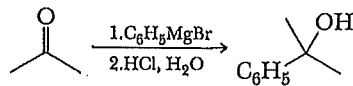
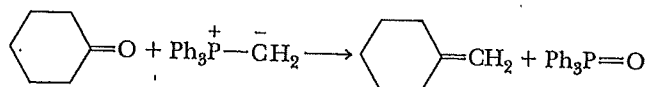


Key Reactions

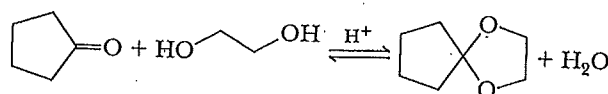
1. **Reaction with Grignard Reagents (Section 16.5A)** Treating formaldehyde with a Grignard reagent followed by hydrolysis gives a primary alcohol. Similar treatment of any other aldehyde gives a secondary alcohol. Treatment of a ketone gives a tertiary alcohol. The mechanism involves an initial attack of the nucleophilic carbon of the Grignard reagent at the electrophilic carbon of the carbonyl to give the alkoxide Mg salt. The flask is opened and the acid is added to protonate the alkoxide, and produce the alcohol.



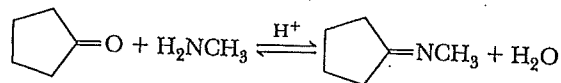
5. **The Wittig Reaction (Section 16.6)** Treating an aldehyde or ketone with a triphenylphosphonium ylide gives a betaine intermediate, which rearranges to an oxaphosphetane intermediate, which in turn fragments to give triphenylphosphine oxide and an alkene.



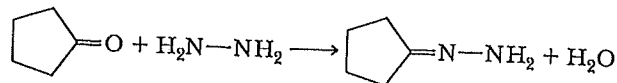
9. **Addition of Alcohols to Form Acetals (Section 16.7B)** Formation of acetals is catalyzed by acid. Acetals are stable to water and aqueous base but are hydrolyzed in aqueous acid. Acetals are valuable as carbonyl-protecting groups. The mechanism for conversion of a hemiacetal to an acetal involves protonation of the OH group of the hemiacetal followed by loss of water to give a resonance-stabilized cation, which is attacked by the second molecule of alcohol.



10. **Addition of Ammonia and Its Derivatives: Formation of Imines (Section 16.8A)** Addition of ammonia or a primary amine to the carbonyl group of an aldehyde or ketone forms a tetrahedral carbonyl addition compound. Loss of water from this intermediate gives an imine. The mechanism for imine formation involves an initial attack of the nucleophilic nitrogen atom on the carbonyl carbon atom, followed by proton transfer to the OH, creating an H₂O group that then departs.

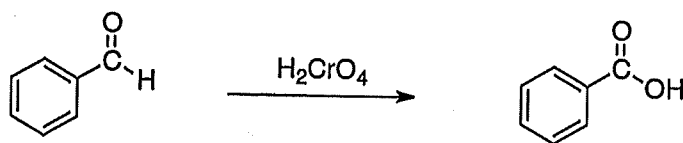


12. **Addition of Hydrazine and Its Derivatives (Section 16.8B)** Treating an aldehyde or ketone with hydrazine gives a hydrazone.



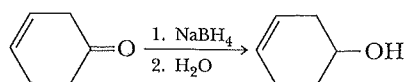
Derivatives of hydrazine react similarly.

14. **Oxidation of an Aldehyde to a Carboxylic Acid (Section 16.10A)** The aldehyde group is among the most easily oxidized functional groups. Oxidizing agents include H₂CrO₄, KMnO₄, Ag₂O, Tollens' reagent, H₂O₂, and O₂.



15. Metal Hydride Reduction (Section 16.11A)

Both LiAlH_4 and NaBH_4 are selective in that neither reduces isolated carbon-carbon double or triple bonds.

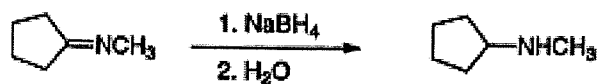


(Formed as a racemic mixture)

17. Reductive Amination (Adapted from Section 16.11A)

secondary amines.

Imines can be reduced to form



or



(Ni can be used instead of Pd)

19. Wolff-Kishner Reduction (Section 16.11E) Formation of a hydrazone followed by treatment with base, commonly KOH in diethylene glycol or potassium *tert*-butoxide in dimethyl sulfoxide, reduces the carbonyl group of an aldehyde or ketone to a methylene group. The mechanism involves initial hydrazone formation, followed by base-catalyzed tautomerization, deprotonation, loss of N_2 , and reprotonation of the carbanion intermediate to give the fully reduced product.



Steps involved in this reaction: Formation of hydrazone followed by elimination of nitrogen.

