

CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Example

1. Write the Lewis dot symbols of the following elements and predict their

valencies :(i) Na (ii) Mg (iii) P (iv)S(v)Cl (vi) Ar.

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2. Deduce the empirical formulae and draw Lewis structures for the ionic

compounds formed from the following pairs of elements

Na, O ,K, S , Na P , Mg, Br, Al, F, Ca, O, li, S



3. Write the various steps involved in the Lewis structure for nitrate $\left(NO_3^{-}
ight)$ ion.

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4. Write the Lewis dot structure of CO molecule .

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5. Write the formal charges on atoms in (i) and carbonate ion (ii) nitrite

ion.

6. By using an expanded octen for the sulphur atom in thionyl chloride

 $(SOCl_2)$, write a Lewis structure with no charge.



- **8.** Explain the structure of $CO_3^{2\,-}$ ion in terms of resonance
- (b) Explain the resonance structures of ${\cal CO}_2$ molecule .

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9. Explain the structure of CO_2 molecule.

10. On the basis of VSEPR theory, prefict the shapes of the following molecules ions :

 $(i)ClF_3 \quad (ii)BrF_5 \quad (iii)IF_7 \quad (iv)H_3O^+ion.$

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11. The dipole moment of LiH is $1.964 \times 10^{-29}C - m$ and the interatomic distance between Li and H in this molecule is 1.596Å. What is the percentage of ionic character in LiH?

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12. Sketch the bond moments and resultant dipole moments in cis and trans forms of $C_2H_2Cl_2$



1. Explain the formation of chemical bond.



4. Draw the Lewis structures the following molecules and ions :

 $PH_3, H_2S, SiCl_4, BeF_2, AlI_3^{2-},$ HCOOH





9. How do you express the bond strength in terms of bond order?	
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10. EXPLAIN BOND PARAMETERS- BOND LENGTH, BOND ORDER AND BOND

STRENGTH

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11. Explain the important aspects of resonance with respect to the CO_3^{2-}

ion.

12. H_3PO_3 can be represented by structure (a) and (b) shown below. Can these two structures be taken as the canonical forms of the resonance hybrid representing H_3PO_3 ?If not, give reasons for the same.



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13. Write the resonance structures for SO_3, NO_2^{θ} , and NO_3^{θ} .

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

(a) Na and Cl (b) K and S (c) Ca and O (d) Al and N.



15. Although both CO_2 and H_2O are triatomic molecules, the shape of H_2O molecules in bent while that of CO_2 is linear. Explain this on the basis of dipole moment.

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16. a) Discuss the significance/applications of dipole moment.

b) Represent diagrammatically the bond moments and the resultant

dipole moment in CO_2, NF_3 and $CHCl_3$



20. The skeletal structure of CH_3COOH as shown below is correct but some of the bords are wrongly shown. Write the correct Lewis structures of acetic acid.

$$H = \frac{H}{C} =$$

21. Apart from tetrahedral geometry, another possible geometry for CH_4 is square planar with the four H atoms at the corners of the square and the C atom at its centre. Explain why CH_4 is not square planar?

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22. Explain why BeH_2 molecule has a zero dipole moment although the

Be - H bonds are polar?

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23. Both NH_3 and NF_3 have identical shapes and same state of hybridisation. Both N-H and N-F bonds have almost the same electronegativity difference. But still, the two molecules have different dipole moment values. How will you account for it ?

24. What is meant by hybridisation of atomic orbitals? Describe the shape

of sp, sp^2 , sp^3 hybrid orbitals.



25. Describe the change in hybridisation (if any) of the Al atom in the

following:

 $AlCl_3 + Cl^{\Theta} \rightarrow AlCl_4^{\Theta}$

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26. Is there any change in hybridisation of the B and N atom as a result

of the following reaction?

 $BF_3 + NH_3
ightarrow F_3B. NH_3$

27. Draw diagrams showing the formation of a double bond and a triple

bond between carbon atoms in C_2H_4 and C_2H_2 molecules.



29. Considering X-axis as the internucler axis, which out of the following

atomic orbitals will from a sigma bond ?

 $(a)1s ext{ and } 1s ext{ (b)}1s ext{ and } 2p_x ext{ (c)} 2p_y ext{ and } 2p_y ext{ (d)} 1s ext{ and } 2s.$

30. Which hybrid orbitals are used by the carbon atoms in the following

molecules ?

 $(a)H_3C - CH_3$ $(b)H_3C - CH = CH_3$ $(c)CH_3 - CHO$ (d)C

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31. What do you understand by bond pairs and lone pairs of electrons?

Illustrate by giving one example of each type.

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32. Distinguish between a sigma and a pi bond.



33. Explain the formation of H_2 molecule on the basis of valance bond

theory.



34. Write the important conditions required for the linear combination of

atomic orbitals to form molecular orbitals.

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35. Use molecular orbital theory to explain why the Be_2 molecules do not

exist?

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36. Compare the relative stability of the following species and indicate

their magnetic properties:

$$O_2, O_2^{\oplus}, O_2^{\Theta}$$
 (superoxide), O_2^{-2} (peroxoide).

37.	Write	the	singificance	of	plus	and	inus	signs	in	representing	the
opi	tals.										

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38. Describe the hybridisation in case of PCl_2 . Why are the axial bonds
longer as compared to equatorial bonds ?
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39. Define hydrogen bond. Is it weaker or stronger than the van der Waals
forces?
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40. What is meant by the term bond order ? Calculate the bond order ?
Columbra the base density $\mathbf{M} = \mathbf{O} = \mathbf{O}^2 - \mathbf{I} = \mathbf{O}^2 - \mathbf{O}^2$

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Calculate the bond order of : N_2, O_2, O_2^- and O_2^2
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41. Interpret the non-linear shape of H_2S molecule and non-planar shape

of PCl_3 using valence shell electron pair repulsion (VSEPR) theory.

(Atomic number : H = 1, P = 15, S = 16, Cl = 17)

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42. Using molecular orbital theory, compare the bond energy and magnetic character of O_2^+ and O_2^- species.

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43. Explain the shape of BrF_5



44. Structures of molecules of two compounds are given:

(a) Which of the two compounds will have intermolecular hydrogen bonding and which compound is expected to show intramolecular hydrogen bonding.

(b) The melting point of a compound depends on, among other things, the extent of hydrogen bonding. On this basis explain which of these two compounds will show higher melting point.

(c) Solubility of compounds in water depends on power of formed hydrogen bonds with water. Which of these compounds will from hydrogen bond will water easily and be more soluble in it ?



45. Why does type of overlap given in the following figure not result in

bnd formation ?



46. Explain why PCl_5 is trigonal bipyramidal whereas IF_5 is square pyramidal ?



47. In both water and dimethyl ether $(CH_3 - O - CH_3)$, oxygen atom is central atom, and has the same hybridisation, yet they have different

bond angles. Which one has greater bond angle ? Give reason.



48. The energy of $\sigma 2p_z$, molecular orbital is greater than $\pi 2p_x$ and $\pi 2p_y$ molecular orbitals in nitrogen molecule. Write the complete sequence of energy levels in the increasing order of energy in the molecule. Compare the relative stability and the magnetic behaviour of the following species. $N_2, N_2^+, N_2^-, N_2^{2+}$

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49. Give the change in bond order in the following ionisation process?

i.
$$O_2 o O_2^\oplus + e^-$$
 , ii. $N_2 o N_2^\oplus + e^-$

50. Give reasons for the following :

- (i) Covalent bonds are directional while ionic bonds are non-directional.
- (ii) Water molecule has bent structure whereas carbon dioxide molecule

is linear.

(iii) Etyne molecule is linear.

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51. What is an ionic bond ? With two suitable examples, explain the diference between an ionic and a covalent bond ?

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52. Explain why CO_3^{2-} ion cannot be represented by a single Lewis structure. How can it be best represented ?

53. Predict the hybridisation of each carbon in the molecule of organic compound given below. Also indicate the total number of sigma and pi bonds in this molecule.



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54. Group the following as linear and non-linear molecules :

 $H_2O, HOCl, BeCl_2, Cl_2O$



55. Elements X,Y and Z have 4,5 and 7 valence electrons respectively, (i)

Write the molecular formula of the compounds formed by these elements

individually with hydrogen (ii) which of these compounds will have the
highest dipolw moment ?
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56. Draw the resonatin structure of

(i) Ozone molecule (ii) Nitrate ion

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57. Presict the shapes of the following molecules on the basis of hybridisation.

 BCl_3, CH_4, CO_2, NH_3

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58. All the C-O bonds in carbonate in $\left(CO_3^{2-}\right)$ are equal in length.

Explain.

59. What is meant by the term vaerange bond enthalpy? Why is there difference in bond enthalpy of O-H bond in ethanol (C_2H_5OH) and water (H_2O) ?

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60. (I) Discuss the significance/applications of dipole moment.

(ii) Represent diagrammatically the bond moments and the resultant dipole moment in CO_2 , NF_3 .

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61. Use the molecular orbital energy level diagram to show that N_2 would

br expected to have a triple bond, F_2 a single bond Ne_2 no bond.

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62. Briefly describe the valence bond theory of covalent bond formation by taking an example of hydrogen. How can you interpret energy changes taking place in the formation of dihydrogen?



63. Describe hybridisation in the case of PCl_5 and SF_6 The axial bonds are longer as compared to equatorial bonds in PCl_5 whereas in SF_6 both axial bonds and equatorial bonds and have the same bond length. Explain.

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64. Discuss the concept of hybridisation. What are its different types in a

carbon atom ?

65. What is the type of hybridisation of carbon atoms marked with star.

$$egin{aligned} & & O \ & (a) \overset{*}{C} H_2 = CH - \overset{||}{*} \overset{||}{C} - O - H & (b) CH_3 - \overset{*}{C} H_2 - OH & (c) CH_3 \ & (d) \overset{*}{C} H_3 - CH = CH - CH_3 & (e) CH_3 - \overset{*}{C} \equiv CH \end{aligned}$$

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66. A molecule of H_2 exist while that of the He_2 does not. Explain.

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67. NaCl and $AgNO_3$ are ionic solids and they readily dissodciate to from ions in solution. Ag^+ ions combine with Cl^- ions to give white precipitate of AgCl. But CCl_4 is covaolent compound and does not give Cl^- ions in solution. Therefore, no reaction is possible between CCl_4 and $AgNO_3$.

68. BeF_2 and H_2O are both tri-atomic molecules but have different
shapes. Discuss.
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69. Bond angle in NH_3 is molre than in PH_3 . Explain.
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70. Why is HCl predominantly covalent in the gaseous state but is ionic in squeous solution ?
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71. Can a non-polar molecule have polar covalent bonds?
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72. (a) Explain sigma and pi bonds with suitable examples,

(b) A pi bond cannot be formed in the absence of sigma bond. Discuss.

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73. PCl_5 exists but NCl_5 does not because	

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74. o- nitrophenol is steam volatile while p-nitrophenol is not. Discuss.

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75. KHF_2 exists while $KHCl_2$ does not. Explain.

76. Yor are given the electronic configuration of five neural atoms -A,B,C,D

and E.

 $A-1s^22s^22p^63s^2, B-1s^22s^22p_23s^1, C-1s^12s^22p_1, D-1s^22s^22p^5, E1s^22s^22p^2, E1s^2z^2p^2, E$

formula for the substances containing (i) A and D (ii) B and D (iv) onle E.

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77. Boiling point of ethane is more than that of methane. Assign reason.

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78. Which comopound from each of the following pairs ismore covalent

and why?

- (a) CuO or CuS (b) AgCl or AgI
- (c) $PbCl_2$ or $PbCl_4$ (d) $BeCl_2$ or $MgCl_2$

79. The bond angles in NH_4^+ and CH_4 are same but NH_3 has different

bond angle. Why?



80. Predict which out of the following species are planar.

 $(i) NH_4^+(ii) CH_3^+(ii) SF_4(iv) OF_2(v) H_2 O$

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81. Why is $MgCl_2$ molecule linear whereas the molecules of $SnCl_2$ chloride has angulare shape ?



82. The hybridisatio of oxygen in both water and diethyl ether molecules

is the same but they differ in their bond angles. Explain.



83. Both Na and H occur in group 1 of the periodic table ,yet melting point

of HCl is $-114^{\circ}C$. Why?

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84. With the help of molecular orbital theory, draw the molecular orbital energy level diagram for N_2 molecule. Also calculate the bond order and predict the magnetic behaviour.



Additional Important Quastions

1. Write the Lewis dot symbols of the following ions :

$$Li^+, Cl^-, O^{2-}, Mg^{2-}$$
 and N^{3-}



2. Write the Lewis dot structures of (a) CCl_4 (b) PH_3 (c) BCl_3 . Is the

octet roule obeyed in these structures ?



3. Explain how valence bond theory accounts for

(i) a carbon-carbn double bond (C=C)

(ii) a carbon -carbon triple bond (C=C)

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4. Dary Lewis structures for H_2CO_3 , SF_6 , PF_7 and CS_2 . Is the octet

rule obeyd in these cases ?

5. ELECTRONEGATIVITY & ELECTRON GAIN ENTHALPY



7. Which of the following has larger bond angle in the following pairs ?

 $(a) NH_3, PH_3(b) BeF_2, BF_3(c)H_2O, CO_2(d)H_2O, H_2S(e) CCl_4, C_2H_2$

?



8. Out of intermolecular and intramolecular hydrogen bonding which has

an infulence on the characteristics of substances ?



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9. Discuss the shape of CO_2 molecule on the basis of hybridisation.

10. Out of the following resonating strictures for
$$CO_2$$
 molecule, which
are important for describing the bonding in the molecule and why ?
 $: \overrightarrow{O} = \underset{(I)}{C} = \overrightarrow{O}: \qquad : \overrightarrow{O} = \underset{(II)}{C} - \overrightarrow{O}: \qquad : \overrightarrow{O}^- = \underset{(III)}{C} - \overset{+}{O}: \qquad : \overrightarrow{O}^- - \underset{(IV)}{C}$
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11. Why is that in the SF_4 molecule, the lone pair of electrons occupies an equatorial position in the overall trigonal pyramidal arrangement in preference to an axial position ?

12. Differentiate between VB theory and Lewis concept.



16. What is the hybridisatio carbon atoms numbered as 1,2 and 4 in the

following molecule ?

$$H_2 \overset{5}{C} = \overset{4}{C} = H \overset{3}{C} - H_2 \overset{2}{C} - \overset{||}{C^1} - H$$

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17. What is meant by the term bond order ? Calculate the bond order ?

Calculate the bond order of : N_2, O_2, O_2^- and O_2^{2-}

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The sdipole miment of hydrogen halides decreases form HF to HI.
 Explain this trend.

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19. Which out of N_2 and H_2O is polar and why?
20. Calculate the electronegativity value of chlorine on Mulliken's scale,

given that IP = 13.0eV and EA = 4.0eV.

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21. H_2O molecule is a triatomic molecule but its geometry is not linear.

Why?

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22. (a) Which of the following species has greater polarising power?

$${(i)Fe^{3+}}~{
m or}~Fe^{2+}{(ii)Cu^{2+}}~{
m or}~Na^+{(iii)Mg^{2+}}~{
m or}~Al^{3+}.$$

(b) Which of the following species is most susceptible to polarisation ?

$${(i)}Br^- \,\, {
m or} \,\, I^-{(ii)}O^{2-} \,\, {
m or} \,\, S^{2-}{(iii)}N^{3-} \,\, {
m or} \,\, O^{2-}$$

23. Why is lithium iodide more covalent than lithium fluoride?

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24. Out of CS_2 and OCS which have higher dipole moment and why?
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25 . Draw the Lewis structure of HCN.
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26. The presence of polar bonds in a polyatomic molecule suggests that

the molecule has non-zero dipole moment.





31. (a) How does bond energy vary from N_2^+ and N_2^- and why ?

(b) On the basis of the molecular orbital theory, what is the similarly between :

 $(i)F_2, O_2^{2\,-} \qquad (ii)CO, N_2, NO^+.$

(c) Like CO why its analong SiO is not so stable?

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32. Why is mobilty of H^+ ions in ice greater as compared to liquid water ?

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33. According to Octed Rule, each atom gains or loses electrons to complete its outermost shell. As a result, molecules are formed. Each contributing element has 8 electrons in the outermost shell, but there are some limitations to this rule in which central atom of some molecules has more han 8 electrons. Some molecules like NO and NO_2 don't satisfy

octet rule as they have add electrons in them.

On the basis of above paragraph, answer the following :

(i) Writer the Lewis structurre of N_2 molecule.

(ii) How the structure of $S\!F_6$ cannot be explained on the basis of octet

rule ?

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34. L.C.A.O. principle is involved in the formation of molecular orbitals according to molecular obtital theory. The energy of bonding molecular orbital is less than that of the combining atomic orbitals while that of the anitibonding bonding melecular orbital is more. The B.O. $=^{1/2} [N_b - N_a]$

Answer the following questions on the basis of the above paragraph : (i) What is bonding molecular orbital ?

(ii) Calculate B.O. of He_2 molecule.



35. Arrange H_2O , NH_3 and CH_4 molecules in decreasing order of bond

angle.

36. Explain sp^2 hybridisation by taking example of ethylene.

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37. In ionic solids, the oppositely charged ions are closely packed in space and have strong electrostatic forces of attraction. These compound have high melting and boiling points and are poor conductors of electricity in the solid state.

(i) Why are ionic solids poor conductros of electricity?

(ii) What happens to electrical conductivity when these are dissolved in water ?

38. The study of dipole moment of a molecule is useful to explain the shape of a molecule and also to predict a number of other properties of the molecule. The net dipole moment of a polyatomic is the resultant of the different bond dipole moments present in that molecule.

Answer the following questions on the basis of above paragraph :

- (i) What is dipole moment?
- (ii) Out of CO_2 and H_2O , which molecule is polar in nature any why?



39. Draw the structure and state polar and non-polar nature of (a) Ch_4 (b) So_4 (c) $CHCl_3$.

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40. Drawn the molecular orbital diagram and write the bond order, magnetic properties of N_2 molecule and $N_2^{\,\oplus}$ ion ?

41. How do you differentiatie between sigma and pi bonds ?



H O T S Conceptual Questions

1. Atom A,B and C occur in the same period and have one, six and seven valence electron respectively.

- (a) Will the bonds between B and C be predominantly ionic or covalent ?
- (b) Will the bond between A and B be predominantly ionic or covalent?
- (c) Write he electronic structure of the compound between B and C



2. Interpret non-linear shape of H_2S and non-planar shape of PCl_3 on the basis of VSEPR theory.



3. In a polar solvent, PCl_5 undergoes an ionization reaction as :

$$2PCl_5 \Leftrightarrow PCl_4^+ + PCl_6^-$$

What are the geometrical shapes of the species involved in the equilibrium mixture ?



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5. In which of the following pairs, the two species are iso-structural?

$$(a)SO_4^{2-} ext{ and } NO_3^{-} (b) ext{ } BF_3 ext{ and } NF_3 (c)BrO_3^{-} ext{ and } XeO_3 (d) ext{ } SF_4 ext{ and } XeF_4$$

6. Answer the following :

- (a) CCl_4 is non-polar but CH_3Cl is polar.
- (b) SiF_4 is non-polar although Si-F bonds are polar.
- (c) A hetero-diatomic molecule is always polar.

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7. Explain why is o-hydroxybenzaldehyde a liquis at room temperaturre while p-hydroxybenzaldehyde is a high melting solid.

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8. (a) H_2^+ and H_2^- ions have same bond order but H_2^- ion is more stable. Explain.

(b) N_2 has a greater bond dissociation enthalpy than N_2^+ ion hals more bond dissociation enthalpy than O_2 . Why ? (c) Can we have a homonuclear diatomic molecule with all its ground state molecular orbitals full of electrons ?

(d) When a magnet is dipped in a jar of liquid oxygen, some oxygen clings

to it. Assign reason :



9. State with reasons :

(i) Which is more acidic : anhydrous HCl or aqueous HCl ?

(ii) Which is more polar : CO_2 or N_2O ?

(iii) Which is more soluble in water : enhyl alcohol or dimethyl ether ?

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10. Assign reason for the following :

(i) Ammonis is soluble in water while phosphine is not

(ii) B_2 is paramagnetic while C_2 is not.

11. Drw all the possible resonating structures for azide ion (N_3^-ion) .

Which our of these are actually feasible ?



Value Based Questions

1. H_2O is a covalent molecule and the two O-H bonds are of polar nature.

The H_2O molecules are involved in intermolecular hydrogen bonding

both in water and ice which differ in their relative densities.

(i) What type of structure does ice possess ?

- (ii) Out of ice and water, which is heavier ?
- (iii) At what temperature, does water have maximum density?
- (iv) What is the value associated with this characteristic of water ?



2. In ionic solids, the oppositelycharged ions are closely packed in space and have strong electrostatic forces of attraction. These compounds have high melting and boiling points and are also proop conductors of electricity in the solid state.

(i) Why are ionic solids poor conductors of electricity ?

(ii) What happens to electrical conductivity when these are dissoved in

water ?

(iii) What is the value associated with it ?

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Prombems For Practice

1. Write the Lewis symbols of (i) C (ii) Cl (iii) O^{2-} (iv) N^{3-}

2. Give two cations and two anions which have the electronic structure of

Ne.



formed.





10. Assign the correct bond angles to each of the following molecules.

Molecules : H_2O , BeF_2 , CH_4 , NH_3 , BCl_3 , SF_6 .

Bond angles : $90^\circ, 107^\circ, 109^\circ-28, 104.5^\circ, 120^\circ, 180^\circ$



bent ?

14. Predict the dipole moment of :

(i) a molecule of the type AX_4 having dquare planar geometry

a molecule of type AX_5 having trogonal biprmidal geometry

(iii) a molecule of the type AX_6 having octahedral geometry.

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15. Which uot of the following pairs has dipole moment?

(i) BF_3 and NCl_3 (ii) H_2O and BF_3 (iii) CO_2 and H_2S

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16. Can a non-polar molecule have polar covalent bonds?

17. Which of the following molecules behave as electrical dipoles ?

(i) $\mathbb{C}l_4$ (ii) $CHCl_3$ (iii) BF_3 (iv) H_2O (v) BeF_2 (vi) NH_3





molecule $CH_2 = CH - CH = CH_2$

25. Assuming z-axis to be intermolecular axis, designate the molecule orbitals from the following combination.

(i) 2px + 2px (ii) 2pz+2pz (iii) 2py-2py



26. Which of the follwing combinations are not permisible ?

(i) 2pz and 2pz (ii) 2s and 2py (iii) 1s and 2s (iv) 2px and 2px

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27. Which combination will lead to π -molecular orbitals ?

(i) 2px-2px (ii) 2pz+2pz (iii) 2s+2pz (iv) 2py+2py

28. Can 1s and 2s atomic orbitals from molecular orbitals

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29. In the molecular orbital configuration of N_2 which orbital has lower energy : σ_{2pz} or π_{2px} ?
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30. What is the bond order of H_2^- ion ?

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31. Arrenge $O_2, O_2^-, O_2^{2-}, O_2^+$ in increasing order of bond energy.







38. Do H_2^+ and H_2^- ions have same or different bond orders ?

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Multiple Choice Questions Mcqs

1. The crystal lattice of electro covalent compounds is composed of

A. atoms

B. molecules

C. oppositeoly charged ions

D. both molecules and ions.

Answer: C

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2. The electronegativity of cesium is 0.7 and that of flourine is 4.0 The

bond formed between the two is:

A. covalent

B. electrovalent

C. co-ordinate

D. metallic.

Answer: B

3. A covalent bond is formed between

A. similar atoms

B. dissimilar atoms

C. similar or dissimilar atoms

D. silimar molecules

Answer: C

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4. Multiple bond can exist in :

A. CH_4 molecule

B. NH_3 molecule

C. Cl_2 molecule

D. N_2 molecule

Answer: D



5. The formula of a compound is A_2B_5 . The number of electrons in the outermst shells of A and B respectively are:

A. 6 and 3

B. 5 and 6

C. 5 and 2

D. 2 and 3.

Answer: C

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6. Which of the following has pyramidal structure ?

A. NH_3

 $\mathsf{B.}\,BF_3$

 $C. CCl_4$

 $D. H_2O.$

Answer: A

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7. According to is M.O. theory, which is the correct increasing sequence of B.O. in N_2, N_2^- and N_2^{2-} ?

A.
$$N_2^{2\,-} \, < \, N_2^{\,-} \, < N_2^{\,-}$$

- B. $N_2 < N_2^{2\,-} < N_2^{-}$
- $\mathsf{C}.\, N_2^{\,-}\,<\,N_2^{2\,-}\,<\,N_2$

D.
$$N_2^{\,-}\,< N_2\,< N_2^{2\,-}$$

Answer: C

8. In which of the following pairs, the two spices are iso-structural?

A.
$$So_3^{2-}$$
 and NO_3^{-}

 $B.BF_3$ and NF_3

 $\mathsf{C}.BrO_3^-$ and XeO_3

D. SF_4 and XeF_4 .

Answer: D

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9. The maximum possible number of hydrogen bonds a water molecule

can form is

A. 1

B. 2

C. 3

D. 4

Answer: D

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10. Which of the following is a non-linear molecule ?

A. CO_2

 $\mathsf{B.}\, C_2 H_2$

C. HCN

 $\mathsf{D}.\,H_2O.$

Answer: D

11. The molecule that has a linear staructure is :

A. CO_2

 $\mathsf{B.}\,NO_2$

 $\mathsf{C}.SO_2$

D. SiO_2

Answer: A

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12. Correct B.O. of O_2 is :

A. 1

B. 2

C. 2.5

D. 3

Answer: B
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Ionic Bond
1. Write the Lewis symbols of Mg and Al.
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2. Which electrons take part in the bond formation?
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3. Give the empirical formaulae for the ionic compounds formed between
K, O and Na, p.
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4. Is ionic bond directional? View Text Solution 5. Which type of elements take part in the bond formation ? Watch Video Solution 6. Which will from stronger ionic bond? (i) Na and F (ii)m Na and Cl. Watch Video Solution 7. Can ionic bond be formed between similar atoms ? Watch Video Solution

8. The electrovalency of the element is equal to the
Watch Video Solution
9. Out of NaCl and MgO which has higher lattice energy ?
Watch Video Solution
10. Deaw Lwis structure of N^{3-} ion.
Watch Video Solution
11. Explain the formation of ionic bond in Ca and Cl atoms.
Watch Video Solution

12. Can sodium chloride conduct eletricity in the solid state ?



16. Define lattice energy. How is lattice energy influenced by (i) charge on

the ions (ii) size of the ions?

Watch Video Solution 17. Elements with low ionization energies generally form cations. Explain.

Watch Video Solution

18. Explain the formation of ionic bond with two examples.

Watch Video Solution

19. Write the favourable factors for the formation of ionic bond.

20. Assign reasons for the following :

- (i) lonic bond is non-following:
- (ii) lonic bond is non-directional
- (iii) lonic compounds have high melting points.

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Covalent And Co Ordinate Bonds

1. How is covalent bond formed ?

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2. What is a double bond ?
| 3. Draw electron dot structures of (i) NH_3 (ii) PCl_5 (iii) C_2H_2 . |
|--|
| Watch Video Solution |
| |
| 4. What is meant by bond pair of electrons ? |
| Watch Video Solution |
| |
| 5. What does VSEPR stand for ? |
| Watch Video Solution |
| |
| 6. Do NH_3 and BF_3 have same shape ? |
| Watch Video Solution |
| |

7. Define covalent bond according to orbital concept.



12. HF is polar while F_2 is non-polar. Explain.

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13. How many sigma bonds and pi bonds are present in a benzene molecules ? .
Watch Video Solution
14. Which out of the following molecules have covalent bonds $(i)CaCl_2(ii)NH_3(iii)nMgO(iv)PCl_5$?
Vatch Video Solution
15. What are <i>SI</i> units of dipole moment?
🖸 Watch Video Solution



19. Presence of a lone pair of electrons distrots the geometry of a covalent molecule.Explain.



Watch Video Solution

23. Arrange H_2O, NH_3 and CH_4 molecules in decreasing order of bond

angle.

24. How will you differentiate between covalent and coordinate bonds?

25. Which of the following has larger bond angle in each pair ?

 $(i)CO_2, BF_3(ii)NH_3, CH_4(iii)H_2O, H_2S(iv)SF_4, C_2H_2.$

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26. Indicate whether the following statement is true or false. Justify your

answer:

View Text Solution

27. Sodium metal vapprises on heating and the vapours have diatomic molecules of sodium (Na_2) . what type of bonding is present in these moleceles ?



28. Which of the following has maximum bond angle ?

 H_2O, NH_3, CO_2, CH_4

Give suitable explanation for your answer.

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29. Why do covalent molecules have definite geometries ?

Watch Video Solution

- 30. (a) What is depoole moment?
- (b) What are the units of dipole moment?
- (i) Dipole moment values help in prediciting the shapes of covalent

molecules. Explain.

31. (a) Explain sigma and pi bonds with suitable examples,

(b) A pi bond cannot be formed in the absence of sigma bond. Discuss.

Watch Video Solution	

32. Define hybridisation. What are the characteristics of hybridisation ?

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33. Discuss the orital stuctures of the following molecules on the basis of

hybridisation.

 $(i)NH_3(ii)C_2H_2(iii)CO_2.$

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34. What is the major difference between valence bond molecular orbital

theories ?







39. A bonding molecular orbital has lesser energy than the corresponding

antibonding molecular orbital. Justify

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40. On the basic of the bond order, predivt which of the following species

is the most stable.

 $(i)O_{2}^{-}(ii)O_{2}(iii)Ne_{2}^{+}$

> Watch Video Solution

41. Explain the diamagnetic behaviour of F_2 molecule on the basis of molecular orbital theory.



42. Write the molecular orbital electronic configuration of peroxide and super oxide ions. Which out of these has higher bond order and why ?



44. With the help of molecular orbital theory predict which of the following species are diamagnetic ?

 $H_2^{\,+}, O_2O_2^{2\,+}$

45. Explain why N_2 has a greater bond dissociation energy than N_2^+ while O_2 has lesser bond dissociation energy than O_2^+ .

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46. Which of the two peroxide ion or superoxide ion has larger bond length ?

Watch Video Solution

47. What is bond order? Discuss its significance.

Watch Video Solution

48. Out of bonding and antibonding M.O, which is filled first and why?



53. Can a stable molecule have zero bond order ? Justify your answer.



54. How will you differentiate between bonding and anti bonding molecular orbitals ?

Watch Video Solution

55. What are bonding and antibonding molecular arbitals ? Define bond order and give is significance.

Watch Video Solution

56. How will your differentiate between atomic and molecular orbitals ?





58. How is bonding molecular orbital of hydrogen different from the antibonding molecular orbital ?



59. How is bond length related to the stability of a molecule ?

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60. Which type of atomic orbitals can overlap to from molecular orbitals ?

61. Which our of O_2^+ and O_2^- is more stable on the basis of bond order

calculations ?



62. What are bonding and antibonding molecular arbitals ? Define bond order and give is significance.

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63. Write the MO electron distribution of O_2 . Specify its bond order and

magnetic property.



64. Draw the energy level diagram of H_2^+ ion and discuss its stability in

terms of bond order.





65. How does the bond length very in dicarbon species

 $C_2,\,C_2^{\,-},\,C_2^{2\,-}$

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66. Calculate the bond order of O_2^- and O_2^{2-} ions on the basis of M.O.

theory and explain their magnetic properties.

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67. Describe mathamatically the formation of molecular orbitals in nomonuclear diamtomc hydrogen molecule by LCAO method.

View Text Solution

68. Compare the relative stabilities of O_2 and O_2^{2-} an indicate their magnetic behavious.



69. (a) What is linear combination of atomic orbitals ?

(b) Ilustrate bonding and antibonding moleular orbitals based on homonuclear dihydrogen molecule.

View Text Solution

70. (a) Which of these have higher bond dissociation energy and why ? $(i)N_2^+(ii)O_2^+$

(b) What kinds of molecular forced exist between the species in the

following pairs of particles and why ?

(i)He and $N_2(ii)Cl_2$ and $NO_3^-(iii)NH_3$ and CO.

View Text Solution

71. Compare the relative stiabilities of O_2^{2-} and N_2^{2-} and comment on

their magnetic (paramagnetic) behaviour.



2. Which types of elements take part in hydrogen bonding ?

3. Intermolecular bonding influences the properties of substances while

inter molecular does not. Comment on the statement.

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4. On the basis of hydrogen bonding explain the following :

(i) H_2O is a liquid at room temperature while H_2S is a gas

(ii) Boiling pint of NH_3 is more than that of PH_3

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5. Ice seems to be denser than water but it floats over it. Explain.

6. Show hydrogen bonding in the molecules of o-nitrophenol and p-nitrophenol.

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7. N and CI have same electronegativily. Whereas hydrogen bonding is present in the molecules of NH_3 , it is absent at the sometime in HCI molecules. Explain.

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8. Water has maximum density and minimum volume at $4^{\circ}C$. Explain.

View Text Solution

9. Does hydrogen bond involved the overlapping in atomic orbital ?

10. How is hydrogen bond formed ? Give hydrogen bonding in $(i)H_2O(ii)HF$ molecules.

Watch Video Solution

Multiple Choice Questions Bank Mcqb

1. The payramidal geometry is associated with :

A. CH_4

 $\mathsf{B.}\,NH_3$

 $\mathsf{C}. H_2 O$

 $\mathsf{D.}\, CO_2$

Answer: B

2. Among LiCI, $BeCI_2$ and CCI_4 the covalent bond character varies as .

A. $LiCl > BeCl_2 < BCl_3 > CCl_4$

 $\mathsf{B}. \ LiCl > BeCl_2 < BCl_3 < CCl_4$

 $\mathsf{C}. \, LiCl < BeCl_2 < BCl_3 < CCl_4$

D. $LiCl > BeCl_2, > BCl_3 > CCl_4$

Answer: C

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3. The bond length the species O_2, O_2^+ and O_2^- are in the order of

A.
$$O_2^+ > O_2 > O_2^-$$

B. $O_2^+ > O_2^- > O_2$
C. $O_2 > O_2^+ > O_2^-$
D. $O_2^- > O_2 > O_2^+$

Answer: D



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5. NH_3 and BF_3 from adduct readily because they from

A. Ionic bond

B. Covalent bond

C. Co-ordinate bond

D. Hydrogen bond

Answer: C

Watch Video Solution

6. The angle between the covalent bonds is maximum in :

A. CH_4

B. BF_3

 $\mathsf{C}. PF_3$

D. NH_3

Answer: B

7. The bond angle around atom which uses sp^2 hybridisation is :

A. 120°

B. 180°

C. 107°

D. $109\,^{\circ}\,28$

Answer: A

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8. In the resonating structures of of benzene, the number of σ and π bonds are:

A. 3π and 12σ

 $\mathsf{B.}\,3\sigma\,$ and $\,12\pi$

 $\mathsf{C.}\,6\pi$ and 6σ

D. 12π and 12σ

Answer: A



9. How many σ and π bonds are present in tetra cyanoethylene ?

A. Nine σ and nine π

B. Five π and nine σ

C. Nine σ and seven π

D. Eight σ and eight π

Answer: A

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10. Which of the following substancs has dipole moment more than zero

A. Water

B. Methane

C. Carbon dioxide

D. Nitrogen

Answer: A

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11. The ion which is iso-electronic with CO is:

A. $CN^{\,-}$

 $\mathsf{B}. O_2^-$

 $\operatorname{C.}N_2^{\,+}$

D. O_2^+

Answer: A

12. Which of the following pair contains iso-structural species ?

A. CH_3^- and CH_3^+ B. NH_4^+ and NH_3 C. SO_4^{2-} and BF_4^- D. NH_2^- and BeF_2

Answer: C

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13. Select the molecules which has only one pi bond

A. $CH\equiv CH$

 $\mathsf{B}.\,CH_2=CHCHO$

 $\mathsf{C}.\,CH_3=CH=CH_2$

 $\mathsf{D}.\,CH_3C\equiv CCOOH$

Answer: C



14. The electronic configuration of metal M is $1s^22s^22p^63s^1$. The formula of its oxide will be :

- A. MO
- B. M_2o
- $\mathsf{C}.\,M_2O_3$
- $D. MO_3$

Answer: B

15. The hybridisation of carbon in diamond, graphite and acetylene are respectively

A.
$$sp^{3}$$
, sp , sp^{2}
B. sp^{3} , sp^{2} , sp
C. sp , sp^{2} , sp^{3}
D. sp^{2} , sp^{3} , sp

Answer: B

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16. In which of the following paird, the two molecules have identical bond

orders :

A. N_2, O_2^+

 ${\tt B}.\,N_2,\,O_2^{\,-}$

 $\mathsf{C}.\,N_2^{\,-},\,O_2$

D.
$$N_2^{2\,-}, N_2$$
.

Answer: A



17. Which of the following hydrides has the least boilling point?

A. H_2S

 $\mathsf{B}.\,H_2O$

 $\mathsf{C}.\,H_2Se$

D. H_2Te

Answer: A



18. The best method to separate a mixture of ortho and para nitrophenol

 $(1\!:\!1)$ is :

A. Steam sidtillation

B. Crystallisation

C. Vaporisation

D. Spectroscopy

Answer: A

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19. Which of the following at ordinary temperature and pressure exists as

linear polymer due to extensive hydeogen bonding ?

A. H_2O

B. HCl

C. HF

D. NH_3

Answer: C



20. Which is a square planar molecule ?

A. XeF_6

B. XeF_4

 $\mathsf{C}. XeOF_4$

D. $XeOF_2F_4$

Answer: B

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21. The structure of $CH_2 = C = CH_2$ is :

A. linear

B. planar

C. non-planar

D. has several resonating structures

Answer: A

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22. Which of the following pairs are iso-structural ?

A. XeF_2, lF_2^{-}

B. NH_3, BF_3

C. CO_3^{2-}, SO_3^{2-}

D. PCl_5, lCl_5

Answer: A



23. The H - O - H bond angle in water is

A. $105^{\,\circ}$

B. $102\,^\circ$

C. 180°

D. $90\,^\circ$

Answer: A



24. When two ice cubes are pressed over each other, they unite to form one cube. Which of the following forces is responsible to hold them together ?

A. lonic interaction

B. Covalent attraction
C. van der Waals' forces

D. Hydrogen bond formation.

Answer: D

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25. In NO_3^- ion, the number of bond pair and lone pair of electrons on nitrogen atom are:

A. 2, 2

B.3, 1

C. 1, 3

D.4, 0

Answer: D

26. The number of σ – and π bonds present in pent-4en-1-yne is :

A. 10, 3

B. 3, 10

C. 4, 9

D. 9, 4.

Answer: A

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27. In which of the following molecules, the central atom has one lone

pair and three bond pairs of electrons,

A. H_2S

B. $AlCl_3$

 $\mathsf{C}.NH_3$

D. BF_3 .

Answer: C



28. If a molecule MX_3 has zero dipole moment, the state hybridisation of

M is :

A. sp^3d

B. sp.

 $\mathsf{C.}\, sp^3p^2$

D. sp^2

Answer: D

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29. Which molecule has trigonal planar geometry?

A. BF_3

 $\mathsf{B.}\,NH_3$

 $C. PCl_3$

 $\mathsf{D}.IF_3.$

Answer: A

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30. Which of the following species has a linear shape?

A. SO_2

 $\mathrm{B.}\,NO_2^{\,+}$

 $\mathsf{C}.\,O_3$

 $\mathsf{D.}\,NO_2^{\,-}\,.$

Answer: B



31. In which of the following pairs, the two species are isostructural :

A. SO_4^{2-} and NO_3^{-}

 $B.BF_3$ and NF_3

 $\mathsf{C}.BrO_3^-$ and XeO_3

D. SF_4 and XeF_4

Answer: C

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32. Four diatomic species are listed in different sequence .Which of these represent the correct order of their increasing bond order?

A.
$$C_2^{2-} < He_2^+ < NO < O_2^-$$

B.
$$He_2^{\,+}\, < O_2^{\,-}\, < NO < C_2^{2\,-}$$

 $\mathsf{C}.\,O_2^{\,-}\,< NO < C_2^{2\,-}\,< He_2^{\,+}$

D.
$$NO < C_2^{2-} < O_2^- < He_2^+$$

Answer: B



33. In which one of the following species , the central atom has the tuype of hybdridiztion which is not the same as that present in other three?

A. SF_4

 $\mathrm{B.}\,I_3^{\,-}$

C. $SbCl_5^{2-}$

D. PCl_5

Answer: C

34. Hydridisation of the central atom in BrF_5 molecule is :

A. sp^3 B. dsp^2 C. sp^3d^2 D. d^2sp^2

Answer: C

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35. In which of the following pairs of molecules centreal atom is sp^2 hybrisised ?

A. NO_2^- and NH_3

 $B.BF_3$ and NH_2^-

 $\mathsf{C}.\,HN_2^{\,-}\,\,\,\mathrm{and}\,\,H_2O$

D. BF_3 and NH_2^-

Answer: B



36. Which of the following pairs is isostractural (i.e having the same shape and hybridization ?

- A. $[BCl_3 \text{ and } BrCl_3]$
- B. $\left[NH_3 \text{ and } NO_3^{-} \right]$
- $\mathsf{C}.[NF_3 \text{ and } BF_3]$
- D. $\left[BF_4^{-} \text{ and } NH_4^{+}\right]$

Answer: D



37. Bond order of 1.5 is shown by:

A. O_2^+

 $\mathsf{B}.O_2^-$

 $\mathsf{C}.\,O_2^{2\,-}$

 $\mathsf{D}. O_2.$

Answer: B

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38. Which of the following species contains three bond pair and one lone

pair around the central atom?

A. H_2O

 $\mathsf{B.}\,BF_3$

 $\mathsf{C}. NH_2^-$

D. PCl_3 .

Answer: D

39. The pair of specied having the same bond order is :

A. O_2^-, B_2 B. O_2^+, NO^+

 $\mathsf{C}.\,NO^+,\,CO,$

 $\mathsf{D}.\,NO_2,O_2.$

Answer: A

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40. During change of O_2 to O_2^{2-} ion, the electrons add on which of the following orbitals ?

A. π^* orbital

B. π orbital

C. σ^* orbital

D. σ orbital.

Answer: A

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41. Which one of the following molecules contains no π - bond ?

A. NO_2

 $\mathsf{B.}\,CO_2$

 $\mathsf{C}.\,H_2O$

 $\mathsf{D.}\,SO_2.$

Answer: C

42. XeF_2 is iso-structural with :

A. $BaCl_2$

 $\mathsf{B}.\,TeF_2$

 $\mathsf{C}.\,lCl_2^-$

D. $SbCl_3$.

Answer: C

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43. Dipole-induced dipole interaction are present in which of the following pairs

A. SiF_4 and He atoms

B. H_2O and alcohol

 $C. Cl_2$ and CCl_4

D. HCl and He atoms.

Answer: B



45. Which of the following species has plane tringular shape ?

 $\mathsf{B.}\,NO_3^{\,-}$

 $\mathsf{C}.\,NO_2^{\,-}$

 $D. CO_2.$

Answer: B

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46. Which one of the following is paramagnetic in nature ?

A. NO

 $\mathsf{B}.\,NO^{\,+}$

 $\mathsf{C}.NO^{-}$

 $\mathsf{D.}\,N_2$

Answer: A

47. Which of the following pairs of ions are isoelectronic and also isostructural ?

A. SO_3^{2-} , NO_3^{-} B. ClO_3^{-} , SO_3^{2-} C. CO_3^{2-} , SO_3^{2-} D. ClO_3^{-} , CO_3^{2-}

Answer: B

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48. The correct bond order in the following species is:

A.
$$O_2^+ < O_2^- < O_2^{2+}$$

B. $O_2^- < O_2^+ < O_2^{2+}$
C. $O_2^{2+} < O_2^+ < O_2^{2-}$
D. $O_2^{2+} < O_2^- < O_2^{2+}$

Answer: B



49. The total number of π -bond electrons in the following structure is



A. 12

B. 16

C. 4

D. 8

Answer: D

50. Which of the following species contains equal number of pi and pi

bonds ?

A. $CH_2(CN)_2$

B. HCO_3^-

 $\mathsf{C}. XeO_4$

 $\mathsf{D.}\,(CN)_2$

Answer: C

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51. Decreasing order of stability of O_2, O_2^-, O_2^+ and O_2^{2-} is

A.
$$O_2^{2-} > O_2^- > O_2^- > O_2^+$$

B.
$$O_2 > O_2^{2-} > O_2^{2-} > O_2^{2-}$$

C.
$$O_2^- > O_2^{2-} > O_2^+ > O_2^+$$

D.
$$O_2^+ > O_2 > O_2^- > O_2^{2-}$$

Answer: D



52. Which of the following sets of molecules contains the same number of lone pairs of electrons in the central atom ?

A. SO_2, ClF_3, BrF_3

 $\mathsf{B.}\,SF_4,NH_3,O_3$

 $\mathsf{C.}\, ClF_3, XeF_2, H_2O$

 $D. H_2O, SF_2, NH_3$

Answer: B

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53. Which one of the following does not match with respect to the shape

of the molecule ?

A. NH_3 - Trigonal pyramidal

B. SF_4 - Tetrahedral

C. H_2S - Bent

D. ClF_3 - T-shape

Answer: B

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54. Find the pair that has the same bond order with diamagnetic and paramagnetic properties respectively.

A. F_2 and O_2

 $\mathsf{B}.\,N_2\,\,\mathrm{and}\,\,O_2^{2\,-}$

 $C. Li_2$ and B_2

 $D. B_2$ and O_2

Answer: C

55. In which one of the following compounds does the central atom obey the octet rule ?

A. XeF_4

 $\mathsf{B.}\, XeOF_2$

 $C. SCl_2$

D. $AlCl_3$

Answer: C

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56. Consider the molecules CH_4 , NH_3 and H_2O which of the given statement is false ?

A. The H-O-H bond angle in H_2O is smaller than the H-N-H bond angle

in NH_3

- B. The H-C-H bond angle in CH_4 is larger than the H-N-H bond angle in NH_3 .
- C. The H-C-H bond angle in CH_4 , the H-N-H bond angle in NH_3 and

the H-O-H bond angle in H_2O are all greater than 90° .

D. The H-O-H bond angle in H_2O is larger than the H-C-H bond angle in

Answer: D

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57. Predict the correct order omong the following:

A. bond pair - bond pair > lone pair - bond - pair > lone pair-lone

pair

 CH_4 .

B. lone pair - bond pair > bond pair - bond pair > bone pair - lone

pair

C. pone pair - lone pair > lone pair - bond pair > bond pair - bond

pair

D. lone pair - lone pair > bond pair - bond pair > lone pair- bond

pair.

Answer: C

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58. The hybridisatipon of atomic orbitals of nitrogen in NO_2^+ , NO_3^- and NH_4^+ respectively are

A. sp, sp^3 and sp^3

 $\mathsf{B}.\,sp^2,\,sp^3 \;\; \mathrm{and} \;\; sp$

 $\mathsf{C}.\,sp,\,sp^2$ and sp^3

 $D. sp^2, sp$ and sp^3

Answer: C



59. The species with fractional bond order is :

A. $O_2^{\,+}$

- B. O_2^{2+}
- C. CO

D. He_2

Answer: A

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Jee Main Other Engineering Entrance Examinations

1. A molecule is square planar with no lone pair. What type of hybridisation is associated with it?

A. sp^3d B. sp^3d^2 C. dsp^3

 $\mathsf{D}.\,dsp^2$

Answer: D

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2. Octrahedral shape is associated with

A. PF_5

 $\mathsf{B.}\,SF_4$

 $\mathsf{C}.\,TeF_6$

D. ClF_3 .

Answer: C



4. The central atom assume sp^3 hybridisation in:

A. PCl_3

 $\mathsf{B.}\,SO_3$

 $\mathsf{C}.\,BF_3$

 $\mathsf{D.}\,NO_3^{\,-}.$

Answer: A

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5. Which of the following has net dipole moment ?

A. CCl_4

B. BF_3

 $\mathsf{C}.NH_3$

 $D. CO_2.$

Answer: C

6. Which of the following hydrogen halide is most volatile.

A. HF

B. HCl

C. HBr

D. Hl.

Answer: B

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7. The structure of lCl_2^- is:

A. trigonal

B. trigonal bipyramidal

C. octahedral

D. square planar.

Answer: B				
Watch Video Solution				
8. The molecules with maximum percentage ionic character is :				
A. HI				
B. HBr				
C. HCl				
D. HF.				
Answer: D				
Watch Video Solution				

9. Ammonia has abnormally high boliling point because it has

A. Alkaline nature

B. Distored shape

C. sp^3 hybridisation

D. Hydrogen bonding.

Answer: D

Watch Video Solution

10. The shape of ClO_3^- ion according to VSEPR theory is:

A. Triangle planar

B. Pyramidal

C. Tetrahedral

D. square planar.

Answer: B

11. According to Fazan rule, the covalent bond is favoured by :

A. Large cation and small anion

- B. Large cation and large anion
- C. Small cation and small anion
- D. Small cation and large anion:

Answer: D

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12. The shape of SF_3Cl_3 molecule is:

A. trgonal bi-pyramidal

B. cubic

C. octahedral

D. thetrahedral.

Answer: C

0	Watch	Video	Solution

13. A molecule of fluorine is formed by :

A. the axial p-p orbital overlap

B. the sidewise p-p orbital overlap

C. the axial s-s orbital overlap.

D. the axial s-p orbital overlap.

Answer: A

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14. Which is the correct arrangement of the molecules basexd on dipole

moments?

A. $BF_3 > NF_3 > NH_3$

- $B. NF_3 > BF_3 > NH_3$
- $C. NH_3 > BF_3 > NF_3$
- D. $NH_3 > NF_3 > BF_3$

Answer: D



15. Covalent compounds have olw m.p. because :

A. Covalent molecules are held by weak van der Waals forces

- B. Covalent bond is less exothermic
- C. Covalent bond is weeker than ionic bond
- D. Covalent molecules have definite shapes.

Answer: A

16. Which of the following is a correct set with respect to molecule, hybridization, and shape?

- A. $BeCl_2$: sp^2 linear
- B. $BeCl_2$: sp^2 , triangular planar
- C. BCl_3 : sp^2 , triangular planar
- D. BCl_3 : sp^3 tetrahedral.

Answer: C

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17. The pair of species having identical shapes for molecules of both species is ? .

A. BF_3 , PCl_3

 $B. PF_5, lF_5$

 $C. CCl_4, SF_4$

 $D. XeF_2, CO_2$

Answer: D

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18. The correct order of decreasing bond angles in H_2S, NH_3, BF_3 and SiH_4 is

A. $H_2S < SiH_4 < NH_3 < BF_3$

B. $NH_3 < H_2S < SiH_4 < BF_3$

C. $H_2S < NH_3 < SiH_4 < BF_3$

 $\mathsf{D}.\,H_2S < NH_3 < BF_3 < SiH_4.$

Answer: C

19. In acetylene molecule, the carbon atoms are linked by:

A. one sigma bond and two pi bonds

B. two sigma bonds and one pi bond

C. Three sigma bonds

D. Three pi bonds.

Answer: A

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20. As PF_5 molecule is sp^3 d hybridised and is trigonal bipyramidal (TbP) shape Which d-orbital is involved in sp^3 d hyridisation .

A. $d_{(x^2-y^2)}$ B. d_{xy} C. d_{z2}

D. d_{zx}

Answer: C



- $\mathsf{C}.\,H_2^{\,+}$
- D. $H_2^{\,-}$

Answer: B



22. Which of the following molecules/ins does not contain unpaired electrons?
A. $O_2^{2\,-}$

 $\mathsf{B}.\,B_2$

 $\mathsf{C.}\,N_2^{\,+}$

 $\mathsf{D}.\,O_2.$

Answer: A

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23. In which of the following, hydrogen bond is the strongest ?

A. O-H....F

B. O-H.....H

C. F-H.....F

D. O-H.....O.

Answer: C

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24. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of the cationic species, K^+ , Ca^{2+} , Mg^{2+} , Ba^{2+} ?

A.
$$Ca^{2+} < , Ca^{2+} < Be^{2+} < K^+$$

B. $Mg^{2+} < , Be^{2+} < K^+ < Ca^{2+}$
C. $Be^{2+} < , K^+ < Ca^+ < Mg^{2+}$
D. $K^+ < , Ca^{2+} < Mg^{2+} < Be^{2+}$

Answer: D

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25. In which of the following ionixation processes , the bond order has increased and the magnetic behaviour has changed ?

A.
$$N_2 o N_2^+$$

B. $C_2
ightarrow C_2^+$ C. $NO
ightarrow NO^+$

 $\mathsf{D}.\,O_2 o O_2.$

Answer: C

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26. Which of the following statements is false ?

A. H_2 molecule has one sigma bond

B. HCl molecule has one sigma bond

C. Water molecule has two sigma bonds and two lone pairs.

D. Acetylene molecule has three pi bonds and thre sigma bonds.

Answer:

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27. N_2 and O_2 are converted into monocations, N_2^+ and O_2^+ respectively. Which of the following is wrong?

A. In N_2^+ , the N-N bond is weakened

B. In O_2^+ , the bond order increases

C. In O_2^+ , paramagnetism decreases

D. $N_2^{\,+}$ becomes diamagnetic

Answer: D

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28. A neutral molecule XF_3 has a zero diple moment. The element X is

most likely :

A. chlorine

B. boron

C. nitrogen

D. carbon

Answer: B



29. The molecule having smallest bond angle is

A. $AsCl_3$

- B. $SbCl_3$
- $C. PCl_3$

D. NCl_3 .

Answer: B



30. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of

A.
$$Li_2^- < Li_2 < Li_2^+$$

B. $Li_2 < Li_2^+ < Li_2^-$
C. $Li_2^- < Li_2^+ < Li_2$
D. $Li_2 < Li_2 < Li_2^+$

Answer: C



31. In the of the following pairs of molecules /ions both the species are not likely to exist?

A. H_2^{-} , He_2^{2+} B. H_2^{+} , He_2^{2-} C. H_2^{-} , He_2^{2-} D. H_2^{2+} , He_2

Answer: D

32. Which of the following is diamagnetic ?

A. $H_2^{\,+}$

 $\mathsf{B.}\,He_2^{\,+}$

 $\mathsf{C}.\,O_2$

 $\mathsf{D.}\,N_2.$

Answer: D

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33. Number of antibonding electrons in O_2^- molecular ion is :

A. 8

B. 6

C. 7

Answer: C



34. The pair of compounds having identical shapes for their molecules is:

A. CH_4, SF_4

B. BCl_3, ClF_3

C. $XeF_2, ZnCl_2$

 $D.SO_2, CO_2$

Answer: C

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35. Which of the following properties is not shown by NO ?

A. its bond order is 2.5

B. Its is diamagnetic in the gaseous state

C. It is a netural oxide

D. Its combines with oxygen to from nitrogen dioxide.

Answer: B

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36. In the formation of π -bond, the atomic orbitals overlap in such a way that

A. their axis remain parallel to each other and perpendicular to the

internuclear axis

B. their axis remain parallel to each other and parallel to the

internuclear axis

C. their axis remain perpendicular to each other and parallel to the

internuclear axis

D. their axis remain perpendicular to each other and perpendicular to

the internuclear axis.

Answer: A

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37. The attractive force which holdes various constituents togrther in different chemical species is called

A. valence bond

B. chemical bond

C. atomic bond

D. electrovalent bond.

Answer: B

38. Which of the following stability order is correct ?

A.
$$O_2^{2-} > O_2^- > O_2^- > O_2^+$$

B.
$$O_2^+ > O_2 > O_2^- > O_2^{2^-}$$

C.
$$O_2^+ > O_2^- > O_2^- > O_2^{2-}$$

D.
$$O_2 > O_2^+ > O_2 > O_2^-$$

Answer: B

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39. The number of lone pairs of electrons on central atom of H_2O , $SnCl_2$, PCl_3 and XeF_2 respectively are:

 $\mathsf{A}.\,2,\,1,\,1,\,3$

B. 2, 2, 1, 3

C.3, 1, 1, 2

D.2, 1, 2, 3

Answer: A

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40. Which of the following changes in the respectively bond N_2 and F_2 molecules ?

A. decrease by 0.5 in both

B. increase by 0.5 in both

C. increase by 0.5 in the former and decrease by 0.5 in the later

D. decrease by 0.5 in the frmer and increase by 0.5 in the later

Answer: D

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41. The species in which the N-atom is in a state of sp hybridisation is

A. NO_2^+

 $\mathsf{B.}\,NO_2^{\,-}$

 $\mathsf{C.}\,NO_3^{\,-}$

 $D. NO_2.$

Answer: A

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42. Which of the following have least dipole moment?

A. H_2O

 $\mathsf{B.}\,BeF_2$

 $\mathsf{C}.\, NH_3$

 $D. BF_3.$

Answer: B



43. The increassing order of bond order of O_2, O_2^+, O_2^- and O_(2)^(--)` is :

A.
$$O_2^+$$
, O_2 , O_2^- , O_2^{--}
B. O_2^{--} , O_2^- , O_2^+ , O_2
C. O_2 , O_2^+ , O_2^- , O_2^{--}

D.
$$O_2^{2-}, O_2^-, O_2^-, O_2, O_2^+$$

Answer: D



44. HCl gas is covalent and NaCl is an ionic compound. This is because

A. sodium is highly electropositive

B. hydrogen is a non-metal

C. HCl is a gas

D. electronegativity difference between H and Cl is less then 2.1

Answer: D

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45. Out of SO_2 , $BeCl_2$, O_3 , H_2O and $HgCl_2$, the linear species are:

A. SO_2 and O_3

 $B.SO_2$ and H_2O

 $C. BeCl_2$ and $HgCl_2$

 $D.O_3$ and H_2O

Answer: C

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46. Hybridisation and shape of BrF_5 is :

A. sp^3d (Trigonal bipyramidal)

B. sp^3d^2 (Octahedral)

C. dsp^2 (Square planar)

D. sp^3d^2 (Square pyramidal)

Answer: D

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Jee Joint Entrange Examination Advanced Comprehension Linked Mcqs

1. L.C.A.O. Principle is involved in the formation of the molecular orbitals according ot molecular orbital theory. The energy of the bonding molecular orbital is less than that of the combining atomic orbitals while that of the antibonding molecular orbitals while that of the order $(B. O.) = \frac{1}{2}(N_b - N_a)$ helps in predicting (i) formation of

molecules/molecular ions, bond dossociation energy, stability and bond length. Only the molecules or ions with positive B.O. can be formed. These will be diamagnetic if all molecular orbitals are dilled and paramagnetic if one of more are half filled. The atomic prbitals at the time of overlap must have the same symmetry as well.

Which of the followijng combinatinos is not allowed (assume z axis as the internuclear azis) ?

A. 2s and 2s

B. $2p_x$ and $2p_x$

C. 2s and $2p_z$

D. $2p_y$ and $2p_y$

Answer: D

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2. L.C.A.O. Principle is involved in the formation of the molecular orbitals according ot molecular orbital theory. The energy of the bonding

molecular orbital is less than that of the combining atomic orbitals while that of the antibonding molecular orbitals while that of the order $(B. O.) = \frac{1}{2}(N_b - N_a)$ helps in predicting (i) formation of molecules/molecular ions, bond dossociation energy, stability and bond length. Only the molecules or ions with positive B.O. can be formed. These will be diamagnetic if all molecular orbitals are dilled and paramagnetic if one of more are half filled. The atomic prbitals at the time of overlap must have the same symmetry as well.

Bond arder is :

A. directly related to bond length

B. inversely related to bond length

C. incersely related to bond strength

D. never fractional.

Answer: B

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3. LC.A.O. Principle is involved in the formation of the molecular orbitals according ot molecular orbital theory. The energy of the bonding molecular orbital is less than that of the combining atomic orbitals while that of the antibonding molecular orbitals while that of the order $(B. O.) = \frac{1}{2}(N_b - N_a)$ helps in predicting (i) formation of molecules/molecular ions, bond dossociation energy, stability and bond length. Only the molecules or ions with positive B.O. can be formed. These will be diamagnetic if all molecular orbitals are dilled and paramagnetic if one of more are half filled. The atomic prbitals at the time of overlap must have the same symmetry as well.

In the formation of N_2^+ from N_2 , the electron is removed from a

A. σ orbital

B. π orbital

C. σ * -orbital

D. π * -prbital.

Answer: A



4. L.C.A.O. Principle is involved in the formation of the molecular orbitals according ot molecular orbital theory. The energy of the bonding molecular orbital is less than that of the combining atomic orbitals while that of the antibonding molecular orbitals while that of the order $(B. O.) = \frac{1}{2}(N_b - N_a)$ helps in predicting (i) formation of molecules/molecular ions, bond dossociation energy, stability and bond length. Only the molecules or ions with positive B.O. can be formed. These will be diamagnetic if all molecular orbitals are dilled and paramagnetic if one of more are half filled. The atomic prbitals at the time of overlap must have the same symmetry as well.

The bond order (B.O.) in B_2 molecule is:

A. 0

B. 1

C. 2

D. 3

Answer: B

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5. L.C.A.O. Principle is involved in the formation of the molecular orbitals according ot molecular orbital theory. The energy of the bonding molecular orbital is less than that of thecombining atomic orbitals while that of the antibonding molecular orbitals while that of the order $(B. O.) = \frac{1}{2}(N_b - N_a)$ helps in predicting (i) formation of molecules/molecular ions, bond dossociation energy, stability and bond length. Only the molecules or ions with positive B.O. can be formed. These will be diamagnetic if all molecular orbitals are dilled and paramagnetic if one of more are half filled. The atomic prbitals at the time of overlap must have the same symmetry as well.

In the homonuclear molecule3 which of the following sets of M.O. orbitals are degenerate ?

A. σ_{1s} and σ_{1s}^*

B. π_{2px} and π_{2py}

C. π_{2px} and σ_{2pz}

D. σ_{2pz} and π^*_{2px}

Answer: B

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6. The concept of hybridisation has been introduced to explain the shapes of molecules. It involves the intermixing of two or more atomic orbitals belonging to same atom but in or more atomic orbitals beloging to sasme atom but in different sub-shells so as to intermix and redistibute energies to from equivalent orbitals called hybrid orbitals.Depending upon toh enumber and nature of the orbitals involved, the hybridisation may be divided into sp (linear), sp^2 (trigonal), sp^3 (tetrahedral), sp^3d (trigonal bipyramidal), sp^3d^3 (octahedral) and sp^3d^3 (pentagonal bipyramidal) types. it may be noted that the orbitals of isolated atoms never hybridise and they do so at the time of bond formation.

A hybrid orbital from s-and p-orbitals can contribute to

A. σ -bond only

B. π -bond only

C. either σ or π -bond

D. cannot be predicted.

Answer: A

View Text Solution

7. The concept of hybridisation has been introduced to explain the shapes of molecules. It involves the intermixing of two or more atomic orbitals belonging to same atom but in or more atomic orbitals beloging to sasme atom but in different sub-shells so as to intermix and redistibute energies to from equivalent orbitals called hybrid orbitals.Depending upon toh enumber and nature of the orbitals involved, the hybridisation may be divided into sp (linear), sp^2 (trigonal), sp^3 (tetrahedral), sp^3d (trigonal bipyramidal), sp^3d^3 (octahedral) and sp^3d^3 (pentagonal bipyramidal) types. it may be noted that the orbitals of isolated atoms never hybridise and they do so at the time of bond formation.

Which carbon is maximum electronegative ?

A. sp^3 -hybridise carbon

B. sp-hybridised carbon

C. sp^2 -hybridised carbon

D. the electron attracting power of carbon is always the same

irrespective of its hybrid state.

Answer: B



8. The concept of hybridisation has been introduced to explain the shapes of molecules. It involves the intermixing of two or more atomic orbitals belonging to same atom but in or more atomic orbitals beloging to sasme atom but in different sub-shells so as to intermix and redistibute energies to from equivalent orbitals called hybrid orbitals.Depending upon toh enumber and nature of the orbitals involved, the hybridisation may be divided into sp (linear), sp^2 (trigonal), sp^3 (tetrahedral), sp^3d (trigonal bipyramidal), sp^3d^3 (octahedral) and sp^3d^3 (pentagonal bipyramidal) types. it may be noted that the orbitals of isolated atoms never hybridise and they do so at the time of bond formation.

The hybrid state of carbon in C_2H_2 is same as that of carbon in:

A. C_2H_6

 $\mathsf{B.}\,CO_2$

C. Benzene

D. C (diamond).

Answer: B



9. The concept of hybridisation has been introduced to explain the shapes of molecules. It involves the intermixing of two or more atomic orbitals belonging to same atom but in or more atomic orbitals beloging

to sasme atom but in different sub-shells so as to intermix and redistibute energies to from equivalent orbitals called hybrid orbitals.Depending upon toh enumber and nature of the orbitals involved, the hybridisation may be divided into sp (linear), sp^2 (trigonal), sp^3 (tetrahedral), sp^3d (trigonal bipyramidal), sp^3d^3 (octahedral) and sp^3d^3 (pentagonal bipyramidal) types. it may be noted that the orbitals of isolated atoms never hybridise and they do so at the time of bond formation.

The hybridisation of phostphorus in $PCOl_3$ is the same as:

A. P in PCl_3

B. S in SF_4

C. Cl in ClF_3

D. B in BCl_3 .

Answer: A

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10. The concept of hybridisation has been introduced to explain the shapes of molecules. It involves the intermixing of two or more atomic orbitals belonging to same atom but in or more atomic orbitals beloging to sasme atom but in different sub-shells so as to intermix and energies to from equivalent orbitals called redistibute hybrid orbitals.Depending upon toh enumber and nature of the orbitals involved, the hybridisation may be divided into sp (linear), sp^2 (trigonal), sp^3 (tetrahedral), sp^3d (trigonal bipyramidal), sp^3d^3 (octahedral) and sp^3d^3 (pentagonal bipyramidal) types. it may be noted that the orbitals of isolated atoms never hybridise and they do so at the time of bond formation.

The d-orbital involved in dsp^2 hybridisation is:

A. d_{xy}

 $\mathsf{B.}\,d_{2_z}$

 $\mathsf{C}.\, d_{x^2-y^2}$

D. d_{xz}

Answer: C

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11. Whenever, anion and cation approach each other, the valence shell of the anion is pulled towards the uncleus of the anion is pulled towards the nucles of the cation and as a result, the shape of the anion gets cation is known as polarization of polarizing an amion by a cation is known as polarrization. The ability or capacity of a cation of polarizethe anion towards litsef, is known as its polarizing power. Similiarty, the ability or capacity of an anion to get polarized by the cation, is known as its polarizability. As a result of polarisation, the two ions tend to come closer and the ionic character of the ionic ond acquired partial covalent character. The magnitude of polarization depends upon a number of factors whihc were suggested by Fazan and are termed as Fazan rules. which of the halides, there is maximum polarization?

A. AlF_3

B. $AlCl_3$

C. $AlBr_3$

 $D. AlI_3.$

Answer: D

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12. Whenever, anion and cation approach each other, the valence shell of the anion is pulled towards the uncleus of the anion is pulled towards the nucles of the cation and as a result, the shape of the anion gets cation is known as polarization of polarizing an amion by a cation is known as polarrization. The ability or capacity of a cation of polarizethe anion towards litsef, is known as its polarizing power. Similiarty, the ability or capacity of an anion to get polarized by the cation, is known as its polarizability. As a result of polarisation, the two ions tend to come closer and the ionic character of the ionic ond acquired partial covalent character. The magnitude of polarization depends upon a number of factors whihc were suggested by Fazan and are termed as Fazan rules. Which is most covalent in nature?

A. NaCl

B. $MgCl_2$

C. $ALCl_3$

 $D. CaCl_2.$

Answer: C



13. Whenever, anion and cation approach each other, the valence shell of the anion is pulled towards the uncleus of the anion is pulled towards the nucles of the cation and as a result, the shape of the anion gets cation is known as polarization of polarizing an amion by a cation is known as polarrization. The ability or capacity of a cation of polarizethe anion towards litsef, is known as its polarizing power. Similiarty. the ability or capacity of an anion to get polarized by the cation, is known as its polarizability. As a result of polarisation, the two ions tend to come closer and the ionic character of the ionic ond acquired partial covalent character. The magnitude of polarization depends upon a number of factors whihc were suggested by Fazan and are termed as Fazan rules. Non-aqueous solvent like eather is added to the mixture of LiCl, NaCl. Which will be extracted by ether ?

A. NaCl

B. LiCl

C. KCl

D. None.

Answer: B

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14. Whenever, anion and cation approach each other, the valence shell of the anion is pulled towards the uncleus of the anion is pulled towards the nucles of the cation and as a result, the shape of the anion gets cation is known as polarization of polarizing an amion by a cation is known as polarrization. The ability or capacity of a cation of polarizethe anion towards litsef, is known as its polarizing power. Similiarty. the ability or capacity of an anion to get polarized by the cation, is known as its polarizability. As a result of polarisation, the two ions tend to come closer and the ionic character of the ionic ond acquired partial covalent character. The magnitude of polarization depends upon a number of factors whihc were suggested by Fazan and are termed as Fazan rules. Which has the minimum melting point ?

A. CaF_2

B. $CaCl_2$

 $\mathsf{C.}\, CaBr_2$

 $\mathsf{D}. Cal_2.$

Answer: D



15. Which one among the following does not have the hydrogen bond?

A. Phenol

B. Liquid NH_3

C. Water

D. HCl

Answer: D

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16. The bond between two identical non-metal atoms has a pair of electrons:

A. unequally shared between the two.

B. transferred fully fro one atom to the other

C. with identical spins

D. equally shared between tham.

Answer: D

17. Hybridisation f sulphur in So_2 is :

A. sp

 $\mathsf{B.}\, sp^2$

 $\mathsf{C.}\,sp^3$

D. dsp^2

Answer: B

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18. The melecule that has linear structure is:

A. CO_2

 $\mathsf{B.}\,NO_2$

 $\mathsf{C}.SO_2$

 $D. SiO_2.$

Answer: A



19. The type of hybrid orbitals used by the chlorine atom in $CIO_{2^-}\,$ is

A. sp^3

B. sp^2

C. sp

D. none of these

Answer: A



20. The maximum possible number of hydrogen bonds a water molecule

can form is

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

Answer: B

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21. The number and type of bonds between two carbon atoms in CaC_2

are:

```
A. one sigma(\sigma) one pi (\pi) bond
```

B. one sigma (σ) and two pi (π) bonds.

C. one sigma (σ) and one half pi (π) bonds
D. one sigma (σ) bond.

Answer: C



22. The cyanide ion CN and N_2 are isoelectronic, but in contrast to CN^- , N_2 is chemically inert, because of

A. low bond energy

B. absence of bond polairty

C. unsymmetical electron distribution

D. Presence of more number of electron is bonding orbitals.

Answer: B

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23. The geometry of H_2S and its dipole moment are :

A. angular and non-zero

B. angular and zero

C. linear and non-zero

D. linear and zero.

Answer: A

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24. The hybridization of atomic orbitals of nitrogen is NO_2^+ , NO_3^- , and

 ${\it NH_4^{\,+}}$ respectively are

A. sp, sp^3 , and sp^2 respectively

B. sp, sp^2 , and sp^3 respectively

C. sp^2 , sp, and sp^3 respectively

D. sp^2 , sp^3 , and sp respectively

Answer: B



25. The common features among the species $CN^{\,-},\,CO$ and $NO^{\,+}$ are :

A. bond order three and isoelectronic

B. bond order three and weak field ligands

C. bond order tow and π -acceptors

D. isoelectronic and weak field ligands.

Answer: A

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26. Identify the least stable among the following

B. Be^-

C. B^-

D. $C^{\,-}$

Answer: B

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27. Which of the following are iso-electronic as well as is structural ?

$$NO_3^-, CO_3^{2-}, ClO_3^-, SO_3$$

A.
$$NO_3^-, CO_2^{2-}$$

 $\mathsf{B}.\,SO_3,\,NO_3^{\,-}$

- $\mathsf{C.}\,ClO_3^{\,-},\,CO_3^{2\,-}$
- D. CO_3^{2-}, SO_3

Answer: A

28. According to MO theory,

A. O_2^+ is paramagnetic and b.o. is ggreater than that of O_2

B. O_2^+ is paramagnetic and b.o. is less than that of O_2

C. O_2^+ is diamagnetic and b.o. is less than that of O_2

D. O_2^+ is diamagnetic and b.o. is more than that of O_2 .

Answer: A

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29. The bond angle in H_2Sis92° . It suggest that :

A. hybridised state of S atom is sp^2

B. bond pair-bond pair repulsions are more due to large size of S atom

C. lone pair-lone pair repulsions are greater than bonds pair-bond pair

repulsion

D. Bonds are more or les purely π -bonds.

Answer: C



30. The species having bond order different from that in CO is

A. NO^{-}

 $B.NO^+$

 $\mathsf{C.}\,CN^{\,-}$

 $\mathsf{D.}\,N_2.$

Answer: A



31. The bond energy (in kcal mol^{-1}) of a C-c single bond is approximately

A. 347 KJ mol^{-1}

B. 500 KJ mol^{-1}

C. 200 KJ mol^{-1}

D. 950 KJ mol^{-1}

Answer: A

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32. In allene (C_3H_4) , the type (s) of the carbon atom (s) is (are) :

A. sp and sp^3

B. sp and sp^2

C. only sp^2

 $D. sp^2$ and sp^3 .

Answer: B



33. The shapes of XeO_2F_2 molecule is

A. trigonal bipyramidal

B. square planar

C. tetrahedral

D. see-saw.

Answer: D



34. Assuming 2s - 2p mixing is *NOT* operative, the paramagnetic species among the following is .

A. Be_2

 $\mathsf{B}.\,B_2$

 $\mathsf{C}.\,C_2$

 $\mathsf{D}.\,N_2$

Answer: C

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Straight Objective Type Mcqs Single Correct Option

1. Carbon tetrachloride has no net dipole moment because of

A. its planar structure

B. its regular tetrahedral geometry

C. similar sizes of carbon and chlirine atoms

D. similar electron affinities of carbon an chlorine.

Answer: B

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Multiple Choice Answer Type Mcqs

- **1.** CO_2 is iso-structural with :
 - A. $HgCl_2$
 - $\mathsf{B.}\, C_2 H_2$
 - C. $SnCl_2$
 - $D. NO_2.$

Answer: A::B

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2. Which of the following have identicla bond order ?

A. CN^{-}

 $\mathsf{B}.O_2^-$

 $C.NO^+$

 $\mathsf{D.}\,CN^{\,+}\,.$

Answer: A::C

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3. Iso-structural species among the folwong are $(l)CH_3^+(ll)H_3O^+(lll)NH_3(IV)CH_3^-$

A. I and II

B. III and IV

C. I and III

D. II,III and IV

Answer: B::D

4. The compound(s) with two lone pairs of electron on the central atom is

(are)

A. BrF_5

 $\mathsf{B.}\, ClF_3$

 $\mathsf{C}.\, XeF_4$

 $\mathsf{D.}\,SF_4.$

Answer: B::C

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5. According to molecular arbital theory,

A. C_2^{2+} is expected to be diamagnetic

B. $O_2^{2\,+}$ os expected to have a bond length than O_2

C. $N_2^{2\,+}~~{
m and}~~N_2^{-}$ have the same bond order.

D. He_2^+ has the same energy as two isolated He atoms.

Answer: A::C

D Watch Video Solution

Reason Type Questions

1. Statement 1 : All molecules with polar bonds may not have dipole moments

Statement 2 : Dipole moment is a vectot quantity and bond dipoles may cancel out.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-1

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-1

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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2. Statement 1: H_2 molecule is more stable than $H_2 - HE$ molecule Statement 2: The antibonding electeon in $H_2 - He$ molecule destabilies. It.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-2

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-2

- C. Statement-1 is true, Statement-2 is false.
- D. Statement-1 is false, Statement-2 is true.

Answer: a



3. Statement 1: N_2 and NO^+ are both dia-magnetic.

Statement 2: NO^+ is isoelectronic with N_2

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-3

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-3

- C. Statement-1 is true, Statement-2 is false.
- D. Statement-1 is false, Statement-2 is true.

Answer: b

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4. Statement 1: PF_5 molecule is little less stable as compared to SF_6 molecule.

Statement :2 In PF_5 molecule is little less stable as compared to SF_6 molecule.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-4

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-4

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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5. Statement 1: The addition of electron in antibonding M.O. decreases

bond order.

Statement 2: Antibonding electrons tend ot bring the atoms close together.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-5

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-5

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: c

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6. Statement 1: When a magnet is dipped in liquid oxygen, some of it sticks to the magnet.

Statemetn 2: Oxygen is paramgnetic in nature.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-6

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-6

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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7. Statement 1 : Bond order in a stable molecule can be fractional.

Statemetn 2: The value of bond order depends upon the number of electrons in bonding and antibonding molecular orbitals.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-7

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-7

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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8. Statement 1: SF_6 molecular has octahedral geometry

Statement 2: Sulphur atom in SF_6 molecule is in sp^3d hybridisation state.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-8

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-8

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: c



9. Assertion : All F - S - F angle in SF_4 are greater than 90° but less than $180^\circ.$

Reason :The lone pair -bond pair repulsion is weaker than bond pair bond pair repulsion

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-9

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-9

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: c

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10. Statement 1: Molecular nitrogen is less reactive than molecular oxygen Statement 2: The bond length of N_2 is less as compared to that of O_2 .

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-10

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-10

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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11. Assertion: Boron always froms covalent bond.

Reason: The small size of B^{3+} favours formation of covalent bond.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-11

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-11

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a



12. Assertion(A) - In case the central atom in a molecule is surrounded only by shared pairs of electrons, the molecule has a regular geometry.Reason(R) -The shared pair of electrons repel each other with equal force so all bonds are equidistant from each other.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-12

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-12

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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13. Statement 1: There are ten valence electrons on the sulphur atom in SF_4 molecule.

Statement 2: The structure of SF_4 molecule is distorted trigonal bipyramidal.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-13

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-13

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: b

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14. Statement 1: BF_3 moleculeis planar while NF_3 is pyramidal.

Statement 2: N atom is smalar in size as compared ot B atom.

A. Statement-1 is true, Statement-2 is also true, Statement -2 is the

correct explanation of statement-1

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct explanation of Statement-1

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: b

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15. Statement 1: o-nitrophenol has higher boilling point than pnitrophenol.

Statement 2: Intermolecular hydrogen bonding is present in pnitrophenol and intrmolecular hydrogen bonding in o-nitrophenol.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-15

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-15

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: d

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16. Statement 1: The B.O. of F_2 molecule is 1.

Statement 2: In F_2 molecule, the number of electrons in the antibonding M.O. is two less than in bonding M.O.

A. Statemetn-1 is true, Statrment-2 is also true, Statement -2 is the

correct explanation of statement-16

B. Statement -1 is true, Statement 2 is also true, Statement-2 is not

the correct ezplanation of Statement-16

C. Statement-1 is true, Statement-2 is false.

D. Statement-1 is false, Statement-2 is true.

Answer: a

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1. Match the statement (A,B,C,D) in column I with the statement (p,q,r,s) in

column II. The answers are to be properly bobbled.

	Colu	mn I			Column II
(A)	NH_3			(p)	Linear
(B)	BeF ₂			(q)	Polar
(C)	H ₂ O			(r)	μ = 0 D
(D)	CO_2			(S)	Angular
	p	q	r	S	
(A)	\bigcirc	0	\bigcirc	0	
(B)	\bigcirc	\bigcirc	\bigcirc	0	
(C)	0		\bigcirc	0	
(D)	\bigcirc	\bigcirc		0	

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2.	Match		t	he	following	columns		
(A) (B) (C) (D)	$\begin{array}{c} \text{Colur}\\ \text{CH}_4\\ \text{C}_2\text{H}_4\\ \text{C}_6\text{H}_6\\ \text{CO}_2 \end{array}$	nn I		(p) (q) (r) (s)	Column II Sigma bond pi bond <i>sp</i> ³ hybridised <i>sp</i> ² hybridised			
	p	q	r	s				
(A)	\bigcirc	\bigcirc	\bigcirc	0				
(B)	0		Ο	۲				
(C)	\bigcirc		Ο	0				
(D)	\bigcirc	0	0	0				
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3.	Ν	latch	ł	the	following	columns		
(A) (B) (C) (D)	$\begin{array}{c} \text{Colu}\\ \text{O}_2\\ \text{N}_2\\ \text{H}_2\\ \text{O}_2^{2-} \end{array}$	ımn !		(p) (q) (r) (s)	Column II Bond order = 2 Diamagnetic Bond order = 3 Paramagnetic			
(A) (B) (C) (D)	 <i>p</i> <i>O</i> <i>O</i> <i>O</i> <i>O</i> 	q () () () () ()	r 0 0 0	s 0 0 0				
Vatch Video Solution								



5.	N	latch		the	following	columns			
(A) (B) (C) (D)	Coluit $O_2^{2^-}$ CO NO ⁺ He ₂ ⁺	mn l		(p) Is (q) F (r) P (s) D	olumn II soelectronic with N ₂ ractional bond order aramagnetic biamagnetic				
(A) (B) (C) (D)		q () () () ()	r () () () ()	s 0 0 0					
	Vatch Video Solution								



Multiple Choice Questions Type 1

1. Isostructural species are those which have the same shape and hybridisation. Among the given identify the isostructural pairs.

A. $[NF_3 \text{ and } BF_3]$

B. $\left[BF_4^{-} \text{ and } NH_4^{+}\right]$

- $C.[BCl_3 \text{ and } BrCl_3]$
- D. $\left[NH_3 \text{ and } NO_3^{-}\right]$

Answer: B

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2. Polarity in a molecule and hence the dipole moment depends primarily on electronegativity of the constituent atoms and shape of a molecule. Which of the following has the highest dipole moment?

A. CO_2

B. Hl

 $\mathsf{C}.\,H_2O$

D. SO_2

Answer: C

3. The types of hybrid orbitals of nitrogen in NO_2^+ , NO_3^+ and NH_4^+ respectively are expented to be :

A.
$$sp$$
, sp^2 and sp^2
B. sp , sp^2 and sp^3
C. sp^2 , sp and sp^3
D. sp^2 , sp^3 and sp

Answer: B



4. Hydrogen bonds are formed in many compounds e.g. H_2O , HF, NH_3 . The boiling point of such compounds depends to a extent on the strength of hydrogen bond and the number of hydrogen bonds. The correct decreasing order of the boiling points above compounds is

A.
$$HF > H_2O > NH_3$$

 $\mathsf{B}. N_2 O > HF > NH_3$

 $\mathsf{C}.\, NH_3 > HF > H_2O$

D. $NH_3 > H_2O > HF$

Answer: B

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5. In $PO_4^{3\,-}$ ion the formal charge on the oxygen atom of P-O bond is

- $\mathsf{A.}+1$
- $\mathsf{B.}-1$
- C. 0.75
- D. + 0.75

Answer: B

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6. In NO_3^- ion, the number of bond pair and lone pair of electrons on nitrogen atom are:

A. 2, 2

B. 3, 1

C. 1, 3

D.4, 0

Answer: D

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7. Which of the following species does not have tetraahedral geometry?

A. BH_4^{-}

 $\mathrm{B.}\,NH_2^{\,-}$

 $\mathsf{C.}\,CO_3^{2\,-}$

D. H_3O^+


Answer: C

9. Which molecule/ion out of the following does not contain unpaired electrons?

A. N_2^+ B. O_2

C. O_2^{2-}

 $\mathsf{D}.\,B_2$

Answer: C

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10. In which of the following substances will hydrogen bond be strongest

?

B. BF_4^{-}

 $\mathsf{C}.\,C_2H_4$

D. SiF_4

Answer: C

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11. In which of the following substances will hydrogen bond be strongest?

A. HCl

 $\mathsf{B}.\,H_2O$

C. Hl

 $\mathsf{D}.\,H_2S$

Answer: B

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12. If the electronic configuration of an element is $1s^22s^22p^23s^23p^63d^24s^2$

, four electrons involved in chemical bond formation will be ……….

A. $3p^6$ B. $3p^6$, $4s^2$ C. $3p^6$, $3d^2$ D. $3d^2$, $4s^2$

Answer: D

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13. Which of the following angles corresponds to sp^2 hybridisation ?

A. 90°

B. 120°

C. 180°

D. 109°

Answer: B Watch Video Solution 14. Stable from of A may be represented by the formula : A. A $\mathsf{B}.A_2$ $\mathsf{C}.A_3$ D. A_4 Answer: A

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15. Stable from of C may be represented by the formula :

 $\mathsf{B.}\,C_2$

 $\mathsf{C}.C_3$

D. C_4

Answer: B

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16. The molecular formula of the compound formed from B and C will be :

A. BC

 $\mathsf{B}.\,B_2C$

 $\mathsf{C}.BC_2$

D. BC_3

Answer: D

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17. The bond between B and C will be

A. Ionic

B. Colvalent

C. Hydrogen

D. Coordinate

Answer: B

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18. Which of the following order of energies of molecular orbitals of N_2 is

correct?

A.
$$\sigma_{2s}^{\,*} < \pi_{2py} = \pi_{2py} < \sigma_{2pz}$$

B. $\sigma_{2s}^{\,*} < \pi_{2px} < \pi_{2py} < \sigma_{2pz}$

C. $\sigma_{2s}^{\,*} < \pi_{2pz} < \pi_{2px} < \sigma_{2py}$

D. $P_{2px} < P_{2py} < s^{*}_{2s} < s_{2pz}$

Answer: A

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19. Which of the following statement is not correct from the view point of molecular orbital theory?

A. Be_2 is not a stable molecule.

B. He_2 is not stable but He_2^+ is expected to exist.

C. Bond strength of N_2 is maximum amongst the homonuclear

diatomic molecules belonging to the second period.

D. The order of energies of molecular orbitals in N_2 molecule of

$$\sigma_{2s} < \sigma_{2s}^* < (\pi_{2px} = \pi_{2px}) < (\pi_{2px}^* - \pi_{2px}^*)$$
 ,

Answer: D

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20. Which of the following options represents the correct bond order? Thinking process

To calcualte bond order, write the molecular orbital configuration of particular species and afterwards using the formula.

Bond order = $\frac{1}{2}$ [Number of bonding (N_6) - Number of anti-bonding electrons (N_a)]

- A. $O_2^- > O_2 > O_2^+$
- ${\tt B}.\,O_2^{\,-}\,< O_2^{\,+}\,< O_2^{\,+}$
- $\mathsf{C}.\,O_2^{\,-}\, > O_2 < O_2^{\,+}$
- D. $O_2^{\,-}\, < O_2 > O_2^{\,+}$

Answer: B

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21. The electronic configuration of the outer most shell of the most electronegative element is :

A. $2s^22p^5$

 $\mathsf{B.}\, 3s^2 3p^5$

 $\mathsf{C.}\,4s^24p^5$

D. $5s^25p^5$

Answer: A



22. Amongst the following elements (whose electronic configuration an given below) the one having highest ionization energy is

A. $[Ne]3s^23p^1$

- $\mathrm{B.}\,[Ne]3s^23p^3$
- $\mathsf{C}.\,[Ne]3s^23p^2$

D. $[Ar] 3d^{10} 4s^2 4p^3$

Answer: B

23. Which of the following attain the linear structure ?

A. $BeCl_2$

 $\mathsf{B}.\,NCO^{\,+}$

 $\mathsf{C}.NO_2$

D. CS_2

Answer: A::D

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24. CO is isoelectronic with

A. NO^+

 $\mathsf{B.}\,N_2$

 $\mathsf{C}.\,SnCl_2$

 $\mathsf{D}.NO_2^-.$

Answer: A::B



25. Which of the following species have the same shape?

A. CO_2

- B. CCl_4
- $\mathsf{C}.O_3$

D. NO_2^-

Answer: C::D

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26. Which of the following statements are correct about CO_3^{2-} ?

A. The hybridisation of central atom is sp^3 .

B. Its rresonance structure has one C-O single bond and two C=O

double bonds.

C. The average formal charge on each oxygen atom is 0.67 units.

D. All C-O bond lengths are equal.

Answer: C::D

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27. Dimagnetic species are those which contain no unpaired electrons.

Which among the followig are diamagnetic ?

A. N_2

B. N_2^{2-}

 $\mathsf{C}.\,O_2$

D. $O_2^{2\,-}$

Answer: A::D



29. Which of the following statements are not correct?

A. NaCl being an ionic compound is a good conductor of electricity in

the solid state.

- B. In canonical structures, there is a difference in the arrangement of atoms.
- C. Hybrid oritals form stronger bonds than pure orbitals.
- D. VSEPR Theory can explain the square planar geometry of XwF_4 .

Answer: A::B

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Multiple Choice Questions Type Ii

1. Which of the following have identical bond order ?

A. CN^{-}

 $B.NO^+$

 $\mathsf{C}.\,O_2^{\,-}$

D. $O_2^{2\,-}$

Answer: A::B

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lii Matching Type Questions

1. Match the species in Column 1 with the type of hybrid orbitals in

Column II.

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2. Match the species in Column I with the geometry/shape in Column II.

	Column I	*****	Column II
Α.	H_3O^+	1.	Linear
B.	HC≡CH	2.	Angular
C.	CIO_2^-	3.	Tetrahedral
D.	NH_4^+	4.	Trigonal bipyramidal
		5.	Pyramidal

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3. Match the species in Column I with the bond order in Column II.

Column I		C	Column II	
Α.	NO	1.	1.5	
B.	CO	2.	2.0	
С.	O_2^-	3.	2.5	
D.	O ₂	4.	3.0	

4. Match the items given in Column 1 with examples give in Column II.

Column I	Column II
(a)Hydrogen bond	(i)C
(b)Resonance	(ii)LiF
(c)Ionic solid	$(iii)H_2$
(d)Covalent solid	(iv)HF
	$(v)O_3$

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5. Match the shape of molecules in Column 1 with the type of

hybridisation in Column II.

Column I	Column II
(a)Tetrahedral	$(i)sp^2$
(b)Trigonal	(ii)sp
(c)Linear	$(iii)sp^3$
(d)Trigonal bipyramidal	$(iv)sp^3d$

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Iv Assertion Reason Type Questions

1. Assertion (A): Sodium chloride formed by the action of chlorine gas on sodium metal is a stable compound.

Reason: (R) This is because sodium and chloride ions acquire octet in sodium chloride formation.

A. A and R both are correct, and R is the correct explanation of A.

B. A and R both are correct , but R is not correct explanation of A.

C. A is true but R is false.

D. A and R bot are false.

Answer: A

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2. Assertion (A): Though the central atom of both NH_3 and H_2O molecules are sp^3 hybridised, yet H-N-H bond angle is greater thant that of H-O-H.

Reason(R): This is because nitrogen atom has one lone pair and oxygen atom has two lone pairs.

A. A and R both are correct and R is the correct explanation of A.

B. A and R both are correct but R is not the correct explanation of A.

C. A is true but R is false.

D. A and R bot are false.

Answer: A

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3. Assertion (A): Among the two O-H bonds in H_2O molecule, the energy required to break the first O-H bond and the other O-H bond is the same. Reason (R) This is because the electronic environment around oxygen is the same even after brekage of one O-H bond.

A. A and R both are correct and R is the correct explanation of A.

B. A and R both are correct but R is not the correct explanation of A.

C. A is true but R is false.

D. A and R bot are false.

Answer: D

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Comprehension

1. Molecular orbitals are formed by the overlap of atomic orbitals. Two atomic orbitals combine atom from two molecular orbitals called vonding molecular orbital (BOM) and anti bonding molecular orbital (ABMO). Energy of anti bonding orbital is raised above the parent atomic orbitals that have combined and the energy of the bonding orbital is lowered than the parent atomic orbitals. Energies of various molecular orbitals for elements hydrogen to nitrogne increase in the order :

 $\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < (\pi_{2py} \approx \pi_{2py}) < \sigma_{2py} < (\pi_{2py}^* \approx \pi_{2py}^*) < \sigma_{2pz}^*$ and for ozygen and fluorine order of energy of molecular orbitals id given below :

$$\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < \sigma_{2pz} < \Big(\pi_{2px}^* pprox \pi_{2py}^*\Big)\sigma_{2pz}^*$$

Different atomic orbitals of one atom combine wiht the atomic orbitals of the second atom whihc have comparable energies and proper orientation. Further, if the overlapping is head on, the molecular orbital is called 'Sigma' (σ) and if the overlap is atreal, the molecular orbital is called 'pi', (π). The molecular orbitals are filled with electrons according to the same rules as followed for filling of atomic orbitals. However, the order for filling is not the same for all molecules or their ions, Bond order is one the most ipmrtaint parameters to compare the strength of bonds. Which of the following statements is correct ?

- A. In the formation of dioxygen atoms, 10 molecular orbitals will be formed.
- B. All the molecular orbitals in the dioxygen will be completely filled.
- C. Total number of bonding molecular orbitals will not be same as total number of anti bonding orbitals in dioxygen

D. Number of filed bonding orbitals will be same as number of filled

antibonding orbitals.

Answer: a

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2. Molecular orbitals are formed by the overlap of atomic orbitals. Two atomic orbitals combine atom from two molecular orbitals called vonding molecular orbital (BOM) and anti bonding molecular orbital (ABMO). Energy of anti bonding orbital is raised above the parent atomic orbitals that have combined and the energy of the bonding orbital is lowered than the parent atomic orbitals. Energies of various molecular orbitals for elements hydrogen to nitrogne increase in the order :

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$$\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < \sigma_{2pz} < \Big(\pi_{2px}^* pprox \pi_{2py}^*\Big)\sigma_{2pz}^*$$

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A. $\sigma_{1s}^{\,*}$

 $\mathrm{B.}\,\sigma_{2pz}^{\,*}$

C. π_{2px}

D. π^*_{2py}

Answer: d

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3. Molecular orbitals are formed by the overlap of atomic orbitals. Two atomic orbitals combine atom from two molecular orbitals called vonding molecular orbital (BOM) and anti bonding molecular orbital (ABMO). Energy of anti bonding orbital is raised above the parent atomic orbitals that have combined and the energy of the bonding orbital is lowered than the parent atomic orbitals. Energies of various molecular orbitals for elements hydrogen to nitrogne increase in the order :

 $\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < (\pi_{2py} \approx \pi_{2py}) < \sigma_{2py} < (\pi_{2py}^* \approx \pi_{2py}^*) < \sigma_{2pz}^*$ and for ozygen and fluorine order of energy of molecular orbitals id given below :

$$\sigma_{1s} < \sigma^*_{1s} < \sigma_{2s} < \sigma^*_{2s} < \sigma_{2pz} < \Big(\pi^*_{2px} pprox \pi^*_{2py}\Big)\sigma^*_{2pz}$$

Different atomic orbitals of one atom combine wiht the atomic orbitals of the second atom whihc have comparable energies and proper orientation. Further, if the overlapping is head on, the molecular orbital is called 'Sigma' (σ) and if the overlap is atreal, the molecular orbital is called 'pi', (π). The molecular orbitals are filled with electrons according to the same rules as followed for filling of atomic orbitals. However, the order for filling is not the same for all molecules or their ions, Bond order is one the most ipmrtaint parameters to compare the strength of bonds. Which of the following pair is expected to have the same bond order ?

A. O_2, N_2 B. O_2^+, N_2^- C. O_2^-, N_2^+ D. O_2^-, N_2^-

Answer: b

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4. Molecular orbitals are formed by the overlap of atomic orbitals. Two atomic orbitals combine atom from two molecular orbitals called vonding molecular orbital (BOM) and anti bonding molecular orbital (ABMO). Energy of anti bonding orbital is raised above the parent atomic orbitals that have combined and the energy of the bonding orbital is lowered than the parent atomic orbitals. Energies of various molecular orbitals for elements hydrogen to nitrogne increase in the order :

$$\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < ig(\pi_{2py} pprox \pi_{2py}ig) < \sigma_{2py} < ig(\pi_{2py}^* pprox \pi_{2py}^*ig) < \sigma_{2pz}^*$$

and for ozygen and fluorine order of energy of molecular orbitals id given below :

$$\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < \sigma_{2pz} < \Big(\pi_{2px}^* pprox \pi_{2py}^*\Big)\sigma_{2pz}^*$$

Different atomic orbitals of one atom combine wiht the atomic orbitals of the second atom which have comparable energies and proper orientation. Further, if the overlapping is head on, the molecular orbital is called 'Sigma' (σ) and if the overlap is atreal, the molecular orbital is called 'pi', (π). The molecular orbitals are filled with electrons according to the same rules as followed for filling of atomic orbitals. However, the order for filling is not the same for all molecules or their ions, Bond order is one the most ipmrtaint parameters to compare the strength of bonds. In which of the following molecules σ_{2pz} molecular orbital is filled after π_{2px} and π_{2py} molecular orbitals ?

A. O_2

 $B. Ne_2$

 $\mathsf{C}.\,N_2$

D. F_2

Answer: c

D View Text Solution