Is cyclobutadiene predicted by the following MO diagram to be stabilized by electron delocalization? Show your calculation.

What is the stabilization due to electron delocalization?

What is the π energy for cyclobutadiene?

Do MO and resonance theory lead to different conclusions with respect to benzene and cyclobutadiene?

Sketch all the MOs for cyclobutadiene (Ψ₂ and Ψ₃ both have 2 nodes).

Which is the least stable?

E_π(cyclobutadiene) = 2β x 2 = 4β
Is cyclobutadiene less stabilized by electron delocalization than butadiene?  

A. Yes  
B. No  

butadiene stabilization energy = 8 kJ/mol (experimental)

Which of the following terms best describes cyclobutadiene?  

A. non aromatic  
B. aromatic  
C. anti aromatic

Hückel’s Rule: If a cyclic, conjugated compound system contains \(4n + 2\) \(\pi\)-electrons, where \(n\) any integer, then it will be stabilized by electron delocalization.

\[4 \pi\text{-electrons} = 4(0.5) + 2 \quad 6 \pi\text{-electrons} = 4(1) + 2\]

Which of the following terms best describes benzene?  

A. non aromatic  
B. aromatic  
C. anti aromatic

Is there a rule that uses MO theory to predict aromaticity?  

A. Yes  
B. No

Which of the following compounds obey Hückel’s rule?

\[A = 1 \quad B = 2 \quad C = 3 \quad D = 4 \quad E = 1 \times 3 \quad F = 3 \times 4\]
Which of the following compounds obey Hückel's rule?

- A
- B
- C
- D
- E
- F

\[ pK_a = 16 \quad -40 \]

\[ A = 1 \quad B = 2 \quad C = 3 \quad D = 4 \quad E = 1 + 3 \quad F = 3 + 4 \]

According to Hückel's rule which of the following compounds is (are) aromatic?

- A. 1
- B. 2
- C. 1 + 2

\[ 6 \pi \text{-electrons} \]

\[ 4n + 2 \quad 4(1) + 2 = 6 \]

Which shape would be expected for the methyl anion? Why?

- A
- B

\[ \text{sp}^3 \]

\[ \text{p} \]

Which of the following compounds is more basic?

\[ pK_a = -5 \quad pK_a = 5.25 \]

The greater the \( K_a \) the more basic the conjugate base. (A) true (B) false

Which shape would be expected for cyclopentadienide anion? Why?

- A
- B
Which nitrogen atom is the most basic?
A. 1  B. 2  C. 1 = 2

[Diagram of nitrogen atoms]

Which hydrogen atom is the most acidic?
A. 1  B. 2  C. 1 = 2

[Diagram of hydrogen atoms]

Which of the following compounds would react faster with Br₂?

A  B  C  no reaction

[Chemical structures with reactions]

What is a good mechanism for the following reaction that accounts for the catalytic role of FeBr₃?

[Mechanism diagram]

Why is the brominum ion not involved?

Would Br\(^\ominus\) be predicted to be (A) more or (B) less reactive than I\(^\ominus\)?

What is the slow step in the following reaction?

[Energy diagram]

How can Br₂ be made more reactive as an electrophile (electron acceptor)?