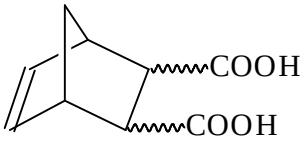
PROBLEM 7

Stereochemistry of organic compounds can sometimes be determined by studying their chemical behavior. The stereochemical configuration of one of the isomers of 5-nonbornene-2,3-dicarboxilyc acids (compound **X**)



(no stereochemistry is shown) was established by the following experiments.

On heating this substance decomposes producing water and a new compound **Y**.
Compound **Y** slowly dissolves in excess of aqueous NaOH with the formation of product $\mathbf{X_1}$ same to that is formed in the reaction of **X** with NaOH.
The resulting solution of $\mathbf{X_1}$ is treated by I_2 to give compounds containing iodine.
Acidification of the solution leads to a mixture of two isomeric compounds, **A** and **B** in the 3:1 ratio.
The titration of 0.3913 *g* of compound **A** by 0.1000 M aqueous solution of NaOH in the presence of phenolphthalein takes 12.70 *ml* of alkali.
The same amount of 0.1000 M solution of NaOH is required for the titration of 0.3913 *g* of compound **B**.
On heating compound **A** slowly transforms into compound **C**, which contains no iodine and is able to react with water.
Under the same conditions compound **B** does not undergo this transformation, but on heating with hydrochloric acid slowly transforms into **A**.

All reactions must be written as balance equations. No mechanisms is required.

1. *Mark by asterisks (*) the asymmetric carbon atoms in the structure of 5-nonbornene-2,3-dicarboxilyc acids.*
2. *Draw the stereochemical formulas of all stereoisomers of compound **X**, and the structures of products of their dehydration in those cases when it is possible.*
3. *Write the reactions of NaOH with a stereoisomer of **X** and a stereoisomer of **Y**.*
4. *Calculate the molecular mass of compound **A**. Write the reactions leading from $\mathbf{X_1}$ to **A**.*
5. *Write the reaction of the formation of **C** from **A** and the reaction of **C** with water.*
6. *Draw the stereochemical formula of compound **X**, which satisfies all of the data given in the problem.*
7. *Write the reactions leading from **B** to **A**.*
8. *Are the compounds **A** and **B** diastereomers?*