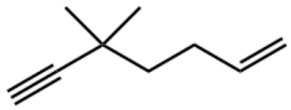
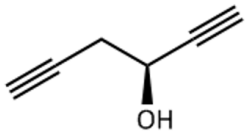
1. Name the following compounds. Don't forget about stereochemistry. (10 points)

a. 

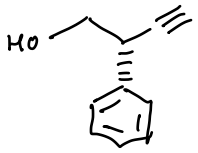
b. 

5,5-dimethylhept-1-en-6-yne

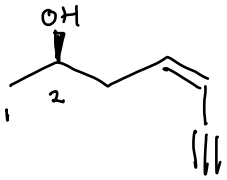
(S)-hexa-1,5-diyn-3-ol

2. Draw the structure of the following compounds. Don't forget about stereochemistry (10 points)

a. (*S*)-2-phenylbut-3-yn-1-ol

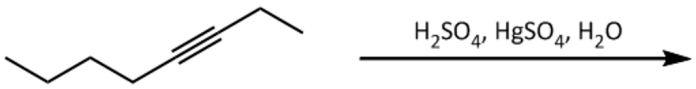


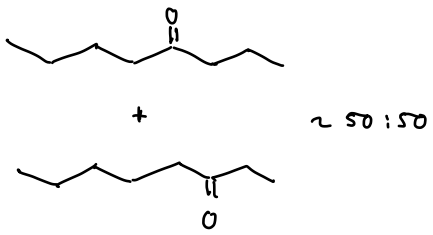
b. (2*R*,4*Z*)-hept-4-en-6-yn-2-ol



3. Consider the reaction of the alkyne shown below. (15 points)

a. Show *all* the products formed in this reaction. (10)
b. Does the addition follow Markovnikov's rule? Explain (5)

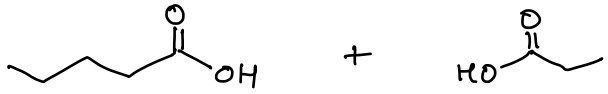


a. 

~ 50:50

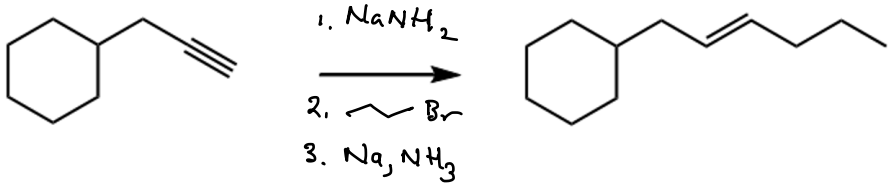
b. No, with a disubstituted alkyne both ends of triple bond have the same substitution, so Markovnikov's rule doesn't apply

4. Show the product (or products) from the ozonolysis (1. O_3, 2. H_2O) of the starting alkyne in Question 3. (5 points)

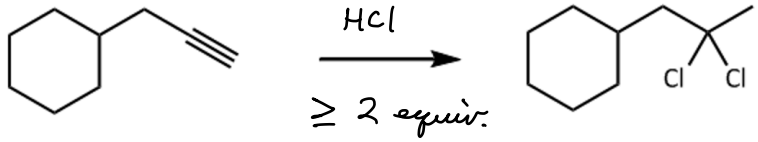


5. Show the reagents needed to convert the alkyne at left to each of the products shown. List the reagents and conditions above and below the arrow (some of these certainly require more than one step!). You don't need to show any intermediates (if there are any). (15 points)

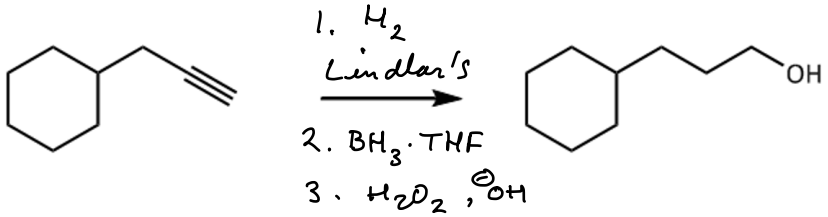
a.



b.

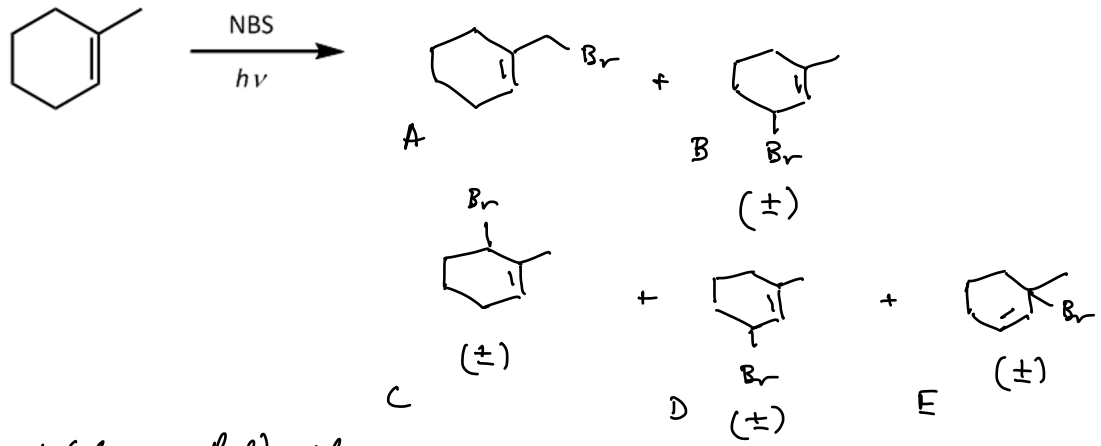


c.



6. Show *all* the products from the following reaction (there is definitely more than one). Clearly indicate the stereochemistry of the product (or products) using appropriate notation. (20 points)
(Note: NBS is the preferred substitute for Br_2)

Extra Credit Provide IUPAC names for all products produced from this reaction (5 EC points each)

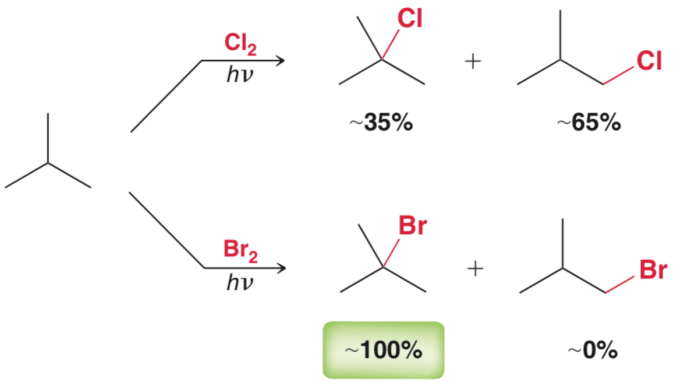


A – 1-(bromomethyl) cyclohex-1-ene
B – (±)-3-bromo-1-methyl cyclohex-1-ene
C – (±)-6-bromo-1-methyl cyclohex-1-ene
D – (±)-3-bromo-3-methyl cyclohex-1-ene

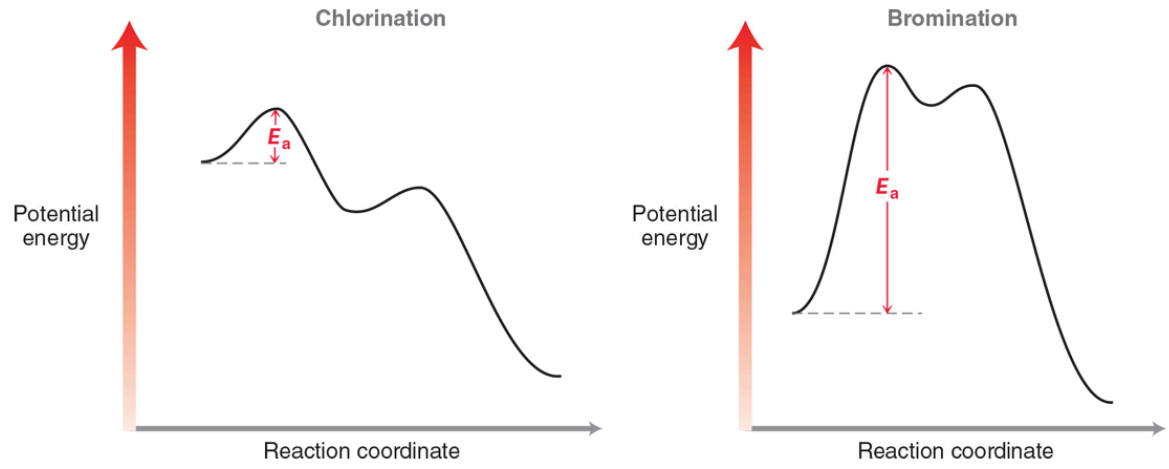
(note the numbering gives the first "branch" the lowest possible number)

7. Given the reaction energy diagrams for the radical chlorination and bromination of alkanes (next page), provide an explanation for the dramatic difference in the ratio of products produced below. Your answer should mention the Hammond postulate. (10 points)

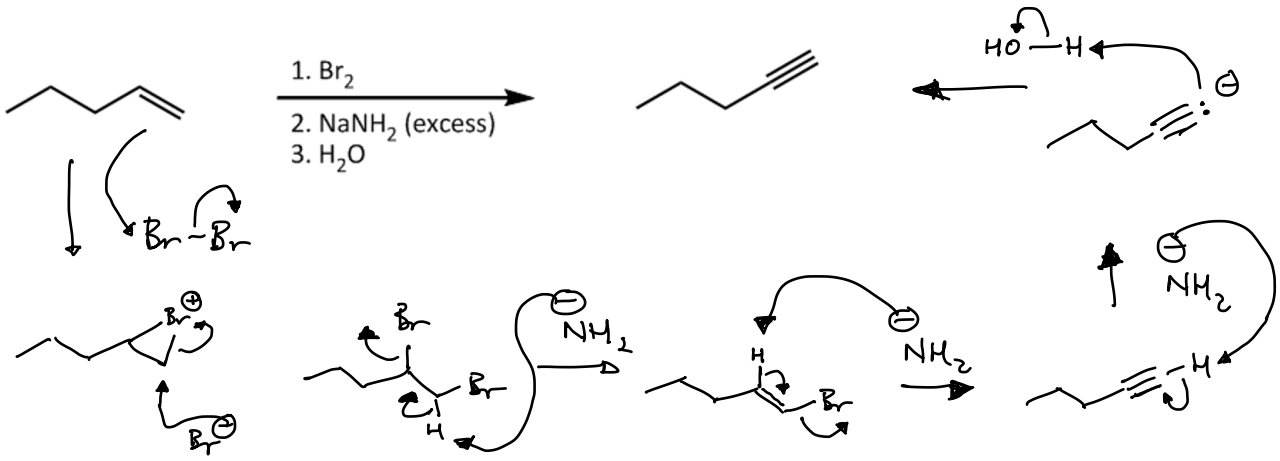
Extra Credit Explain why 1-chloro-2-methylpropane is the major product in the chlorination reaction. (5 EC points)



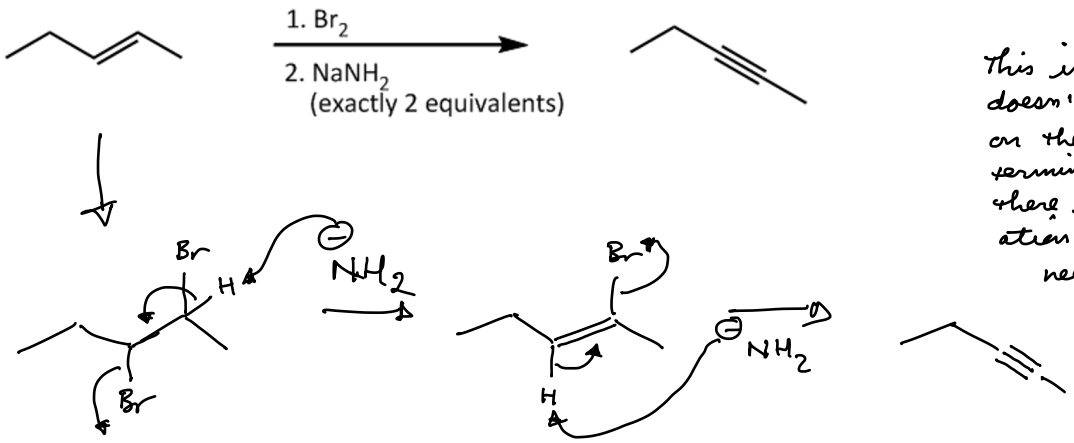
See answer from practice exam



8. The reaction below is the standard method to synthesize an alkyne starting from an alkene. When the alkene is a *terminal* alkene (like pent-1-ene), a *terminal* alkyne is produced. Show the mechanism of each step of this overall sequence and show what the role of the H_2O is at the end. (20 points)



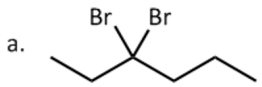
9. When the alkene is an *internal* alkene (like pent-2-ene), an *internal* alkyne is produced. Note that only two equivalents of are required and the is not needed. Explain In terms of your mechanism shown in 8 above, why are only two equivalents of $NaNH_2$ are needed and the H_2O at the end is not required. (10 points)

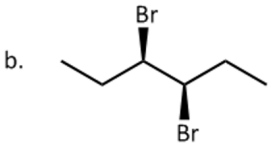


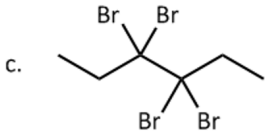
This internal alkyne doesn't have a proton on the end, like a terminal alkyne does, so there is no final deprotonation step, and hence no need for H_2O.

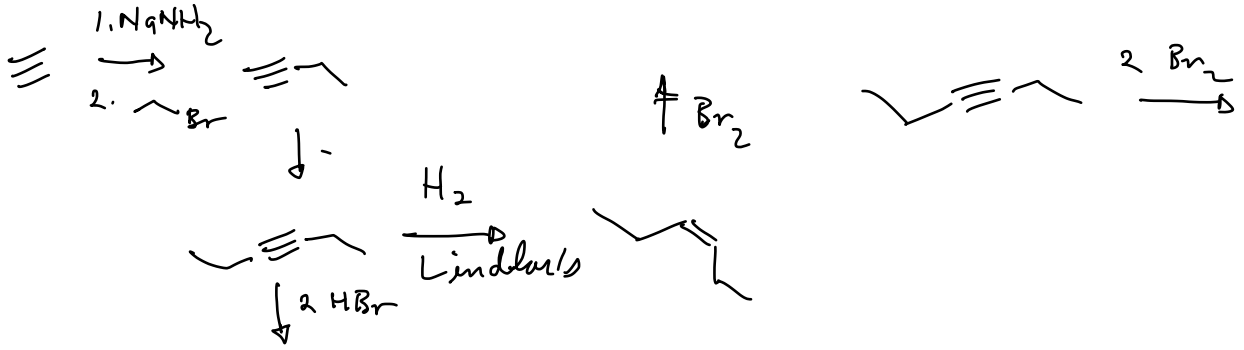
10. Starting from acetylene (HC≡CH), bromoethane (CH_3CH_2Br), and using any other chemical reagents, show how you could prepare the following compounds. Note the stereochemistry in Part b.

(15 points)

a. 

b. 

c. 



11. What is the final product? Show each intermediate compound. (20 points)