TRU Open Press

Frost Circles

Transcript

00:00:00:00 - 00:00:12:38
Dr.Jessie Key: Hello, again, Dr. Jessie Key here. In this video, you'll be exploring the use of Frost Circles to approximate molecular orbital diagrams for assessing aromaticity of conjugated cyclic systems.

00:00:12:38 - 00:00:28:08
Dr.Jessie Key: Let's take a look at an example of how we can draw a frost circle for a conjugated conjugated 3-membered ring. Follow along with a pen and paper. For a conjugated three membered ring, first draw the three-membered ring, pointy end down and encircle it.

00:00:28:08 - 00:00:56:10
Dr.Jessie Key: Next, at each place where the three-membered ring touches the circle, draw a horizontal line which represents a molecular orbital. Then draw a dash line horizontally at the middle of the circle and place an energy y-axis beside your figure. Any orbital drawn below the horizontal line corresponds to a bonding molecular orbital.

00:00:56:42 - 00:01:20:12
Dr.Jessie Key: Orbitals exactly at the horizontal line correspond to non-bonding molecular orbitals. Orbitals above the horizontal line are anti bonding. For the purposes of this course, it is optional to subsequently erase the three-membered ring and circle.

00:01:20:12 - 00:01:57:80
Dr.Jessie Key: But in more formal writing, this would be done to make the image less cluttered. As can be seen in this diagram, with a three-membered ring system, there's only one bonding molecular orbital, which when filled would correspond to 2 pi electrons. This satisfies Hückel’s rule when n is equal to zero, four times zero plus two equals two (4(0)+2 = 2).

00:01:59:80 - 00:02:12:26
Dr.Jessie Key: Let's try another example, a five-membered ring. Draw the five membered ring structure, pointy-end down. Then encircle it and draw lines where the five-membered ring touches the circle.

00:02:12:26 - 00:02:39:08
Dr.Jessie Key: Finally, draw in the horizontal line at the midpoint of the circle and add an energy axis. As can be seen in this diagram, with a five-membered ring system, there are three bonding molecular orbitals which when filled would correspond to 6 pi electrons. This satisfies Hückel's rule when n is equal to one: 4(1)+2 = 6.