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Organic Chemistry: Current Research

Editorial

Reactions of Aldehydes and Ketones

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DESCRIPTION

Aldehydes and ketones go through a number of reactions that result in a range of compounds. Nucleophilic addition reactions are the most prevalent, resulting in the creation of alcohols, alkenes, diols, cyanohydrins (RCH (OH)C & tbond; N), and imines R_2C & dbond; NR.

Because of steric and electrical factors, aldehydes are frequently more reactive toward nucleophilic replacements than ketones. A little hydrogen atom is connected to one side of the carbonyl group in aldehydes, while a bigger R group is attached to the other. R groups, on the other hand, are connected to both sides of the carbonyl group in ketones. As a result, steric hindrance in aldehydes is lower than in ketones.

Addition of Alcohol

Aldehydes contain just one R group to supply electrons to the partly positive carbonyl carbon, whereas ketones have two R groups to offer electrons to the carbonyl carbon. The more electrons provided to the carbonyl carbon, the lower the partial positive charge on this atom becomes, and the weaker it becomes as a nucleus.

Stability of Acetals

Depending on the conditions, aldehydes react with alcohols to form hemiacetals (a functional group made up of one —OH group and one —OR group connected to the same carbon) or acetals (a functional group made up of two —OR groups bonded to the same carbon). The hemiacetal is made by combining the two reactants. When the two reactants are combined with hydrochloric acid, an acetal is formed. Consider the reaction between methanol and ethanol.

Addition of Hydrogen Cyanide

Under acidic conditions, acetal formation reactions are reversible, but not under alkaline conditions. Because of this property, an acetal is an excellent protective group for aldehyde molecules that must undergo further processes. A protective group is a group that is added to a molecule to keep a sensitive group from reacting while another reaction occurs elsewhere in the molecule. The shielding group must be able to quickly retaliate against the original group from which it arose. Protecting an aldehyde group in a molecule so that an ester group can be converted to an alcohol is an example.

A cyanohydrin is formed when hydrogen cyanide is added to a carbonyl group of an aldehyde or most ketones. Ketones that are sterically inhibited, on the other hand, do not undergo this reaction.

Addition of Slides (the Wittig reaction)

Alkenes with unambiguous double bond positions are formed when aldehydes or ketones react with phosphorus slides. Phosphorous slides are made by combining a phosphine with an alkyl halide and then treating them with a base. On nearby atoms, slides contain positive and negative charges.

Addition of Organometallic Reagents

Grignard reagents, organo-lithium compounds, and sodium alkynides react with formaldehyde to make primary alcohols, secondary alcohols from all other aldehydes, and tertiary alcohols from ketones.

Oxidations of Aldehydes and Ketones

Both mild and vigorous oxidising agents can convert aldehydes to carboxylic acid. Ketones, on the other hand, can only be oxidised to diverse compounds with extremely strong oxidising agents. Potassium permanganate ($KMnO_4$) or potassium dichromate ($K_2Cr_2O_7$) in acid solution, as well as Tollens reagent, is common oxidising agents for aldehydes. Peroxy acids such as peroxybenzoic acid are examples of peroxy acids.

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