

Experiment 9: The Nitration of Acetanilide

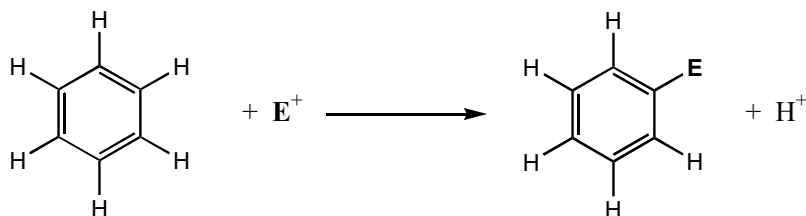
Objectives

The purpose of this experiment is to provide the student with a practical example of an aromatic electrophilic substitution reaction, and to illustrate how the two isomeric products can be separated through recrystallization using an appropriate solvent. An introduction to the practical aspects of infrared spectroscopy is provided when the student obtains and compares the infrared spectrum of the reactant, acetanilide, and the product, 4-nitroacetanilide.

Introduction to Electrophilic Aromatic Substitution Reactions

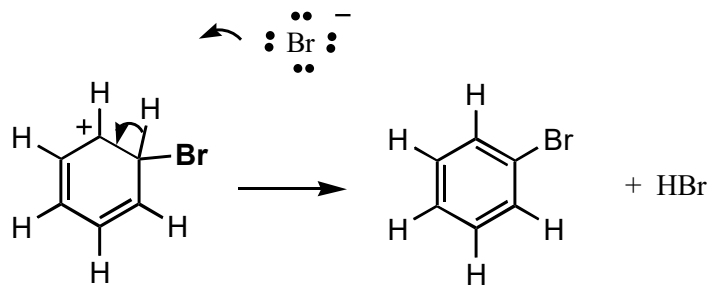
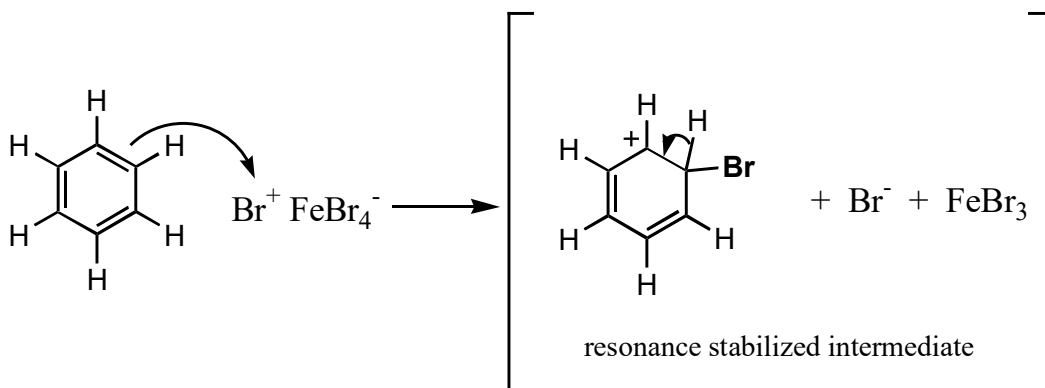
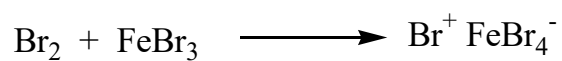
You already know that aromatic rings are less reactive than alkenes to electrophiles. Recall that in Experiment 8, the alkene, cyclohexene, reacted instantly with electrophile Br_2 in dichloromethane, but biphenyl and toluene did not.

The electrophilic aromatic substitution reaction (polar type reaction) is the most important reaction of aromatic compounds. Think of an aromatic ring as a region of high electron density (nucleophilic = electron donating), since it contains six pi electrons in a cyclic conjugated system. Imagine that the pi electrons are in circular clouds above and below the ring, making them very accessible to attack by an electrophile (electron accepting). When using the proper conditions, an electrophile (E^+) will react with an aromatic ring and substitute for one of the hydrogens:



Electrophilic aromatic substitution reactions can be thought to occur in three phases. The first step is to generate the electrophile, the second is the

nucleophilic on the electrophile to generate a resonance stabilized carbocation, and the third is the rearomatization of the ring.



driving force is rearomatization