Objectives

After completing this section, you should be able to

1. use the Hückel $4n + 2$ rule to explain the stability of the cyclopentadienyl anion, the cycloheptatrienyl cation and similar species.
2. use the Hückel $4n + 2$ rule to determine whether or not a given unsaturated cyclic hydrocarbon anion or cation is aromatic.
3. draw the resonance contributors for the cyclopentadienyl anion, cation and radical, and similar species.

Charged Aromatic Compounds

Carbanions and carbocations may also show aromatic stabilization. Some examples are:

- The three-membered ring cation has $2 \pi$-electrons and is surprisingly stable, considering its ring strain.
- Cyclopentadiene is as acidic as ethanol, reflecting the stability of its 6 π-electron conjugate base. Salts of cycloheptatrienyl cation (tropylium ion) are stable in water solution, again reflecting the stability of this 6 $\pi$-electron cation.

Exercises

Questions

Q15.4.1

Draw the resonance structures for cycloheptatriene anion. Are all bonds equivalent? How many lines (signals) would you see in a $^1H^1$C$^{13}$NMR?

Q15.4.2

The following reaction occurs readily. Propose a reason why this occurs?
Solutions

S15.4.1

All protons and carbons are the same, so therefore each spectrum will only have one signal each.

S15.4.2

The ring becomes aromatic with the addition of two electrons. Thereby obeying the 4n+2 rule.

Contributors

- Dr. Dietmar Kennepohl FCIC (Professor of Chemistry, Athabasca University)
- Prof. Steven Farmer (Sonoma State University)