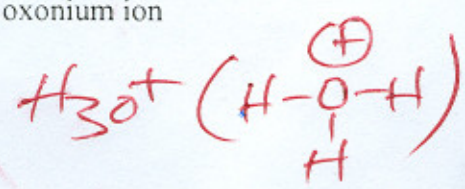
Chemistry 210
October 17, 2007

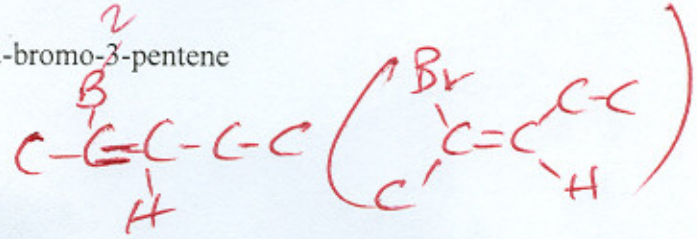
Name Key

16 1. Give structures for each of the following compounds or ions:

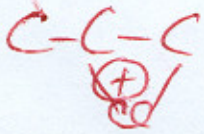
oxonium ion



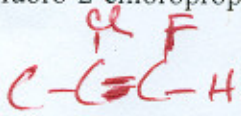
cis-2-bromo-3-pentene



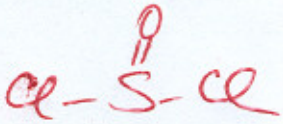
Any chloronium ion (cyclic)



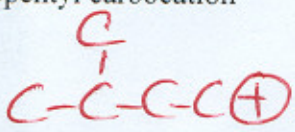
(Z)-1-fluoro-2-chloropropene



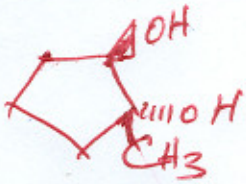
Thionyl chloride



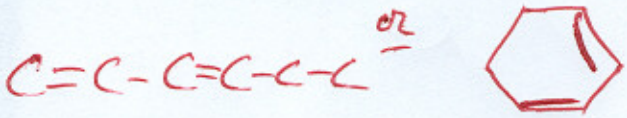
isopentyl carbocation



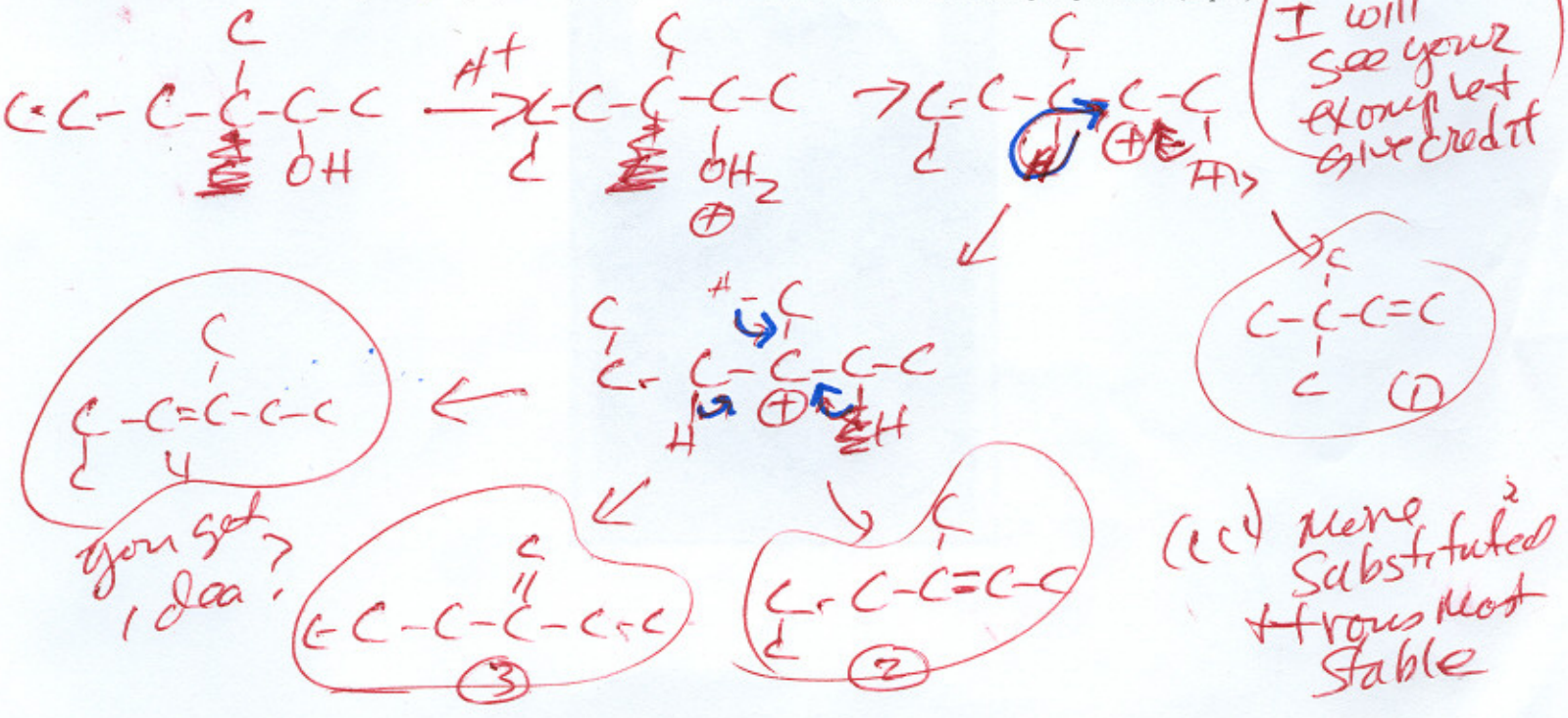
(Z)-1-methyl-1,2-cylcopentanediol



a 6-carbon conjugated diene

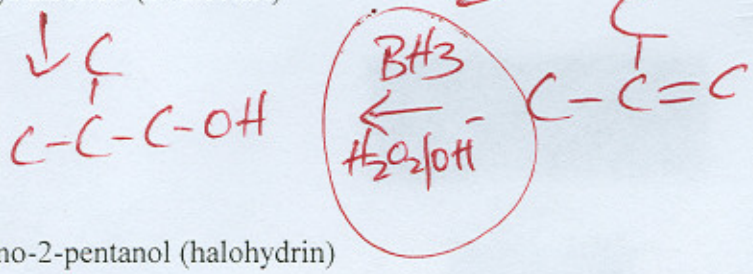


12 2. (i) Acid-catalyzed elimination reactions often produce more than one product. Show the elimination reaction of an alcohol where you could produce at least 4 different products (show their structures), which may involve a hydride or methyl shift in the process (6 pts). (ii) Give the names for each product (1 pts ea) (iii) Predict which would be the major product (2 pts).

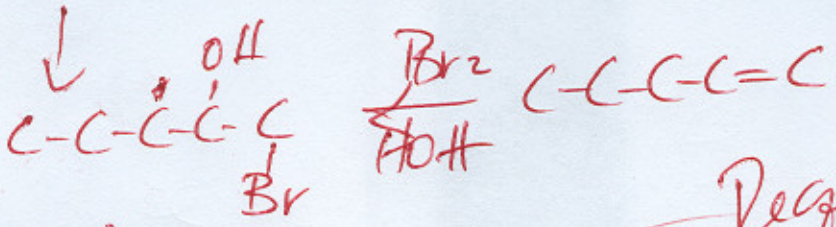


16 3. We have usually started with a reactant and showed the product. However, organic chemists are often given a product, and have to determine a good reactant. For the following products, show a single (and only one) *alkene* that could be used to make the desired product(s). Include any other chemicals (acid, base, water, catalyst, etc.) that could be required. *(You may want to draw the structure of the product in order to give yourself a better idea for the structure of the potential alkene which could be used.)*

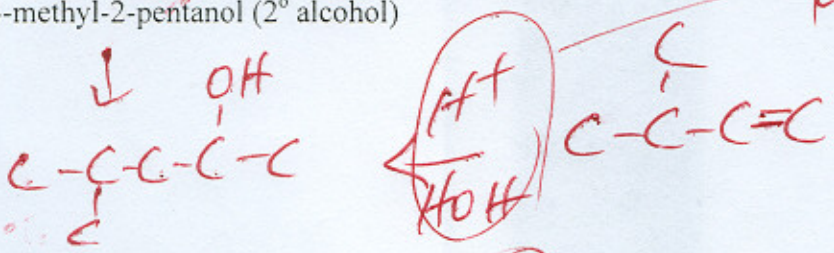
isobutyl alcohol (1° alcohol)



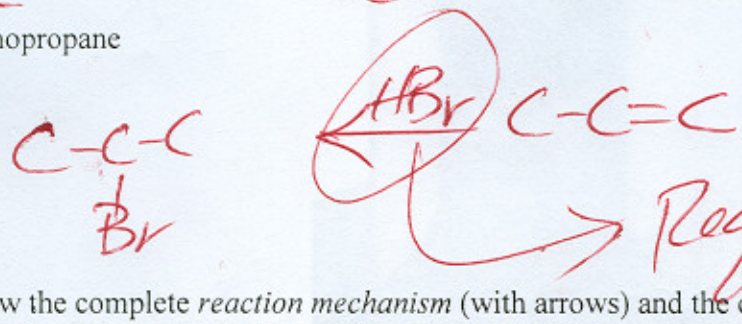
1-bromo-2-pentanol (halohydrin)



4-methyl-2-pentanol (2° alcohol)

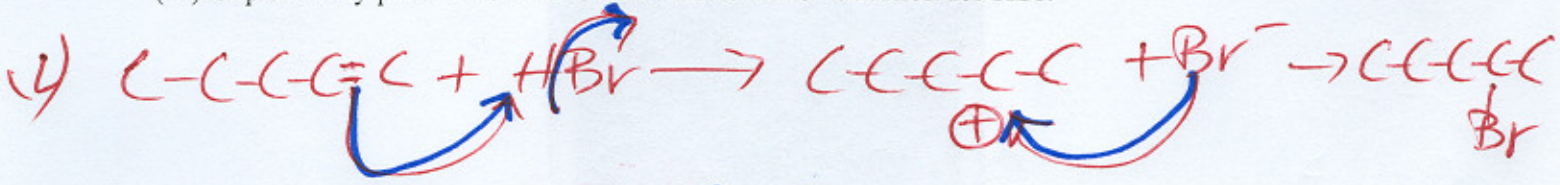


2-bromopropane

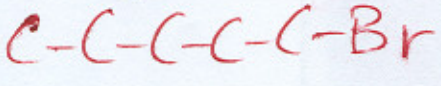


12 4. (i) Show the complete *reaction mechanism* (with arrows) and the correct product for the reaction of 1-pentene and HBr, including the carbocation which is formed. (ii) Show the product (*but no reaction mechanism is necessary*) for reaction of HBr and 1-pentene in the presence of peroxides. (iii) Explain why peroxides lead to anti-Markovnikov addition for HBr.

(i)

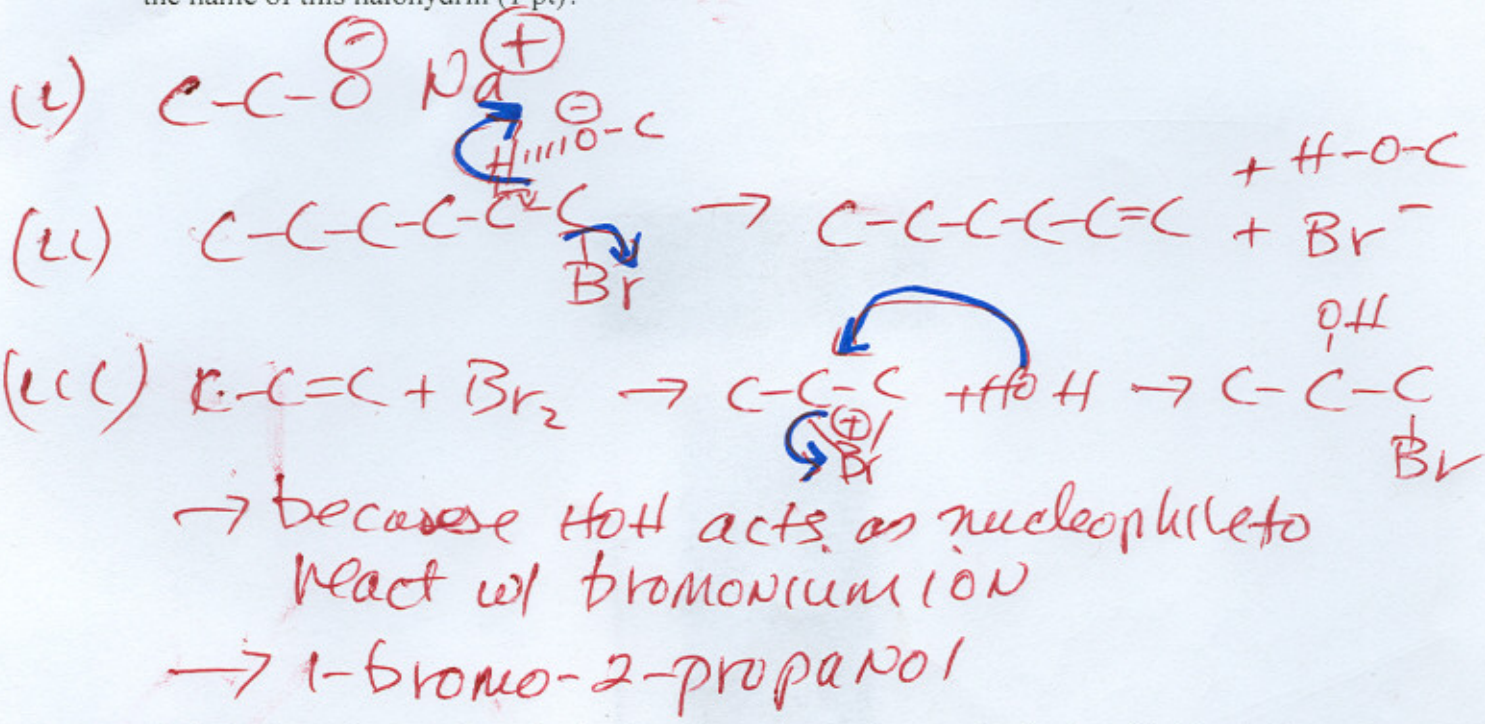


(ii)



(iii) Peroxides lead to anti-Markovnikov addition of HBr because H goes through free radical to 2° free radical more stable

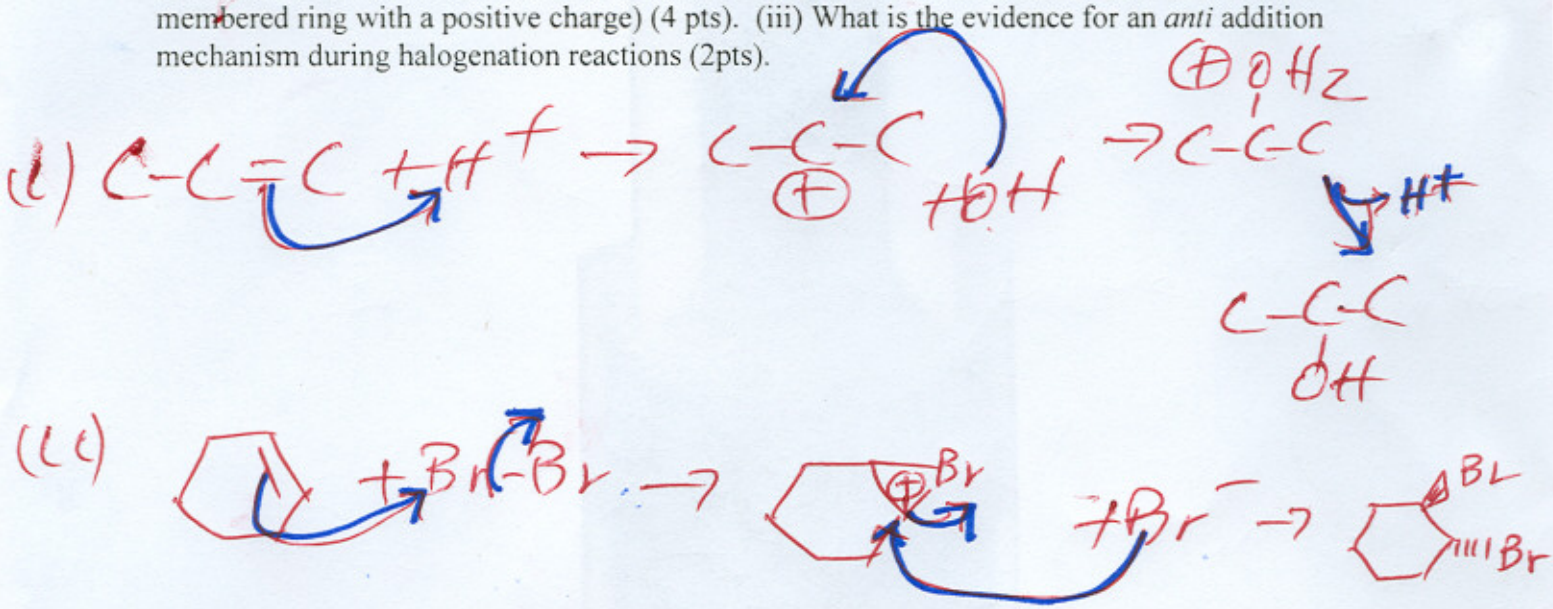
10 5. (i) Show the structure of sodium ethoxide (2 pts). (ii) Show the reaction mechanism for the E2 elimination of 1-bromohexane in the presence of the strong base sodium methoxide (4 pts). (iii) Explain why a halohydrin is produced when propene reacts with Br_2 and water (3 pts). What is the name of this halohydrin (1 pt)?



→ because HOH acts as nucleophile to react w/ bromonium ion

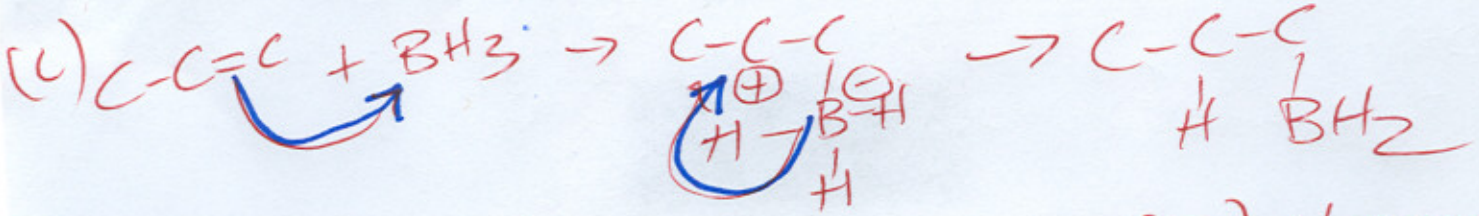
→ 1-bromo-2-propanol

10 6. (i) Hydration of propene is regioselective. Show the reaction mechanism by which hydration takes place and explain why you get a single product (4 pts). (ii) Show the reaction mechanism by which Br_2 reacts with cyclohexene. Be sure to include the intermediate bromonium ion (3-membered ring with a positive charge) (4 pts). (iii) What is the evidence for an *anti* addition mechanism during halogenation reactions (2pts).



(iii) anti-addition because trans product is produced ∴ back side attack.

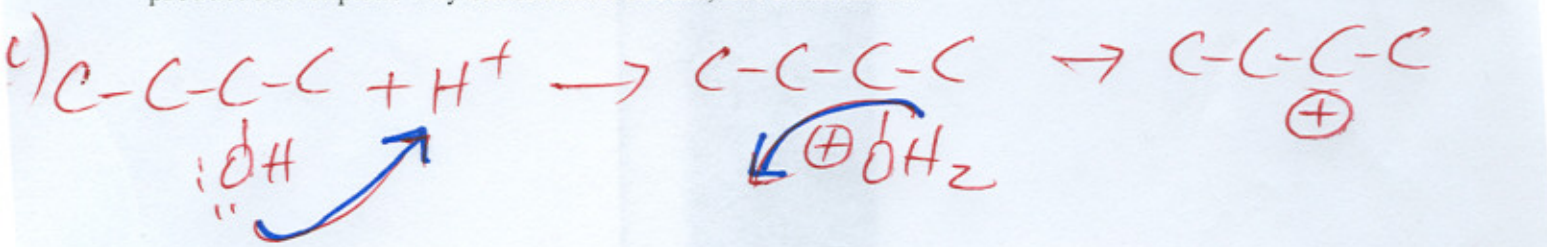
9 7. (i) BH_3 can be used to produce primary alcohols. Show the initial reaction mechanism when BH_3 reacts with propene, up to and including the first hydride ion transfer. (ii) What will be the ultimate structure for the alcohol produced following the complete hydroboration-oxidation process? (iii) Explain why hydroboration-oxidation leads to an alcohol with anti-Markovnikov orientation, compared to normal acid-catalyzed hydration.



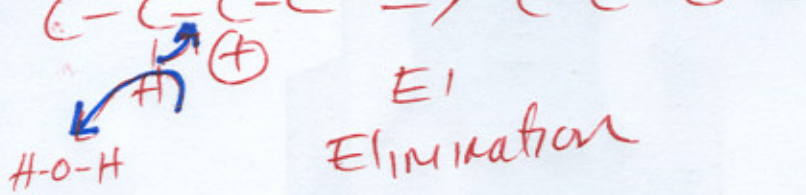
(ii) 1-propanol

(iii) the acid (B) always goes to carbon w/ most H's + hydride goes to 2° carbon

9 8. (i) Starting with *sec*-butyl alcohol, show the complete reaction mechanism required to produce a carbocation in acidic conditions. (ii) If this reaction occurred in the presence of sulfuric acid, show how E1 elimination could occur. (iii) If a carbocation was formed in HCl(aq), show the product and explain why substitution occurs, not elimination.

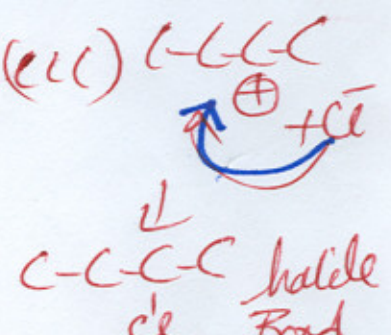


(ii) from (i)



E1 Elimination

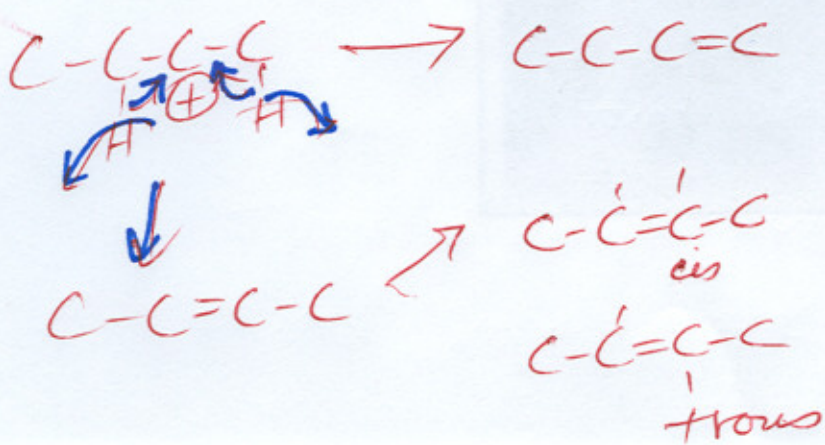
(iii)



halide Bond stable

6 9. If you undergo elimination of 2-butanol, show the products and indicate which is the major and which is the minor product. Justify your answer based on Zaitsev's rule and other requirements.

sec-butyl alcohol



trans-2-butene is major, 1-butene is minor + ~~cis-2-butene~~ cis-2-butene is middle trans more stable than cis. 2-butene more substituted