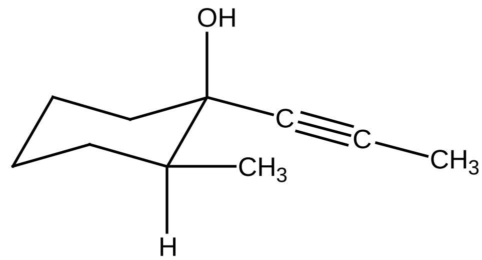
Organic Chemistry Practice Problems

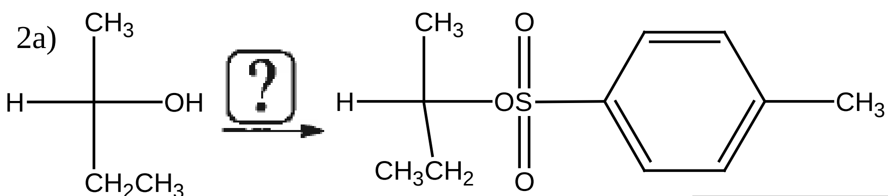
Organic Chemistry I Practice Set #11 (Chapters 8-10 – Carey)

1) For the following compound, provide a name. Be sure to identify stereoisomers properly.

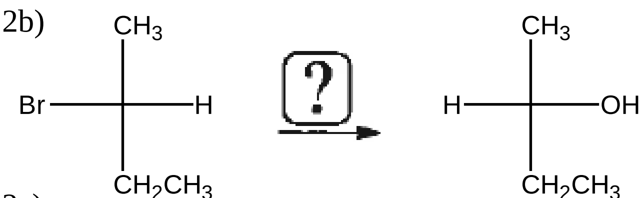


2) Fill in what is missing. Either give all of the missing reagents to complete the reaction or give a structural formula for the ***major organic product(s).*** Show stereoisomers properly if necessary. If no reaction occurs, write ***N.R. If the product is a racemic mixture, show both structures.***

2a)



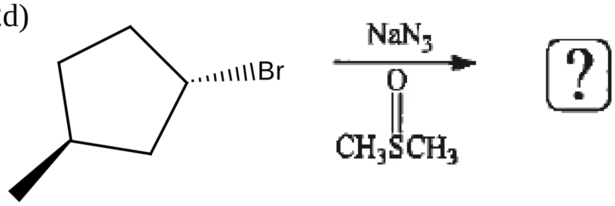
2b)



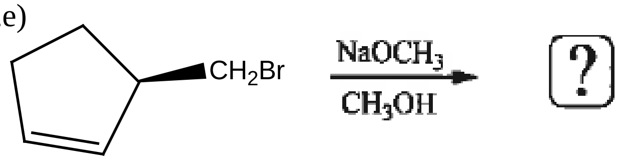
2c)

$CH_3CH_2C{\equiv}CCH_2CH_3 \xrightarrow[H_2O]{HgSO_4,\ H_2SO_4}$?

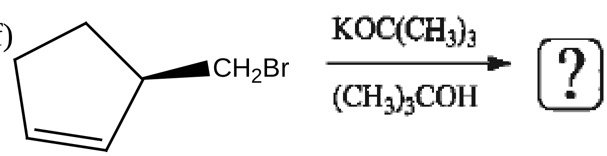
2d)



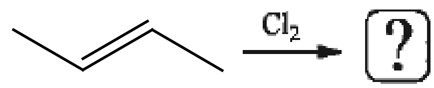
2e)



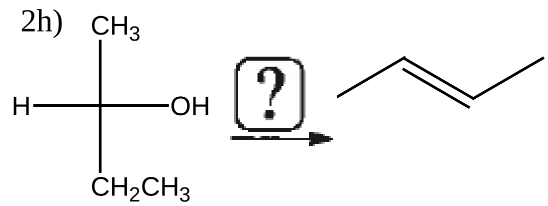
2f)



2g)

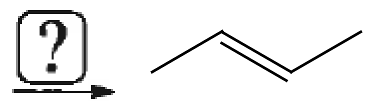


2h)



2i)

$CH_3C{\equiv}CCH_3$

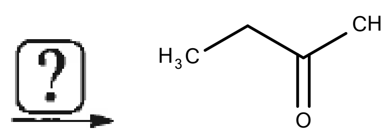


2j)

$CH_3C{\equiv}CCH_3 \xrightarrow{1\ eq.\ Br_2}$?

2k)

$CH_3CH_2C{\equiv}CH$



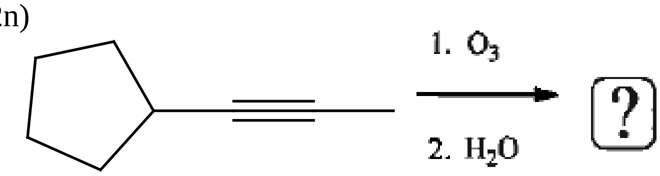
2l)

$CH_3C{\equiv}CCH_3 \xrightarrow{2\ eq.\ HCl}$?

2m)

$CH_3C{\equiv}CCH_3 \xrightarrow{1\ eq.\ HCl}$?

2n)



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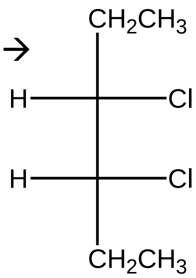
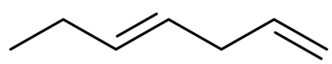
Organic Chemistry Practice Problems

3) Provide an efficient multistep synthesis for each of the following conversions of the given starting material into product. For each transformation, give all necessary reagents and catalysts and give a structural formula of the organic product. Show stereochemistry appropriately when necessary.

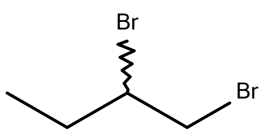
a) $CH_3CH_2C{\equiv}CH$ →



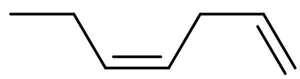
b) $CH_3CH_2CH_2CHBr_2$ →



c)

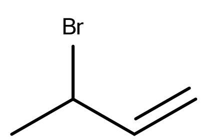


→



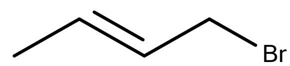
4) Using arrows to show the flow of electrons, write a stepwise mechanism for the reaction shown below. For your mechanism, concisely explain why ***X = 81% yield and Y = 19% yield when the reaction is performed at -80 ℃*** and why ***X = 44% yield and Y = 56% yield when the reaction is performed at room temperature (25 ℃)***.

$H_2C{=}CHCH{=}CH_2$ + HBr →



X

\+



Y

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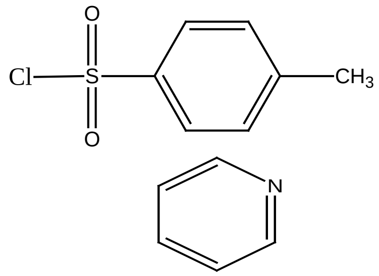
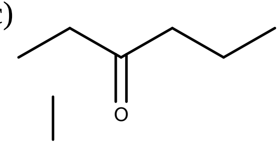
Organic Chemistry I Answers to Practice Set #11 (Chapters 8-10 – Carey)

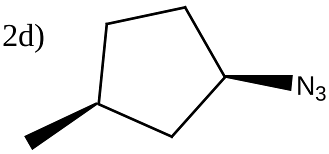
1) (1R,2S)-2-methyl-1-propynylcyclohexanol

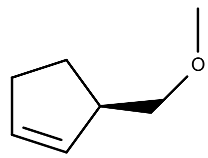
2a) 

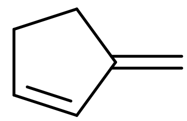
pyridine

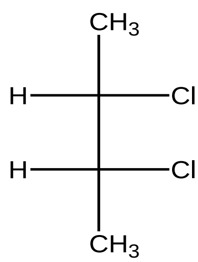
2b) PBr_3

2c) 

2d) 

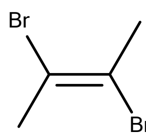
2e) 

2f) 

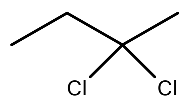
2g) 

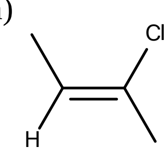
2h) H_2SO_4, heat

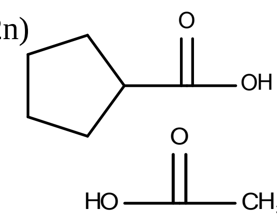
2i) Na, NH_3

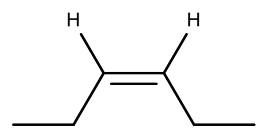
2j) 

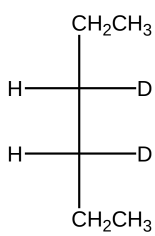
2k) H_2O, H_2SO_4, $HgSO_4$

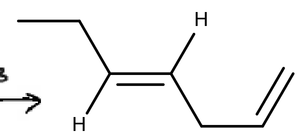
2l) 

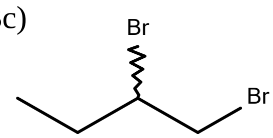
2m) 

2n) 

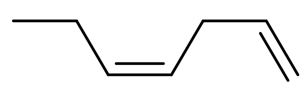
3a) $CH_3CH_2C{\equiv}CH \xrightarrow[\text{2. } CH_3CH_2Br]{\text{1. } NaNH_2,\ NH_3} CH_3CH_2C{\equiv}CCH_2CH_3 \xrightarrow[\text{Lindlar Pd}]{H_2}$ 

$\xrightarrow[\text{Pt}]{D_2}$ 

3b) $CH_3CH_2CH_2CHBr_2 \xrightarrow[\text{2. } BrCH_2CH{=}CH_2]{\text{1. 3 eq. } NaNH_2,\ NH_3} CH_3CH_2C{\equiv}CCH_2CH{=}CH_2 \xrightarrow{Na,\ NH_3}$ 

3c) 

$\xrightarrow[\text{2. } BrCH_2CH{=}CH_2]{\text{1. 3 eq. } NaNH_2,\ NH_3} CH_3CH_2C{\equiv}CCH_2CH{=}CH_2 \xrightarrow[\text{Lindlar Pd}]{H_2}$



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(4) a) $H_2C{=}CH{-}CH{=}CH_2 + H{-}\ddot{B}r\!: \longrightarrow [H_2C{=}CH{-}\overset{\oplus}{C}H{-}CH_3 \leftrightarrow H_2\overset{\oplus}{C}{-}CH{=}CH{-}CH_3]\ :\ddot{B}r^{\ominus}$

There is more $\delta^{\oplus}$ on the 2° C than the 1° C.

At -80°C, 1,2-addition is favored; the reaction is kinetically controlled.

b) $H_2C{=}CH{-}\overset{\oplus}{C}H{-}CH_3 + :\ddot{B}r:^{\ominus} \longrightarrow H_2C{=}CH{-}CH(Br){-}CH_3$

X - major product @ -80°C

At 25°C, conjugate 1,4 is favored; the reaction is thermodynamically controlled.
The double bond in Y is 1,2-disubstituted and therefore alkene Y is thermodynamically more stable than alkene X which has a monosubstituted double bond.

c) $H_2\overset{\oplus}{C}{-}CH{=}CHCH_3 + :\ddot{B}r:^{\ominus} \longrightarrow H_2C(Br)CH{=}CHCH_3$

Y