Cyclobutadiene - can only be isolated at sub-zero temperatures, extremely reactive.

The single bonds are unusually long and weak.

Benzene - easily isolated across a range of temperatures; can only react with strong electrophiles or nucleophiles.

There is no difference between any of the C-C bonds in benzene; all of the bonds are between a single and double bond in length.

unused

SMOG:

2 nodes

1 node (degenerate) (energy)

0 nodes

\[
E = \frac{1}{4} \frac{1}{1} \frac{1}{0} \Rightarrow 4 = e^{-}
\]

Bond order = \( \frac{2-0}{2} = 1 \)

two molecules of ethene

\[
\begin{align*}
\text{total bond order} &= 2
\end{align*}
\]
Antiaromaticity: A significant destabilization of a system caused by the full cyclic conjugation of that system.

When linear buta-1,3-diene is forced to cyclize, two bonding electrons are forced into higher-energy non-bonding orbitals (energetically unfavorable). To avoid this situation, the molecule attempts to distort to prevent full cyclic conjugation. This explains why the shape of cyclobutadiene is not square and the molecule cannot be isolated at RT.

Benzene not used

3 nodes
2 nodes
1 node
(no non-bonding)

Hückel