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**N.C.E.R.T EXERCISE**

1. Explain the formation of a chemical bond ?
2. Write Lewis dot symbols for atoms of the following elements : Mg , Na , B , O , N , Br
3. Write Lewis symbols for the following atoms and ions : S & S2- , Al & Al3+ , H & H –
4. Draw the Lewis structures for the following molecules and ions :

H2S , SiCl4 , BeF2 , , HCOOH

1. Define octet rule. Write its significance and limitations.
2. Write the favourable factors for the formation of ionic bond.
3. Discuss the shape of the following molecules using the VSEPR model :

BeCl2 , BCl3 , SiCl4 , AsF5 , H2S , PH3

1. Although geometries of NH3 and H2O molecules are distorted tetrahedral, bond angle in water is less than that of ammonia. Discuss.
2. How do you express the bond length in terms of bond order ?
3. Define the bond length.
4. Explain the important aspects of resonance with reference to the ion.
5. H3PO3 can be represented by the structures 1 and 2 shown below. Can these two structures be taken as the canonical forms of the resonance hybrid of H3PO3 ? If not, give reason for the same.

 

(1) (2)

1. Write the resonance structures for SO3 , NO2 and .
2. Use Lewis symbols to show electron transfer between the following atoms to form cation and anions :

(a) K & S (b) Ca & O (c) Al & N.

1. Although both CO2 and H2O are triatomic molecules, the shape of H2O molecule is bent while that of CO2 is linear. Explain these on the basis of dipole moment.
2. Write the significance/applications of dipole moment.
3. Define electronegativity. How does it differ from electron gain enthalpy ?
4. Explain with the help of a suitable example polar covalent bond.
5. Arrange the following molecules in order of their increasing ionic character of their bonds :

LiF , K2O , N2 , SO2 , ClF3

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1. The skeletal structure of CH3COOH as shown below is correct, but some of the bonds are shown incorrectly. Write the correct Lewis structure for a acetic acid.



1. A part from tetrahedral geometry, another possible geometry for CH4 is square planar with four H atoms at the corners of the square and the C atom at its centre. Explain why CH4 is not square planer.
2. Explain why BeH2 molecule has a zero dipole moment although the Be – H bonds are polar.
3. Which out of NH3 and NF3 has higher dipole moment and why ?
4. What is meant by hybridization of atomic orbitals ? Describe the shapes sp , sp2 and sp3 hybrid orbitals.
5. Describe the change in hybridization (if any) of the Al atom in the following reaction :

AlCl3 + Cl –  → .

1. If there is any change in the hybridization of B and N atoms as a result of the reaction,

BF3 + NH3 → F3B . NH3 ?

1. Draw diagrams showing the formation of a double bond and a triple bond between carbon atoms in C2H4 and C2H2 molecules.
2. What is the total number of sigma and pi bonds in the following molecules ?

(a) C2H2 (b) C2H4

1. Considering x-axis as the internuclear axis, which out of following will not form a sigma bond and why?

(a) 1s and 1s (b) 1s and 2px (c) 2py and 2py (d) 1s and 2s.

1. Which hybrid orbitals are used by carbon atoms in the following molecules ?

(a) CH3 – CH3 (b) CH3 – CH CH2 (c) CH3 – CH2 – OH (d) CH3 – CHO (e) CH3COOH.

1. What do you understand by bond pairs and lone pairs of electrons ? Illustrate by giving one example of each type.
2. Distinguish between a sigma and a pi bond.
3. Explain the formation of H2 molecule on the basis of valence bond theory.
4. Write the important conditions required for the linear combination of atomic orbitals to form molecular orbitals.
5. Use molecular orbital theory to explain why the Be2 molecule does not exist.
6. Compare the relative stability of the following species and indicate their magnetic properties :

O2 , , (superoxide) , (peroxide)

1. Write the significance of a plus and a minus sign shown in representing the orbitals.
2. Describe the hybridization in case of PCl5. Why are the axial bonds longer as compared to the equatorial bonds?
3. Define hydrogen bond. Is it weaker or stronger than the vander waals forces ?
4. What is meant by the term bond order ? Calculate the bond order of : N2 , O2 , and .

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**COMPETITION FOCUS – 1**

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) [ NF3 & BF3 ] | b) [ & ] | c) [BCl3 & BrCl3 ] | d) [ NH3 & ] |

1. 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) CO2 | b) HI | c) H2O | d) SO2 |

1. The types of hybrid orbitals of nitrogen in , , respectively are expected to be :

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp, sp3 & sp2 | b) sp, sp2 & sp3 | c) sp2, sp & sp3 | d) sp2, sp3 & sp |

1. Hydrogen bonds are formed in many compounds, e.g., H2O , HF , NH3 . The boiling point of such compounds depends to a large extent on the strength of hydrogen bond and the number of hydrogen bonds. The correct decreasing order of the boiling points of above compounds is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) HF > H2O > NH3 | b) H2O > HF > NH3 | c) NH3 > HF > H2O | d) NH3 > H2O > HF |

1. In ion, the formal charge on the oxygen atom of P – O bond is

|  |  |  |  |
| --- | --- | --- | --- |
| a) +1 | b) -1 | c) -0.75 | d) +0.75 |

1. In ion, the number of bond pairs and lone pairs of electrons on nitrogen atom are

|  |  |  |  |
| --- | --- | --- | --- |
| a) 2, 2 | b) 3, 1 | c) 1, 3 | d) 4, 0 |

1. Which of the following species has tetrahedral geometry ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) H3O+ |

1. Number of bonds and bonds in the following structure is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 6, 19 | b) 4, 20 | c) 5, 19 | d) 5, 20 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) O2 | c) | d) B2 |

1. In which of the following molecule / ion all the bonds are not equal ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) XeF4 | b) | c) C2H4 | d) SiF4 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) HCl | b) H2O | c) HI | d) H2S |

1. If the electronic configuration of an element is 1s2 2s2 2p6 3s2 3p6 3d2 4s2 , the four electrons involved in chemical bond formation will be ………… .

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3p6 | b) 3p6 , 4s2 | c) 3p6 , 3d2 | d) 3d2 , 4s2 |

1. Which of the following angle corresponds to sp2 hybridization ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 90˚ | b) 120˚ | c) 180˚ | d) 109˚ |

The electronic configurations of three elements, A, B and C are given below. Answer the questions 14 to 17 on the basis of these configurations.

A : 1s2 2s2 2p6 B : 1s2 2s2 2p6 3s2 3p3 C : 1s2 2s2 2p6 3s2 3p5

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1. Stable form of ‘A’ may be represented by the formula :

|  |  |  |  |
| --- | --- | --- | --- |
| a) A | b) A2 | c) A3 | d) A4 |

1. Stable form of ‘C’ may be represented by the formula :

|  |  |  |  |
| --- | --- | --- | --- |
| a) C | b) C2 | c) C3 | d) C4 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) BC | b) B2C | c) BC2 | d) BC3 |

1. The bond between B and C will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) Ionic | b) Covalent | c) Hydrogen | d) Co-ordinate |

1. Which of the following order of energies of molecular orbitals of N2 is correct ?

|  |  |
| --- | --- |
| a) ( 2pY ) < ( 2pZ ) < ( 2pX ) ( 2pY ) | b) ( 2pY ) > ( 2pZ ) > ( 2pX ) ( 2pY ) |
| c) ( 2pY ) < ( 2pZ ) > ( 2pX ) ( 2pY ) | d) ( 2pY ) > ( 2pZ ) < ( 2pX ) ( 2pY ) |

1. Which of the following statements is not correct from the view point of molecular orbital theory ?

a) Be2 is not a stable molecule.

b) He2 is not stable but is expected to exist.

c) Bond strength of N2 is maximum amongst the homonuclear diatomic molecules belonging to the second period.

d) The order of energies of molecular orbitals in N2 molecule is :

< 2s < 2pZ < ( 2pX = 2pY ) < ( 2pX = 2pY  ) < 2pZ

1. Which of the following options represents the correct bond order :

|  |  |  |  |
| --- | --- | --- | --- |
| a) > O2 > | b) < O2 < | c) > O2 < | d) < O2 > |

1. The electronic configuration of the outermost shell of the most electronegative element is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 2s2 2p5 | b) 3s2 3p5 | c) 4s2 4p5 | d) 5s2 5p5 |

1. Amongst the following elements whose electronic configurations are given below, the one having the highest ionization enthalpy is

|  |  |  |  |
| --- | --- | --- | --- |
| a) [Ne] 3s2 3p1 | b) [Ne] 3s2 3p3 | c) [Ne] 3s2 3p2 | d) [Ar] 3d10 4s2 4p3 |

**More Than One Option**

1. Which of the following have identical bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CN – | b) NO+ | c) | d) |

1. Which of the following attain the linear structure :

|  |  |  |  |
| --- | --- | --- | --- |
| a) BeCl2 | b) NCO+ | c) NO2 | d) CS2 |

1. Co is isoelectronic with

|  |  |  |  |
| --- | --- | --- | --- |
| a) NO+ | b) N2 | c) SnCl2 | d) |

1. Which of the following species has the same shape ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 | b) CCl4 | c) O3 | d) |

1. Which of the following statements are correct about ?

a) The hybridization of central atom is sp3.

b) Its resonance structure has one C – O single bond and two CO double bonds.

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

d) All C – O bond length are equal.

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1. Diamagnetic species are those which contain no unpaired electrons. Which among the following are diamagnetic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) N2 | b) | c) O2 | d) |

1. Species having same bond order are :

|  |  |  |  |
| --- | --- | --- | --- |
| a) N2 | b) | c) | d) |

1. Which of the following statement 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 orbitals form stronger bonds than pure orbitals.

d) VSEPR Theory can explain the square planar geometry of XeF4.

**Answers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. b | 2. c | 3. b | 4. b | 5. c | 6. d | 7. a |
| 8. c | 9. c | 10. c | 11. b | 12. d | 13. b | 14. a |
| 15. b | 16. d | 17. b | 18. a | 19. d | 20. b | 21. a |
| 22. b | 23. a , b | 24. a , d | 25. a , b | 26. c , d | 27. c , d | 28. a , d |
| 29. c , d | 30. a , b |  |  |  |  |  |

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**COMPETITION FOCUS – 2**

1. The species in which central atom uses sp2 hybrid orbitals in its bonding is

|  |  |  |  |
| --- | --- | --- | --- |
| a) PH3 | b) NH3 | c) | d) SbH3 |

1. When two atomic orbitals combine, energy of bonding molecular orbitals is lowered by ‘x’ while that of antibonding molecular orbitals is raised by ‘y’. Then

|  |  |  |  |
| --- | --- | --- | --- |
| a) x = y | b) x < y | c) x > y | d) can be any of these |

1. In which of the following, the double bond consist of both pi bonds

|  |  |  |  |
| --- | --- | --- | --- |
| a) O2 | b) C2 | c) Be2 | d) S2 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) CCl4 | b) CaCl2 | c) NH4Cl | d) H2O |

1. In which of the following the central atom does not use sp3- hybrid orbitals in its bonding.

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) NH3 |

1. The maximum number of hydrogen bonds that a water molecule can form is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 | b) 2 | c) 3 | d) 4 |

1. Which of the following hydrogen halide is most volatile ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) HF | b) HCl | c) HBr | d) HI |

1. Among the following species, identify the isostructural pairs : NF3 , , BF3 , , HN3

|  |  |
| --- | --- |
| a) [NF3 , N] & [BF3 ,] | b) [NF3 , HN3] & [N , BF3] |
| c) [NF3 ,] & [N , BF3] | d) [NF3 , ] & [HN3 , BF3] |

1. Arrange the following compounds in order of increasing dipole moment

Toluene (I) , m-dichlorobenzene (II) , o-dichlorobenzene (III) , p-dichlorobenzene (IV)

|  |  |  |  |
| --- | --- | --- | --- |
| a) I < IV < II < III | b) IV < I < II < III | c) IV < I < III < II | d) IV < II < I < III |

1. KF combines with HF to form KHF2. The compound contains the species

|  |  |  |  |
| --- | --- | --- | --- |
| a) K+ , F- & H+ | b) K+ , F- & HF | c) K+ & [ HF2 ] – | d) [KHF]+ & F2 |

1. Which of the following molecular orbitals has two nodal planes ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) 2pY | c) 2pY | d) 2pX |

1. Which of the following species has lowest first ionization potential ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) O | b) O2 | c) | d) |

1. AsF5 molecule is trigonal bipyramidal. The orbitals of As atom involved in hybridization are

|  |  |  |  |
| --- | --- | --- | --- |
| a) dx2-y2, dz2 , s , px , py | b) dxy , s , px , py , pz | c) s , px , py , pz , dz2 | d) dx2-y2 , s , px , py , pz |

1. N2 and O2 are converted into monocations, and respectively. Which is wrong ?

|  |  |
| --- | --- |
| a) In , the N – N bond weakens. | b) In , the O – O bond order increases. |
| c) In , paramagnetism decreases | d) becomes diamagnetic |

1. Which of the following is not paramagnetic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) S2- | b) NO | c) | d) |

1. The type of hybrid orbitals used by chlorine atom in is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 | b) sp2 | c) sp | d) none of these |

1. Which contain both polar and non-polar bonds ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH4Cl | b) HCN | c) H2O2 | d) CH4 |

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1. Which one of the following compound has sp2 hybridization ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 | b) SO2 | c) N2O | d) CO |

1. Which one of the following has highest dipole moment ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH3 | b) PH3 | c) SbH3 | d) AsH3 |

1. In , the formal charge on each oxygen atom and the P – O bond order respectively are

|  |  |  |  |
| --- | --- | --- | --- |
| a) – 0.75, 0.6 | b) – 0.75, 1.0 | c) – 0.75, 1.25 | d) – 3 , 1.25 |

1. The correct order of increasing C – O bond length of CO , , CO2 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) < CO2 < CO | b) CO2 < < CO | c) CO < < CO2 | d) CO < CO2 < |

1. Which one of the following molecules will form a linear polymeric structure due to hydrogen bonding ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) HCl | b) HF | c) H2O | d) NH3 |

1. Which among the following has the largest dipole moment ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH3 | b) H2O | c) HI | d) SO3 |

1. The hybridization of atomic orbitals of nitrogen in , and are

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp, sp3 and sp2 | b) sp, sp2 and sp3 | c) sp2, sp and sp3 | d) sp2, sp3 and sp |

1. Hybridization of Al in AlCl3 (monomeric form above 800 ˚C) and Al2Cl6 (dimeric form below 400 ˚C) respectively are

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp2, sp3 | b) sp2, sp2 | c) sp3 , sp3 | d) sp2, dsp2 |

1. The correct order of hybridization of the central atom in the following species

NH3 , [PtCl4]2- , PCl5 and BCl3 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) dsp2, dsp3, sp2 , sp2 | b) sp3, dsp2, dsp3 , sp2 | c) dsp2, sp2, sp3 , dsp3 | d) dsp2, sp3 , sp2 , dsp3 |

1. Which one of the following arrangements of molecules is correct on the basis of their dipole moments ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BF3 > NF3 > NH3 | b) NF3 > BF3 > NH3 | c) NH3 >BF3 > NF3 | d) NH3 >NF3 > BF3 |

1. If OF2, number of bond pairs and lone pairs of electrons are respectively

|  |  |  |  |
| --- | --- | --- | --- |
| a) 2 , 0 | b) 2 , 8 | c) 2 , 10 | d) 2 , 9 |

1. The correct sequence of decrease in the bond angles of the following hydrides is

|  |  |
| --- | --- |
| a) NH3 > PH3 > AsH3 > SbH3 | b) NH3 > AsH3 > PH3 > SbH3 |
| c) SbH3 > AsH3 > PH3 > NH3 | d) PH3 > NH3 > AsH3 > SbH3 |

1. The nodal plane in the -bond of ethene is located in

a) the molecular plane

b) a plane parallel to the molecular plane

c) a plane perpendicular to the molecular plane which bisects the carbon-carbon -bond at right angle

d) a plane perpendicular to the molecular plane which contain the carbon-carbon -bond

1. Which of the following are isoelectronic and isostructural ? , , , SO3

|  |  |  |  |
| --- | --- | --- | --- |
| a) , | b) SO3 , | c) , | d) , SO3 |

1. Shape of O2F2 is similar to that of

|  |  |  |  |
| --- | --- | --- | --- |
| a) C2F2 | b) H2O2 | c) H2F2 | d) C2H2 |

1. The ONO bond angle is maximum in

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) NO2 | d) |

1. In BrF3 molecule, the lone pairs occupy equatorial position to minimize

a) lone pair – bond pair repulsion only

b) bond pair – bond pair repulsion only

c) lone pair – lone pair repulsion and lone pair – bond pair repulsion

d) lone pair – lone pair repulsion only

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1. Among the following, the pair in which the two species are not isostructural is

|  |  |  |  |
| --- | --- | --- | --- |
| a) SiF4 & SF4 | b) & XeO3 | c) & | d) & SF6 |

1. The maximum number of 90˚ angles between bond pair-bond pair of electrons is observed in

|  |  |  |  |
| --- | --- | --- | --- |
| a) dsp3 hybridisation | b) sp3d hybridisation | c) dsp2 hybridisation | d) sp3d2 hybridisation |

1. Molecular shapes of SF4 , CF4 , XeF4 are

a) the same with 2 , 0 and 1 lone pairs of electrons respectively

b) the same with 1 , 1 and 1 lone pairs of electrons respectively

c) different with 0 , 1 and 2 lone pairs of electrons respectively

d) different with 1 , 0 and 2 lone pairs of electrons respectively

1. Among the compounds BF3 , NCl3 , H2S , SF4 and BeCl2 , identify the ones in which the central atom has the same type of hybridisation.

|  |  |  |  |
| --- | --- | --- | --- |
| a) BF3 , NCl3 and H2S | b) H2S and BeCl2 | c) NCl3 and H2S | d) SF4 and BeCl2 |

1. Which of the following contain maximum number of lone pairs on the central atom ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) XeF4 | c) SF4 | d) |

1. Based on lattice energy and other considerations, which one of the following alkali metal chlorides is expected to have the highest melting point ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) LiCl | b) NaCl | c) KCl | d) RbCl |

1. The number and type of bonds between two carbon atoms in calcium carbide are

|  |  |  |  |
| --- | --- | --- | --- |
| a) one sigma, one pi | b) one sigma, two pi | c) two sigma , one pi | d) two sigma, two pi |

1. The correct order in which O – O bond length increases in the following is

|  |  |  |  |
| --- | --- | --- | --- |
| a) O3 < H2O2 < O2 | b) O2 < O3 < H2O2 | c) O2 < H2O2 < O3 | d) H2O2 < O2 < O3 |

1. How many bonds are there in ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 14 , 8 | b) 18 , 8 | c) 19 , 4 | d) 14 , 2 |

1. Which one of the following molecule has the smallest bond angle ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH3 | b) PH3 | c) H2O | d) H2Se |

1. In , Lewis base is

|  |  |  |  |
| --- | --- | --- | --- |
| a) I2 | b) | c) | d) I – |

1. Superoctet molecule is

|  |  |  |  |
| --- | --- | --- | --- |
| a) ClF3 | b) NH3 | c) PCl3 | d) CO2 |

1. AlCl3 is covalent while AlF3 is ionic. This is justified by

|  |  |  |  |
| --- | --- | --- | --- |
| a) Crystal structure | b) Valence bond theory | c) Fajan’s rules | d) Lattice energy |

1. Hybridisation of nitrogen atom and electron geometry around nitrogen atom in pyridine is ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp2, planar triangular | b) sp3, pyramidal | c) sp3, tetrahedral | d) sp2, V-shape |

1. Covalency of carbon in CO molecule is three because

a) carbon is linked to highly electronegative oxygen atom.

b) In the ground state, carbon has two unpaired electrons and in the excited state, it can have three.

c) carbon acts as acceptor of electron pair in CO molecule.

d) in inorganic compounds, carbon generally shows a valency of three.

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1. The bond order of is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1/2 | b) 1 | c) 3/2 | d) 2 |

1. Hybridisation of carbon in short lived species, is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp | b) sp2 | c) sp3 | d) none of these |

1. Which of the following statements about carbon monoxide is correct ?

a) It has two lone pairs of electrons on oxygen atom.

b) Carbon atom in it is sp hybridized.

c) In forming metal carbonyls, oxygen is attached to the metal atom.

d) It has large value of dipole moment.

1. Some ether is added to an aqueous solution of a mixture of LiCl , NaCl and AlCl3 . Which will be extracted into ether ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) LiCl , NaCl | b) LiCl , AlCl3 | c) NaCl , AlCl3 | d) LiCl , NaCl , AlCl3 |

1. Which one of the following molecule can be described as a molecule with residual bonding capacity ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) N2 | b) CH4 | c) NaCl | d) BeCl2 |

1. As s-character increases in hybridized orbitals, bond angle

|  |  |  |  |
| --- | --- | --- | --- |
| a) increases | b) decreases | c) becomes zero | d) does not change |

1. In which of the following molecule would you expect the nitrogen to nitrogen bond to be longest ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) N2O | b) N2O4 | c) N2H4 | d) N2 |

1. The first, second, third, fourth and fifth ionization potentials of an element are 7.1 , 14.3 , 34.5 , 46.8 and 162.2 eV respectively. The element is

|  |  |  |  |
| --- | --- | --- | --- |
| a) Ca | b) Si | c) F | d) Al |

1. Polarizing power of Cd2+ on the anions is stronger than that of Ca2+ ion. This is because

a) atomic number of Cd is greater than that of Ca.

b) atomic mass of Cd is greater than that of Ca.

c) size of Cd2+ ion is larger than that of Ca2+ ion.

d) Ca2+ ion has noble gas configuration while Cd2+  ion has pseudo noble gas configuration with 18 electrons in its outer shell.

1. Which of the following are non-polar molecules ? (I) NCl3 (II) SO3 (III) PCl5

|  |  |  |  |
| --- | --- | --- | --- |
| a) I only | b) II only | c) I and II only | d) II and III only |

1. Which bond angle would result in the maximum dipole moment for the triatomic molecule, XY2 shown below ? Y

X Z

|  |  |  |  |
| --- | --- | --- | --- |
| a) 90˚ | b) 120˚ | c) 150˚ | d) 180˚ |

1. In which of the following molecules/ions are all the bonds not equal ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) XeF4 | b) | c) SF4 | d) SiF4 |

1. The correct order regarding the electronegativity of hybrid orbitals of carbon is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp < sp2 > sp3 | b) sp < sp2 < sp3 | c) sp > sp2 < sp3 | d) sp > sp2 > sp3 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) O3 | c) | d) SO2 |

CHEMICAL BONDING Page No. 9

1. The electronegativity difference between N and F is greater than that between N and H yet the dipole moment of NH3 (1.5 D) is larger than that of NF3 (0.2 D). This is because

a) in NH3 as well as NF3 the atomic dipole and bond dipole are in the opposite directions.

b) in NH3 the atomic dipole and bond dipole are in the opposite directions whereas in NF3 these are in the same direction.

c) in NH3 as well as NF3 the atomic dipole and bond dipole are in the same direction.

d) in NH3 the atomic dipole and bond dipole are in the same directions whereas in NF3 these are in the opposite directions

**Answers**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. c | 2. b | 3. b | 4. c | 5. a | 6. d | 7. b | 8. c |
| 9. b | 10. c | 11. c | 12. d | 13. c | 14. d | 15. a | 16. a |
| 17. c | 18. b | 19. a | 20. c | 21. d | 22. d | 23. b | 24. b |
| 25. a | 26. b | 27. d | 28. b | 29. a | 30. a | 31. a | 32. b |
| 33. d | 34. d | 35. a | 36. d | 37. d | 38. c | 39. d | 40. b |
| 41. b | 42. b | 43. c | 44. d | 45. d | 46. a | 47. c | 48. a |
| 49. c | 50. c | 51. a | 52. b | 53. b | 54. d | 55. a | 56. b |
| 57. b | 58. d | 59. c | 60. a | 61. c | 62. d | 63. a | 64. d |

**Matching Type Questions**

1. Column I Column II

|  |  |
| --- | --- |
| (i) SF4 | (a) sp3d2 |
| (ii) IF5 | (b) d2sp3 |
| (iii) | (c) sp3d |
| (iv) | (d) sp3 |
|  | (e) sp |

1. Column I Column II

|  |  |
| --- | --- |
| (i) H3O+ | (a) Linear |
| (ii) HC CH | (b) Angular |
| (iii) | (c) Tetrahedral |
| (iv) | (d) Trigonal bipyramidal |
|  | (e) Pyramidal |

1. Column I Column II

|  |  |
| --- | --- |
| (i) NO | (a) 1.5 |
| (ii) CO | (b) 2.0 |
| (iii) | (c) 2.5 |
| (iv) O2 | (d) 3.0 |
|  | (e) 1.0 |

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1. Column I Column II

|  |  |
| --- | --- |
| (i) Hydrogen bond | (a) C |
| (ii) Resonance | (b) LiF |
| (iii) Ionic solid | (c) H2 |
| (iv) Covalent bond | (d) HF |
|  | (e) O3 |

1. Column I Column II

|  |  |
| --- | --- |
| (i) Tetrahedral | (a) sp2 |
| (ii) Trigonal | (b) sp |
| (iii) Linear | (c) sp3 |
|  | (d) sp3d |

**Answers**

1. (i) – (c) ; (ii) – (a) ; (iii) – (e) ; (iv) – (d) 2. (i) – (e) ; (ii) – (a) ; (iii) – (b) ; (iv) – (c)

3. (i) – (c) ; (ii) – (d) ; (iii) – (a) ; (iv) – (b) 4. (i) – (d) ; (ii) – (e) ; (iii) – (b) ; (iv) – (a)

5. (i) – (c) ; (ii) – (a) ; (iii) – (b)

CHEMICAL BONDING Page No. 11

**Karan Arora M: 9416974837**

**COMPETITION FOCUS – 3**

1. The number of unpaired electrons in a paramagnetic diatomic molecule of an element with atomic number 16 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 4 | b) 1 | c) 2 | d) 3 |

1. In [Ag (CN)2] – , the number of bonds is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 2 | b) 3 | c) 4 | d) 6 |

1. Consider the following molecules or ions : (i) CH2Cl2 (ii) (iii) (iv) (v) NH3 , sp3 hybridisation is involved in the formation of

|  |  |  |  |
| --- | --- | --- | --- |
| a) (i), (ii), (v) only | b) (i), (ii) only | c) (ii) only | d) (i), (ii), (iii), (iv) & (v) |

1. The number of and bonds in allyl isocyanide are

|  |  |  |  |
| --- | --- | --- | --- |
| a) 9 , 3 | b) 9 , 9 | c) 3 , 4 | d) 5 , 7 |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) and XeO3 | b) SF4 and XeF4 | c) and | d) BF3 and NF3 |

1. 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+ , Ca2+ , Mg2+ , Be2+ ?

|  |  |
| --- | --- |
| a) Ca2+ < Mg2+ < Be2+ < K+ | b) Mg2+ < Be2+ < K+ < Ca2+ |
| c) Be2+ < K+ < Ca2+ < Mg2+ | d) K+ < Ca2+ < Mg2+ < Be2+ |

1. In which of the following ionization processes, the bond order has increased and the magnetic behavior has changed ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) N2 → | b) C2 → | c) NO → NO+ | d) O2 → |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) NO – | b) NO+ | c) CN – | d) N2 |

1. The percentage of p-character in the orbitals forming P – P bonds in P4 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 25 | b) 33 | c) 50 | d) 75 |

1. In TeCl4 , the central atom, tellurium, involves the hybridization

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 | b) sp3d | c) sp3d2 | d) dsp2 |

1. The bond lengths and bond angles in the molecules of methane, ammonia and water are given below :

  

This variation in bond angle is a result of :

1. The increasing repulsion between hydrogen atoms as the bond length decreases.

2. The number of non-bonding electrons pairs in the molecule.

3. A non-bonding electron pair having a greater repulsive force than a bonding electron pair.

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1,2 & 3 are correct | b) 1 & 2 only are correct | c) 2 & 3 only are correct | d) 1 only is correct |

1. The correct order of bond order values among the following :

A. NO – B. NO+ C. NO D. NO2+ E. NO 2–

|  |  |  |  |
| --- | --- | --- | --- |
| a) A < D < C < B < E | b) D = B < A < E < C | c) E < A < D = C < B | d) B < C < D < A < E |

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1. Which one of the following pairs consist of only paramagnetic species ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) [O2 , NO] | b) [ , ] | c) [CO , NO] | d) [NO , NO+] |

1. The hybridization of oxygen atom in H2O2 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3d | b) sp | c) sp2 | d) sp3 |

1. The magnetic moment of KO2 at room temperature is ……………. BM.

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1.41 | b) 1.73 | c) 2.23 | d) 2.64 |

1. N2O is isoelectronic with CO2 and , which is the structure of N2O ?

a)  b)  c)  d) 

1. Four diatomic species are listed below in different sequences. Which of these presents the correct order of their increasing bond order ?

|  |  |
| --- | --- |
| a) < NO < < | b) NO < < < |
| c) < < NO < | d) < < NO < |

1. Which one of the following pairs of species have the same bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) & CN – | b) NO+  & CN+ | c) CN – & NO+ | d) CN – & CN+ |

1. Arrange the following ions in the order of decreasing X – O bond length where X is the central atom

|  |  |
| --- | --- |
| a) , , , | b) , , , |
| c) , , , | d) , , , |

1. The state of hybridization of C2 , C3 , C5 & C6 of the hydrocarbon is in the following sequence :



|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 , sp2 , sp2 & sp | b) sp , sp2 , sp2 & sp3 | c) sp , sp2 , sp3 & sp2 | d) sp , sp3 , sp2 & sp3 |

1. In case of alkali metals, the covalent character decreases in the order

|  |  |  |  |
| --- | --- | --- | --- |
| a) MF > MCl > MBr > MI | b) MF > MCl > MI > MBr | c) MI > MBr > MCl > MF | d) MCl > MI > MBr > MF |

1. The bond dissociation energy of B – F in BF3 is 646 KJ mol-1 whereas that of C – F in CF­4 is 515 KJ mol-1. The correct reason for higher B – F bond dissociation energy as compared to that of C – F is

a) smaller size of B-atom as compared to that of C-atom.

b) stronger -bond between B and F in BF3 as compared to that between C and F in CF4 .

c) significant p- p interaction between B and F in BF3 whereas there is no possibility of such interaction between C and F in CF4 .

d) Lower degree of p- p interaction between B and F in BF3 than that between C and F in CF4 .

1. The values of electronegativity of atom A and B are 1.2 and 4.0 respectively. The % ionic character of the A-B bond is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 50 % | b) 72.24 % | c) 55.3 % | d) 43 % |

1. If I2 is dissolved in aqueous KI, the intense yellow species, , is formed. The structure of ion is

|  |  |
| --- | --- |
| a) Square pyramidal | b) Trigonal bipyramidal |
| c) Octahedral | d) Pentagonal bipyramidal |

1. In the change of NO+ to NO, the electron is added to

|  |  |  |  |
| --- | --- | --- | --- |
| a) orbital | b) l | c) | d) |

CHEMICAL BONDING Page No. 13

1. It is believed that atoms combine with each other such that outermost shell acquires stable configuration of 8 electrons. If stability were attained with 6 electrons rather than 8, what would be the formula of the stable fluoride ion ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) F – | b) F + | c) F2+ | d) F3+ |

1. The common features among the species CN – , CO & NO+ are

|  |  |
| --- | --- |
| a) Bond order three and isoelectronic | b) Bond order three and weak-field ligands |
| c) Bond order two and – acceptor | d) Isoelectronic and weak-field ligands |

1. In which pairs of species, both species have similar geometry ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 and SO2 | b) NH3 and BH3 | c) and | d) and |

1. SF2 , SF4 & SF6 have the hybridisations at sulphur atom respectively as

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp2 , sp3 , sp3d2 | b) sp3 , sp3 , sp3d2 | c) sp3 , sp3d , sp3d2 | d) sp3 , sp3d2 , d2sp3 |

1. Two species of F X F angles are present in which of the following molecule ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) SF4 | b) XeF4 | c) SF6 | d) CF4 |

1. Which is correct statement about and – molecular orbitals ? Statements are :

1) – bonding orbitals are ungerade

2) – antibonding orbitals are ungerade

3) – antibonding orbitals are gerade

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 only | b) 2 and 3 only | c) 3 only | d) 2 only |

1. Among the following, the compound that contains ionic, covalent and coordinate linkage is

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH4Cl | b) NaCl | c) CaO | d) NH3 |

1. The correct statement with regard to and is

|  |  |
| --- | --- |
| a) both and do not exist | b) is more stable than |
| c) is more stable than | d) both and are equally stable |

1. Out of N2O , SO2 , , , H2O , , , the linear species are

|  |  |  |  |
| --- | --- | --- | --- |
| a) , , H2O | b) N2O , , | c) N2O , , | d) , , SO2 |

1. Correct order of bond angles for the following is

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH3 > PCl3 > BCl3 | b) BCl3 > NH3 > PCl3 | c) BCl3 > PCl3 > NH3 | d) PCl3 > BCl3 > NH3 |

1. Which of the following species is non-linear

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) |

1. The state of hybridisation of S in SF4 is

|  |  |
| --- | --- |
| a) sp3 and has a lone pair of electrons | b) sp2 and has tetrahedral structure |
| c) sp3d and has a trigonal bipyramidal structure | d) sp3d2 and has an octahedral structure |

1. The d-orbital involved in the hybridisation in PCl5 molecule is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3dx2-y2 | b) 3dz2 | c) 3dxy | d) 4dx2-y2 |

1. The number of b.p. and l.p. in NO3 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3 b.p. + 1 l.p. | b) 4 b.p. + 0 l.p. | c) 2 b.p. + 2 l.p. | d) 1 b.p. + 1 l.p. |

1. Assuming that Hund’s rule is violated, the bond order and magnetic nature of diatomic molecule B2 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 & diamagnetic | b) 0 & diamagnetic | c) 1 & paramagnetic | d) 0 & paramagnetic |

1. Which one of the following species does not exist under normal conditions ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) Li2 | b) | c) Be2 | d) B2 |

1. Which one of the following compounds is a peroxide ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NO2 | b) KO2 | c) BaO2 | d) MnO2 |

CHEMICAL BONDING Page No. 14

1. In which of the following pairs of molecules/ ions , the central atom have sp2 hybridisation ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BF3 & | b) & NH3 | c) BF3 & | d) & H2O |

1. In which one of the following species the central atom has the type of hybridisation which is not the same as that present in the other three ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) PCl5 | b) SF4 | c) | d) |

1. In which of the following molecules the central atom does not have sp3 hybridisation ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CH4 | b) SF4 | c) | d) |

1. Some of the properties of the two species, and H3O+ are described below. Which one of them is correct ?

a) Dissimilar in hybridisation for the central atom with different structures

b) Isostructural with same hybridisation for the central atom

c) Isostructural with different hybridisation for the central atom

d) Similar in hybridisation for the central atom with different structures

1. Which of the following statement are false ?

a) H2 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 three sigma bonds.

1. A neutral molecule XF3 has zero dipole moment. The element X is most likely

|  |  |  |  |
| --- | --- | --- | --- |
| a) chlorine | b) boron | c) nitrogen | d) carbon |

1. All carbon atoms are sp2 hybridized in

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1, 3-butadiene | b) CH2 C CH2 | c) cyclohexane | d) 2-butene |

1. The hybridization of the central atom in BrF5 molecule is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 | b) dsp2 | c) sp3d2 | d) dsp3 |

1. Choose the paramagnetic oxide in the following

|  |  |  |  |
| --- | --- | --- | --- |
| a) MgO | b) BeO | c) CaO | d) KO2 |

1. Which one of the following conversions involves change in both hybridisation and sample ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CH4 → C2H6 | b) NH3 → | c) BF3 → | d) H2O → H3O+ |

1. Peroxide ion …………….

1) has five completely filled antibonding molecular orbitals

2) is diamagnetic 3) has bond order one 4) is isoelectronic with neon

Which of these are correct ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3 & 4 | b) 1, 2 & 4 | c) 2 & 3 | d) 1 & 4 |

1. The electronic configuration of two elements X and Y are given below :

X = 1s2 2s2 2p6 3s2 3p6 4s2 ; Y = 1s2 2s2 2p6 3s2 3p5

The formula of the ionic compound that can be formed between these elements is

|  |  |  |  |
| --- | --- | --- | --- |
| a) XY | b) XY2 | c) X2Y | d) XY3 |

1. The polarity of the covalent bond is maximum in

|  |  |  |  |
| --- | --- | --- | --- |
| a) F – F | b) O – F | c) N – F | d) C – F |

1. The bond angles formed by different hybrid orbitals are in the order :

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp2 > sp3 > sp | b) sp3 > sp2 > sp | c) sp > sp3 > sp2 | d) sp > sp2 sp3 |

CHEMICAL BONDING Page No. 15

1. How many hydrogen bonded water molecule(s) are associated with CuSO4.5H2O ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 | b) 2 | c) 3 | d) 4 |

1. The bond order of N – O bonds in ion is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.33 | b) 1.00 | c) 1.33 | d) 1.50 |

1. Which of the following fluoride of xenon has zero dipole moment ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) XeF2 | b) XeF3 | c) XeF4 | d) XeF6 |

1. Which of the following has a regular geometry ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CHCl3 | b) PCl3 | c) XeF6 | d) SF4 |

1. Which of the following pair of species have the same bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO & NO | b) O2 & NO+ | c) CN– & CO | d) N2 & |

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

|  |  |  |  |
| --- | --- | --- | --- |
| a) & | b) & | c) & | d) & |

1. Be2+  is isoelectronic with which of the following ions ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) H+ | b) Li+ | c) Na+ | d) Mg2+ |

1. Which of the following species has planer triangular shape ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) N3 | b) | c) | d) CO2 |

1. Identify the correct order of solubility in aqueous medium

|  |  |  |  |
| --- | --- | --- | --- |
| a) CuS > ZnS > Na2S | b) ZnS > Na2S > CuS | c) Na2S > CuS > ZnS | d) Na2S > ZnS > CuS |

1. Which one of the following molecules contain no -bond ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 | b) H2O | c) SO2 | d) NO2 |

1. Which of the following is a polar molecule ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BF3 | b) SF4 | c) SiF4 | d) XeF4 |

1. Which of the following is paramagnetic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO | b) | c) CN– | d) NO+ |

1. Bond order of 1.5 is shown by

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) O2 |

1. Which of the following species contains three bond pairs and one lone pair around the central atom ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2O | b) BF3 | c) | d) PCl3 |

1. The pair of species with the same bond order is

|  |  |  |  |
| --- | --- | --- | --- |
| a) & B2 | b) & NO+ | c) NO & CO | d) N2 & O2 |

1. Which of the following has the minimum bond length ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) O2 | d) |

1. Which one of the following species does not exist under normal conditions ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) Be2 | c) B2 | d) Li2 |

1. In which of the following species the central atom has the type of hybridisation which is not the same as that present in the other three ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) SF4 | b) | c) | d) PCl5 |

1. What is dominant intermolecular force on bond that must be overcome in converting liquid CH3OH to gas ?

|  |  |
| --- | --- |
| a) Hydrogen bonding | b) Dipole-dipole interaction |
| c) Covalent bonds | d) London or dispersive force |

1. In which of the following molecules/ions BF3 , , and H2O , the central atom is sp2 hybridized ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) & | b) & H2O | c) & H2O | d) BF3 & |

CHEMICAL BONDING Page No. 16

1. According to molecular orbital theory which of the following lists rank the nitrogen species in terms of increasing bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) < N2 < | b) < < N2 | c) N2 < < | d) < < N2 |

1. Four diatomic species are listed below in different sequences. Which of these presents the correct order of their increasing bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) < NO < < | b) NO < < < | c) < < NO < | d) < < NO < |

1. The correct order of increasing bond angles in the following triatomic species is

|  |  |  |  |
| --- | --- | --- | --- |
| a) < < NO2 | b) < NO2 < | c) < NO2 < | d) < < NO2 |

1. In which of the following pairs, the two species are isostructural ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) SF4 & XeF4 | b) & | c) BF3 & NF3 | d) & XeO3 |

1. Which of the following is not a correct statement

a) The electron deficient molecules can act as Lewis acids

b) The canonical structures have no real existence

c) Every AB5 molecule does infact have square pyramidal structure

d) Multiple bonds are always shorter than corresponding single bond

1. Which of the following is not isostructural with SiCl4 ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) SCl4 | b) | c) | d) |

1. In which of the following molecules are all the bonds not equal ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CIF3 | b) BF3 | c) AlF3 | d) NF3 |

1. Which of the following would have a permanent dipole moment ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BF3 | b) SiF4 | c) SF4 | d) XeF4 |

1. Which of the following molecules has trigonal planar geometry ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) IF3 | b) PCl3 | c) NH3 | d) BF3 |

1. In BeF3 molecule, the lone pairs occupy equatorial positions to minimize

a) lone pair-bond pair repulsion

b) bond pair-bond pair repulsion

c) lone pair-lone pair repulsion and lone pair-bond pair repulsion

d) lone pair-lone pair repulsion

1. Which of the following has p-d bonding ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) |

1. H2O is dipolar, whereas BeF2 is not. It is because

a) the electronegativity of F is greater than that of O

b) H2O involves hydrogen bonding whereas BeF2 is a discrete molecule

c) H2O is linear and BeF2 is angular

d) H2O is angular and BeF2 is linear

1. Which of the following is isoelectronic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 & NO2 | b) & CO2 | c) CN – & CO | d) SO2 & CO2 |

1. Which of the following two are isostructural

|  |  |  |  |
| --- | --- | --- | --- |
| a) XeF2 & | b) NH3 & BF3 | c) & | d) PCl5 & ICl5 |

1. Among the following ions the p-d overlap could be present in

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) |

CHEMICAL BONDING Page No. 17

1. Among the following group which represents the collection of isoelectronic species ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NO , CN – , N2 , | b) NO+ , , , CO | c) N2 , , CO , NO | d) CO , NO+ , CN –, |

1. Which one of the following is not paramagnetic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NO | b) | c) CO | d) |

1. The relationship between the dissociation energy of N2 and is

a) dissociation energy of > dissociation energy of N2

b) dissociation energy of N2 = dissociation energy of

c) dissociation energy of N2 > dissociation energy of

d) dissociation energy of N2 can be lower or higher than the dissociation energy of

1. The high density of water as compared to ice is due to

|  |  |
| --- | --- |
| a) hydrogen bonding interactions | b) dipole-dipole interactions |
| c) dipole-induced dipole interactions | d) induced dipole-induced dipole interactions |

1. The ions that is isoelectronic with CO is

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) CN – |

1. Which one of the following has the highest dipole moment ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) AsH3 | b) SbH3 | c) PH3 | d) NH3 |

1. The correct order of N – O bond lengths in NO , , and N2O4 is

|  |  |
| --- | --- |
| a) N2O4 > > > NO | b) NO > > N2O4 > |
| c) > > N2O4 > NO | d) NO > N2O4 > > |

1. The ground state electronic configuration of valence shell electrons in nitrogen molecule (N2) is written as : KK , 2s2 , 2s2 , ,

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0 | b) 1 | c) 0 | d) 3 |

1. The BCl3 is a planar molecule whereas NCl3 is pyramidal because

a) B – Cl bond is more polar than N – Cl bond

b) N – Cl bond is more covalent than B – Cl bond

c) nitrogen atom is smaller than boron atom

d) BCl3­ has no lone pair but NCl3 has a lone pair of electrons

1. Which of the following species is paramagnetic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) NO | c) CO | d) CN – |

1. The boiling point of p-nitrophenol is higher than that of o-nitrophenol because

a) NO2­ group at p-position behave in a different way from that at o-position

b) intramolecular hydrogen bonding exists in p-nitrophenol

c) there is intermolecular hydrogen bonding in p-nitrophenol

d) p-nitrophenol has a higher molecular weight than o-nitrophenol

1. Linus Pauling received the Nobel prize for his work on

|  |  |  |  |
| --- | --- | --- | --- |
| a) atomic structure | b) Photosynthesis | c) chemical bonds | d) thermodynamics |

1. When the hybridisation state of carbon atom changes from sp3 to sp2 and finally to sp, the angle between the hybridized orbitals

|  |  |
| --- | --- |
| a) decreases gradually | b) decreases considerably |
| c) is not affected | d) increases progressively |

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1. Which of the following statement is not correct ?

|  |  |
| --- | --- |
| a) Double bond is shorter than a single bond | b) Sigma bond is weaker than a pi-bond |
| c) Double bond is stronger than a single bond | d) Covalent bond is stronger than hydrogen bond |

1. Among the following which compound will show the highest lattice energy ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) KF | b) NaF | c) CsF | d) RbF |

1. Strongest hydrogen bonding is shown by

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2O | b) NH­3 | c) HF | d) H2S |

1. Which structure is linear ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) SO2 | b) CO2 | c) | d) |

1. An sp3 hybrid orbitals contains

|  |  |  |  |
| --- | --- | --- | --- |
| a) s-character | b) s-character | c) s-character | d) s-character |

1. Linear combination of two hybridized orbitals belonging to the two atoms, each having one electron leads to a

|  |  |  |  |
| --- | --- | --- | --- |
| a) Sigma bond | b) Double bond | c) Coordinate bond | d) pi-bond |

1. Which one shows maximum hydrogen bonding ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2O | b) H2Se | c) H2S | d) HF |

1. Which one of the following formulae does not correctly represent the bonding capacities of the atoms involved ?

a) b) c) d)

   

1. Among LiCl , BeCl2 , BCl3 and CCl4 , the covalent bond character follows the order

|  |  |
| --- | --- |
| a) LiCl < BeCl2 > BCl3 > CCl4 | b) LiCl < BeCl2 < BCl3 > CCl4 |
| c) LiCl < BeCl2 < BCl3 < CCl4 | d) LiCl > BeCl2 > BCl3 > CCl4 |

1. H2O has a net dipole moment while BeF2 has zero dipole moment because

a) H2O molecule is linear while BeF2 is bent

b) BeF2 molecule is linear while H2O is bent

c) fluorine has more electronegativity than oxygen

d) beryllium has more electronegativity than oxygen

1. In which one of the following molecules, the central atom said to adopt sp2 hybridisations ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BeF2 | b) BF3 | c) C2H2 | d) NH3 |

1. Which of the following molecule does not have a linear arrangement of atoms ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2S | b) C2H2 | c) BeH2 | d) CO2 |

CHEMICAL BONDING Page No. 19

**Karan Arora M: 9416974837**

**More Than One Option**

1. Which of the following statements are not correct ?

a) NaCl (s) being an ionic compound, is a good conductor of electricity

b) In canonical structures there is a difference in the arrangement of atoms

c) Hybrid orbitals form stronger bonds than P-orbitals

d) VSEPR theory cannot explained the square planar geometry of XeF4

1. Species having same bond order are

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) |

1. Paramagnetic species are

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) |

1. Which of the following species have the same shape and same bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| 1) CO2 | 2) | 3) O3 | 4) |
| a) 1 & 2 | b) 3 & 4 | c) 1 & 3 | d) 2 & 4 |

1. CO2 is isostructural with

|  |  |  |  |
| --- | --- | --- | --- |
| a) HgCl2 | b) SnCl2 | c) C2H2 | d) NO2 |

1. Which of the following have identical bond order ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CN– | b) | c) NO+ | d) CN+ |

**Answers**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. c | 2. c | 3. d | 4. a | 5. a | 6. d | 7. c | 8. a |
| 9. d | 10. b | 11. c | 12. c | 13. a | 14. d | 15. b | 16. d |
| 17. d | 18. c | 19. b | 20. d | 21. c | 22. c | 23. b | 24. b |
| 25. d | 26. b | 27. a | 28. d | 29. c | 30. a | 31. a | 32. a |
| 33. c | 34. c | 35. b | 36. d | 37. c | 38. b | 39. b | 40. a |
| 41. c | 42. c | 43. c | 44. d | 45. b | 46. a | 47. d | 48. b |
| 49. a | 50. c | 51. d | 52. c | 53. c | 54. b | 55. d | 56. d |
| 57. a | 58. c | 59. c | 60. a | 61. c | 62. d | 63. b | 64. b |
| 65. d | 66. b | 67. b | 68. b | 69. b | 70. d | 71. a | 72. d |
| 73. b | 74. c | 75. a | 76. d | 77. b | 78. d | 79. b | 80. d |
| 81. c | 82. a | 83. a | 84. c | 85. d | 86. d | 87. b | 88. d |
| 89. c | 90. a | 91. c | 92. d | 93. c | 94. c | 95. a | 96. d |
| 97. d | 98. c | 99. d | 100. d | 101. b | 102. c | 103. c | 104. d |
| 105. b | 106. b | 107. c | 108. b | 109. a | 110. a | 111. d | 112. d |
| 113. c | 114. b | 115. b | 116. a |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 117. a , b , d | 118. a , b , c | 119. a , b , c , d | 120. a , b | 121. a , c | 122. a , c |

CHEMICAL BONDING Page No. 20

**Karan Arora M: 9416974837**

**COMPETITION FOCUS – 4**

1. The cyanide ion and N2 are isoelectronic but in contrast to CN-, N2 is unreactive because of

|  |  |
| --- | --- |
| a) low bond energy | b) Absence of bond polarity |
| c) Unsymmetrical electron distribution | d) Presence of more no. of e- in bonding orbital |

1. The hybridization of ‘C’ in diamond, graphite & acetylene are respectively

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp2, sp, sp3 | b) sp, sp2, sp3 | c) sp3, sp2, sp | d) sp2, sp3,sp |

1. The ‘d’ orbital involved in dsp2 & sp3d hybridization is

|  |  |  |  |
| --- | --- | --- | --- |
| a) dx2-y2, dz2 | b) dz2, dxy | c) dx2-y2, dxy | d) dx2-y2, dxz |

1. Which of the following is trigonal planer

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH3 | b) Cl | c) PCl3 | d) BF3 |

1. Two hybrid orbitals have bond angle of 120˚. The % of ‘S’ character in the hybrid orbital is nearly.

|  |  |  |  |
| --- | --- | --- | --- |
| a) 25% | b) 33% | c) 50% | d) 66% |

1. Which one of the following compounds has sp2 hybridization

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 | b) CO | c) N2O | d) SO2 |

1. What is the hybridization of SOCl2 ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp | b) sp2 | c) sp3 | d) sp3d2 |

1. In which of the following electronegativity of ‘c’ is maximum

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp | b) sp2 | c) sp3 | d) sp4 |

1. The dipole element of o, p, m dichlorobenzene is in the order

|  |  |  |  |
| --- | --- | --- | --- |
| a) o > p > m | b) p > o > m | c) m > o > p | d) o > m > p |

1. The bond angle H – O – H in ice is closest to

|  |  |  |  |
| --- | --- | --- | --- |
| a) 120˚ | b) 60˚ | c) 90˚ | d) 105˚ |

1. Maximum possible no. of H - bonds in which a H2O molecule can participate is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 | b) 4 | c) 3 | d) 2 |

1. NH3 & BF3 forms an adduct readily because they form

|  |  |  |  |
| --- | --- | --- | --- |
| a) co – ordinate bond | b) covalent bond | c) ionic bond | d) hydrogen bond |

1. Which of the following geometrical configuration corresponds to dsp2 hybridization

|  |  |  |  |
| --- | --- | --- | --- |
| a) Tetrahedral | b) Triangular planer | c) Square planer | d) Trigonal Bipyramidal |

1. If a molecule MX3 has zero dipole moment, the σ bonding orbitals used by M (At. no. = 21) are

|  |  |  |  |
| --- | --- | --- | --- |
| a) pure (p) | b) sp hybrid | c) sp3 hybrid | d) sp2 hybrid |

1. Which of the following halogen has highest bond energy

|  |  |  |  |
| --- | --- | --- | --- |
| a) F2 | b) Br2 | c) Cl2 | d) I2 |

1. Increasing order A (lowest first) size of hybrid orbital

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp, sp2, sp3 | b) sp3, sp2, sp | c) sp2, sp3,sp | d) sp2, sp, sp3 |

1. Molecule obtained by sp3d2 hybridization the bond angle of

|  |  |  |  |
| --- | --- | --- | --- |
| a) 90˚ | b) 109˚ 28’ | c) 90˚, 120˚ | d) 120˚ |

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1. Molecule having least dipole moment

|  |  |  |  |
| --- | --- | --- | --- |
| a) CH3Cl | b) CHCl3 | c) CH2Cl2 | d) CCl4 |

1. Hydrogen bonding is maximum in

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2S | b) H2O | c) H2Se | d) H2Te |

1. With which bond angle θ would result in the maximum dipole moment for the triatomic molecule YXY?

|  |  |  |  |
| --- | --- | --- | --- |
| a) θ = 90˚ | b) θ = 120˚ | c) θ = 150˚ | d) θ = 180˚ |

1. KF combines with HF to form KHF2. The compound contains species

|  |  |  |  |
| --- | --- | --- | --- |
| a) K+ , F- & H+ | b) K+ , F- & HF- | c) K+ & [ H ] | d) [KHF]+ & F - |

1. Which one has maximum dipole moment

|  |  |  |  |
| --- | --- | --- | --- |
| a) butene – 1 | b) Cis – butene – 2 | c) Trans – butene – 2 | d) 2 – methyl propane |

1. Among the following species NF3, N, BF3 , H3O+, HN3 . Identify the iso structural units

|  |  |
| --- | --- |
| a) [NF3 , N] & [BF3 , H3O+] | b) [NF3 , HN3] & [N , BF3] |
| c) [NF3 , H3O+ ] & [N , BF3] | d) [NF3 , H3O+ ] & [HN3 , BF3] |

1. No. of π bond of N2 molecule is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 | b) 3 | c) 2 | d) 0 |

1. AsF5 molecule is trigonal bipyramid the hybrid orbital used by ‘As’ atom for bonding are

|  |  |  |  |
| --- | --- | --- | --- |
| a) dx2-y2, dz2 , px, py | b) dxy, s, px, py, pz | c) s, px ,py, pz,dz2 | d) s, px, py, pz, dx2-y2 |

1. The hybridization of atomic orbitals of nitrogen in , ,, are respectively

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp, sp3, sp2 | b) sp, sp2, sp3 | c) sp2, sp, sp3 | d) sp2, sp3, sp |

1. Which one of the following has maximum covalent character

|  |  |  |  |
| --- | --- | --- | --- |
| a) CaCl2 | b) MgCl2 | c) NaCl | d) AlCl3 |

1. Which of the following are isoelectronic species

I II III IV NH3

|  |  |  |  |
| --- | --- | --- | --- |
| a) I, II, III | b) I, II, IV | c) II, III, IV | d) II & I |

1. The shape of is

|  |  |  |  |
| --- | --- | --- | --- |
| a) triangular pyramid | b) tetrahedral | c) triangular planar | d) triangular bipyramid |

1. The correct order of polarizing (decreasing order)

|  |  |  |  |
| --- | --- | --- | --- |
| a) Cl-, Br-, I-, F- | b) F-, I-, Br-, Cl- | c) I-, Br-, Cl-, F- | d) F-, Cl-, Br-, I- |

1. The structure & hybridization of Si(CH3)4 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) Bent , sp | b) square planer, dsp2 | c) trigonal, sp2 | d) tetrahedral, sp3 |

1. Outer most shell A two element X & Y have 2 & 6 electrons respectively. If they combine expected formula of compound will be

|  |  |  |  |
| --- | --- | --- | --- |
| a) XY | b) X2Y | c) X2Y3 | d) XY2 |

1. Methanol & Ethanol are miscible in H2O due to

|  |  |
| --- | --- |
| a) Covalent character | b) Hydrogen bonding |
| c) Oxygen bonding character | d) None of the above |

1. Hydrogen bonding is strongest in

|  |  |  |  |
| --- | --- | --- | --- |
| a) O – H -----S | b) S – H ----- O | c) F – H ----- F | d) F – H ------O |

1. A compound having sp3d3 hybridization has the bond angle

|  |  |  |  |
| --- | --- | --- | --- |
| a) 72˚, 120˚ | b) 90˚, 120˚ | c) 72˚, 90˚ | d) 90˚ |

1. The correct order of dipole moment is

|  |  |
| --- | --- |
| a) CH4 < NF3 < NH3 < H2O | b) NF3 < CH4 < NH3 < H2O |
| c) NH3 < NF3 < CH4 < H2O | d) H2O < NH3 < NF3 < CH4 |

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1. Carbon atom in (CH)4 are

|  |  |
| --- | --- |
| a) sp – hybridized | b) sp2 – hybridized |
| c) sp – and sp2 - hybridized | d) sp, sp2 and sp3 – hybridized |

1. Which of the following is paramagnetic ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) CN- | c) CO | d) NO+ |

1. Which of the molecule is T – shaped?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BeF2 | b) BeCl3 | c) NH3 | d) ClF3 |

1. Which shows a change in the type of hybridization when

|  |  |
| --- | --- |
| a) NH3 combine with H+ | b) AlH3 combines with H- |
| c) In both cases | d) In none cases |

1. Which of the following contains both polar and non – polar bonds?

|  |  |  |  |
| --- | --- | --- | --- |
| a) NH4Cl | b) HCN | c) H2O2 | d) CH4 |

1. The bond order of the superoxide ( ) is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 | b) 1.5 | c) 2 | d) 2.5 |

1. Amongst LiCl, BeCl2, MgCl2, RbCl the compounds with greatest and least ionic character, respectively are

|  |  |  |  |
| --- | --- | --- | --- |
| a) LiCl and RbCl | b) RbCl and BeCl2 | c) RbCl and MgCl2 | d) MgCl2 and BeCl2 |

1. In which molecule sulphur atom is not sp3 - hybridized

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) SF4 | c) SF2 | d) S8 |

1. Which of the following species is electron deficient?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BCl3 | b) PCl3 | c) PCl5 | d) NH3 |

1. The species that does not contain peroxide ions are

|  |  |  |  |
| --- | --- | --- | --- |
| a) PbO2 | b) H2O2 | c) SrO2 | d) BaO2 |

1. The hybridization of carbon atoms in C-C single bond of HC C CH CH2 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 – sp3 | b) sp2 – sp3 | c) sp – sp2 | d) sp3 – sp |

1. The hybridization of CH3 CH2  , CH C , CH2 CH are

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3, sp2, sp | b) sp3, sp, sp2 | c) sp3, sp2, sp2 | d) sp3, sp, sp |

1. Which of the following contain isostructural pairs

|  |  |
| --- | --- |
| a) [ NH3 , BF3 ] & [ H3O+ , BF3 ] | b) [ NH3 , HN3 ] & [ NBF3 ] |
| c) [ PCl3 , BCl3] & [ NBF3 ] | d) [ SO3 , BF3 ] & [ NF3 ,H3O+ ] |

1. The correct order of C-O decreasing bond length

|  |  |
| --- | --- |
| a) CO > CO2 > > RCOOH | b) CO > CO2 > RCOOH > |
| c) > RCOOH > CO2 > CO | d) RCOOH > > CO2 > CO |

1. In dichromate ion

|  |  |
| --- | --- |
| a) 4 Cr- O bond are equivalent | b) 6 Cr- O bond are equivalent |
| c) All Cr- O bond are equivalent | d) All Cr- O bond are non-equivalent |

1. The first I.E. of He is 2.372 kJ/mole then first I.E. of Ne is

|  |  |  |  |
| --- | --- | --- | --- |
| a) 3.09 | b) 2.37 | c) 2.09 | d) 2.88 |

1. PCl5 exists but NCl5 does not because

|  |  |
| --- | --- |
| a) Nitrogen has no vacant d – orbitals | b) NCl5 is unstable |
| c) Nitrogen atom is much small | d) Nitrogen is highly inert |

1. Of the three molecules XeF4, SF4, SiF4, one which have tetrahedral structures is

|  |  |  |  |
| --- | --- | --- | --- |
| a) all the three | b) only SiF4 | c) both SF4 and XeF4 | d) only XeF4 |

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1. The shape of ion would be

|  |  |  |  |
| --- | --- | --- | --- |
| a) square planer | b) tetrahedral | c) irregular tetrahedron | d) square pyramidal |

1. The hydrogen halide has maximum dipole moment is

|  |  |  |  |
| --- | --- | --- | --- |
| a) HF | b) HCl | c) HBr | d) HI |

1. The state of hybridization of Xe in XeF4 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp2 | b) sp3 | c) sp3d | d) sp3d2 |

1. In the cyanide ion, the negative formal charge is mainly on

|  |  |
| --- | --- |
| a) C | b) N |
| c) any of them | d) resonate between C and N |

1. Dipole moment is exhibited by

|  |  |
| --- | --- |
| a) 1, 4 – Dichlorobenzene | b) 1, 2 – Dichlorobenzene |
| c) trans – 1 , 2 – Dichloroethene | d) none of these |

1. In the following molecule, H3C C \* C \* CH3 the two carbon atoms marked by asterisk (\*) possess

the following type of hybridized orbitals

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 - orbital | b) sp2 - orbital | c) sp - orbital | d) s - orbital |

1. The pair of species having identical shape is

|  |  |  |  |
| --- | --- | --- | --- |
| a) CF4 , SF4 | b) PCl3 , BF3 | c) XeF2 , CO2 | d) PF5 , IF5 |

1. Shape of is

|  |  |  |  |
| --- | --- | --- | --- |
| a) Trigonal | b) Linear | c) Octahedral | d) Square planar |

1. The species having octahedral shape is

|  |  |  |  |
| --- | --- | --- | --- |
| a) SF6 | b) | c) PCl5 | d) |

1. How many unpaired electrons are present in ?

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1 | b) 2 | c) 3 | d) 4 |

1. Which of the following has fractional bond order?

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) | c) | d) |

1. Amongst the following compounds, which has the maximum number of sp– hybridized C atoms?

|  |  |
| --- | --- |
| a) (CN)2 | b) CH2 C CN |
| c) HC C CH2 CH CH2 | d) HC C CN |

1. According to Fajan’s rules, ionic bond are formed when

a) Cations have low positive charge and large size

b) Cations have low positive charge and small size

c) Cations have high positive charge and large size and anions have a small size

d) Cations have low positive charge and large size and anions have a small size

1. Which conclusion can we draw from the following reactions?

H2 + 4.5 eV → H + H ; H + 13.6 eV → H+ + e-

a) It is more difficult to break up an H2 molecule than it is to ionize a hydrogen atom.

b) It is easier to break up an H2 molecule than it is to ionize a hydrogen atom.

c) The average energy of formation of H and H+ are the same

d) Electrons and protons attraction in an H2 molecule as well as H atom are the same

1. In an ion

|  |  |
| --- | --- |
| a) one electron is bound to two protons | b) two electrons are bound to two protons |
| c) three electrons are bound to two protons | d) none of these |

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1. Among the following molecules, which is the most ionic?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CaCl2 | b) SnCl2 | c) NaCl | d) CuCl |

1. Among the following, the molecule with the highest dipole moment is

|  |  |  |  |
| --- | --- | --- | --- |
| a) CH3Cl | b) CH2Cl2 | c) CHCl3 | d) CCl4 |

1. Orthonitrophenol is steam volatile but paranitrophenol is not because
2. Orthonitrophenol has intramolecular hydrogen bonding while paranitrophenol has intermolecular

hydrogen bonding

1. Both ortho - and paranitrophenol have intramolecular hydrogen bonding
2. Orthonitrophenol has intermolecular hydrogen bonding while paranitrophenol has intramolecular hydrogen bonding
3. Vander waals forces are dominant in Orthonitrophenol
4. The shape of , , AsCl5 are respectively

a) square planer, tetrahedral and see - saw

b) tetrahedral, see – saw and trigonal bipyramidal

c) tetrahedral, square planer and pentagonal bipyramidal

d) trigonal bipyramidal, tetrahedral and square pyramidal

1. Which of the following pairs are isostructural

|  |  |  |  |
| --- | --- | --- | --- |
| a) and | b) and NH3 | c) and | d) and BeF2 |

1. The geometry of XeO2F2 is

|  |  |  |  |
| --- | --- | --- | --- |
| a) plane triangular | b) see – saw | c) square planer | d) tetrahedral |

1. The Xe atom in XeOF4 involves the hybridization

|  |  |  |  |
| --- | --- | --- | --- |
| a) sp3 | b) sp3d | c) sp3d2 | d) sp3d2 |

1. The hybridization of P in is same as in

|  |  |  |  |
| --- | --- | --- | --- |
| a) I in | b) S in SO3 | c) N in N | d) S in |

1. Which of the following statement is correct?

a) Polarization of an anion is maximum by high charged cation

b) Small sized cation minimizes the polarization

c) A small anion brings about a large degree of polarization

d) A large anion undergoes a small degree of polarization

1. The shape of CO2 molecule is similar to

|  |  |  |  |
| --- | --- | --- | --- |
| a) H2O | b) BeF2 | c) SO2 | d) none of these |

1. Which of the following have identical bond order:

(i) CN- (ii) (iii) NO+ (iv) CN+

|  |  |  |  |
| --- | --- | --- | --- |
| a) (i) and (iii) | b) (ii) and (iv) | c) (i) and (iv) | d) (ii) and (iii) |

1. Which of the following has highest ionic character?

|  |  |  |  |
| --- | --- | --- | --- |
| a) MgCl2 | b) CaCl2 | c) BaCl2 | d) BeCl2 |

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**Answers**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. b | 2. c | 3. a | 4. d | 5. b | 6. d | 7. c | 8. a | 9. d |
| 10. d | 11. b | 12. a | 13. c | 14. d | 15. c | 16. a | 17. a | 18. d |
| 19. b | 20. a | 21. c | 22. b | 23. c | 24. c | 25. c | 26. b | 27. d |
| 28. c | 29. a | 30. c | 31. d | 32. a | 33. b | 34. c | 35. c | 36. a |
| 37. c | 38. a | 39. d | 40. b | 41. c | 42. b | 43. b | 44. b | 45. a |
| 46. a | 47. c | 48. b | 49. d | 50. c | 51. b | 52. c | 53. a | 54. b |
| 55. b | 56. a | 57. d | 58. a | 59. b | 60. c | 61. c | 62. b | 63. a |
| 64. a | 65. d | 66. d | 67. d | 68. b | 69. a | 70. c | 71. a | 72. a |
| 73. b | 74. c | 75. b | 76. c | 77. d | 78. a | 79. b | 80. a | 81. c |

**More Than One Option**

1. PCl3 and PCl5 both exist but only PH3 exists while PH5 does not exist. This is because

a) H is less electronegative than P

b) the activation energy for the formation of PH5 is very high

c) PH5 immediately decomposes to PH3 and H2 because its equilibrium constant for the decomposition is very high

d) An element is able to utilize its d- orbitals for bonding only with elements which are more electronegative than it

1. Which of the following molecule or ion is not linear?

|  |  |  |  |
| --- | --- | --- | --- |
| a) BeCl2 | b) | c) CS2 | d) |

1. Which of the following is non – polar but contains polar bonds?

|  |  |  |  |
| --- | --- | --- | --- |
| a) HCl | b) H2O | c) SO3 | d) CO2 |

1. The 90˚(approx.) angles between bond pair – bond pair of electrons exists in

|  |  |  |  |
| --- | --- | --- | --- |
| a) CIF3 | b) | c) BrF3 | d) |

1. The shape of is

|  |  |
| --- | --- |
| a) square planer | b) square pyramidal |
| c) tetrahedral | d) triangular bipyramidal |

1. Which of the following species is paramagnetic

|  |  |  |  |
| --- | --- | --- | --- |
| a) CN – | b) NO | c) | d) O2 |

1. Shape of is

|  |  |
| --- | --- |
| a) tetrahedral | b) triangular bipyramidal |
| c) distorted trigonal bipyramidal | d) Linear |

1. The stability of O2 , , and in their respective dissociation reaction is in the order

|  |  |
| --- | --- |
| a) < O2 < < | b) < < O2 < |
| c) < < O2 < | d) > O2 > > |

1. Which among the following has bond order zero

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) Ar | c) | d) |

1. In which species the hybrid state of central atom is sp3d:

|  |  |  |  |
| --- | --- | --- | --- |
| a) | b) SF4 | c) PF5 | d) IF5 |

1. KF combines with HF to form KHF2. The compound contains the species

|  |  |  |  |
| --- | --- | --- | --- |
| a) K+ , F- & H+ | b) K+ , F- & HF | c) K+ & [ H ] | d) 1 cation & 1 anion |

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1. Among the following species, identify the isostructural pairs

NF3 , , BF3 , H3O+ , ,

|  |  |
| --- | --- |
| a) [ NF3 , ] and [ BF3 , H3O+ ] | b) [ , ] and [ , BF3 ] |
| c) [ NF3 , H3O+ ] and [ , BF3 ] | d) [ NF3 , H3O+ ] and [ , ] |

1. Which of the following molecule involves sp2 hybridization?

|  |  |  |  |
| --- | --- | --- | --- |
| a) CO2 | b) SO2 | c) N2O | d) SO3 |

1. Which of the following species has unpaired electrons

|  |  |  |  |
| --- | --- | --- | --- |
| a) N2 | b) F2 | c) | d) |

1. NH3 and BF3 form adduct readily

|  |  |
| --- | --- |
| a) Hybridization of NH3 remains same | b) through co –ordination bond between B and N |
| c) Hybridization of NH3 changes from sp3 to sp2 | d) Hybridization of B changes from sp2 to sp3 |

1. Column I Column II

|  |  |
| --- | --- |
| (i) SO2 | (a) sp2 , angular |
| (ii) SO3 | (b) sp3 , tetrahedral |
| (iii) PCl5 | (c) sp3d , triangular bipyramidal |
| (iv) | (d) sp3d , see – saw |
|  | (e) sp2 , triangular planer |

1. Column I Column II

|  |  |
| --- | --- |
| (i) CH4 | (a) Tetrahedral |
| (ii) NH3 | (b) Hydrogen bonding |
| (iii) HCl | (c) See – saw |
| (iv) SF4 | (d) Linear |
|  | (e) Triangular planer |

1. Column I Column II

|  |  |
| --- | --- |
| (i) N2 | (a) zero dipole moment with non- polar bonds |
| (ii) CO2 | (b) zero dipole moment with polar bonds |
| (iii) H2O | (c) tetrahedral |
| (iv) XeF4 | (d) square planar |
|  | (e) angular |

**Answers**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. a , d | 2. d | 3. c , d | 4. a , c | 5. c |
| 6. b , d | 7. c , d | 8. b , d | 9. a , b | 10. b , c |
| 11. c , d | 12. b , c , d | 13. b , d | 14. c , d | 15. a , b , d |

16. (i) – (a) ; (ii) – (e) ; (iii) – (c) ; (iv) – (d) 17. (i) – (a) ; (ii) – (b) ; (iii) – (d) ; (iv) – (c)

18. (i) – (a) ; (ii) – (b) ; (iii) – (e) ; (iv) – (d)

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