



CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

CHEMICAL BONDING

PROBLEMS

1. Write the Lewis dot symbol for Si and P.



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2. Why do atoms combine?



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3. What is chemical bond? When is it formed?



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4. Explain the formula of calcium oxide in terms of the configurations of calcium and oxygen



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5. Why do we consider KCl as an ionic solid ?



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6. Will LiCl dissolve in organic solvents like alcohol or ether, etc. ? Why or why not?



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10. Sodium carbonate is highly soluble in water, but magnesium carbonate is less soluble. Why?



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11. Ionic substance AB crystallises in rock salt structure. If all ions at the centre of the faces and at the body centre are removed, what should be the percentage of number of ions remained?



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12. Will the formal charges of an atom in a molecule remain the same?
Why or why not?



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13. What kind of a bond is formed when the orbitals of two atoms A and B undergo (i) s-s overlap (ii) s-p overlap?



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15. Calculate formal charge of the central atom in ozone molecule.



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16. Which d-orbital is involved in dsp hybridisation?



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17. What are the types of bonds present in hydrogen cyanide molecule?



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18. Discuss the hybridisation of carbon atoms in allene C_3H_4 and show the π orbital overlaps



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19. Predict the shapes of the following species and the type of hybrid orbitals on the central atom.



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22. Calculate the ratio of number of pure and hybrid orbitals used for bonding in an acetylene molecule



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27. Considering X-axis as the internuclear axis, which out of the following atomic orbitals will form a sigma bond ? a) $1s$ and $1s$ b) $1s$ and $2p_x$ c) $2p_y$ and $2p_y$ d) $1s$ and $2s$



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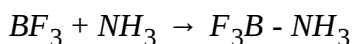
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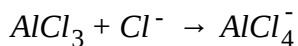
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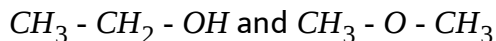
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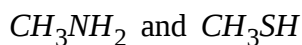
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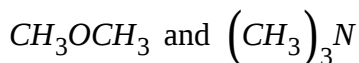
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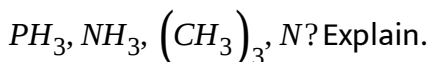
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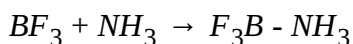
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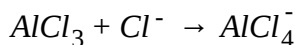
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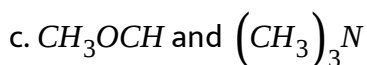
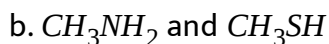
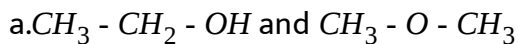
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SUBJECTIVE EXERCISE - 1 (LONG ANSWER QUESTIONS)

1. Explain the formation of ionic bond in terms of atomic orbitals. Discuss the factors that favour the ionic bond formation.



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2. Discuss Born- Haber cycle with reference to sodium chloride.



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3. Draw Lewis structures for the following molecules and ions.



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4. Write a note on Fajan's rules.



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5. Calculate theoretically the lattice energy of an ionic solid.



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SUBJECTIVE EXERCISE - 1 (SHORT ANSWER QUESTIONS)

1. Define "lattice energy" of crystals. Calculate the number of sodium ions and chloride ions per unit cell of NaCl.



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2. Which of the two ions, Ca^{2+} and Zn^{2+} is more stable? Why? For ionic substances which is the proper term to use 'Formula weight' or 'Molecular weight'?



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3. Explain the properties of ionic compounds.



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SUBJECTIVE EXERCISE - 1 (VERY SHORT ANSWER QUESTIONS)

1. Why argon is not represented by Ar_2 ?



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2. What is the valency of an element with $Z=15$?



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3. How many ion pairs present per each unit cell of NaCl ?



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4. Why ionic compounds are bad conductors of electricity in crystalline state but good conductors of electricity in aqueous solutions ?



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SUBJECTIVE EXERCISE - 2 (LONG ANSWER QUESTIONS)

1. Discuss hybridization with suitable examples



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2. Write on VSEPR theory with illustrative examples.



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3. How does Pauling - Slater's valence bond theory explain the bond directions and molecular geometries?



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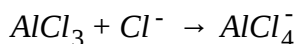
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1. Discuss the formation of $[BF_3 \cdot NH_3]$. Is there any change in the hybridization of B and N in its formation?



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2. What is the change in hybridisation (if any) of the Al atom in the following reaction.



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3. Explain the shape and the bond angle in $BeCl_2$ in terms of VBT



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4. Eventhough, nitrogen in ammonia is in sp^3 hybridization, the bond angle is not $109^\circ 28'$, Explain.



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5. Explain the formation of α -bonds in molecules with atleast two examples



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6. What is a π bond? Explain with two examples.



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7. Draw a similarity between the bonds in H_3O^+ and those in CH_4



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8. Write the order or bond strengths of various bonds formed from 's' and 'p' orbitals. When do they hybridize?



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9. Explain sp^3d^2 hybridization with an example.



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10. What are the guidelines to be followed to predict the formation of Molecular orbitals.



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SUBJECTIVE EXERCISE - 2 (VERY SHORT ANSWER QUESTIONS)

1. Write the MOED of N_2



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2. Predict the shape of a molecule with four bond pairs on the central atom



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3. Predict the shape of the molecule in which central atom has three bond pairs and one lone pair.



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4. Write the MOED of O_2 .



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5. Explain what is meant by localized orbitals.



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6. When does AB molecule become a covalent molecule? (A and B are atoms of elements).



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7. Correct the given structure
$$H = \overset{\overset{H}{|}}{C} - \overset{\overset{:O:}{|}}{C} \cdots \overset{\overset{\cdot\cdot}{|}}{O} - H$$



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8. What are the bond angles in H_2O and NH_3 molecules as per VBT?



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9. What is the magnetic nature of O_2 molecule as per VBT and MOT?



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10. Define electrovalency and covalency. Give one example for each.



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11. What is resonance? Write its importance.



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12. How do you account for the stability of ozone and benzene based on resonance?



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13. What are the main postulates of molecular orbital theory



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14. Discuss the paramagnetism of oxygen and nitric oxide.



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SUBJECTIVE EXERCISE - 3 (LONG ANSWER QUESTIONS)

1. Define and describe hydrogen bonding.



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2. Write an essay on co-ordinate covalent bond.



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SUBJECTIVE EXERCISE - 3 (SHORT ANSWER QUESTIONS)

1. Predict the reason(s) for the observation in boiling points



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2. Write the consequences of hydrogen bonding.



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SUBJECTIVE EXERCISE - 3 (VERY SHORT ANSWER QUESTIONS)

1. What types of bonds are present in NH_4Cl ? Write its structure.



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2. Define hydrogen bond. Is it weaker or stronger than vander Waals forces?



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3. Give reasons for the higher boiling point of H_2O than HF and NH_3



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4. Why o - Nitrophenol is more volatile than p - Nitrophenol.



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5. Why HCl cannot form hydrogen bond.



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6. Water is a liquid at room temperature, but not hydrogen sulphide.

Why?



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7. What are the types of bonds present in H_3O^+ and NH_4^+ ?



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8. Write any two properties of compounds with dative bond.



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9. What is bond length? Discuss different factors influencing bond length.



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10. Distinguish between bond enthalpy and dissociation enthalpy.



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11. Compare carbon-carbon bond lengths and bond energies by taking ethane, ethylene and acetylene as examples.



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12. What is bond angle? What are the different aspects influence bond angle?



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13. What are non-polar and polar covalent bonds? Give examples.



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14. What is dipole moment? How is it calculated?



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15. BF_3 is non-polar but NH_3 is polar. Why?



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16. Write the applications of dipole moment



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17. Dipole moment of HCl is 1.03D. Bond length is 1.27 \AA . Calculate the percentage ionic character of the HCl bond.



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18. A diatomic molecule has a dipole moment 1.2D. If the internuclear distance is 1 \AA , what is the fraction of charge exists on each atom?



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OBJECTIVE EXERCISE-1 (VALENCY AND IONIC BOND)

1. Valency of an element indicates

- A. combining power with hydrogen
- B. acidity
- C. electrons in the outermost orbit
- D. none of these

Answer: A



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2. Between atoms of a molecule, there exists

- A. only attractive forces
- B. only repulsive forces
- C. both attractive and repulsive forces

D. neither attractive nor repulsive forces

Answer: C



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3. When two atoms of chlorine combine to form one molecule of chlorine gas, the energy of the molecule is

- A. greater than that of separate atoms
- B. equal to that of separate atoms
- C. lower than that of separate atoms
- D. none of these

Answer: C



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4. Most energetic species among the following is



Answer: C



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5. The coordination numbers of cation and anion in NaCl crystal are respectively

A. 8,6

B. 8,8

C. 6,6

D. ,8 6

Answer: C



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6. Which of the following is easily formed?

- A. Calcium chloride
- B. Calcium bromide
- C. Potassium chloride
- D. Potassium bromide

Answer: C



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7. Among the compounds NaCl, KCl, RbCl and CsCl, the one with greatest ionic character is

A. NaCl

B. KCl

C. CsCl

D. RbCl

Answer: C



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8. Which of the following is favourable condition for the formation of ionic bond?

A. Small cation with small charge

B. Small anion with large charge

C. Large difference in the electronegativity

D. Small cation with high charge

Answer: C

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9. The total number of Na^+ ions present per unit cell of NaCl is

- A. 1
- B. 6
- C. 8
- D. 4

Answer: D

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10. Which of the following is not involved in Born-Haber cycle?

- A. Sublimation energy
- B. Ionisation potential
- C. Lattice energy

D. Electronegativity

Answer: D



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11. In a NaCl crystal, cations and anions are held together by

- A. Electrons
- B. Electrostatic forces
- C. Nuclear forces
- D. Covalent bonds

Answer: B



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12. Molten sodium chloride conducts electricity due to the presence of

- A. Free electrons
- B. Free ions
- C. Free molecules
- D. Free atoms

Answer: B



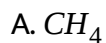
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13. Number of electrons transferred from one Al atom during bond formation in Aluminium fluoride

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

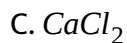
Answer: C

14. Which one of the following has an electrovalent linkage?



Answer: B

15. Which of the following is least ionic?



D. CaI_2

Answer: D



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16. The strongest ionic bond is present in

A. LiF

B. NaF

C. RbF

D. CsF

Answer: A



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17. Which is more stable among the following ?

A. Li^{+}

B. K^{+}

C. Cs^{+}

D. Na^{+}

Answer: C



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18. What is the crystal structure of NaCl ?

A. Body centered cubic

B. Face centered cubic

C. Tetrahedral

D. Octahedral

Answer: B



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19. Which of the following is a favourable factor for cation formation ?

- A. High electronegativity
- B. High electron affinity
- C. Low ionisation potential
- D. Smaller atomic size

Answer: C



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20. Which of the following is not correct

- A. low ionisation potential is a favourable condition for the formation of cation
- B. coordination number of Na in NaCl is 6

C. ionic bond is directional

D. ionic compounds have high melting points

Answer: C



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21. AB is an ionic solid. The ionic radii of A^+ and B^- are respectively r_c and r_a . Lattice energy of AB is proportional to

A. $\frac{r_c}{r_a}$

B. $(r_c + r_a)$

C. $\frac{r_a}{r_c}$

D. $\frac{1}{r_c + r_a}$

Answer: D



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22. (A): Ionic compounds tend to be non-volatile

(R) : Inter ionic forces in ionic compounds are weak

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: C



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23. (A): Among Ca^{2+} and Zn^{2+} ions, Ca^{2+} is more stable than Zn^{2+}

(R) : Both Ca^{2+} and Zn^{2+} ions are diamagnetic

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B



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24. (A): NaCl is bad conductor in the solid state

(R) : Na^+ and Cl^- ions are not free in the solid state

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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25. (A): Ionic compounds exhibit isomerism

(R) : Ionic bond is non directional bond

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: D



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1. The element that exhibits both electrovalency and covalency is

- A. Neon
- B. Sodium
- C. Barium
- D. Ehlorine

Answer: D



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2. The total number of electrons that take part in forming bonds in O_2 molecule according to V.B.T.

- A. 2
- B. 4
- C. 6
- D. 10

Answer: B



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

- A. unequally shared between the two
- B. transferred fully from one atom to another
- C. with identical spin
- D. equally shared between them

Answer: D



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4. Covalent compounds are generally soluble in

- A. polar solvents
- B. non-polar solvents
- C. concentrated acids
- D. all solvents

Answer: B



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5. Which of the following has directional character?

- A. ionic bond
- B. metallic bond
- C. covalent bond
- D. both covalent and ionic bonds

Answer: C



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6. Maximum number of covalent bonds by which two atoms can be bonded to each other

- A. Four
- B. Two
- C. Three
- D. No fixed number

Answer: C



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7. Which of the following substances has covalent bonding?

- A. Sodium chloride
- B. Solid neon
- C. Copper metal

D. Germanium

Answer: D



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8. The molecule that deviates from octet rule is



Answer: B



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9. Most important concept of valence bond theory is

- A. Overlap of atomic orbitals results in the bond
- B. Sharing of odd number of electrons for bonding
- C. Sharing of electrons follow the octet rule
- D. Transfer of electrons follow the octet rule.

Answer: A



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10. Two carbon atoms in which of the following have more number of shared electrons

- A. Benzene
- B. Acetylene
- C. Ethane
- D. Ethylene

Answer: B

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11. The total number of electrons that take part in forming bonds in a C_2H_4 molecule are

A. 12

B. 14

C. 6

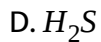
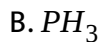
D. 10

Answer: A

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12. Which of the following molecules contain one lone pair of electrons on the central atom?

A. CH_4

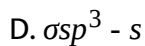
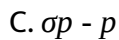
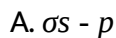


Answer: B



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13. The type of overlap present in the bonds of hydrogen sulphide molecule is



Answer: A



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14. Iodine monochloride molecule is formed by the overlap of

- A. s-s orbitals
- B. s-p orbitals
- C. p-p orbitals end to end
- D. P-p orbitals sideways

Answer: C



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15. In solid state Ar atoms are held together by

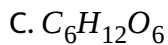
- A. Ionic bonds
- B. Hydrogen bonds
- C. vander Waal forces
- D. Hydrophobic forces

Answer: C



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16. Which of the following boils at higher temperature ?



Answer: D



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17. Anhydrous $AlCl_3$ is covalent while AlF_3 is ionic. This is justified by

A. Crystal structure

B. VB theory

C. Eajan's rules

D. Lattice energy

Answer: C



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18. Cl_4 is insoluble in water because

A. H_2O is non-polar

B. CCl_4 is non -polar

C. They do not form inter molecular H-bonding

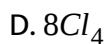
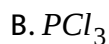
D. They do not form intra molecular H-bonding

Answer: B



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19. Which of the following molecule does not obey the octet rule and also has lone pair on the central atom.

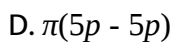
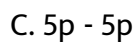
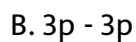
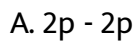


Answer: D



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20. Which of the following overlap is the strongest?



Answer: A



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21. The ion that is isoelectronic with CO



Answer: B



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22. Which is a covalent compound?



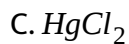


Answer: D



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23. Double bonds are present in



Answer: A



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24. Six electrons are mutually shared in



Answer: D



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25. Octet rule is not followed in



D. All the these

Answer: D



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26. Silicon has 4 electrons in the outermost orbit. In forming the bonds,

- A. It gains electrons
- B. It loses electrons
- C. It shares electrons
- D. None of the above

Answer: C



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27. The type of bonds present in ammonium chloride are

- A. Only ionic and dative

- B. Only covalent and electrovalent
- C. Only covalent and coordinate
- D. Ionic, covalent and coordinate

Answer: D



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28. PH_3 and BF_3 form an adduct readily because they form

- A. A coordinate bond
- B. A covalent bond
- C. An ionic bond
- D. A hydrogen bond

Answer: A



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29. Dative bond is present in the molecule of



Answer: C



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30. According to valence bond theory, water molecule has

A. Two dative bonds and bond angle 90°

B. Two covalent bonds and bond angle 90°

C. Two dative bonds and bond angle 104.5°

D. Two covalent bonds and bond angle 104.5°

Answer: B



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31. According to V.B. theory, the bonds in methane are formed due to the overlapping

A. $1\sigma s - s, 3\sigma s - p$

B. $1\sigma s - P, 3\sigma s - s$

C. $2\sigma s - s, 2\sigma s - p$

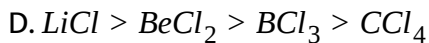
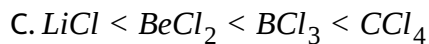
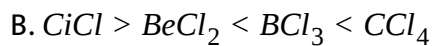
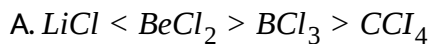
D. $4\sigma sp^3 - s$

Answer: A



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32. Among $LiCl$, $BeCl_2$, BCl_3 , and CCl_4 , the covalent bond character follows the order

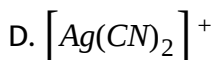
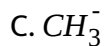
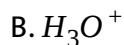


Answer: C



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33. Which of the following does not contain coordinate covalent bond?



Answer: C



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34. In ammonium ion the covalency of nitrogen is

A. 3

B. 4

C. 2

D. 5

Answer: B



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35. The directional nature of covalent bond was introduced by

A. VB theory

B. Kossel and Lewis theory

C. Hybridisation theory

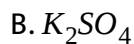
D. VSEPR theory

Answer: A



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



Answer: B



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1. Molecules with sp^2 hybridisation will have the following shape

- A. Linear
- B. Trigonal planar
- C. Tetrahedral
- D. Pyramidal

Answer: B



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2. The hybridization involved in acetylene is

- A. SP
- B. sp^3
- C. sp^3
- D. dsp^2

Answer: A



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3. The type of hybrid orbitals employed in the formation of SF_6 molecules is

A. sp^3d

B. sp^3

C. sp^3d^2

D. d^2sp^3

Answer: C



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4. Hybridization produces a set of orbitals which are

- A. Parallel
- B. Perpendicular
- C. Equivalent
- D. None of these

Answer: C



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5. The % of 'p' character in hybrid orbital of the central atom of water molecule

- A. 0.25
- B. 0.5
- C. 0.75
- D. 33.3 %

Answer: C

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6. Maximum number of planar atoms in SF_6 molecule

A. 5

B. 4

C. 6

D. 7

Answer: A

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7. Which hybridisation is found in NH_3 and H_2O ?

A. sp^3

B. dsp^2

C. sp

D. sp^2

Answer: A



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8. Octahedral shape is due to the hybridisation

A. sp^3d

B. sp^3d^2

C. sp^3

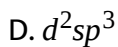
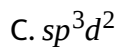
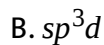
D. sp

Answer: B



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9. In the molecule of XeF_4 hybridisation of 'Xe' atom is

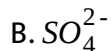
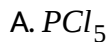


Answer: C



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10. Which of the following has pentagonal bipyramidal shape?

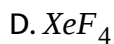
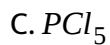
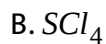


Answer: D



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11. The orientation of hybrid orbitals is tetrahedral in

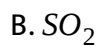
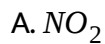


Answer: A



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12. Which one of the following is a linear molecule?



D. H_2S

Answer: C



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13. In BCl_3 molecule, the Cl-B-Cl bond angle is

A. 90°

B. 120°

C. $109^\circ 28'$

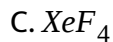
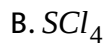
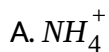
D. 180°

Answer: B



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14. Which of the following has a planar structure ?



Answer: C



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15. The shape of sulphate ion is

A. Tetrahedral

B. Square planar

C. Trigonal

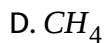
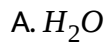
D. Trigonal planar

Answer: A



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16. The angle between two covalent bonds is minimum in



Answer: A



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17. The shape of ClO_3^- is

A. Linear

B. Angular

C. Tetrahedral

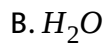
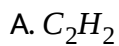
D. Pyramidal

Answer: D



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18. Angular molecule among the following is

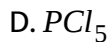


Answer: B



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19. Octahedral molecule among the following is

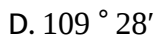
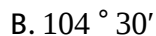


Answer: C



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20. Bond angle (H-O-H) in H_2O is



Answer: B



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21. In PCl_5 Bond angle in plane is

A. 90°

B. 120°

C. 180°

D. $109^\circ 28'$

Answer: B



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22. The orientation of electron pairs and the shape of molecule are different in

A. $BeCl_2$

B. H_2O

C. BCl_3

D. CCl_4

Answer: B



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23. Largest bond angle is present in

A. CH_4

B. C_2H_6

C. C_2H_4

D. C_2H_2

Answer: D



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24. A molecule AX_2 has two lone pairs over A. Its shape is

A. Tetrahedral

B. Pyramidal

C. Angular

D. Linear

Answer: C



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25. The geometry of H_3O^+ ion is

A. Planar

B. Triangular

C. Pyramidal

D. Tetrahedral

Answer: C



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26. The shape of AB_3E type molecule is

- A. Pyramidal
- B. Tetrahedral
- C. Angular
- D. Linear

Answer: A



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27. As the s-character of a hybrid orbital increases the bond angle

- A. Increases
- B. Decreases
- C. does not change

D. Becomes zero

Answer: A



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28. In the formation of SF_6 molecule, the sulphur atom is in

A. 1 st excited state

B. second excited state

C. third excited state

D. fourth excited state

Answer: B



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29. Regarding hybridisation the correct statement is

- A. Orbitals of different atoms hybridize
- B. The angle between any two hybrid orbitals is not the same
- C. Hybrid orbitals always form sigma bonds
- D. Only electrons undergo hybridisation but not orbitals.

Answer: C



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30. Which of the following is a correct pair?

- A. BeCl_2 linear
- B. NH_3 linear
- C. CO_2 , tetrahedral
- D. BF_3 , octahedral

Answer: A



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31. Which one of the following is the correct set with reference to molecular formula, hybridisation of central atom and shape of the molecule?

A. CO_2 , sp^2 , bent

B. H_2O , sp^2 bent

C. BeCl_2 , sp , linear

D. H_2O , sp^3 linear

Answer: C



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32. Which one of the following is a correct set ?

A. H_2O , sp^3 angular

B. H_2O , sp^2 linear

C. NH_4^+ dsp^2 , square planar

D. CH_4 , dsp^2 tetrahedral

Answer: A



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33. Which of the following is a linear molecule?

A. $BeCl_2$

B. H_2O

C. SO_2

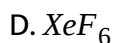
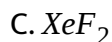
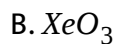
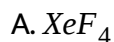
D. CH_4

Answer: A



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34. Which of the following has pyramidal shape?

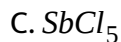


Answer: B



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35. In which of the following molecules, sigma bonds formed by the overlap of sp^3d and P orbitals are absent ?



Answer: D



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36. (A) I_3^- ion is linear. (R) It is not in sp hybridized state.

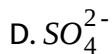
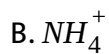
- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: B



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37. Which of the following is not tetrahedral?



Answer: C



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38. Which of the following has square pyramidal structure?



Answer: A



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LIST - 1

A) Diamond

B) Graphite

C) PCl_5

D) CO_2 gas

LIST - 2

1) sp^2

2) sp^3

3) sp^3d

4) sp

5) sp^3d^2

39.

The correct match is

A.

A	B	C	D
3	4	1	2

B.

A	B	C	D
2	1	3	4

C.

A	B	C	D
1	2	3	4

D.

A	B	C	D
2	3	1	2

Answer: B



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OBJECTIVE EXERCISE-1 (MOLECULAR ORBITAL THEORY)

1. Molecular orbital theory was proposed by

- A. Lewis
- B. Muliken
- C. Slater
- D. Pauling

Answer: B



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2. The para magnetic nature of oxygen is best explained by

- A. V.B.theory
- B. Hybridisation
- C. M.O.theory

D. VSEPR theory

Answer: C



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3. Bond order in He_2 species is

A. 0

B. 1

C. 2

D. 3

Answer: A



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4. The bond order in O_2^{2-} species is

A. 1

B. 2

C. 3

D. 4

Answer: A



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5. In O_2 molecule, the correct order of molecular orbitals is

A. $\pi 2p_y > \pi 2p_z$

B. $\pi 2p_y^* = \pi 2p_z$

C. $\sigma 2s < \sigma 2s^*$

D. $\sigma 2s^* > \sigma 2p_x^*$

Answer: C



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6. Fractional bond order is in

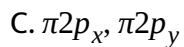
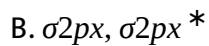
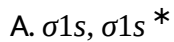


Answer: B



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7. Among the following degenerate orbitals are



D. $\pi 2py, \pi 2pz^*$

Answer: C



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8. Maximum number of electrons that can be present in any molecular orbital is

A. 3

B. 6

C. 8

D. 2

Answer: D



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9. While filling electrons in π_{2p_x} and π_{2p_y} , the electronic configuration rules that one to be followed is

- A. Pauli's exclusion principle
- B. Aufbau principle
- C. Both Pauli's and Hund's rule
- D. All the above

Answer: C



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10. Number of bonding electrons in N_2 molecule are

- A. 4
- B. 5
- C. 6
- D. 10

Answer: D



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11. Bond order is maximum among the following



Answer: A



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12. The shape of molecular orbital depends upon

A. Size of the molecule

- B. Size of the atoms involved
- C. Shape of the atomic orbital
- D. All the above

Answer: C



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13. Number of anti bonding electrons in O_2 molecule are

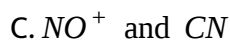
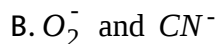
- A. 10
- B. 6
- C. 4
- D. 2

Answer: B



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14. Which of the following species have the same bond order?

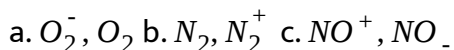


Answer: C



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15. In which pair, the stronger bond is found in the first species?



A. a only

B. b only

C. a and c only

D. b and c only

Answer: D



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16. The common features among the species CN^{-1} , CO and NO^{+} are

- A. bond order three and isoelectronic
- B. bond order three and weak field ligands
- C. bond order two and π electron acceptors
- D. isoelectronic and weak field ligands

Answer: A



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17. Which of the following species is not diamagnetic ?

- A. N_2



Answer: D



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18. Bond energy is maximum in



Answer: B



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19. The bond order

- A. Can have negative value
- B. Is any number other than zero
- C. Is any integer
- D. Can have any value including zero

Answer: D



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20. According to Molecular orbital theory, a molecule of H_2 has two electrons in

A. σ_{1s}

B. σ_{2s}^*

C. σ_{2s}

D. σ_{1s}^*

Answer: A



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21. Higher the bond order greater is the

A. Bond dissociation energy

B. Bond length

C. Paramagnetism

D. Ionic character

Answer: A



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22. Which of the following molecular orbital has the lowest energy for O_2 molecule?

A. σ_{2pz}

B. π_{2py}

C. π_{2pz}^*

D. σ_{2px}^*

Answer: A



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23. Molecular orbitals are

A. Monocentric

B. Bicentric

C. Polycentric

D. None

Answer: C



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24. Which of the following is paramagnetic with bond order 0.5



Answer: D



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OBJECTIVE EXERCISE-1 (HYDROGEN BOND)

1. Abnormal boiling point of a compound is due to

A. van der Waal's forces

B. Covalent bonding

C. Intermolecular hydrogen bonding

D. Intramolecular hydrogen bonding

Answer: C



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2. Which among the following compounds does not show hydrogen bonding?

A. Ammonia

B. Ethyl alcohol

C. Acetic acid

D. Diethyl ether

Answer: D



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3. In which of the following , the hydrogen bonding is strongest in the liquid phase?

A. HF

B. CH_4

C. HI

D. PH_3

Answer: A



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4. Water has a higher boiling point than the corresponding hydrides H_2S , H_2Se and H_2Te . This is because water has

A. Ionic bonds

B. Hydrogen bonds

C. Covalent bonds

D. Van der Waals' forces

Answer: B



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

A. liquid HCl

B. liquid NH_3

C. Water

D. Phenol

Answer: A



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6. Intramolecular hydrogen bond is present in

A. orthohydroxy benzaldehyde

B. parahydroxy benzaldehyde

C. ethyl alcohol

D. hydrogen fluoride

Answer: A



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7. Hydrogen bond is

A. A weak covalent bond

B. A weak electrostatic force

C. weak metallic force

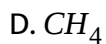
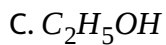
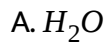
D. It is not a bond

Answer: B



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8. Inter molecular hydrogen bonding is absent in

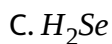
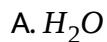


Answer: D



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9. Which among the following has the highest volatility ?



D. H_2Te

Answer: B



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10. Among the following, which has the highest boiling point ?

A. NH_3

B. PH_3

C. AsH_3

D. CH_4

Answer: A



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11. Intramolecular hydrogen bonding is present in

A. meta nitrophenol

B. salicylic acid

C. hydrogen chloride

D. benzophenone

Answer: B



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12. Which of the following has the lowest boiling point ?

A. CH_4

B. H_2O

C. HF

D. C_2H_5OH

Answer: A



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13. (A) : Parahydroxy benzaldehyde is more soluble in water than orthohydroxy benzaldehyde. (R) : Parahydroxy benzaldehyde and orthohydroxy benzaldehyde are position isomers.

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: B



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14. (A) : Water has more boiling point than that of hydrogen fluoride. (R): The molecular weight of H_2O is more than HF

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: C

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LIST - 1

A) NaCl

B) CH_4

C) NH_4^+

D) Cu metal

LIST - 2

1) Covalent bond

2) Ionic bond

3) Metallic bond

4) Covalent and dative bond

15.

The correct match is

A. a.

A	B	C	D
2	1	4	3

B. b.

A	B	C	D
2	4	1	3

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

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

Answer: A



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OBJECTIVE EXERCISE-1 (DIPOLEMENT)

1. The unit of dipolement is

A. Einstin

B. Dalton

C. Debye

D. Curie

Answer: C



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2. One Debye (D) equal to

A. 1×10^{-4} esu .cm

B. 1×10^{-18} esu .cm

C. 1×10^{-10} esu.cm

D. 1×10^{-16} esu .cm

Answer: B



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3. Carbon tetrachloride has no dipole moment because of

A. Its regular tetrahedral structure

B. Its planar structure

C. Similar sizes of carbon and chlorine atoms

D. similar electron affinities of carbon and chlorine

Answer: A



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4. The unequal sharing of the bond pair of electrons between two atoms in a molecule causes

- A. Dipole
- B. radical formation
- C. Covalent bond
- D. Decomposition of molecule

Answer: C



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5. Molecule with zero dipole moment is



Answer: C



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6. The dipole moment of CO_2 is zero, because its bond angle is

A. 120°

B. 180°

C. 130°

D. 90°

Answer: B



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7. S.I. unit for dipole moment is

- A. e.s.u-cm
- B. Coulomb-cm
- C. coulomb-metre
- D. e.s.u - metre

Answer: C



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8. Molecule with zero dipole moment is

- A. BCl_3
- B. $BeCl_2$
- C. CCl_4

D. All of these

Answer: D



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9. Which of the following has highest dipole moment?

A. BF_3

B. CO_2

C. CCl_4

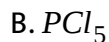
D. NF_3

Answer: D



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10. Molecule with dipole moment among the following



Answer: B



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11. (A): The dipole moment value of NH_3 is greater than zero (R) : In NH_3 bond angle is approximately 104°

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C



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OBJECTIVE EXERCISE-1 (BOND CHARACTERS)

1. The O-H bond length in H_2O is $x A^\circ$. The o-H bond length in H_2O_2 is

A. $< x A^\circ$

B. $x A^\circ$

C. $> A^\circ$

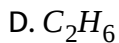
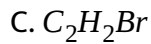
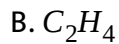
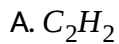
D. $2x$

Answer: B



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2. The C-C bond distance is largest in

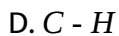
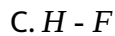
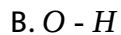


Answer: D



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3. Bond polarity is least in



Answer: D



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4. Bond energy is highest in the molecules

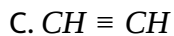
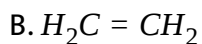
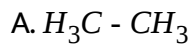


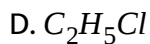
Answer: D



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5. Bond energy of C,C bond is highest in



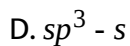
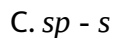
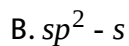
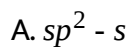


Answer: C



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6. Bond energy is highest in the overlapping



Answer: C



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7. Bond energy is least in the following

A. HF

B. HCl

C. HBr

D. HI

Answer: D



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8. (A) : Dinitrogen is chemically unreactive at ordinary temperature and is very stable (R) : The bond dissociation energy is more in N_2 molecule

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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9. Bond length of H_2 is 0.074nm , Bond length of Cl_2 is 1.98\AA . Bond length of HCl is

A. 2.72\AA

B. 136pm

C. 1.027nm

D. 0.136\AA

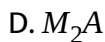
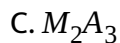
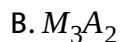
Answer: B



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OBJECTIVE EXERCISE-2A (IONIC BOND)

1. The charge on a cation 'M' is +2 and anion 'A' is -3. The compound formed has the formula

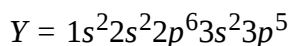
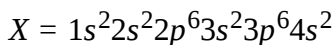


Answer: B



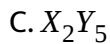
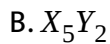
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2. Two elements 'X' and 'Y' have the following configuration



The compound formed by the combination of 'X' and 'Y' will be



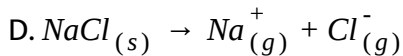
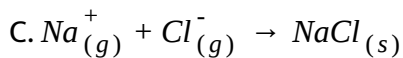
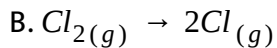
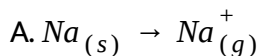


Answer: A



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3. Which of the following reaction involves the liberation of energy?

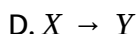
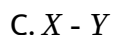
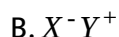
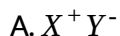


Answer: C



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4. An element 'X' is strongly electropositive and an element 'Y' is strongly electronegative and both are univalent. The compound formed would be

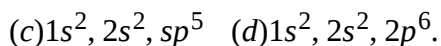
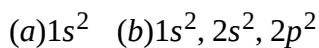


Answer: A



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5. The electronic structure of four elements a,b,c and d are



The tendency to form electrovalent bond is greatest in

A. a

B. b

C. c

D. d

Answer: C



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6. An atom of an element 'A' has three electrons in its outermost shell and that of 'B' has six electrons in the outer most shell. The formula of the compound formed between these two elements is

A. A_3B_4

B. A_2B_3

C. A_3B_2

D. A_2B

Answer: B

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7. If Na^+ ion is larger than Mg^{2+} ion and S^{2-} ion is larger than Cl^- ion, which of the following will be least soluble in water?

A. NaCl

B. Na_2S

C. MgCl_2

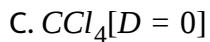
D. MgS

Answer: D

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8. In which of the following solvents should KCl be soluble at 25°C ? (D = Dielectric constant value)

A. C_6H_6 [D = 0]



Answer: D



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9. The following has more size



Answer: D



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10. The mass of one unit cell of NaCl is

- A. 234amu
- B. 234gm
- C. 58.5amu
- D. 58.5gm

Answer: A



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11. A, B and C are atoms of elements with atomic number Z , $Z+1$ and $Z+2$ respectively. If 'B' has octet configuration, the bond formed between 'A' and C predominantly is

- A. Covalent bond
- B. Tonic bond
- C. Dative bond

D. Hydrogen bond

Answer: B



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12. Lattice energy of NaCl is 'X'. If the ionic size of A^{+2} is equal to that of Na^{+} and B^{-2} is equal to Cl^{-} , then lattice energy associated with the crystal AB is

A. X

B. 2X

C. 4X

D. 8X

Answer: C



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13. The number of unit cells present in 1 mole of NaCl crystal is

A. 6.023×10^{23}

B. 1.5×10^{23}

C. 4

D. 1

Answer: B



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14. The order of relative ease of formation of various ions is

A. $F^- > O^{-2} > N^{-3}$

B. $N^{-3} > O^{-2} > F^-$

C. $O^{-2} > N^{-3} > F^-$

D. $F^- > N^{-3} > O^{-2}$

Answer: A



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15. The incorrect statement regarding the formation of ionic bond

- A. It involves electrostatic attraction
- B. It is a redox process
- C. It is an exothermic process
- D. It involves the absorption of energy

Answer: D



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16. What is the total number of ions present in one unit cell of sodium chloride lattice ?

A. 2

B. 6

C. 12

D. 8

Answer: D



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17. Born - Haber cycle is used to determine

A. Electron affinity

B. Lattice energy

C. Crystal lattice energy

D. All the above

Answer: D



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18. (A) : Na_2SO_4 is more soluble in water while BaSO_4 , is less soluble (R) :

Lattice energy of Na_2SO_4 is greater than that of BaSO_4

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: C



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OBJECTIVE EXERCISE-2A (COVALENT AND DATIVE BOND)

1. The element that exhibits neither electrovalency nor covalency is

- A. Neon
- B. Sodium
- C. Barium
- D. Chlorine

Answer: A



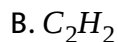
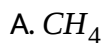
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2. The attraction that non-polar molecules have for each other is primarily caused by

- A. van der Waal's forces
- B. Difference in electronegativities
- C. Hydrogen bonding
- D. High ionisation energy

Answer: A

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



Answer: C

4. Which of the following ion has maximum polarising power



D. Ca^{+2}

Answer: B



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5. The bond between chlorine and bromine in BrCl is

A. ionic

B. non-polar

C. polar with negative end on Br

D. polar with negative end on Cl

Answer: D



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6. Oxygen cannot exhibit tetravalency and hexavalency like sulphur. This is because

- A. Oxygen has two unpaired electrons
- B. Oxygen can form double bond
- C. Oxygen lacks valence d-orbitals
- D. Oxygen has only 2 electrons in valence shell

Answer: C



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7. The covalency of nitrogen in HNO_2 is

- A. 0
- B. 2
- C. 3
- D. 5

Answer: C



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8. van der Waals forces are maximum in the following substance

A. HBr

B. LiBr

C. LiCl

D. AgBr

Answer: D



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9. An aqueous solution of silver nitrate gives a white precipitate with

A. C_2H_5Cl

B. CHCl_3

C. HCl

D. None of the above

Answer: C



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10. Which of the following is very much volatile ?

A. Diamond

B. Sodium chloride

C. Calcium

D. Dry ice

Answer: D



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11. Which of the following is truly covalent?



Answer: D



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12. Which of the following is covalent?



Answer: A



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13. If the electronegativity of two atoms is low, then expected bond between the elements is

- A. Ionic Bond
- B. Covalent Bond
- C. Dative bond
- D. Metallic Bond

Answer: D



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14. Direct overlap leads

- A. σ bond
- B. π bond
- C. both σ & π Bonds
- D. Neither σ nor π bond

Answer: A



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15. The bonds present in N_2O_5 are

- A. Ionic
- B. Covalent
- C. Ionic and covalent
- D. Covalent and dative

Answer: D



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16. In which type of bond formation, can a proton participate?

A. Hydrogen bond

B. Electrovalent

C. Dative

D. Covalent

Answer: C



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17. The bonds present in $\left[Cu(NH_3)_4 \right] SO_4$ between copper and ammonia are

A. ionic

B. covalent

C. co-ordinate

D. hydrogen

Answer: C



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18. The types of bonds present in $CuSO_{4.5}H_2O$ are

A. electrovalent and covalent

B. electrovalent, covalent, co-ordinate and hydrogen bond

C. covalent and co-ordinate covalent

D. electrovalent

Answer: B



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19. (A): BeF_2 is predominantly a covalent compound. (R) : Electronegativity difference between Be and F is too small

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: C



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20. (A) : SiF_4 has octet configuration, but acts as an electron pair acceptor (R): Central atom of Si has vacant d-orbitals in its valence shell

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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OBJECTIVE EXERCISE-2A (HYBRIDISATION AND VSEPR THEORY)

1. Increasing order of size of hybrid orbitals is

A. sp , sp^2 , sp^3

B. sp^3 , sp^2 , sp

C. sp^2 , sp^3 , sp

D. sp^2 , sp , sp^3

Answer: A



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2. The type of hybridisation present on "S" in SO_2 and SO_3 molecules respectively

A. sp, sp^2

B. sp^2, sp^2

C. sp, sp^3

D. sp^2, sp^3

Answer: B



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3. The hybridisation of Ag in the complex $\left[Ag(NH_3)_2\right]^+$ is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: A



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4. Atomic number of the central atom in MCl_2 is 50. The shape of gaseous MCl_2 is given as

A. $Cl - M \cdot \cdot - Cl$

$\cdot \cdot \pm$
 $\cdot \cdot$

B. $Cl - M - Cl$

$\cdot \cdot$

C. $Cl - M \cdot \cdot - Cl$

$\cdot \cdot$

D. $Cl - ()M - Cl$

Answer: D



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5. An element M reacts with chlorine to form a compound X. The bond angle in X is 120° . What is M?

A. Be

B. B

C. Mg

D. N

Answer: B



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6. When the hybridisation state of carbon atom changes from sp^3 to sp^2 and finally to sp , the angle between the hybrid orbitals

A. Decreases gradually

- B. Decreases considerably
- C. No change
- D. Increases progressively

Answer: D



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7. Hybridisation of one s and one p orbitals form

- A. Two mutually perpendicular orbitals
- B. Two orbitals at 180°
- C. Four orbitals directed tetrahedrally
- D. Three orbitals in plane

Answer: B



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8. Which orbital is used by oxygen atom to form a σ bond with other oxygen atom in O_2 molecule?

- A. pure p-orbital
- B. sp-hybrid orbital
- C. sp^2 -hybrid orbital
- D. sp^3 -hybrid orbital

Answer: A



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9. The hybrid state of carbon in acetylene is the same as that of carbon in

- A. Benzene
- B. Carbon dioxide
- C. Graphite
- D. Ethylene

Answer: B



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10. Regarding hybridisation which is incorrect?

A. BF_3 , C_2H_4 , C_6H_6 involve sp^2 hybridisation

B. BeF_2 , C_2H_2 , CO_2 involve sp hybridisation

C. NH_3 , H_2O , CCl_4 involve sp^3 hybridisation

D. CH_4 , C_2H_4 , C_2H_2 involve sp^2 hybridisation

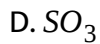
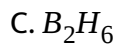
Answer: D



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11. sp^2 Hybrid orbitals are not present in

A. SO_2

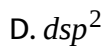


Answer: C



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12. Which hybridization is found in $HClO_4$ and $HClO_3$?



Answer: A



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13. The ratio of pure orbitals to hybridized orbitals in ethylene is

A. 2:3

B. 3:1

C. 1:1

D. 1:3

Answer: C



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14. The ratio of hybrid and unhybrid orbitals involved in the bonding of a benzene molecule is

A. 3:2

B. 1:1

C. 3:1

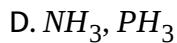
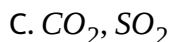
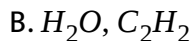
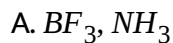
D. 1:3

Answer: A



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15. The pair having similar geometry is

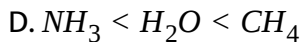
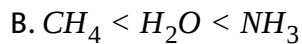


Answer: D



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16. The correct order of magnitude of bond angles among the compounds CH_4 , NH_3 and H_2O is

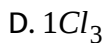
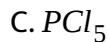
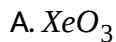


Answer: A



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17. The molecule with maximum number of lone pairs on central atom is

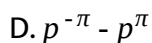
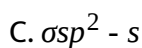
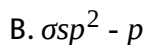
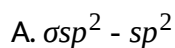


Answer: D



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18. The type of overlapping not observed in the formation of ethylene molecule is



Answer: B



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19. The hybrid orbitals have bond angle of $109^{\circ}28'$. The ratio of percentage of 's' and 'p' characters is



C. 1:3

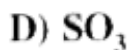
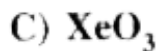
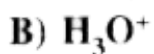
D. 2:3

Answer: C



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LIST - 1



LIST - 2

1) sp^3 hybridisation, two lone pair

2) sp^2 hybridisation, one lone pair

3) sp^3 hybridisation, no lone pair

4) sp^3 hybridisation, one lone pair

5) sp^2 hybridisation, no lone pair

20.

The correct match is

A B C D

A. 1 2 4 5

A B C D

B. 2 2 3 5

A B C D

C. 3 4 4 5

A B C D

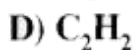
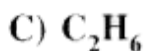
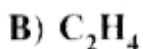
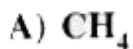
D. 4 4 3 5

Answer: C



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LIST - 1



LIST - 2

1) $\text{sp}^2\text{-sp}^2$ overlap, $\text{sp}^2\text{-s}$ overlap

2) sp-sp overlap, sp-s overlap

3) $\text{sp}^3\text{-s}$ overlap only

4) $\text{sp}^3\text{-sp}^3$ overlap, $\text{sp}^3\text{-sp}^2$ overlap

5) $\text{sp}^3\text{-sp}^3$ overlap, $\text{sp}^3\text{-s}$ overlap

21.

The correct match is

A B C D

A. 5 2 1 3

A B C D

B. 3 5 1 2

A B C D

C. 3 4 1 2

A B C D

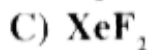
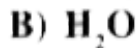
D. 3 1 5 2

Answer: D



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List I (Molecule



**List II (No. of l.p.
on central atom)**

I) Two

II) Three

III) Zero

IV) Four

V) One

22.

The correct match is

A.

A	B	C	D
V	I	III	I

B.

A	B	C	D
III	I	II	V

C.

A	B	C	D
V	I	II	III

D.

A	B	C	D
I	V	III	IV

Answer: C



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

A. Be_2 is not a stable molecule

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

C. Bond strength of N_2 is maximum amongst the homonuclear diatomic molecules

D. The order of energies of molecular orbitals in F_2 molecule is

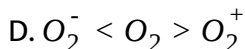
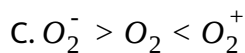
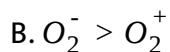
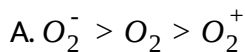
$$\begin{aligned} E(\sigma 2s) &< E(\sigma^* 2s) < E(\pi 2p_x) \\ &= E(\pi 2p_y) < E(\sigma 2p_z) < E(\pi^* 2p_x) \\ &= E(\pi^* 2p_y) < E(\sigma^* 2p_z) \end{aligned}$$

Answer: D



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2. Which of the following orders regarding the bond order is correct?

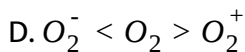
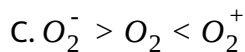
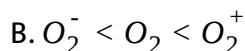
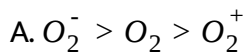


Answer: B



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3. Which of the following orders regarding the bond length is correct?



Answer: A



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4. The molecule electronic configuration of B_2 is

A. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p)_x^1(\pi p)_y^1$

B. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p)_x^2$

C. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p)^2$

D. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p)^1(\pi p)^1$

Answer: A



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5. When N_2 goes to N_2^+ , then N-N bond distanceand when O_2 goes to O_2^+ the O-O bond distance.....

A. increases, decreases

B. decreases, increases

C. increases, increases

D. decreases, decreases

Answer: A



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6. The wave function of a molecular orbital formed by reinforce of wave functions of Ψ_A and Ψ_B of atomic orbital A and B is represented as

A. $\phi_A + \phi_B$

B. $\phi_A - \phi_B$

C. $\phi_A \pm \phi_B$

D. $2\phi_A + \phi_B$

Answer: A



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7. The wavelength of the wave function of a bonding molecular orbital formed by LCAO is

- A. Equal to the wave function of atomic orbital
- B. Less than the wave function of atomic orbital
- C. Greater than the wave function of atomic orbital
- D. Double the wave function of atomic orbital

Answer: B



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8. The molecular orbital electronic configuration is $(\sigma_{1s})^2, (\sigma_{1s}^*)^1$. It corresponding to

- A. He_2
- B. He_2^+
- C. H_2^-

D. both 2 & 3

Answer: D



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9. A bonding molecular orbital is produced by

- A. Destructive interference of wave functions
- B. Constructive interference of wave functions
- C. Pairing of electrons with opposite spins
- D. Combination of +ve and -ve wave functions

Answer: B



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10. π_{2px}^* differs from π_{2py}^* molecular orbital in which of the following

A. Number of nodal planes

B. Energy

C. Symmetry

D. Shape

Answer: C



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11. The bond order of individual carbon bonds in benzene is

A. one

B. two

C. Between one and two

D. One and two alternately

Answer: C



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12. In the formation of a homo diatomic neutral molecule, if N atomic orbitals combine, then the total number of bonding molecular orbital formed is

A. $2N$

B. N

C. $N/2$

D. $N/4$

Answer: C



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13. In an anti bonding molecular orbital, electron density is minimum

A. around one atom of the molecule

B. between two nuclei

C. at a point away from nuclei of the molecule

D. at no place

Answer: B



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14. The correct order of the energy of molecular orbitals in a molecules having four electrons

A. $\sigma_{2s}^* > \sigma_{2pz} > \pi_{2px}$

B. $\sigma_{2s}^* < \pi_{2p} < \sigma_{2pz}$

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

D. $\sigma_{2pz} < \sigma_{2s}^* < \pi_{2px}$

Answer: B



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15. Maximum number of hydroge bonds that one water molecle is capable of forming is

A. 1

B. 2

C. 3

D. 4

Answer: D



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16. Which of the following compounds has hydrogen bonding?

A. HCl

B. C_2H

C. RCH_2NHCH_3

D. RCH_2CHO

Answer: C



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17. Acetic acid exist as a dimer in benzene due to

- A. Condensation reaction
- B. Hydrogen bonding
- C. Presence of phenyl group
- D. Presence of hydrogen atom at α -carbon

Answer: B



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18. Hydrogen bond may be formed between

- A. Two hydrogen atoms

- B. Hydrogen atom and electropositive atom
- C. H-atom and electronegative atom with small size
- D. H-atom and electronegative atom with larger size

Answer: C



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19. Order of intermolecular attractive forces

- A. Water > Alcohol > Ether
- B. Ether > Alcohol > Water
- C. Alcohol > Water > Ether
- D. Ether > Water > Alcohol

Answer: B



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20. Which of the following hydrogen bonds is relatively weaker?

A. N.....H-N

B. F.....H-F

C. N.....H-O

D. O.....H-O

Answer: A



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21. Boiling point is highest for

A. HF

B. H_2O

C. NH_3

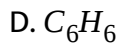
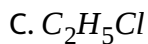
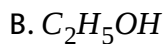
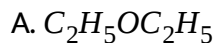
D. CH_4

Answer: B



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22. Which of the following is soluble in water?



Answer: B



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23. Among the three isomers of nitro phenol, which is least soluble in water?

- A. ortho isomer
- B. para isomer
- C. meta isomer
- D. all are insoluble

Answer: A



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24. Strongest hydrogen bonds can be formed by

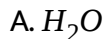
- A. HF
- B. H_2O
- C. NH_3
- D. HCl

Answer: A

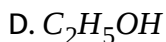


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25. Hydrogen bonds are present even in vapour state of



C. p-hydroxy benzaldehyde



Answer: B



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26. (A) : Water is a liquid whereas sulphur dioxide is a gas at room temp

(R) : Molecular mass of SO_2 is more than that of H_2O

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B



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27. (A): O-Hydroxy benzaldehyde is steam volatile but not P-hydroxy benzaldehyde (R) : Intramolecular hydrogen bond is present in orthohydroxy benzaldehyde but intermolecular hydrogen bond in parahydroxy benzaldehyde

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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28. Between any two of the following molecules, hydrogen bonding is not possible

- A. Two primary amine molecules
- B. Two secondary amine molecules
- C. Two tertiary amine molecules
- D. Two ammonia molecules

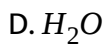
Answer: C



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OBJECTIVE EXERCISE-2A (DIPOLE MOMENT)

1. Which one of the following has $\mu = 0$

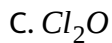
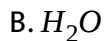
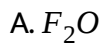


Answer: B



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2. Bent molecule having dipole moment among the following



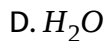
D. All of these

Answer: D



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3. Molecule with zero dipole moment is

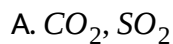


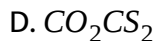
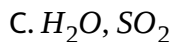
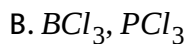
Answer: A



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4. In which of the following pairs, both molecules poses dipole moment?





Answer: C



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5. (A): The dipole moment value of NH_3 is greater than zero (R) : In NH_3 bond angle is approximately 104°

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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6. The dipole moment of HX molecule is 1.92 D and bond distance is 1.2 Å.

What is the percentage ionic character of HX ?

A. 10.66

B. 12.33

C. 16.66

D. 19.33

Answer: C

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OBJECTIVE EXERCISE-2A (BOND CHARACTERS)

1. Which of the following has least bond energy?

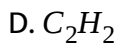
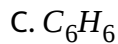
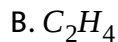
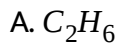


Answer: A



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2. Which of the following hydrocarbon has least C-C bond length?

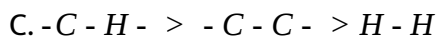
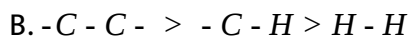
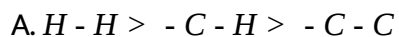


Answer: D



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3. The decreasing order of bond dissociation energies of C-C, C-H and H-H bonds is

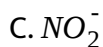
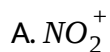


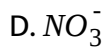
Answer: A



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4. Which of the following has largest bond angle?



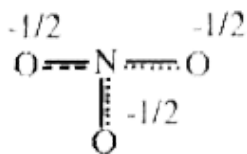


Answer: A

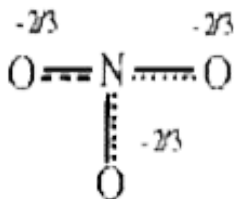


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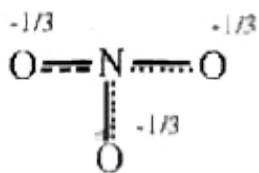
5. The resonance hybrid of nitrate ion is



A.

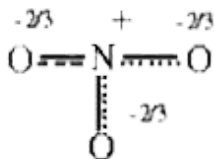


B.



C.

D.



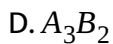
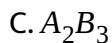
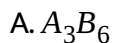
Answer: C



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OBJECTIVE EXERCISE-2B

1. An atom A belongs to IIA group and another atom B belongs to VA group. The formula of the compound formed is



Answer: C



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2. Many ionic crystals dissolve in water because

- A. Water is an amphoteric solvent
- B. Water is a high boiling liquid, which has no taste and no odour
- C. The process is accompanied by a positive heat of solution
- D. Water decreases the inter ionic attraction in the crystal lattice due to solvation.

Answer: D



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3. Ionic compounds like AgCl , CaF_2 , and BaSO_4 are insoluble in water. This is because,

- A. ionic compounds are insoluble in water

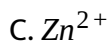
- B. the dielectric constant of water is very high
- C. water is not a good ionising solvent
- D. these molecules have high lattice energy than hydration energy.

Answer: D



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4. The ion that has pseudo-octet configuration



Answer: C



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5. Most of the ionic substances

- A. Are non-electrolytes in molten state
- B. Have directional character
- C. Are soluble in polar solvents like water
- D. Conduct electricity in solid state

Answer: C



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6. Which of the following is more ionic

- A. Si_2N_4
- B. AlN
- C. BN
- D. Ca_3N_2

Answer: D



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7. When the ratio of the radius of cation and anion in the crystal lattice is 0.53, the co-ordination number in the lattice is

- A. four
- B. six
- C. eight
- D. twelve

Answer: B



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8. Born Haber cycle is based on

- A. Law of conservation of mass
- B. Law of conservation of energy
- C. Fajans law
- D. hess law

Answer: B



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9. $Na_{(g)} + Cl_{(g)} \rightarrow + Cl^{-}_{(g)}$ This reaction is

- A. Exothermic
- B. Endothermic
- C. Neither exothermic nor endothermic
- D. None of these

Answer: B



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10. The ratio of anion radius to cation radius of a crystal is 10 : 9.3. Then, the coordination number of the cation in the crystal is

A. 2

B. 8

C. 6

D. 4

Answer: B



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11. $\text{NaCl}_{(aq)} + \text{AgNO}_{3(aq)} \rightarrow \text{AgCl} \downarrow + \text{NaNO}_{3(aq)}$ the change taking place here is

A. Loss of \bar{e}

B. gain of \bar{e}

C. Both loss and gain of \bar{e}

D. Rearrangement of Ions.

Answer: D



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12. Which of the following is false?

A. The bond formed between two non metallic elements is covalent bond

B. The bond formed between two inert gas elements is van der Waals bond

C. The bond formed between a metal and a non-metal is electrovalent bond

D. The bond formed between two metallic elements is an ionic bond

Answer: D



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13. The electronegativities of two elements are 1.0 and 3.5. Bond formed between them would be

- A. Electrovalent
- B. Polar covalent
- C. Pure covalent
- D. Metallic

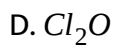
Answer: A



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14. Odd electron bond is not present in

- A. NO
- B. ClO_2



Answer: D



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15. The total number of valency electrons in PO_4^{3-} ion is

A. 32

B. 16

C. 28

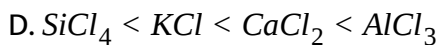
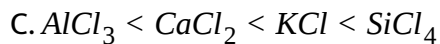
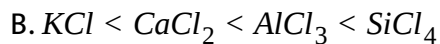
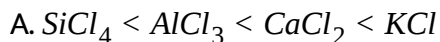
D. 30

Answer: A



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16. The correct order of increasing covalent character is

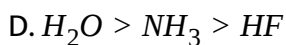
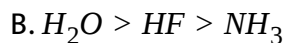
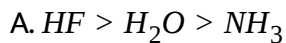


Answer: B



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17. The correct order of decreasing polarity is



Answer: A



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18. Number of sigma and pi bonds present in tetracyanoethylene are

A. 5σ and 9π

B. 9σ and 5π

C. 5σ and 8π

D. 9σ and 9π

Answer: D



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19. (A): Dinitrogen is chemically unreactive at ordinary temperature and is very stable (B): The bond dissociation energy is more in N_2 molecule

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: A



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20. Given electronic configurations of four elements E_1, E_2, E_3 and E_4 are respectively $1s^2, 1s^22s^22p^1, 1s^22s^22p^5$ and $1s^22s^22p^6$. The element which is capable of forming ionic as well as covalent bonds is

A. E_1

B. E_2

C. E_3

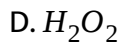
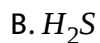
D. E_4

Answer: C



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21. Which of the following has both polar and non-polar covalent bonds ?



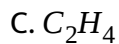
Answer: D



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22. Carbondioxide is isostructural with





Answer: D



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23. The number of σ bonds formed between two carbon atoms in C_2H_6 , C_2H_4 & C_2H_2 respectively are

A. 1, 1, 1

B. 1, 2, 3

C. 7, 6, 5

D. 3, 2, 1

Answer: A



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24. The bonds present in $K_4[Fe(CN)_6]$ are

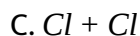
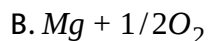
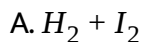
- A. All ionic
- B. All covalent
- C. Ionic and covalent
- D. Ionic, covalent and co-ordinate covalent

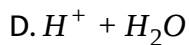
Answer: D



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25. Which of the following combination is best explained by the coordinate covalent bond?



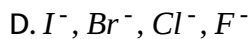
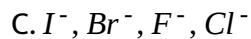
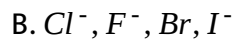
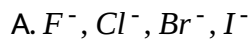


Answer: D



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26. The correct decreasing order of polarisability of halide ions is



Answer: D



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27. The bonds present in carbonmonoxide are

- A. covalent
- B. electrovalent
- C. dative
- D. covalent and dative

Answer: D



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28. In which of the following types of geometry, all the bond angles are not the same?

- A. Square planar
- B. Trigonal planar
- C. Trigonal bipyramidal
- D. Tetrahedral

Answer: C

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29. The type of hybrid orbitals used by chlorine atom in ClO_2^- is,

A. sp^3

B. sp^2

C. sp

D. dsp^2

Answer: A

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30. The shape of tri-iodide ion is

A. Angular

B. Linear

C. Planar

D. Tetrahedral

Answer: B



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31. The hybrid orbitals have a bond angle of 120° . The percentage of s-character in the hybrid orbital is nearly

A. 0.25

B. 0.33

C. 0.5

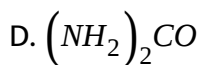
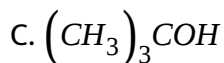
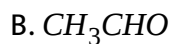
D. 0.66

Answer: B



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32. In which of the following, carbon uses sp^3 hybrid orbitals only for bonding ?

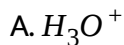


Answer: C

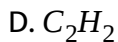


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33. dsp^2 hybridisation is present in



+



Answer: C



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34. The hybridisation of oxygen in OF_2 molecule is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: C



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35. The shape of PO_4^{3-} ion is

A. square planar

- B. tetrahedral
- C. Trigonal bipyramidal
- D. Hexagonal

Answer: B



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36. Which of the following structure is most expected for the molecule ' XeOF_4 '?

- A. Tetrahedral
- B. Square pyramidal
- C. Square planar
- D. Octahedral

Answer: B



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37. Maximum number of atoms present in one plane of ethylene molecule is

A. 4

B. 5

C. 6

D. 2

Answer: C



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38. At what ratio hybrid and unhybrid orbitals are taking part in bond formation in acetylene molecule ?

A. 1 : 1

B. 2 : 3

C. 3:4

D. 1:2

Answer: B



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39. An element 'M' reacts with chlorine to form the compound MCl_4 . In this compound no lone pairs are present and the bond angle is $109^\circ 28'$.

What is 'M'?

A. *Be*

B. *Si*

C. *N*

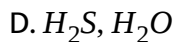
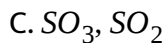
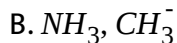
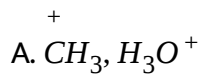
D. *P*

Answer: B



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40. Iso electronic pair among the following

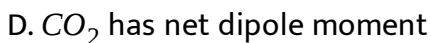
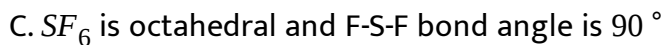
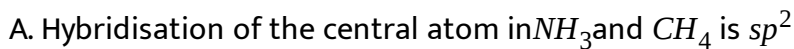


Answer: B



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41. Which of the following statement is true ?



Answer: C



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42. Match the following

List I

A) Ethane

B) Ethylene

C) Acetylene

D) Benzene

List II

1) 2 sp carbons

2) 6 sp² carbons

3) 2 sp³ carbons

4) 2 sp² carbons

5) 1sp and 1sp² carbons

The correct answer is

A.

A	B	C	D
3	4	1	2

B.

A	B	C	D
4	5	3	2

C.

A	B	C	D
3	1	2	5

D.

A	B	C	D
2	3	4	5

Answer: A





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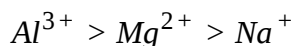
43. Which of the following is correct ?

A. the number of electrons present in the valence shell of S in SF_6 is 12

B. the rates of ionic reactions are very slow

C. according to VSEPR theory, $SnCl_2$ is a linear molecule

D. correct order of ability to form ionic compounds is



Answer: A



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44. (A) : NO_3^- is planar whereas NH_3 has pyramidal shape (R) : In NO_3^- sp^2 hybridisation whereas in NH_3 , sp^3 hybridisation takes place with a lone pair

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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LIST - 1

LIST - 2

A) OF_2

1) Tetrahedral,

bond angle $109^\circ 28'$

B) $[\text{NiCN}_4]^{-2}$

2) Linear, bond angle 180°

C) I_3^-

3) Square planar,

bond angle 90°

D) XeF_4

4) Angular, bond angle 102°

45.

The correct match is

A. a.

A	B	C	D
4	3	2	3

B. b.

A	B	C	D
3	3	2	4

C. c.

A	B	C	D
4	2	3	3

D. d.

A	B	C	D
1	2	2	3

Answer: A



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46. A simplified application of MO theory to the hypothetical "molecule"

OF would give its bond order as

A. 2

B. 1.5

C. 1.0

D. 0.5

Answer: B



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47. The bond order of CO molecule on the basis of MO theory is

A. Zero

B. 2

C. 1

D. 3

Answer: D



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48. In which set of diatomic species the bond order is 2.5 ?

A. NO , CN , CN^-

B. O_2^+ , N_2^+ , CN^+

C. N_2^+ , NO , CN

D. O_2^- , NO^- , CN^-

Answer: C



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49. For a homodiatomic molecule with a total number of electrons 14, after filling $\sigma^* 2s$ M.O. the next electron goes to

A. σ_{2pz}

B. π_{2px}

C. π_{2py}

D. π_{2px} or π_{2py}

Answer: D



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50. Incorrect statement among the following is ?

A. In BF_3 , the bond order is 1.33

B. NO , O_2 , O_2^+ and ClO_2 are paramagnetic species

C. N_2 , F_2 and CO have the same bond order.

D. Molecular orbital theory is applicable to diatomic as well as triatomic molecules.

Answer: C



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51. Which one of the following statement regarding molecular orbital is incorrect ?

A. The energy of the anti bonding M.O is more than the combining atomic orbital and it destabilizes the molecule

- B. The energy of the bonding M.O is less than combining atomic orbital and it stabilizes the molecules.
- C. The increase in the energy of anti bonding molecular orbital is same as the decrease in the energy of bonding molecular orbital
- D. None

Answer: D



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52. N_2 and O_2 are converted into monoanions N_2^- and O_2^- respectively, which of the following statements is wrong?

- A. In N_2^- N - N bond weakens
- B. In O_2^- , O - O bond order increases
- C. In O_2^{9-} (-), O - O bond order decreases
- D. N_2 becomes paramagnetic x

Answer: B



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53. Boiling points of methanol, water and dimethyl ether are respectively 65°C , 100°C and 34.5°C . Which of the following best explains the wide variations in boiling points?

- A. Density of water is 1gml^{-1} , methanol is 0.79gml^{-1} and dimethyl ether is 0.71gml^{-2}
- B. Molecular weight increases from water (18) to methanol (32) to dimethyl ether (46)
- C. Extent of hydrogen bonding decreases from water to methanol, while it is absent in ether
- D. The number of H atoms per molecule increases from water to methanol to ether.

Answer: C



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54. The pairs of bases in DNA are held together by

- A. Hydrogen bonds
- B. Ionic bonds
- C. Phosphate groups
- D. Deoxyribose groups

Answer: A



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55. The pair of molecules forming strongest inter molecular hydrogen bonds are

A. SiH_4 and SiF_4

B. H_2O and NH_3

C. CH_3COCH_3 and CHCl_3

D. $\begin{array}{c} \text{O} \\ || \\ \text{H} - \text{C} - \text{OH} \end{array}$ and $\begin{array}{c} \text{O} \\ || \\ \text{CH}_3 - \text{C} - \text{OH} \end{array}$

Answer: D

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

A. NO_2 group at para position behaves in a different way from that at ortho position

B. Intramolecular hydrogen bonding exists in p-nitrophenol

C. There is intermolecular hydrogen bonding in p-nitrophenol

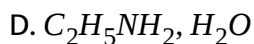
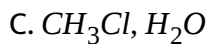
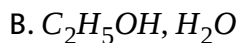
D. p-nitrophenol has a higher molecular weight than o-nitrophenol

Answer: C



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57. The pair of substances that has no hydrogen bonding between them is



Answer: D



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LIST - 1

A) $\text{K}_4[\text{Fe}(\text{CN})_6]$

B) Solid CO_2

C) HF vapour

D) C_6H_6

LIST - 2

1) Covalent bond

2) Covalent bond,
vanderwaals bonds

3) Ionic, covalent
and dative bonds

4) Hydrogen bond,
covalent bonds

5) Metallic bonds

58.

The correct match is

A. A B C D
 4 3 2 1

B. A B C D
 1 2 3 5

C. A B C D
 1 3 4 2

D. A B C D
 3 2 4 1

Answer: C



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59. In SF_6 molecules

- A. bonds are polar but molecule is non polar
- B. bonds are polar and molecule is also polar
- C. bonds are non polar but molecule is polar
- D. bonds are non polar and molecule is non polar

Answer: A



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60. Dipole moment is least in

- A. para - dichlorobenzene
- B. meta - dichlorobenzene
- C. ortho- dichlorobenzene
- D. monochloro benzene

Answer: A



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61. The dipole moment of HX molecule is 1.92 D and bond distance is 1.2 Å.

What is the percentage ionic character of HX ?

A. 0.33

B. 0.25

C. 0.7

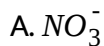
D. 0.66

Answer: A



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62. Which of the following has a net dipole moment ?



Answer: D



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63. Which of the following will have zero dipole moment?

A. 1, 1 -dichloroethylene

B. cis-1,2-dichloroethylene

C. trans-1,2-dichloroethylene

D. none of these

Answer: C



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64. The molecules BF_3 and NF_3 are covalent compounds. But BF_3 is non-polar and NF_3 is polar. The reason is

- A. Boron is a metal and nitrogen is a gas in uncombined state
- B. BF bonds have no dipole moment where as NF bonds have dipole moment
- C. Atomic size of boron is smaller that that of nitrogen
- D. BF_3 is planar but NF_3 is pyramidal in shape

Answer: D



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65. Which of the following has highest dipole moment?

A. BF_3

B. CO_2



Answer: D



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66. BeF_2 has zero dipole moment where as H_2O has a dipole moment because

A. H_2O is a linear molecule

B. H_2O is a bent molecule

C. F is more electronegative than O

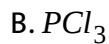
D. Hydrogen bonding is present in H_2O

Answer: B



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67. Molecule with dipole moment among the following



Answer: B



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68. Which of the following has highest dipole moment?

A. 1,2-dichloro benzene

B. 1,3-dichloro benzene

C. 1,4-dichloro benzene

D. Chloro benzene

Answer: B



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69. A molecule MX_3 has zero dipole moment. The % of 's' character in the hybridized orbitals of M is

A. 0.25

B. 33.3 %

C. 0.5

D. 0.75

Answer: B



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70. A diatomic molecule has a dipole moment 1.2D. If the internuclear distance is 1 \AA , what is the fraction of charge exists on each atom?

A. 0.25

B. 0.5

C. 0.33

D. 0.75

Answer: A



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71. The C-H bond distance is largest in

A. C_2H_2

B. C_2H_4

C. C_6H_6

D. $C_2H_4Br_2$

Answer: D



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72. In compounds of type ECl_3 , where E = B, P, As or Bi, the angles Cl-E - Cl for different E are in the order

A. $B > P = As = Bi$

B. $B > P > As > Bi$

C. $B < P = As = Bi$

D. $B < P < As < Bi$

Answer: B



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73. The geometry of H_2S and its dipole moment are

A. Angular and non-zero

B. Angular and zero

C. Linear and non-zero

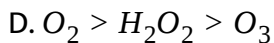
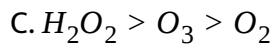
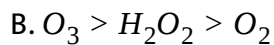
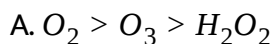
D. Linear and zero

Answer: A



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74. In O_2 , H_2O_2 and O_3 the correct order of oxygen -oxygen bond length is

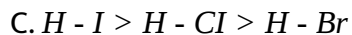
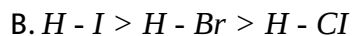


Answer: C



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75. The correct order of bond lengths is

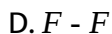
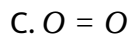
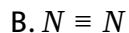
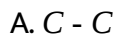


Answer: B



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76. Bond energy is least in the following



Answer: D



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77. Which of the following statements is incorrect ?

- A. As bond length increases, bond strength decreases
- B. As character increases, electronegativity increases
- C. As lone pairs increase, bond angle decreases
- D. As the size of bonded atoms increases bond strength increases

Answer: D



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78. Bond length of H_2 is 0.074nm, Bond length of Cl_2 is 1.98\AA . Bond length of HCl is

A. 2.72\AA^0

B. 136pm

C. 1.025nm

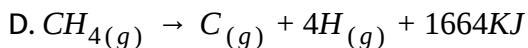
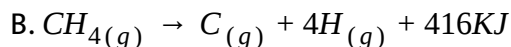
D. 0.136\AA^0

Answer: C



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79. Average C-H energy is 416 KJ.mol^{-1} Which of the following is correct ?

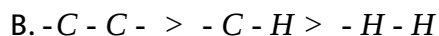
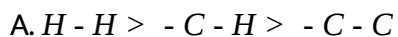


Answer: C



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80. The decreasing order of bond dissociation energies of C-C, C-H and H-H bonds is

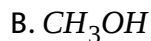
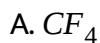


Answer: C



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81. The highest dipole moment is of



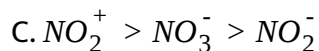
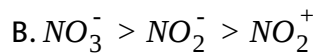
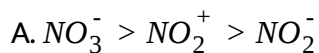
D. CH_3F

Answer: B



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82. The correct order of N-O bond length in NO , NO_2^- and NO_3^- will be



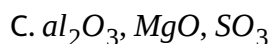
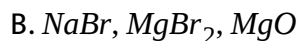
Answer: B



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OBJECTIVE EXERCISE-3

1. For which of the following sets, all the compounds are ionic ?



Answer: B



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2. The following are some statements about the crystal lattice structure of sodium chloride i) If the corners of unit cell are occupied by Na^+ , the face edges are occupied by sodium ions ii) The ratio between radii of Na^+ and Cl^- ions is 0.93 iii) If the body centered ion of unit cell is Na^+ face centered ion in it is Cl^- The correct combination is

A. only iii is correct

B. only ii is wrong

C. only i is wrong

D. all are wrong

Answer: A



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3. Which of the following pairs will form the most stable ionic bond?

A. Na and F

B. Fe and Cl

C. N and O

D. Li and I

Answer: A



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4. Coordination number of cation is minimum in

A. NaCl

B. CsCl

C. ZnO

D. KCl

Answer: D



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5. The following are some statements about the characteristics of covalent compounds i) The combination of a metal and non-metal must give a covalent compound. ii) All covalent substances are bad conductors of electricity. iii) All covalent substances are gases at room temperature. The correct combination is

A. all are correct

- B. only i and ii are correct
- C. only ii and iii are correct
- D. all are wrong

Answer: C



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6. Some statements about valence bond theory are given below

- (i) The strength of bond depends upon extent of overlapping.
- (ii) The theory explains the directional nature of covalent bond.
- (iii) According to this theory oxygen molecule is paramagnetic in nature.

- A. all are correct
- B. only i and iii are correct
- C. only i and ii are correct
- D. all are wrong

Answer: C



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7. The following are some statements about the type of chemical bond present in a given compound i) All complex compounds contain ionic, covalent and dative bonds. ii) The compound having monoatomic cation and monoatomic anion contains ionic bond. iii) The compound having dative bond must possess covalent bond also. The correct combination is

- A. all are correct
- B. only i and ii are correct
- C. only ii and iii are correct
- D. only i and iii are correct

Answer: C



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8. Consider the following statements. The common features of the molecules BF_3 , SF_6 and NO are that i) all contain odd electron bond ii) all are gases at room temperature iii) all contain unpaired electrons iv) all do not confirm to the octet rule

A. i and ii

B. iii and iv

C. i and iii

D. ii and iv

Answer: D

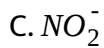


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9. Which of the following contains unpaired electrons ?

A. NO_2

B. CO_2



Answer: A



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10. The formal charges on the three oxygen atoms in O_3 , molecule are

A. 0, 0, 0

B. 0, 0, -1

C. 0, 0 +1

D. 0, +1, -1

Answer: D



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11. Which of the following when dissolved in water forms a solution which is nonconducting ?

- A. Chile salt petre
- B. Green vitrol
- C. Potash alum
- D. Alcohol

Answer: D



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12. i) The formation of a cation from a neutral atom is favoured by small size of the atom ii) π -bond does not exist between two atoms without σ -bond iii) The formation of chemical bond is associated with an increase in potential energy. The correct combination of the above statements is

- A. only i and ii are correct

- B. only ii is correct
- C. only ii and iii are correct
- D. only i and iii are correct

Answer: B



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13. How many unit cells are present in a cube shaped ideal crystal of NaCl of mass 1g ? (atomic masses : Na = 23, Cl=35.5)

- A. 1.7×10^{21} unit cells
- B. 2.57×10^{21} unit cells
- C. 5.14×10^{21} unit cell
- D. 1.28×10^{21} unit cell

Answer: B



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14. In the electronic structure of acetic acid there are

- A. 16 shared and 8 unshared valence electrons
- B. 8 shared and 16 unshared valence electrons
- C. 12 shared and 12 unshared valence electrons
- D. 18 shared and 6 unshared valence electrons

Answer: A



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15. Octet rule is mostly violated in the compounds formed by

- A. Alkali metals
- B. Alkaline earth metals
- C. p-block elements
- D. Transition elements

Answer: D



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16. The following are some statements about hybridisation i) Pure orbitals of same atom of an element will participate. ii) The number of hybrid orbitals formed is twice the number of pure orbitals that participate in hybridisation. iii) Completely filled (or) half-filled (or) vacant orbitals may participate in this process. The correct combination is

- A. all are correct
- B. only i and ii are correct
- C. only iii is correct
- D. only i and iii are correct

Answer: D



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17. The nodal plane in the π -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 sigma bond at right angle
- D. A plane perpendicular to the molecular plane which contains the carbon-carbon π -bond

Answer: A



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18. A square planar complex is formed by hybridisation of which of the following atomic orbitals ?

A. s, p_x, p_y, d_{yz}

B. $s, p_x, p_y, d_{x^2-y^2}$

C. s, p, p_y, d_{z^2}

D. s, p_y, P_z, d_{xy}

Answer: B



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19. Which of the following statements is incorrect for PCl_5 ?

A. Its all P-Cl bond lengths are equal

B. It involves sp^3d hybridisation

C. It has irregular geometry

D. Its shape is trigonal bipyramid

Answer: A



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20. Using MO theory predict which of the following species has the shortest bond length?



Answer: B



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21. From the following given statements

(i) O.....H hydrogen bond length is more than covalent O-H bond length.

(ii) The ionic bond strength of CsF is more than that of NaF.

(iii) The number of electrons present in all inner shells of sodium atom

are 10.

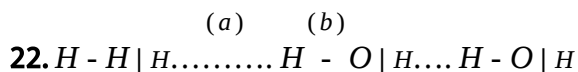
The correct combination is

- A. only i is correct
- B. only i and ii are correct
- C. only ii and iii are correct
- D. only i and iii are correct

Answer: D



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Here a and b are hydrogen bond and covalent bonds , their lengths are

- A. 0.97 \AA , 0.97 \AA
- B. 1.73 \AA , 0.97 \AA
- C. 1.73 \AA , 1.73 \AA

D. 0.97\AA , 1.73\AA

Answer: B



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23. The high density of water 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

Answer: A



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

A. HF

B. HCl

C. HBr

D. HI

Answer: B



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25. A stronger hydrogen bonding is present in

A. Ethanol

B. Diethylether

C. Ethylchloride

D. Dimethylamine

Answer: A



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26. Organic compound soluble in water contains

A. C, H

B. C, H, O

C. C, S

D. C, H, Cl

Answer: B



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27. Dipole moment of H_2X is $1.0 D$. If the bond angle is 90° , the approximate bond moment of $H-X$ bond is ($\cos 45^\circ = 0.7$)

A. $0.4D$

B. $0.5D$

C. $0.7D$

D. 06D

Answer: C



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28. The dipole moment of HX is 1.2D. If the % ionic character of the bond is 25%, then its bond length is

A. 10\AA

B. 10^{-10}m

C. 10^{-8}m

D. 10^6m

Answer: B



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29. Which bond angle θ would result in the maximum dipole moment for the diatomic molecule XY_2

A. $\theta = 90^\circ$

B. $\theta = 120^\circ$

C. $\theta = 150^\circ$

D. $\theta = 180^\circ$

Answer: A



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30. If the bond length and dipole moment of a diatomic molecule are 1.25 \AA and 1.0 D respectively, what is the percent ionic character of the bond ?

A. 10.66

B. 12.33

C. 16.66

D. 19.33

Answer: C



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31. (A): The dipole moment value of NH_3 is greater than zero (B): In NH_3 bond angle is approximately 104°

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C



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32. (A): SiF_4 is non polar even though fluorine is much more electronegative than silicon (B) : The four bond dipoles cancel one another in SiF_4 molecule

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: A



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33. A: SO_2 molecule has unsymmetrical shape

R: The dipole moment of SO_2 molecule is equal to zero.

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: A



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34. The following are some statements about dipole moment.

- i. The dipolemoment of any covalent molecule is zero.
- ii. The dipolemoment of adiatomic molecule having non -polar bonds is zero
- iii. The dipolemoment of a diatomic molecule having polar covalent bond is non -zero.

A. all the three statements are correct

B. only ii is correct

C. only ii and iii are correct

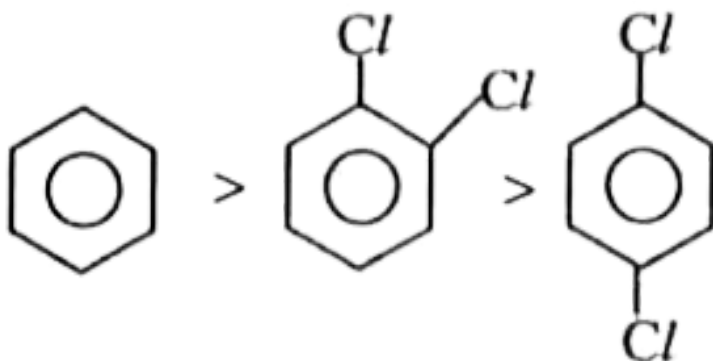
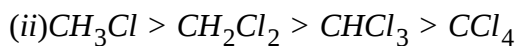
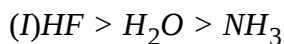
D. only i and iii correct.

Answer: C



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35. From the following given statements of the order of dipole moments.



the correct combination is

A. all are correct

B. i, ii are correct

C. only iii is correct

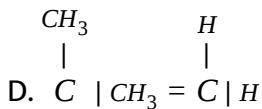
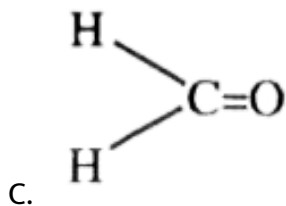
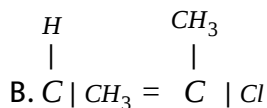
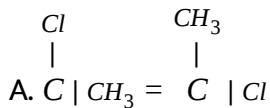
D. only i is correct

Answer: B



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36. Which of the following has highest dipole moment?



Answer: C



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37. The Cl-O bond order in perchlorate ion

A. 1

B. 2

C. 1.75

D. 2.5

Answer: C



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38. Which of the following is more stable

A. HF

B. HCl

C. HBr

D. HI

Answer: A



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39. The bond dissociation of the molecules A_2 , B_2 , C_2 are 498, 158, 945 kJ/mole respectively. If so, the correct decreasing order of their bond orders is

A. A_2 , B_2 , C_2

B. C_2 , B_2 , A_2

C. C_2 , A_2 , B_2

D. B_2 , C_2 , A_2

Answer: C

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40. The table shown lists the bond dissociation energies (E_{diss}) for single covalent bonds formed between carbon and atoms of elements A,B,C and D. Which element is the smallest atom ?

A) C – A	240
B) C – B	328
C) C – C	276
D) C – D	485

A. C

B. D

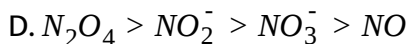
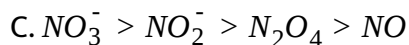
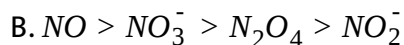
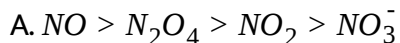
C. A

D. B

Answer: B

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41. The correct order of N -O bond length in NO , NO_2^- , NO_3^- and N_2O_4 will be

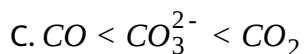
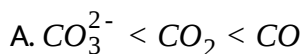


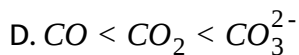
Answer: C



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42. The correct order of increasing C-O bond length of CO , CO_3^{2-} and CO_2





Answer: D



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

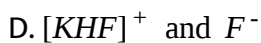
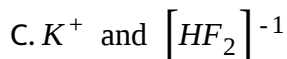
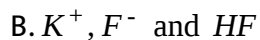
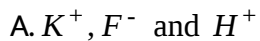
- A. One sigma (σ) and one pi (π) bonds
- B. One sigma (σ) and two pi (π) bonds
- C. One sigma (σ) and a half pi (π) bonds
- D. One sigma (σ) bond only

Answer: B



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44. KF combines with HF to form KHF_2 . The compound contains the species



Answer: C



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45. The bond order of individual carbon bonds in benzene is

A. One

B. Two

C. Between one and two

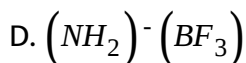
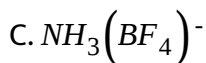
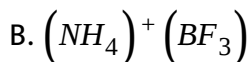
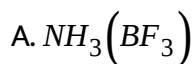
D. None of these

Answer: C



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46. In which of the following species the inter atomic bond angle is $109^\circ.28'$?



Answer: A



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47. Which one of the following pairs of molecules will have permanent dipole moments for both members?

A. SiF_4 and CO_2

B. SiF_4 and NO_2

C. NO_2 and CO_2

D. NO_2 and O_3

Answer: D



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48. Which of the following compounds has the smallest bond angle in its molecule

A. NH_3

B. SO_2

C. OH_2

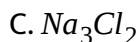
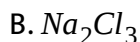
D. SH_2

Answer: D

EXERCISE ON PASSAGE

1. Sodium chloride crystallises into F.C.C lattice with Na occupying corner of a cube and the centre of each face, whereas Cl^- occupies the centre of each edge and centre of the cube. The r_c/r_a value for NaCl is 0.53 and coordination number is 6,6.

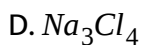
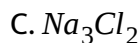
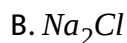
If all the ions present in one plane that is passing through the centre are removed, the formula of the resulting unit cell is



Answer: A

2. Sodium chloride crystallises into F.C.C lattice with Na occupying corner of a cube and the centre of each face, whereas Cl^- occupies the centre of each edge and centre of the cube. The r_c/r_a value for NaCl is 0.53 and coordination number is 6.

If all the face centred ions along one of the axis are removed, the stoichiometry of the resulting solid is



Answer: D



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3. Sodium chloride crystallises into F.C.C lattice with Na^+ occupying corner of a cube and the centre of each face, whereas Cl^- occupies the centre of each edge and centre of the cube. The r_c/r_a value for NaCl is 0.53 and coordination number is 6,6.

In NaCl crystal lattice each sodium ion is surrounded by — number of chloride ions in — fashion

- A. 8, tetrahedral
- B. 6, octahedral
- C. 8, square planar
- D. 6, distorted octahedron

Answer: B



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4. Sodium chloride crystallises into F.C.C lattice with Na^+ occupying corner of a cube and the centre of each face, whereas Cl^- occupies the

centre of each edge and centre of the cube. The r_c/r_a value for NaCl is 0.53 and coordination number is 6.

In NaCl unit cell, the edge length is

A. $2r_c + 2r_a$

B. $r_c + r_a$

C. $\frac{r_c + r_a}{2}$

D. $\sqrt{3}(r_c + r_a)$

Answer: A



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5. According to V.B.T. a covalent bond is formed by the overlapping of half filled atomic orbitals with electron spinning in the opposite direction. The strength of a bond depends on extent of overlapping. Double bond energy is not twice that of single bond energy because a double bond is made up of a weak π bond and strong σ bond.

According to V.B.T, in the formation of CH_4 molecule the type of overlappings observed are

A. $p - s, s - s$

B. $p - s$

C. $sp^3 - s, s - s$

D. $sp^2 - s, s - s$

Answer: A



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6. According to V.B.T. a covalent bond is formed by the overlapping of half filled atomic orbitals with electron spinning in the opposite direction. The strength of a bond depends on extent of overlapping. Double bond energy is not twice that of single bond energy because a double bond is made up of a weak π bond and strong σ bond energy

The expected bond angle in NH_3 molecule according to V.B.T is

A. 90°

B. 107°

C. $109^\circ .28'$

D. 120°

Answer: A



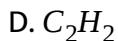
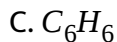
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7. According to V.B.T. a covalent bond is formed by the overlapping of half filled atomic orbitals with electron spinning in the opposite direction. The strength of a bond depends on extent of overlapping. Double bond energy is not twice that of single bond energy because a double bond is made up of a weak π bond and strong σ bond.

More energy is required to break the bond between the carbon atoms in

A. C_2H_6

B. C_2H_4



Answer: D



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8. According to V.B.T. a covalent bond is formed by the overlapping of half filled atomic orbitals with electron spinning in the opposite direction. The strength of a bond depends on extent of overlapping. Double bond energy is not twice that of single bond energy because a double bond is made up of a weak π bond and strong σ bond.

Bond energy is highest in



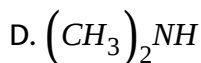
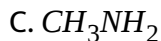
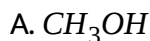
Answer: D



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9. Hydrogen bond is a weak electrostatic force of attraction between covalently bonded hydrogen and more electronegative species like F, O and N. It plays an important role in influencing many physical constants. It is a weaker bond than covalent bond but stronger than van der Waals forces of attraction.

Hydrogen bonding is absent in



Answer: B



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10. Hydrogen bond is a weak electrostatic force of attraction between covalently bonded hydrogen and more electronegative species like F,O and N. It play an important role in influencing many physical constants. It is a weaker bond than covalent bond but stronger than vanderWaal forces of attraction.

Chelation is observed in

A. P - nitrophenol.

B. O - nitrophenol

C. Benzaldehyde

D. HF

Answer: B



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11. Hydrogen bond is a weak electrostatic force of attraction between covalently bonded hydrogen and more electronegative species like F,O and N. It play an important role in influencing many physical constants. It is a weaker bond than covalent bond but stronger than vanderWaal forces of attraction.

During the boiling of a liquid, the bonds broken are

- A. Intramolecular Hydrogen bonding
- B. Intermolecular Hydrogen bonding
- C. Covalent bond
- D. Dative bond

Answer: B

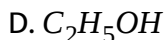
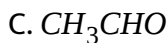
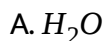


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12. Hydrogen bond is a weak electrostatic force of attraction between covalently bonded hydrogen and more electronegative species like F,O

and N. It play an important role in influencing many physical constants. It is a weaker bond than covalent bond but stronger than vanderWaal forces of attraction.

Which of the following can exist as a hexamer in vapour state ?



Answer: B

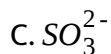


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13. The geometry of a molecule depends upon the repulsions between electron pairs present in the valence shell of the central atom. LP - LP repulsions are greater than LP-BP which are greater than BP - BP. A pi bond can not decide the geometry of a molecule because pi bond has no independent existence. Deviations in bond angle are due to the

presence of lone pairs.

Which of the following differs from the rest in geometry ?



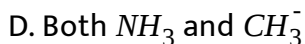
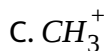
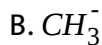
Answer: C



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14. The geometry of a molecule depends upon the repulsions between electron pairs present in the valence shell of the central atom. LP - LP repulsions are greater than LP-BP which are greater than BP - BP. A pi bond can not decide the geometry of a molecule because pi bond has no independent existence. Deviations in bond angle are due to the presence of lone pairs.

In which of the following orientation of electron pairs around the central atom is tetrahedral ?



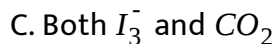
Answer: D



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15. The geometry of a molecule depends upon the repulsions between electron pairs present in the valence shell of the central atom. LP - LP repulsions are greater than LP-BP which are greater than BP - BP. A pi bond can not decide the geometry of a molecule because pi bond has no independent existence. Deviations in bond angle are due to the presence of lone pairs.

Which of the following molecule is linear in shape ?



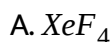
Answer: B

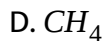
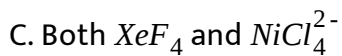


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16. The geometry of a molecule depends upon the repulsions between electron pairs present in the valence shell of the central atom. LP - LP repulsions are greater than LP-BP which are greater than BP - BP. A pi bond can not decide the geometry of a molecule because pi bond has no independent existence. Deviations in bond angle are due to the presence of lone pairs.

Square planar species among the following is





Answer: A



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LEVEL -I (EAMCET) (EXERCISE-I)

1. Valency of an element indicates

A. combining power with hydrogen

B. acidity

C. electrons in the outermost orbit

D. none of these

Answer: A



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2. Between atoms of a molecule, there exists

- A. only attractive forces
- B. only repulsive forces
- C. both attractive and repulsive forces
- D. neither attractive nor repulsive forces

Answer: C



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3. When two atoms of chlorine combine to form one molecule of chlorine gas, the energy of the molecule is

- A. greater than that of separate atoms
- B. equal to that of separate atoms

C. lower than that of separate atoms

D. none of these

Answer: C



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4. Most energetic species among the following is

A. H_2

B. Ne

C. F

D. F_2

Answer: C



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5. The coordination numbers of cation and anion in NaCl crystal are respectively

A. 8,6

B. 8,8

C. 6,6

D. 6,8

Answer: C



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6. Which of the following is easily formed?

A. Calcium chloride

B. Calcium bromide

C. Potassium chloride

D. Potassium bromide

Answer: C



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7. Among the compounds NaCl, KCl, RbCl and CsCl, the one with greatest ionic character is

A. NaCl

B. KCl

C. CsCl

D. RbCl

Answer: C



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8. The 8:8 type of packing is present in

A. NaCl

B. KCl

C. CsCl

D. MgF_2

Answer: C



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9. Which of the following is favourable condition for the formation of ionic bond?

A. Small cation with small charge

B. Small anion with large charge

C. Large difference in the electronegativity

D. Small cation with high charge

Answer: C

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10. The total number of Na^+ ions present per unit cell of NaCl is

- A. 1
- B. 6
- C. 8
- D. 4

Answer: D

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11. The number of ion pairs that constitute one unit cell of CsCl

- A. 4
- B. 2
- C. 8

D. 1

Answer: D



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12. Which of the following is not involved in Born-Haber cycle?

A. Sublimation energy

B. Ionisation potential

C. Lattice energy

D. Electronegativity

Answer: D



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13. In a NaCl crystal, cations and anions are held together by

- A. Electrons
- B. Electrostatic forces
- C. Nuclear forces
- D. Covalent bonds

Answer: B



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14. Molten sodium chloride conducts electricity due to the presence of

- A. Free electrons
- B. Free ions
- C. Free molecules
- D. Free atoms

Answer: B



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15. Number of electrons transferred from one Al atom during bond formation in Aluminium fluoride

A. 1

B. 2

C. 3

D. 4

Answer: C



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16. Which one of the following has an electrovalent linkage?

A. CH_4

B. $MgCl_2$

C. $SiCl_4$

D. BF_3

Answer: B



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17. Which of the following is least ionic?

A. CaF_2

B. $CaBr_2$

C. $CaCl_2$

D. CaI_2

Answer: D



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18. The strongest ionic bond is present in

A. LiF

B. NaF

C. RbF

D. CsF

Answer: A



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19. Which is more stable among the following ?

A. Li^+

B. K^+

C. Cs^+

D. Na^+

Answer: C



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20. What is the crystal structure of cesium chloride ?

- A. Body centered cubic
- B. Face centered cubic
- C. Tetrahedral
- D. Octahedral

Answer: A



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LEVEL -I (EAMCET) (EXERCISE-II)

1. The element that exhibits both electrovalency and covalency is

- A. Neon
- B. Sodium

C. Barium

D. Chlorine

Answer: D



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2. Number of electrons forming bonds in O_2 molecule according to valency bond theory.

A. 2

B. 4

C. 6

D. 10

Answer: B



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3. In the formation of covalent bond

- A. transfer of electrons take place
- B. electrons are gained by only one atom
- C. with identical spin
- D. equally shared between them

Answer: C



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

- A. unequally shared between the two
- B. transferred fully from one atom to another
- C. with identical spin
- D. equally shared between them

Answer: D



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5. A covalent bond is likely to be formed between two elements which

- A. have high electronegativities
- B. have low ionization energies
- C. have low melting points
- D. form ions with a small charge

Answer: A



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6. Covalent compounds are generally soluble in

- A. polar solvents

B. non-polar solvents

C. concentrated acids

D. all solvents

Answer: B



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7. Which of the following has directional character?

A. ionic bond

B. metallic bond

C. covalent bond

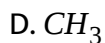
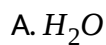
D. both covalent and ionic bonds

Answer: C



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8. The angle between two covalent bonds is minimum in



Answer: A



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9. The shape of ClO_3^- is

A. Linear

B. Angular

C. Tetrahedral

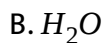
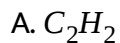
D. Pyramidal

Answer: D



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10. Angular molecule among the following is



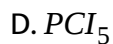
Answer: B



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11. Octahedral molecule among the following is





Answer: C



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12. Bond angle (H-O-H) in H_2O is

A. 90°

B. $104^\circ 30'$

C. $107^\circ 18'$

D. $109^\circ 28'$

Answer: B



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13. In PCl_5 Bond angle in plane is

- A. 90°
- B. $104^\circ 30'$
- C. $107^\circ 18'$
- D. $109^\circ 28'$

Answer: B



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LEVEL -I (EAMCET) (EXERCISE-IV)

1. The para magnetic nature of oxygen is best explained by

- A. V.B.theory
- B. Hybridisation
- C. M.O.theory

D. VSEPR theory

Answer: C



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2. Bond order in He_2 species is

A. 0

B. 1

C. 2

D. 3

Answer: A



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3. The bond order in O_2^- species is

A. 1

B. 2

C. 3

D. 4

Answer: A



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4. In O_2 molecule, the correct order of molecular orbitals is

A. $\pi 2py > \pi 2pz$

B. $\pi 2py = \pi 2pz$

C. $\rho 2s < \rho 2s$

D. $\rho 2s > \rho 2px$

Answer: C



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5. Fractional bond order is in

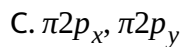
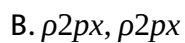
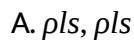


Answer: B



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6. Among the following degenerate orbitals are



D. $\pi 2py, \pi 2pz$

Answer: C



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7. Maximum number of electrons that can be present in any molecular orbital is

A. 3

B. 6

C. 8

D. 2

Answer: D



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8. While filling electrons in π_{2p_x} and π_{2p_y} , the electronic configuration rules that one to be followed is

- A. Paulis exclusion principle
- B. Aufbau principle
- C. Both Paulis and Hund's rule
- D. All the above

Answer: C



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9. Number of bonding electrons in N_2 molecule are

- A. 4
- B. 5
- C. 6
- D. 10

Answer: D



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10. Bond order is maximum among the following



Answer: A



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11. The shape of molecular orbital depends upon

A. Size of the molecule

- B. Size of the atoms involved
- C. Shape of the atomic orbital
- D. All the above

Answer: C



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12. Number of anti bonding electrons in O_2 molecule are

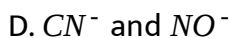
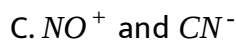
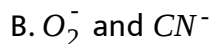
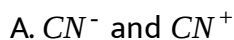
- A. 10
- B. 6
- C. 4
- D. 2

Answer: B



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

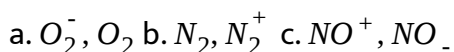


Answer: C



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14. In which pair, the stronger bond is found in the first species?



A. a only

B. b only

C. a and c only

D. b and c only

Answer: D



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15. The common features among the species CN^{-1} , CO and NO^{+} are

- A. bond order three and isoelectronic
- B. bond order three and weak field ligands
- C. bond order two and π electron acceptors
- D. isoelectronic and weak field ligands

Answer: A



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16. Which of the following species is not diamagnetic ?

- A. N_2



Answer: D



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17. Bond energy is maximum in



Answer: B



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18. The bond order

- A. Can have negative value
- B. Is any number other than zero
- C. Is any integer
- D. Can have any value including zero

Answer: D



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19. According to Molecular orbital theory, a molecule of H_2 has two electrons in

- A. ρ_{1s}
- B. ρ_{2s}
- C. ρ_{2s}
- D. ρ_{1s}

Answer: A



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20. Higher the bond order greater is the

A. Bond dissociation energy

B. Bond length

C. Paramagnetism

D. Ionic character

Answer: A



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21. Which of the following molecular orbital has the lowest energy?

A. p_{2pz}

B. π_{2py}

C. π_{2pz}

D. ρ_{2px}

Answer: A



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22. Molecular orbitals are

A. Monocentric

B. Bicentric

C. Polycentric

D. None

Answer: C



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23. Which of the following is paramagnetic with bond order 0.5



Answer: D



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24. Double bonds are present in



Answer: A



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25. Six electrons are mutually shared in



Answer: D



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26. Octet rule is followed for the central atom in the formation of





Answer: D



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27. Silicon has 4 electrons in the outermost orbit. In forming the bonds,

A. It gains electrons

B. It loses electrons

C. It shares electron

D. None of the above

Answer: C



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28. What are the bonds present in ammonium chloride?

- A. Only ionic and dative
- B. Only covalent and electrovalent
- C. Only covalent and coordinate
- D. Ionic, covalent and coordinate

Answer: D



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29. PH_3 and BF_3 form an adduct readily because they form

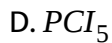
- A. A coordinate bond
- B. A covalent bond
- C. An ionic bond
- D. A hydrogen bond

Answer: A



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30. Dative bond is present in the molecule of

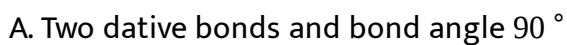


Answer: C



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31. According to valence bond theory, water molecule has



- B. Two dative bonds and bond angle 90°
- C. Two dative bonds and bond angle 104.5°
- D. Two dative bonds and bond angle 104.5°

Answer: B



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LEVEL -I (EAMCET) (EXERCISE-V)

1. Maximum number of hydroge bonds that one water molecule is capable of forming is

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

Answer: D



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2. Which of the following compounds has hydrogen bonding?

A. HCl

B. C_2H_6

C. $\text{RCH}_2\text{NHCH}_3$

D. RCH_2CHO

Answer: C



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3. Acetic acid exist as a dimer in benzene due to

A. Condensation reaction

B. Hydrogen bonding

C. presence of phenyl group

D. presence of hydrogen atom at α -carbon

Answer: B



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4. Hydrogen bond may be formed between

A. Two hydrogen atoms

B. Hydrogen atom and electropositive atom

C. H-atom and electronegative atom with small size

D. H-atom and electronegative atom with larger size

Answer: C



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5. Order of intermolecular attractive forces

A. Water < Alcohol < Ether

B. Ether < Alcohol < Water

C. Alcohol < Water < Ether

D. Ether < Water < Alcohol

Answer: B



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6. Which of the following hydrogen bonds is relatively weak?

A. N..... H-N

B. F..... H-F

C. N..... H-O

D. O H-O

Answer: A



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7. Boiling point is highest for

A. HF

B. H_2O

C. NH_3

D. CH_4

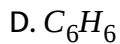
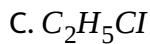
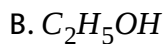
Answer: B



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8. Which of the following is soluble in water?

A. $C_2H_5OC_2H_5$



Answer: B



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9. Among the three isomers of nitro phenol, which is least soluble in water?

A. ortho isomer

B. para isomer

C. meta isomer

D. all are insoluble

Answer: A



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10. Strongest hydrogen bonds can be formed by

A. HF

B. H_2O

C. NH_3

D. HCl

Answer: A



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11. Hydrogen bonds are present even in vapour state of

A. H_2O

B. HF

C. p-hydroxy benzaldehyde

D. C_2H_5OH

Answer: B



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12. (A) : Water is a liquid whereas sulphur dioxide is a gas at room temp

(R) : Molecular mass of SO_2 is more than that of H_2O

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B



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13. (A): O-Hydroxy benzaldehyde is steam volatile but not P-hydroxy benzaldehyde (R) : Intramolecular hydrogen bond is present in orthohydroxy benzaldehyde but intermolecular hydrogen bond in parahydroxy benzaldehyde

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: A



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14. Between any two of the following molecules, hydrogen bonding is not possible

- A. Two primary amine molecules
- B. Two secondary amine molecules
- C. Two tertiary amine molecules
- D. Two ammonia molecules

Answer: C



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15. For which of the following sets, all the compounds are ionic ?

- A. NaF , BF_3 , MgF_2
- B. NaBr , MgBr_2 , MgO
- C. Al_2O_3 , MgO , SO_3
- D. NCl_3 , BeCl_2 , AlCl_3

Answer: B



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16. The following are some statements about the crystal lattice structure of sodium chloride i) If the corners of unit cell are occupied by Na^+ , the face edges are occupied by sodium ions ii) The ratio between radii of Na^+ and Cl^- ions is 0.93 iii) If the body centered ion of unit cell is Na^+ face centered ion in it is Cl^- The correct combination is

A. only iii is correct

B. only ii is wrong

C. only i is wrong

D. all are wrong

Answer: A



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17. Which of the following pairs will form the most stable ionic bond?

A. Na and F

B. Fe and Cl

C. N and O

D. Li and I

Answer: A



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18. The following are some statements about the characteristics of covalent compounds i) The combination of a metal and non-metal must give a covalent compound. ii) All covalent substances are bad conductors of electricity. iii) All covalent substances are gases at room temperature. The correct combination is

A. all are correct

B. only i and ii are correct

C. only ii and iii are correct

D. all are wrong

Answer: D



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19. Coordination number of cation is minimum in

A. NaCl

B. CsCl

C. ZnO

D. KCl

Answer: C



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20. Some statements about valence bond theory are given below

- (i) The strength of bond depends upon extent of overlapping.
- (ii) The theory explains the directional nature of covalent bond.
- (iii) According to this theory oxygen molecule is paramagnetic in nature.

- A. all are correct
- B. only i and iii are correct
- C. only i and ii are correct
- D. all are wrong

Answer: C



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21. The following are some statements about the type of chemical bond present in a given compound i) All complex compounds contain ionic, covalent and dative bonds. ii) The compound having monoatomic cation

and monoatomic anion contains ionic bond. iii) The compound having dative bond must possess covalent bond also. The correct combination is

- A. all are correct
- B. only i and ii are correct
- C. only ii and iii are correct
- D. only i and iii are correct

Answer: C

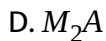
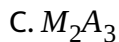


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LEVEL -I (MAIN) (EXERCISE-I)

1. The charge on cation M is +2 and anion A is -3. The compound formed has the formula

- A. MA_2
- B. M_3A_2

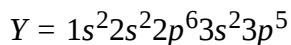
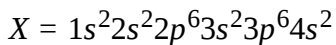


Answer: B

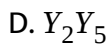
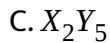
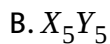


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2. Two elements X and Y have the following configuration



The compound formed by the combination of X and Y will be

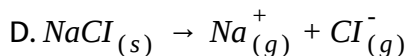
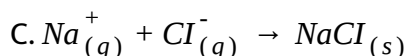
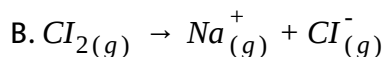
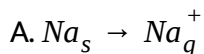


Answer: A



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3. Which of the following reaction involves the liberation of energy?

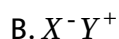
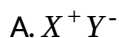


Answer: C



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4. An element 'X' is strongly electropositive and an element 'Y' is strongly electronegative and both are univalent. The compound formed would be



C. $X - Y$

D. $X \rightarrow Y$

Answer: A



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5. From the electronic structure of four elements predict the with greater tendency to form electrovalent bond is greatest in

A. $1s^2$

B. $1s^2, 2s^2, 2p^2$

C. $1s^2, 2s^2, 2p^5$

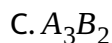
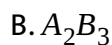
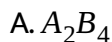
D. $1s^2, 2s^2, 2p^6$

Answer: C



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6. An atom of an element 'A' has three electrons in its outermost shell and that of 'B' has six electrons in the outer most shell. The formula of the compound formed between these two elements is



Answer: B



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7. If Na^+ ion is larger than Mg^{2+} ion and S^{2-} ion is larger than Cl^- ion, which of the following will be least soluble in water?





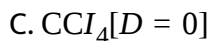
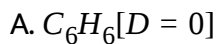
Answer: D



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8. In which of the following solvents should KCl be soluble at $25^\circ C$?

(D=Dielectric constant value)

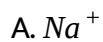


Answer: D



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9. The following has more size



Answer: D



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10. The mass of one unit cell of NaCl is

A. 234amu

B. 234gm

C. 58.5amu

D. 58.5gm

Answer: A



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11. A, B and C are atoms of elements with atomic number Z , $Z+1$ and $Z+2$ respectively. If 'B' has octet configuration, the bond formed between 'A' and C predominantly is

A. Covalent bond

B. Ionic bond

C. Dative bond

D. Hydrogen bond

Answer: B



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12. Lattice energy of NaCl is 'X'. If the ionic size of A^{+2} is equal to that of Na^{+} and B^{-2} is equal to Cl^{-} , then lattice energy associated with the crystal AB is

- A. X
- B. 2X
- C. 4X
- D. 8X

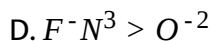
Answer: C



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13. The number of unit cells present in 1 mole of NaCl crystal is

- A. $6.023 \times 10^{23} > O^{-2} > N^{-3}$
- B. $N^{-3} > O^{-2} > F^{-}$
- C. $O^{-2} > N^{-3} > F^{-}$

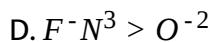
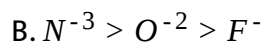
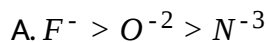


Answer: B



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14. The order of relative ease of formation of various ions is



Answer: A



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15. The incorrect statement regarding the formation of ionic bond

- A. It involves electrostatic attraction
- B. It is a redox process
- C. It is an exothermic process
- D. It involves the absorption of energy

Answer: D



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16. What is the total number of ions present in one unit cell of sodium chloride lattice ?

- A. 2
- B. 6
- C. 12
- D. 8

Answer: D

17. (A) : Na_2SO_4 is more soluble in water while $BaSO_4$, is less soluble (R) :

Lattice energy of Na_2SO_4 is greater than that of $BaSO_4$

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: C

18. Which of the following is a favourable factor for cation formation ?

- A. High electronegativity

- B. High electron affinity
- C. Low ionisation potential
- D. Smaller atomic size

Answer: C



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19. Which of the following is not correct

- A. low ionisation potential is a favourable condition for the formation of cation
- B. coordination number of Cs in CsCl is 8
- C. ionic bond is directional
- D. ionic compounds have high melting points

Answer: C



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20. AB is an ionic solid. The ionic radii of A^+ and B^- are respectively r_c and r_a . Lattice energy of AB is proportional to

A. $\frac{r_c}{r_a}$

B. $(r_c + r_a)$

C. $\frac{r_a}{r_c}$

D. $\frac{1}{r_c + r_a}$

Answer: D



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LEVEL -I (MAIN) (EXERCISE-II

1. The element that exhibits neither electrovalency nor covalency is

A. Neon

B. Sodium

C. Barium

D. Chlorine

Answer: A



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2. The attraction that non-polar molecules have for each other is primarily caused by

A. Van der Waal's forces

B. Difference in electronegativities

C. Hydrogen bonding

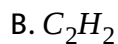
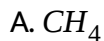
D. High ionisation energy

Answer: A



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

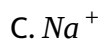


Answer: C



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4. Which of the following ion has maximum polarising power



Answer: B



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5. The bond between chlorine and bromine in BrCl is

- A. ionic
- B. non-polar
- C. polar with negative end on Br
- D. polar with negative end on Cl

Answer: D



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6. Oxygen cannot exhibit tetravalency and hexavalency like sulphur. This is because

- A. Oxygen has two unpaired electrons
- B. Oxygen can form double bond
- C. Oxygen lacks valence d-orbitals
- D. Oxygen has only 2 electrons in valence shell

Answer: C



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7. The covalency of nitrogen in HNO_2 is

- A. 0
- B. 2
- C. 3
- D. 5

Answer: C



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8. van der Waals forces are maximum in the following substance

A. HBr

B. LiBr

C. LiCl

D. AgBr

Answer: D



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9. An aqueous solution of silver nitrate gives a white precipitate with

A. C_2H_5Cl

B. $CHCl_3$

C. HCl

D. CCl_4

Answer: C



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10. Which of the following is most volatile

A. Diamond

B. Sodium chloride

C. Calcium

D. Dry ice

Answer: D



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11. Which of the following is truly covalent?

A. AgCl

B. KCl

C. BaCl_2

D. COCl_2

Answer: D



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12. Which of the following is covalent?

A. H_2

B. CaO

C. KCl

D. Na_2S

Answer: A



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13. If the electronegativity of two atoms is low, then expected bond between the elements is

- A. Ionic Bond
- B. Covalent Bond
- C. Dative bond
- D. Metallic Bond

Answer: D



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14. Direct overlap leads

- A. ρ Bond
- B. π bond
- C. Both ρ & π bonds

D. Neither ρ nor π bond

Answer: A



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15. The bonds present in N_2O_5 are

A. Ionic

B. Covalent

C. Ionic and covalent

D. Covalent and dative

Answer: D



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16. In which type of bond formation, can a proton participate?

A. Hydrogen bond

B. Electrovalent

C. Dative

D. Covalent

Answer: C



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17. The bonds present in $\left[Cu(NH_3)_4 \right] SO_4$ between copper and ammonia are

A. ionic

B. covalent

C. co-ordinate

D. hydrogen

Answer: C



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18. The types of bonds present in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (blue vitriol) are

- A. electrovalent and covalent
- B. electrovalent, covalent, co-ordinate and hydrogen bond
- C. covalent and co-ordinate covalent
- D. electrovalent

Answer: B



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19. The bonds present in HCl molecule are

- A. Non-polar Covalent
- B. Polar Covalent
- C. Ionic

D. dative

Answer: B



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20. (A): BeF_2 is predominantly a covalent compound. (R) :

Electronegativity difference between Be and F is too small

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C



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21. (A) : SiF_4 has octet configuration but acts as an electron pair acceptor

(R) : Central atom or Si has vacant d-orbitals in its valence shell

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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LEVEL -I (MAIN) (EXERCISE-III)

1. Increasing order of size of hybrid orbitals is

A. sp, sp^2, sp^3

B. sp^3 , sp^2 , sp

C. sp^2 , sp^3 , sp

D. sp^2 , sp , sp^3

Answer: A



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2. The type of hybridisation present on "S" in SO_2 and SO_3 molecules respectively

A. sp , sp^2

B. sp^2 , sp^2

C. sp , sp^3

D. sp^2 , sp^3

Answer: B



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3. The hybridisation of Ag in the complex $\left[Ag(NH_3)_2\right]^+$ is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: A



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4. Atomic number of the central atom in MCl_2 is 50. The shape of gaseous MCl_2 is given as



A.



B.



C.



D.

Answer: D



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5. An element M reacts with chlorine to form a compound X. The bond angle in X is 120° . What is M?

A. Be

B. B

C. Mg

D. N

Answer: B



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6. When the hybridisation state of carbon atom changes from sp^3 to sp^2 and finally to sp , the angle between the hybrid orbitals

A. Decreases gradually

- B. Decreased considerably
- C. No change
- D. Increases progressively

Answer: D



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7. Hybridisation of one s and one p orbitals form

- A. Two mutually perpendicular orbitals
- B. Two orbitals at 180°
- C. Four orbitals directed tetrahedrally
- D. Three orbitals in plane

Answer: B



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8. Which orbital is used by oxygen atom to form a σ bond with other oxygen atom in O_2 molecule?

- A. pure p-orbital
- B. sp-hybrid orbital
- C. sp^2 -hybrid orbital
- D. sp^3 - hybrid orbital

Answer: A



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9. The hybrid state of carbon in acetylene is the same as that of carbon in

- A. Benzene
- B. Carbon dioxide
- C. Graphite
- D. Ethylene

Answer: B



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10. Regarding hybridisation which is incorrect?

A. BF_3 , C_2H_4 , C_6H_6 involves sp^2 hybridisation

B. BeF_2 , C_2H_2 , CO_2 involves sp hybridisation

C. NH_3 , H_2O , CCl_4 involves sp^3 hybridisations

D. CH_4 , C_2H_4 , C_2H_2 involves sp^2 hybridisation

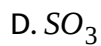
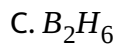
Answer: D



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11. sp^2 Hybrid orbitals are not present in

A. SO_2

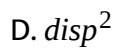


Answer: C



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12. Which hybridisation is found in $HClO_4$ and $HClO_3$?



Answer: A



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13. The ratio of pure orbitals to hybridized orbitals in ethylene is

A. 2:3

B. 3:1

C. 1:1

D. 1:3

Answer: C



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14. The ratio of hybrid and unhybrid orbitals involved in the bonding of a benzene molecule is

A. 3:2

B. 1:1

C. 3:1

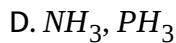
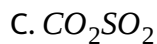
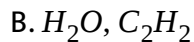
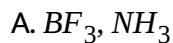
D. 1:3

Answer: A



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15. The pair having similar geometry is

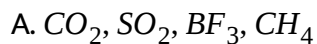


Answer: D



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16. The correct increasing order of bond angle is



B. CH_4 , SO_2 , BF_3 , CO_2

C. BF_3 , CH_4 , CO_2 , SO_2

D. CO_2 , CH_4 , BF_3 , SO_2

Answer: B



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17. The molecule with maximum number of lone pairs on central atom is

A. XeO_3

B. SF_4

C. PCl_3

D. ICl_3

Answer: D



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18. The type of overlapping not observed in the formation of ethylene molecule is

A. $\rho sp^2 - sp^2$

B. $\rho sp^2 - p$

C. $\rho sp^2 - s$

D. $p^\pi - p^\pi$

Answer: B



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19. The hybrid orbitals have bond angle of $109^\circ 28'$. The ratio of percentage of 's' and 'p' characters is

A. 1:1

B. 1:2

C. 1:2

D. 1:3

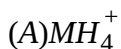
Answer: C



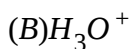
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List-1

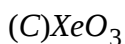
List-2



(1) sp^3 hybridisation, two lone pairs



(2) sp^3 hybridisation, one lone pair



(3) sp^3 hybridisation, no lone pair



(4) sp^3 hybridisation, one lone pair

(5) sp^2 hybridisation, no lone pair

20.

The correct match is

A B C D

A. 1 2 3 4

A B C D

B. 2 2 3 5

A B C D

C. 3 4 4 5

A B C D

D. 4 4 3 5

Answer: C

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List-1 List-2

(A) CH_4 (1) $sp^2 - sp^2$ overlap, $sp^2 - s$ overlap

(B) C_2H_4 (2) $sp - sp$ overlap, $sp - s$ overlap

21. (C) C_2H_6 (3) $sp^3 - s$ overlap only

(D) C_2H_2 (4) $sp^3 - sp^3$ overlap, $sp^3 - sp^2$ overlap

(5) $sp^2 sp^3 - sp^3$ overlap, $sp^3 - s$ overlap

The correct match is

A. A B C D
 5 2 1 3

B. A B C D
 3 5 1 2

C. A B C D
 3 4 1 2

D. A B C D
 3 1 5 2

Answer: D

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

A. Be_2 is not a stable molecule

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

C. Bond strength of N_2 is maximum amongst the homonuclear diatomic molecules

D. The order of energies of molecular orbitals in F_2 molecule is

$$E(\sigma_{2s}) < E(\sigma_{2s}^*) < E(\pi_{2x}) = E(\pi_{2y}) < E(\sigma_{2p_x}) < E(\pi_{2p_x}^*) = E(\pi_{2p_y}^*)$$

Answer: B

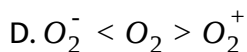
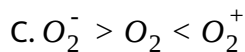


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2. Which of the following orders regarding the bond order is correct?

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

B. $O_2^- < O_2 < O_2^+$

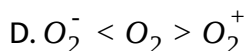
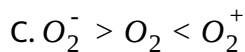
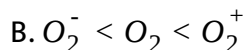
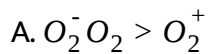


Answer: A



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3. Which of the following orders regarding the bond length is correct?



Answer: C



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4. The molecule electronic configuration of B_2 is

A. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p)_x^1(\pi 2p)_y^1$

B. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p)_x^2$

C. $KK(\sigma 2s)^2(\sigma 2s)^2(\pi 2p)^2$

D. $KK(\sigma 2s)^2(\sigma^* 2s)^2(\sigma 2p)^1(\pi 2p)^1$

Answer: A



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5. When N_2 goes to N_2^+ , then N-N bond distanceand when O_2 goes to O_2^+ the O-O bond distance.....

A. increases, decreases

B. decreases, increases

C. increases, increases

D. decreases, decreases

Answer: C



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6. The wave function of a molecular orbital formed by reinforce of wave functions of Ψ_A and Ψ_B of atomic orbital A and B is represented as

A. $\psi_A + \psi_B$

B. $\psi_A - \psi_B$

C. $\psi_A \pm \psi_B$

D. $2\psi_A + \psi_B$

Answer: B



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7. The wavelength of the wave function of a bonding molecular orbital formed by LCAO is

- A. Equal to the wave function of atomic orbital
- B. Less than the wave function of atomic orbital
- C. Greater than the wave function of atomic orbital
- D. Double the wave function of atomic orbital

Answer: D



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8. The molecular orbital electronic configuration is $\sigma_{1s}^2, (\sigma_{1s}^*)^1$. It corresponds to

- A. He_2
- B. He_2^+
- C. H_2^-
- D. H_2^+

Answer: D



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9. A bonding molecular orbital is produced by

- A. Destructive interference of wave functions
- B. Constructive interference of wave functions
- C. Pairing of electrons with opposite spins
- D. Combination of +ve and -ve wave functions

Answer: D



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10. π_{2px}^* differs from π_{2py}^* molecular orbital in which of the following

- A. Number of planes
- B. Energy
- C. Symmetry

D. Shape

Answer: A



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11. The bond order of individual carbon bonds in benzene is

A. one

B. two

C. Between one and two

D. One and two alternately

Answer: B



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12. In the formation of a homo diatomic neutral molecule, if N atomic orbitals combine, then the total number of bonding molecular orbital formed is

- A. $2N$
- B. N
- C. $N/2$
- D. $N/4$

Answer: C



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13. In an anti bonding molecular orbital, electron density is minimum

- A. around one atom of the molecule
- B. between 2 nuclei
- C. at a point away from nuclei of the molecule

D. at no place

Answer: B



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14. The correct order of the energy of molecular orbitals in a molecules having four electrons

A. $\sigma_{2s}^* > \sigma_{2pz} > \pi_{2px}$

B. $\sigma_{2s}^* < \pi_{2p} < \sigma_{2pz}$

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

D. $\sigma_{2pz} < \sigma_{2s}^* < \pi_{2px}$

Answer: A



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15. The type of overlap present in the bonds of hydrogen sulphide molecule is

A. $\sigma s - p$

B. $\sigma s - s$

C. $\sigma p - p$

D. $\sigma p - p$

Answer: D



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16. Hydrogen chloride molecule contains

A. Covalent bond

B. Double bond

C. Co-ordinate bond

D. Electrovalent bond

Answer: D



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17. Iodine monochloride molecule is formed by the overlap of

- A. s-s orbitals
- B. s-p orbitals
- C. p-p orbitals end to end
- D. p-p orbitals sideways

Answer: C



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18. Which is true regarding a sigma bond

- A. It has lateral overlap

- B. It has two electron pairs in the bond
- C. It has electron transfer
- D. It has head-to-head overlap

Answer: C



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19. In solid argon, the atoms are held together by

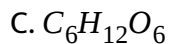
- A. Ionic bonds
- B. Hydrogen bonds
- C. Vander Waal forces
- D. Hydrophobic forces

Answer: C



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20. Which of the following boils at higher temperature ?



Answer: D



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21. Anhydrous AlCl_3 is covalent while AlF_3 is ionic. This is justified by

A. Crystal structure

B. VB theory

C. Fajan's rules

D. Lattice energy

Answer: C



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22. Cl_4 is insoluble in water because

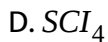
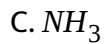
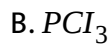
- A. H_2O is non polar
- B. CCl_4 is non -polar
- C. They do not form inter molecular H-bonding
- D. They do not form intra molecular H-bonding

Answer: B



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23. Which of the following molecule does not obey the octet rule and also has lone pair on the central atom.

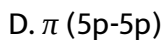
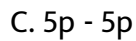
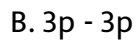
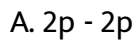


Answer: D



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24. Which of the following overlap is the strongest?



Answer: A



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LEVEL -I (MAIN) (EXERCISE-V)

1. Abnonnal boiling point of a compound is due lo

- A. Van der waal's forces
- B. Covalent bonding
- C. Intermolecular hydrogen bonding
- D. Intramolecular hydrogen bonding'

Answer: C



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2. Which among the following compounds does not show hydrogen bonding?

- A. Ammonia

B. Ethyl alcohol

C. Acetic acid

D. Diethyl ether

Answer: D



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3. In which of the following compounds is hydrogen bonding strongest in liquid phase ?

A. HF

B. CH_4

C. HI

D. PH_3

Answer: A



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4. Water has a higher boiling point than the corresponding hydrides

H_2S , H_2Se and H_2Te . This is because water has

- A. Ionic bonds
- B. Hydrogen bonds
- C. Covalent bonds
- D. Vander Waals' forces

Answer: B



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

- A. liquid HCl
- B. liquid NH_3
- C. Water

D. Phenol

Answer: A



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6. Intramolecular hydrogen bond is present in

A. orthohydroxy benzaldehyde

B. parahydroxy benzaldehyde

C. ethyl alcohol

D. hydrogen fluoride

Answer: A



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7. Hydrogen bond 'is

- A. A weak covalent bond
- B. A weak electrostatic force
- C. A weak metallic force
- D. It is not a bond

Answer: B



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8. Inter molecular hydrogen bonding is absent in

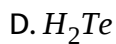
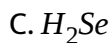
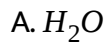
- A. H_2O
- B. NH_3
- C. C_2H_5OH
- D. CH_4

Answer: D



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9. Which among the following has the highest volatility

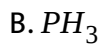
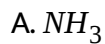


Answer: B



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10. Among the following which has the highest boiling point



D. CH_4

Answer: A



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11. Intramolecular hydrogen bonding is present in

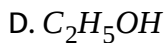
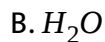
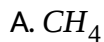
- A. meta nitrophenol
- B. Salicylic acid
- C. hydrogen chloride
- D. benzophenone

Answer: B



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12. Which of the following has the lowest boiling point ?



Answer: A



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List-1 List-2

(A) $NaCl$ (2) Covalent bond

13. (B) CH_4 (2) Ionic bond

(C) N_4^+ (3) Metallic bond

The correct match is

A. A B C D
 2 1 4 3

B. A B C D
 2 4 1 3

C. A B C D
 2 3 1 4

D. A B C D
 1 2 3 4

Answer: A



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14. (A) : Parahydroxy benzaldehyde is more soluble in water than orthohydroxy benzaldehyde.

(R) : Parahydroxy benzaldehyde and orthohydroxy benzaldehyde are position isomers.

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: B



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15. (A) : Water has more boiling point than that of hydrogen fluoride.

(R) : The molecular weight of H_2O is more than HF

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. (A) is false but (R) is true

Answer: C



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16. (A): Ionic compounds tend to be non-volatile

(R) : Inter ionic forces in ionic compounds are weak

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C



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17. (A): Among Ca^{2+} and Zn^{2+} ions, Ca^{2+} is more stable than Zn^{2+}

(R) : Both Ca^{2+} and Zn^{2+} ions are diamagnetic

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: B



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18. (A): NaCl is bad conductor in the solid state

(R) : Na^+ and Cl^- ions are not free in the solid state

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A



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19. (A): Ionic compounds exhibit isomerism

(R) : Ionic bond is non directional bond

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of

(A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D



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LEVEL - II (TYPE-I) (LECTURE SHEET - 1)

1. Which order are correct?

A. Thermal stability: $\text{BeSO}_4 < \text{MgSO}_4 < \text{CaSO}_4 < \text{SrSO}_4 < \text{BaSO}_4$

B. Basic nature : $ZnO > BeO > MgO > CaO$

C. Solubility in water : $LiOH > NaOH > KOH > RbOH > CsOH$

D. Melting point : $NaCl > KCl > RbCl > CsCl > LiCl$

Answer: A::D



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2. The bond between the atom, may be formed by

A. Transfer of electrons

B. Sharing of electrons

C. Transfer of protons

D. Transfer of neutrons

Answer: A::B



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3. In correct option(s) is (are)

- A. NaCl is soluble in CCl_4
- B. KHF_2 has ionic bond
- C. The shape of ClF_3 is T-shape
- D. LiCl is completely ionic compound

Answer: A::D



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4. The type of bonds present in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is(are)

- A. electrovalent
- B. covalent
- C. dative
- D. B-bond

Answer: A::B::C::D



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5. The radius and charge of each of six ions are shown in the table below. The ionic solids JX, LY and MZ are of the same Lattice type. What is the correct order of Lattice energies?

A. $JX = LY = MA$

B. $JX > LY$

C. $LY < MZ$

D. $IX > MZ$

Answer: B::C



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Column-I Column-II

(A) O_2^+ (P) bond order ≥ 1

6. (B) He_2^+ (Q) Paramagnetic

(C) C_2^{2-} (R) Homonuclear atomic orbital combine with each other

(D) NO (S) Outermost electron in antibonding molecular orbital



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LEVEL - II {TYPE-I} (LECTURE SHEET - 1) (Section - B : Linked Comprehension Type Questions)

1. The Chemical bond formed due to electron transfer is called ionic bond or electrovalent bond. Ionic bond will be formed more easily between the elements with low ionisation potential and high electron affinity. Energy changes involved during the formation of ionic compound can be calculated by Born - Haber cycle. Lattice enthalpy changes are directly proportional to the stability of ionic compound.

Which of the following has electrovalent bond ?

A. HCl



Answer: B::C



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2. The chemical bond formed due to electron transfer is called ionic bond or electrovalent bond, ionic bond will be formed more easily between the elements with low ionization potential and high electron affinity. Energy changes involved during the formation of ionic compound can be calculated by Born-Haber cycle. Lattice enthalpy changes are directly proportional to the stability of ionic compound

Born-Haber cycle is based on

A. Faraday's law

B. Gay-Lussac's law

C. Emeton's law

D. Hess's law

Answer: D



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3. The chemical bond formed due to electron transfer is called ionic bond or electrovalent bond, ionic bond will be formed more easily between the elements with low ionization potential and high electron affinity. Energy changes involved during the formation of ionic compound can be calculated by Born-Haber cycle. Lattice enthalpy changes are directly proportional to the stability of ionic compound

Most stable ionic compound among the following is

A. Li_2O

B. MgO

C. Cs_2O

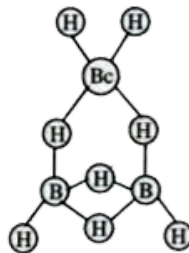
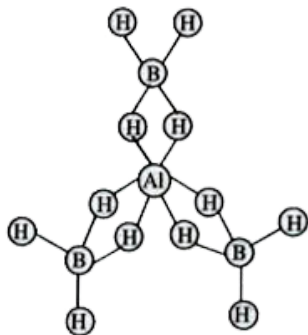
Answer: B::C



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4. NaBH_4 is ionic compound contain BH_4^- tetrahydridoborate ion and in solid state NaBH_4 has sodium chloride structure. Not all tetrahydridoborates are ionic. The beryllium, aluminium and transition metal borohydrides become increasingly covalent and volatile. In these type of tetrahydrido borate the BH_4^- form covalent bond with metal ion. One or more H atoms in a BH_4^- act as a bridged bond to metal, forming a three centre bond with two electrons shared by three atoms. The BH_4^- is usually in that it may form one two or three such three centre bonds to the metal ion when forms covalent bond.

$\text{Be}(\text{BH}_4)_2$ and $\text{Al}(\text{BH}_4)_3$ are covalent and structures are given below:



Select incorrect statement about ' $Li[AlH_4]$ '

A. hybridisation of Al is same as B in $Na[BH_4]$

B. geometry around Al is same as $AlCl_4^-$

C. AlH_4^- , BH_4^- , $AlCl_4^-$ iso-structural

D. AlH_4^- , $AlCl_4^-$, BH_4^- , are iso-electronic

Answer: D

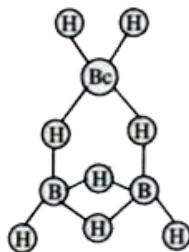
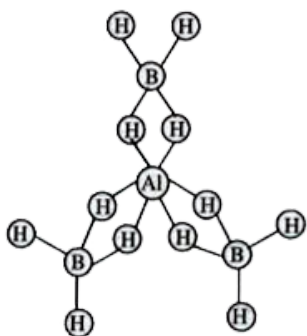


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metal borohydrides become increasingly covalent and volatile. In these type of tetrahydrido borate the BH_4^- form covalent bond with metal ion. One or more H atoms in a BH_4^- act as a bridged bond to metal, forming a three centre bond with two electrons shared by three atoms. The BH_4^- is usually in that it may form one two or three such three centre bonds to the metal ion when forms covalent bond.

$Be(BH_4)_2$ and $Al(BH_4)_3$ are covalent and structures are given below:



- A. Each tetrahydride borate form two hydrogen bridges
- B. Two BH_4 form 2 hydrogen bridges and one BH_4 form one hydrogen bridge
- C. One BH_4 form 2 hydrogen bridge and two BH_4 form one hydrogen bridge
- D. B form only 2c - 2e bond

Answer: A



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LEVEL - II {TYPE-I} (Section - C : Matching/Straight Objective Type Questions)

1. Match the following.

Column -I

Column-II

(A) Electron deficient

(P) ClF_3

(B) Odd electron molecule

(Q) $BeCl_2$

(C) Expansion of octet

(R) BF_3

(D) T shaped molecule

(S) NO

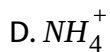
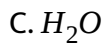


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LEVEL - II {TYPE-I} (PRACTICE SHEET -1)

1. Which of the following contains a coordinate covalent bond ?

A. H_3O^+

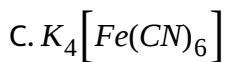
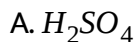


Answer: A::D



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2. The compound(s) which contain ionic, covalent and coordinate bonds is (are)



Answer: A::B::C



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3. What types of bonds are present in NH_4Cl ? Write its structure.

- A. ionic
- B. covalent
- C. coordinate
- D. singlet

Answer: A::B::C



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4. Which of the following shows iso-structural species ?

- A. NH_4^+ and $AlCl_4^-$
- B. CH_3^- and H_3O^+
- C. SO_4^{2-} , PO_4^{3-} and BF_4^-
- D. $SiCl_4$ and CO_2

Answer: A::B::C



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5. What is/are true about resonance ?

- A. The resonance structures are hypothetical
- B. The unpaired electrons in various resonating structures are same
- C. Hybrid structure is most energetic
- D. Hybrid structure is least energetic

Answer: A::B::D



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LEVEL - II (TYPE-I) (PRACTICE SHEET -1) (Section - B : Linked Comprehension Type Questions)

1. Ionic bond is defined as the electrostatic force of attraction holding the oppositely charged ions. Ionic compounds are mostly crystalline solids having high melting and boiling points, electrical conductivity in molten state, solubility in water etc., Covalent bond is defined as the force which binds atoms of same or different elements by mutual sharing of electrons in a covalent bond. Covalent compounds are solids, liquids or gases. They are low melting and boiling point compounds. They are more soluble in non polar solvents.

The valence electrons not involved in formation of covalent bonds are called

- A. Bond pairs
- B. Lone pairs
- C. Unshared pairs
- D. None of these

Answer: C



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2. Ionic bond is defined as the electrostatic force of attraction holding the oppositely charged ions. Ionic compounds are mostly crystalline solids having high melting and boiling points, electrical conductivity in molten state, solubility in water etc., Covalent bond is defined as the force which binds atoms of same or different elements by mutual sharing of electrons in a covalent bond. Covalent compounds are solids, liquids or gases. They are low melting and boiling point compounds. They are more soluble in non polar solvents.

The amount of energy released when one mole of ionic solid formed by close packing of gaseous ions is called

- A. Ionization energy
- B. Salvation energy
- C. Lattice energy
- D. Hydration energy

Answer: C



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3. Ionic bond is defined as the electrostatic force of attraction holding the oppositely charged ions. Ionic compounds are mostly crystalline solids having high melting and boiling points, electrical conductivity in molten state, solubility in water etc., Covalent bond is defined as the force which binds atoms of same or different elements by mutual sharing of electrons in a covalent bond. Covalent compounds are solids, liquids or gases. They are low melting and boiling point compounds. They are more soluble in non polar solvents.

Examples of covalent compounds are

- A. urea
- B. Barium chloride
- C. Sodium chloride
- D. Calcium fluoride

Answer: A



4. The chemical bond formed due to electron transfer is called ionic bond or electrovalent bond, ionic bond will be formed more easily between the elements with low ionization potential and high electron affinity. Energy changes involved during the formation of ionic compound can be calculated by Born-Haber cycle. Lattice enthalpy changes are directly proportional to the stability of ionic compound

Born-Haber cycle is based on

- A. Faraday's law
- B. Gay-Lussac's law
- C. Hess's law
- D. Hess'law

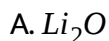
Answer: D



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5. The chemical bond formed due to electron transfer is called ionic bond or electrovalent bond, ionic bond will be formed more easily between the elements with low ionization potential and high electron affinity. Energy changes involved during the formation of ionic compound can be calculated by Born-Haber cycle. Lattice enthalpy changes are directly proportional to the stability of ionic compound

Most stable ionic compound among the following is



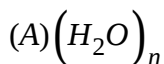
Answer: B::C



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Column -I

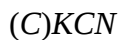
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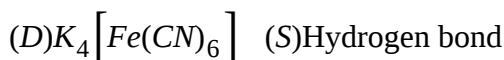
(P) Ionic bond



(Q) Covalent bond



(R) Co-ordinate bond



(S) Hydrogen bond



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2.

(Column -I, Column-II), $((A)MgCl_2, (P)1)$, $((B)AlF_3, (Q)3)$, $((C)Na_2SO_4, (R) - ($



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LEVEL - II (TYPE-I) (LECTURE SHEET - 2) (Section - B : Linked Comprehension Type Questions)

1. Bonding formation between two atoms is then envisaged as the progressive overlapping of an atomic orbital from each of the

participating atoms, the greater the overlap achieved (the overlap integral), the stronger the bond so formed.

For σ bond formation the relative overlapping power of :

- A. s-orbital is greater than p-orbital because s-orbital are closer to nucleus
- B. p-orbitals is greater than s-orbital because electrons of p-orbitals are oriented on internuclear axis
- C. s-orbitals is greater than p-orbital because of spherical shape of s-orbital
- D. p-orbital is greater than s-orbital because electrons of p-orbitals are oriiented on internuclear axis

Answer: D



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1. Which statement(s) is (are) correct ?

- A. A sigma bond is stronger than π -bond
- B. A sigma bond is weaker than π -bond
- C. Hydrogen bonding is weaker than covalent bonding
- D. A triple bond is weaker than double bond

Answer: A::C



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2. What is/are true about resonance ?

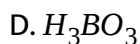
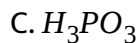
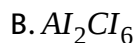
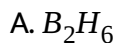
- A. The resonance structures are hypothetical
- B. The unpaired electrons in various resonating structures are same
- C. Hybrid structure is most energetic
- D. Hybrid structure is least energetic

Answer: A::B::D



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3. In which of the following molecules, vacant orbitals take part in hybridization?

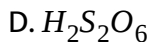
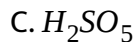
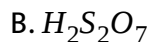
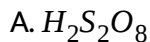


Answer: A::B



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4. Which of the following molecules have (-O-O-) bond i.e., peroxide bond?



Answer: A::C



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5. Select the correct statements about the following : $NO[BF_4]$

A. It has 5σ and 2π bonds

B. It has diamagnetic character

C. B-F bond length in this compound is shorter than that in BF_3

D. N-O bond length in this compound is greater than that of NO

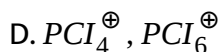
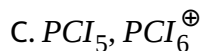
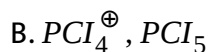
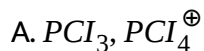
Answer: A::B



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6. Bonding formation between two atoms is then envisaged as the progressive overlapping of an atomic orbital from each of the participating atoms, the greater the overlap achieved (the overlap integral), the stronger the bond so formed.

In which of the following pair both have similarity in bond angle(s) between adjacent chlorine?



Answer: C



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7. Bonding formation between two atoms is then envisaged as the progressive overlapping of an atomic orbital from each of the participating atoms, the greater the overlap achieved (the overlap integral), the stronger the bond so formed.

In inorganic benzene ($B_3N_3H_6$):

- A. only six $(sp^2 - sp^2)\sigma$ bonds and three $p\pi - p\pi$ coordinate bond
- B. twelve $(sp^2 - sp^2)\sigma$ bonds and three $\pi - \pi$ coordinate bond
- C. six $(sp^2 - sp^2)\sigma$ bonds, six $(sp^2 - sp)\sigma$ bonds, and three $p\pi - p\pi$ coordinate bond
- D. six $(sp^2 - sp^2)\sigma$ bonds, six $(sp^2 - sp^2)$ coordinate bond

Answer: C



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8. To draw the Lewis structure of covalent molecules/ions following steps are followed:

i) Identify the central atom in the given species. Generally central atom is that atom which is less in number, usually electronegativity of central atom is less. Hydrogen is never a central atom

ii) Atoms which are directly attached with central atoms are called surrounding atoms.

iii) Arrange the surrounding atoms around central atoms and make a single bond between each pair of central and surrounding atoms. If by doing so the octet of surrounding atoms is not complete, then make double or triple bond to ensure that the octet of all the surrounding atoms is complete, keeping in mind the covalency of central atoms. Usually covalency of any element is the number of unpaired electrons either in ground or in excited state.

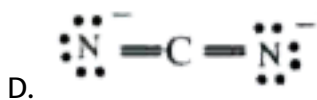
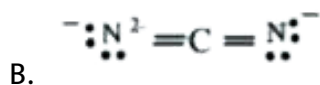
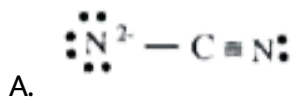
iv) Covalency of any of the second period element can never exceed four i.e., it can't have more than eight electrons in its valency shell. However, covalency of 3rd and lower period elements can be less than, equal to or greater than four.

v) Represent the lone pair of electron particularly of central atom

vi) If the given species is polyatomic ion then before making any bond between central atoms and surrounding atoms distribute the charge on

surrounding atoms symmetrically as far as possible and then follow all the above mentioned steps.

Which of the following structures of $(CN_4)^{2-}$ is incorrect ?

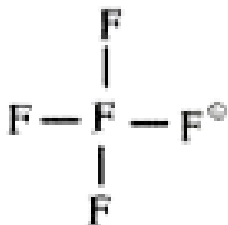


Answer: D

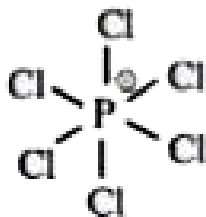


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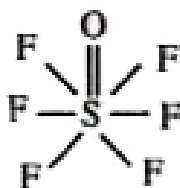
9. Which of the following is correct representation of Lewis structure of given species?



A.



B.



D.

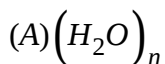
Answer: B



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Column -I

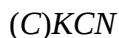
Column-II



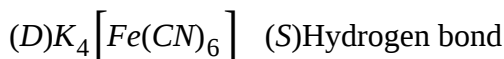
(P) Ionic bond



(Q) Covalent bond



(R) Co-ordinate bond



(S) Hydrogen bond



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LEVEL - II (TYPE-I) (LECTURE SHEET - 2) (Section - C : Matching/Straight Objective Type Questions)

1. If $A = \left\{ 0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2} \right\}$ and $f: A \rightarrow B$ is a surjection defined by $f(x) = \cos x$ then find B.



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LEVEL - II (TYPE-I) PRACTICE SHEET - 2 (Section -A : More than One correct answer Type Questions)

1. Select correct statement for AB_nL_2 :

[A = central atom, L = lone pair of electron A, n = number of monovalent atom B]

A. Molecule will be planar and non polar when $n = 4$

B. Molecule will be non planar and polar when $n = 3$

C. Molecule will be planar and polar when $n = 2$

D. bond polarity is equal to molecular polarity when $n = 2$

Answer: A::C



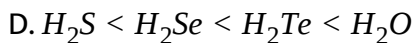
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2. Correct order of boiling points of hydrogen halides is

A. $(CH_3)_3N < (CH_3)_3P < (CH_3)_3As < (CH_3)_3Sb$

B. $NH_3 < PH_3 < AsH_3 < SbH_3$

C. $(CH_3)_2O < (CH_3)_2S < (CH_3)_2Se < (CH_3)_2Te$



Answer: A::C::D



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3. Which of the following statement is correct

A. $(CH_3)_3COH$ is less acidic than $(CH_3)_3SiOH$

B. In trisilyl phosphine $p\pi - d\pi$ back bonding takes place

C. There are two $d\pi - p\pi$ bonds in a SO_2 molecule

D. Fraction of s-character in hybrid orbital around the central atom in

PCl_4^+ molecule is 0.25

Answer: A::D



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4. Silanes ($\text{Si}_n\text{H}_{2n+2}$) compounds are less stable (highly reactive) than the corresponding hydrocarbons ($\text{C}_n\text{H}_{2n+2}$). Why?

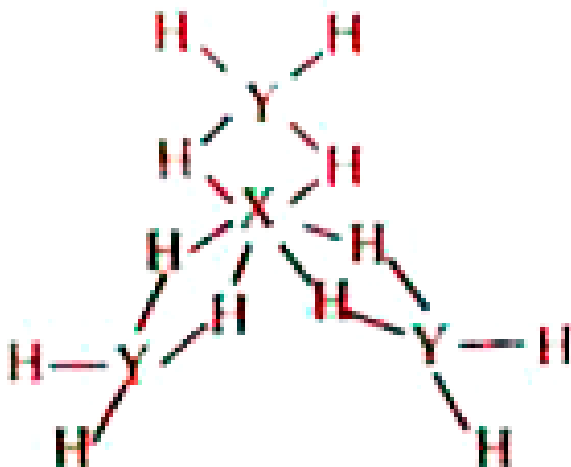
- A. The Si-Si bond is slightly weaker than the C - C bond
- B. The Si-H bond are weaker than C-H bond
- C. Silicon atoms have larger and therefore provide greater surface area for attack by nucleophiles
- D. Silicon atoms have low-lying d-orbitals that can act as acceptors of electron pairs from nucleophiles

Answer: A::B::C::D



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5. A molecule having molecular formula XY_3H_{12} has following structure (H represents H-atom):



What are the structural features of the molecule ?

- A. X belongs to IIIrd period whereas Y belongs to IIInd period of periodic table
- B. X and Y both belong to IIIrd group i the periodic table
- C. There are six 3e - 2e bonds and six 2e - 3e bonds
- D. All y atoms are sp^3 - hybridised

Answer: A::B::C::D



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LEVEL - II (TYPE-I) PRACTICE SHEET - 2 (Section - B : Linked Comprehension
Type Questions)

1. When half-filled valence orbital of one atom overlaps with half-filled valence orbital of other atom, a covalent bond is formed. Head on or axial overlap leads to the formation of sigma bond. Sidewise or lateral overlap of atomic orbitals (p) give rise to the formation of π -bond. Similarly side wise overlap between d-orbitals can lead to the formation of δ -bond. In case of π -bond, the probability of finding the shared electron cloud is zero along the line joining two nuclei while the probability of finding the shared electron cloud is maximum along the inter nuclear axis.

If x-axis is the internuclear axis then which of the following combination will result into the formation of π -bond?

A. $s + 2p_x$

B. $2p_x + 2p_x$

C. $2p_y + 2p_y$

D. $s + s$

Answer: C



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2. When half-filled valence orbital of one atom overlaps with half-filled valence orbital of other atom, a covalent bond is formed. Head on or axial overlap leads to the formation of sigma bond. Sidewise or lateral overlap of atomic orbitals (p) give rise to the formation of π -bond. Similarly side wise overlap between d-orbitals can lead to the formation of δ -bond. In case of π -bond, the probability of finding the shared electron cloud is zero along the line joining two nuclei while the probability of finding the shared electron cloud is maximum along the inter nuclear axis.

The strength of bonds by s-s, p-p, s-p overlap is in the order :

A. $s - s < s - p < p - p$

B. $s - s < p - p < s - p$

C. $s - p < s - s < p - p$

D. $p - p < s - s < s - p$

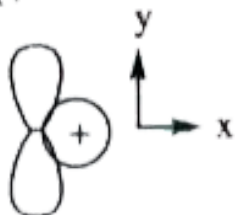
Answer: A

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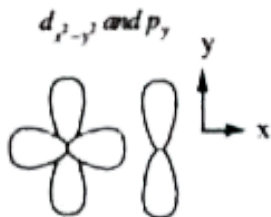
3. When half-filled valence orbital of one atom overlaps with half-filled valence orbital of other atom, a covalent bond is formed. Head on or axial overlap leads to the formation of sigma bond. Sidewise or lateral overlap of atomic orbitals (p) give rise to the formation of π -bond. Similarly side wise overlap between d-orbitals can lead to the formation of δ -bond. In case of π -bond, the probability of finding the shared electron cloud is zero along the line joining two nuclei while the probability of finding the shared electron cloud is maximum along the inter nuclear axis.

If the internuclear axis is x-axis, which of the following will not give non bonding combination?

p, and s



A.

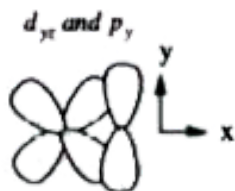


B.

s and s



C.



D.

Answer: C



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4. Sigma bonds are :

A. Cylindrically symmetrical about the bond axis

- B. Perpendicular to the bond axis
- C. asymmetrical about the bond axis
- D. None of the above

Answer: A

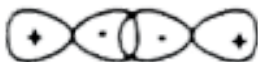


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5. Which of the following is called negative overlap?



A.



B.



C.



D.

Answer: C



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LEVEL - II (TYPE-I) PRACTICE SHEET - 2 (Section - C : Matching/Straight Objective Type Questions)

1. Match the molecular species in Column-I and their magnetic and molecular orbital properties in Column-II :

Column-I	Column-II
(A) O_2	(P) Bond order = 2
(B) N_2	(Q) Diamagnetic
(C) H_2	(R) Bond order = 3
(D) O_2^{2-}	(S) Paramagnetic



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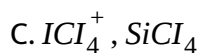
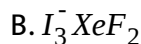
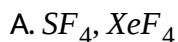
- | Column-I | Column-II |
|----------------|---|
| (A) Boron | (P) Vacant orbital in valency shell |
| (B) Phosphorus | (Q) Unpaired electron in valency shell |
| 2. (C) Iron | (R) Non-metallic properties |
| (D) Calcium | (S) No unpaired electron |
| | (T) X_2O_3 type (empirical ratio) oxide formation |



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LEVEL - II (TYPE-I) LECTURE SHEET -3 (Section - A : More than One correct answer Type Questions)

1. In which of the following pairs, both the species have the same hybridisation ?



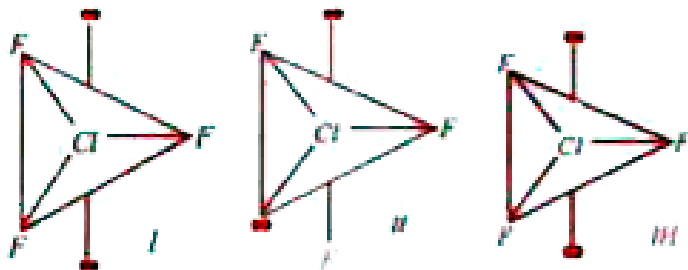
D. ClO_3^- , PO_4^{3-}

Answer: B::D



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2. In ClF_3 the central chlorine atom is sp^3d hybridised and theoretically three structures are possible.



Which of the following is true .

A. All the 3 structure are equally stable

B. Structure III is most stable

C. In structure m there are four 90° lp-bp repulsions and no 90° lp-bp repulsions.

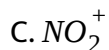
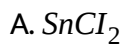
D. In structure I there are 6 lp-lp repulsions at 90°

Answer: B::C::D



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3. The linear structure is assumed by :

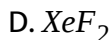
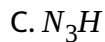
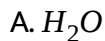


Answer: B::C::D



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4. Geometry of the molecule is distorted by VSEPR in

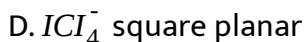
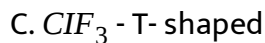
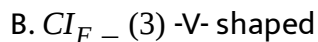
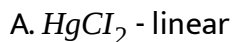


Answer: A::B::C::D



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5. Which combination of the compounds and their geometry are correct ?



Answer: A::C::D



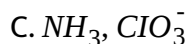
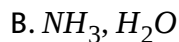
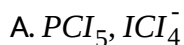
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LEVEL - II (TYPE-I) LECTURE SHEET -3 (Section - B : Linked Comprehension Type Questions)

1. 1) Total number of electron pairs = $\frac{1}{2}$ (number of valence electrons \pm electron (for ionic charge))
- 2) Number of bond electron pairs = number of atoms -
- 3) Number of electron pairs around central atom = total number of electron pairs - 3 [number atoms (except H)]
- 4) Number lone pair = (number of central electron pairs - number bond pairs)

Read the above method and answer the following questions :

Pair of species with same shape and same state of hybridisation of the central atom is :



D. ICI_4^- , CIO_3^-

Answer: C



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2. 1) Total number of electron pairs = $\frac{1}{2}$ (number of valence electrons \pm electron (for ionic charge))

2) Number of bond electron pairs = number of atoms -

3) Number of electron pairs around central atom = total number of electron pairs - 3 [number atoms (except H)]

4) Number lone pair = (number of central electron pairs - number bond pairs)

Read the above method and answer the following questions :

Square planar shape is predicted for:

A. ICI_4^- , CIO_3^-

B. PCI_4^- , PCI_6^-

C. ICI_4^- , PCI_4^+

D. ICI_4^- , XeF_4

Answer: D



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3. 1) Total number of electron pairs = $\frac{1}{2}$ (number of valence electrons \pm electron (for ionic charge))

2) Number of bond electron pairs = number of atoms -

3) Number of electron pairs around central atom = total number of electron pairs - 3 [number atoms (except H)]

4) Number lone pair = (number of central electron pairs - number bond pairs)

Read the above method and answer the following questions :

Based on the given structure of the some of the molecules have been matched. Which is the incorrect matching ?

A. PCI_5^- trigonal bipyramidal

B. CIO_3^- square planar

C. ICI_4^- square planar

D. PCI_4^+ tetrahedral

Answer: B



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4. During chemical bond formation the potential energy of the bonding atoms decreases. According to VBT bond strength depends on extent of over lapping. Shapes and bond angles of the molecules were explained by VSEPR theory. This theory explains the Geometry of the molecules based on the repulsions among the valance shell electron pairs.

As number of lone pairs increases repulsions increases apd the shape is altered accordingly.

AB_4E_2 type of molecule with square planar shape is

A. CIF_3

B. SF_4

C. H_2O

D. XeF_4

Answer: D



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5. During chemical bond formation the potential energy of the bonding atoms decreases. According to VBT bond strength depends on extent of over lapping. Shapes and bond angles of the molecules were explained by VSEPR theory. This theory explains the Geometry of the molecules based on the repulsions among the valance shell electron pairs.

As number of lone pairs increases repulsions increases apd the shape is altered accordingly.

Katio of lone pairs and bond pair electrons in H_2O molecule respectively

A. 2:3

B. 1:1

C. 1:3

D. 1:2

Answer: B



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6. Match the Column-I with Column-II

Column-I

Column-II

(A) XeF_2

(P) Distorted octahedral

(B) XeF_6

(Q) Pyramidal

(C) NH_3

(R) Tetrahedral

(D) XeO_4

(S) Linear



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LEVEL - II (TYPE-I) LECTURE SHEET -3 (Section - C : Matching/Straight Objective Type Questions)

1. Match the molecules/ions in Column-I with shapes in Column-II

Column-I

Column-II

(A) BeCl_2

(P) Square planar

(B) $[\text{PCl}_4]^+$

(Q) Linear

(C) XeF_4

(R) Tetrahedral

(D) XeO_3

(S) Pyramidal



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LEVEL - II (TYPE-I) (PRACTICE SHEET - 3) (Section - A : More than One correct answer Type Questions)

1. In which species the hybrid state of central atom is/are sp^3d ?

A. I_3^+

B. SF_4

C. PF_5

D. IF_5

Answer: B::C



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2. A molecule with two σ , two π^- bonds and one lone pair of electrons in the valence shell of X (central atom)

- A. trigonal planar geometry
- B. sp^3 hybridization
- C. formula of the molecule is XY_2
- D. square pyramidal geometry

Answer: A::B::C



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

A. BrO_3^- and XeO_3

B. HgCl_2 and CO_2

C. XeF_4 and SF_4

D. BF_3 and NF_3

Answer: A::B



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4. Indicate the wrong statement

A. A sigma bond has no free rotation along its axis

B. p-orbitals always have only sidewise overlapping

C. s-orbitals never form π - bonds

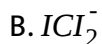
D. There can be more than one sigma bond between two atoms

Answer: A::B::D



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5. Which of the following molecules or ions is/are linear?



Answer: A::B::C



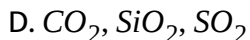
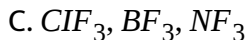
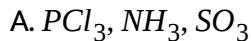
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LEVEL - II (TYPE-I) (PRACTICE SHEET - 3) (Section - B : Linked Comprehension Type Questions)

1. The mixing or redistribution of energy among the atomic orbitals is known as hybridisation. In hybridisation each electron can be described

by its wave function ψ .

Which of the following set of species has same electronic geometry



Answer: B

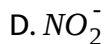


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2. The mixing or redistribution of energy among the atomic orbitals is known as hybridisation. In hybridisation each electron can be described by its wave function ψ .

In which of the following species lone pair - bond pair repulsion is maximum





Answer: C



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3. The mixing or redistribution of energy among the atomic orbitals is known as hybridisation. In hybridisation each electron can be described by its wave function ψ .

BF_3 form adduct with NH_3 as Lewis acid-base reaction, in which atom hybridisation will change?

A. both N and B

B. only B not N

C. only N not B

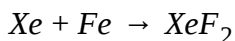
D. none of these

Answer: B

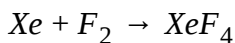


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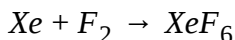
4. Xe reacts with F_2 at different ratio to give different types of xenon fluorides.



(2:1)



(1:5)



(1: 20)

Which of the following option is correct regarding XeF_2

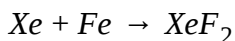
- A. two fluorine occupy equatorial position
- B. There are total two bond pair and two lone pair present in XeF_2
- C. Its structure is linear and it is isostructural with I_3^-
- D. Hybridisation of XeF_2 is sp^3

Answer: C

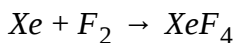


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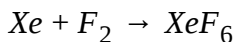
5. Xe reacts with F_2 at different ratio to give different types of xenon fluorides.



(2:1)



(1:5)



(1: 20)

The shape and hybridisation of XeF_4 is

- A. tetrahedral and sp^3
- B. square pyramidal and $sp^3 d$
- C. square planar and $sp^3 d$
- D. square planar and $sp^3 d$

Answer: D



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LEVEL - II (TYPE-I) (PRACTICE SHEET - 3) (Section - C : Matching/Straight Objective Type Questions)

Column-I Column-II

- A) CH_3^+ P) Electrically neutral
1. B) CH_3^- Q) having $6e^-$ in the outer shell
- C) \dot{CH}_3 R) sp_2
- D) $:CH_2$ S) sp^3



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Column-I

Column-II

- A) N_2 P) 40% carbon by mass
2. B) CO Q) Empirical formula CH_2O
- C) $C_6H_{12}O_6$ R) Vapour density : 14
- D) CH_3COOH S) $14N_A$ electrons in a mole



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LEVEL - II (TYPE-I) (LECTURE SHEET -4) (Section - A : More than One correct answer Type Questions)

1. Which of the following statement(s) is/are incorrect?

A. O_2 is paramagnetic, O_3 is also paramagnetic

B. O_2 is paramagnetic, O_3 is diamagnetic

C. B_2 is paramagnetic C_2 is also paramagnetic

D. Different observation is found in their bond length when

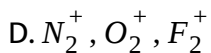
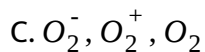
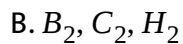
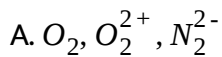


Answer: A::C::D



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2. In which of the following sets all the species are paramagnetic in nature ?



Answer: C::D



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3. Which of the following have identical bond order ?



Answer: A::C



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4. The molecules that will have dipole moment

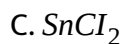
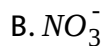
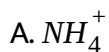
- A. 2, 2-dimethylpropane
- B. trans - 2-pentene
- C. cis-3-hexene
- D. 2,2,3,3-tetramethylbutane

Answer: B::C



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5. The molecules or ions in which the central atom has only bond pairs of electrons are



D. SF_4

Answer: A::B



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LEVEL - II (TYPE-I) (LECTURE SHEET -4) (Section - B : Linked Comprehension Type Questions)

1. Bond energy : Energy required to break a bond (equal to the energy released when a bond is formed) is named bond energy. Its unit is Kcal/mole. Stability of bond energy is character

$$\propto \frac{1}{\% \text{ P character}} \propto \text{bond order} \propto \frac{1}{\text{bond length}}$$

Higher is the number of bonds at a place, higher is the bond energy.

Write down bond energy order of C - H bond in (A) $-C-H$, (B) $=C-H$, (C) $\equiv C-H$

A. $A > B > C$

B. $A < B < C$

$$C. B > A > C$$

$$D. A > C > B$$

Answer: B



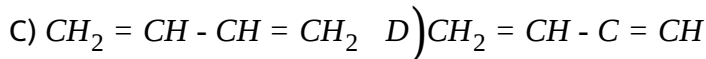
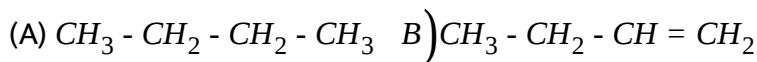
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2. Bond energy : Energy required to break a bond (equal to the energy released when a bond is formed) is named bond energy. Its unit is Kcal/mole. Stability of bond energy is proportional to % s character

$$\propto \frac{1}{\% \text{ P character}} \propto \text{bond order} \propto \frac{1}{\text{bond length}}$$

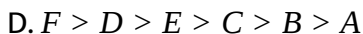
Higher is the number of bonds at a place, higher is the bond energy.

Write down the bond energy order of $C_2 - C_3$ in



$$A. E > D > C > F > B > A$$

$$B. A > C > D > B > E > F$$



Answer: D



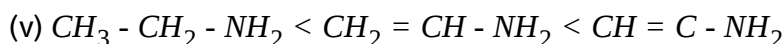
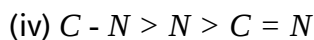
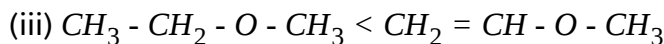
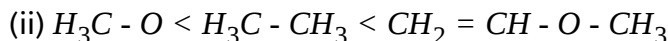
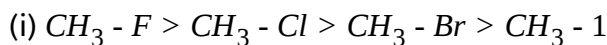
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3. Bond energy : Energy required to break a bond (equal to the energy released when a bond is formed) is named bond energy. Its unit is Kcal/mole. Stability of bond energy \propto % s character

$$\propto \frac{1}{\% \text{ P character}} \propto \text{bond order} \propto \frac{1}{\text{bond length}}$$

Higher is the number of bonds at a place, higher is the bond energy.

Which are true in terms of bond energy ?



A. (i), (ii), (iv), (v)

B. (i), (ii), (iii), (v)

C. (i), (iii), (iv), (v)

D. all are correct

Answer: B



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4. The electrons in atoms occupy atomic orbitals (AO_s) that are represented as theregions around the nuclei where there is a high probability of finding the electrons. In the so-called LCAO (linear combitaks) approach, as pioneered by Hund and Mulliken, when AOs come close together, they overlap forming MOs (molecular orbitals). Two AO s can overlap to form two MOs, one of which lies at a lower energy level (BMO) than the other at a higher energy level and is called an antibonding molecular orbital (ABMO). Each MO can hold one or two electrons in accordance with Pauli's exclusion principle. MOT can explain

the paramagnetism of molecules such as O_2 and NO and other spectral features.

In a molecule number of electrons in bonding MO is more as compared to antibonding MO, hence

- A. a bond will be formed
- B. no bond will be formed
- C. ionization is not sufficient
- D. None of the above

Answer: A



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5. The electrons in atoms occupy atomic orbitals (AO_s) that are represented as the regions around the nuclei where there is a high probability of finding the electrons. In the so-called LCAO (linear combination) approach, as pioneered by Hund and Mulliken, when AOs come close together, they overlap forming MOs (molecular orbitals). Two

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Bond strength increases with

- A. bond length increasing
- B. antibonding electrons being higher in number
- C. bond order increasing
- D. bond angle increasing

Answer: C



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6. Match the molecular species in Column-I and their magnetic and molecular orbital properties in Column-II :

Column-I Column-II

(A) O_2 (P) Bond order = 2

(B) N_2 (Q) Diamagnetic

(C) H_2 (R) Bond order = 3

(D) O_2^{2-} (S) Paramagnetic



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7. Match the following

Column-I

Column-II

(A) Fractional bond order (P) O_2^-

(B) Paramagnetic nature (Q) O_2^+

(C) Bond order value 3 (R) NO^+

(D) Bond order value 2.5 (S) CN



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LEVEL - II (TYPE-I) (PRACTICE SHEET - 4) (Section -A : More than One correct answer Type Questions)

1. In which case bond energy decreases from left to right ?

A. N_2, P_2, As_2, Sb_2

B. F_2, Cl_2, Br_2, I_2

C. O_2, S_2, Se_2, Te_2

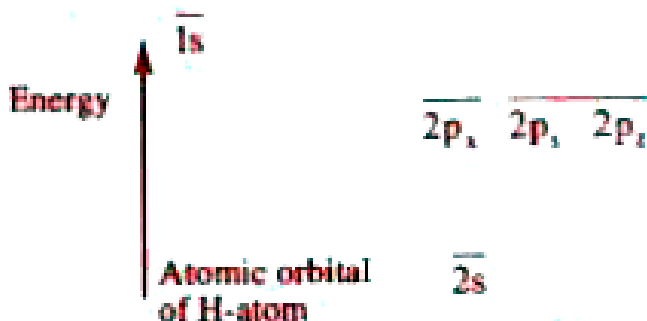
D. C_2, N_2, O_2, F_2

Answer: A::C



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2. The diatomic molecule OH exists in the gas phase. The energy levels of O and H atoms are shown in the figure. Assume that the molecular axis of OH molecules is z-axis



Predict which of the following is correct about OH molecule

- A. The bond order is one
- B. It is paramagnetic
- C. The σ -bonding molecular orbital is formed by LCAO of 2s atomic orbital of oxygen and 1s atomic orbital of H-atom
- D. There is high probability of formation of sigma bonding molecular orbital by LCAO of 1s atomic orbital of H-atom and $2p_z$ atomic orbital of oxygen atom

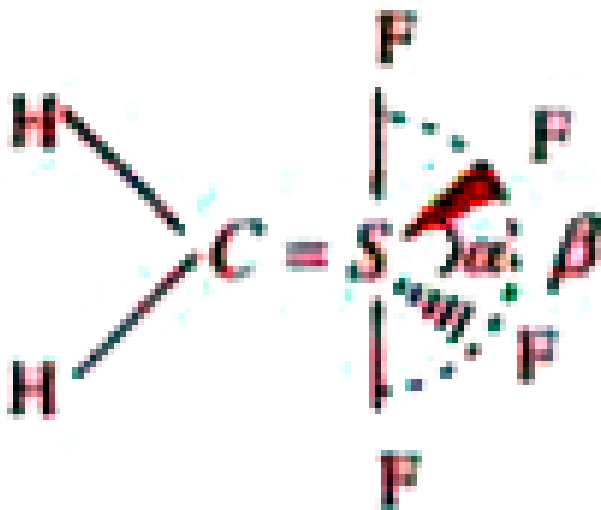
Answer: A::B::D



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3. In CH_2SF_4 axial F-SF = β equation F-SF = α

Which of the following option is correct regarding α and β



A. $180^\circ > \alpha > 120^\circ$

B. $180^\circ > \beta > 120^\circ$

C. $120^\circ > \alpha > 90^\circ$

D. $90^\circ > \alpha > 0^\circ$

Answer: B::C

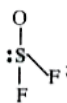


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4. What is the correct order of bond angle of the following molecule

A. CF_4 , CCl_4 , CBr_4 , $\left[XMX \text{ bond angle } \alpha > \beta > \gamma \text{ (X= halgen atom)} \right]$

B. $NCI_3 > PCI_3 > AsCl_3$, $\left[CIMCI \text{ bond angle (M = central atom)} \right]$

C.  $FSO > FSF$ bond angle

D. $NO_2^+ > NO_2 < NO_2^-$, $\left[ONO \text{ bond angle} \right]$

Answer: B::C::D



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5. Select correct statements

A. bond length of $NO^+ > NO$

B. Bond order of $NO^+ > NO$

C. bond energy of $NO^+ > NO$

D. NO is paramagnetic but NO^+ is diamagnetic

Answer: B::D



LEVEL - II (TYPE-I) (PRACTICE SHEET - 4) (Section - B : Linked Comprehension Type Questions)

1. According to molecular orbital theory, atomic orbitals of nearly same energy of different atoms are combined and form molecule. In homodiatomic molecule two atomic orbitals which have wave function ψ_A and ψ_B are combined in two ways $(\psi_A \pm \psi_B)$. They have two type of electron density, one is bonding $\left[(\psi_A \pm \psi_B)^2 \right]$ where e^- density increase between nucleus. Another is antibonding $\left[(\psi_A \pm \psi_B)^2 \right]$ where e^- density decreases between nucleus. These molecular orbitals are filled according to Hund, Pauli, aufbau principle. Existence of molecule depends on bond order.

$$\text{where bond order} = \frac{\text{Number of bonding } e^- \text{ s} - \text{number of antibonding } e^- \text{ s}}{2}$$

If the molecule have unpaired electron it is paramagnetic otherwise diamagnetic

Statement- 1: Removal of two e^- from N^2 , magnetic behaviour does not

change while addition of two electrons in O_2 magnetic behaviour changes.

Statement-2: In N_2 removal of electron takes place from bonding orbital while addition of e^- in O_2 is in antibonding orbital

- 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. According to molecular orbital theory, atomic orbitals of nearly same energy of different atoms are combined and form molecule. In

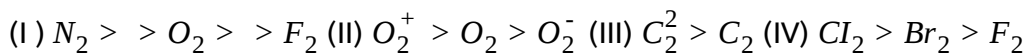
homodiatomic molecule two atomic orbitals which have wave function ψ_A and ψ_B are combined in two ways $(\psi_A \pm \psi_B)$. They have two type of electron density, one is bonding $\left[(\psi_A \pm \psi_B)^2 \right]$ where e^- density increase between nucleus. Another is antibonding $\left[(\psi_A \pm \psi_B)^2 \right]$ where e^- density decreases between nucleus. These molecular orbitals are filled according to Hund, Pauli, aufbau principle. Existence of molecule depends on bond order.

where bond order =
$$\frac{\text{Number of bonding } e^- \text{ s} - \text{number of antibonding } e^- \text{ s}}{2}$$

If the molecule have unpaired electron it is paramagnetic otherwise diamagnetic

Statement- 1: Removal of two e^- from N_2^2 , magnetic behaviour does not change while addition of two electrons in O_2 magnetic behaviour changes.

Which of the following correct trends of bond energy is possible to explain by following statement. "Successive filling of antibonding orbital reduce the bond energy between two atoms"?



A. all of these

B. I, II, III

C. I, II

D. only I

Answer: C



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3. According to molecular orbital theory, atomic orbitals of nearly same energy of different atoms are combined and form molecule. In homodiatomic molecule two atomic orbitals which have wave function ψ_A and ψ_B are combined in two ways $(\psi_A \pm \psi_B)$. They have two type of electron density, one is bonding $[(\psi_A \pm \psi_B)^2]$ where e^- density increase between nucleus. Another is antibonding $[(\psi_A \pm \psi_B)^2]$ where e^- density decreases between nucleus. These molecular orbitals are filled according to Hund, Pauli, aufbau principle. Existence of molecule depends on bond order.

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Statement-2: In N_2 removal of electron takes place from bonding orbital while addition of e^- in O_2 is in antibonding orbital



Answer: B



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4. Bond Length: Internuclear distance between two adjacent atoms in an species is known as bond length, -Bond length depends on:

i) size of the atom involved in the bond formation

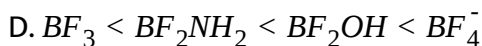
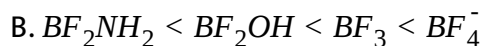
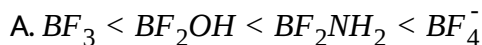
ii) size of the orbitals involved in the bond formation

iii) Lone pair-lone pair repulsion

iv) Resonance

v) s-character of combining orbitals with the increasing size of the atoms and atomic orbitals bond length increases. Lone pair-lone pair repulsion increases bond length (if atoms are small sized) whereas resonance can increase some bond lengths and decrease some other bond length. With increasing s-character bond length decreases, whereas with increasing multiplicity of bonds, bond length decreases. However, in some cases, bond lengths are also affected by relative position of bonds (between two similar atoms). Usually but not always with increasing bond length, bond strength (and hence bond dissociation energy) decreases.

The correct order of B-F bond length follows the sequence



Answer: A



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5. Bond Length: Internuclear distance between two adjacent atoms in an species is known as bond length, -Bond length depends on:

i) size of the atom involved in the bond formation

ii) size of the orbitals involved in the bond formation

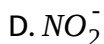
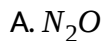
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bond strength (and hence bond dissociation energy) decreases.

In which of the following all bonds are not equivalent?



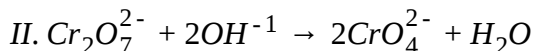
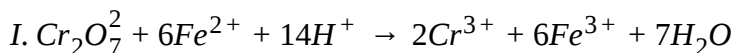
Answer: A

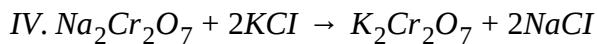
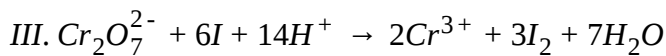


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LEVEL - II (TYPE-I) (PRACTICE SHEET - 4) (Section - C : Matching/Straight Objective Type Questions)

1. Identify the reactions in which dichromate acts as an oxidising reagent .





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LEVEL - II (TYPE-I) (LECTURE SHEET - 5) (Section - A : More than One correct answer Type Questions)

1. Which of the following molecules are expected to exhibit intermolecular H-bonding

A. acetic acid

B. O-nitrophenol

C. P-nitrophenol

D. O-boric acid

Answer: A::C::D



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2. The molecules that will have dipole moment

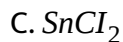
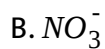
- A. 2,2-dimethylpropane
- B. trans-2-pentene
- C. cis-3-hexene
- D. 2,2,3,3-tetramethylbutane

Answer: C::D



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3. The molecules or ions in which the central atom has only bond pairs of electrons are



Answer: A::C



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4. Which of the following molecules involve intramolecular H-bond?

A. Ortho-nitrophenol

B. Chloral hydrate

C. Para-nitrophenol

D. Benzoic acid

Answer: B::C



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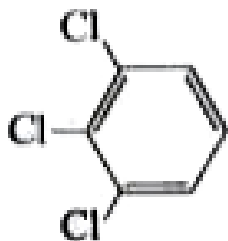
5. Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal

charge but opposite in sign. Such a bond which has some ionic character is described as polar covalent bond. Polar covalent molecules can exhibit dipole moment. Dipole moment is equal to the product of charge separation, q and the bond length, d for the bond. The unit of dipole moment is Debye. One Debye is equal to 10^{-18} esu cm.

Dipole moment is a vector quantity. It has both magnitude and direction. Hence, dipole moment of molecules depends upon the relative orientation of the bond dipoles, but not on the polarity of bonds alone. A symmetrical structure shows zero dipole moment. Thus, dipole moments help to predict the geometry of the molecules. Dipole moment values can be used to distinguish between cis-and trans-isomers, ortho-, meta-and para-forms of a substance, etc. The percentage of ionic character of a bond can be calculated by the application of the following formula :

$$\% \text{ ionic character} = \frac{\text{Experimental value of dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

Which are non-polar molecules?

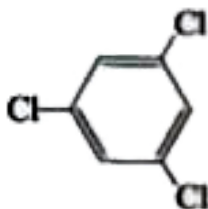


A.



B.

C.



D.

Answer: B



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6. Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal charge but opposite in sign. Such a bond which has some ionic character is described as polar covalent bond. Polar covalent molecules can exhibit dipole moment. Dipole moment is equal to the product of charge

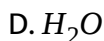
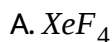
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$$\% \text{ ionic character} = \frac{\text{Experimental value of dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

Which are non-polar molecules?



Answer: D



7. Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal charge but opposite in sign. Such a bond which has some ionic character is described as polar covalent bond. Polar covalent molecules can exhibit dipole moment. Dipole moment is equal to the product of charge separation, q and the bond length, d for the bond. The unit of dipole moment is Debye. One Debye is equal to 10^{-18} esu cm.

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$$\% \text{ ionic character} = \frac{\text{Experimental value of dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

A diatomic molecule has a dipole moment of 1.2 D. If the bond length is 1.0×10^{-8} cm, what fraction of charge does exist on each atom?

A. 0.1

B. 0.2

C. 0.25

D. 0.3

Answer: B



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8. Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal charge but opposite in sign. Such a bond which has some ionic character is described as polar covalent bond. Polar covalent molecules can exhibit dipole moment. Dipole moment is equal to the product of charge

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$$\% \text{ ionic character} = \frac{\text{Experimental value of dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

Arrange the following compounds in increasing order of dipole moments, toluene (I), o- dichlorobenzene (II), m-dicblorobenzene (III) and p dichlorobenzene (IV) :

A. $IV < I < II < III$

B. $I < IV < II < III$

C. $IV < I < III < II$

D. $IV < II < I < III$

Answer: A



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9. Covalent molecules formed by heteroatoms bound to have some ionic character. The ionic character is due to shifting of the electron pair towards A or B in the molecule AB. Hence, atoms acquire small and equal charge but opposite in sign. Such a bond which has some ionic character is described as polar covalent bond. Polar covalent molecules can exhibit dipole moment. Dipole moment is equal to the product of charge separation, q and the bond length, d for the bond. The unit of dipole moment is Debye. One Debye is equal to 10^{-18} esu cm.

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bond can be calculated by the application of the following formula :

$$\% \text{ ionic character} = \frac{\text{Experimental value of dipole moment}}{\text{Theoretical value of dipole moment}} \times 100$$

The dipole moment of NF_3 is very much less than that of NH_3 because :

- A. Number of lone pairs in NF_3 is much less greater than in NH_3
- B. unshared electron pair is not present in NF as in NH_3
- C. both have different shapes
- D. of different directions of moments of N-H and N-F bonds

Answer: C

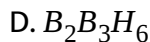
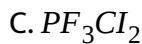
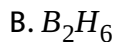


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LEVEL - II (TYPE-I) (LECTURE SHEET - 5) (Section - B : Linked Comprehension Type Questions)

1. Select the non-polar molecules among the following :

A. NO_2



Answer: A::B



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LEVEL - II (TYPE-I) (LECTURE SHEET - 5) (Section - C : Matching/Straight Objective Type Questions)

1.

Column-I

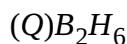
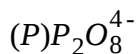
(A) Tetrahedral bonded by edge

(B) Tetrahedral bonded by their center

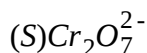
(C) Tetrahedral bonded by common comer

(D) Tetrahedral bonded by individual comer

Column-II



(R) 1 : 1 adduct of BF_3 and NH_3



(T) single chain silicate



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2.

Column-I Column-II

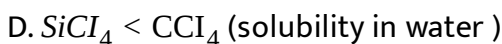
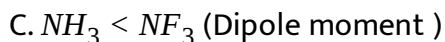
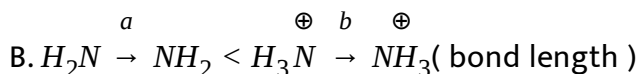
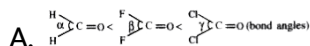
- | | |
|------------------------|---|
| (A) NO_3^- | (P) Numerical value of oxidation number of central atom is equal to its |
| (B) CO_3^{2-} | (Q) Negative charge on central atom |
| (C) ICl_4^- | (R) Maximum possible oxidation number of central atom |
| (D) SO_3^{2-} | (S) Minimum possible oxidation number of surrounding atom |
| | (T) One co-ordinate covalent bond is present |



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LEVEL - II (TYPE-I) (PRACTICE SHEET - 5) (Section - A : More than One correct answer Type Questions)

1. Which of the following option is incorrect?



Answer: A::B::C::D



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2. During hydrolysis of P_4O_{10} , products is/are:

A. Tetrametaphosphoric acid ($H_4P_2O_{12}$)

B. Hypophosphoric acid ($H_4P_2O_6$)

C. Pyrophosphoric acid ($H_4P_2O_7$)

D. Tetrapolyphosphoric acid ($H_6P_4O_{13}$)

Answer: A::C::D



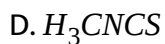
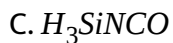
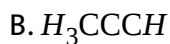
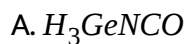
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3. In which of the following



type skeleton

is present (X = undefined atom)

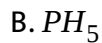


Answer: A::D



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4. Which of the following molecule(s) does not have existence?



Answer: A::B::C



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5. All the orbitals used by carbon for the formation of CH_4 have

A. same % P_x - character

B. same % p_y - character

C. same % S - character

D. same % p - character

Answer: C::D



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LEVEL - II (TYPE-I) (PRACTICE SHEET - 5) (Section - B : Linked Comprehension Type Questions)

1. Hydrogen bonding is said to be formed, -when slightly acidic hydrogen-atom attached to a strongly, electronegative fluorine, oxygen or nitrogen atom. is held with weak. electrostatic forces by the non-bonded pair of electrons of another atom. The co-ordination number of hydrogen in such cases is two. It acts as a bridge between two atoms, to one of which it is covalently bonded and to other attached through electrostatic forces, also called hydrogen bond.

Though the hydrogen atoms in a methyl group are not polarised, if an electronegative group like chloro, carbonyl, nitro or cyano (in order to increase electronegativity) is attached to it, the C-H bond gets polarised due to the inductive effect and the hydrogen atom becomes slightly acidic resulting in the formation of weak hydrogen bonds. Though a weak bond the H-bond effects is large number of the physical properties of compounds some of which are

- Boiling points of liquids

- Solubility of polar compounds in polar solvents (containing H attached with strong electronegative atom)
- Viscosity of liquids .

Acidity

Which of the following combinations can involve hydrogen bonding

- I) Mixture of KF and HF II) Mixture of CH_3COCH_3 and CHCl_3
III) Mixture of NH_4Cl and H_2O IV) Mixture of CH_3 and H_2O

- A. (I), (II) and (IV)
B. (I) and (II)
C. (I), (II) and (III)
D. (I) ,(II) ,(III) and (IV)

Answer: D



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2. Hydrogen bonding is said to be formed, -when slightly acidic hydrogen-atom attached to a strongly, electronegative fluorine, oxygen or nitrogen

atom. is held with weak. electrostatic forces by the non-bonded pair of electrons of another atom. The co-ordination number of hydrogen in such cases is two. It acts as a bridge between two atoms, to one of which it is covalently bonded and to other attached through electrostatic forces, also called hydrogen bond.

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I) Mixture of KF and HF II) Mixture of CH_3COCH_3 and $CHCl_3$

III) Mixture of NH_4Cl and H_2O IV) Mixture of CH_3 and H_2O

A. High value of pK_{a2} for maleate acid ion $\begin{pmatrix} CHCOO^- \\ || \\ CHCOOH \\ (CH_3)PO_4 \end{pmatrix}$ as compared

to fumarate ion $\begin{pmatrix} CHCOO^- \\ || \\ CHCOOH \end{pmatrix}$

B. High viscosity of H_3PO_4 compared with $(CH_3)PO_4$

C. High volatility of ortho-nitrophenol compared with para-isomer

D. Stability of chloral hydrate $[CCl_3CH(OH)_2]$ compared with $CH_3CH(OH)_2$

Answer: B



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3. Hydrogen bonding is said to be formed, -when slightly acidic hydrogen-atom attached to a strongly, electronegative fluorine, oxygen or nitrogen atom. is held with weak. electrostatic forces by the non-bonded pair of electrons of another atom. The co-ordination number of hydrogen in such cases is two. It acts as a bridge between two atoms, to one of which it is covalently bonded and to other attached through electrostatic forces, also called hydrogen bond.

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Acidity

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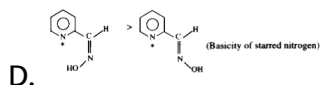
I) Mixture of KF and HF II) Mixture of CH_3COCH_3 and $CHCl_3$

III) Mixture of NH_4Cl and H_2O IV) Mixture of CH_3 and H_2O

A. $H_2O > HF$ - (Enthalpy of vaporisation)

B. $SbH_3 > NH_3 > AsH_3 > PH_3$ - (Boiling point)

C. $CH_2OHCHOHCH_3OH > CH_2OHCH_2OH$ - (Viscosity)



Answer: C



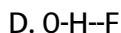
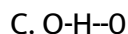
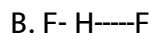
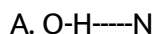
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4. Boiling point of covalent compound depends on intermolecular force.

Intermolecular forces are the force of attraction and repulsion between interacting particles (atoms and molecules). This term does not include the electrostatic forces that exist between the two oppositely charged

ions and the forces that hold atoms of a molecule together i.e., covalent bonds

Which of the following hydrogen bonds is the strongest?



Answer: B

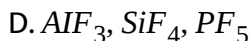
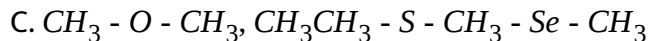
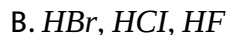


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5. Boiling point of covalent compound depends on intermolecular force. Intermolecular forces are the force of attraction and repulsion between interacting particles (atoms and molecules). This term does not include the electrostatic forces that exist between the two oppositely charged ions and the forces that hold atoms of a molecule together i.e., covalent

bonds

Which of the following hydrogen bonds is the strongest?



Answer: D



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LEVEL - II (TYPE-I) (PRACTICE SHEET - 5) (Section - C : Matching/Straight Objective Type Questions)

1. Dipole moment of $HCl = 1.03 \text{ D}$, $HI = 0.38 \text{ D}$. Bond length of $HCl = 1.3 \text{ \AA}$ and $HI = 1.6 \text{ \AA}$. The ratio of fraction of electric charge, δ , existing on each atom in HCl and HI is

A. 12:1

B. 2.7:1

C. 3.3:1

D. 1:3.3

Answer: C



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2. Which of the following has the highest dipole moment

A. AsH_3

B. SbH_3

C. PH_3

D. NH_3

Answer: D



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3. Dipole moment of CO_2 is zero and which implies that

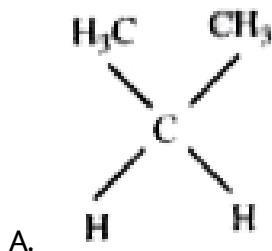
- A. carbon and oxygen have equal electronegativities
- B. carbon has no polar bond
- C. CO_2 is a linear molecule
- D. carbon has bond moments of zero value

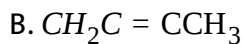
Answer: C



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4. Which of the following hydrocarbons has the lowest dipole moment?



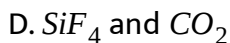
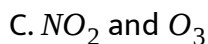
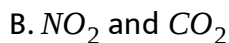
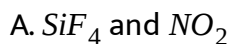


Answer: B



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5. Which one of the following pairs of molecules will have permanent dipole moments for both members?



Answer: C



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LEVEL - II (TYPE-II) (LECTURE SHEET - 1) (Subjective/Analytical Type Questions)

1. What changes are observed in atoms undergoing ionic bonding?



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2. Explain the factors favourable for the formation of Ionic Compounds.



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3. What type of bond is formed when atoms have high difference of electronegativity?

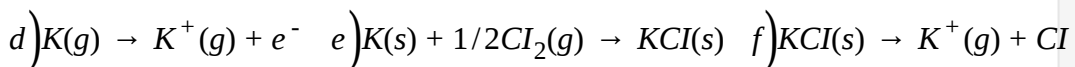
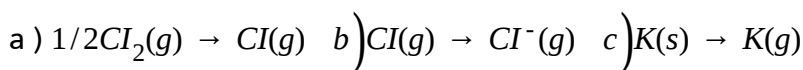


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4. What are the coordination numbers of NaCl and CsCl?

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5. Identify the type of energy change (ionization energy, energy of atomization, etc) show by each of these steps in the Born Haber cycle for potassium chloride. State with a reason whether the step is exothermic or endothermic.

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6. Screening effect influences

A) atomic radius

B) Ionisation enthalpy

C) electron gain enthalpy

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7. Draw and label a Born-Haber cycle for the formation of calcium oxide.



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8. Calculate the lattice enthalpy of calcium oxide from the following data.

Data found in the IB chemistry data booklet and the Born Haber cycle drawn in part (a)

enthalpy of atomisation of $\text{Ca}_{(s)} = +178 \text{ kJ mol}^{-1}$

second ionization energy of $\text{Ca}_{(g)} = +1150 \text{ kJ mol}^{-1}$

enthalpy of formation of calcium oxide = -635 kJ mol^{-1}



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LEVEL - II (TYPE-II) (PRACTICE SHEET - 1) (Subjective/Analytical Type Questions)

1. Using your knowledge of electronegativity, tell whether each of the following bonds will be ionic.

(a) H-H , b) O-Cl c) Na-F , d) C-N , c) Cs - F , f) Zn Cl



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2. For each pair, indicate which bond will be stronger

a) C-H , Li-F b) Li-F, Mg-O c) Li - F , Cs - 1



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3. Give the following information, calculate the lattice enthalpy of the sodium chloride lattice:

$$\Delta(\text{atomisation Na}) = + 107 \text{kJmol}^{-1} \quad \Delta H(1^{\text{st}} \text{ionisation Na}) = + 496 \text{kJmol}^{-1}$$

$$\Delta H(\text{bond dissociation } \text{Cl}_2) = + 242 \text{kJmol}^{-1} \quad \Delta(1^{\text{st}} \text{electron affinity Cl}) = - 349 \text{kJmol}^{-1}$$

$$\Delta H(\text{NaCl}) = - 411 \text{kJmol}^{-1}$$



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4. Which ions are present in MgO(s) Calculate the enthalpy change for the reaction $\text{Mg(s)} + 1/2\text{O}_2(\text{g}) \rightarrow \text{MgO(s)}$

What kind of enthalpy change is this? Standard enthalpy of formation of MgO .

$$\Delta H_{a \rightarrow m(\text{O})} = +249\text{kJmol}^{-1} \quad \Delta H_{a \rightarrow m(\text{Mg})} = +148\text{kJmol}^{-1}$$

$$\Delta H_{1\text{st ionisation energy}(\text{Mg})} = +738\text{kJmol}^{-1} \quad \Delta H_{2\text{nd electron energy}(\text{Mg})} = +1451\text{kJmol}^{-1}$$

$$\Delta H_{1\text{st electron affinity}(\text{O})} = -141\text{kJmol}^{-1} \quad \Delta H_{2\text{nd electron affinity}(\text{O})} = +798\text{kJmol}^{-1}$$

$$\Delta H_{\text{lattice energy}(\text{MgO})} = -3791\text{kJmol}^{-1}$$



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5. Construct a Born-Haber cycle and use it to calculate the first electron affinity of chlorine.

$$\Delta H_{a \rightarrow m(\text{Cl})} = +122\text{kJmol}^{-1} \quad \Delta H_{a \rightarrow m(\text{Mg})} = +148\text{kJmol}^{-1}$$

$$\Delta H_{1\text{st ionisation energy}(\text{Mg})} = +738\text{kJmol}^{-1} \quad \Delta H_{2\text{nd ionisation energy}(\text{MgCl}_2)} = +1451\text{kJmol}^{-1}$$

$$\Delta H_{\text{lattice energy}(\text{MgCl}_2)} = -2526\text{kJmol}^{-1} \quad \Delta H_{2\text{nd formation}(\text{MgCl}_2)} = -641\text{kJmol}^{-1}$$



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6. Give the following information, calculate the lattice enthalpy of the sodium chloride lattice:

$$\Delta(\text{atomisation Na}) = +107 \text{ kJ mol}^{-1} \quad \Delta H(1^{\text{st}} \text{ionisation Na}) = +496 \text{ kJ mol}^{-1}$$

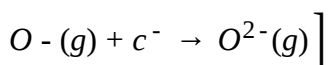
$$\Delta H(\text{bond dissociation } \text{Cl}_2) = +242 \text{ kJ mol}^{-1} \quad \Delta(1^{\text{st}} \text{electron affinity Cl}) = -349 \text{ kJ mol}^{-1}$$

$$\Delta H(\text{NaCl}) = -411 \text{ kJ mol}^{-1}$$



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7. Given the following information of magnesium oxide, and magnesium oxide calculate the second electron gain enthalpy for oxygen [i.e. for



for $\text{Mg}(s) \quad \Delta H_{\text{sub}} = +148 \text{ kJ/mol}$ bond dissociation energy for

$$\text{O}_2 = +499 \text{ kJ/mol}$$

1^{st} ionization energy for $\text{Mg} = +738 \text{ kJ/mol}$ 1^{st} electron gain enthalpy for

$$\text{O} = -141 \text{ kJ/mol}$$

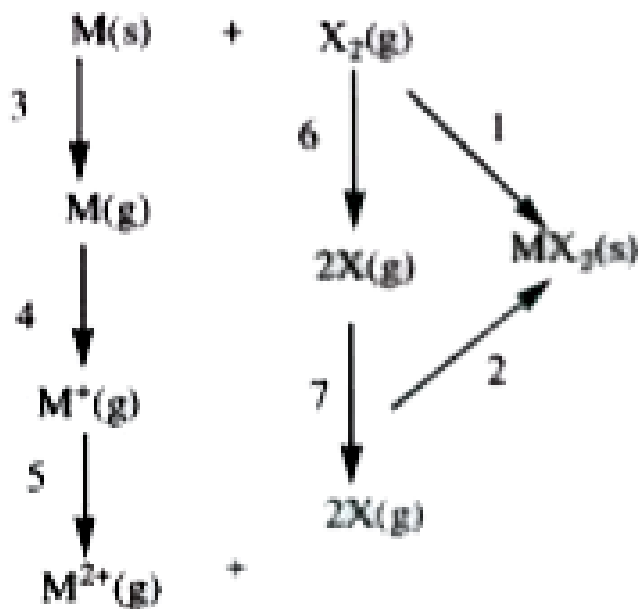
2^{nd} ionization energy for $\text{Mg} = +1450 \text{ kJ/mol}$ for $\text{MgO}(s)$, lattice energy

$$= +3890 \text{ kJ/mol}$$

for $\text{MgO}(s)$, enthalpy of formation $= -602 \text{ kJ/mol}$



8. Consider an ionic compound MX_2 where M is a metal that forms a cation of +2 charge, and X is a nonmetal that forms an anion of -1 charge. A Born-Haber cycle for MX_2 is given below. Each step in the cycle has been assigned a number.



a) Identify one step (1-7) that is endothermic as written. 3, 4, 5, 6 b) Which step

(1-7) corresponds to $\Delta H_{\text{sub}}^{\circ}$? 3

c) Which step (1-7) corresponds to ΔH_f°

d) Use the following energy values to calculate the lattice energy (in

kJ/mol) for MX_2

$$\Delta H_{\text{sub}}^{\circ} = 296 \text{ kJ mol}^{-1}, \Delta H_f^{\circ} = -421 \text{ kJ mol}^{-1}, 1^{\text{st}} \text{ ionization energy} = 378 \text{ kJ/mol},$$

2^{nd} ionization energy = 555 kJ/mol, bond dissociation enthalpy = 310 kJ/mol

electron affinity = -427 kJ/mol



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LEVEL - II (TYPE-II) (LECTURE SHEET - 2) (Subjective/Analytical Type Questions)

1. Write Lewis dot structures for S and S^{2-} .



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2. What is octet rule ?



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3. Which of the two ions Ca^{2+} or Zn^{2+} is more stable and why?



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4. Cl^- ion is more stable than Cl atom - Why?



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5. Why argon does not form Ar_2 molecule?



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6. If A and B are two different atoms, when does AB molecule become covalent?



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7. What is Octet rule ? Briefly explain its significance and limitations.



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8. What types of bonds are present in NH_4Cl ? Write its structure.



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LEVEL - II (TYPE-II) (PRACTICE SHEET - 2) (Subjective/Analytical Type Questions)

1. Give the main feature of Lewis approach of chemical bonding.



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2. Write electron dot structure (Lewis structure) of Na, Ca, B, Br, Xe, As, Ge, N^{3-} .



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3. Give the main feature of Kossel's explanation of chemical bonding.



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4. How can you explain the formation of NaCl according to Kossel's concept?



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5. Define electrovalent bond.



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6. Write the Lewis structure for CO molecule.



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7. Give the Lewis dot structure of HNO_3 .



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8. Explain the shape and bond angle in BCl_3 molecule in terms of Valence Bond Theory.



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LEVEL - II (TYPE-II) (LECTURE SHEET - 3) (Subjective/Analytical Type Questions)

1. Predict the change, if any, in hybridization of Al atom in the following reaction $AlCl_3 + Cl^- \rightarrow AlCl_4^-$.



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2. What is the best possible arrangement of four bond pairs in the valence shell of an atom to minimise repulsions ?



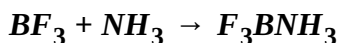
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3. What is meant by localized orbitals ?



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4. Is there any change in the hybridization of Boron and Nitrogen atoms as a result of the following reaction ?



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5. Explain the structure of CH_4 molecule.



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6. Even though nitrogen in ammonia is in sp^3 hybridization, the bond angle deviates from $109^\circ 28'$. Explain.



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7. Explain the hybridization involved in PCl_5 molecule.



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8. Explain the hybridisation involved in SF_6 .



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LEVEL - II (TYPE-II) (PRACTICE SHEET- 3) (Subjective/Analytical Type Questions)

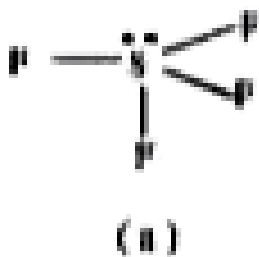
1. What's the main difference between lone pair and bonded pair of electrons.

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2. CO_2 is linear whereas SO_2 is bend-shaped. Give reason? Why does H_2O have bent structure?

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3. For the molecule ,



Why is structure (b) more stable than structure (a)?



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4. How would you attribute the structure of PH_3 molecule using VSEPR model?



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5. In SF_4 molecule, lone pair of electrons occupies equatorial position but not axial position why?



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6. S - orbital does not show any preference for direction. Why?



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7. What is the state of hybridization of carbon atoms in diamond and graphite?



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8. Out of p - orbital and sp - hybrid orbital which has greater directional character and why?



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LEVEL - II (TYPE-II) (LECTURE SHEET - 4) (Subjective/Analytical Type Questions)

1. Using Molecular Orbital Theory explain why the B_2 molecule is paramagnetic ?



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2. Write the important conditions necessary for linear combination of atomic orbitals.



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3. What is meant by the term Bond order? Calculate the bond orders in the following.

(a) N_2 (b) O_2 (c) O_2^+ and (c) O_2^-



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4. What is meant by the term Bond order? Calculate the bond orders in the following.

(a) N_2 (b) O_2 (c) O_2^+ and (c) O_2^-



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5. What is meant by the term Bond order? Calculate the bond orders in the following.

(a) N_2 (b) O_2 (c) O_2^+ and (c) O_2^-



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6. What is meant by the term Bond order? Calculate the bond orders in the following.

(a) N_2 (b) O_2 (c) O_2^+ and (d) O_2^-



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7. Why is σ - bond stronger than π - bond ?



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8. How many Sigma and Pi bonds are Present in (a) C_2H_2 and (b) C_2H_4 ?



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1. What type of bonds are formed due to orbital overlap?



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2. According to V.B.T. a covalent bond is formed by the overlapping of half filled atomic orbitals with electron spinning in the opposite direction. The strength of a bond depends on extent of overlapping. Double bond energy is not twice that of single bond energy because a double bond is made up of a weak π bond and strong σ bond energy

The expected bond angle in NH_3 molecule according to V.B.T is



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3. What is zero overlap?



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4. Out of O_2 and O_3 , which is paramagnetic ?



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5. Why are bonding molecular orbitals more stable than anti bonding molecular orbitals?



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6. He_2 does not exist. Explain in terms of LCAO.



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7. Give reason why H_2^+ ions are more stable than H_2 though have the same bond order.



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8. Find the sum of the following

$$\frac{{}^{15}C_1}{{}^{15}C_0} + 2\frac{{}^{15}C_2}{{}^{15}C_1} + 3\frac{{}^{15}C_3}{{}^{15}C_2} + \dots + 15\frac{{}^{15}C_{15}}{{}^{15}C_{14}}$$



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LEVEL - II (TYPE-II) (LECTURE SHEET- 5) (Subjective/Analytical Type Questions)

1. (A) : Water has more boiling point than that of hydrogen fluoride.

(R) : The molecular weight of H_2O is more than HF



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2. What is the effect of Hydrogen bonding on boiling point?



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3. Explain why H_2O has dipole moment while CO_2 does not have.



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4. Define Dipole moment. Write its applications.



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5. Explain why BeF_2 , molecule has zero dipole moment although the Be-F bonds are polar.



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6. Define dipole moment. Give the mathematical expression of dipole moment



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7. Dipole moment is a scalar or a vector quantity?



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8. Even though both NH_3 and NF_3 are pyramidal, NH_3 has a higher dipole moment compared to NF_3 . Why?



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LEVEL - II (TYPE-II) (PRACTICE SHEET- 5) (Subjective/Analytical Type Questions)

1. Why is dipole moment of CO_2 , BF_3 , Cl_4 is zero?



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2. The molecules BF_3 and NF_3 are covalent compounds. But BF_3 is non-polar and NF_3 is polar. The reason is



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3. On which factor does dipole moment depend in case of polyatomic molecules.



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4. Explain why BeF_2 , molecule has zero dipole moment although the Be-F bonds are polar.



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5. Define hydrogen bonding. What are the types of H-bonding? Which of them is stronger.



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6. NH_3 has a much higher boiling point than PH_3 because



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7. Write the possible resonance structures for SO_3 .



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8. Write the resonance structures for NO_2 and NO_3^- .



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SUBJECTIVE EXERCISE -1 (Long answer questions)

1. Explain the formation of ionic bond in terms of atomic orbitals. Discuss the factors that favour the ionic bond formation.



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2. Discuss Born- Haber cycle with reference to sodium chloride.



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3. Draw Lewis Structures for the following molecules.

(a) H_2S (b) $SiCl_4$

(c) BeF_2 and (d) $HCOOH$



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4. Write a note on Fajan's rules.



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5. Calculate theoretically the lattice energy of an ionic solid.



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SUBJECTIVE EXERCISE -1 (Short answer questions)

1. Define "lattice energy" of crystals. Calculate the number of sodium ions and chloride ions per unit cell of NaCl.



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2. Which of the two ions Ca^{2+} or Zn^{2+} is more stable and why?



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3. For ionic substances which is the proper term to use Formula weight or Molecular weight?



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4. Explain the properties of ionic compounds.



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SUBJECTIVE EXERCISE -1 (Very Short answer questions)

1. Why argon is not represented by Ar_2 ?



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2. What is the valency of an element with $Z=15$?



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3. How many ion pairs present per each unit cell of NaCl ?



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4. Why ionic compounds are bad conductors of electricity in crystalline state but good conductors of electricity in aqueous solutions ?



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SUBJECTIVE EXERCISE -2 (Long Short answer questions)

1. Discuss hybridization with suitable examples



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2. Write on VSEPR theory with illustrative examples.



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3. How does Pauling - Slater's valence bond theory explain the bond directions and molecular geometries?

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SUBJECTIVE EXERCISE -2 (Short answer questions)

1. Discuss the formation of $[BF_3 \cdot NH_3]$. Is there any change in the hybridization of B and N in its formation?

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2. Predict the change, if any, in hybridization of Al atom in the following reaction $AlCl_3 + Cl^- \rightarrow AlCl_4^-$.

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3. Explain the shape and the bond angle in $BeCl_2$ in terms of VBT

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4. Eventhough, nitrogen in ammonia is in sp^3 hybridization, the bond angle is not $109^\circ 28'$, Explain.



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5. Explain the formation of α -bonds in molecules with atleast two examples



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6. What is π bond? Explain with thwo examples.



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7. Draw a similarity between the bonds in H_3O^+ and those in CH_4



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8. Write the order or bond strengths of various bonds formed from s and p orbitals. When to they hybridize?



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9. Explain sp^3d^2 hybridization with an example.



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10. What are the guidelines to be followed to predict the formation of Molecular orbitals.



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SUBJECTIVE EXERCISE -2 (Very Short answer questions)

1. Write the MOED of N_2



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2. Predict the shape of a molecule with four bond pairs on the central atom



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3. Predict the shape of the molecule in which central atom has three bond pairs and one lone pair.



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4. Write the MOED of O_2 .



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5. What is meant by localized orbitals ?



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6. When does AB molecule become a covalent molecule? (A and B are atoms of elements).



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7. Correct the given structure
$$H = \overset{H}{\underset{|}{C}} - \overset{:O:}{\underset{|}{C}} \cdots \overset{\cdot\cdot}{\underset{\cdot\cdot}{O}} - H$$



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8. What are the bond angles in H_2O and NH_3 molecules as per VBT?



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9. What is the magnetic nature of O_2 molecule as per VBT and MOT?



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10. Define electrovalency and covalency. Give one example for each.



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11. What is resonance? Write its importance.



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12. How do you account for the stability of ozone and benzene based on resonance?



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13. What are the main postulates of molecular orbital theory



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14. Discuss the paramagnetism of oxygen and nitric oxide.



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SUBJECTIVE EXERCISE -3 (Long answer questions)

1. Define and describe hydrogen bonding.



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2. Write an essay on co-ordinate covalent bond.



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SUBJECTIVE EXERCISE -3 (Short answer questions)

1. Predict the reason(s) for the observation in boiling points



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2. Write the consequences of hydrogen bonding.



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3. How is percentage of ionic character of covalent substance calculated?



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SUBJECTIVE EXERCISE -3 (Very Short answer questions)

1. What types of bonds are present in NH_4Cl ? Write its structure.



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2. Define hydrogen bond. Is it weaker or stronger than vander Waals forces?



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3. Give reasons for the higher boiling point of H_2O than HF and NH_3



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4. Why o - Nitrophenol is more volatile than p - Nitrophenol.



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5. Why HCl cannot form hydrogen bond.



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6. Water is a liquid at room temperature, but not hydrogen sulphide.

Why?



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7. What are the types of bonds present in H_3O^+ and NH_4^+ ?



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8. Write any two properties of compounds with dative bond.



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9. What is bond length? Discuss different factors influencing bond length.



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10. Distinguish between bond enthalpy and dissociation enthalpy.



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11. Compare carbon -carbon bond lengths and bond energies by taking ethane, ethylene and acetylene as examples.



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12. What is bond angle? What are the different aspects influence bond angle?



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13. What are non-polar and polar covalent bonds? Give examples.



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14. What is dipole moment? How is it calculated?



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15. Write the SI unit of dipole moment.



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16. BF_3 is non-polar but NH_3 is polar. Why?



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17. Write two applications of dipole moment.



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18. cis-1,2-Dichloroethene is polar, but trans-1,2-dichloroethane is non polar. Why?



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19. A diatomic molecule has a dipole moment 1.2D. If the internuclear distance is 1 \AA , what is the fraction of charge exists on each atom?



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20. Dipole moment of HCl is 1.03D. Bond length is 1.27 \AA . Calculate the percentage ionic character of the HCl bond.



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OBJECTIVE EXERCISE -1(VALENCY AND IONIC BOND)

1. Which of the following statements concerning elements with atomic number 10 is true?

- A. It forms a covalent net work of solids
- B. Its molecules are monoatomic
- C. It has a very high value of electron affinity
- D. It has extremely low value of ionisation energy

Answer: B



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2. Ease of formation of anion is favoured by

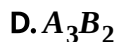
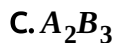
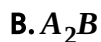
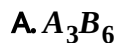
- A. lower value of ionisation energy
- B. higher value of electronegativity
- C. lower value of electron affinity
- D. higher value of electron affinity

Answer: D



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3. An atom A belongs to IIA group and another atom B belongs to VA group. The formula of the compound formed is



Answer: D



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4. Valency of an element indicates

A. combining power with hydrogen

B. acidity

C. electrons in the outermost orbit

D. None of these

Answer: A



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5. Between atoms of a molecule, there exists

A. only attractive forces

B. only repulsive forces

C. both attractive and repulsive forces

D. neither attractive nor repulsive forces

Answer: C



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6. When two atoms of chlorine combine to form one molecule of chlorine gas, the energy of the molecule is

- A. greater than that of separate atoms
- B. equal to that of separate atoms
- C. lower than that of separate atoms
- D. None of these

Answer: C



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7. Most energetic species among the following is

- A. H_2
- B. Ne
- C. F

D. F_2

Answer: C



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OBJECTIVE EXERCISE -1(IONIC BOND)

1. Which of the following is easily formed?

A. Calcium chloride

B. Calcium bromide

C. Potassium chloride

D. Potassium bromide

Answer: C



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2. The coordination number of Cl^- ion in CsCl crystal is

- A. 4
- B. 6
- C. 8
- D. 12

Answer: C



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3. Which of the following is favourable condition for the formation of ionic bond?

- A. Small cation with small charge
- B. Small anion with large charge
- C. large difference in the electronegativity
- D. Small cation with high charge

Answer: C



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4. In a NaCl crystal, cations and anions are held together by

- A. Electrons**
- B. Electrostatic forces**
- C. Nuclear force**
- D. Convalent bonds**

Answer: B



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5. Molten sodium chloride conducts electricity due to the presence of

- A. Free electrons**

B. Fee ions

C. Free molecules

D. Free atoms

Answer: B



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6. Number of electrons transferred from one Al atom during bond formation in Aluminium fluoride

A. 1

B. 2

C. 3

D. 4

Answer: C



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7. Which one of the following has an electrovalent linkage?



Answer: B



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8. Which of the following is least ionic?



Answer: D



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9. The strongest ionic bond is present in

A. LiF

B. NaF

C. RbF

D. CsF

Answer: A



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10. Which is more stable among the following ?

A. Li^+

B. K^+

C. Cs^+

D. Na^+

Answer: C



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11. What is the crystal structure of NaCl?

A. Body centered cubic

B. Face centered cubic

C. Tetrahedral

D. Octahderal

Answer: B



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12. Which of the following is a favourable factor for cation formation?

- A. High electronegativity
- B. High electron affinity
- C. Low ionisation potential
- D. Small atomic size

Answer: C



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13. Which of the following is not correct

- A. low ionisation potential is a favourable condition for the formation of cation
- B. coordination number of Na in NaCl is 6
- C. ionic bond is directional

D. ionic compounds have high melting points

Answer: C



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14. A5 is an ionic solid. The ionic radii of A⁺ and B are respectively r and r .

Lattice energy of AB is proportional to

A. $\frac{r_c}{r_a}$

B. $(r_c + r_a)$

C. $\frac{r_a}{r_c}$

D. $\frac{1}{r_c + r_a}$

Answer: D



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15. Ionic compounds in general posses.

- A. High electron affinity of anion forming species
- B. Low lattice energy of crystal
- C. High ionisation energy of cation forming species
- D. Low heat of sublimation of cation forming solid

Answer: A



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16. The one that has pseudo octet configuration

- A. Ni^{2+} ion
- B. Fe^{2+} ion
- C. Cu^{+} ion
- D. Cr^{+} ion

Answer: C



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17. Most of the ionic substances are

A. Electrolytes in molten state

B. With directional character

C. Soluble in solvents like ether

A. A,C are true

B. B,C are true

C. A,B are true

D. All are true

Answer: C



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18. The compound with highest melting point is

A. NaF

B. NaCl

C. NaBr

D. NaI

Answer: A



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19. CuCl has more covalent character than NaCl because

A. Na^+ has more polarizing power than Cu^+

B. Cu^+ has more polarizing power than Na^+

C. Cl^- has pseudo inert gas electron configuration

D. Na^+ has pseudo inert gas electron configuration

Answer: B



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OBJECTIVE EXERCISE -1(COVALENT AND DATIVE BOND)

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

- A. unequally shared between the two**
- B. transferred fully from one atom to another**
- C. with identical spin**
- D. equally shared between them**

Answer: D



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2. Covalent compounds are generally soluble in

- A. polar solvents**
- B. non polar solvents**
- C. concentrated acids**
- D. all solvents**

Answer: B



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3. Which of the following has directional character?

- A. ionic bond**
- B. metallic bond**
- C. covalent bond**
- D. both covalent and ionic bonds**

Answer: C



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4. Maximum number of covalent bonds by which two atoms can be bonded to each other

A. Four

B. Two

C. Three

D. No fixed number

Answer: C



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5. Which of the following substances has covalent bonding?

A. Sodium chloride

B. Solid neon

C. Copper metal

D. Germanium

Answer: D



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6. The molecule that deviates from octet rule is

A. CCl_4

B. BF_3

C. MgO

D. NCl_3

Answer: B



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7. Most important concept of valence bond theory is

- A. Overlap of atomic orbitals results in the bond**
- B. Sharing of odd number of electrons for bonding**
- C. Sharing of electrons follow the octet rule**
- D. Transfer of electrons follow the octet rule.**

Answer: A



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8. Two carbon atoms in which of the following have more number of shared electrons

- A. Benzene**
- B. Acetylene**
- C. Ethane**

D. Ethylene

Answer: B



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9. The total number of electrons that take part in forming bonds in a C_2H_4 molecule are

A. 12

B. 14

C. 6

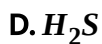
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Answer: A



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10. Which of the following molecules contain one lone pair of electrons on the central atom?

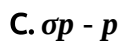


Answer: B



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11. The type of overlap present in the bonds of hydrogen sulphide molecule is



D. $\sigma sp^3 - s$

Answer: A



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12. Iodine monochloride molecule is formed by the overlap of

A. s-s orbitals

B. s-p orbitals

C. p-p orbitals end to end

D. pp-orbitals sideways

Answer: C



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13. In solid state Ar atoms are held together by

A. Ionic bonds

B. Hydrogen bonds

C. Vander Waal forces

D. Hydrophobic forces

Answer: C



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14. Which of the following boils at higher temperature ?

A. CCl_4

B. CO_2

C. $\text{C}_6\text{H}_{12}\text{O}_6$

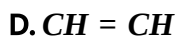
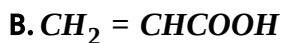
D. KCl

Answer: D



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15. Choose the molecule which has only one pi bond between carbon atoms



Answer: C



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16. Amongst the following molecules the one with the largest distance between the two adjacent carbon atoms is

A. Ethane

B. Ethene

C. Ethyne

D. Benzene

Answer: A



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17. The total number of valency electrons present in SO_4^{2-} ion

A. 32

B. 16

C. 28

D. 30

Answer: A



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18. Anhydrous AlCl_3 is covalent while AlF_3 is ionic. This is justified by

A. Crystal structure

B. VB theory

C. Fajan.s rule

D. Lattice energy

Answer: C



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19. Cl_4 is insoluble in water because

A. H_2O is non polar

B. CCl_4 is non polar

C. They do not form inter molecular H-bonding

D. They do not form intra molecular H-bonding

Answer: B



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20. Which of the following molecule does not obey the octet rule and also has lone pair on the central atom?



Answer: D



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21. Which of the following overlap is the strongest?

A. $2p-2p$

B. $3p-3p$

C. $5p-5p$

D. $\pi(5p - 5p)$

Answer: A



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22. The io that is isoelectronic with CO

A. O_2^+

B. CN^-

C. O_2^-

D. N_2^+

Answer: B



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23. Which is a covalent compound?

A. RbF

B. MgCl_2

C. CaC_2

D. NH_3

Answer: D



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24. Double bonds are present in

A. CO_2

B. BeCl_2

C. HgCl_2

D. MgO

Answer: A



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25. Six electrons are mutually shared in

A. F_2

B. Cl_2

C. O_2

D. N_2

Answer: D



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26. Octet rule is not followed in

A. SF_6

B. PF_5

C. $BeCl_2$

D. All the three

Answer: D



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27. Silicon has 4 electrons in the outermost orbit. In forming the bonds.

A. It gains electrons

B. It loses electrons

C. it shares electrons

D. None of the above

Answer: C



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28. The type of bonds present in ammonium chloride are

- A. Only ionic and dative
- B. Only covalent and electrovalent
- C. Only covalent and coordinate
- D. Ionic, covalent and coordinate

Answer: D



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29. PH_3 and BF_3 form an adduct readily because they form

- A. A coordinate bond
- B. A covalent bond
- C. An ionic bond

D. A hydrogen bond

Answer: A



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30. Dative bond is present in the molecule of

A. NH_3

B. CO_2

C. CO

D. PCl_5

Answer: C



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31. According to valence bond theory, water molecule has

- A. Two dative bonds and bond angle 90°
- B. Two covalent bonds and bond angle 90°
- C. Two dative bonds and bond angle 104.5°
- D. Two covalent bonds and bond angle 104.5°

Answer: B



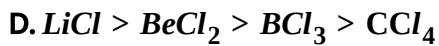
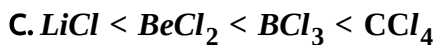
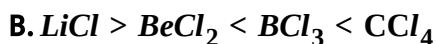
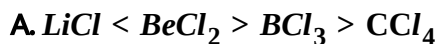
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32. According to V.B. Theory, the bonds in methane are formed due to the overlapping

- A. $1\sigma s - s, 3\sigma s - p$
- B. $1\sigma s - \pm 3\sigma s - s$
- C. $2\sigma s - 2, 2\sigma s - p$
- D. $4\sigma sp^3 - s$

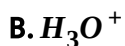
Answer: A

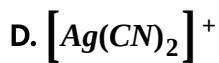
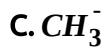
33. Among LiCl , BeCl_2 , BCl_3 and CCl_4 the covalent bond character follows the order



Answer: C

34. Which of the following does not contain coordinate covalent bond?





Answer: C



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35. In ammionium ion the covalency of nitrogen is

A. 3

B. 4

C. 2

D. 5

Answer: B



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36. The directional nature of covalent bond was introduced by

- A. VB theory**
- B. VSEPR theory**
- C. Kossel and Lewes theory**
- D. Hybridisation theory**

Answer: A



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37. The element that exhibits both electrovalency and covalency is

- A. Neon**
- B. Sodium**
- C. Barium**
- D. Chlorine**

Answer: D



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38. The total number of electrons that take part in forming bonds in O_2 molecule according to V.B.T.

A. 2

B. 4

C. 6

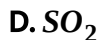
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Answer: B



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



Answer: B



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40. Which one of the following is not correct ?

- A. Number of unshared electrons on the atom is also considered for calculation of formal charge.
- B. Formal charges help in the selection of the lowest energy structure of molecule.
- C. Formal charges indicate real charge separation within the molecule.
- D. Formal charge of each atom of polyatomic ion can be calculated.

Answer: C



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OBJECTIVE EXERCISE -1(HYBRIDISATION AND VSEPR THEORY)

1. Hybridization produces a set of orbitals which are

- A. Parallel**
- B. Perpendicular**
- C. Equivalent**
- D. None of these**

Answer: C



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2. The % of p character in hybrid orbital of the central atom of water molecule

- A. 0.25
- B. 0.5
- C. 0.75
- D. 0.333

Answer: C



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3. Maximum number of planar atoms in SF_5 molecule

- A. 5
- B. 4
- C. 6
- D. 7

Answer: A



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4. Which hybridization is found in NH_3 and H_2O ?

A. sp^3

B. dsp^2

C. sp

D. sp^2

Answer: A



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5. Octahedral shape is due to the hybridisation

A. sp^3d

B. sp^3d^2

C. sp^3

D. sp

Answer: B



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6. The type of hybrid orbitals used by the central atom in perchloate ion is

A. sp^3

B. sp^2

C. sp

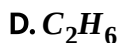
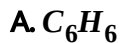
D. dsp^2

Answer: A



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7. Which among the following molecules is not flat?



Answer: D



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8. The hybrid orbitals have a bond angle of 109.5° . The percentage of p-character in the hybrid orbital is nearly

A. 0.25

B. 0.33

C. 0.5

D. 0.75

Answer: D



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9. The hybrid state of 1 and 3 carbon atoms in $CH_2 = C = CH_2$

A. sp^3

B. sp^2

C. sp

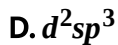
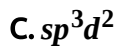
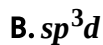
D. sp^3d

Answer: B



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10. In the molecule of XeF_4 , hybridisation of Xe atoms is

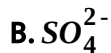


Answer: C



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11. Which of the following has pentagonal bipyramidal shape?

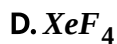


Answer: D



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12. The orientation of hybrid orbitals is tetrahedral in

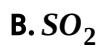
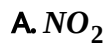


Answer: A



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13. Which one of the following is a linear molecule?



D. H_2S

Answer: C



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14. In BCl_3 molecule the Cl-B-Cl bond angle is

A. 90°

B. 120°

C. $109^\circ .28$.

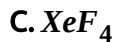
D. 180°

Answer: B



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15. Which of the following has a planar structure?



Answer: C



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16. The shape of sulphate ion is

A. Tetrahedral

B. Square planar

C. Trigonal

D. Trigonal planar

Answer: A



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17. The angle between two covalent bonds is minimum in

A. H_2O is non polar

B. CO_2

C. NH_3

D. CH_4

Answer: A



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18. The shape of ClO_3^- is

A. Linear

B. Angular

C. Tetrahedral

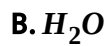
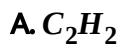
D. Pyramidal

Answer: D



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19. Angular molecule among the following is



Answer: B



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20. Octahedral molecule among the following is

A. SO_3

B. $CHCl_3$

C. SF_6

D. PCl_5

Answer: C



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21. Bond angle (H-O-H) in H_2O is

A. 90°

B. $104^\circ 30'$

C. $107^\circ 18'$

D. $109^\circ 28'$

Answer: B



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22. In PCl_5 Bond angle in plane is

A. 90°

B. 120°

C. 180°

D. $109^\circ .28$.

Answer: B



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23. Ratio of hybrid and unhybrid orbitals taking part in bond formation in ethylene molecule

A. 1 : 1

B. 2 : 3

C. 3 : 4

D. 1 : 2

Answer: A



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24. The state of hybridisation of S in SO_2 is similar to that of C in

A. C_2H_2

B. C_2H_4

C. CH_4

D. CO_2

Answer: B



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25. The shape of nitrite ion is

- A. Square planar
- B. Tetrahedral
- C. Trigonal planar
- D. Pyramidal

Answer: C



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26. Which of the following statement is false?

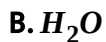
- A. Hybridisation of the central atom in H_2O and CH_4 is sp^3
- B. SO_2 has V shape while C_2H_2 is linear
- C. XeF_6 is octahedral and bond angle is 90°
- D. CO_2 has net dipole moment, because carbon oxygen bond is polar

Answer: D



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27. The orientation of electron pairs and the shape of molecule are different in

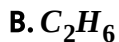


Answer: B



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28. Largest bond angle is present in



D. C_2H_2

Answer: D



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29. A molecule AX_2 has two lone pairs over A. Its shape is

A. Tetrahedral

B. Pyramidal

C. Angular

D. Linear

Answer: C



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30. The geometry of H_3O^+ ion is

- A. planar
- B. Triangular
- C. Pyramidal
- D. Tetrahedral

Answer: C



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31. The shape of AB_3E type molecule is

- A. Pyramidal
- B. Tetrahedral
- C. Angular
- D. Linear

Answer: A



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32. As the s-character of a hybrid orbital increases the bond angle

- A. Increases
- B. Decreases
- C. Does not change
- D. Becomes zero

Answer: A



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33. In the formation of SF_6 molecule, the sulphur atom is in

- A. first excited state
- B. second excited state
- C. third excited state

D. fourth excited state

Answer: B



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34. Regarding hybridisation the correct statement is

- A. Orbitals of different atoms hybridize**
- B. the angle between any two hybrid orbitals is not the same**
- C. Hybrid orbitals always form sigma bonds**
- D. Only electrons undergo hybridisation but not orbitals.**

Answer: C



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35. Which of the following is a correct pair?

A. BeCl_2 linear

B. NH_3 linear

C. CO_2 tetrahedral

D. BF_3 octahedral

Answer: A



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36. Which one of the following is the correct set with reference to molecular formula, hybridisation of central atom and shape of the molecule?

A. CO_2 , sp^2 bent

B. H_2O , sp^2 bent

C. BeCl_2 , sp , linear

D. H_2O , sp^3 linear

Answer: C



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37. Which one of the following is a correct set?

A. H_2O , sp^3 hybridisation, angular

B. H_2O , sp^2 hybridisation, linear

C. NH_4^+ , dsp^2 hybridisation, square planar

D. CH_4 , dsp^2 hybridisation, tetrahedral

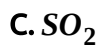
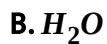
Answer: A



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38. Which of the following is a linear molecule ?

A. $BeCl_2$

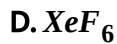
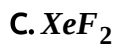
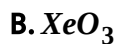
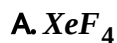


Answer: A



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39. Which of the following has pyramidal shape?



Answer: B



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40. In which of the following molecules, sigma bonds formed by the overlap of sp^3d and P orbitals are absent ?

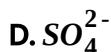


Answer: D



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41. Which of the following is not tetrahedral?



Answer: C



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42. Which of the following has square pyramidal structure?



Answer: A



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43. Molecules with sp^2 hybridisation will have the following shape

A. linear

B. Trigonal planar

C. Tetrahedral

D. Pyramidal

Answer: B



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44. The hybridisation involved in acetylene is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: D



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45. The type of hybrid orbitals employed in the formation of SF_6 molecules is

A. sp^3d

B. sp^3

C. sp^3d^2

D. d^2sp^3

Answer: C



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46. The hybridisation of oxygen in OF_2 molecule is

A. Sodium chloride

B. sp^2

C. sp^3

D. dsp^2

Answer: C



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47. In hydrazine (N_2H_4) the hybridization of nitrogen is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: C



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48. Structure of ICl_2^- is

A. trigonal

B. octahedral

C. square planar

D. distorted trigonal pyramidal

Answer: D



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49. List -1 List-2

A. Diamond 1. sp^2 hybridisation

B. Graphite 2. sp^3 hybridisation

C. PCl_5 3. sp^3d hybridisation

D. CO_2 gas 5. sp^3d^2 hybridisation

The correct match is

A.

A	B	C	D
3	4	1	2

B.

A	B	C	D
2	1	3	4

C.

A	B	C	D
1	2	3	4

A B C D
D. 2 3 1 2

Answer: B



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50. Which one of the following is not correct

- A. Number of unshared electrons on the atom is also considered for calculation of formal charge.
- B. Formal charges help in the selection of the lowest energy structure of molecule.
- C. Formal charges indicate real charge separation within the molecule.
- D. Formal charge of each atom of polyatomic ion can be calculated.

Answer: C



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1. Molecular orbital theory was proposed by

- A. Lewis**
- B. Mulliken**
- C. Slater**
- D. Pauling**

Answer: B



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2. The para magnetic nature of oxygen is best explained by

- A. V.B. theory**
- B. Hybridisation**
- C. M.O. theory**

D. VSEPR theory

Answer: C



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3. Bond order in He_2 species is

A. 0

B. 1

C. 2

D. 3

Answer: A



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4. The diamagnetic molecules are

A. B_2, C_2, N_2

B. O_2, N_2, F_2

C. C_2, N_2, F_2

D. B_2, O_2, N_2

Answer: C



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5. The shape of molecular orbital depends upon

A. Size of the molecule

B. Size of the atoms involved

C. Shape of the atomic orbital

D. All the above

Answer: C



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6. Number of anti bonding electrons in O_2 molecule are

A. 10

B. 6

C. 4

D. 2

Answer: B



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7. Which of the following species have the same bond order?

A. CN^- and CN^+

B. O_2^- and CN^-

C. NO^+ and CN^-

D. CN^- and NO^-

Answer: C



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8. In which pair, the stronger bond is found in the first species?

a. O_2^- , O_2 b. N_2 , N_2^+ c. NO^+ , NO^-

A. a only

B. b only

C. a and c only

D. b and c only

Answer: D



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9. A. Diamagnetic C_2 molecule have been detected in vapour phase in which double bond consists of both pi bonds

R: In C_2 molecule four electrons are present in two π molecular orbitals

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true and R is false

D. A is false and R is true

Answer: A



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10. Which of the following species is not diamagnetic ?

A. N_2

B. F_2

C. Li_2

D. O_2

Answer: D



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11. Bond energy is maximum in

A. F_2

B. N_2

C. O_2

D. Br_2

Answer: B



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12. The bond order

- A. can have negative value
- B. is any number other than zero
- C. is any integer
- D. can have any value including zero

Answer: D



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13. Which of the following molecular orbital has the lowest energy?

- A. $\sigma 2p_z$
- B. $\sigma^* 2p_z$
- C. $\pi^* 2p_x$
- D. $\pi^* 2p_y$

Answer: A



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14. Bond order is 2.5 in

A. CN, B. N_2^+ C. NO

A. A,B only

B. B,C only

C. A,C only

D. A,B and C

Answer: D



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15. What is the above CN^- and N_2 ?

A. Both are isoelectronic

B. Both are chemically inert

C. Both are highly reactive

D. Both have same polarity of bonds

Answer: A



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16. If the formation of diatomic boron molecule is predicted based on MO theory, the bond order would be

A. 0.5

B. 1

C. 1.5

D. 12

Answer: B



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17. According to Molecular orbital theory, a molecule of H_2 has two electrons in

A. σ_{1s}

B. σ_{2s}^*

C. σ_{2s}

D. σ_{1s}^*

Answer: A



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18. Higher the bond order greater is the

A. Bond dissociation energy

B. Bond length

C. Paramagnetism

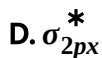
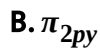
D. Ionic character

Answer: A



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19. Which of the following molecular orbital has the lowest energy for O_2 molecule?



Answer: A



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20. A: Oxygen molecule is paramagnetic in nature whose magnetic moment is $\sqrt{8}$ BM

R: Oxygen molecule has two unpaired electrons in bonding molecular orbitals

- A. Both a and R are true and R is the correct explanation of A**
- B. Both A and R are true and R is not the correct explanation of A**
- C. A is true and R is false**
- D. A is false and R is true**

Answer: C



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21. Which of the following is paramagnetic with bond order 0.5

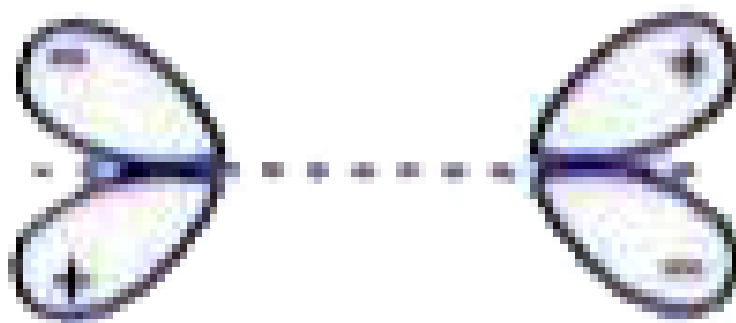


Answer: D



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22. The molecule orbital shown in the diagram can be described as



A. σ

B. σ^*

C. π

D. π^*

Answer: D



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23. The bond order in O_2^{2-} species is

A. 1

B. 2

C. 3

D. 4

Answer: A



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24. In O_2 molecule, the correct order of molecular orbitals is

A. $\pi 2py > \pi 2pz$

B. $\pi 2py * = \pi 2pz$

C. $\sigma 2s < \sigma 2s *$

D. $\sigma 2s * > \sigma 2px *$

Answer: C



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25. Fractional bond order is in

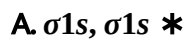


Answer: B



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26. Among the following degenerate orbitals are



B. $\sigma 2p_x, \sigma 2p_x$ *

C. $\pi 2p_x, \pi 2p_y$

D. $\pi 2p_y, \pi 2p_z$ *

Answer: C



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27. Maximum number of electrons that can be present in any molecular orbital is

A. 3

B. 6

C. 8

D. 2

Answer: D



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28. While filling electrons in π_{2p_x} and π_{2p_y} , the electronic configuration rules that one to be followed is

- A. Pauli's exculsion principle
- B. Aufbau principle
- C. Both Pauli's and Hund's rule
- D. All the above

Answer: C



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29. Number of bonding electrons in N_2 molecule are

- A. 4
- B. 5
- C. 6

D. 10

Answer: D



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30. Bond order is maximum among the following



Answer: A



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OBJECTIVE EXERCISE -1(HYDROGEN BOND)

1. Organic compound soluble in water contains

- A. C,H
- B. C,H,O
- C. C,S
- D. C,H,Cl

Answer: B



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2. Between any two of the following molecules, hydrogen bonding is not possible

- A. Two primary amine molecules
- B. Two secondary amine molecules
- C. Two tertiary amine molecules
- D. Two ammonia molecules

Answer: C



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3. Hydrogen bond is

- A. A weak covalent bond**
- B. A weak electrostatic force**
- C. A weak metallic force**
- D. it is not a bond**

Answer: B



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4. Inter molecular hydrogen bonding is absent in

- A. H_2O is non polar**

B. NH_3 linear

C. C_2CH_5OH

D. CH_4

Answer: D



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5. Which among the following has the highest volatility ?

A. H_2O is non polar

B. H_2S

C. H_2Se

D. H_2Te

Answer: B



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6. Among the following, which has the highest boiling point ?



Answer: A



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7. Intramolecular hydrogen bonding is present in

A. meta nitrophenol

B. salicylic acid

C. hydrogen chloride

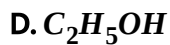
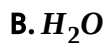
D. benzophenone

Answer: B



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8. Which of the following has the lowest boiling point ?



Answer: A



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9. Abnonnal boiling point of a compound is due lo

A. van der Waals forces

- B. Covalent bonding**
- C. Intermolecular hydrogen bonding**
- D. Intramolecular hydrogen bonding**

Answer: C



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10. The pairs of bases in nucleic acids are held together by

- A. Hydrogen bonds**
- B. Oxyribose groups**
- C. Phosphate groups**
- D. Ionic bonds**

Answer: A



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11. Intramolecular hydrogen bonding is present in

- A. meta introphenol**
- B. salicylaldehyde**
- C. hydrogen chloride**
- D. benzopheone**

Answer: B



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12. Hydrogen bonding is exhibited by

- A. All the molecules containing H-atomsd**
- B. Molecules in which H is covalently bonded of F,O or N**
- C. Molecules in which two H atoms are present**

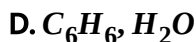
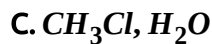
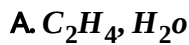
D. Molecules in which H is bonded to atoms with electronegativity greater than 2.1.

Answer: B



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13. The pair of substances that has hydrogen bonding between them is



Answer: B



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14. Which among the following compounds does not show hydrogen bonding?

A. Ammonia

B. Ethyl alcohol

C. Acetic acid

D. Diethyl ether

Answer: D



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15. In which of the following , the hydrogen bonding is strongest in the liquid phase?

A. HF

B. CH_4

C. HI

D. PH_3

Answer: A



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16. Water has a higher boiling point than the corresponding hydrides H_2S , H_2Se and H_2Te . This is because water has

A. Ionic bonds

B. Hydrogen bonds

C. Covalent bonds

D. Vander Waals. forces

Answer: B



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

A. Liquid HCl

B. Liquid NH_3

C. Water

D. Phenol

Answer: A



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18. Intramolecular hydrogen bond is present in

A. orthohydroxy benzaldehyde

B. parahydroxy benzaldehyde

C. ethyl alcohol

D. hydrogen fluoride

Answer: A



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19. Intermolecular hydrogen bonding is strongest in

A. Methuylamine

B. Phenol

C. Formaldehyde

D. Methanol

Answer: D



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20. List -1 List-2

A. NaCl 1. Covalent bond

B. CH_4 2. Ionic bond C. NH_4^{+} 3. Metallic bond D. Cu "metal" 4.

"Covalent and dative bond"

The correct match is

A.

	A	B	C	D
	2	1	4	3

B.

	A	B	C	D
	2	4	1	3

C.

	A	B	C	D
	2	3	1	4

D.

	A	B	C	D
	1	2	3	4

Answer: A



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21. The unit of dipole moment is

A. Einstein

B. Dalton

C. Debye

D. Curie

Answer: C



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22. One Debye (D) equal to

A. 1×10^{-4} esu. Cm

B. 1×10^{-18} esu.co

C. 1×10^{-10} esu.com

D. 1×10^{-16} esu.cm

Answer: B



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23. Carbon tetrachloride has no dipole moment because of

A. Its regular tetrahedral structura

B. Its palnar structure

C. Similar size of caron and chlorine atoms

D. Similar electron affinities of carbon and chlorine

Answer: A



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24. Which of the following will have zero dipole moment?

A. 1,1-dichloroethylene

B. cis-1,2-dichloroethylene

C. tans-1,2-dichloroethylene

D. 1,1,2-trichloro ethylene

Answer: C



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25. Dipole moment is least in the molecule

A. 1,2-dichlorobenzene

B. 1,3-dichlorobenzene

C. 1,4-dichlorobenzene

D. chlorobenzene

Answer: C



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26. Molecule with dipole moment among the following

A. SF_6

B. SF_4

C. Cl_4

D. CH_4

Answer: B



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27. The unequal sharing of the bond pair of electrons between two atoms in a molecule causes

- A. Non polar covalen bond**
- B. Radical formation**
- C. Polar covalent bond**
- D. Decomposition of molecule**

Answer: C



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28. The molecule having zero dipole moment is



Answer: C



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29. The dipole moment of CO_2 is zero, because its bond angle is

A. 120°

B. 180°

C. 130°

D. 90°

Answer: B



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30. S.I. unit for dipole moment is

- A. e.s.u -cm
- B. Coulomb -cm
- C. coulomb -metre
- D. e.s.u-metre

Answer: C



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31. The molecule having zero dipole moment is

- A. BCl_3
- B. BeCl_2
- C. CCl_4

D. All of these

Answer: D



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



Answer: D



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33. Molecule with dipole moment among the following



Answer: B



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



Answer: D



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35. Which one of the following pairs of molecules will have permanent dipole moments for both members?

A. SiF_4 and CO_2

B. SiF_4 and NO_2

C. NO_2 and CO_2

D. NO_2 and O_3

Answer: D



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36. Which of the following is correctly matched?

A. NH_3 - polar molecule with no polar bonds

B. CH_4 - polar molecule with polar bonds

C. CHCl_3 - polar molecule with polar bonds

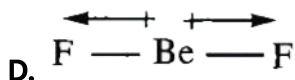
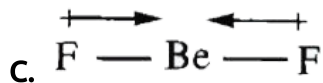
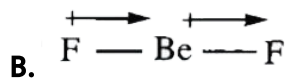
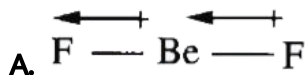
D. H_2S - non polar molecule with polar bonds

Answer: C



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37. The bond dipoles in BeF_2 can be represented



Answer: D



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1. A: SO_2 molecule has unsymmetrical shape

R: The dipole moment of SO_2 molecule is equal to zero.

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

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

C. A is true, R is false

D. A is false and R is true

Answer: C



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2. Bond energy is highest in the following

A. CO

B. O_2

C. NO

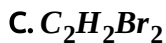
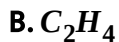
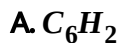
D. N_2

Answer: A



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3. The C-C bond distance is largest in

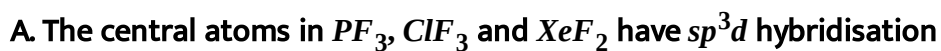


Answer: D



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4. Which one of the following is not correct?



B. The bond order of H_2 , N_2 and O_2 follows the order $N_2 > O_2 > H_2$

C. The ionic nature KCl , $MgCl_2$ and $AlCl_3$ follows the order



D. In $CsCl$ lattice, each Cs is surrounded by $8Cl^-$ ions

Answer: A



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5. From the following given statements

(i) O.....H hydrogen bond length is more than covalent O-H bond length.

(ii) The ionic bond strength of CsF is more than that of NaF .

(iii) The number of electrons present in all inner shells of sodium atom are 10.

The correct combination is

A. only I is correct

- B. only I and ii are correct**
- C. only ii and iii are correct**
- D. only I and iii are correct**

Answer: D



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6. The high density of water 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**

Answer: A



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7. Among the following, the species having square planar geometry for central atom are

(i) XeF_4 (ii) SF_4

(iii) $[NiCl_4]$ (iv) $[PtCl_4]^{2-}$

A. I and ii

B. iii and iv

C. ii and iii

D. I and iv

Answer: D



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8. Bond polarity is least in

A. N-H

B. O-H

C. H-F

D. C-H

Answer: D



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9. Bond energy is least in the following

A. HF

B. HCl

C. HBr

D. HI

Answer: D



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10. Bond length of H_2 is 0.074nm, Bond length of Cl_2 is 1.98\AA . Bond length of HCl is

A. 2.72\AA

B. 136 pm

C. 1.027

D. 0.136\AA

Answer: B



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11. Which of the following compounds has the smallest bond angle in its molecule

A. NH_3

B. SO_2

C. OH_2

D. SH_2

Answer: D



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12. The O-H bond length in H_2O is $x\text{\AA}$. The O-H bond length in H_2O_2 is

A. $< x\text{\AA}$

B. $x\text{\AA}$

C. $> x\text{\AA}$

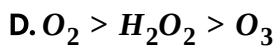
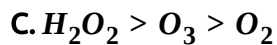
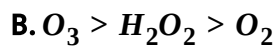
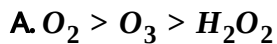
D. $2x\text{\AA}$

Answer: B



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13. In O_2 , H_2O_2 and O_3 the correct order of oxygen -oxygen bond length is



Answer: C



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14. Bond energy is highest in the molecules

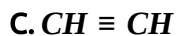
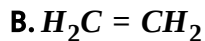
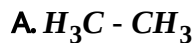


Answer: D



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15. Bond energy of C,C bond is highest in

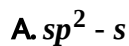


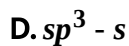
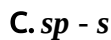
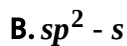
Answer: C



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16. Bond energy is highest in the overlapping



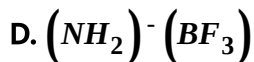
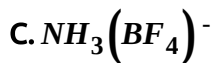
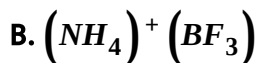
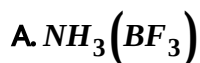


Answer: C



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17. In which of the following species the inter atomic bond angle is $109^\circ.28'$?

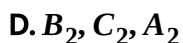
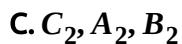
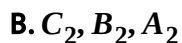
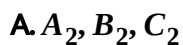


Answer: A



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18. The bond dissociation of the molecules A_2 , B_2 , C_2 are 498, 158, 945 kJ/mole respectively. If so, the correct decreasing order of their bond orders is

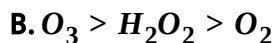
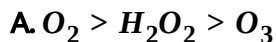


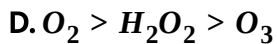
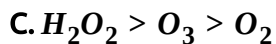
Answer: C



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19. The correct order of O-O bond length in O_2 , H_2O_2 and O_3 is



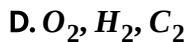
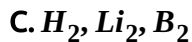
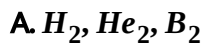


Answer: C



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20. In which of the following set all molecules have equal bond order?

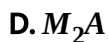
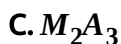
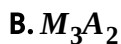


Answer: C



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1. The charge on a cation 'M' is +2 and anion 'A' is -3. The compound formed has the formula

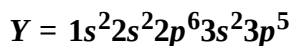
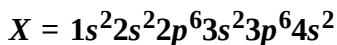


Answer: B

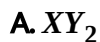


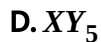
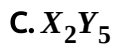
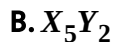
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2. Two elements 'X' and 'Y' have the following configuration



The compound formed by the combination of 'X' and 'Y' will be



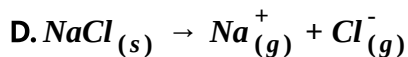
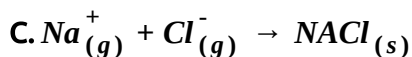
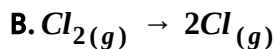
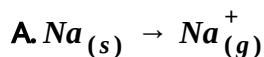


Answer: A



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3. Which of the following reaction involves the liberation of energy?

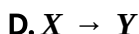
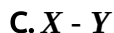
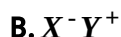
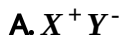


Answer: C



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4. An element 'X' is strongly electropositive and an element 'Y' is strongly electronegative and both are univalent. The compound formed would be

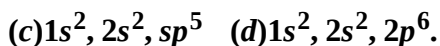
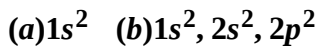


Answer: A



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5. The electronic structure of four elements a,b,c and d are



The tendency to form electrovalent bond is greatest in

A. a

B. b

C. c

D. d

Answer: C



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6. An atom of an element 'A' has three electrons in its outermost shell and that of 'B' has six electrons in the outer most shell. The formula of the compound formed between these two elements is

A. A_3B_4

B. A_2B_3

C. A_3B_2

D. A_2B

Answer: B

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7. If Na^+ ion is larger than Mg^{2+} ion and S^{2-} ion is larger than Cl^- ion, which of the following will be least soluble in water?

A. $NaCl$

B. Na_2S

C. $MgCl_2$

D. MgS

Answer: D

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8. In which of the following solvents should KCl be soluble at $25^\circ C$? (D = Dielectric constant value)

A. C_6H_6 [D = 0]



Answer: D



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9. The following has more size



Answer: D



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10. A, B and C are atoms of elements with atomic number Z , $Z+1$ and $Z+2$ respectively. If 'B' has octet configuration, the bond formed between 'A' and C predominantly is

A. Covalent bond

B. Ionic bond

C. Dative bond

D. Hydrogen bond

Answer: B



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11. Lattice energy of NaCl is 'X'. If the ionic size of A^{+2} is equal to that of Na^{+} and B^{-2} is equal to Cl^{-} , then lattice energy associated with the crystal AB is

A. X

B. 2X

C. 4X

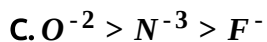
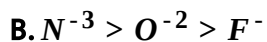
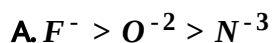
D. 8X

Answer: C



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12. The order of relative ease of formation of various ions is



Answer: A



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13. The incorrect statement regarding the formation of ionic bond

- A. It involves electrostatic attraction
- B. It is a redox process
- C. It is an exothermic process
- D. It involves the absorption of energy

Answer: D



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14. For which of the following sets, all the compounds are ionic ?

- A. NaF , BF_3 , MgF_2
- B. NaBr , MgBr_2 , MgO
- C. Al_2O_3 , MgO , SO_3
- D. NCl_3 , BeCl_2 , AlCl_3

Answer: B



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15. Which element among the following cannot exhibit variable electrovalency?

A. ${}_{29}\text{Cu}$

B. ${}_{50}\text{Sn}$

C. ${}_{25}\text{Mn}$

D. ${}_{38}\text{Sr}$

Answer: D



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16. Which of the following pairs will form the most stable ionic bond?

A. Na and F

B. Fe and Cl

C. N and O

D. Li and I

Answer: A



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17. Among the following compounds, the one with greatest ionic character is

A. NaCl

B. KCl

C. CsCl

D. RbCl

Answer: C

18. Some statements are give below:

- (i) The formation of a cation from a neutral atom is favoured by small size of the atom
- (ii) π bond does not exist between two atoms without σ bond
- (iii) The formation of chemical bond is associated with an increase in potential energy.

A. only I and ii are correct

B. only ii is correct

C. only ii and iii are correct

D. only I and iii are correct

Answer: B

19. $\text{Na}_{(g)} + \text{Cl}_{(g)} \rightarrow + \text{Cl}^{-}_{(g)}$ This reaction is

- A. Exothermic
- B. Endothermic
- C. Neither exothermic nor endothermic
- D. None of these

Answer: B



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20. Given electronic configurations of four elements E_1, E_2, E_3 and E_4 are respectively $1s^2, 1s^22s^22p^1, 1s^22s^22p^5$ and $1s^22s^22p^6$. The element which is capable of forming ionic as well as covalent bonds is

- A. E_1
- B. E_2
- C. E_3

D. E_4

Answer: C



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OBJECTIVE EXERCISE -2(COVALENT AND DATIVE BOND)

1. The covalency of nitrogen in HNO_2 is

A. 0

B. 2

C. 3

D. 5

Answer: C



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2. van der Waals forces are maximum in the following substance

A. HBr

B. LiBr

C. LiCl

D. AgBr

Answer: D



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3. Which of the following is an example of super octet molecules?

A. ClF_3

B. PCl_5

C. IF_7

D. All the three

Answer: D



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4. An aqueous solution of silver nitrate gives a white precipitate with



Answer: C



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5. Which of the following is very much volatile ?

A. Diamond

B. Sodium chloride

C. Calcium

D. Dry ice

Answer: D



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6. Which of the following is truly covalent?

A. AgCl

B. KCl

C. $BaCl_2$

D. $CoCl_2$

Answer: D



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7. Which of the following is covalent?



Answer: A



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8. If the electronegativity of two atoms is low, then expected bond between the elements is

A. Ionic bonds

B. Covalent bond

C. Dative bond

D. Metallic bond

Answer: D



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9. Direct overlap leads

- A. σ bond**
- B. π bond**
- C. Both σ and π bonds**
- D. Neither σ nor π bond**

Answer: A



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10. The bonds present in N_2O_5 are

- A. Ionic**

B. Covalent

C. Ionic and covalent

D. Covalent and dative

Answer: D



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11. In which type of bond formation, can a proton participate?

A. Hydrogen bond

B. Electrovalent

C. Dative

D. Covalent and dative

Answer: C



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12. The bonds present in $\left[\text{Cu}(\text{NH}_3)_4 \right] \text{SO}_4$ between copper and ammonia are

- A. ionic
- B. covalent
- C. co-ordinate
- D. hydrogen

Answer: C



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13. How many water molecules present in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ are hydrogen bonded?

- A. electrovalent and covalent
- B. electrovalent, covalent, co-ordinate and hydrogen bond
- C. covalent and co-ordinate covalent

D. electrovalent

Answer: B



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14. The element that exhibits neither electrovalency nor covalency is

A. Neon

B. Sodium

C. Barium

D. Chlorine

Answer: A



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15. Octet rule is mostly violated in the compounds formed by

A. alkali metals

B. alkaline earth metals

C. p-block elements

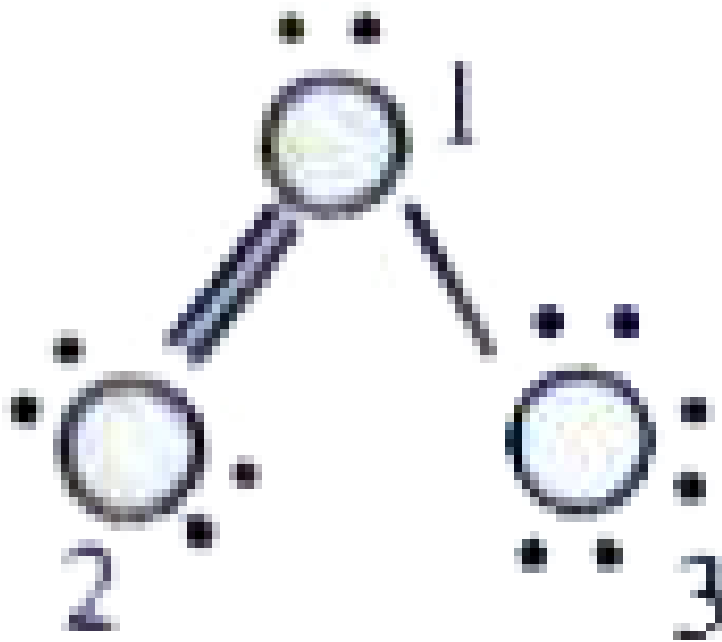
D. transition elements

Answer: D



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16. In



molecule, the

formal charges of oxygen atoms 1,2,3 are respectively

A. -1, 0, + 1

B. 0, - 1, + 1

C. 0, + 1, - 1

D. +1, 0, - 1

Answer: D



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17. Which of the following statements is incorrect for PCl_5 ?

- A. Its all P-Cl bond lengths are equal
- B. It involves $sp^3 d$ hybridisation
- C. It has irregular geometry
- D. Its shape is trigonal bipyramid

Answer: A



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18. The attraction that non polar molecules have for each other is primarily caused by

- A. van der Waals forces
- B. Difference in electronegativities

C. Hydrogen bonding

D. High ionisation energy

Answer: A



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19. In bisulphate ion the formal charge on sulphur atom is

A. +1

B. +2

C. +4

D. +6

Answer: B



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



Answer: C



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21. Which of the following ion has maximum polarising power



Answer: B



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22. The bond between chlorine and bromine in BrCl is

- A. ionic**
- B. non polar solvents**
- C. polar with negative end on Br**
- D. polar with negative end on Cl**

Answer: D



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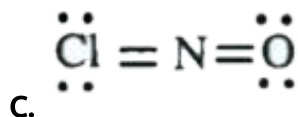
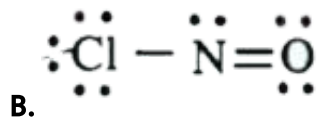
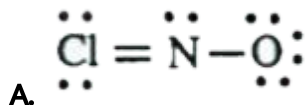
23. Oxygen cannot exhibit tetravalency and hexavalency like sulphur. This is because

- A. Oxygen has two unpaired electrons
- B. Oxygen can form double bond
- C. Oxygen lacks valence d-orbitals
- D. Oxygen has only 2 electrons in valence shell

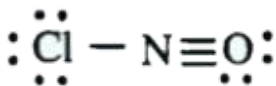
Answer: C

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24. Which of the following is the most likely Lewis structure of nitrosyl chloride NOCl



D.



Answer: B



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25. The following are some statements about the characteristics of covalent compounds i) The combination of a metal and non-metal must give a covalent compound. ii) All covalent substances are bad conductors of electricity. iii) All covalent substances are gases at room temperature.

The correct combination is

- A. all are correct
- B. only I and ii are correct
- C. only ii and iii are correct
- D. all are wrong

Answer: D



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26. Some statements about valence bond theory are given below

- (i) The strength of bond depends upon extent of overlapping.
- (ii) The theory explains the directional nature of covalent bond.
- (iii) According to this theory oxygen molecule is paramagnetic in nature.

A. all are correct

B. only I and ii are correct

C. only I and ii are correct

D. all are wrong

Answer: C



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27. The formal charges on the three oxygen atoms in O_3 molecule are

A. 0,0,0

B. 0,0,-1

C. 0,0+1

D. 0,+1,-1

Answer: D



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28. In the electronic structure of acetic acid there are

A. 16 shared and 8 unshared valence electrons

B. 8 shared and 16 unshared valence electrons

C. 12 shared and 12 unshared valence electrons

D. 18 shared and 6 unshared valence electrons

Answer: A



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29. The formal charge of central oxyge atom in ozone molecule is

A. -1

B. -2

C. +1

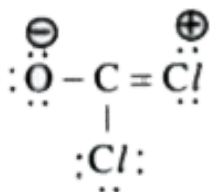
D. 0

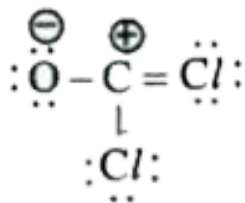
Answer: C



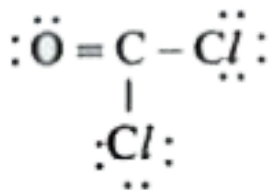
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30. Select the most stable structure of COCl_2

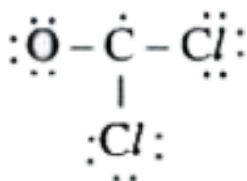




B.



C.



D.

Answer: C



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OBJECTIVE EXERCISE -2(HYBRIDISATION AND VSEPR THEORY)

1. Increasing order of size of hybrid orbitals is

A. sp, sp^2, sp^3

B. sp^3 , sp^2 , sp

C. sp^2 , sp^3 , sp

D. sp^2 , sp , sp^3

Answer: A



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2. The type of hybridisation present on "S" in SO_2 and SO_3 molecules respectively

A. sp , sp^2

B. sp^2 , sp^2

C. sp , sp^3

D. sp^2 , sp^3

Answer: B



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3. The hybridisation of Ag in the complex $\left[Ag(NH_3)_2\right]^+$ is

A. sp

B. sp^2

C. sp^3

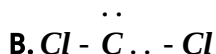
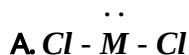
D. dsp^2

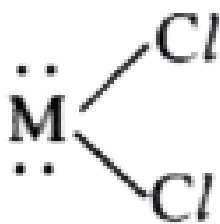
Answer: A



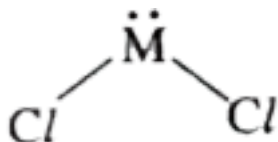
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4. Atomic number of the central atom in MCl_2 is 50. The shape of gaseous MCl_2 is given as





C.



D.

Answer: D



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5. An element M reacts with chlorine to form a compound X. The bond angle in X is 120° . What is M?

A. Be

B. B

C. Mg

D. N

Answer: B



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6. When the hybridisation state of carbon atom changes from sp^3 to sp^2 and finally to sp , the angle between the hybrid orbitals

- A. Decreases gradually**
- B. Decreases considerably**
- C. No change**
- D. Increases progressively**

Answer: D



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7. Hybridisation of one s and one p orbitals form

A. form 2 mutually perpendicular orbitals

B. form 2 orbitals at 180°

C. form 4 orbitals directed tetrahedrally

D. form 3 orbitals in plane

Answer: B



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8. In which of the following types of geometry, all the bond angles are not the same?

A. Square planar

B. Trigonal planar

C. Trigonal bipyramidal

D. Tetrahedral

Answer: C

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9. Which orbital is used by oxygen atom to form a σ bond with other oxygen atom in O_2 molecule?

- A. pure p-orbital
- B. sp-hybrid orbital
- C. sp^2 - hybrid orbital
- D. sp^3 - hybrid orbital

Answer: A

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10. The hybrid state of carbon in acetylene is the same as that of carbon in

- A. Benzene

B. Carbondioxide

C. Graphite

D. Ethylene

Answer: B



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11. Regarding hybridisation which is incorrect?

A. BF_3 , C_2H_4 , C_6H_6 involve sp^2 hybridisation

B. BeF_2 , C_2H_2 , CO_2 involve sp hybridisation

C. NH_3 , H_2 , CCl_4 involve sp^3 hybridisation

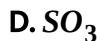
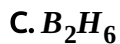
D. CH_4 , C_2H_4 , C_2H_2 involve sp^2 hybridisation

Answer: D



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12. sp^2 Hybrid orbitals are not present in

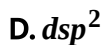


Answer: C



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13. Which hybridization is found in $HClO_4$ and $HClO_3$?



Answer: A



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14. The ratio of pure orbitals to hybridized orbitals in ethylene is

A. 2 : 3

B. 3 : 1

C. 1 : 1

D. 1 : 3

Answer: C



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15. The ratio of hybrid and unhybrid orbitals involved in the bonding of a benzene molecule is

A. 3 : 2

B. 1 : 1

C. 3 : 1

D. 1 : 3

Answer: A



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16. The pair having similar geometry is

A. BF_3 , NH_3

B. H_2O , C_2H_2

C. CO_2 , SO_2

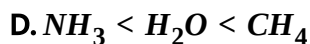
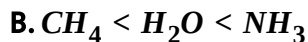
D. NH_3 , PH_3

Answer: D



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17. The correct order of magnitude of bond angles among the compounds CH_4 , NH_3 and H_2O is

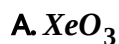


Answer: A



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18. The molecule with maximum number of lone pairs on central atoms is



D. ICl_3

Answer: D



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19. The type of overlapping not observed in the formation of ethylene molecule is

A. $\sigma sp^2 - sp^2$

B. $\sigma sp^2 - p$

C. $\sigma sp^2 - s$

D. $p^\pi - p^\pi$

Answer: B



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20. List -1 List -2

A. NH_4^+ 1. sp^3 hybridisation, two lone pair

B. H_3O^+ 2. sp^2 hybridisation, one lone pair

C. XeO_3 3. sp^3 hybridisation, no lone pair

D. SO_3 4. sp^3 hybridisation, one lone pair

5. sp^2 hybridisation no lone pair

The correct match is

A.

A	B	C	D
1	2	4	5

B.

A	B	C	D
2	2	3	5

C.

A	B	C	D
3	4	4	5

D.

A	B	C	D
4	4	3	5

Answer: C



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21. The hybrid orbitals have a bond angle of $109^{\circ}28'$. The ratio of percentage of s and p character is

A. 1 : 1

B. 1 : 2

C. 1 : 3

D. 2 : 3

Answer: C



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22. Which has triangular planar shape?

A. CH_3^+

B. ClO_2^-

C. H_3O^+

D. ClO_3^-

Answer: A



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23. List I (molecule) List II (no of l.p on central atom)

A. NH_3 I. Two

B. H_2O II Three

C. XeF_2 III. Zero

D. CH_4 IV. Four

V one

A.

	A	B	C	D
A.	V	I	III	I

B.

	A	B	C	D
B.	III	I	II	V

C.

	A	B	C	D
C.	V	I	II	III

D.

	A	B	C	D
D.	I	V	III	IV

Answer: C



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24. In general, the d-orbital involved in sp^3d hybridization is

A. d_{xy}

B. d_z^2

C. $d_{x^2-y^2}$

D. d_{yz}

Answer: B



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25. If E= number of lone pairs of electrons of Xe B=the number of bonding pairs of electrons S=shape of the molecule

then, the correct set of E,B and S of XeF_4

A. $E \quad B \quad S$
1. 4 2 Square planar

B. $E \quad B \quad S$
2. 3 3 octahedral

- $E \quad B \quad S$
C. 3. 3 3 Square planar
- $E \quad B \quad S$
D. 4. 2 4 Square planar

Answer: D



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26. Which of the following structure of a molecule is expected to have three bond pairs and one lone pair of electrons?

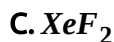
- A. Octahedral
- B. Trigonal planar
- C. Pyramidal
- D. Tetrahedral

Answer: C



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27. Identify all the compound (s) that are isostructural with CO_2



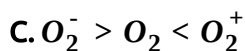
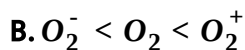
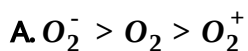
Answer: C

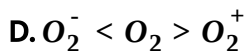


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OBJECTIVE EXERCISE -2(MOLECULAR ORBITAL THEORY)

1. Which of the following orders regarding the bond length is correct?



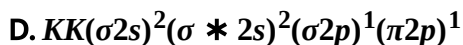
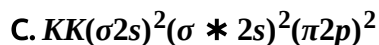
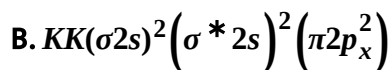
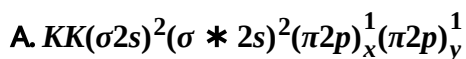


Answer: A



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2. The molecule electronic configuration of B_2 is

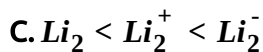
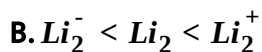


Answer: A



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



Answer: D

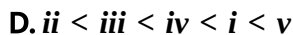
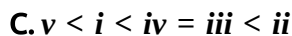
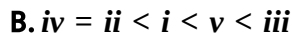
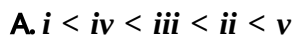


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4. The correct order of bond order values among the following is

(i) NO_2^- ii. NO^+ iii. NO

iv. NO^{+2} v. NO^{-2}



Answer: C



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5. When N_2 goes to N_2^+ , then N-N bond distanceand when O_2 goes to O_2^+ the O-O bond distance.....

- A. increases, decreases
- B. decreases, increased
- C. increases , increases
- D. decreases, decreases

Answer: A



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6. The total number of antibonding electrons in nitrogen and oxygen molecules respectively is

A. 4,6

B. 6,8

C. 5,8

D. 4,8

Answer: A



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7. The correct order of N-O bond length in NO , NO_2^- and NO_3^- will be

A. $\text{NO} > \text{NO}_2^- > \text{NO}_3^-$

B. $\text{NO} > \text{NO}_3^- > \text{NO}_2^-$

C. $\text{NO}_2^- > \text{NO}_3^- > \text{NO}$

D. $\text{NO}_3^- > \text{NO}_2^- > \text{NO}$

Answer: D



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8. The Cl-O bond order in perchlorate ion

A. 1

B. 2

C. 1.75

D. 2.5

Answer: C



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9. Which combination of atomic orbitals is not allowed according to MO theory?

A. $p_x - p_x$

B. $p_x - p_y$

C. $p_y - p_y$

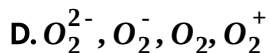
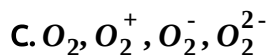
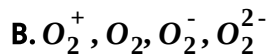
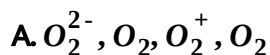
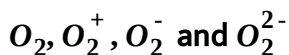
D. $p_z - p_z$

Answer: B



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10. Arrange the following in increasing order of their bond order:



Answer: D



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11. The wave function of a molecular orbital formed by reinforcement of wave functions of Ψ_A and Ψ_B of atomic orbital A and B is represented as

A. $\Psi_A + \Psi_B$

B. $\Psi_A - \Psi_B$

C. $\Psi_A + \Psi_B$

D. $2\Psi_A + \Psi_B$

Answer: A



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12. Which of the following orders regarding the bond order is correct?

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

B. $O_2^- < O_2 < O_2^+$

C. $O_2^- > O_2 < O_2^+$

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

Answer: C



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13. A bonding molecular orbital is produced by

- A. Destructive interference of wave functions**
- B. Constructive interference of wave functions**
- C. Pairing of electrons with opposite spins**
- D. Combination of +ve and -ve wave functions**

Answer: B



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14. For a homodiatomic molecule with a total number of electrons 14, after filling $\sigma * 2s$ M.O. the next electron goes to

A. σ_{2pz}

B. π_{2py}

C. π_{2py}

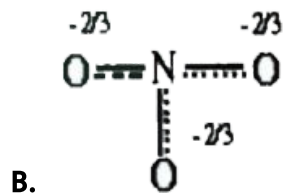
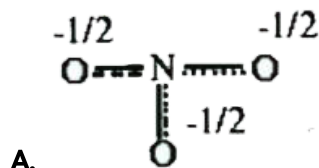
D. π_{2px} or π_{2py}

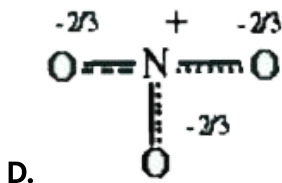
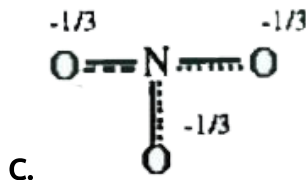
Answer: D



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15. The resonance hybrid of nitrate ion is





Answer: C



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16. Which one of the following is correct regarding σ molecular orbital?

- A. The rotation along the internuclear axis is symmetric
- B. It is formed by the partial overlap of atomic orbitals at right angle to internuclear axis
- C. It is very weak bond
- D. It has less overlapping region

Answer: A



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17. π_{2px}^* differs from π_{2py}^* molecular orbital in which of the following

A. Number of nodal planes

B. Energy

C. Symmetry

D. shape

Answer: C



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18. The bond order of individual carbon bonds in benzene is

A. one

B. two

C. between one and two

D. one and two alternately

Answer: C



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19. In the formation of a homo diatomic neutral molecule, if N atomic orbitals combine, then the total number of bonding molecular orbitals formed is

A. $2N$

B. N

C. $N/2$

D. $N/4$

Answer: C



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20. In an anti bonding molecular orbital, electron density is minimum

- A. around one atom of the molecule
- B. between two nuclei
- C. at a point away from nuclei of the molecule
- D. at no place

Answer: B



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

- A. CN^- and NO^+
- B. CN^- and CN^+
- C. O_2^- and CN^-

D. NO^+ and CN^+

Answer: A



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22. The correct order of the energy of molecular orbitals in a molecules having four electrons

A. $\sigma_{2s}^* > \sigma_{2pz} > \pi_{2px}$

B. $\sigma_{2s}^* > \pi_{2p} > \pi_{2pz}$

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

D. $\sigma_{2pz} < \sigma_{2s}^* < \pi_{2px}$

Answer: B



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23. The molecular orbital electronic configuration is $(\sigma_{1s})^2, (\sigma_{1s}^*)^1$. It corresponding to



D. Both 2 and 3

Answer: D



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24. List -I List -II (Bonds)

A. CO_2 1. 1, paramagnetic

B. O_2 2. 1, diamagnetic

C. B_2 3. 2, paramagnetic

D. Li_2 4. 2, diamagnetic

5. 3, diamagnetic

- A.

A	B	C	D
3	5	2	1
- B.

A	B	C	D
4	3	1	2
- C.

A	B	C	D
4	2	1	3
- D.

A	B	C	D
3	2	5	4

Answer: B



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OBJECTIVE EXERCISE -2(HYDROGEN BOND)

1. Maximum number of hydroge bonds that one water molecle is capable of forming is

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

Answer: D



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2. Acetic acid exist as a dimer in benzene due to

- A. Condensation reaction**
- B. Hydrogen bonding**
- C. Presence of phynyl group**
- D. Presence of hydrogen atom at α - carbon**

Answer: B



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3. Hydrogen bond may be formed between

- A. Two hydroge atoms**

B. Hydroge atom and electropositive atom

C. H-atom and electronegative atm with small size

D. H-atom and electronegative atomwith larger size

Answer: C



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4. Order of intemolecular attractive forces

A. waterlt AlcoholltEther

B. EtherltAlcoholltWater

C. AlcoholltWaterltEther

D. EtherltWaterltAlcohol

Answer: B



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5. Which of the following hydrogen bonds is relatively weaker?

A. N.....H-N

B. F.....H-F

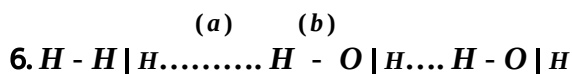
C. N.....H-O

D. O.....H-O

Answer: A



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Here a and b are hydrogen bond and covalent bonds, their lengths are

A. 0.97 \AA , 0.97 \AA

B. 1.73 \AA , 0.97 \AA

C. 1.73 \AA , 1.73 \AA

D. 0.97 \AA , 1.73 \AA

Answer: B



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7. Which of the following hydroge halide is most volatile?

A. HF

B. HCl

C. HBr

D. HI

Answer: B



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8. A stronger hydrogen bonding is present in

A. Ethanol

B. Diethylether

C. Etylchloride

D. Dimethylamine

Answer: A



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9. Boiling point is highest for

A. Hydrogenfluoride

B. Water

C. Ammonia

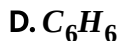
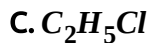
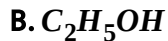
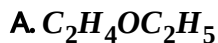
D. Methane

Answer: B



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10. Which of the following is soluble in water?



Answer: B



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11. Among the three isomers of nitro phenol, which is least soluble in water?

A. ortho isomer

B. para isomer

C. meta isomer

D. all are insoluble

Answer: A



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12. Strongest hydrogen bonds can be formed by

A. HF

B. H_2O

C. NH_3

D. HCl

Answer: A



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13. Hydrogen bonds are present even in vapour state of

A. H_2O is non polar

B. HF

C. p-hydroxy benzaldehyde

D. C_2H_5OH

Answer: B



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14. Between any two of the following molecules, hydrogen bonding is not possible

A. Two primary amine molecules

B. Two secondary amine molecules

C. Two tertiary amine molecules

D. Two ammonia molecules

Answer: C



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15. Maximum number of hydroge bonds that one water molecle is capable of forming is

A. 1

B. 2

C. 3

D. 4

Answer: D



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16. Two ice cubes are pressed over each other and unite to form one cube, which force is rsponsible, for holding them together?

A. van der Waal.s forces

B. Covalent attraction

C. Hydrogen bond formation

D. Dipole dipole attraction

Answer: C



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17. Which of the following compounds has hydrogen bonding?

A. HCl

B. C_2H_6

C. RCH_2NHCH_3

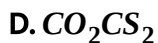
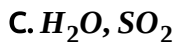
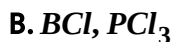
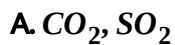
D. RCH_2CHO

Answer: C



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1. In which of the following pairs, both molecules poses dipole moment?

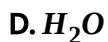


Answer: C



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2. Which of the following compounds has zero dipole moment?



Answer: A



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3. Dipole moment of H_2X is 1.0 D. If the bond angle is 90° , the approximate bond moment of H-X bond is ($\cos 45^\circ = 0.7$)

A. 0.4 D

B. 0.5 D

C. 0.7 D

D. 0.6 D

Answer: C



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4. The dipole moment of HX is 1.2 D. If the % ionic character of the bond is 25%, then its bond length is

A. 10\AA

B. 10^{-10}m

C. 10^{-8}m

D. 10^6m

Answer: B



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5. Which bond angle θ would result in the maximum dipole moment for the triatomic molecule XY_2

A. $\theta = 90^\circ$

B. $\theta = 120^\circ$

C. $\theta = 150^\circ$

D. $\theta = 180^\circ$

Answer: A

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6. From the following dipole moment (in Debye) values of methyl halides, identify the value of $CH_3 - F$

A. 1.460

B. 1.636

C. 1.730

D. 1.847

Answer: C

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7. A: Water molecule has zero dipole moment

R: In water molecule dipole moment of the two O-H bonds cancel each other.

- A. Both A and R are true, and R is correct explanation of A
- B. Both A and R are true nad R is not the correct explanation of A
- C. Both A and R are false
- D. A is false and R is true

Answer: C



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8. The dipole moment of BF_3 is zero because

- A. The electronegativity difference between boron and fluorine molecule
- B. It is a covalent molecule
- C. It is a tetra atomic molecule
- D. It is having trigonal planar geometry.

Answer: D



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

- A. pure p
- B. sp hybrid
- C. sp^2 hybrid
- D. sp^3 hybrid

Answer: C



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10. Bent molecule having dipole moment among the following

- A. F_2O
- B. H_2O

C. Cl_2O

D. All of these

Answer: D



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11. Which one of the following $\mu = 0$

A. CH_2Cl_2

B. SO_3

C. NH_3

D. H_2O

Answer: B



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12. The difference of electronegativity between X and Y is 2. If X and Y form covalent bond, the percentage of ionic character in X-Y bond is

- A. 0.4
- B. 0.42
- C. 0.25
- D. 0.46

Answer: D



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13. Arrange in the order of increasing dipole moment

- I. toluene
- II. m-dichlorobenzene
- III. o-dichlorobenzene
- IV. p-dichlorobenzene

A. $\text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I}$

B. $\text{I} \text{V} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I}$

C. $\text{I} \text{V} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I}$

D. $\text{I} \text{V} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I}$

Answer: B



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14. Which bond is most polar?

A. Cl-F

B. Br-F

C. I-F

D. F-F

Answer: C



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15. The dipole moment of HX is 1.2 D. If the % ionic character of the bond is 25%, then its bond length is

A. 10 \AA

B. 10^{-10} m

C. 10^{-8} m

D. 10^6 m

Answer: B



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16. The following are some statements about dipole moment.

i. The dipole moment of any covalent molecule is zero.

ii. The dipole moment of a diatomic molecule having non-polar bonds is zero

iii. The dipole moment of a diatomic molecule having polar covalent bond is non-zero.

A. all the three statements are correct

B. only ii is correct

C. only ii and iii are correct

D. only i and iii are correct

Answer: C



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17. Which of the following is more stable

A. HF

B. HCl

C. HBr

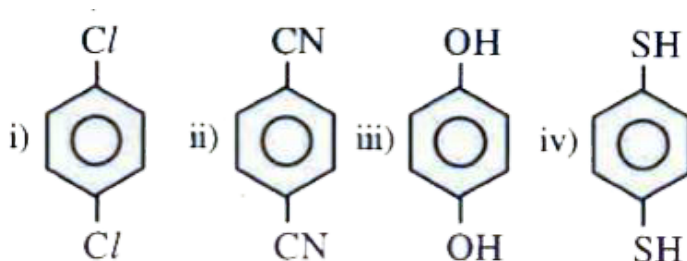
D. HI

Answer: A



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18. For which of the following molecule significant $\mu \neq 0$?



A. only I

B. I and ii

C. only iii

D. iii and iv

Answer: D



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19. The table shown lists the bond dissociation energies (E_{diss}) for single covalent bonds formed between carbon and atoms of elements A, B, C, and D. Which element is the smallest atom?

Bond between C and E_{diss}

other atom KJmol^{-1}

A. C - A 240

B. C - B 328

D. C - D 276

D. C - D 485

A. C

B. Diethylether

C. A

D. B

Answer: B



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

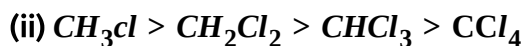
- A. One sigma (σ) and one pi (π) bonds
- B. One sigma (σ) and two pi (π) bonds
- C. One sigma (σ) and a half pi (π) bonds
- D. One sigma (σ) bond only

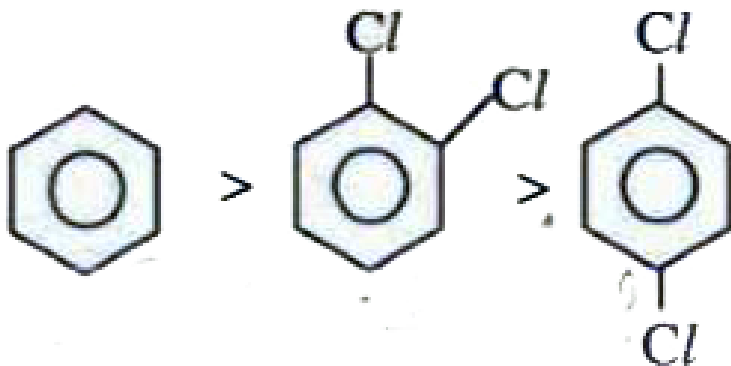
Answer: B



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21. From the following give statements of the order of dipole moments.





The correct combination is

- A. all are correct
- B. i,ii are correct
- C. only iii is correct
- D. only I is correct

Answer: B



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22. KF combines with HF to form KHF_2 . The compound contains the species

A. K^+ , F^- and H^+

B. K^+ , F^- and HF

C. K^+ , and $[HF_2]^{-1}$

D. $[KHF]^+$ and F^-

Answer: C



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OBJECTIVE EXERCISE -2(BOND CHARACTERS)

1. The correct order of O-O bond length in O_2 , H_2O_2 and O_3 is

A. $O_3 > H_2O_2 > O_2$

B. $O_2 > H_2O_2 > O_3$

C. $O_2 > O_3 > H_2O_2$

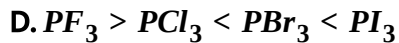
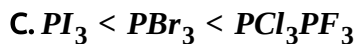
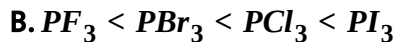
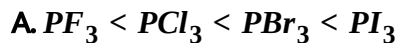
D. $H_2O_2 > O_3 > O_2$

Answer: D



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2. The correct order of increasing bond angles is



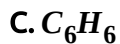
Answer: A



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3. Which of the following hydrocarbon has least C-C bond length?



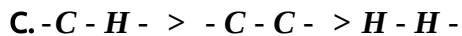


Answer: D



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4. The decreasing order of bond dissociation energies of C-C, C-H and H-H bonds is

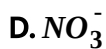
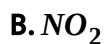


Answer: A



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5. Which of the following has largest bond angle?



Answer: A



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6. Using MO theory predict which of the following species has the shortest bond length?



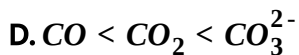
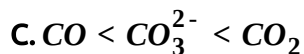
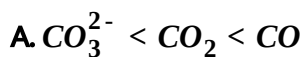


Answer: B



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7. The correct order of increasing C-O bond length of CO , CO_3^{2-} and CO_2



Answer: D



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8. Which of the following has least bond energy?



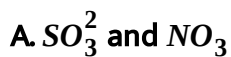
Answer: A



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OBJECTIVE EXERCISE -3 (RECENT AIPMT/NEET QUESTIONS)

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



Answer: C



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



Answer: D



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3. In which of the following molecules/ions BF_3 , NO_2 , NH_2 and H_2O the central atom is sp^2 hybridised ?

A. NH_2 and H_2O

B. NO_2 and H_2O

C. BF_3 and NO_2

D. NO_2 and NH_2^-

Answer: C



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

A. $C_2^2 < He_2^+ < NO < O_2$

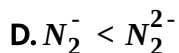
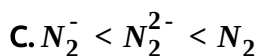
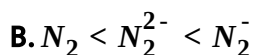
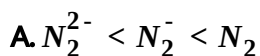
B. $He_2^+ < O_2 < NO < C_2^{2-}$

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

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

Answer: B

5. According to MO theory which of the lists rank the nitrogen species in terms of increasing bond order?



Answer: A

6. What is the dominant intermolecular force or bond that must be overcome in converting liquid CH_3OH to a gas?

A. Dipole-dipole interaction

B. covalent bonds

C. London dispersion force

D. Hydrogen bonding

Answer: D



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7. In which of the following pairs of molecules/ ions, the central atoms have sp^2 hybridisation?

A. NO_2^- and NH_3

B. BF_3 and NO_2^-

C. NH_2^- and H_2O

D. BF_3 and NH_2^-

Answer: B



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



Answer: B



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9. In which one of the following species the central atom has the type of hybridization which is not the same as that present in the order three?





Answer: C



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10. Some of the properties of the two species, NO_2^- and H_3O^+ are described below. Which one of them is correct?

- A. Dissimilar in hybridization for the central atom with different structures.
- B. Isostructural with same hybridization for the central atom
- C. Isostructural with different hybridization for the central atom
- D. Similar in hybridization for the central atom with different structures

Answer: A

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11. In which of the following molecules the central atom does not have sp^3 hybridization?



Answer: B

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



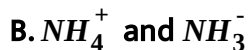


Answer: A



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13. Which of the two ions from the list given below that have the geometry that is explained by the same hybridization of orbitals NO_2^- and NO_3^- , NH_2^- , NH_4^+ , SCN^- ?

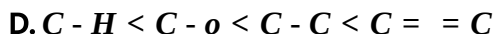
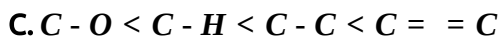
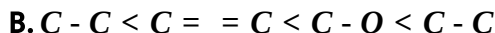
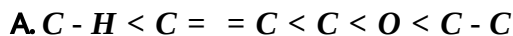


Answer: A



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14. The correct order of increasing bond length of C-H, C-O, and C=C is



Answer: A



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15. The pairs of species of oxygen and their magnetic behaviour are noted below. Which at the following presents the correct description?



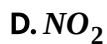
D. O, O_2^{2-} -Both paramagnetic

Answer: C



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16. Bond order of 1.5 is shown by



Answer: B



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

A. H_2O is non polar

B. BF_3

C. NH_2^- and H_2O

D. PCl_3

Answer: D



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

A. O_2^{2-} , B_2

B. O_2^+ , NO^+

C. NO , CO

D. N_2 , O_2

Answer: A



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19. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals?

A. π^* orbital

B. π orbital

C. σ^* orbital

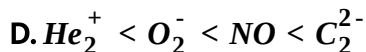
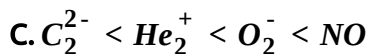
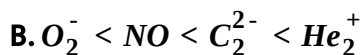
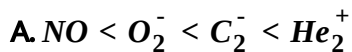
D. σ orbital

Answer: A



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20. Four diatomic species are listed below. Identify the correct order in which the bond order is increasing in them

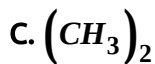
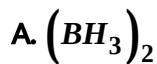


Answer: D



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21. Which of the following is electron deficient?



Answer: A



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22. XeF_2 is isostructural with

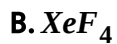


Answer: D



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23. Which of the following is a polar molecule



D. SF_4 and XeF_4

Answer: D



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24. Which of the following is paramagnetic?

A. CN^-

B. NO^+

C. CO

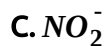
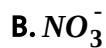
D. O_2^-

Answer: D



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25. Which one of the following species has plane triangular shape?



Answer: B



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26. Which of the following molecules has the maximum dipole moment?

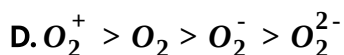
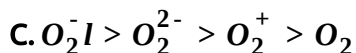
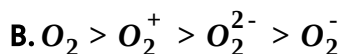
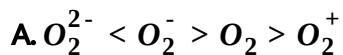


Answer: C



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



Answer: D



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28. In which of the following pairs, both the species are not isostructural?

A. Diamond, Silicon carbide

B. NH_3 , PH_3

C. XeF_4 , XeO_4

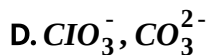
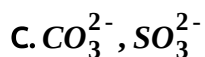
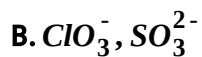
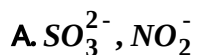
D. SiCl_4 , PCl_4

Answer: C



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

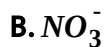


Answer: B



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30. Maximum bond angle at nitrogen is present in which of the following?

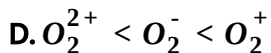
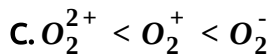
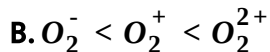
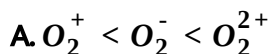


Answer: A



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31. The correct bond order in the following species is

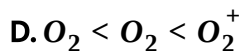
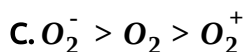
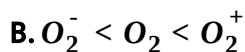
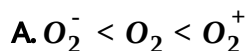


Answer: B



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32. Which of the following options represents the correct bond order?



Answer: D



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33. Match the compounds given in column I with the hybridisation and shape given in column II and mark the correct option.

Column -I Column -II

a. XeF_6 i. Distorted octahedral

b. XeO_3 ii. Square planar

c. XeOF_4 iii. Pyramidal

d. XeF_4 iv. Square pyramidal

A.

a	b	c	d
i	iii	iv	ii

B.

a	b	c	d
i	ii	iv	iii

C.

a	b	c	d
iv	iii	i	ii

D.

a	b	c	d
iv	i	ii	iii

Answer: A



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34. Predict the correct order among the following

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

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

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

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

Answer: A



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

A. sp , sp^3 and sp^2

B. sp^2 , sp^3 and s

C. sp , sp^2 and sp^3

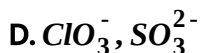
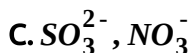
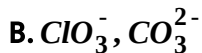
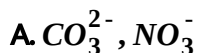
D. sp^2 , sp and sp^3

Answer: C



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36. Which of the following pairs of ions is isoelectronic and isostructural?



Answer: D



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37. Consider the molecules CH_4 , NH_3 and H_2O Which of the statements is false?

A. The H-C-H bond angle in CH_4 the H-N-H bond angle in NH_3 in the H-O-H bond angle in H_2O are all greater than 90°

B. The H-O-H bond angle in H_2O is larger than the H-C-H bond angle in CH_4

C. The H-O-H bond angle in H_2O is smaller than the H-N-H bond angle in NH_3

D. The H-C-H bond angle in CH_4 is larger than the H-N-H bond angle in NH_3

Answer: B



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38. The species, having bond angles of 120°

A. BCl_3

B. PH_3

C. ClF_3

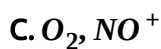
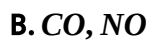
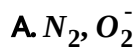
D. NCL_3

Answer: A



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



Answer: D



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