WORKED ANSWER KEY - Aromaticity and Huckel’s Rule

Instructor and self-check copy. Full explanations for six multiple-choice questions plus two constructed-response tasks.

Part A. Concept and product prediction

1. Which condition is essential for an aromatic ring?

Correct: B. A continuous cyclic system of p orbitals

Reason: Aromaticity requires continuous cyclic conjugation and sufficient orbital overlap.

2. How many pi electrons are in benzene?

Correct: B. 6

Reason: Three pi bonds contain six pi electrons.

3. A planar conjugated ring has 4 pi electrons. It is generally

Correct: B. Antiaromatic

Reason: A fully conjugated planar ring with 4n pi electrons is antiaromatic.

4. What is the classification of ordinary cyclooctatetraene?

Correct: C. Nonaromatic

Reason: Its nonplanar conformation interrupts cyclic p orbital overlap.

5. Which lone pair is in the aromatic sextet of pyridine?

Correct: B. No nitrogen lone pair; the six electrons come from pi bonds

Reason: Pyridine nitrogen’s lone pair is in plane and does not contribute to the six pi electrons.

6. What is the pi-electron count of cyclopentadienyl anion?

Correct: C. 6

Reason: Two double bonds contribute four electrons and the conjugated lone pair adds two.

Part B. Show your reasoning

7. Draw benzene and cyclobutadiene. For each, state pi-electron count and classification, assuming a planar fully conjugated ring for cyclobutadiene.

Worked answer: Benzene: six-membered conjugated ring with 3 pi bonds, 6 pi electrons; aromatic (4n+2, n=1). Ideal planar cyclobutadiene: four-membered conjugated ring with 2 pi bonds, 4 pi electrons; antiaromatic.

8. Explain why cyclooctatetraene is nonaromatic even though it has four double bonds.

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Worked answer: Cyclooctatetraene has 8 pi electrons but adopts a nonplanar tub conformation. Its p orbitals do not overlap continuously around a planar cyclic path, so it is nonaromatic.

Use the key to assess chemical reasoning, not just a matching final answer.