

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

t-butyl oxonium ion

trans-2-methyl-3-hexene

propylbromonium ion

sec-butylcarbocation

thionyl chloride

(*Z*)-1,2-dibromo-1-butene

(*E*)-1-methyl-1,2-cyclopentanediol

a 4-carbon aldehyde

12 2. Show the reaction mechanism for the acid-catalyzed elimination reaction of 3-methyl-2-butanol that actually produces three different alkenes. Alkyl and/or hydride shifts may be required. For the three potential products predict the order of increasing percentage of product formed (the product which is preferred will be formed more!).

- 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 any *alkene* that could be used to produce the product shown. Include any other chemicals which may be required for these chemical transformations. (*Draw the structure of the product, to give yourself a better idea about structures of potential alkene reactants.*)

t-butyl alcohol

1-bromo-2-pentanol

2-butanol

1-butanol

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

- 10 5. (i) Show the reaction mechanism for the E2 elimination of 1-bromobutane in the presence of sodium ethoxide. (ii) Show how a halohydrin can be formed starting with propene, Br₂ and water.
- 10 6. (i) Hydrogenation of alkenes is stereoselective. Describe how catalytic hydrogenation of an alkene occurs via *syn* addition. (ii) Show the reaction mechanism by which Br₂ reacts with propene, producing a bromonium ion (3-membered ring with a positive charge), and why the reaction goes through an *anti* addition mechanism.
- 8 7. (i) Show the initial reaction mechanism between propene and BH₃ up to and including the first hydride ion transfer. (ii) What will be the structure for the alcohol produced following a complete hydroboration-oxidation process?

- 6 8. Each of the following compounds are weak nucleophiles as shown. Show a reaction that you could use to make each into a stronger nucleophile (a more basic compound or ion).

HOH

NH₃

ethanol

- 10 9. Show the reaction mechanism by which *t*-butyl bromide reacts with water to produce *t*-butyl alcohol, going through a carbocation.