CHEM40003: Aromatic Chemistry

Overview

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Aims
To provide an introduction to aromaticity and to the structure and reactivity of carboaromatic molecules with particular reference to the reactions of benzene and its derivatives.

Building Upon: A level chemistry or equivalent
Looking forward to: All year 2, 3 and 4 organic courses

Summary
Aromatic molecules make up a large proportion of known molecules. They are particularly thermodynamically stable systems and show characteristic reactivity patterns. In this lecture series, the characteristics of carboaromatic molecules will be examined and in particular, the structure and reactions of benzene and its derivatives will be introduced.

Objectives:
On completion of this course you should be able to:

• describe the characteristics of an aromatic molecule.
• give reasons for the 'unusual' stability of aromatic molecules.
• understand in detail the mechanism of aromatic electrophilic substitution (S\textsubscript{E}Ar) and discuss examples of this type of reaction from a synthetic, kinetic and thermodynamic standpoint.
• understand in detail the mechanism of aromatic nucleophilic substitution (S\textsubscript{N}Ar) and other mechanisms of aromatic substitution by nucleophilies.

Course delivery (4 lectures & 1 problem class)

Lecture 1: will examine aromaticity: Historical perspective (Kekulé), characteristics, NMR ring currents, valence bond & molecular orbital representations (Hückel's rule), anti-aromaticity.

Lectures 2-3: will cover electrophilic aromatic substitution (S\textsubscript{E}Ar): Mechanism (Wheland intermediates, energy profile diagrams & deuterium isotope effects), nitration, sulfonylation, halogenation, Friedel-Crafts alklylation and acylation, Directing effects (ortho-para ratios, ipso-substitution).

Lecture 4: will introduce nucleophilic aromatic substitution: S\textsubscript{N}Ar, S\textsubscript{N}1 (diazonium salt formation & diazo-coupling, Sandmeyer reactions), S\textsubscript{RN}1 and aryne mechanisms.

Problem class: This will constitute an interactive quiz to revise key points from the above lectures.

Reference material
The following texts contain information pertinent to the course content.