Chapter: Chemical Bonding and Molecular Structure

Chemical Bonding

Question 1

What is meant by the term chemical bond? How does Kessel-Lewis approach of bonding differ from the modern views?

Ans.

The attractive force which holds various constituents (atoms, ions etc) together in different chemical species is called chemical bond. According to Kossel-Lewis approach, a chemical bond is formed between two atoms either by the transfer of electrons or by mutual sharing of electrons. But according to the modern view a chemical bond is formed only when there is a net decrease of energy between the two approaching atoms due to attractive and repulsive forces.

Question 2

Calculate the formal charge on the following:

a) O atoms of O_3

b) Cl atom in $HClO_4$ion

c) S in HSO_4^- ion

Ans.

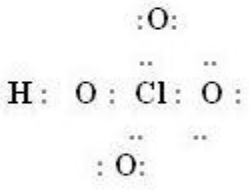
a) :O:: O: O:

Formal charge on $O^1 = 6 - \frac{1}{2}(6) - 2 = +1$

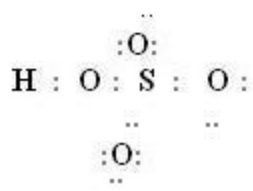
Formal charge on $O^2 = 6 - \frac{1}{2}(4) - 4 = 0$

Formal charge on $O^3 = 6 - \frac{1}{2}(2) - 6 = -1$

b) Formal charge on Cl atom in $HClO_4 = 7 - \frac{1}{2}(8) - 0 = 3$



c) Formal charge on S atom in $HSO_4 = 6 - \frac{1}{2}(8) - (0) = 2$

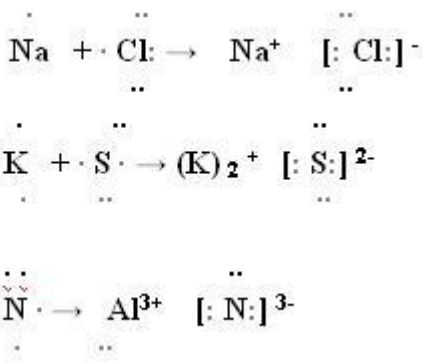


Question 3

Using Lewis dot symbols, show electron transfer between the following atoms to form cations and anions:

a) Na and Cl
b) Ca and O
c) Al and N

Ans.



Question 4

What is formal charge? How can we calculate the formal charge on an atom in Lewis structure?

Ans.

Formal charge on an atom is the difference between the number of valence electrons in an isolated atom and the number of electrons assigned to that atom in a Lewis structure.

Formal charge = $V - \frac{1}{2} S - L$

Here V= total number of valence electrons on free atom
S= total number of shared electrons
L= total number of unshared valence electrons.

Question 5

The elements of the third period of the periodic table have expanded octet. Explain?

Ans.

The elements present in the third period and beyond it have 3d orbitals apart from 3s and 3p orbitals for bonding. So in number of compounds of these elements there are more than eight valence electrons around the central atom. This is known as expanded octet.

Question 6

Define octet rule. What is its significance?

Ans.

The octet rule states that atoms of various elements enter into chemical combination so as to attain the configuration of eight electrons in their outermost shell. It is quite useful in explaining the normal valency of large number of elements.

Question 7

Name the noble gas which is an exception to the octet rule?

Ans.

Helium is an exception to the octet rule as it has a duplet of electrons.

Question 8

The formation of NaCl involves conversion of sodium atom into sodium ion and chlorine atom into chloride ion. Comment upon the energy changes involved in these reactions.

Ans.

In the formation of NaCl conversion of sodium atom in to sodium ion is an endothermic process and the conversion of chlorine atom into chloride ion is an exothermic process.

Question 9

What do you understand by the term valence electrons?

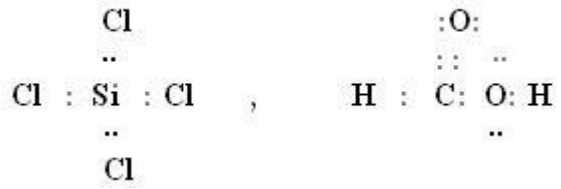
Ans.

The electrons present in the outer shell of an atom that take part in a chemical reaction are known as valence electrons.

Question 10

Draw the Lewis structures of $SiCl_4$ and HCOOH?

Ans.



Ionic bond

Question 11

"In the molecule H-Br the H would have a partial negative charge and the Br would have a partial positive charge." Is it true? Explain.

Ans.

No, the statement is wrong. In HBr, the H has partial positive charge while Br has partial negative charge. Br being more electronegative attracts the shared pair of electrons towards itself. The compound HBr is a polar covalent compound.

Question 12

What is the maximum number of covalent bonds an element with atomic number 16 can make with hydrogen? Give its formula and the type of bond formed.

Ans.

Sulphur has atomic number = 16. Electronic configuration = 2, 8, 6. It needs 2 more electrons to complete its octet.

Thus, it shares its 2 electrons with two different hydrogen atoms and forms two single-covalent bonds.

The formula of the compound is H_2S and it has polar covalent bond.

Question 13

Classify the given compounds as ionic or covalent?

CH_4, NaCl, H_2O, CO_2, O_2, KBr.

Ans.

Ionic compounds are formed by complete transfer of electrons from one atom to another. The ionic compounds are: NaCl, KBr.

Covalent compounds are formed by sharing of electrons between the atoms in the molecule. The covalent compounds are: CH_4, H_2O, CO_2, O_2.

Question 14

What type of bond is present in present in NH_3? Explain in brief.

Ans.

Ammonia (NH3) has polar covalent bond.

A non-polar covalent bond is formed when the shared pair of electron is not equally shared between the atoms of the molecule. The shared pair of electrons shifts towards the more electronegative atom. This results in formation of partial charges on the atoms in the molecule. Nitrogen has partial negative charge while hydrogen has partial positive charge. Thus, ammonia has polar covalent bond.

Question 15

Which molecule is most likely to have a dipole moment: CS_2, SO_3, H_2S and $SnCl_4$? Give reasons for your answer.

Ans.

H_2S molecule has irregular geometry. It has two lone pair of electrons on sulphur atom. Thus, it is expected to have a dipole moment.

Question 16

Explain why reactions involving covalent compounds are generally slow?

Ans.

Covalent bond compounds are formed by the mutual sharing of electrons between the atoms in the compound. These compounds do not produce ions in the aqueous solution.

Reactions of covalent bonded compounds involve breaking of bonds in reacting molecules and forming new covalent bonds in the products. Thus, these reactions are relatively slow.

Question 17

What is lattice energy? Which compound NaCl or MgO has higher lattice energy and why?

Ans.

Lattice energy is the amount of energy released when one mole of ionic solid is formed by the close packing of gaseous ions. Lattice energy depends on:

- **Size of the ions**: Small is the size of ion, lesser is the inter-nuclear distance and greater will be the attraction, thus larger will be the magnitude of lattice energy.
- **Charge on the ions**: More the charge on the ion, higher is the lattice energy. Between NaCl and MgO, lattice energy of MgO is higher as the positive charge on Mg is higher than Na ion.

Question 18

Ionic compounds do not conduct electricity when solid. Why? When do they conduct electricity?

Ans.

Ionic compounds are formed by attraction between the positive and negative ions. These ions cannot move out of their fixed positions. Thus, solid ionic compounds do not conduct electricity.

When ionic compounds are in molten state or dissolved in water forming a solution, the ions can move. Then ionic compounds conduct electricity.

Question 19

How is ionic bond formed? Give the main physical and chemical properties of compounds having ionic bonding.

Ans.

Ionic bond is formed by the transfer of one or more electrons from one atom to another. The atom which gives electron is the metal while the receiving atom is generally the non-metal.

General characteristics of ionic bonding:

- Ionic bond is non-directional in character.
- Compounds having ionic bond are soluble in polar solvents.
- They have high melting and boiling point.
- Ionic bonded compounds conduct electricity in solution and molten form.
- In solution, ionic compounds show fast and instantaneous reactions.

Question 20

A diatomic molecule has dipole moment of 1.92D and bond length of 2A. Calculate the percentage ionic character of the molecule.

Ans.

Dipole moment (m) = e x d

Or, 1.92×10^{-18} esu cm = e x 2×10^{-8} cm

e = $1.92 \times 10^{-18} / 2 \times 10^{-8}$

Charge (e) = 9.6×10^{-9} esu

Charge on isolated ion = 4.8×10^{-10} esu

Percentage of ionic character = 9.6×10^{-9} esu x 100 / 4.8×10^{-10} esu

Percentage of ionic character = 20%

Bond parameters

Question 21

Discuss the factors on which the magnitude of bond energy depends.

Ans.

Bond energy depends on:

- *Size of the participating atom*: Large the size of participating atom, smaller is the value of bond energy. The large size of the atom allows lesser extent of orbital overlapping.
- *Multiplicity of bond*: The magnitude of bond energy increases with the multiplicity of bond, even though the atoms involved would be the same. This is because the number of shared electrons increases with the multiplicity of bonds.

Question 22

What do you understand by the bond energy for the O=O bond is 498 kJ/mole?

Ans.

If the bond energy for O=O bond is 498 kJ/mole, 498 kJ is needed to break one mole of O=O bonds.

Bond energy is the amount of energy required to break one mole of bond of same kind, so as to separate the bonded atoms in the gaseous state.

Question 23

Compare three types of bonding in terms of bond energy and directional characteristics.

Ans.

Type of Bond	Bond Energy	Other characteristics
Ionic	strong	Non-directional
Covalent	variable	Directional
Metallic	variable	Non-directional

Question 24

Define bond length. Mentions its unit of measurement. On what factors does bond length depend?

Ans.

The average distance between the centres of the nuclei of the two bonded atoms in a molecule is known as bond length. It is expressed in Angstrom units (Å) or picometres (pm).

Bond length depends on:

Size of atoms: Bond length increases with the increase in the size of the atoms.

Multiplicity of bonds: the bond length decreases with the multiplicity of bonds.

Question 25

Calculate the bond order of the following molecules/ions: H_2^+, N_2, CN, CO. State its magnetic behavior.

Ans.

Bond order = (number of bonded electrons – number of non-bonded electrons)/2

(i) H_2^+,
B.O. = (1 – 0) / 2
B.O. = 0.5, paramagnetic

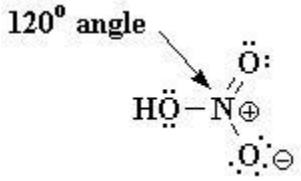
(ii) N_2,
B.O. = (8 – 2) / 2
B.O. = 3, diamagnetic.

(iii) CN,
B.O. = (7 – 2) / 2
B.O. = 2.5, paramagnetic

(iv) CO.
B.O. = (8 – 2) / 2
B.O. = 0.5, diamagnetic.

Question 26
Why is the bond angle of water molecule less than the normal?
Ans.
Water molecule is made of two hydrogen atoms and one oxygen atom. Oxygen atom has 2 lone pair of electrons. This causes a slight redistributing of the charges around the oxygen.
The lone pair of electrons pushes the bonded electrons together, decreasing the size of the angle.

Question27
Draw an accurate Lewis structure for $HONO_2$, including all non-bonded electron pairs and formal charges. Additionally, provide bond angles around the nitrogen atom.
Ans.
The structure of HNO_3 is:



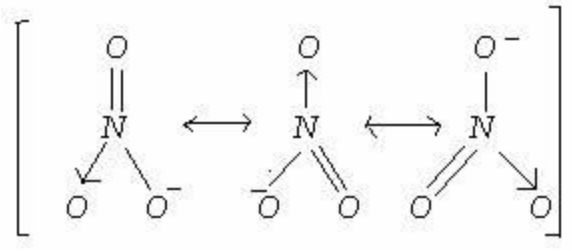
Question 28
What are bond pair and lone pair of electrons?
Ans.
Bond pair of electrons is the electron pair that is directly involved in bond formation.
The lone pair of electrons is electron pairs which are not involved directly in bonding.

Question 29

Draw the resonating structures of nitrate ion? Calculate the bond order of N-O.

Ans.

The resonating structures of nitrate ion NO_3^- are:



Bond order of NO bond is = 4/3 = 1.33

Question 30

Define bond enthalpy. Give its units.

Ans.

The amount of energy required to break one mole of bonds of a particular type between two atoms in a gaseous state is known as bond enthalpy.

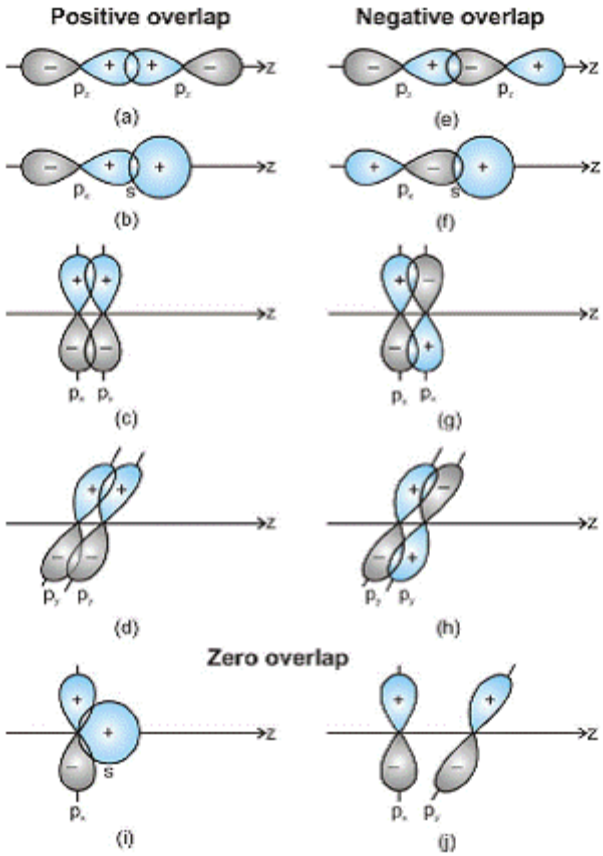
Its unit is kJ mol^{-1}.

Hybridization

Question 31

Draw the diagrams showing positive, negative and zero overlap.

Ans.



Question 32

Explain why helium molecule does not exist?

Ans.

Helium atom ($1s^2$) has 2 electrons in its 1s orbital. During the approach of two helium atoms, the repulsive forces are dominant over the attractive forces. As a result the energy of the system increases which leads to instability. Since energy of the separate helium atoms is smaller than that of the system when they are close to each other, they prefer to stay separate and do not form He_2 molecule.

Question 33

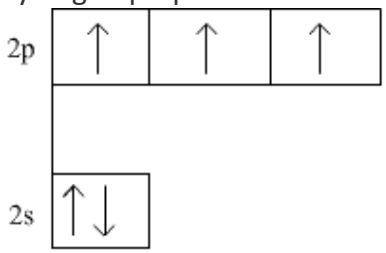
Define hybridization. Show the formation of ammonia (NH_3) molecule.

Ans.

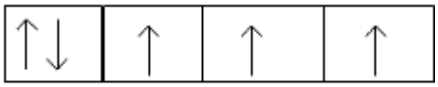
i) The phenomena of intermixing of atomic orbitals of slightly different energies of the atom (by redistributing their energies) to form new set of orbitals of equivalent energies and identical shape is known as hybridization.

ii) **Formation of ammonia molecule**-In ammonia molecule the nitrogen atom is sp^3 hybridized. Three sp^3-hybrid orbitals of N atom are used for forming sp^3-s σ (sigma)

bonds with H atoms. The fourth sp^3-hybrid orbital carry lone pair of electrons. The relatively larger lp-bp interactions cause H-N-H angle to decrease from 109^o 28' to 107^o.

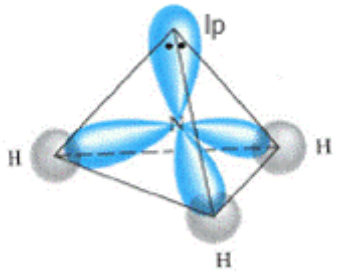


Ground State of N atom.



Sp^3

Hybrid State of N atom.



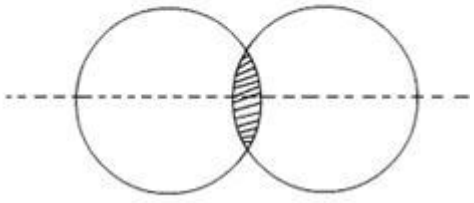
Question 34

Explain the formation of sigma and pi bond.

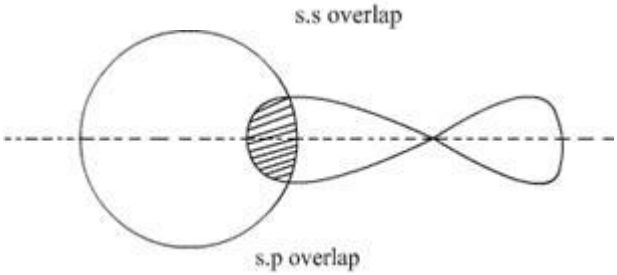
Ans.

Sigma bond is formed by the axial overlapping of half filled atomic orbitals where as pi bond is formed by the lateral or sidewise over lap of the atomic orbitals.

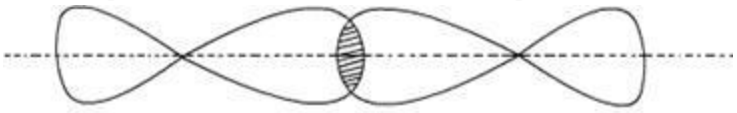
Sigma (σ) boud



s.s overlap

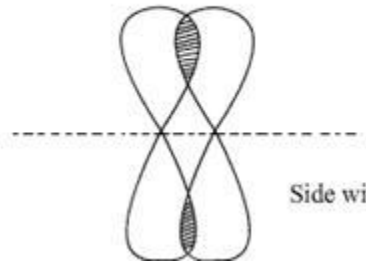


s.p overlap



p.p overlap

Pi (π) boud



Side wise overlap of p-orbitals

Question 35

Differentiate between valence bond theory and Lewis concept in regard to the formation of covalent bond

Ans.

Lewis concept	**Valence bond theory**
i) Lewis concept considers the formation of covalent bond by mutual sharing of electrons.	i) Valence bond theory considers the formation of covalent bond by over lap of half filled atomic orbitals.
ii) It does not provide explanation for different shape of molecules.	ii) Valence bond theory explains the shape of molecules.
iii) Lewis structure does not explain the bond strength	iii) Valence bond theory explains the bond strength.

Question 36

What is the hybrid state of

B in BF_3, Al in $AlCl_3$, Be in $BeCl_2$, C in CO_2 and C_2H_4; S in SO_2 and SO_3.

Ans.

Element	**Compound**	**Hybrid state**
B	BF_3	sp^2
Al	$AlCl_3$	sp^2
Be	$BeCl_2$	sp
C	CO_2	sp
C	C_2H_4	sp^2
S	SO_2 and SO	sp^2 in both

Question 37

Name the d- orbitals that are involved in sp^3d^2 hybridization

Ans.

In sp^3d^2 hybridization dx^2-y^2 and dz^2 orbitals are involved.

Question 38

Name one cation which is isostructural with NH_3.

Ans.

H_3O^+ is sp^3 hybridized and have pyramidal shape so it is isostructural with NH_3.

Question 39

How many lone pairs, bond pairs are present around S in SF_4 molecule? What is their arrangement?

Ans.

In SF_4 molecule, 4 bond pair and 1 lone pair is present. The arrangement is trigonal bipyramidal.

Question 40

Among H_2^+ and H_2^- molecular ions which ion is more stable and why?

Ans.

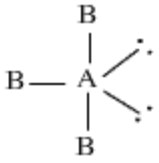
Among H_2^+ and H_2^- molecular ions, H_2^+ ion is more stable because the electron in H_2^+ is present only in bonding orbital.

Geometry & shapes of molecules

Question 41

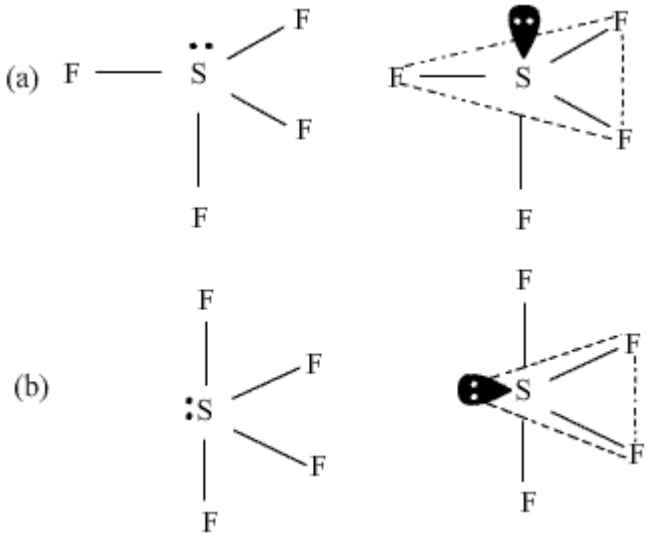
Draw the shapes of AB_2E_2 and AB_2E_3 type of molecules. Also mention the number of bond pairs, lone pair of electrons and example of the molecules.

Ans.

Molecule type	No. of bonding pairs	No. of lone pairs	Arrangement of electron pairs	Shape	Examples
AB_2E_2	2	2	 Tetrahedral	Bent	H_2O
AB_3E_2	3	2	 Trigonal bi-pyramidal	T-shape	ClF_3

Question 42

Among the following structures of SF_4 which one is more stable and why? What is this shape called?



Ans.

In figure (a), the lone pair of electrons is present at the axial position so there are three lone pair-bond pair repulsions at 90°. In the second figure, the lone pair of electrons is present in the equatorial position and there are two lone-pair bond-pair repulsions. Hence figure b is more stable as compared to figure a. The shape shown in figure b is distorted tetrahedron, a folded square or a see saw.

Question 43

The bond angles of PF_3, PCl_3, PBr_3 and PI_3 are 97°, 100°, 101.5° and 102° respectively. This data shows a gradual increase in the bond angle. Explain why?

Ans.

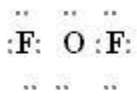
As the electro negativity of surrounding atom decreases, the electron pair lie closer to the central atom so the repulsion between the electrons increases and the bond angle also increases.

Question 44

Using VSEPR theories identify the type of hybridization and draw the structure of OF_2 molecule.

Ans.

The Lewis dot structure OF_2 is:



In OF_2 molecule O is surrounded by 2 bond pair and 2 lone pair of electrons. Hence the arrangement of the bond pairs and the lone pairs should be tetrahedral. Therefore the hybrid state of oxygen should be sp^3.

Question 45

Explain why $MgCl_2$ is a linear molecule while $SnCl_2$ is angular?

Ans.

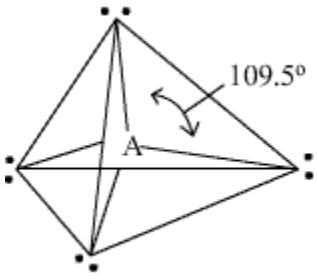
In $MgCl_2$, the central atom i.e. the magnesium ion is surrounded by only two bond pairs so there is no repulsion and the compound posses a regular geometry where as in the case of $SnCl_2$ molecule the central atom is surrounded by two bond pairs and two lone pairs of electrons which leads to repulsion among them as a result the molecule posses distorted geometry.

Question 46

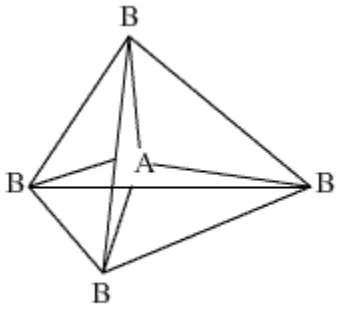
A compound A has 4 pairs of electrons around the central atom and makes an angle of $109^o28'$. Draw the shape of the compound.

Ans.

The compound has 4 pairs of electrons around the central atom and makes an angle of $109^o28'$, so it is tetrahedral in shape.



Tetrahedral



Tetrahedral

Question 47

Give examples of the compounds which show AB_5 and AB_6 geometry.

Ans.

AB_6-SF_6, TeF_6

AB_5-PCl_5, $SbCl_5$.

Question 48

What is the dipole moment and geometry of H_2 and CO_2 molecule?

Ans.

The dipole moment of H_2 and CO_2 molecules is zero and their shapes are linear.

Question 49

Why does the pair of electrons in the valence shell repel each other?

Ans.

The pairs of electrons in the valence shell repel each other because their electron clouds are negatively charged.

Question 50

Name two species which have tetrahedral shape.

Ans.

CH_4 and NH_4^+ have tetrahedral shape.

Resonance and Hydrogen bond

Question 51

(i) Describe the conditions necessary for hydrogen bonding.

(ii) Differentiate between intermolecular and intramolecular hydrogen bonding.

(iii) How does energy of the conical structures contribute to the stability of resonance hybrid?

Ans.

(i) The two conditions that are necessary for hydrogen bonding are:
(a) Hydrogen atom should be bonded to a highly electronegative atom.
(b) The size of the electronegative atom should be small.

(ii)

Intermolecular hydrogen bonding	Intramolecular hydrogen bonding
(i) It is formed between two different molecules of the same or different substances.	(i) It is formed between the hydrogen atom and highly electronegative atom present within the same molecule.
(ii) Example: HF, alcohol, water molecule.	(ii) Example: O-nitro phenol, O-nitro benzoic acid.

(iii) The conical structures of similar energy contribute equally to the resonance hybrid where as the structure with higher energy is less stable and has lesser contribution to the resonance hybrid.

Question 52

The dipole moment of a diatomic molecule is 4.1625 x 10^{-30}cm, express it in Debye units.

Ans.

$$1D = 10^{-18} \text{ esu cm}$$

$$1 \text{ esu} = \frac{1.602 \times 10^{-19}}{4.81 \times 10^{-10}} C = 3.33 \times 10^{-10} \text{ C} \quad \left(1 \text{ cm} = 10^{-2} \text{ m}\right)$$

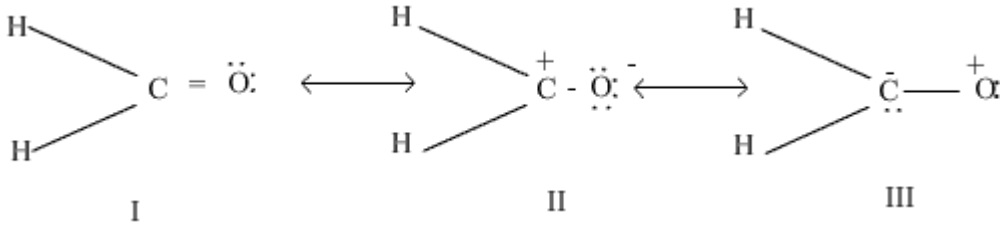
$$1D = 10^{-18} \text{ esu cm}$$

$$10^{-18} \times 3.33 \times 10^{-10} \text{ (C)} \times 10^{-2} \text{ (m)} = 3.33 \times 10^{-30} \text{ cm}$$

$$= \frac{4.1625 \times 10^{-30}}{3033 \times 10^{-30}} = 1.25 \text{ D}$$

Question 53

Out of the following resonating forms of formaldehyde which one is least significant and why?

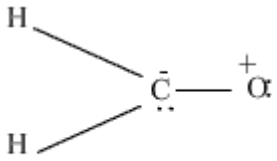


I II III

ii) What are the factors on which the dipole moment of polyatomic molecules depends?

Ans.

i) Among the given structures the III structure is least significant because here positive charge is present on more electronegative atom.



III

ii) The dipole moment of polyatomic molecules depends upon the individual dipole moments of the bonds and the spatial arrangement of various bonds of the molecules.

Question 54

"BeH_2 molecule has zero dipole moment although the Be-H bonds are polar." Explain this sentence on the basis of the concept of dipole moment.

Ans.

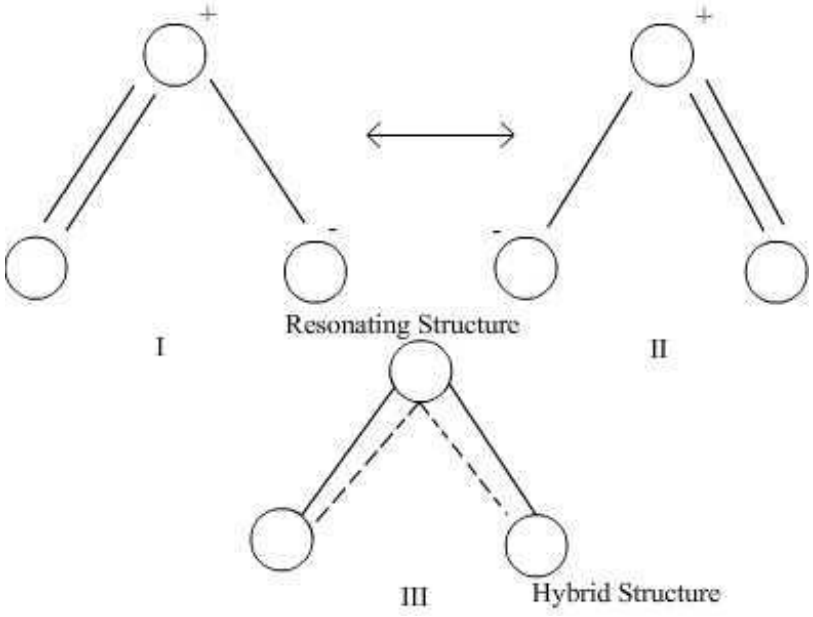
The BeH_2 molecule is linear with (H-Be-H) bond angle equal to 180^o. Although the Be-H bonds are polar due to the difference in the electro negativities of Be and H atom, the bond polarities cancel each other. As a result the resultant dipole moment is zero.

Question 55

Give two resonating structure of ozone which satisfy octet rule. Also give probable hybrid structure.

Ans.

The resonating structure of O_3 molecule which satisfy the octet rule are structure I and II .The probable hybrid structure is represented by structure III.



Question 56

Explain why H_2O is liquid while H_2S is a gas.

Ans.

The water molecules are associated with one another by strong intermolecular hydrogen bonds, whereas the intermolecular forces in liquid H_2S are weak dipole-dipole forces. As a result, the boiling point of H_2S is much lower than that of H_2O.so at ordinary temperature H_2O is liquid whereas H_2S is gas.

Question 57

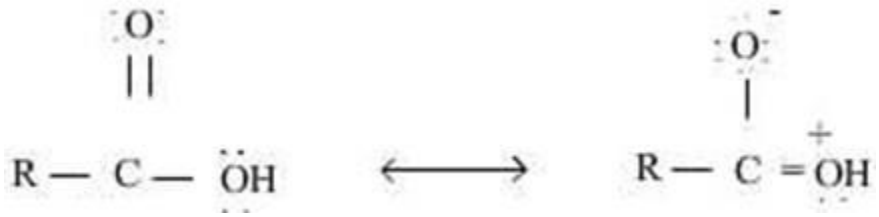
SO_2 and CO_2 are triatomic molecules. Compare their dipole moment? Justify your answer.

Ans.

The dipole moment of CO_2 is zero due to its linear structure. But the dipole moment of SO_2 is more than 0 because of its bent shape.

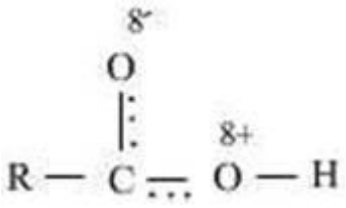
Question 58

The resonating structures of a molecule are given below. Draw the probable hybrid structure.



Ans.

The probable structure of the molecule is:



Question 59

Which has higher boiling point o-nitro phenol or p-nitro phenol? Give reason for your answer?

Ans.

p-Nitro phenol has higher boiling point because of intermolecular hydrogen bonding.

Question 60

Explain why sucrose is quite soluble in water though it is a covalent compound?

Ans.

A molecule of sucrose contains many –OH groups and hence is capable of forming H-bond with water. As a result of this it is soluble in water.

Molecular orbital theory

Question 61

Explain why the energy levels of molecular orbitals of B_2, C_2 and $N_2$are different?

Ans.

The combination of atomic orbitals takes place due to orbital-orbital interactions. Due to these interactions the energy level diagram gets modified. In case of atoms like boron, carbon and nitrogen the energy difference of 2s and 2p levels is quite small. Due to close proximity of 2s and 2p orbitals, the $\sigma 2s, \sigma^* 2s, \sigma 2pz$ *and* $\sigma^* 2pz$ orbitals

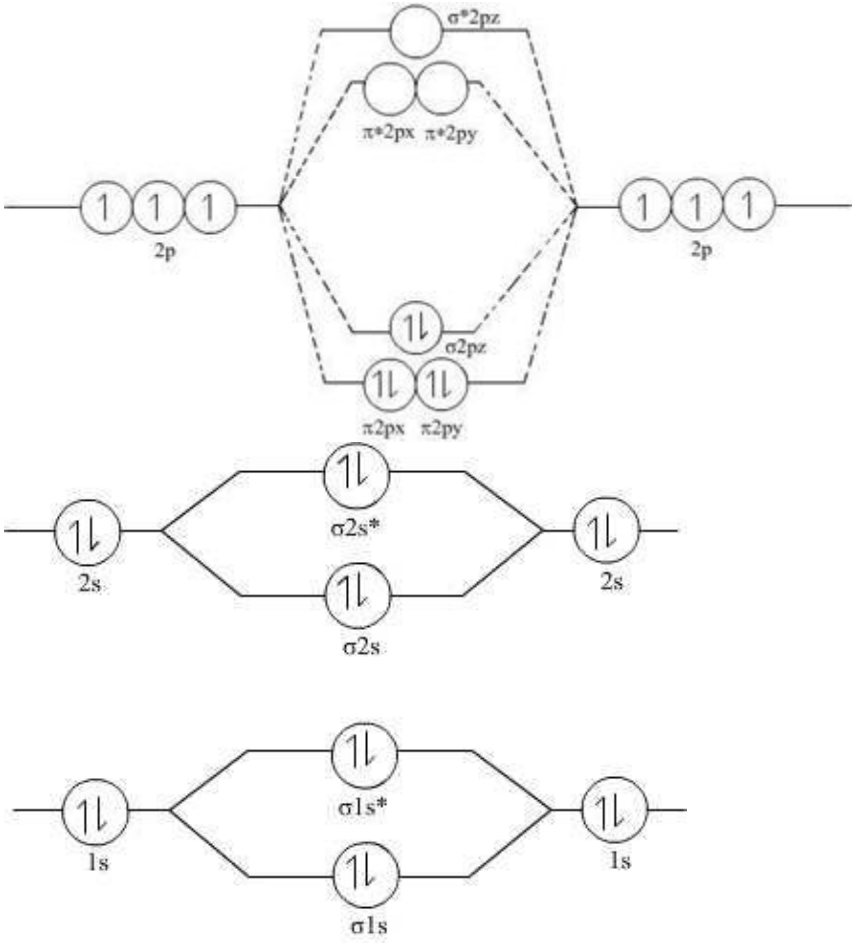
undergo mixing interactions in view of which the energy of $\sigma 2pz$ orbitals is raised and it becomes greater than $\pi 2px \text{ and } \pi 2py$ which do not experience these intermixing interactions. The molecules O_2 and F_2 do not exhibit these mixing interactions due to larger difference of energy between their 2s and 2pz orbitals which makes intermixing interactions insignificant.

Question 62

Draw the molecular orbital diagram of N_2. Also find its bond order and magnetic character?

Ans.

Molecular orbital diagram of N_2



BO = $\frac{1}{2}$ [Nb-Na] = $\frac{1}{2}$ [10-4] = 3

Since all the electrons in nitrogen are paired, it is diamagnetic molecule.

Question 63

Using Molecular Orbital theory, compare the bond enthalpy and bond length of CN and CN^- species.

Ans.

Number of electron in CN = 6+7=13

MO configuration of CN

$= KK(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2px})^2 (\pi_{2py})^2 (\sigma_{2pz})^1$

B.O = $\frac{1}{2}$ [7-2] = 2.5

MO configuration of CN-

$= KK(\sigma_{2s})^2 (\sigma^*_{2s})^2 (\pi_{2px})^2 (\pi_{2py})^2 (\sigma_{2pz})^2$

BO = $\frac{1}{2}$ (8-2) = 3

Higher the bond order greater is the bond energy and shorter is the bond length. Hence bond enthalpy of CN^- is greater than CN and bond length of CN^- is shorter than the bond length of CN.

Question 64

Two p-orbitals from one atom and two p-orbitals from other atom are combined to form molecular orbitals. How many molecular orbitals will result from this combination? Explain.

Ans.

Four molecular orbitals are formed when two p-orbitals from one atom combines with the two p-orbitals of the other atom. Out of these four molecular orbitals, two are bonding molecular orbitals and the other two are antibonding molecular orbitals.

Question 65

Explain why the bond order of N_2 is greater than N_2^+ but the bond order of O_2 is less than that of O_2^+.

Ans.

When N_2 changes to N_2^+, the electron is removed from the bonding molecular orbital while when O_2 changes to O_2^+, the electron is removed from antibonding molecular orbital. This is the reason why the bond order of N_2 is greater than N_2^+ but the bond order of O_2 is less than that of O_2^+.

Question 66

Differentiate between bonding and antibonding molecular orbitals.

Ans.

Bonding molecular orbital	**Antibonding molecular orbital**
i) It is formed by the addition overlap of atomic orbitals.	i) It is formed by subtraction overlap of atomic orbital.
ii) It may or may not have a node.	ii) It always has a node in between the nuclei of bonded atoms.
iii) In this orbital electron density is more in between the nuclei. Electrons in this orbital lead to attraction between atoms.	iii) In this orbital electron density is less in between the nuclei. Electrons in this orbital lead to repulsion between atoms.
iv) Its energy is less than the energy of the atomic orbitals.	iv) Its energy is more than the energy of the atomic orbitals.

Question 67

How are the shapes of molecular orbitals determined?

Ans.

The shapes of the molecular orbitals depend upon the shapes of the combining atomic orbitals.

Question 68

Out of H and H_2, which has higher first ionisation enthalpy?

Ans.

H_2 has higher first ionisation energy because σ1s orbital in H_2 has lower energy than 1s orbital of H atom.

Question 69

What is the relationship between bond order and the dissociation energy of a molecule?

Ans.

The dissociation energy of the molecule is directly proportional to the bond order.

Question 70

An atomic orbital is monocentric while a molecular orbital is polycentric. Explain

Ans.

An atomic orbital is under the influence of one nucleus while a molecular orbital is influenced by two or more nuclei depending upon the number of atoms in the molecule.

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