01 Jan 1971

Conversions From Cyclohexanol: An Undergraduate Laboratory Project

Samir B. Hanna
Missouri University of Science and Technology

James T. Wrobleski

Joseph T. Bohanon

Billy W. Peace

Recommended Citation

S. B. Hanna et al., "Conversions From Cyclohexanol: An Undergraduate Laboratory Project," *Journal of Chemical Education*, vol. 48, no. 8, pp. 556 - 557, American Chemical Society, Jan 1971.
The definitive version is available at https://doi.org/10.1021/ed048p556

Samir B. Hanna,
James T. Wrobleski,
Joseph T. Bohanon,
and **Billy W. Peace**
University of Missouri-Rolla
Rolla, 65401

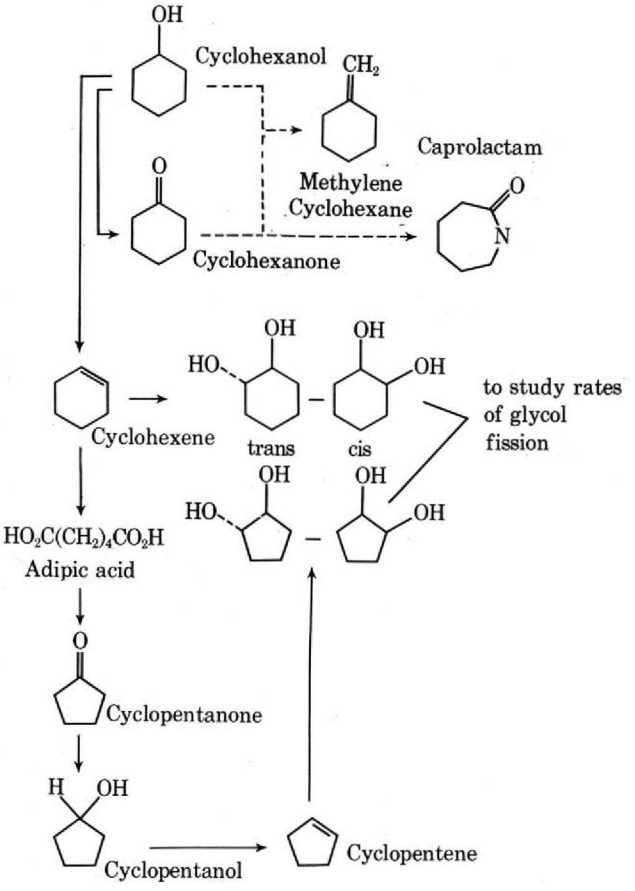
Conversions from Cyclohexanol

An undergraduate laboratory project

The ready availability of cyclohexanol suggested to us the following laboratory project in the second term of the introductory organic course. The required transformations were distributed to the students in chart form (see Figure), with the direction that they develop or choose and adapt from the literature the experimental procedures. The transformations were chosen such that the students develop a sense of continuity in their work and become familiar with a relatively wide variety of synthetic transformations. Principles of ring expansion and contraction, oxidation, stereospecific hydroxylation, reduction, elimination, and condensation are exemplified in this project. Some of the reactions used are shown in the Appendix. Although the physical-organic part of the project, *viz.*, the study of the rates of *cis*- and *trans*-glycol fission, was not accomplished, the project proved stimulating, challenging, and a good introduction to "research-type" problems.

In the process of carrying out the project, the students found it essential to search the literature, become acquainted with the library facilities, and particularly with reference works on synthesis. This was done by the students with minimum direction.

The project required five 5-hr weekly laboratory sessions. At the end of the fourth and the sixth weeks we had informal gatherings to discuss the merit, the difficulties and the relative success of the different chosen



Aims of the group project. Students were not required to follow the indicated pathways, but were encouraged to attempt to complete the synthesis of all compounds.

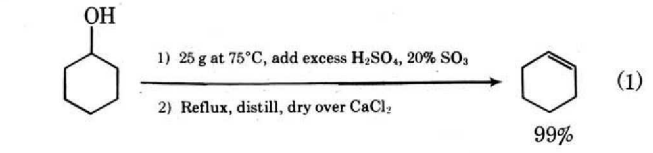
The authors gratefully acknowledge support of this work by National Science Foundation Undergraduate Equipment Grant GY 3514.

[1] Rand, L., Wagner, W., Warner, P. O., and Kovak, L. R., *J. Org. Chem.*, **27**, 1034 (1962).

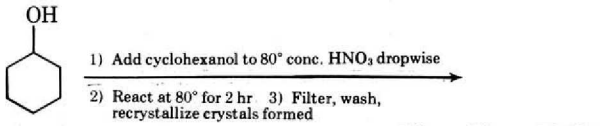
routes. Gas chromatography and infrared spectroscopy were available for purity determination and product identification.

We wish to draw attention particularly to two transformations. In the formation of cyclopentanone from adipic acid, better yields were obtained with the old technique of pyrolyzing the barium salt than with the newly suggested technique[1] of using KF; the latter gave yields varying from 5 to 35%. In the transformation of cyclohexanol to methylene cyclohexane the longer route involving Grignard reagent gave a better yield than the usually chosen Wittig route.

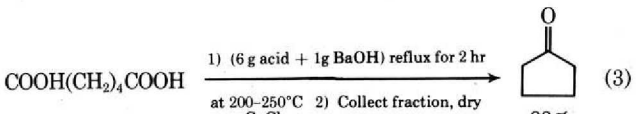
Appendix



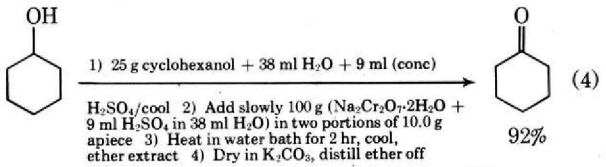
99% (1)



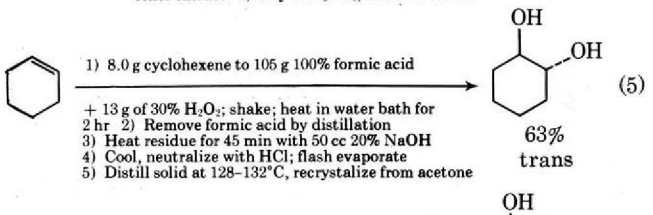
$CH_2—CH_2—COOH$
$CH_2—CH_2—COOH$
90% (2)



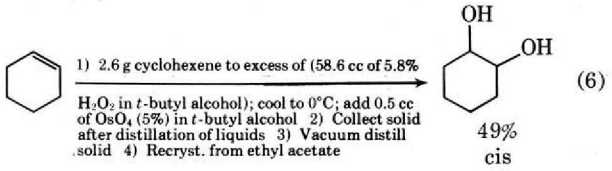
93% (3)



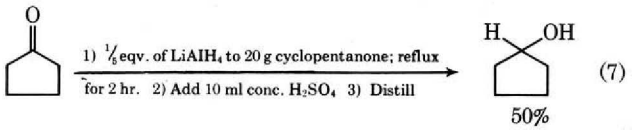
92% (4)



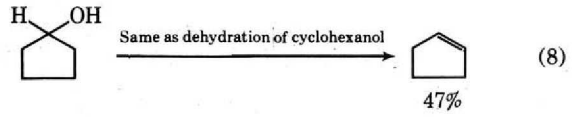
63% trans (5)



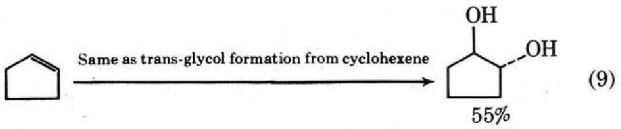
49% cis (6)



50% (7)

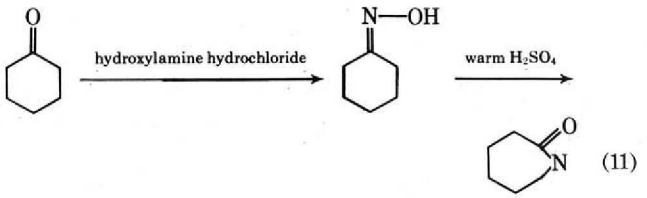


47% (8)

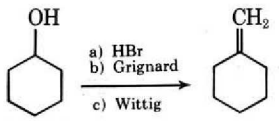


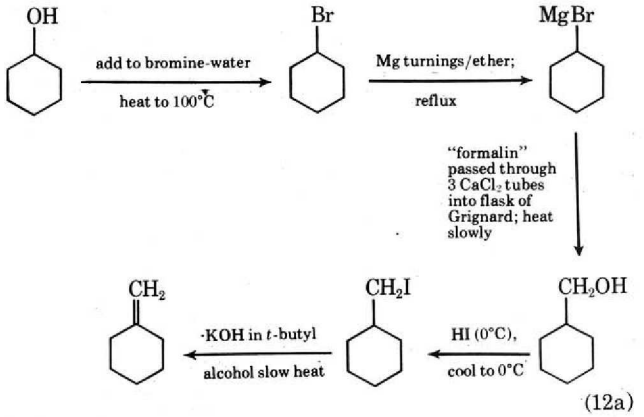
55% trans (9)

0% cis (10)



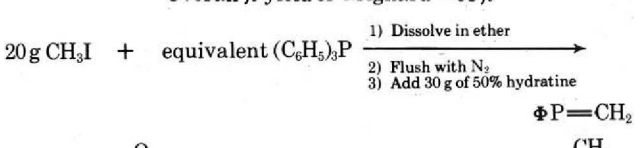
(11)

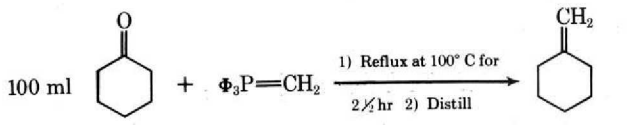




(12a)

Overall % yield of Grignard = 63%





(12b)

Overall % yield of Wittig = 50%