CBSE TEST PAPER-06

CLASS - XI CHEMISTRY (Chemical Bonding and Molecular Structure)

General Instruction:

- All questions are compulsory.
- Marks are given alongwith their questions.

1. Define hybridisation. [1]

2. Give the features of hybridisation. [2]

3. What are the important consolations for hybridisation? [2]

4. Describe the shape of sp, sp^2 and sp^3 hybrid orbital? [2]

5. State the hybrid orbitals associated with B in BCl_3 and C in C_2H_4 [1]

6. What is the state of hybridization of carbon atoms in diamond and graphite? [1]

7. Ethylene is a planar molecule whereas acetylene is a linear molecule. Give reason. [2]

8. In H_2O, H_2S, H_2Se, H_2Te, the bond angle decreases though all have the same bent shape. Why? [2]

9. What type of hybridisation takes place in (i) P in PCL_5 and (ii) S in SF_6? [1]

10. Out of p-orbital and sp-hybrid orbital which has greater directional character and Why? [2]

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[ANSWERS]

Ans1. Hybridisation is defined as the process of intermixing of the orbitals of slightly different energies so as to redistribute their energies, resulting in the formation of new set of orbitals of equivalent energies and shape.

Ans2. The main features of hybridization are

i) The number of hybrid orbitals is equal to number of the atomic orbitals that get hybridized.

ii) The hybridized orbitals are always equivalent in energy and shape.

iii) The hybrid orbitals are more effective in forming stable bonds than the pure atomic orbitals.

iv) The hybrid orbitals orient in a manner to minimize repulsion resulting in a particular geometrical shape.

Ans3. (i) The orbitals present in the valence shell of the atom are hybridized.

(ii) The orbitals undergoing hybridization should have almost the same energy.

(iii) It is not essential that electrons get promoted prior to hybridization.

(iv) It is necessary that only half filled orbitals participate in hybridisation even filled orbitlals can take part.

Ans4. (i) Sp-hybrid orbital is oriented to an angle 180^0.

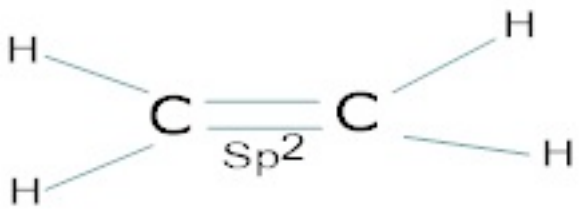
(ii) Sp^2-hybrid orbital lie in a plane and is directed towards the corners of equilateral triangle making an angle of 120^0.

(iii) Sp^3-hybrid orbitals are directed towards the four corners of tetrahedron making an angle of $109^0\,28'$

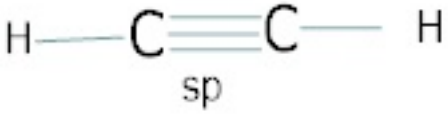
Ans5. (i) Sp^2 hybridization (ii) Sp^2 hybridization.

Ans6. In Diamond it is Sp^3

In graphite it is Sp^2



Ans7. In case of ethylene, C_2H_4, *show* Sp^2 hybridization where the four hydrogen atoms are placed in four corners of a plane sharing 120^0



Whereas acetylene shows sp hybridization and shares an angle of 180^0 and thus it is linear.

Ans8. In all the four cases, the molecules undergo Sp^3 hybridization forming four hybrid orbitals, two of which are occupied by lp of electrons and two by bp electrons. Thus they are expected to have $109^028'$ angle but this does not happen. In case of H_2O molecule, as oxygen is small in size and has high electronegativity value, the bp are closer due to which it is subjected to larger repulsion (bp-bp). In case of H_2S as S atom is larger than O, bp-bp repulsion is less as compared to H_2O and it is true for H_2Se and H_2Te as well.

Ans9. (i) Sp^3d (ii) Sp^3d^2.

Ans10. Sp-hybrid orbital has greater directional character than p-orbital. Because in case of p-orbitals, the two lobes are equal in size and equal electron density is distributed whereas in Sp-hybrid orbital, electron density is greater on one side.