

Maharashtra State Board 11th Chemistry Solutions Chapter 5 Chemical Bonding

1. Select and write the most appropriate alternatives from the given choices.

Question A.

Which molecule is linear?

- a. SO_3
- b. CO_2
- c. H_2S
- d. Cl_2O

Answer:

- b. CO_2

Question B.

When the following bond types are listed in decreasing order of strength (strongest first). Which is the correct order ?

- a. covalent > hydrogen > van der waals
- b. covalent > vander waal's > hydrogen
- c. hydrogen > covalent > vander waal's
- d. vander waal's > hydrogen > covalent.

Answer:

- a. covalent > hydrogen > van der waals

Question C.

Valence Shell Electron Pair repulsion (VSEPR) theory is used to predict which of the following :

- a. Energy levels in an atom
- b. the shapes of molecules and ions.
- c. the electrone getivities of elements.
- d. the type of bonding in compounds.

Answer:

- b. the shapes of molecules and ions.

Question D.

Which of the following is true for CO_2 ?

	C=O bond	CO_2 molecule
A	polar	non-polar
B	non-polar	polar
C	polar	polar
D	non-polar	non-polar

Answer:

	C=O bond	CO_2 molecule
A	polar	non-polar

Question E.

Which O_2 molecule is paramagnetic. It is explained on the basis of :

- a. Hybridisation
- b. VBT
- c. MOT
- d. VSEPR

Answer:

- c. MOT

Question F.

The angle between two covalent bonds is minimum in:

- a. CH_4
- b. C_2H_2
- c. NH_3
- d. H_2O

Answer:

- d. H_2O

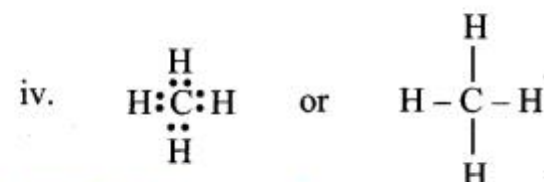
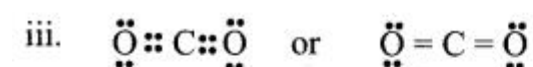
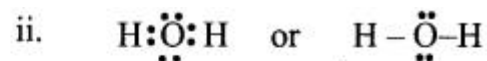
2. Draw

Question A.

Lewis dot diagrams for the following

- Hydrogen (H_2)
- Water (H_2O)
- Carbon dioxide (CO_2)
- Methane (CH_4)
- Lithium Fluoride (LiF)

Answer:

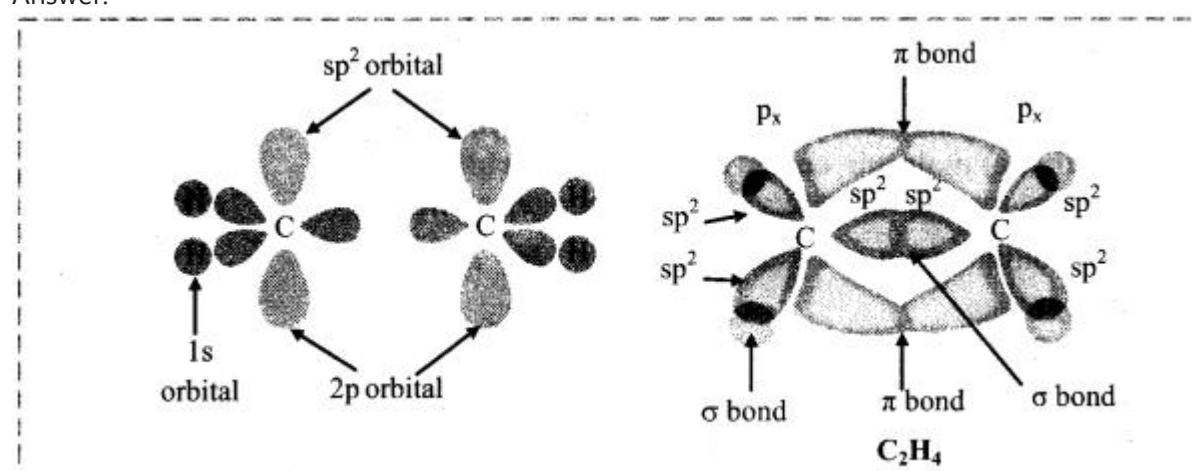


[Note: H atom in H_2 and Li atom in LiF attain the configuration of helium (a duplet of electrons).]

Question B.

Diagram for bonding in ethene with sp^2 Hybridisation.

Answer:

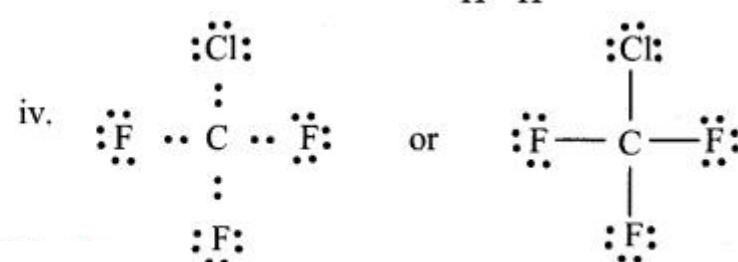
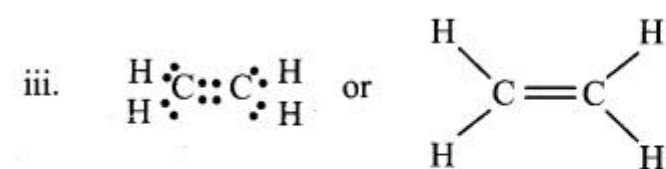
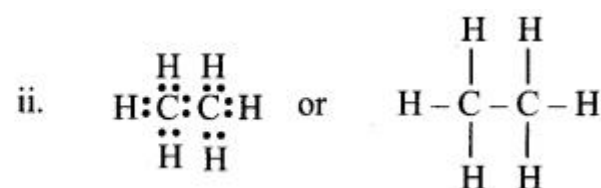
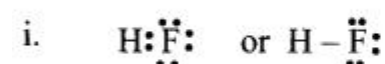


Question C.

Lewis electron dot structures of

- HF
- C_2H_6
- C_2H_4
- CF_3Cl
- SO_2

Answer:



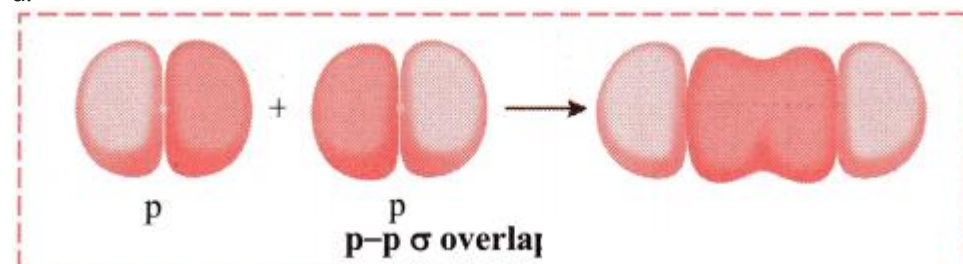
Question D.

Draw orbital diagrams of

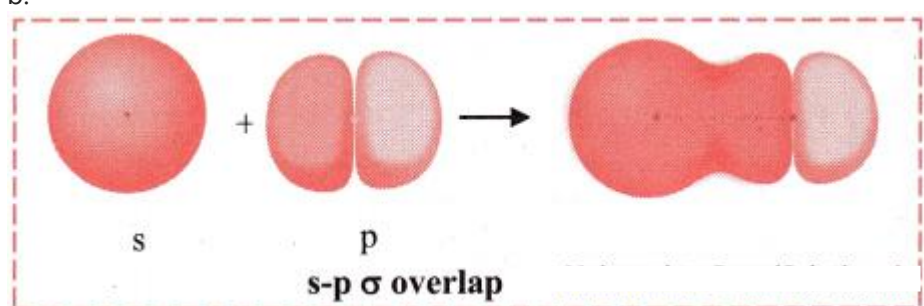
- Fluorine molecule
- Hydrogen fluoride molecule

Answer:

a.



b.



3. Answer the following questions

Question A.

Distinguish between sigma and pi bond.

Answer:

σ (sigma) bond	π (pi) bond
1. It is formed when atomic orbitals overlap along internuclear axis.	1. It is formed when atomic orbitals overlap side-ways (laterally).
2. Electron density is high along the axis of the molecule (i.e., internuclear axis).	2. Electron density is zero along the axis of the molecule (i.e., internuclear axis).
3. In the formation of sigma bond, the extent of overlap is greater, hence, more energy is released.	3. In the formation of pi bond, the extent of overlap is less, hence, less energy is released.
4. It is a strong bond.	4. It is a weak bond.
5. Formation of sigma bonds involves s-s, s-p, p-p overlap and overlap between hybrid orbitals.	5. Formation of pi bonds involves p-p or d-d overlap. The overlap between hybrid orbitals is not involved.

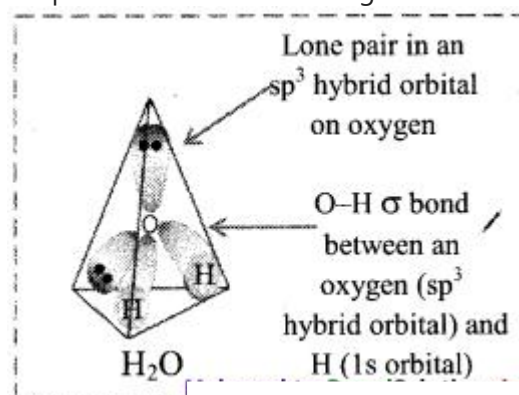
Question B.

Display electron distribution around the oxygen atom in water molecule and state shape of the molecule, also write H-O-H bond angle.

Answer:

Electron distribution around oxygen atom in water molecule:

Shape of water molecule: Angular or V shaped H-O-H bond angle = $104^{\circ}35'$



Question C.

State octet rule. Explain its inadequacies with respect to

a. Incomplete octet

b. Expanded octet

Answer:

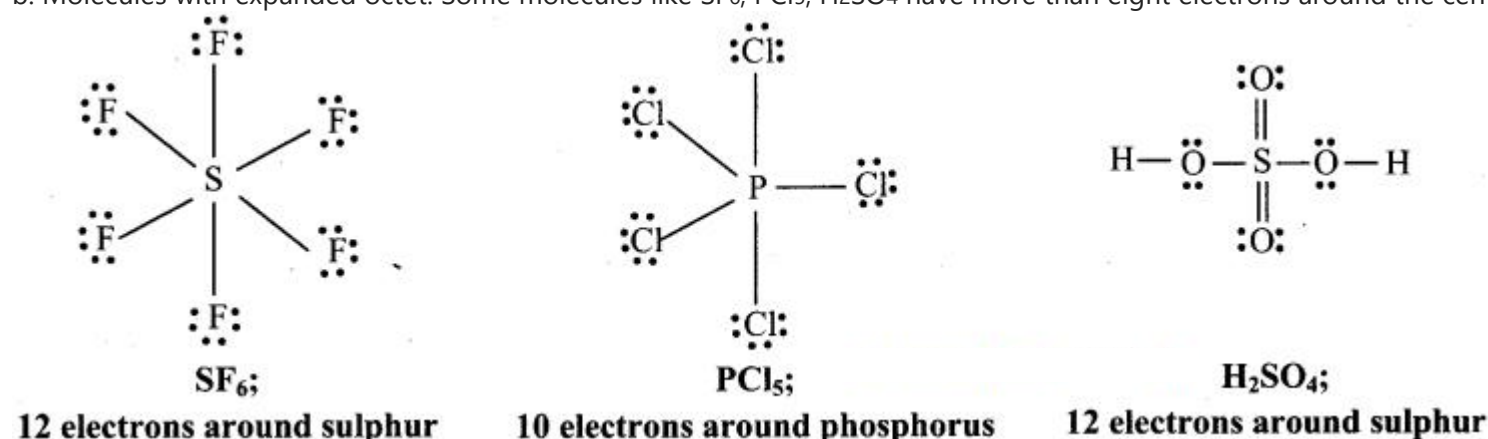
Statement: During the formation of chemical bond, atom loses, gains or shares electrons so that its outermost orbit (valence shell) contains eight electrons. Therefore, the atom attains the nearest inert gas electronic configuration.

a. Molecules with incomplete octet: e.g. BF_3 , BeCl_2 , LiCl

In these covalent molecules, the atoms B, Be and Li have less than eight electrons in their valence shell but these molecules are stable.

Li in LiCl has only two electrons, Be in BeCl_2 has four electrons while B in BF_3 has six electrons in the valence shell.

b. Molecules with expanded octet: Some molecules like SF₆, PCl₅, H₂SO₄ have more than eight electrons around the central atom.



Question D.

Explain in brief with one example:

- Ionic bond
- covalent bond
- co-ordinate bond

Answer:

a. Formation of calcium chloride (CaCl₂):

i. The electronic configurations of calcium and chlorine are:

Na (Z = 11): 1s² 2s² 2p⁶ 3s² 3p⁶ 4s² or (2, 8, 8, 2)

Cl (Z = 17): 1s² 2s² 2p⁶ 3s² 3p⁵ or (2, 8, 7)

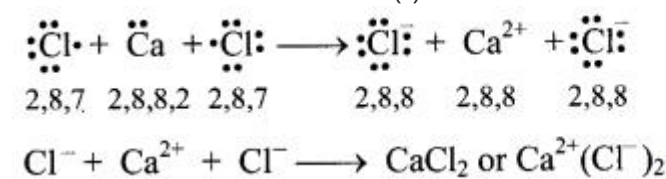
ii. Calcium has two electrons in its valence shell. It has tendency to lose two electrons to acquire the electronic configuration of the nearest inert gas, argon (2, 8, 8).

iii. Chlorine has seven electrons in its valence shell. It has tendency to gain one electron and thereby acquire the electronic configuration of the nearest inert gas, argon (2, 8, 8).

iv. During the combination of calcium and chlorine atoms, the calcium atom transfers its valence electrons to two chlorine atoms.

v. Calcium atom changes into Ca²⁺ ion while the two chlorine atoms change into two Cl⁻ ions. These ions are held together by strong electrostatic force of attraction.

vi. The formation of ionic bond(s) between Ca and Cl can be shown as follows:



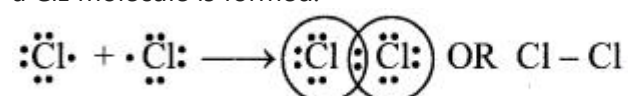
b. Formation of Cl₂ molecule:

i. The electronic configuration of Cl atom is [Ne] 3s² 3p⁵.

ii. It needs one more electron to complete its valence shell.

iii. When two chlorine atoms approach each other at a certain internuclear distance, they share their valence electrons. In the process, both the atoms attain the valence shell of octet of nearest noble gas, argon.

iv. The shared pair of electrons belongs equally to both the chlorine atoms. The two atoms are said to be linked by a single covalent bond and a Cl₂ molecule is formed.

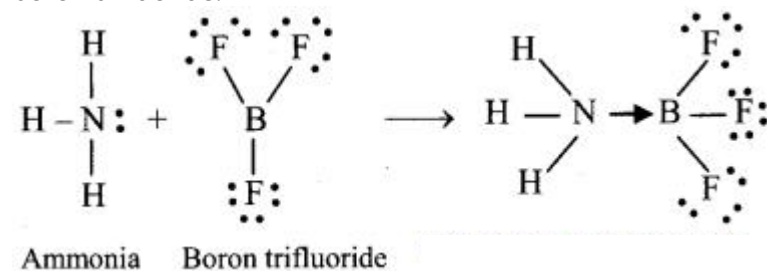


c. co-ordinate bond:

i. A coordinate bond is a type of covalent bond where both of the electrons that form the bond originate from the same atom

ii. An atom with a lone pair of electrons (non-bonding pair of electrons) is capable of forming a coordinate bond.

iii. For example, reaction of ammonia with boron trifluoride: Before the reaction, nitrogen (N) in ammonia has eight valence electrons, including a lone pair of electrons. Boron (B) in boron trifluoride has only six valence electrons, so it is two electrons short of an octet. The two unpaired electrons form a bond between nitrogen and boron, resulting in complete octets for both atoms. A coordinate bond is represented by an arrow. The direction of the arrow indicates that the electrons are moving from nitrogen to boron. Thus, ammonia forms a coordinate bond with boron trifluoride.



iv. Once formed, a coordinate covalent bond is the same as any other covalent bond.

Question E.

Give reasons for need of Hybridisation.

Answer:

The concept of hybridization was introduced because the valence bond theory failed to explain the following points:

i. Valencies of certain elements:

The maximum number of covalent bonds which an atom can form equals the number of unpaired electrons present in its valence shell.

However, valence bond theory failed to explain how beryllium, boron and carbon forms two, three and four covalent bonds respectively.

a. Beryllium: The electronic configuration of beryllium is 1s² 2s². The expected valency is zero (as there is no unpaired electron) but the

observed valency is 2 as in BeCl_2 .

b. Boron: The electronic configuration of boron is $1s^2 2s^2 2p_{1x}$. The valency is expected to be 1 but it is 3 as in BF_3 .

c. Carbon: The electronic configuration of carbon is $1s^2 2s^2 2p_{1x} 2p_{1y}$. The valency is expected to be 2, but observed valency is 4 as in CH_4 .

ii. The shapes and geometry of certain molecules:

The valence bond theory cannot explain shapes, geometries and bond angles in certain molecules,

e.g. a. Tetrahedral shape of methane molecule.

b. Bond angles in molecules like NH_3 ($107^\circ 18'$) and H_2O ($104^\circ 35'$).

However, the valency of the above elements and the observe structural properties of the above molecules can be explained by the concept of hybridization. These are the reasons for need of the concept of hybridization.

Question F.

Explain geometry of methane molecule on the basis of Hybridisation.

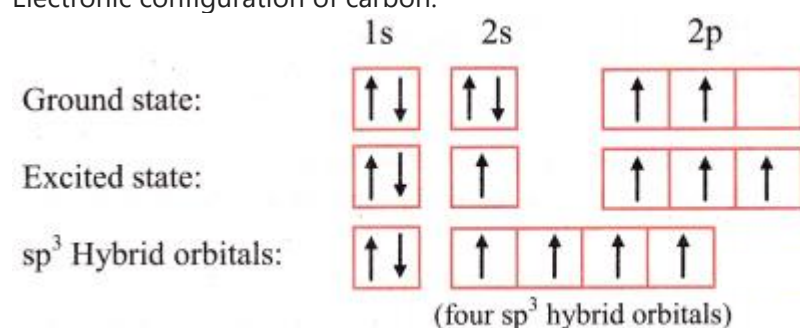
Answer:

Formation of methane (CH_4) molecule on the basis of sp^3 hybridization:

i. Methane molecule (CH_4) has one carbon atom and four hydrogen atoms.

ii. The ground state electronic configuration of C ($Z = 6$) is $1s^2 2p_{1x} 2p_{1y} 2p_{1z}$;

Electronic configuration of carbon:

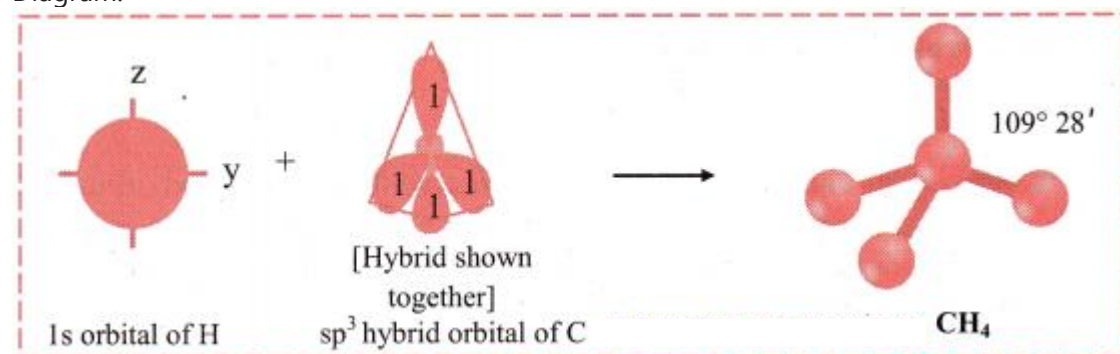


iii. In order to form four equivalent bonds with hydrogen, the 2s and 2p orbitals of C-atom undergo sp^3 hybridization.

iv. One electron from the 2s orbital of carbon atom is excited to the 2p_z orbital. Then the four orbitals 2s, p_x, p_y and p_z mix and recast to form four new sp^3 hybrid orbitals having same shape and equal energy. They are maximum apart and have tetrahedral geometry with H-C-H bond angle of $109^\circ 28'$. Each hybrid orbital contains one unpaired electron.

v. Each of these sp^3 hybrid orbitals with one electron overlap axially with the 1s orbital of hydrogen atom to form one C-H sigma bond. Thus, in CH_4 molecule, there are four C-H bonds formed by the sp^3 -s overlap.

Diagram:



Question G.

In Ammonia molecule the bond angle is $107^\circ 18'$ and in water molecule it is $104^\circ 35'$, although in both the central atoms are sp^3 hybridized. Explain.

Answer:

i. The ammonia molecule has sp^3 hybridization. The expected bond angle is $109^\circ 28'$. But the actual bond angle is $107^\circ 28'$. It is due to the following reasons.

- One lone pair and three bond pairs are present in ammonia molecule.
- The strength of lone pair-bond pair repulsion is much higher than that of bond pair-bond pair repulsion.
- Due to these repulsions, there is a small decrease in bond angle ($\sim 2^\circ$) from $109^\circ 28'$ to $107^\circ 18'$.

ii. The water molecule has sp^3 hybridization. The expected bond angle is $109^\circ 28'$. But the actual bond angle is $104^\circ 35'$. It is due to the following reasons.

- Two lone pairs and two bond pairs are present in water molecule.
- The decreasing order of the repulsion is Lone pair-Lone pair > Lone pair-Bond pair > Bond pair-Bond pair.
- Due to these repulsions, there is a small decrease in bond angle ($\sim 5^\circ$) from $109^\circ 28'$ to $104^\circ 35'$.

Question H.

Give reasons for:

a. Sigma (σ) bond is stronger than Pi (π) bond.

b. HF is a polar molecule

c. Carbon is a tetravalent in nature.

Answer:

a. i. The strength of the bond depends on the extent of overlap of the orbitals. Greater the overlap, stronger is the bond.

ii. A sigma bond is formed by the coaxial overlap of the atomic orbitals which are oriented along the internuclear axis, hence the extent of overlap is maximum.

iii. A pi bond is formed by the lateral overlap of the atomic orbitals which are oriented perpendicular to the internuclear axis, hence the extent

of orbital overlapping in side wise manner is less.

Hence, sigma bond is stronger than pi bond.

b. i. When a covalent bond is formed between two atoms of different elements that have different electronegativities, the shared electron pair does not remain at the centre. The electron pair is pulled towards the more electronegative atom resulting in the separation of charges.

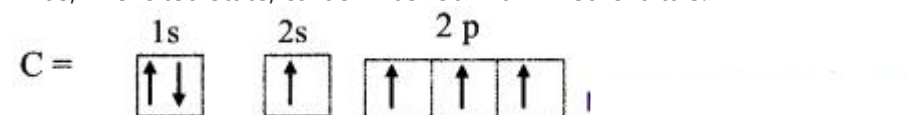
ii. In H-F, fluorine is more electronegative than hydrogen. Therefore, the shared electron pair is pulled towards fluorine and fluorine acquires partial -ve charge and simultaneously hydrogen acquires partial +ve charge. This gives rise to dipole and H-F bond becomes polar. Hence, H-F is a polar molecule.

c. The electronic configuration of carbon is:

$1s^2 2s^2 2p_x^1 2p_y^1$

One electron from '2s' orbital is promoted to the empty '2p' orbital.

Thus, in excited state, carbon has four half-filled orbitals.



Hence, carbon can form 4 bonds and is tetravalent in nature.

Question I.

Which type of hybridization is present in ammonia molecule? Write the geometry and bond angle present in ammonia.

Answer:

The type of hybridization present in ammonia (NH_3) molecule is sp^3 .

Geometry of ammonia molecule is pyramidal or distorted tetrahedral.

Bond angle in ammonia molecule is $107^\circ 18'$.

Question J.

Identify the type of orbital overlap present in

a. H_2

b. F_2

c. H-F molecule.

Explain diagrammatically.

Answer:

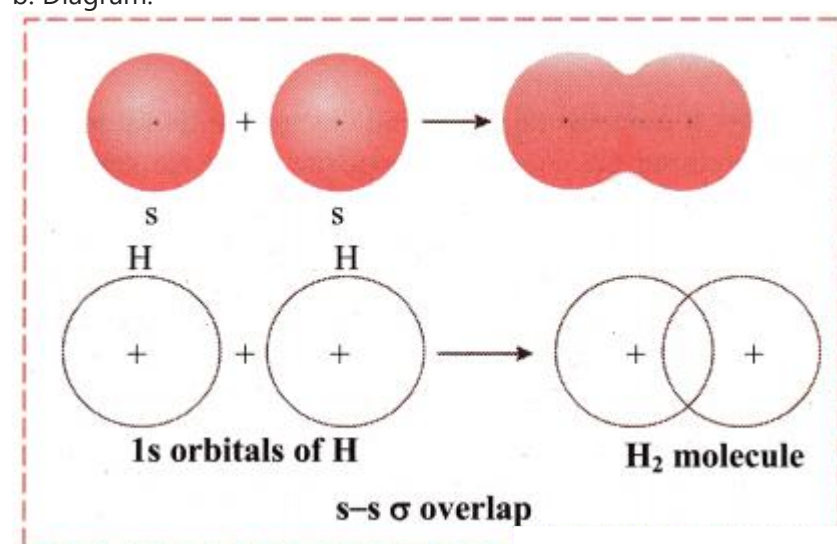
i. s-s σ overlap:

a. The overlap between two half-filled s orbitals of two different atoms containing unpaired electrons with opposite spins is called s-s overlap.

e.g. Formation of H_2 molecule by s-s overlap:

Hydrogen atom ($Z = 1$) has electronic configuration: $1s^1$. The $1s$ orbitals of two hydrogen atoms overlap along the internuclear axis to form a σ bond between the atoms in H_2 molecule.

b. Diagram:



ii. p-p σ overlap:

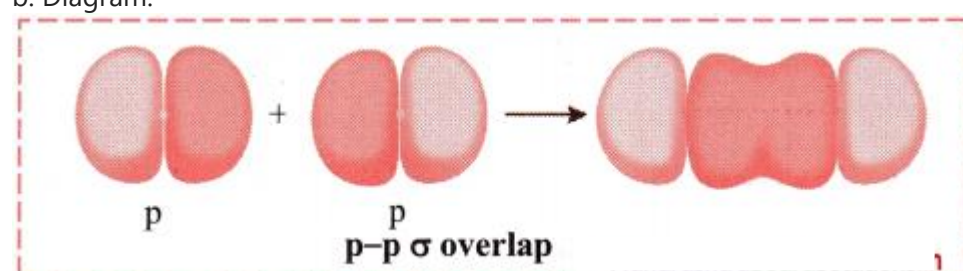
a. This type of overlap takes place when two p orbitals from different atoms overlap along the internuclear axis.

e.g. Formation of F_2 molecule by p-p overlap:

Fluorine atom ($Z = 9$) has electronic configuration $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^2$.

During the formation of F_2 molecule, half-filled $2p_z$ orbital of one F atom overlaps with similar half-filled $2p_z$ orbital containing electron with opposite spin of another F atom axially and a p-p σ bond is formed.

b. Diagram:



iii. s-p σ overlap:

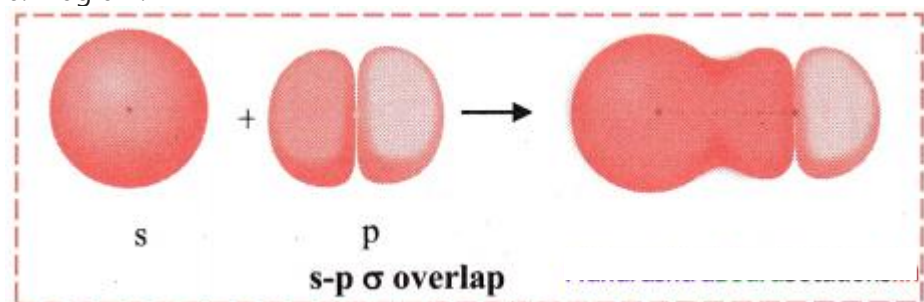
a. In this type of overlap one half filled s orbital of one atom and one half filled p orbital of another orbital overlap along the internuclear axis.

e.g. Formation of HF molecule by s-p overlap:

Hydrogen atom ($Z = 1$) has electronic configuration: $1s^1$ and fluorine atom ($Z = 9$) has electronic configuration $1s^2 2s^2 2p_x^2 2p_y^2 2p_z^1$.

During the formation of HF molecule, half-filled $1s$ orbital of hydrogen atom overlaps coaxially with half-filled $2p_z$ orbital of fluorine atom with opposite electron spin and an s-p σ bond is formed.

b. Diagram:



Question K.

F-Be-F is a linear molecule but H-O-H is angular. Explain.

Answer:

i. In the BeF_2 molecule, the central beryllium atom undergoes sp hybridization giving rise to two sp hybridized orbitals placed diagonally opposite with an angle of 180° . Thus, F-Be-F is a linear molecule.

ii. In the H_2O molecule, the central oxygen atom undergoes sp^3 hybridization giving rise to four sp^3 hybridized orbitals directed towards four corners of a tetrahedron. There are two lone pairs of electrons in two of the sp^3 hybrid orbitals of oxygen. The lone pair-lone pair repulsion distorts the structure. Hence, H-O-H is angular or V-shaped.

Question L.

BF_3 molecule is planar but NH_3 pyramidal. Explain.

Answer:

i. In the BF_3 molecule, the central boron atom undergoes sp^2 hybridization giving rise to three sp^2 hybridized orbitals directed towards three corners of an equilateral triangle. Thus, the geometry is trigonal planar.

ii. In the NH_3 molecule, the central nitrogen atom undergoes sp^3 hybridization giving rise to four sp^3 hybridized orbitals directed towards four corners of a tetrahedron. The expected geometry of NH_3 molecule is regular tetrahedral with bond angle $109^\circ 28'$. There is one lone pair of electrons in one of the sp^3 hybrid orbitals of nitrogen. The lone pair-bond pair repulsion distorts the bond angle. Hence, the structure of NH_3 is distorted and it has pyramidal geometry.

Question M.

In case of bond formation in Acetylene molecule :

a. How many covalent bonds are formed ?

b. State number of sigma and pi bonds formed.

c. Name the type of Hybridisation.

Answer:

a. In acetylene molecule, there are five covalent bonds.

b. In acetylene molecule, there are three sigma bonds and two pi bonds.

c. In acetylene molecule, each carbon atom undergoes sp hybridization.

Question N.

Define :

a. Bond Enthalpy

b. Bond Length

Answer:

a. Bond Enthalpy:

Bond enthalpy is defined as the amount of energy required to break one mole of a bond of one type, present between two atoms in a gaseous state.

b. Bond Length:

Bond length is defined as the equilibrium distance between the nuclei of two covalently bonded atoms in a molecule.

Question O.

Predict the shape and bond angles in the following molecules:

a. CF_4

b. NF_3

c. HCN

d. H_2S

Answer:

a. CF_4 : There are four bond pairs on the central atom. Hence, shape of CF_4 is tetrahedral and F-C-F bond angle is $109^\circ 28'$.

b. NF_3 : There are three bond pairs and one lone pair on the central atom. Hence, shape of NF_3 is trigonal pyramidal and F-N-F bond angle is less than $109^\circ 28'$.

c. HCN : There are two bond pairs on the central atom. Hence, shape of HCN is linear and H-C-N bond angle is 180° .

d. H_2S : There are two bond pairs and two lone pairs on the central atom. Hence, shape of H_2S is bent or V-shaped and H-S-H bond angle is slightly less than $109^\circ 28'$.

4. Using data from the Table, answer the following :

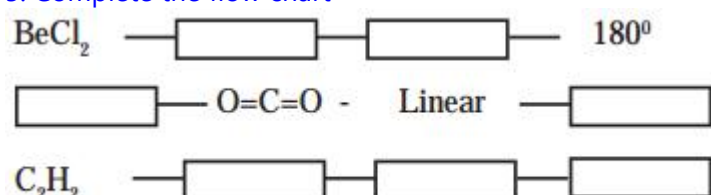
Examoles	C ₂ H ₆ Ethane	C ₂ H ₄ Ethene	C ₂ H ₂ Ethyne
Structure	$\text{>C}-\text{C}<$	$\text{>C}=\text{C}<$	$\text{-C}\equiv\text{C-}$
Type of bond between carbons	single	double	triple
Bond length (nm)	0.154	0.134	0.120
Bond Enthalpy kJ mol ⁻¹	348	612	837

- What happens to the bond length when unsaturation increases?
- Which is the most stable compound?
- Indicate the relation between bond strength and Bond enthalpy.
- Comment on overall relation between Bond length, Bond Enthalpy and Bond strength and stability.

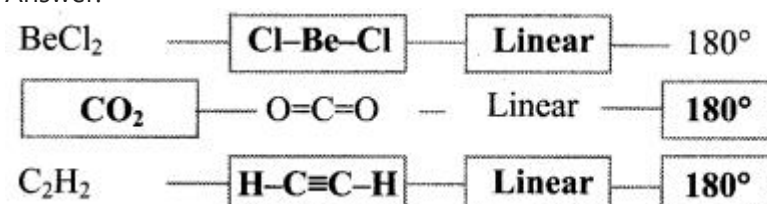
Answer:

- When unsaturation increases, the bond length decreases.
- The stable compound is ethyne (C₂H₂).
- Bond strength \propto Bond enthalpy
Larger the bond enthalpy, stronger is the bond.
- As bond length decreases, bond enthalpy, bond strength and stability increase.

5. Complete the flow chart



Answer:



6. Complete the following Table

Molecule	Type of Hybridisation	Type of bonds	Geometry	Bond angle
CH ₄	-	4C-H 4σ bonds	Tetrahedral	-
NH ₃	sp ³	3N-H 3σbonds 1 lone pair	-	-
H ₂ O	-	-	angular	104.5°
BF ₃	sp ²	-	-	120°
C ₂ H ₄	-	-	-	120°
BeF ₂	-	2 Be-F	Linear	-
C ₂ H ₂	sp	(3σ+2π) 1C-C σ 2C-H σ 2C-C π	-	-

Answer:

Molecule	Type of hybridization	Type of bonds	Geometry	Bond angle
CH ₄	sp ³	4C-H 4σ bonds	Tetrahedral	109.5°
NH ₃	sp ³	3N-H 3σ bonds 1 lone pair	Pyramidal	107°18'
H ₂ O	sp ³	2 O-H, 2 σ bonds 2 lone pairs	Angular	104.5°
BF ₃	sp ²	3 B-F, 3 σ bonds, One empty p orbital	Trigonal planar	120°
C ₂ H ₄	sp ²	(5 σ + 1 π) 1C-C σ, 4C-H σ, 1C-C π	Trigonal planar	120°
BeF ₂	sp	2 Be-F	Linear	180°
C ₂ H ₂	sp	(3 σ + 2 π) 1C-C σ 2C-H σ 2C-C π	Linear	180°

7. Answer in one sentence:

Question A.

Indicate the factor on which stability of ionic compound is measured?

Answer:

The stability of an ionic compound is measured by the amount of energy released during lattice formation.

Question B.

Arrange the following compounds on the basis of lattice energies in decreasing (descending) order: BeF₂, AlCl₃, LiCl, CaCl₂, NaCl.

Answer:

AlCl₃ > BeF₂ > CaCl₂ > LiCl > NaCl

Question C.

Give the total number of electrons around sulphur (S) in SF₆ compound.

Answer:

The total number of electrons around sulphur (S) in SF₆ is 12.

Question D.

Covalent bond is directional in nature. Justify.

Answer:

Covalent bond is formed by the overlap of two half-filled atomic orbitals. The atomic orbitals are oriented in specific directions in space (except s-orbital which is spherical). Hence, covalent bond is directional in nature.

Question E.

What are the interacting forces present during formation of a molecule of a compound ?

Answer:

- Forces of attraction: The nucleus of one atom attracts the electrons of the other atom and vice-versa.
- Forces of repulsion: The electron of one atom repels the electron of the other atom and vice-versa (as electrons are negatively charged). There is repulsion between the two nuclei (as the nuclei are positively charged).

Question F.

Give the type of overlap by which pi (π) bond is formed.

Answer:

The type of overlap by which pi (π) bond is formed is p-p lateral overlap.

Question G .

Mention the steps involved in Hybridization.

Answer:

The steps involved in hybridization are:

- formation of the excited state and
- mixing and recasting of orbitals.

Question H.

Write the formula to calculate bond order of molecule.

Answer:

Bond order of a molecule = $\frac{N_b - N_a}{2}$

where, N_b is the number of electrons present in bonding MOs and N_a is the number of electrons present in antibonding MOs.

Question I.

Why is O₂ molecule paramagnetic?

Answer:

The electronic configuration of O₂ molecule is $(\sigma 1s)^2 (\sigma^* 1s)^2 (\sigma 2s)^2 (\sigma^* 2s)^2 (\sigma 2p_z)^2 (\pi 2p_x)^2 (\pi 2p_y)^2 (\pi^* 2p_x)^1 (\pi^* 2p_y)^1$

Since the oxygen molecule contains two unpaired electrons, it is paramagnetic.

Question J.

What do you mean by formal charge ? Explain its significance with the help of suitable example.

Answer:

Formal charge is the charge assigned to an atom in a molecule, assuming that all electrons are shared equally between atoms, regardless of their relative electronegativities.

Structure (I):

Number of atom	Total number of electrons in free atom (V.E.)	Total number of non-bonding electrons (N.E.)	Total number of shared electrons in bond (B.E.)	Formal charge $F.C = (V.E.) - (N.E.) - \frac{1}{2} (B.E.)$
1	6	4	4	$F.C = 6 - 4 - \frac{1}{2} (4) = 0$
2	4	0	8	$F.C = 4 - 0 - \frac{1}{2} (8) = 0$
3	6	4	4	$F.C = 6 - 4 - \frac{1}{2} (4) = 0$

Structure (II):

Number of atom	Total number of electrons in free atom (V.E.)	Total number of non-bonding electrons (N.E.)	Total number of shared electrons in bond (B.E.)	Formal charge $F.C = (V.E.) - (N.E.) - \frac{1}{2} (B.E.)$
1	6	2	6	$F.C = 6 - 2 - \frac{1}{2} (6) = +1$
2	4	0	8	$F.C = 4 - 0 - \frac{1}{2} (8) = 0$
3	6	6	2	$F.C = 6 - 6 - \frac{1}{2} (2) = -1$

Structure (III):

Number of atom	Total number of electrons in free atom (V.E.)	Total number of non-bonding electrons (N.E.)	Total number of shared electrons in bond (B.E.)	Formal charge $F.C = (V.E.) - (N.E.) - \frac{1}{2} (B.E.)$
1	6	6	2	$F.C = 6 - 6 - \frac{1}{2} (2) = -1$
2	4	0	8	$F.C = 4 - 0 - \frac{1}{2} (8) = 0$
3	6	2	6	$F.C = 6 - 2 - \frac{1}{2} (6) = +1$

While determining the best Lewis structure per molecule, the structure is chosen such that the formal charge is as close to zero as possible. The structure having the lowest formal charge has the lowest energy.

In structure (I), the formal charge on each atom is 0 while in structures (II) and (III) formal charge on carbon is 0 while oxygens have formal charge -1 or +1. Hence, the possible structure with the lowest energy will be structure (I). Thus, formal charges help in the selection of the lowest energy structure from a number of possible Lewis structures for a given species.

11th Chemistry Digest Chapter 5 Chemical Bonding Intext Questions and Answers

(Textbook Page No. 55)

Question 1.

Why are atoms held together in chemical compounds?

Answer:

Atoms are held together in chemical compounds due to chemical bonds.

Question 2.

How are chemical bonds formed between two atoms?

Answer:

There are two ways of formation of chemical bonds:

1. by loss and gain of electrons
2. by sharing a pair of electrons between the two atoms.

In either process of formation of chemical bond, each atom attains a stable noble gas electronic configuration.

Question 3.

Which electrons are involved in the formation of chemical bonds?

Answer:

The electrons present in the outermost shell of an atom are involved in the formation of a chemical bond.

[Internet my friend \(Textbook Page No. 55\)](#)

Question 1.

Search more atoms, which complete their octet during chemical combinations.

Answer:

In compounds like KCl, MgCl_2 , CaO, NaF, etc, the constituent atoms complete their octet by lose or gain of electrons.

e.g. $\text{K} \rightarrow \text{K}^+ + \text{e}^-$

$\text{Cl} + \text{e}^- \rightarrow \text{Cl}^-$

$\text{K}^+ + \text{Cl}^- \rightarrow \text{KCl}$

[Note: Students are expected to search more atoms on their own.]

[Use your brainpower. \(Textbook Page No. 60\)](#)

Question 1.

Which atom in NH_4^+ will have formal charge +1?

Answer:

In NH_4^+ , nitrogen atom (N) will have formal charge of +1.

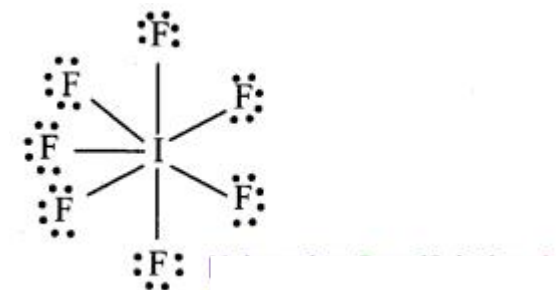
[Use your brainpower. \(Textbook Page No. 61\)](#)

Question 1.

How many electrons will be around I in the compound IF_7 ?

Answer:

Lewis structure of IF_7 is:



In IF_7 , iodine (I) atom will be surrounded by 14 electrons.

Question 2.

Why is H_2 stable even though it never satisfies the octet rule?

Answer:

The valence shell configuration of hydrogen atom is $1s^1$. Two hydrogen atoms approach each other and share their valence electrons. By having two electrons in its valence shell, H atom attains the nearest noble gas configuration of He. H_2 molecule attains stability due to duplet formation. Hence, H_2 is stable even though it never satisfies the octet rule.

[\(Textbook Page No. 64\)](#)

Question 1.

Lowering of energy takes during bond formation. How does this happen?

Answer:

i. When two combining atoms approach each other to form a covalent bond, the following interacting forces come into play.

- Forces of attraction: The nucleus of one atom attracts the electrons of the other atom and vice-versa.
- Forces of repulsion: The electron of one atom repels the electron of the other atom and vice-versa (as electrons are negatively charged). There is repulsion between the two nuclei (as the nuclei are positively charged).

ii. The balance between attractive and repulsive forces decide whether the bond will be formed or not.

iii. When the magnitude of attractive forces is more than the magnitude of repulsive forces, the energy of the system decreases and a covalent bond is formed.

iv. When the magnitude of repulsive forces becomes more than that of attraction, the total energy of the system increases and a covalent bond is not formed.

Hence, lowering of energy takes during bond formation.

[Can you tell? \(TextBook Page No. 76\)](#)

Allguidesite -

- Arjun

- Digvijay

Question 1.

Which molecules are polar?

H-I, H-O-H, H-Br, Br₂, N₂, I₂, NH₃

Answer:

i. H-I: Polar

ii. H-O-H: Polar

iii. H-Br: Polar

iv. Br₂: Nonpolar

v. N₂: Nonpolar

vi. I₂: Nonpolar

vii. NH₃: Polar

ALLguidesite