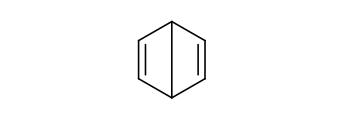
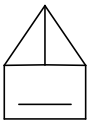
WORKSHOP, Chapter 11

Aromaticity and Aromatic Reactions

1. The following are some of the structures proposed for benzene over the years. All of them have been synthesized and are known to revert to benzene when warmed. With the help of arrows show how each of these rearranges to benzene.

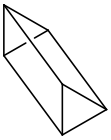


bicyclo[2.2.0]hexa-2,5-diene



benzvalene

benzene



prismane

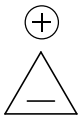
2. Provide reasonable explanation for the following observations:

a. Pyridine and pyrrole exhibit the properties of typical aromatic compounds. Pyridine is commonly used as a base; the pKa of the corresponding conjugate acid is 5.29. On the other hand, pyrrole is not basic; the pKa of the corresponding conjugate acid is -4.4.

Pyridine

pyrrole

b. Despite the ring strain, cyclopropenium ion represents one of the most stable carbocations known. Explain this stability. Predict chemical properties for cyclopropene and cyclopropenone.



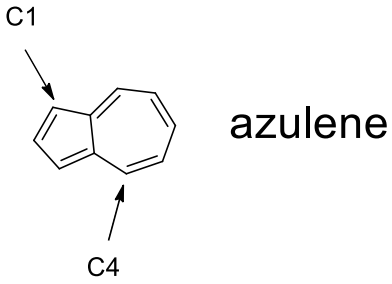
cyclopropenium ion

cyclopropene

cyclopropenone

3. Explain these interesting properties of azulene with aromaticity in charged molecules.

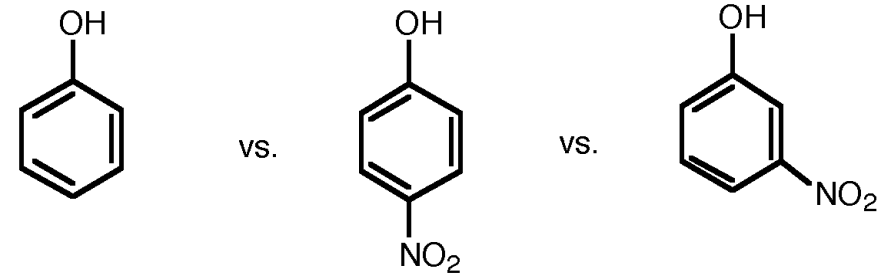
Azulene readily attacks electrophiles at C1. However, azulene is attacked by nucleophiles at C4. You will need to show the mechanism and resonance structures to understand this question.



azulene

4. Explain the differences in acidity.

a.



$pK_a = 9.9$

$pK_a = 7.2$

$pK_a = 8.3$

5. What are the products from the following reaction?