

Answer on Question #56653 - Chemistry - Organic Chemistry

Question: Establish the structure of camphor by degradation and synthetic methods.

Answer: Molecular formula of camphor is $C_{10}H_{16}O$.

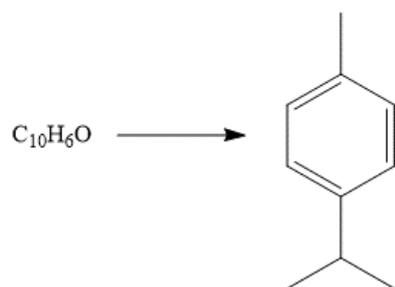
The first step to determine the structure of camphor is to determine the nature of the Oxygen atom. The nature of the Oxygen atom in camphor is found to be ketonic as it forms an oxime with hydroxylamine, and a phenyl hydrazone with phenyl hydrazine.



Camphor when oxidized with nitric acid yields a dicarboxylic acid called camphoric. On reduction with sodium amalgam it gives a secondary alcohol, borneol. Thus the oxo function in camphor is a cyclic ketone.

The molecular formula of the saturated hydrocarbon of camphor ($C_{10}H_{16}O$) corresponds to the general formula of a bicyclic compound (C_nH_{2n-2}).

When distilled with zinc chloride or phosphorous peroxide, it yields p-cymene. The formation of p-cymene confirms the presence of a six-membered ring.

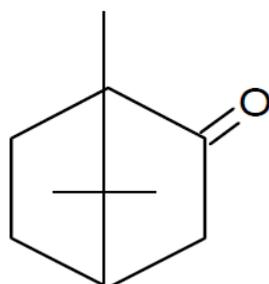


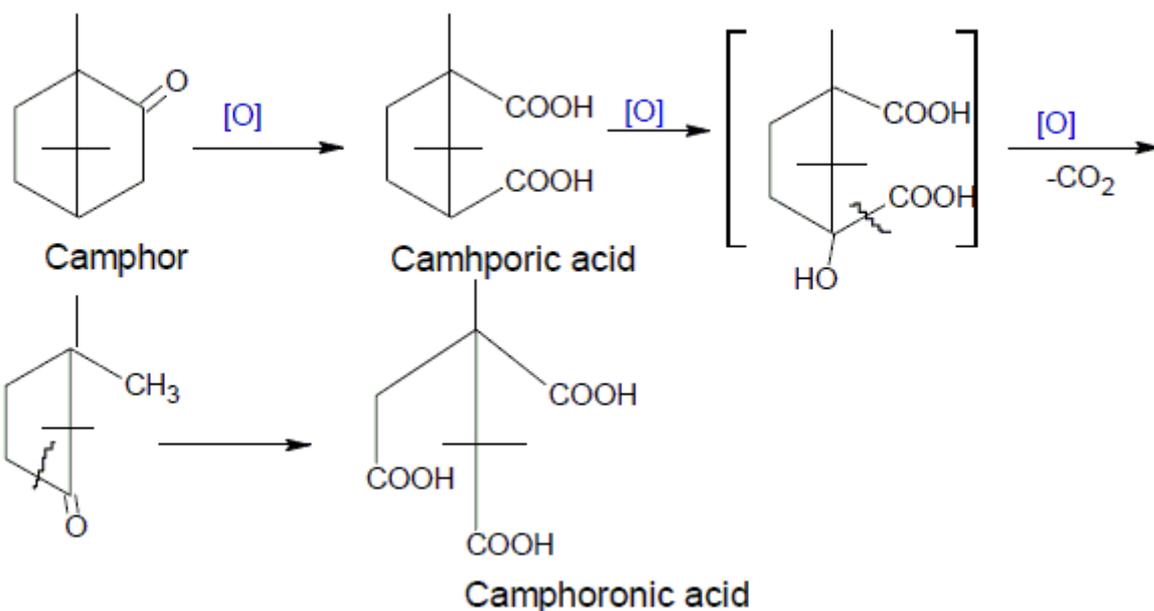
Oxidation of camphor with nitric acid gives camphoric acid $C_{10}H_{16}O_4$, and further oxidation of camphoric acid gives camphoronic acid $C_9H_{14}O_6$.

Camphoric acid is a saturated dicarboxylic acid with the same number of carbon atoms as camphor, it suggests that a keto group is present in one of the rings and the ring containing the keto group is opened in the formation of camphoric acid. Thus camphoric acid should be a monocyclic compound.

Camphoronic acid is a tricarboxylic acid. In order to determine the structure of camphor, the structures of camphoric acid and camphoronic acid should be known.

It is possible if camphor has this structure:





Finally structure was confirmed by the synthesis.

