

## 9.19: ADDITIONAL EXERCISES

### ADDITION OF HYDROGEN HALIDES TO ALKENES

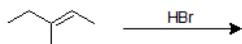
9-1 Give the IUPAC name for the product of the following reaction.



9-2 Draw the reaction mechanism of the previous problem (9-1).

9-3 Identify the product of the following reactions.

(a)

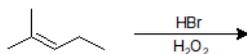


(b)



9-4 Identify the products of the following reactions.

(a)

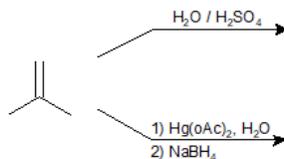


(b)

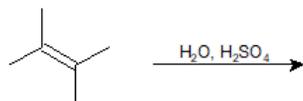


### ADDITION OF WATER: HYDRATION OF ALKENES

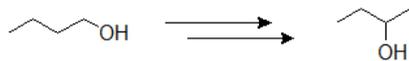
9-5 Identify the product of the following reactions.



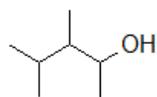
9-6 Identify the product of the following reaction.



9-7 Propose a plausible route of synthesis for the following product starting with 1-butanol.



9-8 Which of the following alkenes can be used to obtain 3,4-dimethylpentan-2-ol through a hydration reaction using dilute acid?



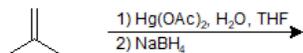
- (2Z)-3,4-dimethylpent-2-ene
- 3,4-dimethylpent-1-ene
- 2,3,4-trimethylpent-2-ene
- 2,4-dimethyl-3-methylidenepentane

## HYDRATION BY OXYMERCURATION-DEMERCURATION

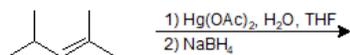
9-9 Explain why hydration of an alkene by Oxymercuration-Demercuration gives the Markovnikov product.

9-10 Identify the products of the following reactions.

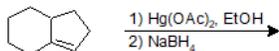
(a)



(b)



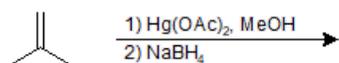
9-11 Identify the product of the following reaction.



9-12 Propose a possible route of synthesis for the following ether starting with 2-ethylbutan-1-ol.



9-13 Give the IUPAC name of the product of the following reaction.

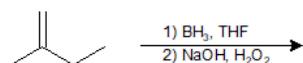


- a) 2-methylpropan-2-ol
- b) 2,2-dimethylbutane
- c) 2-methoxy-2-methylpropane
- d) 1,1-dimethylcyclopropane

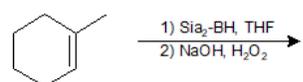
## HYDROBORATION OF ALKENES

9-14 Identify the products of the following reactions.

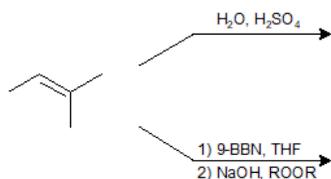
(a)



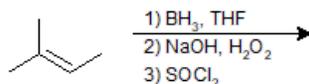
(b)



9-15 Identify the products of the following reactions.



9-16 Give the IUPAC name for the product of the following reaction.



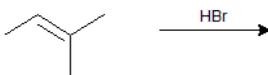
## ADDITION OF HALOGENS TO ALKENES

9-17 Identify the products of the following reactions.

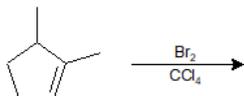
(a)



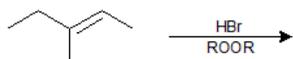
(b)



9-18 Identify the product of the following reaction.

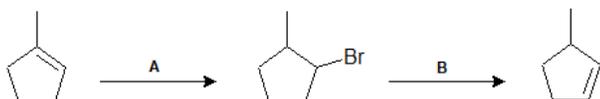


9-19 What is the product of the following reaction?



- a) (2Z)-2-bromo-3-methylpent-2-ene
- b) 2-bromo-3-methylpentane
- c) 2,3-dibromo-3-methylpentane
- d) (2E)-4-bromo-3-methylpent-2-ene

9-20 What reagents can be used in each step to obtain the following products?



9-21 Explain why you do not obtain a mixture of cis- and trans-brominated products when you react  $\text{Br}_2/\text{CCl}_4$  with cyclopentene.

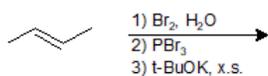
## FORMATION OF HALOHYDRINS

9-22 Identify the product of the following reaction, making sure to include stereochemistry.

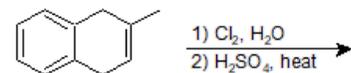


9-23 Draw the mechanism of the reaction in the previous problem (9-22).

9-24 Give the IUPAC name for the product of the following reaction.



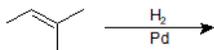
9-25 Identify the product of the following reaction.



## CATALYTIC HYDROGENATION OF ALKENES

9-26 Identify the products of the following reactions.

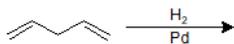
(a)



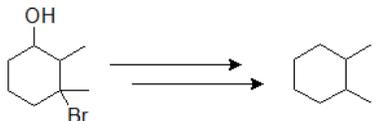
(b)



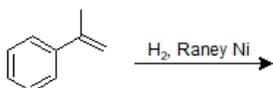
(c)



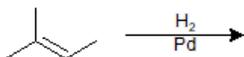
9-27 Suggest a possible route of synthesis, that includes a catalytic hydrogenation step, to obtain the following product.



9-28 Identify the product of the following reaction.

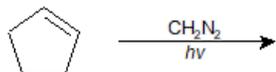


9-29 Identify the product of the following reaction, making sure to include stereochemistry.

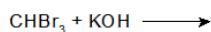


## ADDITION OF CARBENES TO ALKENES

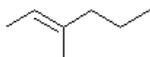
9-30 Identify the product of the following reaction.



9-31 Identify the product(s) of the following reaction.



9-32 Identify the product of the reaction when (2E)-3-methylhex-2-ene reacts with the carbene product from the previous problem (9-31), then reacts with Br<sub>2</sub> and hv.

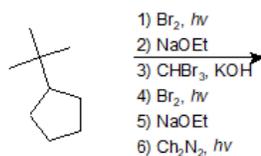


(2E)-3-methylhex-2-ene

9-33 Propose a possible route of synthesis for the following reaction.

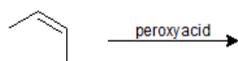


9-34 Identify the product of the following reaction.



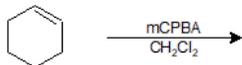
## EPOXIDATION OF ALKENES AND ACID-CATALYZED OPENING OF EPOXIDES

9-35 Identify the product of the following reaction.

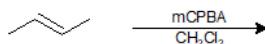


9-36 Identify the product of the following reactions, specifying stereochemistry where appropriate.

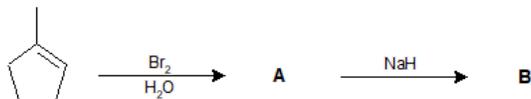
(a)



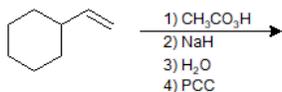
(b)



9-37 Identify the products of the following reaction, including stereochemistry.

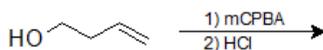


9-38 What is the product of the following reaction?



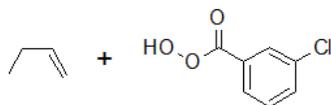
- a) benzoic acid
- b) 1-cyclohexylethan-1-ol
- c) 1-cyclohexylethan-1-one
- d) cyclohexanol

9-39 What is the product of the following reaction?



- a) 4-chlorobutane-1,3-diol
- b) 3-chlorobutan-1-ol
- c) 2-chlorobutane-1,4-diol
- d) 2,4-dichlorobutan-1-ol

9-40 Draw the arrows for the following epoxidation reaction to show the movement of electrons.



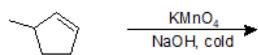
## SYN DIHYDROXYLATION OF ALKENES

9-41 Identify the product of the following reaction, including stereochemistry.

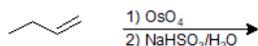
(a)



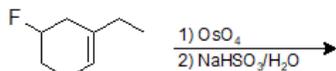
(b)



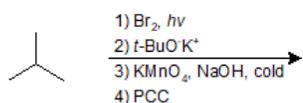
(c)



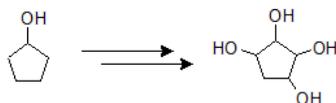
9-42 Give the IUPAC name for the product(s) of the following reaction. Include stereochemistry.



9-43 Identify the product of the following reaction.



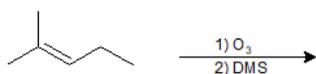
9-44 Suggest a possible route of synthesis for the following compound starting with cyclopentanol.



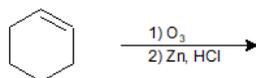
## OXIDATIVE CLEAVAGE OF ALKENES

9-45 Identify the products of the following reactions.

(a)

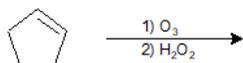


(b)



9-46 Identify the products of the following reactions.

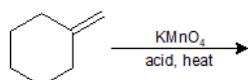
(a)



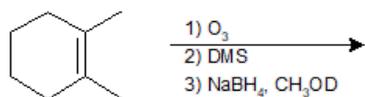
(b)



(c)

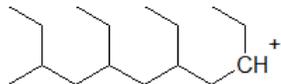


9-47 Identify the product of the following reaction.



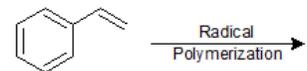
## POLYMERIZATION OF ALKENES

**9-48** Identify the alkene monomer that composes the following polymer.



**9-49** Draw the mechanism for the acid catalyzed formation of the polymer in the previous problem (**9-48**).

**9-50** Draw the resulting polymer of the following reaction. Draw the chain four monomers in length.




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