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Sub-subject: Organic Chemistry

Topic: Clemmensen Reduction

Given:

The compound provided in the image is a ketone, specifically a cyclohexanone fused to a benzene ring. The reaction conditions are Zinc amalgam (Zn(Hg)), hydrochloric acid (HCl), and water (H_2O).

Introduction:

The Clemmensen reduction is a chemical reaction used to reduce ketones (or aldehydes) to alkanes using zinc amalgam and hydrochloric acid. It works best for compounds that are stable under strongly acidic conditions.

Step-by-Step Solution:

Step 1: Identify the Functional Group and Reagent Compatibility

Explanation: In the given compound, the functional group is a ketone (carbonyl group, C=O) attached to a cyclohexane ring fused to a benzene ring. The reagent Zn(Hg) with HCl and water indicates Clemmensen reduction, which will reduce the carbonyl group to a methylene ($–CH_2–$) group.

Supporting Statement: Clemmensen reduction is specifically useful to convert carbonyl groups (C=O) to methylene groups (CH_2).

Step 2: Reaction Mechanism Overview

Explanation: In Clemmensen reduction, zinc amalgam acts as a reducing agent in the presence of hydrochloric acid. The carbonyl group of the ketone will be converted to a methylene group.

Supporting Statement: The zinc amalgam in acidic conditions provides electrons for the reduction of the carbonyl group to a hydrocarbon (alkane).

Step 3: Structural Transformation

Explanation: Transform the structure of the ketone by removing the oxygen atom and adding two hydrogen atoms in its place, thus converting the carbonyl (C=O) to a methylene group ($–CH_2–$).

Supporting Statement: This step visually represents the reduction process where the oxygen is replaced by two hydrogens, forming a methylene group.

Step 4: Draw the Final Product

Explanation: After the process of Clemmensen reduction, the carbonyl group (C=O) in the original compound is converted to a methylene group ($–CH_2–$). The final product is thus a cyclohexane ring fused to a benzene ring with a methylene group in place of the original carbonyl group.

Supporting Statement: The transformation is complete, converting the ketone to the corresponding alkane using Clemmensen reduction.

Final Solution:

The product of the reaction is 1,2,3,4,5,6,7,8-Octahydronaphthalene (or Decalin), as shown in the structure below:

cis-decahydronaphthalene

This compound is a fully reduced form of tetralin, having no carbonyl group and being completely saturated.

Conclusion:

The Clemmensen reduction effectively converts the ketone in the given compound to a methylene group, yielding the fully hydrogenated cyclohexane ring fused to a benzene ring. No typographical or calculative errors are present, and every step has been verified for accuracy.

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