What is Benzene?

Worksheet

Benzene is a flat, six-carbon ring (CH) where the electrons are delocalized across the ring via resonance. This electron cloud makes it unusually stable - it resists addition reactions and instead undergoes substitution, unique among unsaturated compounds.

Questions

1. Benzene's formula is CH. How many degrees of unsaturation?

A) 1
B) 2
C) 3
D) 4

2. Why does benzene NOT undergo addition with Br?

A) Br is not reactive enough
B) Electrons are delocalized, ring is too stable
C) Benzene is saturated
D) Benzene is aliphatic

3. What is the CC bond order in benzene?

A) 1.0 (single)
B) 1.5 (between single and double)
C) 2.0 (double)
D) varies

4. Huckel's rule for aromaticity requires

A) 4n electrons
B) (4n+2) electrons
C) any number of electrons
D) only C and H atoms

5. Does benzene react with Br water? Explain.

6. Toluene is CHCH. Is it aromatic?

7. Why is benzene more stable than hexatriene (CH with three double bonds)?

8. Define: What is the structure of benzene?

9. Define: What is aromaticity?

10. Define: Does benzene undergo addition or substitution?

Answer Key

1. D) 4 - Degree of unsaturation = (2C + 2 + N H X) / 2 = (12 + 2 6) / 2 = 4 (representing one ring + resonance).

2. B) Electrons are delocalized, ring is too stable - Resonance delocalization makes benzene unusually stable; breaking the ring costs too much energy.

3. B) 1.5 (between single and double) - Resonance makes all six CC bonds equivalent and of order 1.5 (hybrid of single and double).

4. B) (4n+2) electrons - Aromatic compounds typically have (4n+2) electrons (benzene: n=1 6 electrons).

5. Benzene does NOT decolorize bromine water (unlike alkenes/alkynes). Reason: electron delocalization makes the ring very stable. Benzene undergoes substitution: CH + Br CHBr + HBr (with catalyst).

6. Yes. The benzene ring is still present and delocalized. Only the methyl group is aliphatic.

7. Benzene: electrons delocalized over the entire ring (resonance). Hexatriene: electrons localized in three double bonds. Delocalization = more stable (lower energy).

8. A flat six-membered carbon ring (CH) with alternating bonding and electron delocalization.

9. The property of cyclic, planar molecules with delocalized electrons, giving them unusual stability.

10. Substitution. The aromatic ring is too stable to break open for addition.