CHEMISTRY

JEE MAIN AND ADVANCED

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Example

1. Draw Lewis dot symbol for Beryllium (Be) and Boron (B)

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2. Draw the Lewis dot structure of the following molecules

(i) Methyl alcohol (CH_3OH)

(ii) Ammonia molecule (NH_3)

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3. Draw the Lewis dot structure of Hydrogen sulphide molecule .

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4. Write the Lewis dot structure of CO molecule .

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5. Draw the Lewis structure of SO_4^{2-} ioin

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6. Draw the Lewis structure of ClO_4 (per chlorate ion)

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7. Calculate the formal charge on S in HSO_4^- ion

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8. What is the bond order between carbon and nitrogen in $C \equiv N^-$?

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9. Discuss the shape of the BeF_2 molecules using VSEPR model

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10. Discuss the shape of the IF_5 using VSEPR model .

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Try Yourself

1. Suppose an element X has Lewis symbol as $\dot{X}$. Identify the element X from the following options

A. Na

B. Mg

C. Al

D. Si

Answer: A

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2. Draw the Lewis symbol for the following nitrogen (N) and fluorine (F)

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3. Draw the Lewis dot structure of hydrogen moelcule .

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4. Draw the Lewis dot structure of the HCl molecule .

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5. Draw the Lewis dot structure of Methane (CH_4) molecule .

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6. Draw the Lewis dot structure of Hydrogen cyanide (HCN) molecule .

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7. Draw the Lewis structure of NH_4^+ ion .

A.

$T = 8 + 8 = 16, V = 5 + 4 - 1 = 8, S = 16 - 8 = 8, U = 8 - 8 =$

B.

C.

D.

Answer:

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8. Write the Lewis structure of hydrogen peroxide .

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9. Write the Lewis dot structure of the nitrite ion $\left(NO_2^{\Theta}\right)$.

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10. Draw the Lewis structure of $SOCl_2$ (Thionyl chloride)

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11. The formal charges on the three O atoms in the O_3 molecule are

A. 

B.

C.

D.

Answer:

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12. Calculate the formal charge on Cl atom in $HClO_4$.

A. 

Non bonded electrons = 0

Shared electrons = 8 .

B.

C.

D.

Answer: 2

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13. Write is the bond order between C and C in $H - C \equiv C - H$?

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14. What is the bond order between C and O in CO ?

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15. Explain the reasonance structure of CO_2 molecule?

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

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17. Discuss the shape of the BCl_3 molecules using VSEPR model .

A. Shape : Trigonal planar .

B.

C.

D.

Answer:

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18. Discuss the shape of the SiF_4 molecule using VSEPR model .

A. Tetrahedral

B.

C.

D.

Answer:

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19. Discuss the shape of H_3O^+ using VSEPR model .

A. Shape : Pyramidal

B.

C.

D.

Answer:

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20. Discuss the shape of RF_4^- using VSEPR model

A. Shape : Tetrahedral

B.

C.

D.

Answer:

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Assignment Section A Objective Type Questions One Option Is Correct

1. When two atoms combine to form a molecule .

A. Energy is released

B. Energy is absorbed

C. Energy is neither released nor absorbed

D. Energy may either released or absorbed

Answer: A

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2. The combination of atoms occur because they tend

A. To decrease number of electrons in the outermost orbit

B. To attain an inert gas configuration

C. To remain same number of electrons in the outer most orbit

D. To attaiin 18 electrons in the outermost orbit

Answer: B

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3. An electrovalent bond is formed between

A. Two electronegative atoms

B. Two metals

C. Electropositive and electronegative atoms

D. Two electropositive atoms

Answer: C

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4. Most favourable conditions for electrovalent bonding are

A. Low ionisation potential of one atom and high electron affinity of the other atom

B. High electron affinity and high ionisation potential of both the atoms

C. Low electron affinity and low ionisation potential of both the atoms

D. High ionisation potential of one atom and low electron affinity of the other atom .

Answer: A

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

A. Atoms

B. Molecules

C. Oppositely charged ions

D. Both molecules and ions

Answer: C

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6. 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. Coordinate

D. Metallic .

Answer: B

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7. Most covalent compound among the following

A. LiCl

B. BeO

C. NaCl

D. MgO

Answer: B

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8. Which of the following elements has the strongest tendency to form electrovalent compound ?

A. Li

B. Na

C. Be

D. Mg

Answer: B

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9. Lattice energy of an ionic compound depedns upon :

A. Charge on the ion only

B. Size of the ion only

C. Packing of the ion only

D. Charge and size of the ion

Answer: D

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10. Multiple covalent bonds exist in a molecule of

A. F_2

B. N_2

C. CH_4

D. H_2

Answer: B

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11. Which of the following statements is not true about covalent compounds ?

A. They may exhibit isomerism

B. They have low melting and boiling points

C. They show ionic reactions

D. They show molecular reactions

Answer: C

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12. Element X is strongly electropositive and element Y is strongly electronegative. Both are univalent. The compound formed would be

A. $X^{+}Y^{-}$

B. $X - Y$

C. $X^{-}Y^{+}$

D. $X \rightarrow Y$

Answer: A

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13. In a triple bond total number of share electrons are

A. 3 electrons

B. 4 electrons

C. Several electrons

D. 6 electrons

Answer: D

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14. Element A has three electrons in the outermost orbit and B has six electrons in the outermost orbit The formula of the compound will be .

A. A_2B_3

B. A_2B_6

C. A_2B

D. A_3B_2

Answer: A

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15. 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: B

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16. Which shows the highest lattice energy ?

A. RbF

B. CsF

C. NaF

D. KF

Answer: C

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17. Polarisation involves the distortion of the shape of an anion by an adjacently placed cation In this context, which of the following statements is correct ? .

A. Maximum polarisation is done by a cation of high charge

B. A large cation is likely to bring large degree of polarisation

C. A smaller anion is likely to undergo a high degree of polarisation .

D. Minimum polarisation is done by a cation of small size

Answer: A

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18. The most covalent halide is

A. AlF_3

B. $AlCl_3$

C. $AlBr_3$

D. AlI_3

Answer: D

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19. Pi (π) bond is formed by the overlap of

A. s-s orbitals

B. s- p orbitals

C. p-p orbitals in end to end manner

D. p-p orbitals in sidewise manner

Answer: D

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20. In the formation of ethylene molecule , the carbon atom makes use of

A. sp^3 hybridisation

B. sp^2 hybridisation

C. sp hybridisation

D. dsp^2 hybridisation

Answer: B

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21. Incorrect statement is

A. Hybridisation is intermixing of orbitals of nearly equal energies

B. Hybrid orbitals are identical in all respect

C. Hybrid orbitals can form σ bond and πbond

D. Shape of molecule depends upon type of hybridisation only

Answer: D

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22. Which one of the following has pyramid shape ?

A. NH_3

B. SiF_4

C. H_2O

D. BF_3

Answer: A

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23. Which of the molecule has p-p overlapping ?

A. Cl_2

B. HCl

C. H_2O

D. NH_3

Answer: A

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24. A molecule possessing dipole moment is

A. CH_4

B. H_2O

C. BF_3

D. CO_2

Answer: B

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25. In which of the following molecule in the bond angle is maximum ?

A. CH_4

B. H_2O

C. NH_3

D. CO_2

Answer: D

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26. CO_2 is isostructural with

A. SO_2

B. NO_2

C. C_2H_2

D. $SnCl_2$

Answer: C

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27. Which one of the following contains both ionic and covalent bonds?

A. CH_4

B. $NaOH$

C. KCl

D. SO_2

Answer: B

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28. The compound with the highest boiling point is

A. CH_3OH

B. CH_3Br

C. CH_3Cl

D. CH_4

Answer: A

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29. The bond between carbon atom (1) and carbon atom (2) in the compound $N \equiv C - CH = CH_2$ in involves the hybridisation as :

A. sp and sp^2

B. sp^2 and sp^3

C. sp and sp^3

D. sp and sp

Answer: A

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30. Number of σ bonds , π bonds and lone pair on Xe form of $XeOF_4$

A. $4, 1, 1$

B. $4, 2, 1$

C. $5, 1, 1$

D. $6, 2, 0$

Answer: C

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31. The hydrogen bond is strongest in

A. $O-H- \ - \ - \ -S$

B. $N-H- \ - \ - \ - \ -N$

C. $F-H- \ - \ - \ - \ -F$

D. Both (1) & (2)

Answer: C

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32. How many sigma bonds and pi bonds are present in a benzene molecules ? .

A. Three sigma and three pi

B. Twelve sigma and three pi

C. Six pi and three sigma

D. Nine sigma and three pi

Answer: B

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33. Atomic orbitals involved in hybridisation of SF_6 molecule

A. $3s$, $3p_x$, $3p_y$, $3p_z$, $3d_{z^2}$, $d_{x^2-y^2}$

B. $3s3p_x$, $3p_y$, $3p_z$, $3d_{z^2}$

C. $3s$, $3p_x$, $3p_y$, $3p_z$, $3d_{x^2-y^2}$, d_{xy}

D. $3s$, $3p_x$, $3p_y$, $3d_{xy}$, $3d_{yz}$, $3d_{xz}$

Answer: A

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34. The hybridisation of 'S' in SO_2 is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: B

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35. The compound in which the distance between the two adjacent carbon atoms is largest is :

A. Benzene

B. Ethyne

C. Ethene

D. Ethane

Answer: D

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36. Which of the following compound of group-14 elements would you expect to be most ionic in character ?

A. CCl_4

B. $SiCl_4$

C. $PbCl_2$

D. $PbCl_4$

Answer: C

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37. The order rule is not valid for the molecule

A. CO_2

B. CCl_4

C. O_2

D. $BeCl_2$

Answer: D

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38. The compound which contains both ionic and covalent bonds is

A. CH_4

B. H_2

C. KCN

D. KCl

Answer: C

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39. The ion that is isoelectronic with CO is

A. CN^-

B. O_2^-

C. O_2^-

D. N_2^+

Answer: A

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40. The type of bonds present in NH_4Cl are

A. Electrovalent , covalent and coordinate

B. Only ionic

C. Only covalent

D. Covalent and coordinate

Answer: A

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41. One hybridization of one s and one p orbital we get

A. Two mutually perpendicular hybrid orbitals

B. Two equivalent hybrid orbitals at 180°

C. Four hybrid orbitals directed tetrahedrally

D. Three hybrid orbitals in the plane

Answer: B

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42. If molecule MX_3 has zero dipole moment, the sigma bonding orbitals used by M (atomic number < 21) are

A. Pure p

B. sp hybrids

C. sp^2 hybrids

D. sp^3 hybrids

Answer: C

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43. The species in which the cantral atom uses sp^2 hybrid orbital in its bonding is:

A. PH_3

B. AsH_3

C. NH_3

D. CH_3^+

Answer: D

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44. The melecule that has linear structure is:

A. CO_2

B. NO_2

C. SO_2

D. SiO_2

Answer: A

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45. The $CI - C - CI$ angle in $1, 1, 2, 2,$ tetrachloroethone and tetrachloromethane respectively will be about:

A. 109.5° and 90°

B. 120° and 109.5°

C. 90° and 109.5°

D. 109.5° and 120°

Answer: B

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46. Coordinate linkage is formed

A. By transfer of one electron from one atom to another

B. By the loss of one electron each from both the atoms

C. By sharing of one electron from each atom

D. When contribution of one electron pair is made by one atom and both the atoms share equally

Answer: D

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47. The molecule which has the largest dipole moment amongst the following is

A. CH_4

B. $CHCl_3$

C. CCl_4

D. CHl_3

Answer: B

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48. The number of unpaired electrons in O_2 molecule is

A. Zero

B. 1

C. 2

D. 3

Answer: C

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49. The carbon-carbon bond order in benzene is

A. One

B. Two

C. One and half

D. One and two alternately

Answer: C

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50. Which is the weakest among the following types of bonds

A. Ionic bond

B. Covalent bond

C. Metallic bond

D. Hydrogen bond

Answer: D

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51. In a series ethane $(CH_3 - CH_3)$ ethylene $(CH_2 = CH_2)$ and acetylene $(CH \equiv CH)$, the C-H bond energy is

A. The same in all the three compounds

B. Greatest in acetylene

C. Greatest in ethylene

D. Greatest in ethane

Answer: B

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52. High boiling point of water is due to :

A. Its high specific heat

B. Hydrogen bonding between the molecules

C. Weak dissociation of water molecules

D. Its high dielectric constant

Answer: B

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53. The number of valence electrons in carbon atom is

A. Zero

B. 2

C. 6

D. 4

Answer: D

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54. The triple bond in ethyne is made of

A. Three sigma bond

B. Three pi bond

C. One signal bond and two pi bonds

D. Two sigma and one pi bonds

Answer: C

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55. Which of the following has zero dipole moment ?

A. CO_2

B. H_2O

C. SO_2

D. NO_2

Answer: A

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56. Which of the following is diamagnetic ?

A. O_2^+

B. O_2

C. O_2^-

D. O_2^{2-}

Answer: D

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57. sp^3 dhybridisation has

A. Octahedral shape

B. Square planar shape

C. Trigonal bipyramidal shape

D. Pentagonal bipyramidal shape

Answer: C

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58. An sp^3 hybrid orbital possesses

A. $\frac{1}{4}$ s-character

B. $\frac{1}{2}$ s-character

C. $\frac{2}{3}$ s-character

D. $\frac{3}{4}$ s-character

Answer: A

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59. Strongest hydrogen bonding is present in

A. HF

B. HCl

C. HBr

D. HI

Answer: A

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60. Resonance structure of a molecule cannot have

A. Identical arrangement of atoms

B. Nearly same energy content

C. The same number of paired electrons

D. Identical bonding

Answer: D

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Assignment Section B Objective Type Questions One Option Is Correct

1. Which of the following has maximum ionic character ?

A. LiCl

B. NaCl

C. KCl

D. CsCl

Answer: D

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2. Which of the following compounds has a central atom assuming sp^3 hybridisation ?

A. SO_3

B. PCl_5

C. NH_3

D. CO_3^{2-}

Answer: C

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3. Which is the correct arrangement of the molecules basexd on dipole moments ?

A. $BF_3 = NH_3 = NF_3$

B. $BF_3 > NH_3 > NF_3$

C. $BF_3 < NH_3 < NF_3$

D. $BF_3 < NF_3 < NH_3$

Answer: D

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4. Paramagnetism is not shown by

A. O_2

B. O_2^-

C. H_2^+

D. O_2^{2-}

Answer: D

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5. The hydridisation of S in SO_4^{2-} is same as

A. I in lCl_4^-

B. S in SO_3

C. P in PO_4^{3-}

D. N in NO_3^-

Answer: C

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6. Which of the following pairs have same hybridisation ?

A. CH_3^- and CH_3^+

B. NH_3 and SO_2

C. SO_4^{2-} and BF_4^-

D. BF_3 and NF_3

Answer: C

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7. The maximum possible number of hydrogen bonds a water molecule can form is

A. 2

B. 4

C. 5

D. 6

Answer: B

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8. Strongest Hydrogen bonding is present in

A. HF

B. NH_3

C. C_2H_5OH

D. H_2O

Answer: A

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9. Which of the following has zero dipole moment ?

A. CO_2

B. NH_3

C. NF_3

D. H_2O

Answer: A

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10. The compound which contains both ionic and covalent bonds is

A. KCN

B. KCl

C. K_2S

D. H_2O_2

Answer: A

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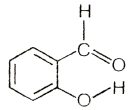
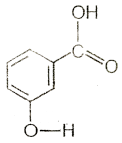
11. Which of the following species will have intramolecular hydrogen bonding ?

A. (1)



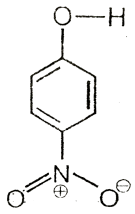
o-Hydroxybenzaldehyde

B. (2)



m-Hydroxybenzoic acid

C. (3)



p-Nitrophenol

D. (4) 

o-Chlorobenzaldehyde

Answer: A

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

A. CH_3^- and CH_3

B. NH_4^+ and BH_4^-

C. SO_4^{2-} and BF_3

D. NH_2^- and BeF_2

Answer: B

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13. O_2 and N_2 are respectively

A. Diamagnetic , Paramagnetic

B. Paramagnetic , Diamagnetic

C. Both the paramagnetic

D. Both are diamagnetic

Answer: B

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14. Molecular shape of ClF_3, l_3^- and XeO_3 respectively are

A. T-shape , Linear , Pyramidal

B. Planar , Linear , Tetrahedral

C. T-shape , Planar , Pyramidal

D. Trigonal bipyramidal , Linear , Tetrahedral

Answer: A

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15. Hydrogen bond

A. Have energy of the order of 100 kJ/mol

B. Have a powerful effect on the structures and properties of many compounds

C. Is the interaction between lone pair of electrons with all atoms

D. In HCl is maximum

Answer: B

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16. In case of XeO_2F_2 and XeF_6 , Xe is with

A. Same hybridization but with different geometry

B. Different hybridization with same geometry

C. Different hybridization and different geometry

D. Same geometry and same hybridization

Answer: C

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17. In which of the following hybridisation of underlined atom changes

A. $\underline{N}H_3 + H^+ \rightarrow \underline{H}H_4^+$

B. $\underline{B}F_3 + F^- \rightarrow \underline{B}F_4^-$

C. $\underline{C_2}H_2 + H_2 \rightarrow \underline{C_2}H_6$

D. All of these

Answer: A

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18. The ion that is isoelectronic with CO is

A. CN^-

B. O_2^+

C. O_2^-

D. N_2^+

Answer: A

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19. CO_2 is isostructural with

A. NO_2^+

B. $SnCl_2$

C. C_2H_4

D. NO_2

Answer: A

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20. When NH_3 is treated with HCl, H-N-H bond angle

A. Increases

B. Decreases

C. Remains same

D. Depends upon temperature

Answer: A

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21. Among KO_2, AlO_2^- BaO_2 and NO_2^+ unpaired electron is present in :

A. NO_2^+ and BaO_2

B. KO_2 and AlO_2^+

C. KO_2 only

D. BaO_2 only

Answer: C

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22. Correct order of bond angle for $O-P-X$

$$\begin{array}{c} O \\ / \\ P \\ \backslash \\ X \end{array}$$

in the given molecules is

$\underset{I}{POF_3}\ \underset{II}{POCl_3}\ \underset{III}{POBr_3}\ \underset{IV}{POI_3}$ are

A. $I > II > III > IV$

B. $IV > III > II > I$

C. $II > III > I > IV$

D. $III > II > IV > I$

Answer: A

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23. Which of the following is non-linear ?

A. I_3^-

B. XeF_2

C. SO_2

D. $CH \equiv C - C \equiv CH$

Answer: C

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24. Which of the following is electron deficient (Lewis acid) ?

A. $CaCl_2$

B. BF_3

C. Al_2Cl_6

D. CCl_4

Answer: B

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25. In which of the following set of compounds , bond angle remains constant for all members ?

A. NH_3, PH_3, AsH_3

B. PF_3, PCl_3, PBr_3

C. OH_2, OF_2, OCl_2

D. BF_3, BCl_3, BBr_3

Answer: D

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26. Which of the following compounds have zero dipole moment ?

A. BF_3

B. $SnCl_2$

C. H_2O

D. NH_3

Answer: A

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27. Pick out the isoelectronic structures from the following

(i) CH_3^+ , (ii) H_3O^+

(iii) NH_3 , (iv) CH_3^-

A. (i) and (ii)

B. (iii) and (iv)

C. (i) and (iii)

D. (ii) , (iii) and (iv)

Answer: D

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28. The type of hybrid orbitals used by chlorine atom in ClO_2^- is :

A. sp^3

B. sp^2

C. sp

D. sp^3d

Answer: A

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29. Which of the following molecule is of T -shape ?

A. I_3^-

B. ClF_3

C. SF_4

D. XeF_4

Answer: B

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30. The molecule which has pyramidal shape is

A. SO_3

B. NO_3^-

C. CO_3^{2-}

D. PF_3

Answer: D

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31. Which of the following compounds is non-polar ?

A. CCl_4

B. CH_2Cl_2

C. $CHCl_3$

D. CH_3Cl

Answer: A

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32. Polarisation involves the distortion of the shape of an anion by an adjacently placed cation In this context, which of the following statements is correct ? .

A. Maximum polarization is done by cation of high charge

B. A large cation is likely to bring larger degree of polarization

C. A smaller anion is likely to undergo a higher degree of polarization

D. Minimum polarization is done by cation of small size

Answer: A

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33. Arrange the given species in increasing order of O-O bond length

$\underset{I}{H_2O_2}, \underset{II}{KO_2}, \underset{III}{Na_2O_2}, \underset{IV}{O_2}$

A. $I < III < IV < II$

B. $II < I < IV < III$

C. $IV < I < III < II$

D. $IV < II < I < III$

Answer: D

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34. In which of the following , central atom does not have one lone pairs of electron ?

A. PCl_5

B. NH_3

C. PCl_3

D. XeF_6

Answer: A

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35. In which conversion , bond length decreases ?

A. $N_2 \rightarrow N_2^+$

B. $N_2 \rightarrow N_2^-$

C. $CO \rightarrow CO^{+}$

D. $O_2 \rightarrow O_2^{-}$

Answer: C

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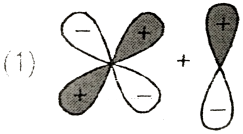
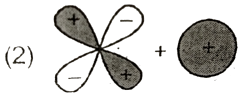
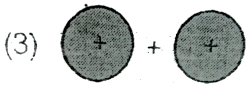
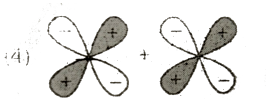
36. Which of the following combination of orbitals will form a nonbonding molecular orbital ?

A. 

B. 

C. 

D. 

Answer: B

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37. Correct order for N-O bond length in the given species is

$\underset{I}{NO}\ \underset{II}{NO^+}\ \underset{III}{NO_2^-}\ \underset{IV}{NO_3^-}$

A. $I < II < III < IV$

B. $II < I < III < IV$

C. $II < III < IV < I$

D. $I < III < IV < II$

Answer: B

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Assignment Section C Objective Type Questions More Than One Options Are Correct

1. CO_2 has same geometry as .

A. Hg_2Cl_2

B. NO_2

C. C_2H_2

D. C_3H_6

Answer: A::C

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2. Molecules with see-saw shape are

A. SF_4

B. $XeOF_4$

C. XeO_2F_2

D. $HgCl_2$

Answer: A::C

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3. Which of the following can show variable valency ?

A. F

B. Cl

C. Br

D. I

Answer: B::C::D

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4. Molecular axis is Z axis , then which of the following combination of orbitals will result in formation of σ molecular orbitals ?

A. $p_x - p_x$

B. $s - s$

C. $p_z - p_z$

D. $p_y - p_y$

Answer: B::C

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5. Isostructural group of molecules are

A. NH_3, NF_3, BF_3

B. NO_3, NO_2, SF_4

C. XeO_4, NH_4^+, CH_4

D. CH_3^-, NH_3, NF_3

Answer: C::D

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6. In solid PCl_5 exist as $[PCl_4]^+[PCl_6]^-$. The hybridisation is P is /are

A. sp^3

B. sp^3d

C. sp^3d^2

D. sp^3d^3

Answer: A::C

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7. Which of the following is a correct statement ?

A. All molecules will polar bond have dipole moment

B. $SnCl_2$ is non-linear molecule

C. Dipole moment of CH_3Cl is greater than CH_3F

D. I_3^- has linear shape

Answer: B::C::D

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8. Which of the following is a correct statement ?

A. CO_2 is a monomer while SiO_2 is a three dimensional giant molecule

B. Graphite is a nonconductor of electricity

C. In $(CH_3)_3$, $C-N-C$ bond angle is approximately 107° whereas in $(SiH_3)_3$ N , $Si-N-Si$ bond angle is approximately 120°

D. In CO_3^{2-} ion all C-O bonds are equal , while in H_2CO_3 all C-O bonds are not equal

Answer: A::C::D

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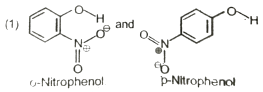
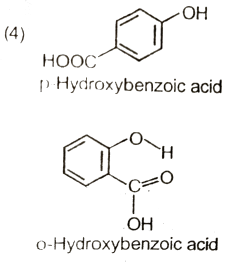
9. In which of the following pairs first partner is more soluble in water than second partner ?

A. 

B. NaCl and AgCl

C. $Be(OH)_2$ and $Ba(OH)_2$

D. 

Answer: B::D

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10. Bond order increases in which of the given transitions ?

A. $CO \rightarrow CO^{+}$

B. $N_2 \rightarrow N_2^{-}$

C. $O_2 \rightarrow O_2^{+}$

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

Answer: A::C

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11. Which of the following are correctly matched with name of bond present between them ?

A.

Joining Entities	Bond
2 ice cubes pressed together	Hydrogen bonding

B.

Joining Entities	Bond
Hydrated sodium ions with hydrated chloride ion	Dipole-dipole in

C.

Joining Entities	Bond
H_2O gas molecule	Hydrogen bonding

D.

Joining Entities	Bond
HCl gas molecules	London's dispersive force

Answer: A::B

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12. Amongst the given structures , which are permissible resonance forms ?

A. $\overset{\oplus}{C}H_2 - \underset{\underset{CH_3}{|}}{\overset{\cdot\cdot}{N}} - \overset{\cdot\cdot}{\underset{\cdot\cdot}{O}}:^{\ominus}$

B. $CH_2 = \underset{\underset{CH_3}{|}}{N} = \overset{\cdot\cdot}{O}:$

C. $CH_2 = \underset{\underset{CH_3}{|}}{\overset{+}{N}} - \overset{\cdot\cdot}{\underset{\cdot\cdot}{O}}:^{-}$

D. $\overset{-}{C}H_2 - \underset{\underset{CH_3}{|}}{\overset{+}{N}} = O$

Answer: A::C::D

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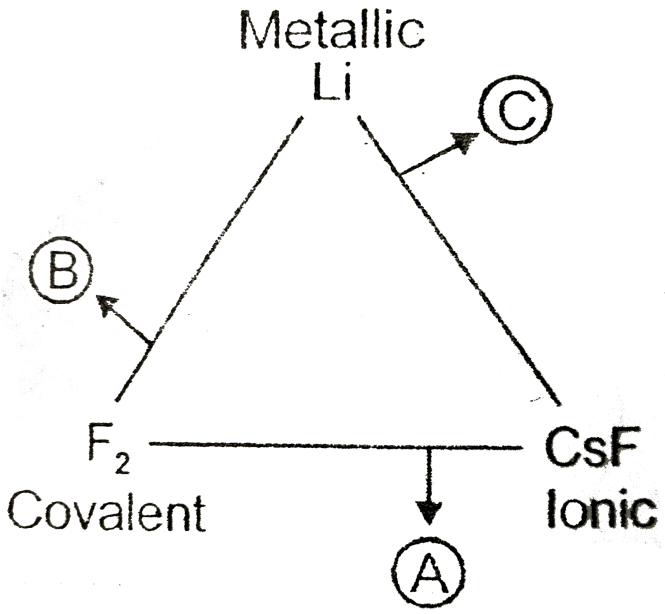
13. Given below is a triangle illustrate the transition between ionic , metallic and covalent bonding



Where A, B and C respectively are compound which have more ionic , covalent and metallic character respectively . which combination go well for A , B and C ?

A. MgF_2, I_2, Na_3Bi

B. IF_7, CIF, Na_3N

C. LIF, S_8, Na_3Sb

D. OF_2, CIF, NF_3

Answer: A::C

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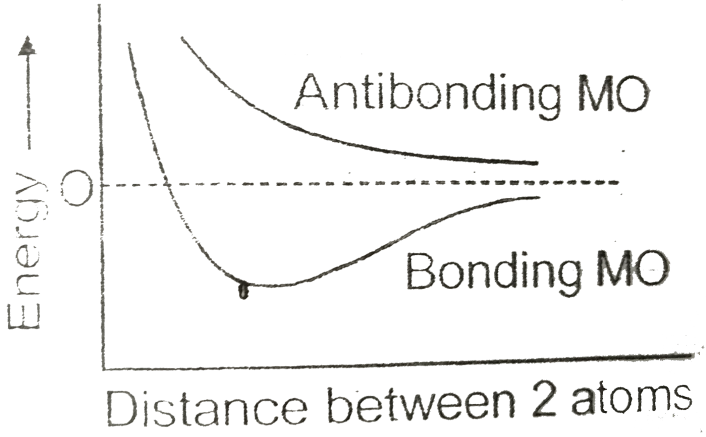
Assignment Section D Linked Comprehension Type Questions

1. Molecular orbital (MOT) the atoms in a molecule are supposed to loose their individual control over the electrons . The nuclei of the bonded atoms are considered to be present at equilibrium in inter-nuclear positions . The orbitals where the probability of finding electrons is maximum are called molecular orbitals extending over 2 or more nuclei when a pair of atomic orbitals combine and give rise to a pair of molecular MO's in internuclear region but decreased for antibonding MO's . Shielding of the nuclei by-increased electron density in bonding MO's reduces inter nuclear repulsion & thus stabilizes the molecule whereas lower electron density in antibonding MO's increases the repulsion and destabilises the system .



Which of the following is the correct order of bond strength of given species ?

A. $N_2 > N_2^+ > N_2^-$

B. $N_2 > N_2^- > N_2^+$

C. $N_2^+ > N_2 > N_2^-$

D. $N_2^- > N_2 > N_2^+$

Answer: A

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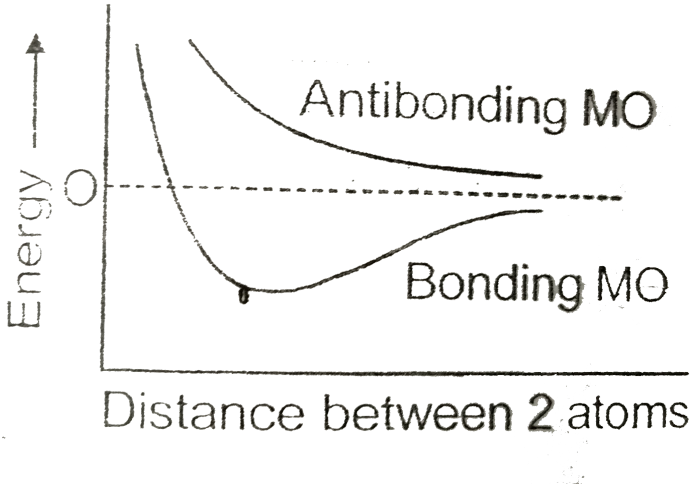
2. Molecular orbital (MOT) the atoms in a molecule are supposed to loose their individual control over the electrons . The nuclei of the bonded atoms are considered to be present at equilibrium in inter-nuclear positions . The orbitals where the probability of finding electrons is maximum are called molecular orbitals extending over 2 or more nuclei when a pair of atomic orbitals combine and give rise to a pair of molecular MO's in internuclear region but decreased for antibonding MO's . Shielding of the nuclei by-increased electron density in bonding MO's reduces inter nuclear repulsion & thus stabilizes the molecule whereas lower electron density in antibonding MO's increases the repulsion and destabilises the system .



Which of the following hetero-diatomic molecular ion is paramagnetic ?

A. NO^+

B. CO

C. CN^-

D. NO^-

Answer: D

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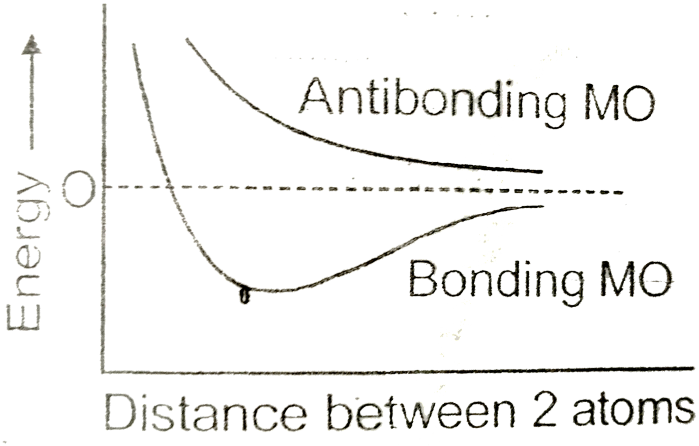
3. Molecular orbital (MOT) the atoms in a molecule are supposed to loose their individual control over the electrons . The nuclei of the bonded atoms are considered to be present at equilibrium in inter-nuclear positions . The orbitals where the probability of finding electrons is maximum are multicentred orbitals called molecular orbitals extending over 2 or more nuclei when a pair of atomic orbitals combine and give rise to a pair of molecular MO's in internuclear region but decreased for antibonding MO's . Shielding of the nuclei by-increased electron density in bonding MO's reduces inter nuclear repulsion & thus stabilizes the

molecule whereas lower electron density in antibonding MO's increases the repulsion and destabilises the system .



Which of the following species have identical value of bond order ?

A. F_2 and Ne

B. C_2 and N_2

C. N_2^+ and O_2^+

D. All of these

Answer: C

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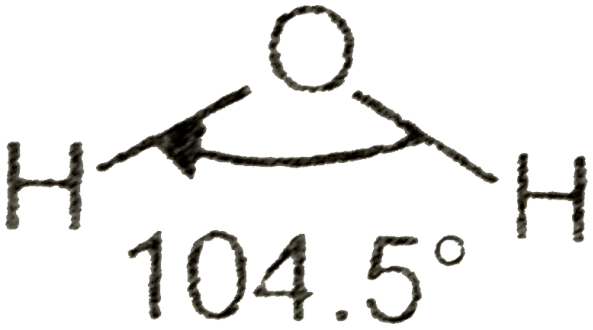
4. Electric Dipole moment is a vector quantify . If a compound contain more than one polar bond then , the net electric dipole moment is equal to vector sum of individual dipole moment .

e.g., In H_2O

$\mu = 1.84D$



Which of the following compounds have zero dipole moment ?

A. SF_4

B. ICl_4^-

C. H_2S

D. $SnCl_2$

Answer: B

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5. Electric Dipole moment is a vector quantify . If a compound contain more than one polar bond then , the net electric dipole moment is equal to vector sum of individual dipole moment .

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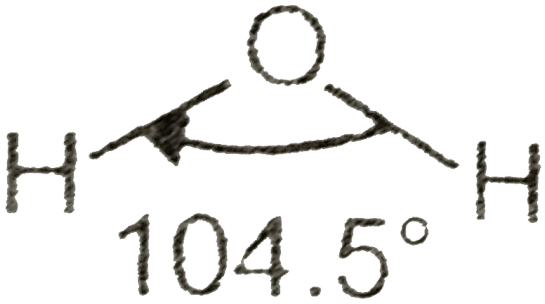
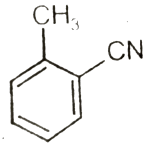
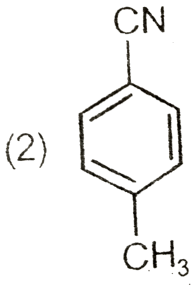
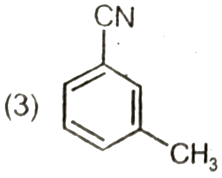


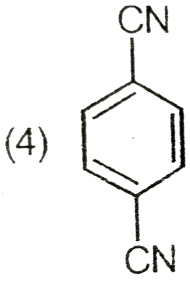
Out of following which has the highest dipole moment

A. (1)



B. 

C. 

D. 

Answer: B

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6. Electric Dipole moment is a vector quantify . If a compound contain more than one polar bond then , the net electric dipole moment is equal to vector sum of individual dipole moment .

e.g., In H_2O

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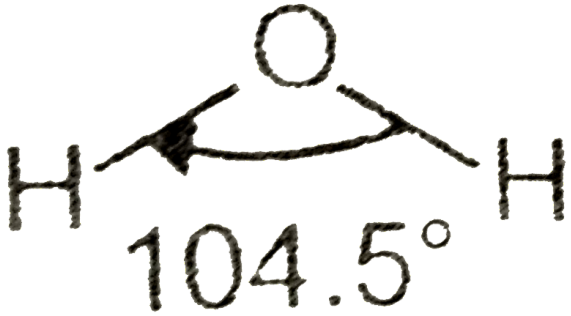

The compound has molecular formula H_2O, dipole moment of the compound is-

A. 1.84

B. 1

C. 3

D. Both (1) & (2)

Answer: A

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7. Lattice energy : Lattice energy is the amount of energy released when one mole of ionic compound is formed from its gaseous ions

$$\underset{(g)}{Na^{+}} + \underset{(g)}{Cl^{-}} \rightarrow NaCl(s) + \Delta x kJ$$

Lattice energy also depend on the 3-D arrangement of ion .

Which of the following has the highest Lattice energy ?

A. MgO

B. NaCl

C. CaO

D. KCl

Answer: A

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8. Lattice energy : Lattice energy is the amount of energy released when one mole of ionic compound is formed from its gaseous ions

$$\underset{(g)}{Na^{+}} + \underset{(g)}{Cl^{-}} \rightarrow NaCl(s) + \Delta x kJ$$

Lattice energy also depend on the 3-D arrangement of ion .

In the given compounds least Lattice energy is present in

A. AgF

B. AgBr

C. AgCl

D. NaCl

Answer: B

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9. Shape of the compound depend on type and number of electron pair around central atom . These electron pair repel each other and stay as far as possible . The repulsion sequence is as

$L.P-L.P. > B.P. - L.P. > B.P - B.P.$

Choose the incorrect match

A. $\begin{matrix} \text{Compound} & \text{Structure} \\ (1)SnCl_2 & \text{Linear} \end{matrix}$

B. Compound Structure
(2) CO_2 Linear

C. Compound Structure
(3) I_3^- Linear

D. Compound Structure
(4) N_3^- Linear

Answer: A

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10. Shape of the compound depend on type and number of electron pair around central atom . These electron pair repel each other and stay as far as possible . The repulsion sequence is as

$L.P - L.P. > B.P. - L.P. > B.P - B.P.$

Which of the given compound is planar ?

A. XeF_5^-

B. XeF_4

C. ICl_4^-

D. All of these

Answer: D

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11. Shape of the compound depend on type and number of electron pair around central atom . These electron pair repel each other and stay as far as possible . The repulsion sequence is as

$L.P-L.P. > B.P. - L.P. > B.P - B.P.$

d_{z^2} orbital take part in hybridisation

A. dsp^3

B. sp^3d^2

C. d^2sp^3

D. All of these

Answer: D

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Assignment Section E Assertion Reason Type Questions

1. Statement-1 : Polarisation is the distortion of the shape of an anion by adjacently placed cation.

and

Statement-2 : Maximum polarisation is brought by a cation of high charge .

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for 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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2. Statement-1 : PH_3 and PF_3 are pyramidal in shape with one lone pair on P . But PF_3 has greatest bond angle than PH_3.

and

Statement-2 : Back bonding is present in PF_3 but absent in PH_3.

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-2

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-2

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: A

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3. Statement-1 : AlF_3 is a high melting point solid whereas SiF_4 is a gas

and

Statement-2 : Both AlF_3 and SiF_4 are covalent molecules .

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-3

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: C

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4. Statement-1 : CS_2 behave as a non-polar solvent

and

Statement-2 : The shape of CS_2 is linear .

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-1

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for 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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5. Statement-1 : PCl_5 has trigonal bipyramidal shape .

and

Statement-2 : Length of all P-Cl bonds in PCl_5 is equal

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-5

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for 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 : 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. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-6

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-6

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: D

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7. Statement-1 : H_2O is liquid whereas H_2S is gas .

and

Statement-2 : Oxygen is more electronegative than sulphur .

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-7

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-7

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: B

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8. Statement-1 : Boiling point of H_2O is more than HF .

and

Statement-2 : Intermolecular hydrogen bonding in HF is stronger than H_2O.

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-8

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-8

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: B

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9. Statement-1 : In LiCl more covalent character is present in LiF.

and

Statement-2 : Polarizability of Br^- is more than Cl^-

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-9

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-9

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: A

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10. Statement-1 : O_2^- and O_2^+ are paramagnetic .

and

Statement-2 : Bond order of O_2^+ and O_2^- is same .

A. Statement-1 is True , Statement-2 is True , Statement-2 is a correct explanation for Statement-10

B. Statement-1 is True , Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-10

C. Statement-1 is True , Statement-2 is False

D. Statement-1 is False , Statement-2 is True

Answer: C

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Assignment Section F Matrix Match Type Questions

1. Match the following

Column-I (Molecule)	Column-II (Number of lone pair + bond pair respectively at central atom)
(A) ClF_3	(p) 2 + 2
(B) XeF_4	(q) 2 + 3
(C) I_3^-	(r) 2 + 4
(D) H_2S	(s) 3 + 2

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2. Match the following

Column-I (Molecule)	Column-II (Hybridisation of central atom)
(A) H_2Te	(p) sp^3d
(B) XeF_4	(q) sp^2
(C) ICl_2^-	(r) sp^3
(D) HCOOH	(s) sp^3d^2

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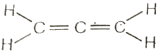
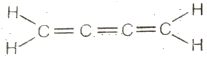
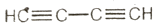
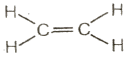
3. Match the following

Column-I	Column-II
(A) 	(p) For π-electron cloud molecular plane is the nodal plane.
(B) 	(q) All atoms lie in one plane.
(C) 	(r) Compound with mutually perpendicular neighbouring π electron clouds.
(D) 	(s) Nonconjugated neighbouring π-electron clouds.

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Assignment Section G Interger Answer Type Questions

1. How many no. of σ-bonds are present in H_2SO_4 ?

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2. How many P-O-P bonds are present in P_4O_{10} ?

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3. How many hybrid orbitals are used for bond formation in SF_4 ?

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4. How many right angle bonds are present in BrF_5.

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5. What will be the bond order between O - O in peroxide of sodium ?

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6. Maximum valency that is possible for P with Cl is _____.

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7. Number of right angle bonds in PCl_5 is _____.

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8. Number of $p\pi - p\pi$, double bond in given compound $CN - CN = CH - CN$ is ___.

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Assignment Section H Multiple True False Type Questions Identify The Correct Combination Of True T And False F Of The Given Three Statements

1. Statement-1 : Strength of H-bonding depends upon temperature .

Statement-2 : H-bonding has no effect on specific heat of a substance .

Statement-3 : One hydrogen atom bonded to an electronegative element can form only one H-bond .

A. TTT

B. TFF

C. TFT

D. FFT

Answer: C

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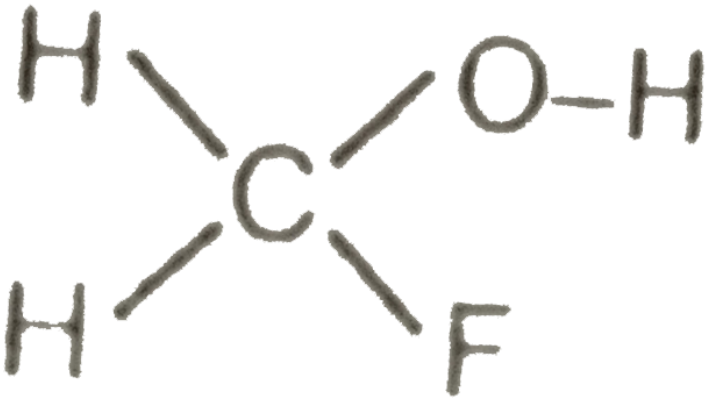
2. Statement-1 : In the molecule



will form intramolecular H-bonding to a greater extent .

Statement-2 : Bond order greater than three is not possible .

Statement-3 : Increase in percentage of P orbital increases the directional nature of bond .

A. TFF

B. FTT

C. FFT

D. TFT

Answer: D

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3. Statement-1 : All hybrid orbitals of same composition have same shape and energy .

Statement-2 : All hybrid orbitals on carbon in CH_3Cl have same as character .

Statement-3 : Hybridisation is a physical process .

A. TFT

B. TTT

C. FFT

D. TFF

Answer: B

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4. Statement-1 : Intramolecular H-bonding have no effect on boiling point

Statement-2 : Nature of hydrogen bonding is non-directional .

Statement-3 : Covalent bond is directional .

A. TFT

B. TFF

C. FTT

D. TTF

Answer: A

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5. Statement-1 : NH_3 is pyramidal in shape .

Statement-2 : $SiCl_4$ and $GaCl_4^-$ are isostructural .

Statement-3 : sd^3 hybridisation may be possible

A. TTF

B. TTT

C. FTT

D. TFT

Answer: B

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Assignment Section I Subjective Type Questions

1. Why H_2 is more stable than H_2^+ while He_2^+ is more stable than He_2 ?

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2. CO is stable , but analogous SiO is not stable . Why ?

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3. Why H-S-H bond angle in H_2S is smaller than $H-O-H$ bond angle in H_2O ?

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4. Na_2CO_3 does not decompose on heating whereas $CaCO_3$ decomposes . Why ?

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5. Why $AlCl_3$ is a covalent molecule but is ionized in water to give Al^{+3} and Cl^- ions ?

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6. Why is red phosphorus less reactive than white phosphorus ?

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7. Why carbon exists as graphite but silicon does not exist in any such form ?

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8. Iodine in lF_7 is surrounded by 7 pairs of electrons yet it is stable .

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9. Calculate the percentage of covalent character of HX having bond length = 1.62 Å and observed dipole moment = 0.39 D.

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10. Why XeF_5^- is planar ?

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Assignment Section J Aakash Challengers Questions

1. Shape of the compounds XeF_3^+ and XeF_5^+ are respectively

A. T-shape , square pyramid

B. Sea-saw , square pyramidal

C. T-shaped , square pyramidal

D. T-shaped in both

Answer: A

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2. In which of the following compounds , back bonding is possible

A. PF_3

B. PH_3

C. NH_3

D. NF_3

Answer: A

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3. The correct sequence regarding bond angle

A. $NH_3 > PH_3 > AsH_3$

B. $NH_3 = PH_3 = AsH_3$

C. $AsH_3 > PH_3 > NH_3$

D. $PH_3 > NH_3 > AsH_3$

Answer: A

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4. Correct regarding hydrogen bond strength and boiling point respectively

A. $HF > H_2O, H_2O > HF$

B. $HF > H_2O, HF > H_2O$

C. $H_2O > HF, H_2O > HF$

D. $H_2O > HF$

Answer: A

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5. The correct order of pair regarding nodal surface

A. $\sigma 2s > \sigma^{+} 2s$

B. $\sigma 2s < \sigma^{*} 2p_z$

C. $\sigma^{*} 2s > \sigma^{*} 2p_z$

D. $\sigma^* 2p_z < \pi 2px$

Answer: B

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6. Which of the following representation represent π^* molecular orbital , (z is considered as internuclear axis)

A. 

B. 

C. 

D. 

Answer: B

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7. Choose the correct pair regarding dipole moment

A. $CH_3Cl > CH_3F$

B. $NH_3 > NF_3$

C. $HF > HCl$

D. All of these

Answer: D

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8. During oxidation , in which of the following bond order increase ?

A. N_2

B. CO

C. O_2^-

D. Both (2) & (3)

Answer: D

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9. Choose the correct statement regarding PCl_5

A. All P-Cl bond lengths are equal

B. $P - Cl_{\text{axial}}$ bond lengths is more than $P - Cl_{\text{equitorial}}$

C. $P - Cl_{\text{equitorial}}$ bond lengths are more than $P - Cl_{\text{axial}}$

D. $P - Cl_{\text{equitorial}}$ bond length may be equal or larger than $P - Cl_{\text{axial}}$

Answer: B

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10. Which of the forces are considered as shortest ranged ?

A. Ionic bond

B. Ion-dipole interaction

C. Covalent bond

D. London forces

Answer: C

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