

**CHEM-1110****ORGANIC CHEMISTRY- II**

1. Draw the structures of all the monochloro derivatives of isopropylcyclobutane. Are any structures capable of exhibiting cis-trans isomerism or optical isomerism.
2. Draw the structures for the four structural isomers of  $C_5H_{10}O$  that contain a **four-membered** cyclic ring and an **alcohol functional group**. Indicate which structures can have cis-trans isomers and which can have optical isomers.
3. Using the formula  $C_7H_{12}O$ , provide structures to satisfy each of the following requirements.
  - a) a compound which will react with Na and  $H_2/Pd$ .
  - b) a compound which will react with  $KMnO_4$  but not Na.
  - c) a compound which will react with  $H_2/Pd$  but not  $KMnO_4$ .
4. Draw the structural formula for an unsaturated alkyl chloride of molecular formula  $C_5H_9Cl$  that shows
  - a) neither cis-trans (geometric) nor optical isomers.
  - b) both cis-trans and optical isomers. Mark chiral C with a star.
  - c) cis-trans but not optical isomers.
  - d) optical but not cis-trans isomers. Mark chiral C with a star.
5. Using the molecular formula  $C_4H_8O$ , provide a structure to satisfy each of the following requirements.
  - a) reacts with Na, but not with  $KMnO_4$ .
  - b) reacts with  $KMnO_4$ , but not with Na.
  - c) reacts with  $H_2/Pd$  and Na.
  - d) reacts with  $H_2/Pd$ , but not with  $KMnO_4$ .
  - e) does not react with any of  $H_2/Pd$ , Na, or  $KMnO_4$

6. Using any reagents, show how the following syntheses can be carried out.
- 2-bromopropane from 1-propanol
  - ethyl acetate from ethanol
  - isopropyl propanoate from 1-propanol
  - chloromethylbenzene from benzene
  - benzoic acid from benzene.
7.  $C_5H_{12}O$ , an organic compound, on gentle oxidation is converted into a compound of formula  $C_5H_{10}O$ . This new compound gives a positive Brady's test and also a positive test with Tollens reagent. Draw two or more reasonable structures for the organic compound.
8. There are six structural isomers of  $C_5H_8$  which are cyclic alkenes which do not contain an ethyl group. Provide the structure of the six compounds. No names are necessary.

You are now presented with samples of four of the above compounds in bottles labelled A, B, C, and D but you do not know which compound is in which bottle.

Based on the results of the following reactions with  $KMnO_4$

Compound A formed a dicarboxylic acid (compound E) which contains a chiral carbon atom.

Compound B formed a dicarboxylic acid (compound F) which contained a quaternary,  $4^\circ$ , carbon atom.

Compound C formed a diketone (compound G) which contained no chiral carbon atoms.

Compound D formed compound H which had a carboxylic acid and a ketone and also had a chiral carbon atom.

Identify compounds A, B, C, and D and the compounds formed by them.

9. In the dichlorination of propane four products with the formula  $C_3H_6Cl_2$  were isolated and labeled **A**, **B**, **C**, and **D**. Each was separated and further chlorinated to give one or more trichlorinated propanes,  $C_3H_5Cl_3$ . **A** and **B** gave three, **C** gave one and **D** gave two. One of the products from **A** was

- identical with the product from **C**. Give the structures for dichlorinated compounds.
10. Draw structures of all the dibromination products of cyclopentane. Which are capable of having cis-trans isomers and which are capable of having optical isomers. Label all chiral carbons with a star.
  11. Give the structures of the three alkenes formed when 1-phenyl-2-propanol is heated with conc.  $\text{H}_2\text{SO}_4$ .
  12. Give the structures for all the aldehydes and ketones that have the molecular formula  $\text{C}_6\text{H}_{12}\text{O}$ . Are any structures capable of having optical isomers? Label chiral carbons with a star.
  13. Write the structure of
    - a) an alkene that on oxidation with hot and conc.  $\text{KMnO}_4$  would yield butanone and butanoic acid.
    - b) an alkene that on oxidation with hot and conc.  $\text{KMnO}_4$  would yield 2-pentanone and  $\text{CO}_2$ .
  14. Write the structure of
    - a) an alkane,  $\text{C}_6\text{H}_{14}$ , that has no secondary H atoms.
    - b) an alkane of molar mass 72 that on chlorination would yield only one monochloro product.
    - c) an alkane of formula  $\text{C}_8\text{H}_{18}$  that would yield only one monochloro product on chlorination.
    - d) An alkane of molar mass of 86 that would yield two monochloro derivatives.
  15. Each of two compounds **A** and **B** has the formula  $\text{C}_8\text{H}_{10}$ . After vigorous oxidation with hot and conc.  $\text{KMnO}_4$ , compound **A** yields benzoic acid; under the same conditions compound **B** yields 1,2 dicarboxybenzene (phthalic acid). Draw the structures for **A** and **B**.