

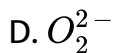
## CHEMISTRY

### BOOKS - MTG WBEE CHEMISTRY (HINGLISH)

## CHEMICAL BONDING AND MOLECULAR STRUCTURE

### Wbjee Workout Category 1 Single Option Correct Type

1. Which of the following molecular species has unpaired electron(s)?



**Answer: C**



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2. The Type of hybridisation in diborane is

A. sp-hybridized

B.  $sp^2$ - hybridized

C.  $sp^3$ -hybridized

D.  $sp^3d^2$ -hybridized

**Answer: C**



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3. The bond order of NO is 2.5 while that of  $NO^+$  is 3. Which of the following statements is true for these two species?

- A. Bond length in  $NO^+$  is greater than in NO
- B. Bond length in NO is greater than in  $NO^+$
- C. Bond length in  $NO^+$  is equal to that in NO
- D. Bond length in unpredictable.

**Answer: B**



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4. Which of the following is diamagnetic?

- A. Superoxide ion
- B. Carbon molecule

C. Unipositive ion of nitrogen molecule

D. Oxygen molecule

**Answer: B**

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5. The statement true for  $N_3^-$  is

A. it has a non linear structure

B. it is called pseudohalogen

C. the formal oxidation state of nitrogen in this anion is -1

D. it is isoelectronic with  $NO_2$

**Answer: C**

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6. Dipole moment is shown by

- A. 1,4-dichlorobenzene
- B. cis-1,2-dichloroethene
- C. trans 1,2-dichloroethene
- D. trans -2,3- dichloro-2-butene

**Answer: B**

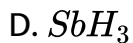


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7. The species in which the central atom uses  $sp^2$  hybrid orbitals in its bonding is

A.  $PH_3$

B.  $NH_3$

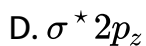
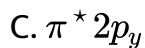
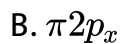
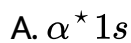


**Answer: C**



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8. Which of the following molecular orbital has two nodal plane?



**Answer: C**



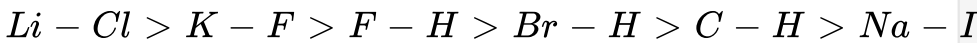
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9. What is the order of polarity of the following bond?

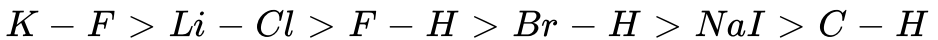
(i) C-H (ii) F-H (iii) Br-H

(iv) Na-I (v) K-F (vi) Li-Cl

A.



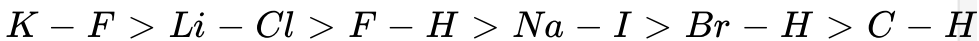
B.



C.



D.



**Answer: D**



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10. The central atom does not assume  $sp^2$  hybridisation in



**Answer: A**



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11. The maximum number of  $90^\circ$  angles between bond pair bond pair of electrons is observed in





B.  $sp^3d$  hybridisation

C.  $dsp^2$  hybridisation

D.  $sp^3d^2$  hybridisation.

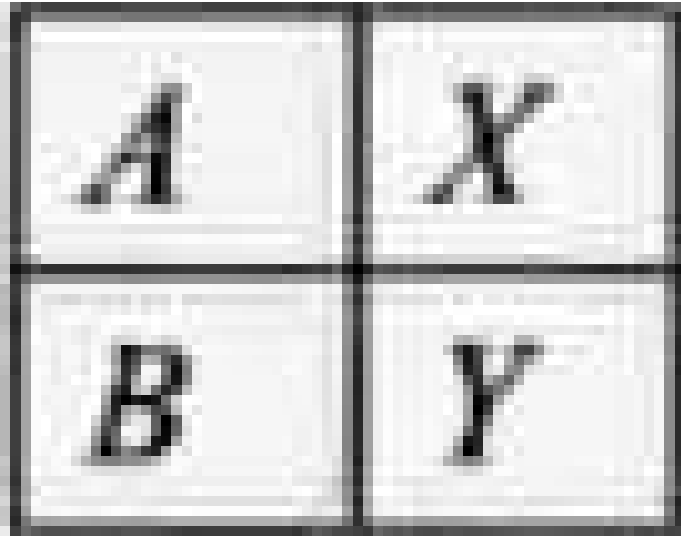
**Answer: D**



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**12.** A section of the periodic table is given below with elements A,B and X,Y in two groups. Which of the bond given below is the least

polar?



A. AX

B. AY

C. BX

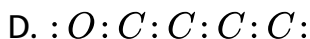
D. BY

**Answer: B**



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13. Carbon suboxide ( $C_3O_2$ ) has recently been shown as a component of the atmosphere of Venus. Which of the following formulation represents the correct ground state Lewis structure for carbon suboxide?



**Answer: C**



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14. In  $NO_3^-$  ion number of bond pairs and lone pairs of electrons on nitrogen atom are

A. 2,2

B. 3,1

C. 1,3

D. 4,0

**Answer: D**



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

A. all ionic

B. all covalent

C. ionic, covalent and coordinate

D. ionic and covalent.

**Answer: C**

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**16.** The molecule /species having one unpaired electron is

A. O

B. CO

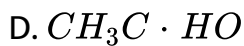
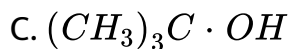
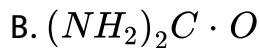
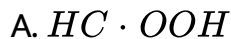
C.  $CN^-$

D.  $O_2$

**Answer: A**

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17. The compound in which  $C$  uses  $sp^3$  hybrid orbitals for bond formation is



**Answer: C**



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18. The type of hybrid orbitals used by chlorine atom in  $ClO_3^-$  is



C. *sp*

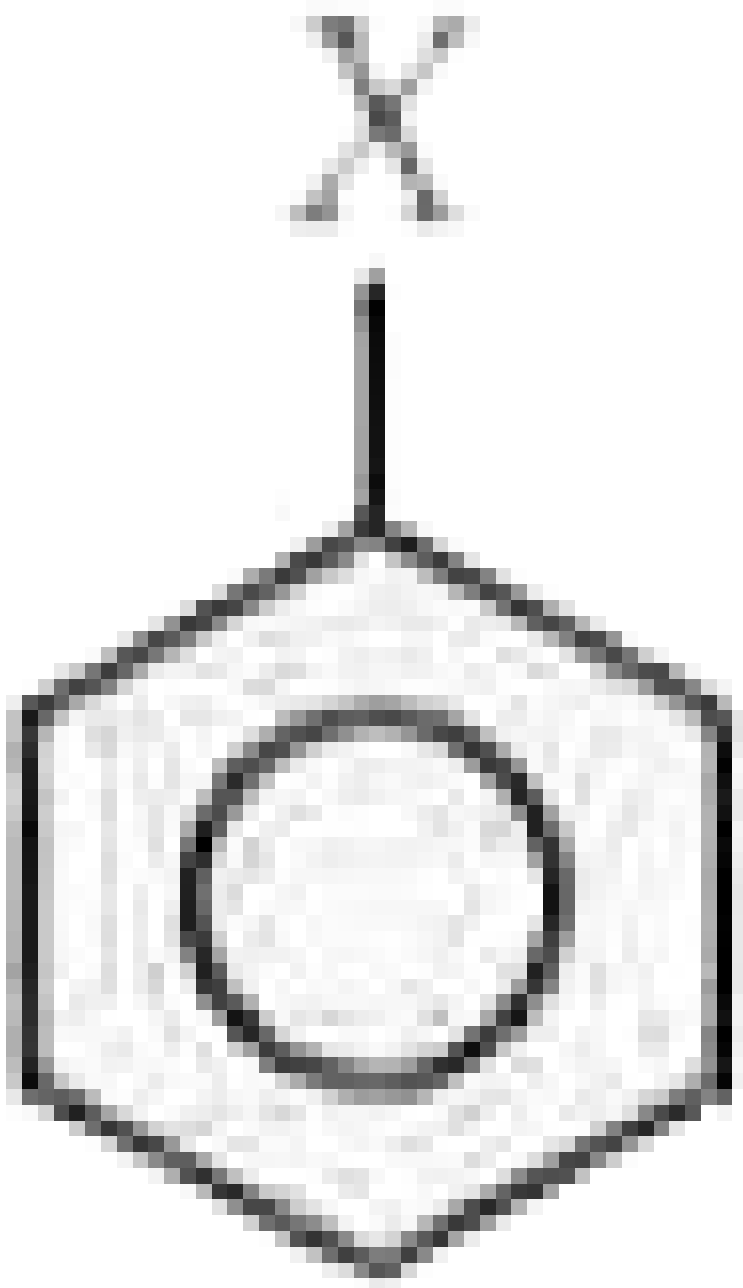
D. None of these

**Answer: A**



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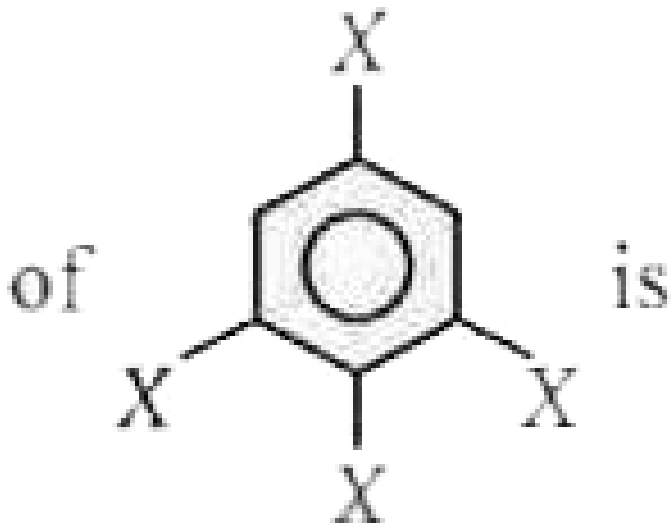
## 19. Dipole moment of





is 1.5 D. The

dipole moment of



is

- A. 1.5 D
- B. 2.25 D
- C. 1D
- D. 3 D

**Answer: A**

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A.  $-1, -1, +1$

B.  $-1, +1, -1$

C.  $+1, -1, -1$

D.  $+1, -1, +1$

**Answer: B**



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**22.** The state of hybridization of the central atom and the number of lone pairs over the central atom in  $POCl_3$  are

A.  $sp, 0$

B.  $sp^2, 0$

C.  $sp^3, 0$

D.  $dsp^2, 1$

**Answer: C**



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**23.** The paramagnetic behaviour of  $B_2$  is due to the presence of

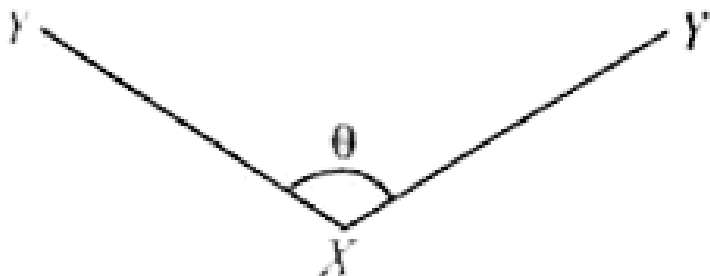
- A. 2 unpaired electrons in  $\pi_b MO$
- B. 2 unpaired electrons in  $\pi^* MO$
- C. 2 unpaired electrons in  $\sigma^* MO$
- D. 2 unpaired electron in  $\sigma_b MO$

**Answer: A**



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24. Which bond angle  $\theta$  would result in the maximum dipole moment for the triatomic molecule  $XY_2$  as shown in figure?



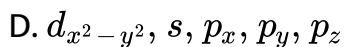
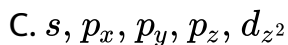
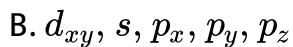
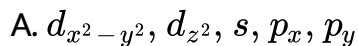
- A.  $90^\circ$
- B.  $120^\circ$
- C.  $150^\circ$
- D.  $180^\circ$

**Answer: A**



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25.  $AsF_5$  molecule is trigonal bipyramidal. The orbitals of As atom involved in hybridisation are

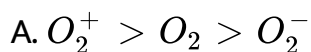


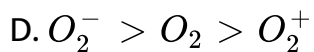
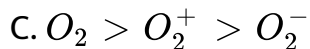
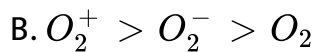
**Answer: C**



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26. The bond lengths in the species  $O_2, O_2^+$  and  $O_2^-$  are in the order



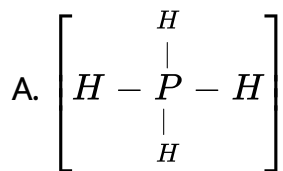


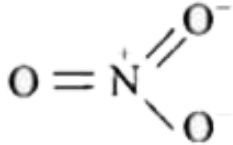
**Answer: D**



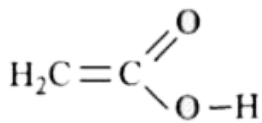
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27. Which one of the following formulae does not correctly represent the bonding capacities of the two atoms involved?





C.



D.

**Answer: D**



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**28.** The bond angle and % of d-character in  $\text{SF}_6$  are

A.  $120^\circ$ , 20 %

B.  $90^\circ$ , 33 %

C.  $109^\circ$ , 25 %

D.  $90^\circ$ , 25 %

**Answer: B**





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

A.  $NO_2^+$  and  $BaO_2$

B.  $KO_2$  and  $AlO_2^-$

C.  $KO_2$

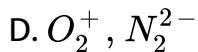
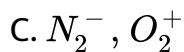
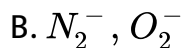
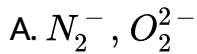
D.  $BaO_2$  only

**Answer: C**



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30. In which of the following pairs the two species have identical bond order?



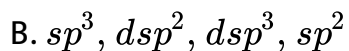
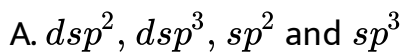
**Answer: C**



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## Wbjee Workout Category 2 Single Option Correct Type

1. The correct order of hybridization of the central atom in the following species  $NH_3$ ,  $[PtCl_4]^{2-}$ ,  $PCl_5$  and  $BCl_3$  is



C.  $dsp^2$ ,  $sp^2$ ,  $sp^3$ ,  $dsp^3$

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

**Answer: B**



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

A.  $NO_2$  group at p-position behaves in a different way from that at o-position

B. intramolecular hydrogen bonding exists in p-nitrophenol

C. there is intermolecular hydrogen bonding in p-nitrophenol

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

Answer: C



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3. Which one of the following is the correct order of interactions?

- A. Covalent hydrogen bonding van der Waal's dipole - dipole
- B. vander Waal's hydrogen bonding dipole - dipole covalent
- C. vander Waal's dipole -dipole hydrogen bonding covalent
- D. Dipole - dipole vander Waal's hydrogen bonding covalent.

**Answer: B**

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4. The relationship between the dissociation energy of  $N_2$  and  $N_2^+$  is

- A. dissociation energy of  $N_2 =$  dissociation energy of  $N_2^+$
- B. dissociation energy of  $N_2$  can either be lower or higher than the dissociation energy of  $N_2^+$
- C. dissociation energy of  $N_2 >$  dissociation energy of  $N_2^+$
- D. dissociation energy of  $N_2^+ >$  dissociation energy

**Answer: C**

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5. In  $PO_4^{3-}$  the formal charge on the each oxygen atom and the P-O bond order respectively are

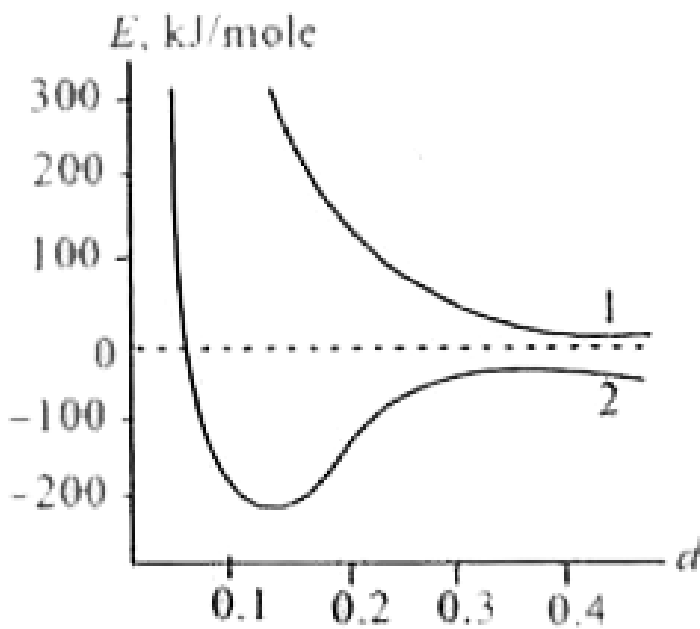
- A.  $-0.75, 0.6$
- B.  $-0.75, 1.0$
- C.  $-0.75, 1.25$
- D.  $-3.1, 1.25$

**Answer: C**



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6. Consider the given figure showing that possible levels of the energy of  $H_2^+$  ion depending on internuclear distance versus potential energy of the system.



It may be easily assumed that the ground state of the molecular hydrogen ion  $H_2^+$  corresponds to the lowest level which means that

A. curve 1 represents the most stable state of the system for

$H_2^+$  ion

B. curve 2 represents the most stable state of the system of

$H_2^+$  ion

C. data is insufficient

D. None of these

**Answer: B**



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7. Molecular shapes of  $SF_4$ ,  $CF_4$ ,  $XeF_4$  are

- A. the same with 2,0 and 1 lone pairs of electrons respectively
- B. the same with 1,1 and 1 lone pairs of electrons respectively
- C. different with 0,1 and 2 lone pairs of electrons respectively
- D. different with 1,0 and 2 lone pairs of electrons respectively.

**Answer: D**



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8.  $N_2$  and  $O_2$  are converted into monocations  $N_2^+$  and  $O_2^+$  respectively. Which of the following statements is wrong?

- A. In  $N_2^+$ , the N-N bond weakens
- B. In  $O_2^+$ , the O-O bond order increases
- C. In  $O_2^+$ , paramagnetism decreases
- D.  $N_2^+$  becomes diamagnetic

**Answer: D**



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9. According to molecular orbital theory, which of the following statement about the magnetic character and bond order is correct regarding  $O_2^+$ ?

- A. Paramagnetic and bond order  $< O_2$

B. Paramagnetic and bond order  $> O_2$

C. Diamagnetic and bond order  $< O_2$

D. Diamagnetic and bond order  $> O_2$

**Answer: B**



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10. The dipole moment of HBr is  $0.78 \times 10^{-18}$  esu cm and interatomic spacing is  $1.41 \text{ \AA}$ . The % ionic character of HBr is

A. 7.5

B. 11.7

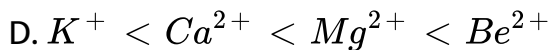
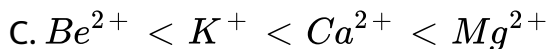
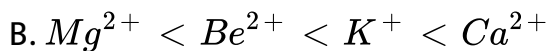
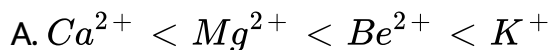
C. 15

D. 27

**Answer: B**

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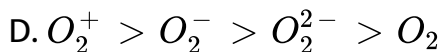
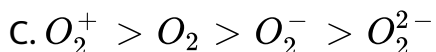
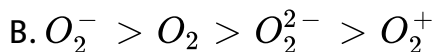
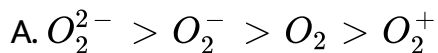
11. The charge /size ratio of cation determines its polarising power. Which one of the following sequences represents the increasing order of the polarising power of the cationic species,  $K^+$ ,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Be^{2+}$ ?



**Answer: D**

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12. The bond stability of  $O_2^+$ ,  $O_2$ ,  $O_2^-$ ,  $O_2^{2-}$  varies in the order



**Answer: C**



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13. In the following of  $\pi$  bond the atomic orbitals overlap in such a way that

- A. their axes remain parallel to each other and perpendicular to the internuclear axis
- B. their axes remain parallel to each other and parallel to the internuclear axis
- C. their axes remain perpendicular to each other and parallel to the internuclear axis
- D. their axes remain perpendicular to each other and perpendicular to the internuclear axis.

**Answer: A**



**View Text Solution**

**14.** Some of the properties of the two species,  $NO_3^-$  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 structure.

**Answer: A**



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

- A. low bond energy

B. absence of bond polarity

C. unsymmetrical electron distribution

D. presence of more number of electrons in bonding orbitals.

**Answer: B**



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### Wbjee Workout Category 3 One Or More Than One Option Correct Type

1. Among the compounds of  $BF_3$ ,  $NCl_3$ ,  $H_2S$ ,  $SF_4$  and  $BeCl_2$  identify the ones in which the central atoms has the same type of hybridisation.

A.  $BF_3$ ,  $NCl_3$  and  $H_2S$

B.  $H_2S$  and  $BeCl_2$

C.  $NCl_3$  and  $H_2S$

D.  $SF_4$  and  $BeCl_2$

**Answer: C**

 [View Text Solution](#)

2. Identify correct statement (s)

A. Ionic compounds has high melting and boiling points.

B.  $CO_2$  is less polar than  $N_2O$

C. Ortho nitrophenol is more volatile than paranitrophenol.

D. Ethyl alcohol is more soluble in water than dimethyl ether.

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

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### 3. Identify the incorrect statements

- A. All the five P-Cl bonds are identical in  $PCl_5$
- B.  $\angle H - P - H$  bonds angles in  $PH_3$  are smaller than  $\angle H - N - H$  bonds angles in  $NH_3$ .
- C.  $CO_2$  is non polar, while  $SO_2$  is polar.
- D. The dipole moment of  $NF_3$  is much higher than  $NH_3$

**Answer: A::D**



**View Text Solution**

### 4. Amongst the following, the correct statement(s) is /are

- A. NO has one unpaired electron in the antibonding molecular orbital
- B.  $NO^+$  is more stable than  $O_2^+$
- C.  $OF^+$  is more paramagnetic than  $Ne_2^+$
- D. In a  $\pi$  bond, the electron density is concentrated along the bond axis.

**Answer: A::B::C**



**View Text Solution**

5. Select the incorrect statement(s) about  $C_2$  molecule

- A. It exists in vapour phase
- B. It contains 12 electrons out of which 8 are present in bonding orbitals and 4 in antibonding orbitals.

C. It is paramagnetic in nature.

D. It contains double bonds of which both are  $\pi$ - bonds.

**Answer: C**

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6. Compared to meta and para isomers, o-nitrophenol has

A. lower solubility in water

B. higher melting point and boiling point

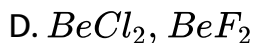
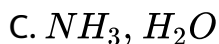
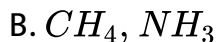
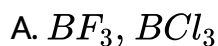
C. lower enthalpy of fusion

D. all of these

**Answer: A:C**

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7. Which of the following pairs contains same number of electrons but their shapes are different?



**Answer: B::C**



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8. According to Fajan's rules, ionic bonds are formed when

A. cations have low positive charge, large size and anions have large size

B. cations have low positive charge and small size

C. cations have high positive charge and large size

D. cations have low positive charge, large size and anions have small size

**Answer: D**



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9. Mark out the incorrect match of shape.

A.  $XeOF_2$  - Trigonal planar

B.  $ICl_4^-$  - Square planar

C.  $[SbF_5]^{2-}$  - Square pyramidal

D.  $NH_2^-$  - Pyramidal

**Answer: A::D**

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10. When  $O_2$  is adsorbed on a metallic surface, electron transfer occurs from the metal to  $O_2$ . The true statement(s) regarding this adsorption is (are)

- A.  $O_2$  is physisorbed
- B. heat is released
- C. occupancy of  $\pi^* \text{wp}$  of  $O_2$  is increased
- D. bond length of  $O_2$  is increased.

**Answer: B::C::D**

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11. According to molecular orbital theory, which of the following statement about the magnetic character and bond order is correct regarding  $O_2^+$ ?

- A.  $C_2^{2-}$  is expected to be diamagnetic
- B.  $O_2^{2+}$  is expected to have a longer bond length than  $O_2$
- C.  $N_2^+$  and  $N_2^-$  have the same bond order
- D.  $He_2^+$  has the same energy as two isolated He atoms.

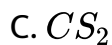
**Answer: A::C**



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12. The linear structure is assumed by

- A.  $CO_3^{2-}$

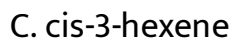
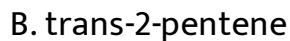


**Answer: B::C::D**



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**13.** The molecules that will have dipole moment are

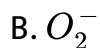


**Answer: B::C**



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14. Which of the following have identical bond order?



**Answer: A::C**

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15. The pair(s) of reagents that yield paramagnetic species is/are



B. K and excess of  $O_2$

C. Cu and dilute  $HNO_3$

D.  $O_2$  and 2-ethylantraquinol.

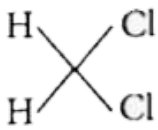
**Answer: A::B::C**



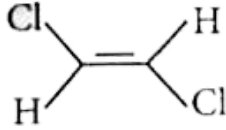
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## Wb Jee Previous Years Questions Category 1 Single Option Correct Type

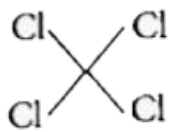
1. The compound that will have a permanent dipole moment among the following is



I



II



III



IV

A. I

B. II

C. III

D. IV

**Answer:**



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2. In case of heteronuclear diatomics of the type AB, where A is more electronegative than B, bonding molecular orbital resembles

the character of A more that of B.

The statement

A. is false

B. is true

C. cannot be evaluated since data is not sufficient

D. is true only for certain systems.

**Answer:**



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**3.** The number of lone pairs of electrons on the central atoms of  $H_2O$ ,  $SnCl_2$ ,  $PCl_3$  and  $XeF_2$  respectively are

A. 2,1,1,3

B. 2,2,1,3

C. 3,1,1,2

D. 2,1,2,3

**Answer:**



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4. The correct order of O-O bond length in  $O_2$ ,  $H_2O_2$  and  $O_3$  is

A.  $O_2 > O_3 > H_2O$

B.  $H_2O_2 > O_3 > O_2$

C.  $O_3 > O_2 > H_2O_2$

D.  $O_3 > H_2O_2 > O_2$

**Answer:**



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5. The shape of  $XeF_5^-$  will be

- A. square pyramid
- B. trigonal bipyramidal
- C. planar
- D. pentagonal bipyramid

**Answer:**



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6. The ground state magnetic property of  $B_2$  and  $C_2$  molecules will be

- A.  $B_2$  paramagnetic and  $C_2$  diamagnetic
- B.  $B_2$  diamagnetic and  $C_2$  paramagnetic

C. both are diamagnetic

D. both are paramagnetic.

**Answer:**



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7. Which of the following has the strongest H-bond?

A. O-H...S

B. S-H-O

C. F-H-F

D. F-H-O

**Answer:**



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8. The melting point (i)  $BeCl_2$  (ii)  $CaCl_2$  and (iii)  $HgCl_2$  follows the order

A. (i)lt(ii)lt(iii)

B. (iii)lt(i)lt(ii)

C. (i)lt(iii)lt(ii)

D. (ii)lt(i)lt(iii)

**Answer:**



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9. The H-N-H angle in ammonia is  $107.6^\circ$ , while the H-P angle in phosphine is  $93.5^\circ$ . Relative to phosphine, the p-character of the lone pair on ammonia is expected to be



- A. less
- B. more
- C. same
- D. cannot be predicted

**Answer:**



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## Wb Jee Previous Years Questions Category 2 One Or More Than One Option Correct Type

1. In basic medium the amount of  $Ni^{2+}$  in a solution can be estimated with the dimethylglyoxime reagent. The correct statemnt(s) about the reaction an the product is (are)

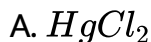
- A. in ammoniacal solution  $Ni^{2+}$  salts give cherry red precipitate of nickel (II) dimethylglyoximate
- B. two dimethylglyoximate units are bound to one  $Ni^{2+}$
- C. in the complex two dimethylglyoximate units are hydrogen bonded to each other
- D. each dimethylglyoximate unit forms a six membered chelate ring with  $Ni^{2+}$

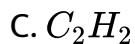
**Answer:**



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2. Of the following molecules, which have shape similar to  $CO_2$ ?





**Answer:**

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**3.** Which statements are correct for the peroxide ion?

A. It has five completely filled anti-bonding molecular orbitals.

B. It is diamagnetic

C. it has bond order one

D. it is isoelectronic with neon

**Answer:**

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