What is Hybridization? sp, sp, sp

Worksheet

Hybridization is the blending of s and p orbitals to form hybrid orbitals suited for bonding. sp hybridisation gives linear geometry (180); sp gives trigonal-planar (120); sp gives tetrahedral (109.5).

Questions

1. sp hybridisation produces

A) tetrahedral geometry
B) trigonal-planar geometry
C) linear geometry
D) octahedral geometry

2. Bond angles in sp hybridisation are

A) 90
B) 109.5
C) 120
D) 180

3. How many hybrid orbitals from sp hybridisation?

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

4. Carbon in CH uses which hybridisation?

A) sp
B) sp
C) sp
D) spd

5. What is the hybridisation of carbon in CH and what geometry does it adopt?

6. Determine the hybridisation of nitrogen in NH.

7. What is the hybridisation and geometry of carbon in CH (ethene)?

8. Define: What is hybridisation?

9. Define: sp hybridisation: geometry and angle?

10. Define: sp hybridisation: geometry and angle?

Answer Key

1. C) linear geometry - sp mixes 1 s and 1 p orbital to form 2 hybrid orbitals pointing 180 apart (linear).

2. B) 109.5 - sp hybrid orbitals point toward tetrahedral vertices, giving 109.5 angles.

3. C) 3 - sp mixes 1 s + 2 p orbitals, producing 3 hybrid orbitals.

4. B) sp - Each carbon forms 3 bonds (needs 3 hybrid orbitals) sp; the unhybridised p orbital forms the bond.

5. Carbon has 4 valence electrons; forms 4 C-H bonds Carbon needs 4 hybrid orbitals sp hybridisation (1 s + 3 p mixed) sp orbitals point tetrahedral 4 hybrid orbitals, 109.5 angles Geometry: Tetrahedral

6. Nitrogen: 5 valence electrons; forms 3 N-H bonds + 1 lone pair Needs 4 hybrid orbitals sp hybridisation 4 sp orbitals at 109.5; one holds a lone pair Geometry: Trigonal pyramidal (bond angles compressed to 107 by lone pair repulsion)

7. Each carbon forms 3 bonds (1 C-C + 2 C-H) + 1 bond 3 bonds need 3 hybrid orbitals sp hybridisation sp orbitals at 120 angles Geometry: Trigonal planar around each carbon

8. The mixing of atomic orbitals (s, p, d) to form hybrid orbitals suited for bonding and directed toward partners.

9. Linear geometry with 180 bond angles; formed by mixing 1 s + 1 p orbital.

10. Trigonal-planar geometry with 120 bond angles; formed by mixing 1 s + 2 p orbitals.