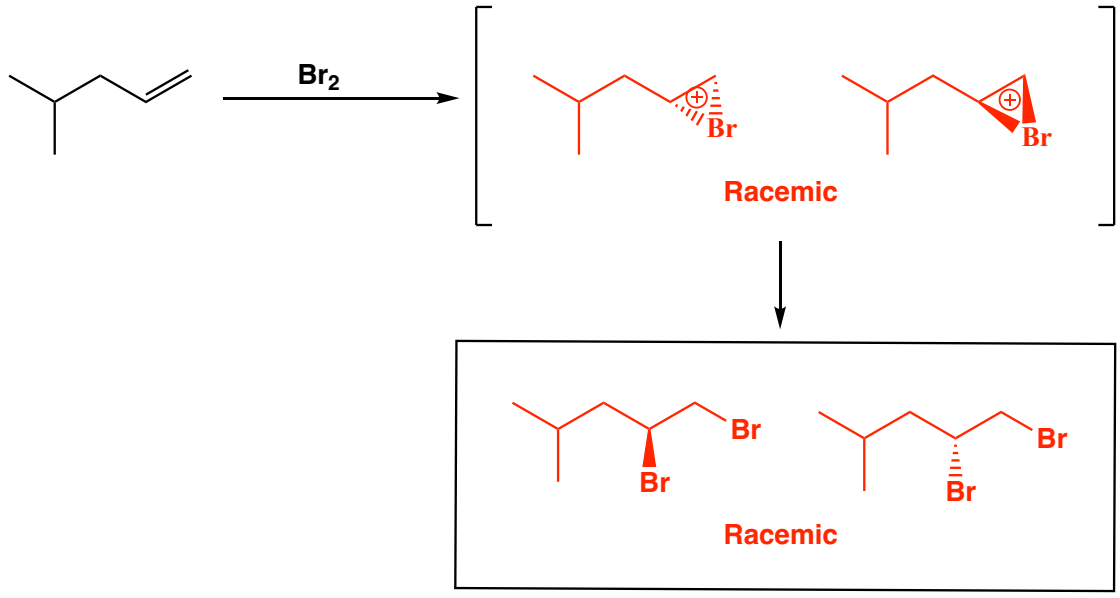
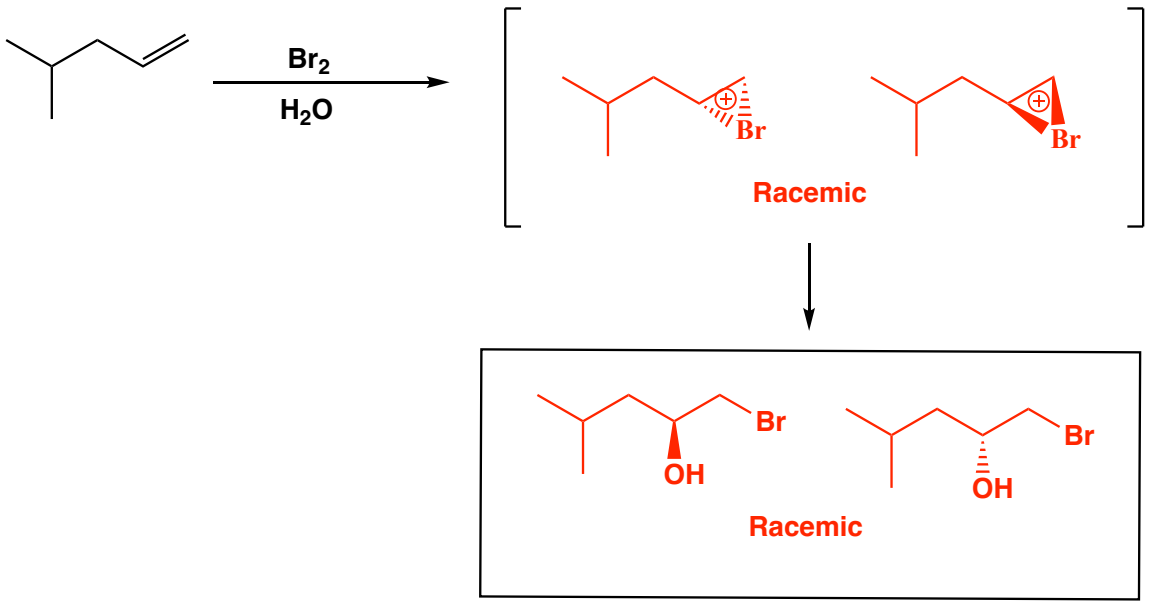
16. (3 or 5 pts each) The following reactions all involve chemistry of alkenes. Fill in the box with the product(s) that are missing from the chemical reaction equations. **Draw only the predominant regioisomer product or products (i.e. Markovnikov or non-Markovnikov products)** and please remember that **you must draw the structures of all the product stereoisomers using wedges and dashes to indicate stereochemistry as appropriate**. When a racemic mixture is formed, **you must write "racemic" under both structures EVEN THOUGH YOU DREW BOTH STRUCTURES**.

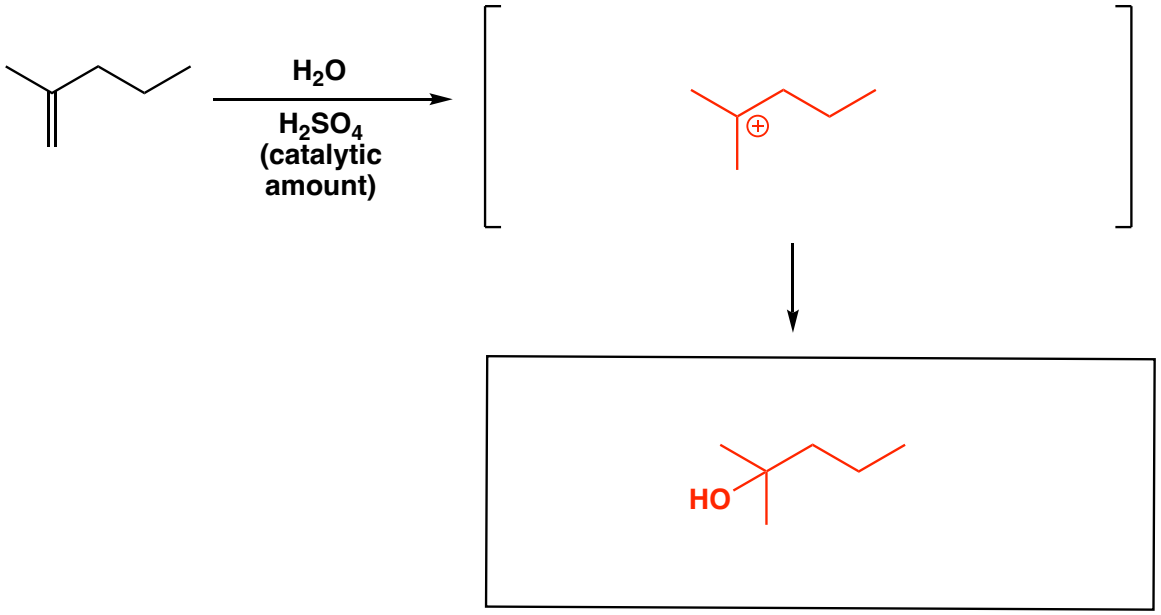
A.



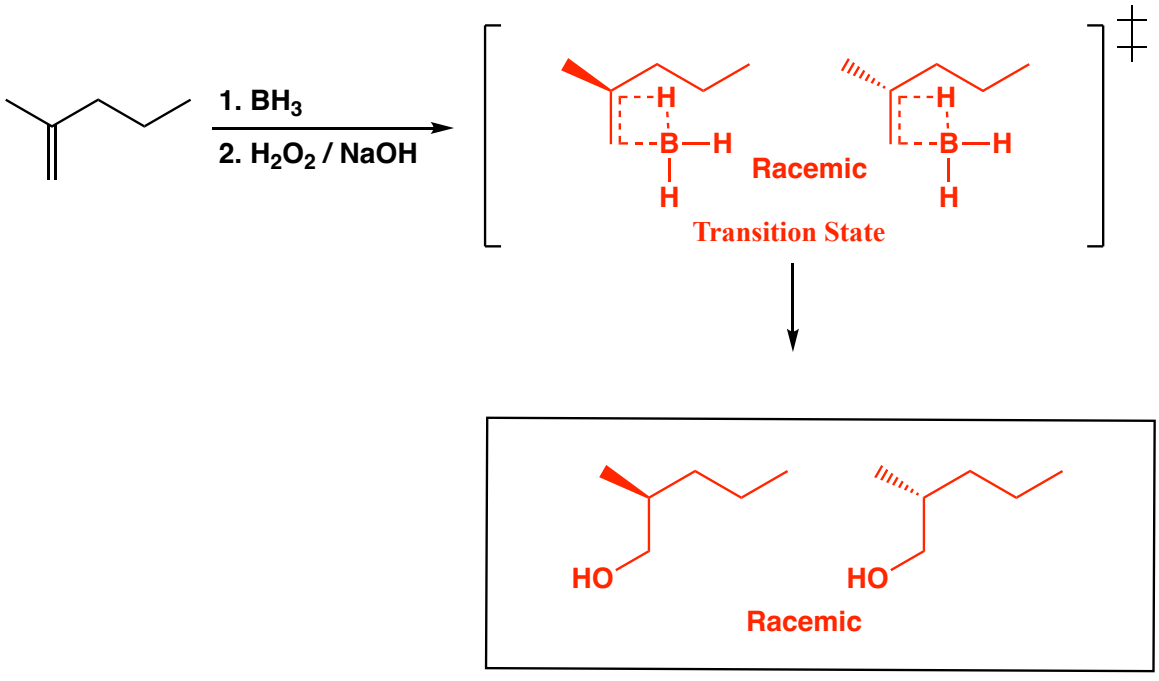
B.



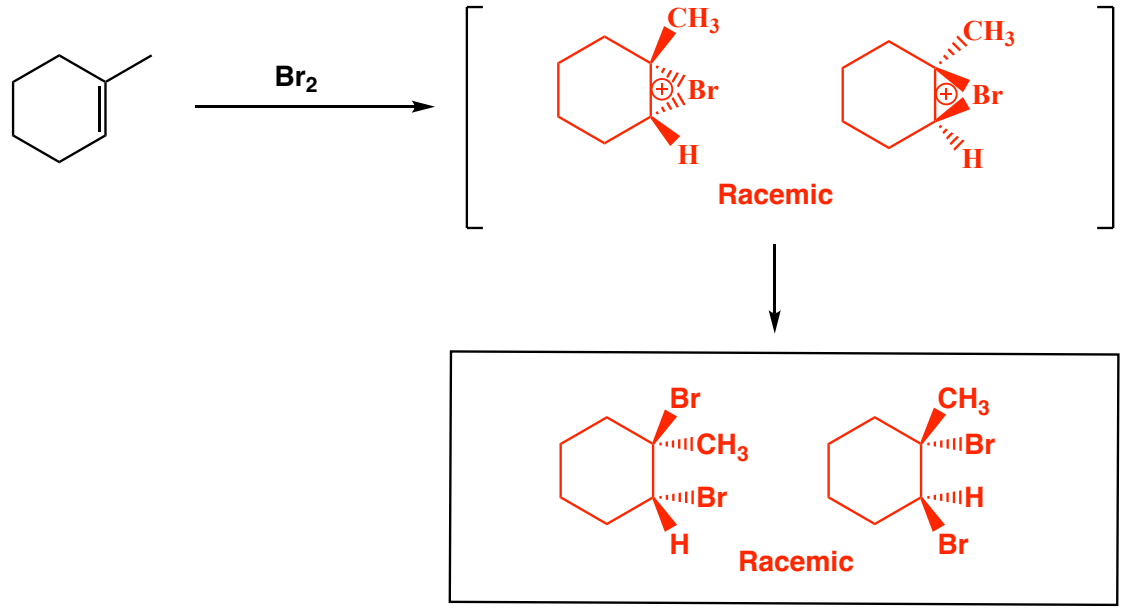
C.


H2O
H2SO4
(catalytic
amount)
HO

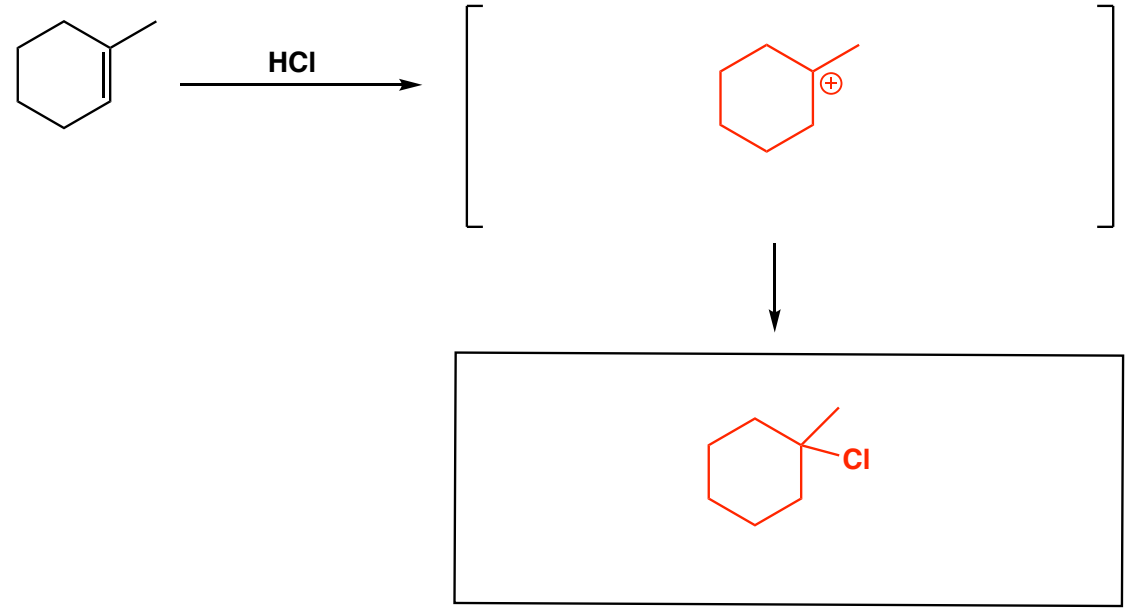
D.


1. BH3
2. H2O2 / NaOH
H
B
H
H
Racemic
Transition State
HO
HO
Racemic

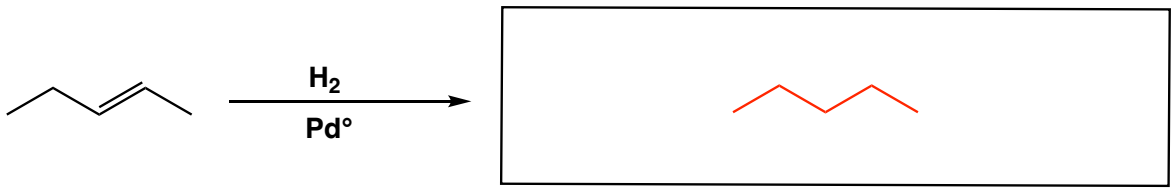
F.


Br2
CH3
Br
H
CH3
Br
H
Racemic
Br
CH3
Br
H
CH3
Br
H
Br
Racemic

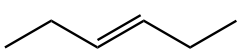
G.


HCl
Cl

H.

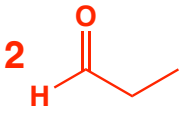

H2
Pd°

I.

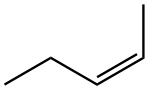


1. O_3

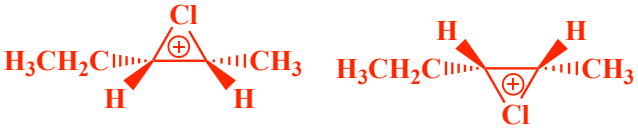
2. $(CH_3)_2S$



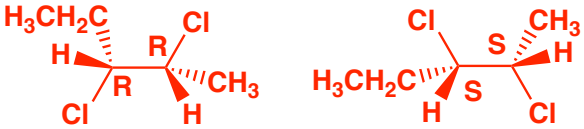
J.



Cl_2

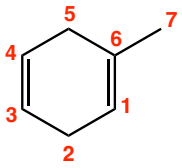


Racemic



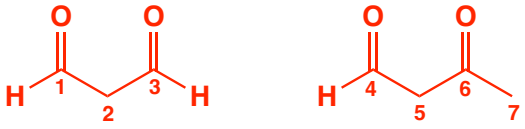
Racemic

K.

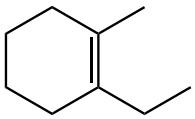


1. O_3

2. $(CH_3)_2S$

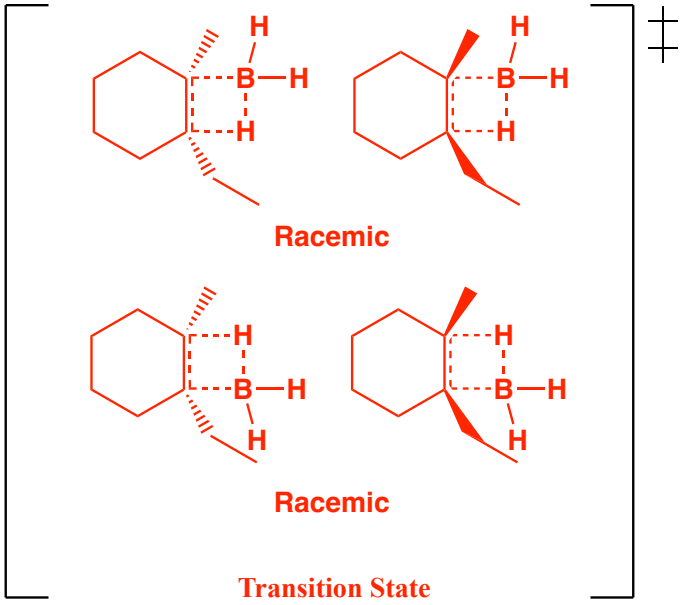


L



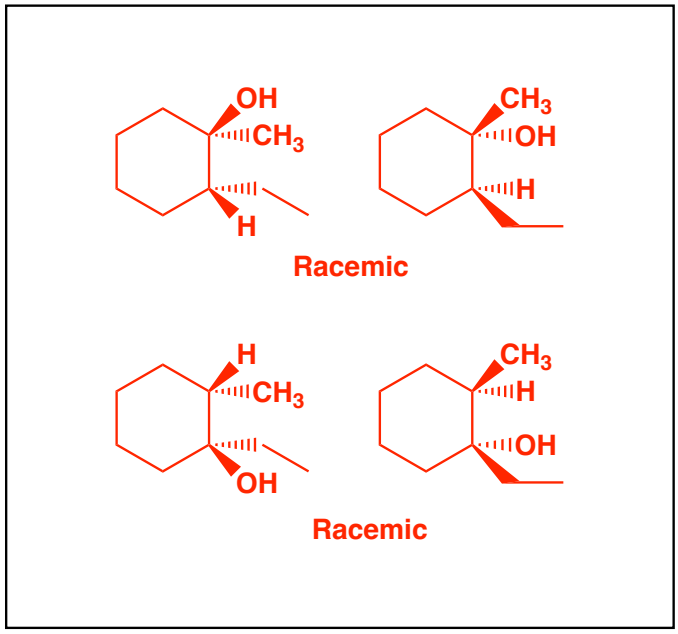
1. BH_3

2. H_2O_2 / $HO^{\ominus}$

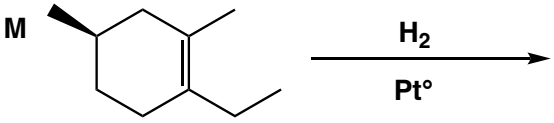


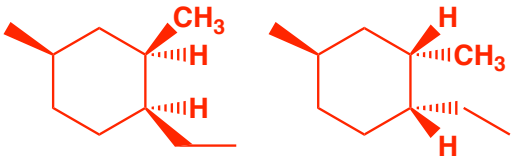
(2 pts) Will the product mixture you drew to the right rotate the plane of plane polarized light?

No



Think about this last one:



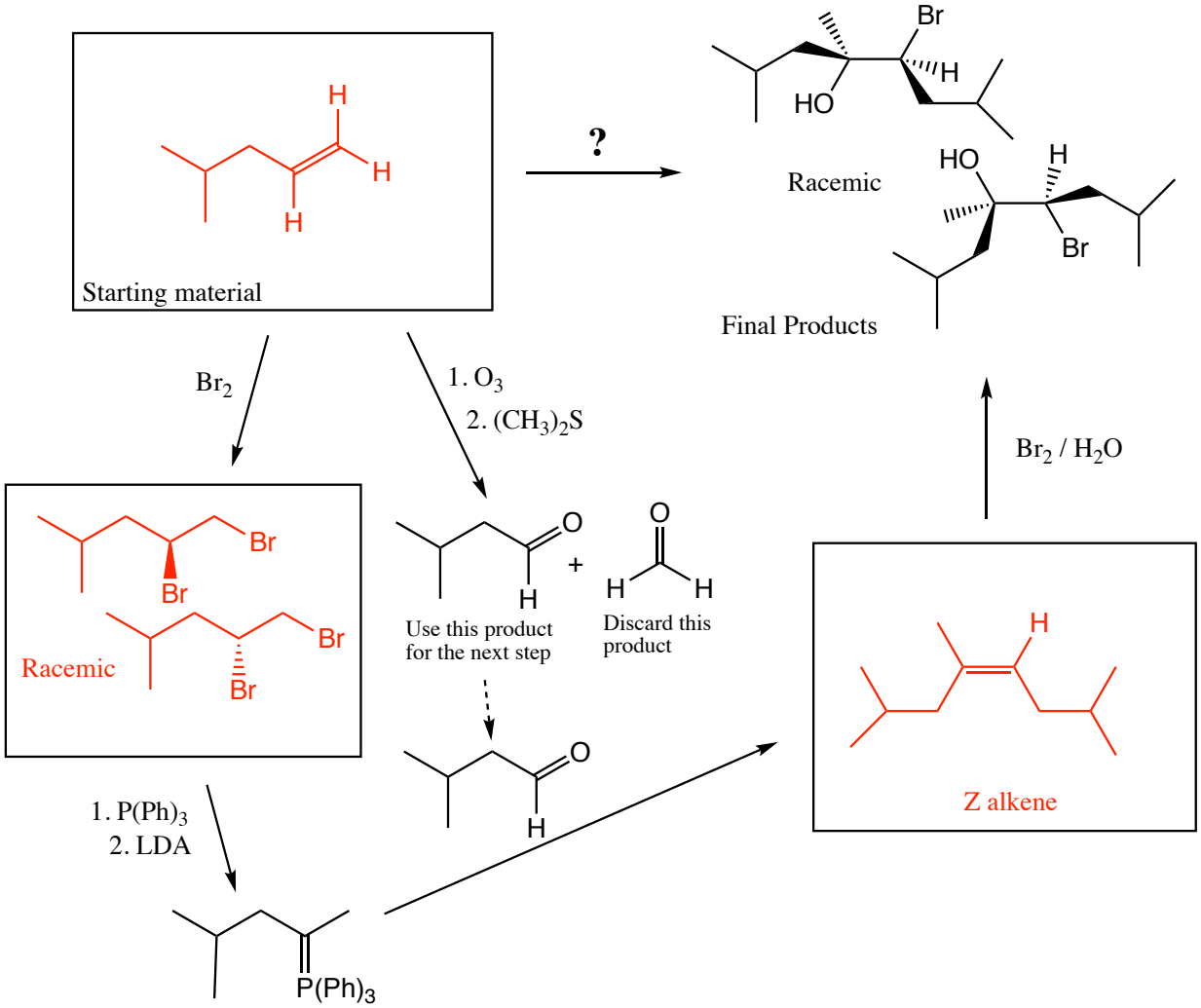


NOT racemic, these are diastereomers.

(2 pts) Will the product mixture you drew to the right rotate the plane of plane polarized light?

Yes

17. (17 pts total) **The point of organic chemistry is synthesis**, the conversion of simpler molecules to more complicated ones with enhanced structure and function. Each reaction you are learning should be thought of as a "tool" that allows you to create a desired type of molecule. These tools can be used in an almost infinite number of combinations to create truly interesting molecules. **In the boxes provided, draw the structures of the molecule indicated in this synthesis scheme.** FOR THIS ONE, IF STEREOISOMERS ARE CREATED YOU MUST DRAW THEM ALL USING WEDGES AND DASHES. And you must write "racemic" when appropriate. You will not recognize all of this chemistry, but by the time you finish O Chem II next spring you will!!



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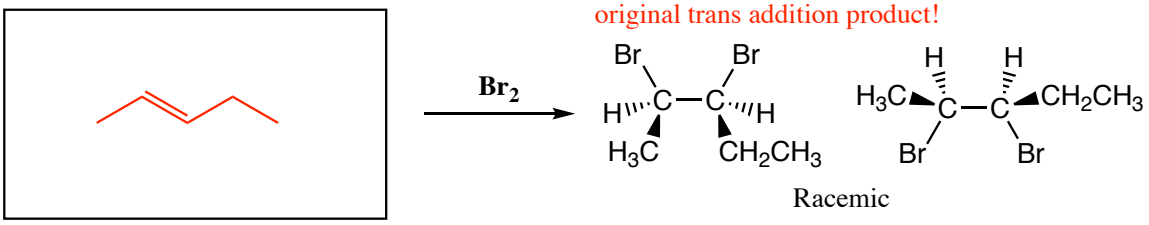
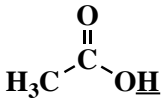
18. (4 pts) **Fill in the box with the appropriate starting alkene** Think about his one!!

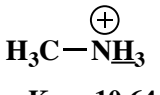
You need to rotate the central C-C bond to find the original trans addition product!



10. (18 pts) **Complete the following two structures by adding appropriate numbers of lone pair electrons, H atoms, and formal charges to the atoms in the boxes.** You must adjust your answers to indicate the predominant species at each indicated pH value. (You do not have to add anything such as H atoms to atoms not drawn in the boxes.) This problem is testing your understanding of the relationship of protonation state to pH to pKa values for certain functional groups we have discussed. **Next, in the space provided, write the overall charge on each structure at the indicated pH. For your reference, here are the relevant pK_a values:**

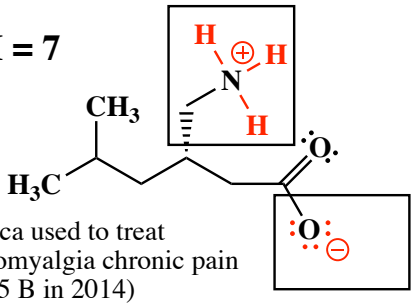


pK_a = 4.76



pK_a = 10.64

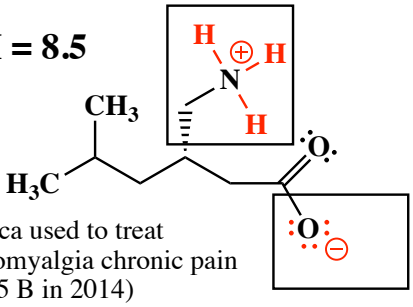
pH = 7



Lyrica used to treat fibromyalgia chronic pain ($4.5 B in 2014)

Total charge on molecule: 0

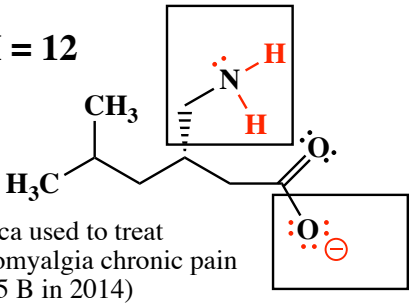
pH = 8.5



Lyrica used to treat fibromyalgia chronic pain ($4.5 B in 2014)

Total charge on molecule: 0

pH = 12



Lyrica used to treat fibromyalgia chronic pain ($4.5 B in 2014)

Total charge on molecule: -1