

Chapter 14: Aromatic Compounds

Learning Objectives:

1. Recognize and distinguish between aromatic and antiaromatic compounds by their structures.
2. Know the properties of aromatic and antiaromatic compounds, and the chemical consequences of aromaticity.
3. Recognize and be able to write the mechanism of electrophilic aromatic substitution
4. Be able to outline the completed electrophilic aromatic substitution reactions of the following types: halogenation, nitration, sulfonation, and Friedel-Crafts acylation & alkylation

Sections:

- 14.1 Aromatic Compounds Are Unusually Stable
- 14.2 The Two Criteria for Aromaticity*
- 14.3 Applying the Criteria for Aromaticity
- 14.4 Aromatic Heterocyclic Compounds
- 14.5 Some Chemical Consequences of Aromaticity*
- 14.6 Antiaromaticity
- 14.7 A Molecular Orbital Description of Aromaticity and Antiaromaticity
- 14.8 Nomenclature of Monosubstituted Benzenes
- 14.9 How Benzene Reacts*
- 14.10 The General Mechanism for Electrophilic Aromatic Substitution Reactions*
- 14.11 Halogenation of Benzene*
- 14.12 Nitration of Benzene*
- 14.13 Sulfonation of Benzene*
- 14.14 Friedel-Crafts Acylation of Benzene*
- 14.15 Friedel-Crafts Alkylation of Benzene*
- 14.16 Alkylation of Benzene by Acylation-Reduction*
- 14.17 Using Coupling Reaction to Alkylate Benzene[#]
- 14.18 It Is Important to Have More Than One Way to Carry Out a Reaction
- 14.19 How Some Substituents Can Be Chemically Changed*

* Sections that will be focused

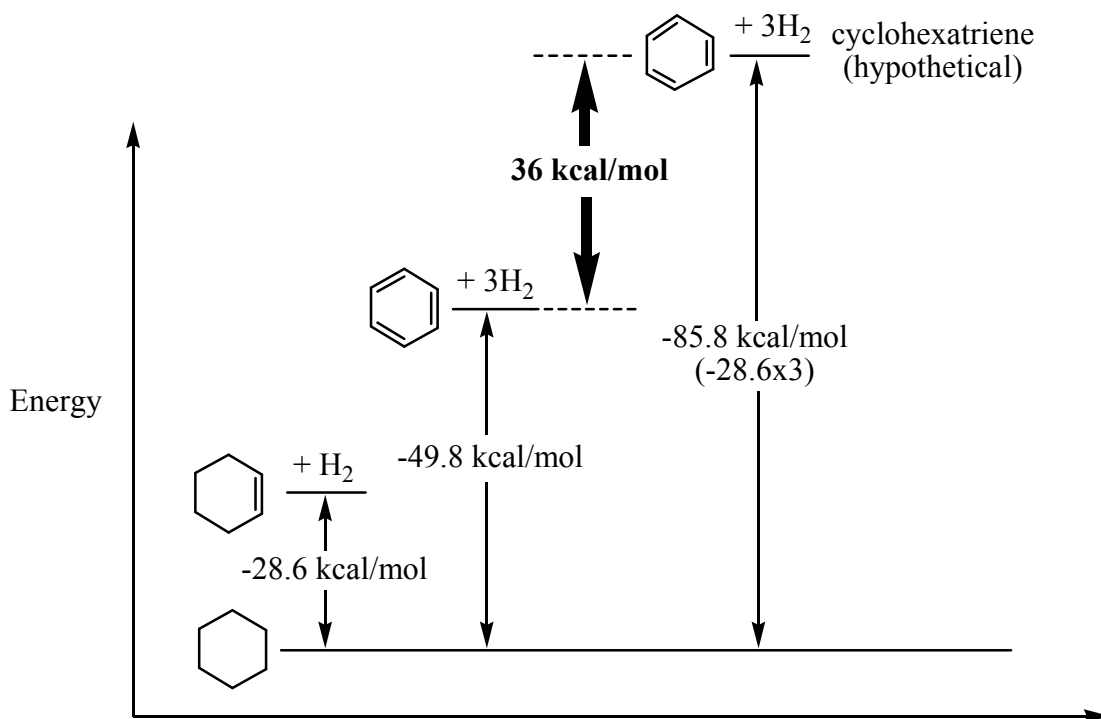
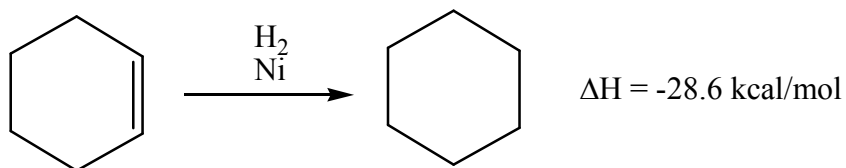
[#] Sections that will be skipped

Recommended additional problems

14.30 – 14.49

Class Note

14.1 Aromatic Compounds Are Unusually Stable



14.2 The Two Criteria for Aromaticity* and 14.6 Antiaromaticity

A. Cyclic molecule

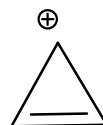
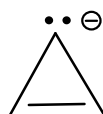
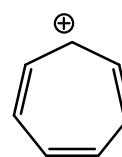
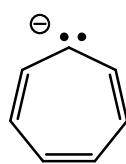
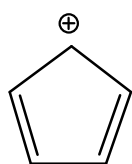
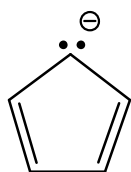
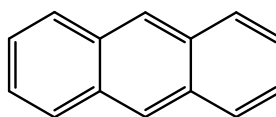
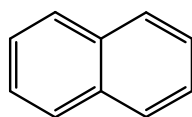
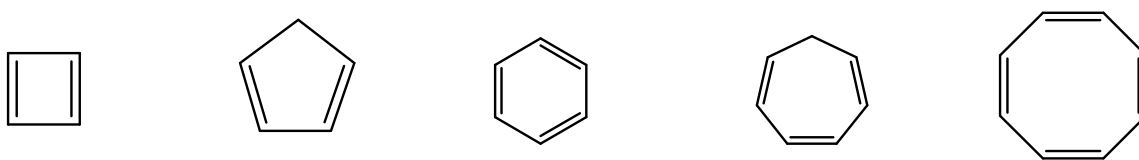
B. Every atom has p orbital

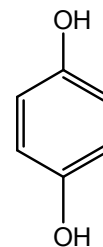
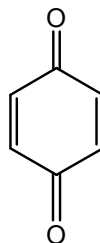
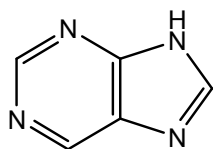
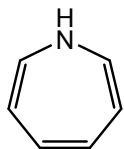
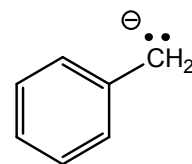
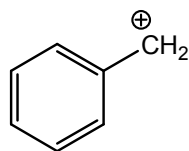
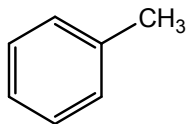
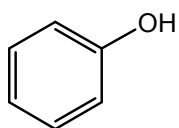
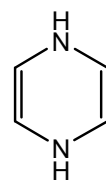
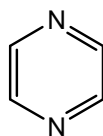
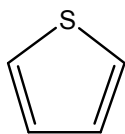
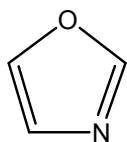
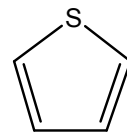
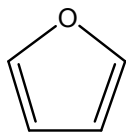
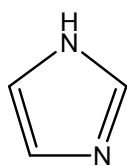
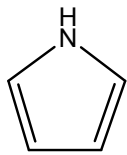
C. Planar molecule

D. Comply with $4n+2$ rule (as compared with $4n$ rule)

E. Consequence of aromaticity

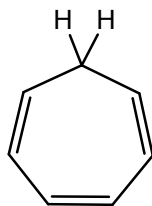
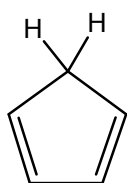
14.3 Applying the Criteria for Aromaticity and 14.4 Aromatic Heterocyclic Compounds



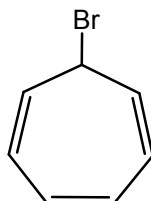
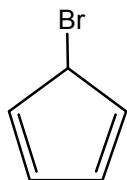


14.5 Some Chemical Consequences of Aromaticity*

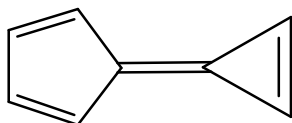
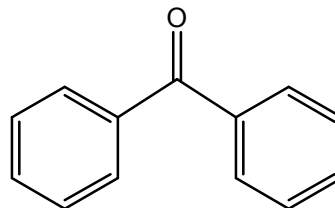
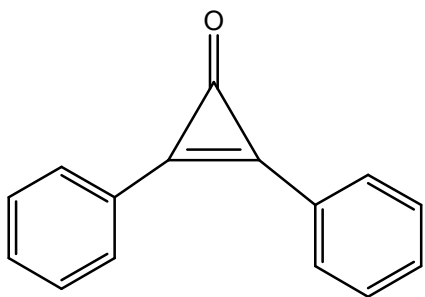
A. Acidity of protons



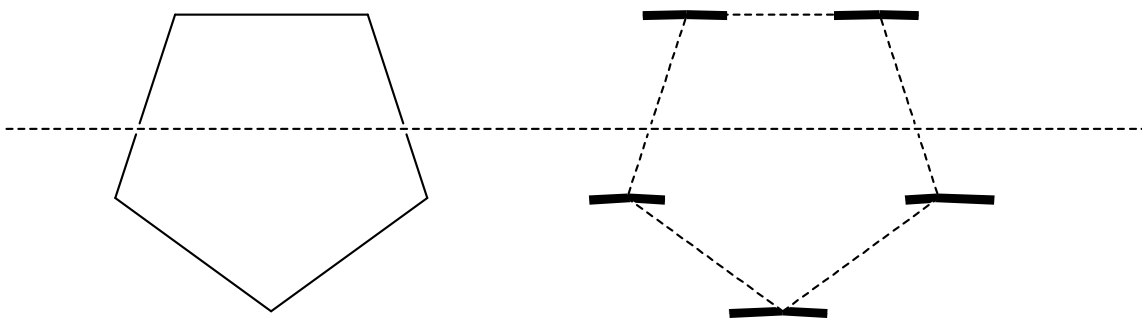
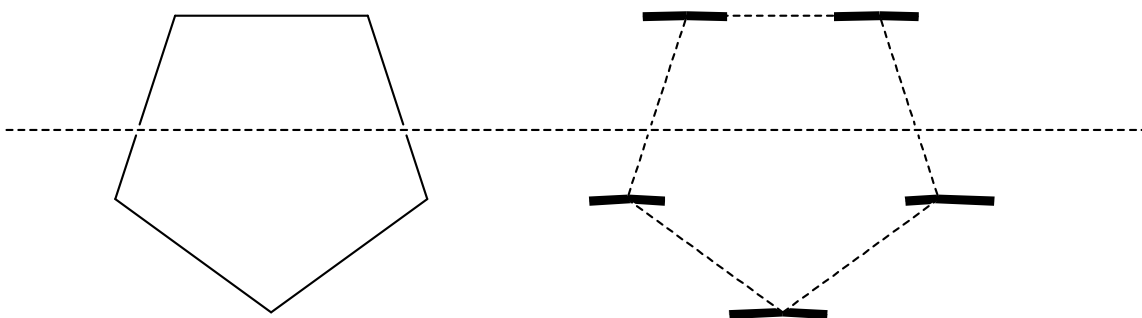
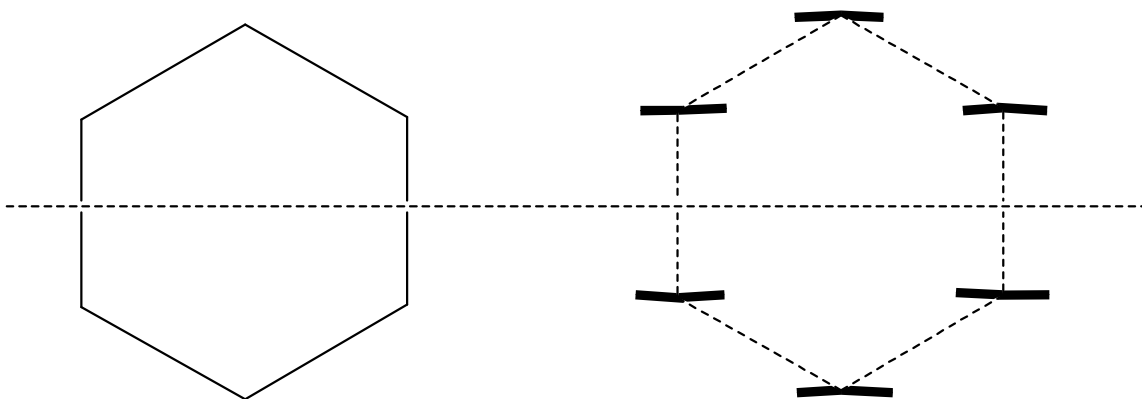
B. Aromaticity on leaving group



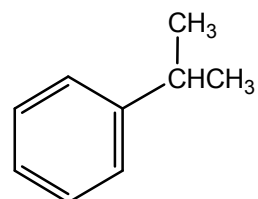
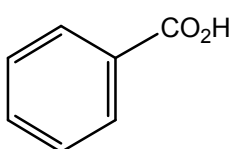
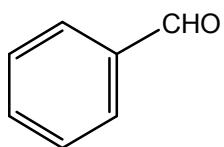
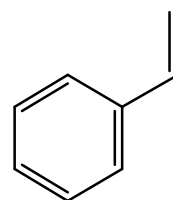
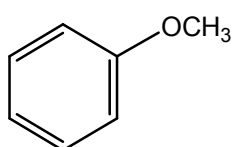
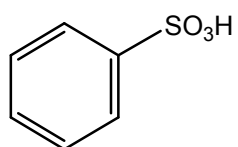
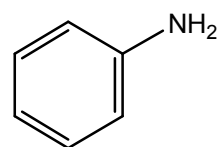
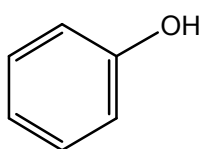
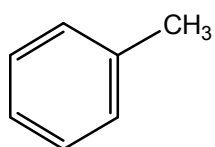
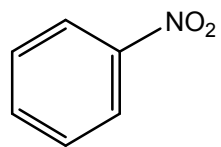
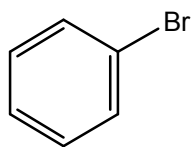
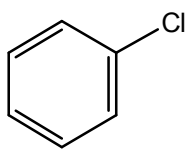
C. Aromaticity on dipole moment (polarity)



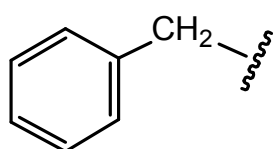
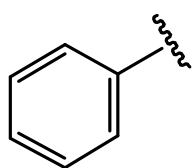
14.7 A Molecular Orbital Description of Aromaticity and Antiaromaticity



14.8 Nomenclature of Monosubstituted Benzenes



As substituent:



14.9 How Benzene Reacts* and 14.10 The General Mechanism for Electrophilic Aromatic Substitution Reactions*

Addition vs. Substitution

Electrophilic Aromatic Substitution vs. Nucleophilic Aromatic Substitution

A. General Mechanism of Electrophilic Aromatic Substitution

B. Reaction coordinate diagram

14.11 Halogenation of Benzene*

14.12 Nitration of Benzene*

14.13 Sulfonation of Benzene*

14.14 Friedel-Crafts Acylation of Benzene*

14.15 Friedel-Crafts Alkylation of Benzene*

Result from carbocation migration

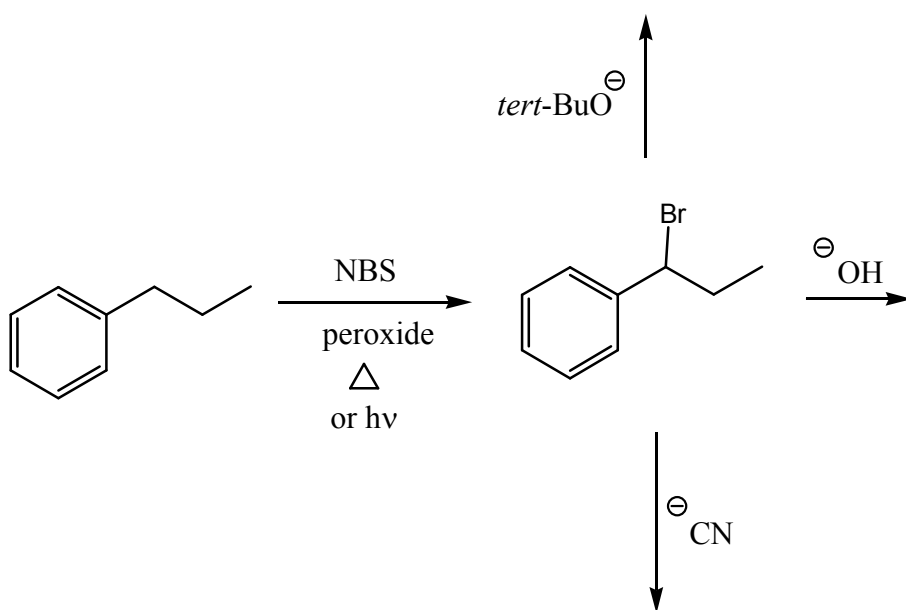
14.16 Alkylation of Benzene by Acylation-Reduction* and 14.18 It Is Important to
Have More Than One Way to Carry Out a Reaction

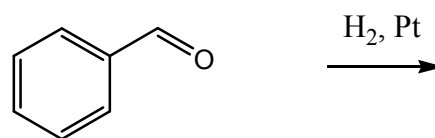
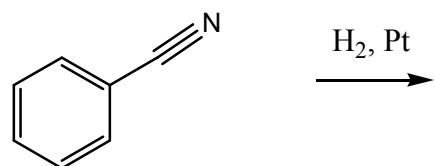
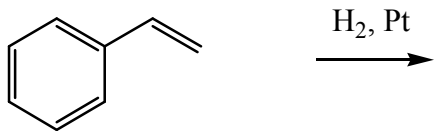
A. Clemmensen reduction

B. Wolff-Kishner reduction

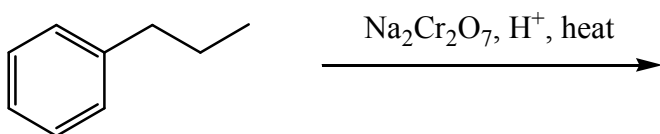
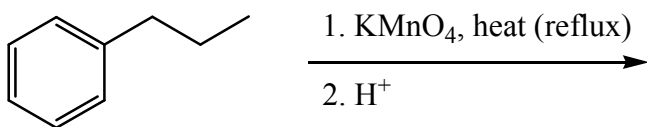
14.19 How Some Substituents Can Be Chemically Changed*

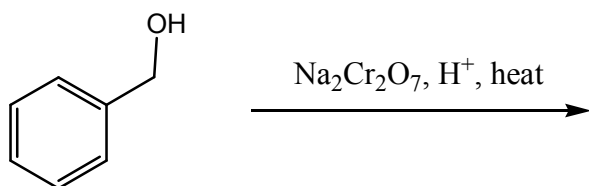
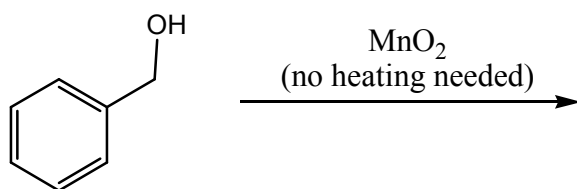
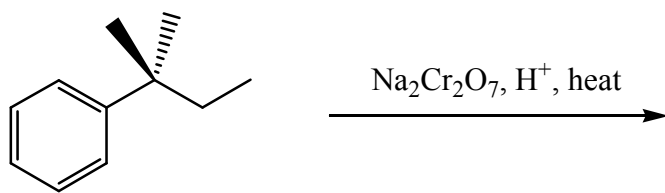
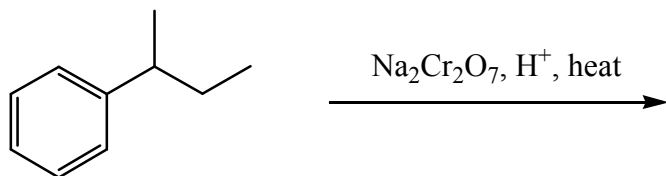
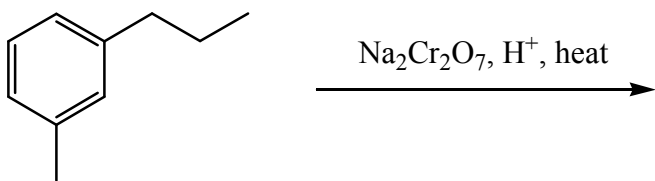
A. Reactions of Alkyl Substituents





B. Oxidations of Alkyl Substituents





C. Reduction of Nitro Group

