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Wurtz reaction mechanism pdf

What is wurtz reaction with example. Write note on wurtz reaction. What is wurtz reaction explain with example. Explain the wurtz reaction. What is wurtz reaction.

Reactions >> Name Reactions The Wurtz Coupling is one of the oldest organic reactions, and produces the simple dimer derived from two equivalents of alkyl halides. The intramolecular version of the reaction has also found application in the preparation of strained ring compounds: Using two different alkyl halides will lead to an approximately statistical mixture of products. A more selective unsymmetric modification is possible if starting materials have different rates of reactivity (see Wurtz-Fittig Reaction). Mechanism of the Wurtz Reaction Side products: Wurtz reaction is a coupling reaction which is developed by Charles-Adolphe and used in organic chemistry and organometallic chemistry. Wurtz reaction aids in the industrial preparation of alkanes. The method is used to prepare symmetrical alkanes, it is not used for asymmetrical alkanes. The reaction involves the exchange of halogen and metal with the involvement of radical species R to form a carbon-carbon bond arising in a nucleophilic substitution reaction. Wurtz reaction is one of the first name reactions in organic chemistry. It is a method to synthesize higher alkanes by a reaction between alkyl halides and metallic sodium in the presence of dry ether. Wurtz Reaction Equation The basic Wurtz Reaction The basic Wurtz React reacting methyl bromide with sodium in the presence of anhydrous ether or tetrahydrofuran. The reaction is:2CH3Br + 2Na → C2H6 +2NaBr Here, a large alkane molecule is developed by joining two compounds of alkyl halides are used in the reaction then a combination of three alkanes will be formed. In such a case, if methyl and ethyl iodides are used to react with sodium then a mixture of propane, butane and ethane will be formed, although it's difficult to separate the alkanes from the mixture.

Examples and reaction conditions The reaction is intolerant of a range of functional groups which would be attacked by sodium. For similar reasons, the reaction is conducted in unreactive solvents such as ethers.

Reactions that took place can be written as follows- $2CH3I + 2Na \rightarrow C2H6 + 2NaISo$ Wurtz reaction is not considered for the synthesis of alkanes with the odd number of carbon atoms, as it provides a combination of non-separable alkanes. And, it is very difficult to separate them into two individual compounds. The reaction shows productive results with primary alkyl iodides. The yields can be poor and with alkene contamination. Wurtz reaction Mechanisms have been suggested for performing the Wurtz reaction. First Mechanisms by a formation of free radicals as an intermediate. This mechanism works when the reaction will be performed in the vapour phase is considered a suitable phase for free radicals. The steps taken in the reaction are as follow: Step 1: A transfer of one electron from a sodium atom makes a free radical of alkylR-X + Na \rightarrow R• + Na+X-Step 2: In the second step, the second of unpaired electrons.(Image will be uploaded soon)Second Mechanism: This mechanism uses an organometallic compound as an intermediate and the reaction is performed in a solution. CH3-CH2-I + 2Na • → CH3-CH ethylene.Wurtz Reaction Examples of the Wurtz reaction is given below:Alkyl halide in presence of dry ether medium when treated with sodium metal yields di-alkane.R-X + 2 Na + X-R → R-R + 2 Na-X (Basic reaction)R = alkyl groupX = halogen (F, Cl, Br, I)Dry ether is used to provide anhydrous condition as moisture and sodium metal react strongly in the presence of water.Na + H2O →NaOH + H2This reaction produces NaOH that reacts with an alkyl halide to produce alcohol R-X + OH- →R-OHE.g.: CH3-Cl + Na →CH3-CH3 + NaClLimitations of Wurtz reaction are given below.Methane (CH4) is not prepared by using the Wurtz reaction because the number of carbon atoms is increasing every time in production. The minimum number of carbon atoms for the reaction should be two which does not apply in the case of methane.

That means the lowest alkane developed through the Wurtz reaction is ethane. Oxygen and moisture should not be allowed in the reaction medium, else sodium will be burnt by reacting with water and oxygen. Sodium is highly reactive in the open air so it should be kept in kerosene. Na + H2O →NaOH + H2 (gas)4Na + O2 2Na2OThe Wurtz reaction is restricted to the symmetric alkane's synthesis. It is not applicable for the synthesis of two dissimilar alkyl halides as the product of these could be a combination of alkanes that are not easy to separate. If the reaction is between R-X and R'-X, it gives R-R and R'-R'- it will be difficult to separate the two products. They are not easily separable as they have a very low difference in their boiling points and need a close watch to be distinguished quickly. Due to steric repulsion in alkyl groups, 3R-X does not provide a worthy yield of R-R. The Wurtz coupling method would generally fail when tertiary alkyl halides are used because tertiary alkyl halides include elimination reactions as side reactions. It happened due to steric-hindrance. In the case of the Wurtz reaction, there exists a side reaction using which an alkene product is formed. In case the alkyl halides turn out to be bulky in nature, especially at the halogen end, there is a greater amount of alkene formed. The Wurtz reaction strictly needs anhydrous conditions as it forms an alkyl free radical in the reaction; this free radical is highly basic and can eliminate protons from water. Tetrahydrofuran is considered as a solvent in the

place of ether when aryl and alkyl fluorides, and aryl chlorides are used. Wurtz-Fittig reaction modification in the Wurtz reaction is known as the Wurtz-Fittig reaction. It is a reaction that involves alkyl and aryl halides. This reaction is performed with aryl halides and Na metal in the presence of dry ether to give substituted aromatic compounds. Example of Wurtz-Fittig reaction - (Image will be uploaded soon) Hence, the Wurtz reaction is an important reaction that is used for the preparation of symmetrical alkanes. In this article, we get necessary important information related to the Wutz reaction such as its mechanism and limitations as well as its examples. A reaction in which sodium is reacted with two alkyl halides provided by a solution of dry ether Wurtz reaction Named after Charles Adolphe Wurtz Reaction type Coupling reaction Identifiers Organic Chemistry Portal wurtz-reaction In organic chemistry, the Wurtz reaction, named after Charles Adolphe Wurtz, is a coupling reaction, whereby two alkyl halides are treated with sodium metal to form a higher alkane. 2 R-X+2 Na $\rightarrow R-R+2$ NaX The reaction is of little value except for intramolecular versions. A related reaction, which combines alkyl halides with aryl halides with aryl halides is called the Wurtz-Fittig reaction. [1] Mechanism The reaction proceeds by an initial metal-halogen exchange, which is described with the following idealized stoichiometry: R-X + 2 M - RM + MX This step may involve the intermediacy of radical species R. The conversion resembles the formation of a Grignard reagent. The RM intermediates have been isolated in several cases. The radical is susceptible to diverse reactions. The organometallic intermediate (RM) next reacts with the alkyl halide (RX) forming a new carbon-carbon covalent bond. RM + RX \rightarrow R - R + MX The process resembles an SN2 reaction, but the mechanism is probably complex.

In efforts to improve the reaction yields, other metals have also been tested to effect the Wurtz-like couplings: silver, zinc, iron, activated copper, indium, as well as mixture of manganese and copper chloride. Wurtz-reaction conditions lead to formation of cyclic products, although yields are variable.

R+X + 2Na + X+R dont R-R + 2NaX

C.g. -: CHz + Bx + 2Na + By - CHz - CHz - 2Naby CHz - CHz -

Under Wurtz conditions, vicinal dihalides yield alkenes, whereas geminal dihalides convert to alkynes. Bicyclobutane was prepared this way from 1-bromo-3-chlorocyclobutane in 95% yield. The reaction is conducted in refluxing dioxane, at which temperature, the sodium is liquid.[2] Extensions to main group compounds Although the Wurtz reaction is only of limited value in organic synthesis, analogous couplings are useful for coupling main group halides. Hexamethyldisilane arises efficiently by treatment of trimethylsilyl chloride with sodium: 2 Me3SiCl + 2 Na \rightarrow Me3Si-Similar couplings have been applied to many main group halides. When applied to main group dihalides, rings and polymers result. Polysilanes are produced in this way[3] n Me2SiCl2 + 2n Na → (Me2Si)n + 2n NaCl See also Wurtz-Fittig reaction Ullmann reaction Further reading Adolphe Wurtz (1855). "Sur une nouvelle classe de radicaux

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If mixture of alkyl halides are used then mixture of products are formed .This is formed since intermediates from methyl halide and

ethyl halide are formed

and react with methyl halide and ethyl halide . Both self reaction and cross products are formed leading to mixture of products .

Hence symmetrical alkanes cannot be formed as 100 % products

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