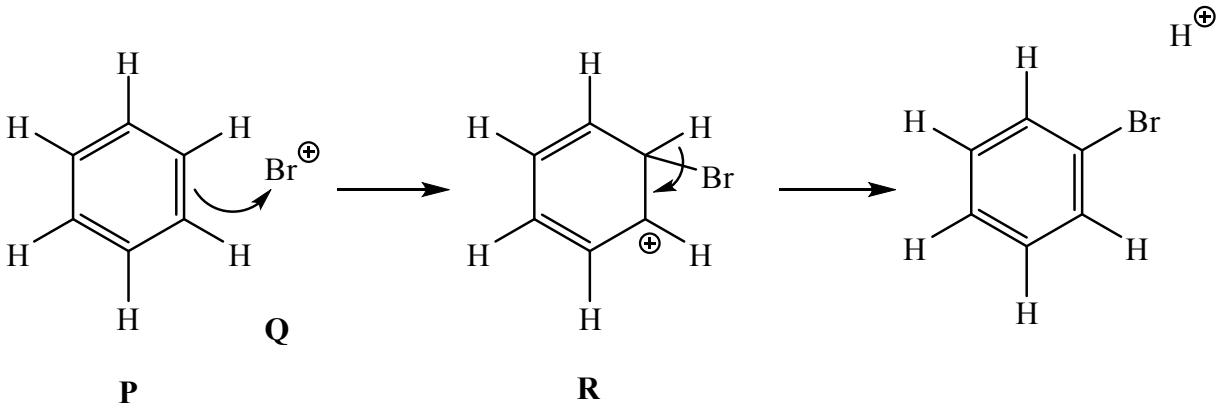
CHEM1102 Answers to Problem Sheet 3

1. Consider the reaction below:



(a) **The Br^+ ion, Q, is attracted to the π electrons of the benzene ring.**

(b) **P is aromatic. The aromaticity is lost in R.**

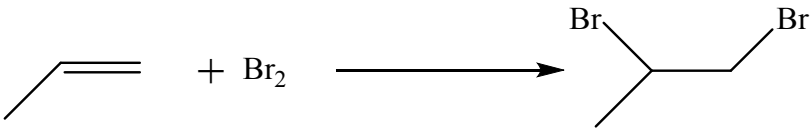
(c) **R has a positive charge on carbon and so is a carbocation.**

(d) **See diagram.**

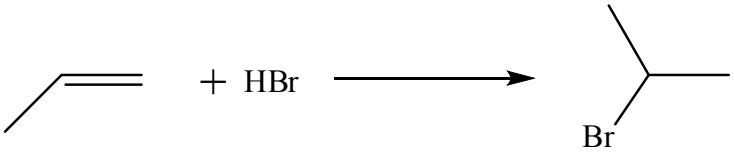
(e) **The reaction involves *electrophilic* attack on carbon resulting in *substitution* of H^+ by Br^+: the reaction is an electrophilic substitution.**

2.

(a)

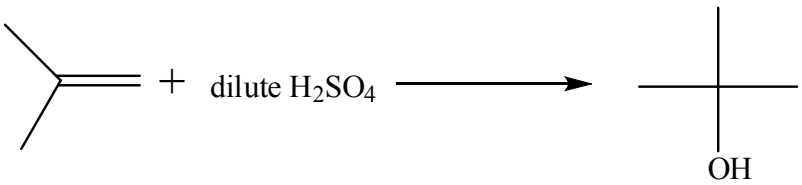


(b)



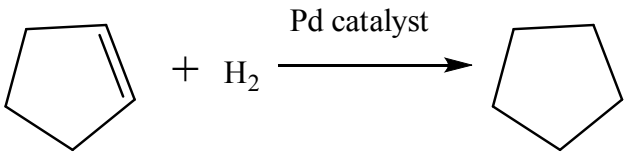
Markovnikov addition - H becomes attached to carbon with fewer alkyl groups attached.

(c)

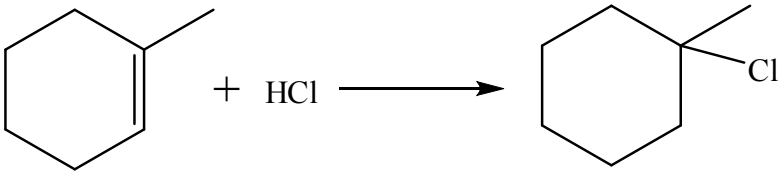


Markovnikov addition - H becomes attached to carbon with fewer alkyl groups attached.

(d)

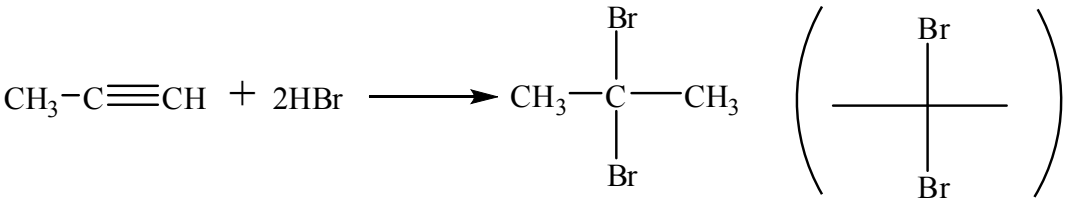


(e)



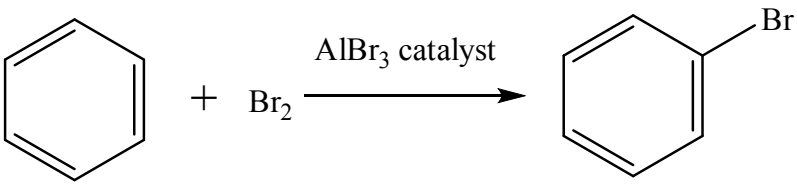
Markovnikov addition - H becomes attached to carbon with fewer alkyl groups attached.

(f)

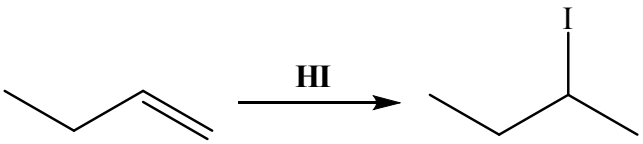


Markovnikov addition *twice* - each time H becomes attached to carbon with fewer alkyl groups attached.

(g)



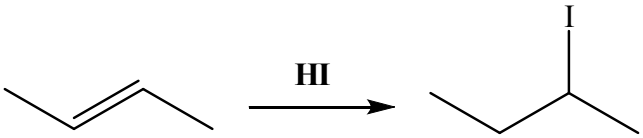
3.



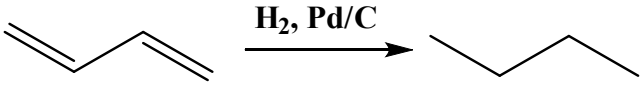
(a)

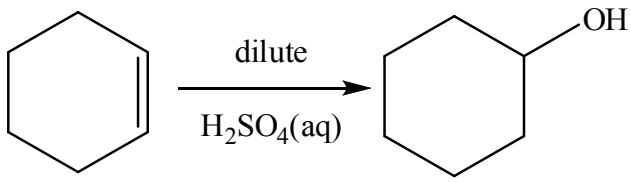
Markovnikov addition - H becomes attached to the carbon with fewer alkyl groups attached

(b)



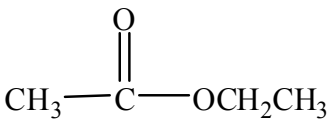
(c)



(d) 

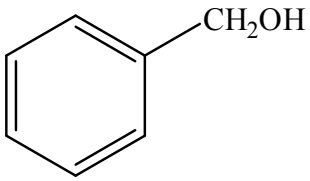
4. **The compound is $C_2H_6N_2$. Molar masses: C_3H_6O 58.042 g mol^{-1}, C_4H_{10} 58.078 g mol^{-1}, $C_2H_6N_2$ 58.053 g mol^{-1}**

5.



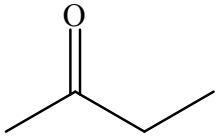
A

$C_4H_8O_2$ m/z = 88



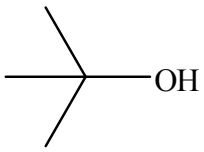
B

C_7H_8O m/z = 108



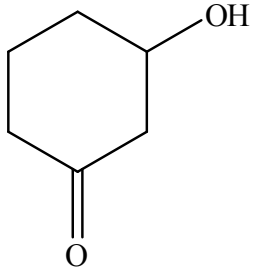
C

C_4H_8O m/z = 72



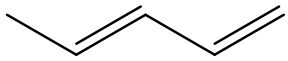
D

$C_4H_{10}O_2$ m/z = 74



E

$C_6H_{10}O_2$ m/z = 114



F

C_5H_8 m/z = 68

(a) **D will give a molecular ion at m/z = 74 in the mass spectrum**

(b) **B and F will show strong absorption in the UV spectrum, as both have conjugated (i.e. adjacent) π bonds**

(c) **A, C and E will show absorption around 1700 cm^{-1} in the infrared spectrum, as all have carbonyl groups**

(d) **B, D and E will show absorption around 3500 cm^{-1} in the infrared region, as all have OH groups**

(e) **F will *not* show absorption either around 1700 or 3500 cm^{-1} in the infrared region, as it has no carbonyl or OH group**

See the 'Organic Spectroscopy' website for more information and practice: https://scilearn.sydney.edu.au/OrganicSpectroscopy/