Electrophilic Aromatic Substitution Examples

Aromaticity can also be considered a manifestation of cyclic delocalization and of resonance. This is usually considered to be because electrons are free to cycle around circular arrangements of atoms that are alternately single- and double-bonded to one another. This commonly seen model of aromatic rings, namely the idea that benzene was formed from a six-membered carbon ring with alternating single and double bonds (cyclohexatriene), was developed by Kekulé (see History section below). Each bond may be seen as a hybrid of a single bond and a double bond, every bond in the ring identical to every other. The model for benzene consists of two resonance forms, which corresponds to the double and single bonds superimposing to give rise to six one-and... f02cece52a Burn with a strong sooty yellow flame, due to high C:H ratio f02cece52a The word "aromatic" originates from the past grouping of molecules based on odor, before their general chemical properties were understood. The current definition of aromatic compounds does not have any relation to their odor. Aromatic compounds are now defined as cyclic compounds satisfying Hückel's rule. f02cece52a High carbon-hydrogen ratio f02cece52a

Aromatic compound flame, due to high C:H ratio Undergo electrophilic substitution reactions and nucleophilic aromatic substitutions Arenes are typically split into two categories Aromatic compounds or arenes are organic compounds "with a chemistry typified by benzene" and "cyclically conjugated. " f02cece52a

Typically unreactive f02cece52a The SN1 mechanism is possible but very unfavourable unless the leaving group is an exceptionally good one. It would involve the unaided loss of the leaving group and the formation of an aryl cation. In the SN1 reactions all... f02cece52a Aromatic compounds have the following general properties: f02cece52a

Substitution reaction Substitution reactions in organic chemistry are classified either as electrophilic or nucleophilic depending upon the reagent involved, whether a reactive intermediate involved in the reaction is a carbocation, a carbanion or a free radical, and whether the substrate is aliphatic or aromatic. Electrophiles are involved in electrophilic substitution reactions, particularly in electrophilic aromatic substitutions. It also is helpful for optimizing a reaction with regard to variables such as temperature and choice of solvent. In this example, the benzene ring's electron A substitution reaction (also known as single displacement reaction or single substitution reaction) is a chemical reaction during which one functional group in a compound is replaced by another functional group. Substitution reactions are of prime importance in organic chemistry. Detailed understanding of a reaction type helps to predict the product outcome in a reaction f02cece52a

A few types of aromatic compounds, such as phenol, will react without a catalyst, but for typical benzene derivatives with less reactive substrates, a Lewis acid is required as a catalyst. Typical Lewis acid catalysts include $AlCl_3$, $FeCl_3$, $FeBr_3$ and $ZnCl_2$. These work by forming a highly electrophilic complex which is attacked by the benzene ring. f02cece52a There are many major industrial applications of nitration in the strict sense; the most important by volume are for the production of nitroaromatic compounds such as nitrobenzene. The technology is long-standing and mature. f02cece52a An electron withdrawing group (EWG) will have the opposite effect on the nucleophilicity of the ring. The EWG removes electron density from a π system, making it less reactive in this type of reaction, and therefore called deactivating groups. f02cece52a

Nucleophilic aromatic substitution It follows the general rule for which SN2 reactions occur only at a tetrahedral carbon atom. Aromatic rings are usually nucleophilic, but some aromatic compounds do undergo nucleophilic substitution. The mechanism of SN2 reaction does not occur due to steric hindrance of the benzene ring. In order to attack the C atom, the nucleophile must approach in line with the C-LG (leaving group) bond from the back, where the benzene ring lies. This reaction differs from a common SN2 reaction, because it happens at a trigonal carbon atom (sp2 hybridization). A nucleophilic aromatic substitution (SNAr) is a substitution reaction in organic chemistry in which the nucleophile displaces a good leaving group, such A nucleophilic aromatic substitution (SNAr) is a substitution reaction in organic chemistry in which the nucleophile displaces a good leaving group, such as a halide, on an aromatic ring. Just as normally nucleophilic alkenes can be made to undergo conjugate substitution if they carry electron-withdrawing substituents, so normally nucleophilic aromatic rings also become electrophilic if they have the right substituents f02cece52a

Nitration reactions are notably used for the production of explosives, for example the conversion of guanidine to nitroguanidine and the conversion of toluene to trinitrotoluene (TNT). Nitrations are, however, of wide importance as virtually all aromatic amines (anilines... f02cece52a The most general form of the reaction may be given as the following: f02cece52a == Ortho, meta, and para substitution == f02cece52a An electron donating group (EDG) or electron releasing group (ERG, Z in structural formulas) is an atom or functional group that donates some of its electron density into a conjugated π system via resonance (mesomerism) or inductive effects (or induction)—called +M or +I effects, respectively—thus making the π system more nucleophilic. As a result of these electronic effects, an aromatic ring to which such a group is attached is more likely to participate in electrophilic substitution reaction. EDGs are therefore often known as activating groups, though steric effects can interfere with the reaction. f02cece52a Undergo electrophilic substitution reactions and nucleophilic aromatic substitutions f02cece52a

Electrophilic halogenation chemistry, an electrophilic aromatic halogenation is a type of electrophilic aromatic substitution. This organic reaction is typical of aromatic compounds In organic chemistry, an electrophilic aromatic halogenation is a type of electrophilic aromatic substitution. This organic reaction is typical of aromatic compounds and a very useful method for adding substituents to an aromatic system f02cece52a

EDGs and EWGs also determine the positions (relative to themselves) on the aromatic ring where substitution reactions are most likely... f02cece52a

Aromaticity J. seven years later by J. The earliest use of the term was in an article by August Wilhelm Hofmann in 1855.

There is no general relationship between aromaticity as a chemical property and the olfactory properties of such compounds. Second, he is describing electrophilic aromatic substitution, proceeding (third) through a Wheland intermediate, in which In organic chemistry, aromaticity is a chemical property describing the way in which a conjugated ring of unsaturated bonds, lone pairs, or empty orbitals exhibits a stabilization stronger than would be expected from conjugation alone. Thomson f02cece52a

Nuc f02cece52a Arenes are typically split into two categories - benzoids, that contain a benzene derivative and follow the benzene ring model, and non-benzoids that contain other aromatic cyclic derivatives. Aromatic compounds are commonly used in organic synthesis and are involved in many reaction types, following both additions and removals, as well as saturation and dearomatization. f02cece52a

Arene substitution pattern Trimethylsilyl, tert-butyl, and isopropyl groups can form Arene substitution patterns are part of organic chemistry IUPAC nomenclature and pinpoint the position of substituents other than hydrogen in relation to each other on an aromatic hydrocarbon. the same ring position in an intermediate compound in an electrophilic aromatic substitution f02cece52a

Nitration is strongly affected by substituents on aromatic rings (see electrophilic aromatic substitution). The term also is applied incorrectly to the different process of forming nitrate esters (−ONO2) between alcohols and nitric acid (as occurs in the synthesis of nitroglycerin). For example, nitration of nitrobenzene gives all three In organic chemistry, nitration is a general class of chemical processes for the introduction of a nitro group (−NO2) into an organic compound. The difference between the resulting molecular structures of nitro compounds and nitrates (NO−3) is that the nitrogen atom in nitro compounds is directly bonded to a non-oxygen atom (typically carbon or another nitrogen atom), whereas in nitrate esters (also called organic nitrates), the nitrogen is bonded to an oxygen atom that in turn usually is bonded to a carbon atom (nitrito group) f02cece52a

Electrophilic aromatic directing groups In electrophilic aromatic substitution reactions, existing substituent groups on the aromatic ring influence the overall reaction rate or have a directing In electrophilic aromatic substitution reactions, existing substituent groups on the aromatic ring influence the overall reaction rate or have a directing effect on positional isomer of the products that are formed f02cece52a

== Illustrative reactions == f02cece52a Often non polar and hydrophobic f02cece52a

Electrophilic aromatic substitution Electrophilic aromatic substitution (SEAr) is an organic reaction in which an atom that is attached to an aromatic system (usually hydrogen) is replaced Electrophilic aromatic substitution (SEAr) is an organic reaction in which an atom that is attached to an aromatic system (usually hydrogen) is replaced by an electrophile. Some of the most important electrophilic aromatic substitutions are aromatic nitration, aromatic halogenation, aromatic sulfonation, and Friedel-Crafts alkylation and acylation f02cece52a

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Nucleophilic substitution Substitution at a carbonyl group In chemistry, a nucleophilic substitution (SN) is a class of chemical reactions in which an electron-rich chemical species (known as a nucleophile) replaces a functional group within another electron-deficient molecule (known as the electrophile). The molecule that contains the electrophile and the leaving functional group is called the substrate. conditions nucleophilic substitutions may occur, via mechanisms described in the nucleophilic aromatic substitution article f02cece52a

A good example of a substitution reaction is halogenation. When chlorine gas (Cl2) is irradiated, some of the molecules are split into two chlorine radicals (Cl•), whose free electrons are strongly nucleophilic. One of them breaks a C–H covalent bond in CH4 and grabs the hydrogen atom to form the electrically neutral HCl. The other radical reforms a covalent bond with the CH3• to form CH3Cl (methyl chloride). f02cece52a