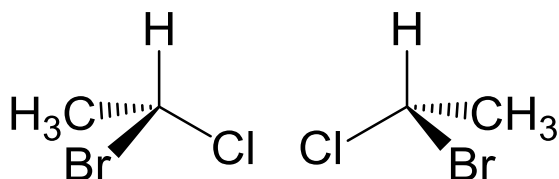


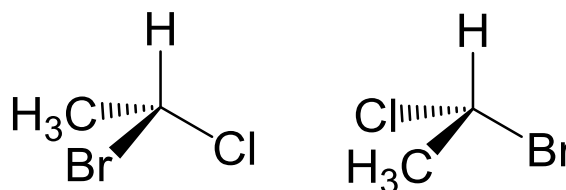
## Chem 1105-2015 Summer Problem Set #1

1. How many dimethylcyclobutane molecules are there? Name them.
2. Draw the line notation for the following compounds and if a stereocenter is present, mark it with an asterisk: a) 3-methyl-1-pentene; b) 4-methyl-1-pentene
3. Determine if the following pairs are the same molecules or enantiomers.

a)



b)

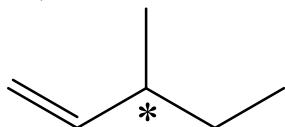


4. Which of the following compounds exhibit geometric isomerism? Draw and name the isomers in each case: a) propene; b) 3-hexene; c) 1,1-dichloroethene; d) 1,2-dichloroethene
5. Butylated hydroxytoluene(BHT) is a common preservative added to cereals and other dry foods. Its systematic name is 1-hydroxy-2,6-di-tert-butyl-4-methylbenzene(where “tert-butyl” is 1,1-dimethylethyl). Draw the structure of BHT.
6. Draw and name all the constitutional isomers of dichlorobenzene.
7. Draw and name all amines with the formula  $C_4H_{11}N$ .
- 8.a) What feature(s) in their IR spectra would be used to distinguish between acetic acid,  $CH_3COOH$ , and methyl acetate,  $CH_3COOCH_3$ ?
- b) State the number of absorptions or signals observed in the  $^1H$ -NMR spectrum and  $^{13}C$ -NMR spectrum of BHT or 1-hydroxy-2,6-di-tert-butyl-4-methylbenzene(where “tert-butyl” is 1,1-dimethylethyl).
9. Write equations for the following: a) an addition reaction between  $H_2O$  and 3-hexene( $H^+$  is a catalyst); b) an elimination reaction between 2-bromopropane and hot potassium ethoxide,  $CH_3-CH_2-OK$ (KBr and ethanol are also products); c) a light induced substitution reaction between  $Cl_2$  and ethane to form 1,1-dichloroethane.
10. Draw the structure of the products for the following reactions:
  - a) The  $S_N2$  reaction of cyanide ion with 2-chlorooctane.
  - b) The reaction of cyclopropyllithium with 3,3-dimethyl-2-butanone after treatment with water.
11. Is the organic reactant oxidized, reduced, or neither in each of the following reactions?
  - a) 2-hexene in the presence of  $KMnO_4$  is converted to 2,3-dihydroxyhexane
  - b) cyclohexane in the presence of light/heat and catalyst produces benzene and hydrogen

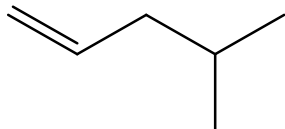
**Answer Set for Chem 1105-2015 Summer Problem Set #1**

1. 3: 1,1-dimethylcyclobutane, 1,2-dimethylcyclobutane , and 1,3-dimethylcyclobutane

2.a)



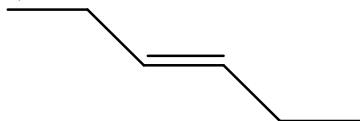
b) No stereocenter



3.a) enantiomers; b) same molecule

4.a) no geometric isomers

b) trans-3-hexene

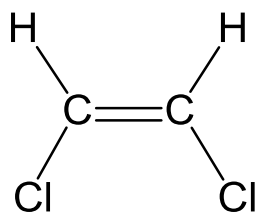


cis-3-hexene

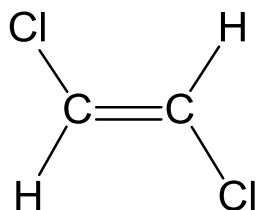


c) no geometric isomers

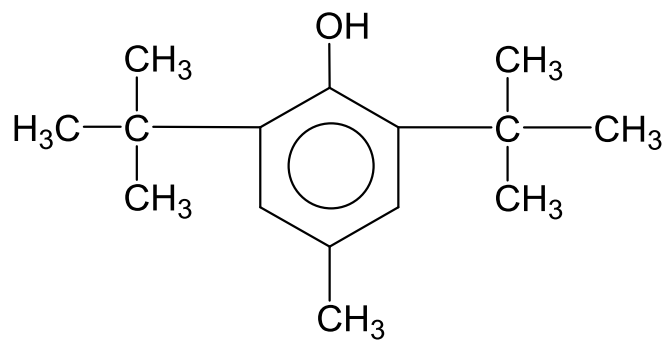
d) cis-1,2-dichloroethene



trans-1,2-dichloroethene

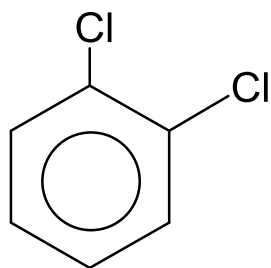


5.

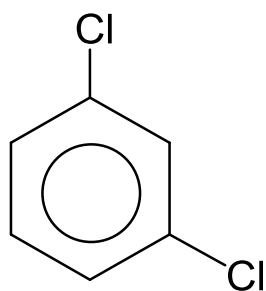


butyated hydroxytoluene  
BHT

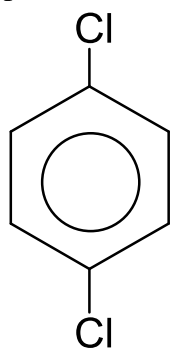
6. o-dichlorobenzene



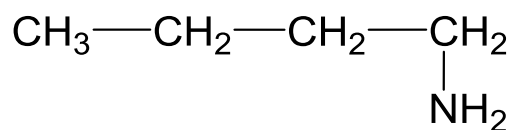
m-dichlorobenzene



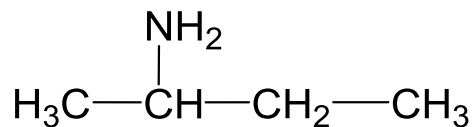
p-dichlorobenzene



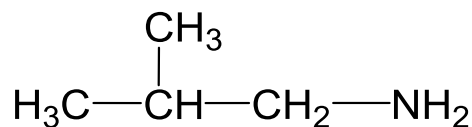
7. 1-butanamine



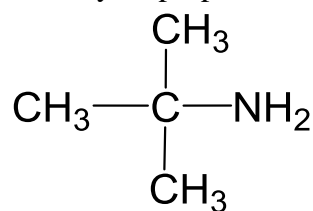
2-butanamine



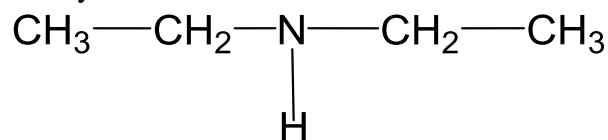
2-methyl-1-propanamine



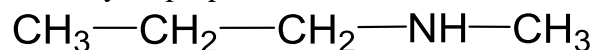
2-methyl-2-propanamine



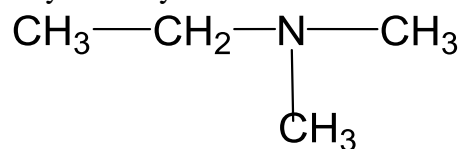
Diethylamine



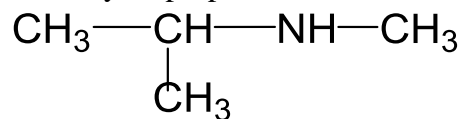
N-methyl-1-propanamine



ethyl dimethylamine



N-methyl-2-propanamine



8.a) Acetic acid would show a broad OH peak around  $3200 - 3600\text{ cm}^{-1}$  while methyl acetate would not.

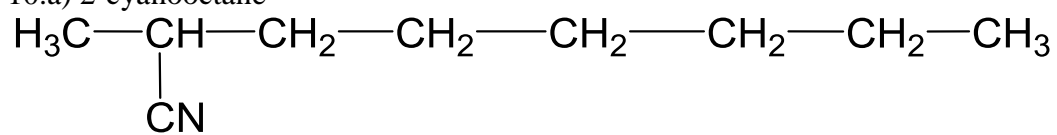
b)  $^1\text{H-NMR}$ : 4;  $^{13}\text{C-NMR}$ : 7

9.a)  $\text{CH}_3\text{CH}_2\text{CH=CHCH}_2\text{CH}_3 + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CH(OH)CH}_2\text{CH}_3$

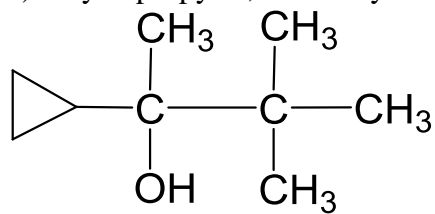
b)  $\text{CH}_3\text{CHBrCH}_3 + \text{CH}_3\text{CH}_2\text{OK} \rightarrow \text{CH}_3\text{CH=CH}_2 + \text{CH}_3\text{CH}_2\text{OH} + \text{KBr}$

c)  $\text{CH}_3\text{CH}_3 + 2\text{Cl}_2 \rightarrow \text{CHCl}_2\text{CH}_3 + 2\text{HCl}$

10.a) 2-cyanoctane



b) 2-cyclopropyl-3,3-dimethyl-2-butanol



11.a) oxidized; b) oxidized