



## CHEMISTRY

### FOR IIT JEE ASPIRANTS OF CLASS 11 FOR CHEMISTRY

### CHEMICAL BONDING AND MOLECULAR STRUCTURE

#### Example

1. Lattice energy in sodium chloride is  $y$  kJ. Assuming the same interionic distance, what will be the lattice energy of magnesium sulphide ?

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2. Both Na and H occur in group 1 of the periodic table ,yet melting point of HCl is  $-114^{\circ}\text{C}$ . Why ?

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3. Why is HCl predominantly covalent in the gaseous state but is ionic in aqueous solution ?

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4. Sigma bond is stronger than the pi bond. Explain.

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5. A diatomic molecule has

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6. Write the increasing order of bond energies of  $H_2$ ,  $F_2$  and HF molecules.

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7. Dissociation enthalpies of methane, ethane and ethylene are respectively 400, 680 and  $540 \text{ kcal mol}^{-1}$ . Calculate  $\sigma \text{C} - \text{H}$ ,  $\sigma \text{C} - \text{C}$  and  $\pi \text{C} - \text{C}$  bond energies.

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8. The As-Cl bond distance in  $\text{AsCl}_3$  is  $2.20 \text{ \AA}$ . Estimate the SBCR (single bond covalent radius) of As. (Assume EN of both to be same and radius of Cl =  $0.99 \text{ \AA}$ ).

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9. What is the nitrogen - oxygen bond order in  $\text{NO}_3^-$  ion ?

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10. Write the order of oxygen - oxygen bond energies of  $O_2$ ,  $O_3$  and  $H_2O_2$  molecules.

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11. The dipole moments of  $SO_2$  and  $CO_2$  are  $5.37 \times 10^{-30}$  C.m and zero respectively. What can be said about the shapes of the two molecules?

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12. Dipole moment of  $H_2S$  is 0.95 D, Find the S- H bond moment. Bond angle in  $H_2S$  is 96 degree and  $\cos 48$  degree is 0.66.

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13. The dipole moment of HBr is  $2.60 \times 10^{-30}$  C.m and the interatomic spacing is  $1.41 \text{ \AA}$ . What is the percentage ionic character of HBr ?

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14. Can  $P_x$  overlap a  $P_y$  orbital ? Why or why not ?

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15. 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  $2s$ .

A.  $1s$  and  $1s$

B.  $1s$  and  $2p_x$

C.  $2p_y$  and  $2p_y$

D.  $1s$  and  $2s$

**Answer:**

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16. What are the type of bonds present in hydrogen cyanide molecule ?

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17. Discuss the hybridisation of carbon atoms in allene ( $C_3H_4$ ) and show the  $\pi$ -orbital overlap.

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

(a)  $PbCl_4$ , (b)  $SbF_6^-$  and (c)  $PCl_3$

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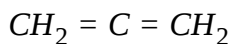
19. Write the decreasing order of

(a) carbon - carbon and

(b) carbon - hydrogen bond lengths in ethane, ethylene and acetylene molecules.

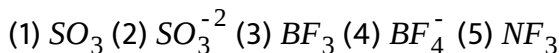
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20. Calculate the ratio between hybrid orbitals and pure orbitals in Allene.



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21. Deduce the shape of



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22.  $PCl_3$  has the shape of a trigonal pyramid, whereas  $IF_5$  has the shape of a square pyramid. Account for this difference.



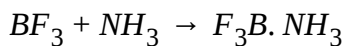
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23. The type of bond s present in ammonium chloride is (are) :



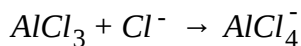
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24. Is there any change in hybridisation of the *B* and *N* atom as a result of the following reaction?



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25. What is the change in hybridization (if any) of the Al atom in the following reaction.



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26. Does peroxide ion,  $O_2^{2-}$ , has a longer or shorter bond length than  $O_2$ ? Explain.

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27. Which of the following molecules has the higher bond order ?

(1) BN (2) CO (3) NO (4)  $Ne_2$  (5)  $F_2$

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28. The bond order in  $N_2^-$  is

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29. Which one in each of the following pairs is expected to exhibit hydrogen bonding together ?

(a)  $CH_3 - CH_2 - OH$  and  $CH_3 - O - CH_3$

(b)  $CH_3NH_2$  and  $CH_3SH$

(c)  $CH_3OCH_3$  and  $(CH_3)_3N$

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30. Which is expected to have highest melting point :

$PH_3$ ,  $NH_3$ ,  $(CH_3)_3N$  -  $N$ ? Explain.

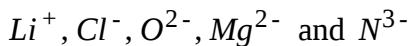
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## Check Your Grasp

1. The pair of elements which on combination is most likely to form an ionic compound is:

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

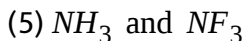
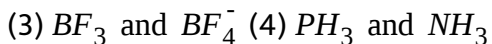
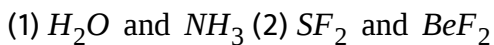


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3. Why  $CaCl_2$  and  $NaCl$  are bad conductor of electricity in the solid state.

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4. Which one of each of the following pairs is expected have the larger bond angle ?



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5. Write down the conjugate base of the following: (i)  $NH_4^+$ , (ii)  $HCOOH$   
(iii)  $H_3O^+$   $H_2NCONH_3^+$

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6. The molecule electronic configuration of oxygen molecule is.

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7. Write molecule electronic configuration of  $H_2$ ,  $H_2^+$ ,  $H_2^-$  and calculate the bond order in each case.

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## Evaluate Your Self 1

1. The compound containing coordinate bond is

A.  $SO_3$

B.  $O_3$

C.  $H_2SO_4$

D. All of these

**Answer: D**

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**2. Benzoic acid contains**

A.  $15\sigma$  and  $2\pi$  - bond

B.  $15\sigma$  and  $4\pi$ - bonds

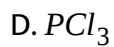
C.  $14\sigma$  and  $4\pi$  - bonds

D.  $13\sigma$  and  $4\pi$  - bonds

**Answer: B**

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3. Which of the following is an electrovalent linkage ?



**Answer: A**



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4. How many bonds are there in



A.  $14\sigma, 8\pi$

B.  $18\sigma, 8\pi$

C.  $19\sigma, 4\pi$

D.  $14\sigma, 2\pi$

**Answer: C**



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5. Which statement is not correct ?

- A. A sigma bond is weaker than a  $\pi$ -bond.
- B. A sigma bond is stroger than a  $\pi$ -bond.
- C. A double bond is stronger than a sigma bond.
- D. A double bond is shorter than a single bond.

**Answer: A**

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**6. Most covalent halifde of aluminium is**

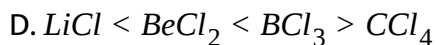
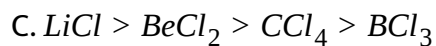
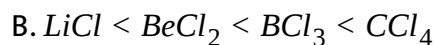
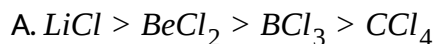
- A.  $AlCl_3$
- B.  $AlI_3$
- C.  $AlBr_3$
- D.  $AlF_3$

**Answer: B**

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7. Among  $\text{LiCl}$ ,  $\text{BeCl}_2$ ,  $\text{BCl}_3$  and  $\text{CCl}_4$ , the covalent bond character follows the order-



**Answer: B**

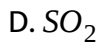
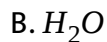


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## Evaluate Your Self 2

1. Which of the following has zero dipole moment ?

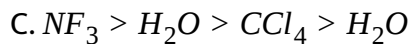
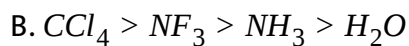
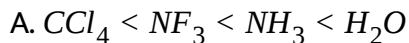




**Answer: C**

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2. Increasing order of dipole moment is  $H_2O$ ,  $NH_3$ ,  $NF_3$  and  $CCl_4$  is



D. all the four have equal dipole moments

**Answer: A**

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3. Non- zero dipole moment is shown by

A.  $CCl_4$

B.  $CO_2$

C.  $H_2O$

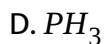
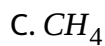
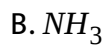


D.

**Answer: C**

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4. Which of the following has zero dipole moment ?

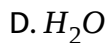
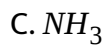


**Answer: C**



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5. Which of the following molecules has zero dipole moment ?

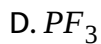
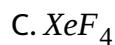


**Answer: A**



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**6. Which of the following is polar ?**



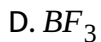
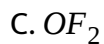
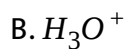
**Answer: D**



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### Evaluate Your Self 3

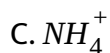
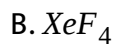
**1. Which of the following does not have  $sp^3$  hybridisation ?**



**Answer: D**

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2. The central atom of which of the following compounds has four bond pairs and two lone pair

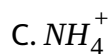
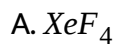


**Answer: B**



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3. Which of following has square planar shape ?



Answer: A



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



C.  $H_2O$

D.  $IF_3$

**Answer: A**

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5. Shape and hybridisation of  $SO_2$  are

A. V shape,  $sp$

B. triangular planar,  $sp^2$

C. V shape,  $sp^2$

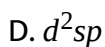
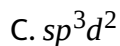
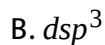
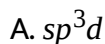
D. tetrahedral,  $sp^2$

**Answer: C**

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6. What type of orbital hybridisation is considered on P in  $PCl_5$ ?

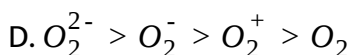
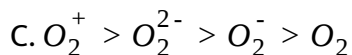
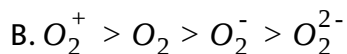
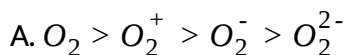


**Answer: A**



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7. The bond length in  $O_2^+$ ,  $O_2$ ,  $O_2^-$  and  $O_2^{2-}$  follows the order :



**Answer: B**

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**8. Which of the following is not paramagnetic ?**



**Answer: A**

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**9. Which of the following is not paramagnetic ?**





**Answer: A**



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**10.** How many bonds  $B_2$  have ?

A. 0

B. 1

C. 2

D. 3

**Answer: B**



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11. Which one of the following molecules is paramagnetic ?



**Answer: B**



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12. The bond order of CO molecule is

A. 2

B. 2.5

C. 3

D. 3.5

**Answer: C**



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## Cuq Interoduction Valence And Formula Writing

1. Chemical bond formation takes place when

- A. Energy is absorbed
- B. Forces of attraction overcome forces of repulsion
- C. Forces of repulsion overcome forces of attraction
- D. Forces of attraction are eqaul to forces of repulsion.

**Answer: D**



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2. During bond formation, potential energy of the system

- A. Increases
- B. Decreases
- C. Remains the same
- D. Can't be predicted

**Answer: B**



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3. Two atoms X and Y have 5 and 7 valence electrons. The formula of the compound formed by their combination is

- A.  $XY$
- B.  $XY_2$
- C.  $XY_3$
- D.  $X_3Y$

**Answer: C**



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4. Electronic configuration of an element A is  $1s^2 2s^2 2p^6 3s^1$  and electronic configuration of another element B is  $1s^2 2s^2 2p^6 3s^2 3p^4$ . The possible compound that can be formed between A and B is

A.  $AB$

B.  $AB_2$

C.  $A_2B$

D.  $A_2B_2$

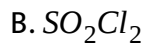
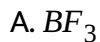
**Answer: C**



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Cuq Kossel Lewis Thory

1. Covalence for central atom is maximum in

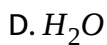
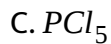


**Answer: B**



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2. The covalence of central atom is maximum in



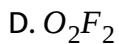
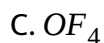
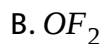


**Answer: C**



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**3.** A molecule which cannot exist theoretically is :



**Answer: C**



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**4.** The mol.wt of an Oxide of Hydrogen is 34. Therefore the number of covalent bonds in its molecule are

A. 4

B. 5

C. 2

D. 3

**Answer: D**

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5. Which of the following has an unpaired electron in it

A.  $NO_2$

B.  $CO_2$

C.  $NO_2^-$

D.  $CN^-$

**Answer: A**

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6. What is the expected valency of sulphur ( $Z=16$ )?

A. 4

B. 6

C. 8

D. 7

**Answer: B**



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7. The electrovalency of the element is equal to the

A. Sodium hydride

B. Calcium carbide

C. Magnesium oxide

D. Aluminium fluoride

**Answer: D**

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**8. In Covalence**

- A. Transfer of electrons takes place
- B. Sharing of electron takes place
- C. Sharing of electron by one atom only
- D. None of these take place.

**Answer: B**

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**9. Variable valency is generally shown by-**

- A. Alkali metals
- B. Transition metals
- C. Alkaline earth metals
- D. Inert gases

**Answer: B**

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

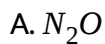
- A. Unequally shared between them
- B. Transferred fully from one atom to the other atom
- C. With identical spins
- D. Equally shared between them

**Answer: D**



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11. Only triple bond is present in



Answer: D



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12. Which of the following is not property of covalent compounds

A. They have low melting points

B. They are not electrical conductors

C. They exhibit space isomerism

D. They undergo chemical reaction quickly

**Answer: D**



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**13.** The number of electron pairs present in the valence shell of central atom in  $SF_6$  molecule are

A. 4

B. 6

C. 8

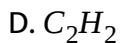
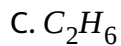
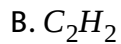
D. 7

**Answer: B**



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14. Which of the following has no multiple bonds



Answer: C



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15. In  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ , the number of covalent bonds is

A. 3

B. 6

C. 9

D. 18



Answer: D

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16. An element  $X$  forms compounds of the formula  $XCl_3$ ,  $X_2O_5$  &  $Ca_3X_2$  but does not form  $XCl_5$ , which of the following is the elements ( $X$ ) :-

A.  $Al$

B.  $P$

C.  $B$

D.  $N$

Answer: D

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1. Which of the following metals are obtained by electrolysis of their chlorides in molten state?

A. Cryolite

B. Sylvine

C. Urea

D. Rock salt

**Answer: C**



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2. Ionic compounds do not exhibit space isomerism because

A. They are solids

B. The ionic bond is non-directional

C. They are electrolytes

D. they contain ions

**Answer: B**

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3. KCl easily dissolves in water because

- A. It is a salt of potassium
- B. It reacts with water
- C. It is an electrovalent compound
- D. Its ions are casily solvated

**Answer: D**

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4. In a 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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5. The electronegativities of F, *Cl*, *Br*, and *I* are 4.0, 3.0, 2.8, and 2.5, respectively. The hydrogen halide with a high percentage of ionic character is

- A. HF
- B. HCl
- C. HBr
- D. HI

**Answer: A**



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**6.** The stability of ionic crystal depends principally on

- A. Electronegativity
- B. Lattice energy
- C. Sublimation energy
- D. Electron affinity

**Answer: B**



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**7.** Which of the following is an ionic compound ?

- A. Sodium hydride

B. Carborundum

C. Potassium oxide

D. Calcium carbide

**Answer: B**



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**8. Fused ionic compounds**

A. Are insulators

B. Are used as semi-conductors

C. Conduct electricity

D. Do not conduct electricity

**Answer: C**



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9. Molten sodium chloride conducts electricity due to the presence of:

- A. Free electrons
- B. Free ions
- C. Free molecules
- D. Atoms of sodium and chlorine

**Answer: B**



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10. The ionic reactions are usually very fast because :

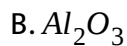
- A. Fast
- B. Slow
- C. Very slow
- D. Medium

**Answer: A**



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**11.** Which of the following are not ionic compounds?



**Answer: D**



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**12.** When  $NaCl$  is dissolved in water the sodium ion becomes

A. Oxidised



B. Reduced

C. Hydrolysed

D. Hydrated

**Answer: D**

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**13.** A bond is said to be 50% ionic, when the difference in the electronegativity value of the participating atoms is \_\_\_\_\_.

A. More than 1.7

B. Equal to 1.7

C. Less than 1.7

D. Much greater than 1.7

**Answer: B**

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14. CaO and NaCl have the same crystal structure and approximately the same ionic radii. If  $U$  is the lattice energy of NaCl, the approximate lattice energy of CaO is

A.  $U/2$

B.  $U$

C.  $4U$

D.  $2U$

**Answer: C**



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15. Indicate the nature of bonding in  $CCl_4$  and  $CaH_2$

A. Covalent in  $CCl_4$  and electrovalent in  $CaH_2$

B. Electrovalent in both  $CCl_4$  and  $CaH_2$

C. Covalent in both  $CCl_4$  and  $CaH_2$

D. Electrovalent in  $CCl_4$  and covalent in  $CaH_2$

**Answer: A**

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## Cuq Fajan S Rules

1. Highest covalent character is found in

A.  $CaF_2$

B.  $CaCl_2$

C.  $CaBr_2$

D.  $CaI_2$

**Answer: D**

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2. Which of the following has the highest melting point?

A. NaCl

B.  $MgCl_2$

C.  $AlCl_3$

D.  $LiCl$

**Answer: A**



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3. Arrange LiF, NaF, KF, RbF and CsF in order of increasing lattice energy.

A. RbF, CsF

B. NaF, NaF

C. CsF, NaF

D. CsF, CsF

**Answer: C**

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## Cuq Bond Parameters

1. In which of the following bond angle is maximum

A.  $CH_4$

B.  $H_2O$

C.  $NH_3$

D.  $CO_2$

**Answer: D**

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2. Among the following highest bond energy is for

A. H - H

B. C - H

C. C - C

D. F - F

**Answer: A**

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3. The correct order of O - O bond length in  $O_2H_2O_2$  and  $O_3$  is

A.  $O_2 > O_3 > H_2O_2$

B.  $O_3 > H_2O_2 > O_2$

C.  $H_2O_2 > O_3 > O_2$

D.  $O_2 > H_2O_2 > O_3$

**Answer: C**



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## Cuq Polarity And Dipole Moment

1. Which of the following order of dipole moment is correct for these compounds ?

A.  $ID = 3.3356C. m$

B.  $ID = 3.3356 \times 10^{-30}C. m$

C.  $ICm = 3.3356D$

D.  $ICm = 3.3356 \times 10^{-30}D$

**Answer: B**



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2. The unit of dipole moment is

- A. Einstein
- B. Dalton
- C. Debye
- D. Curie

**Answer: C**



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3. The unit of 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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4. A pure covalent bond is formed between :

A. H-Cl

B. Cl - Cl

C. C - Cl

D. Na - Cl

**Answer: B**

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5. Which of the following is not a polar molecule ?

A. HCl

B. HF

C.  $H_2S$

D.  $NH_3$

**Answer: B**

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6. Which of the following pair of molecules will have permanent dipole moment?

A.  $NO_2$  and  $CO_2$

B.  $NO_2$  and  $O_3$

C.  $SiF_4$  and  $CO_2$

D.  $SiF_4$  and  $NO_2$

**Answer: B**

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## Cuq Resonance And Formal Charge

1. Resonance structures of a molecule do not have:

- A. identical arrangement fo atoms
- B. nearly same energy content
- C. the same number of paired electrons
- D. identical bonding

**Answer: D**

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2. In which of the following compounds resonance does not occurs

(a)  $H_2O$  (b)  $SiO_2$  (c)  $SO_2$  (d)  $CO_2$

- A. a and d

B. a and b

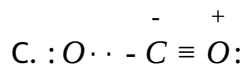
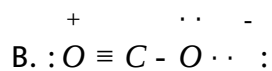
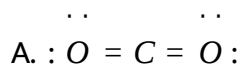
C. c and d

D. b, c and d

**Answer: B**

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3. Which of the following Lewis dot structure of  $CO_2$  is incorrect ?

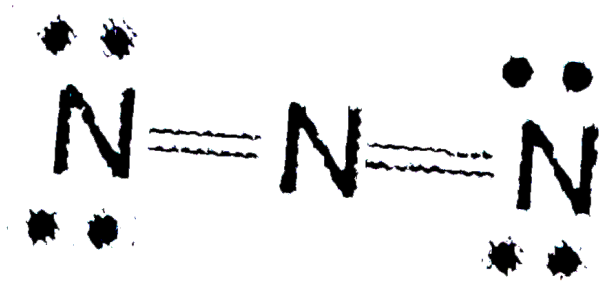


D. All

**Answer: C**

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4. In the following electron dot structure, calculate the formal charge from left to right nitrogen atom respectively:



A. -1, -1, +1

B. -1, +1, -1

C. +1, -1, -1

D. +1, -1, +1

**Answer: B**

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1. Which overlap is involved in HCl molecule ?

A. s-s

B. p-p

C. s-d

D. s-p

**Answer: D**



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2. The number of sigma bonds formed in ethane by the overlapping of  $sp^3 - sp^3$  orbitals

A.  $sp^2 - s$

B.  $sp^3 - p$

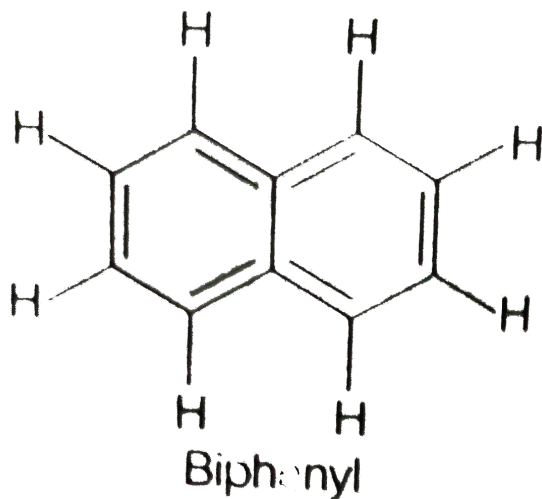
C. s - s

D. p-p co axial

Answer: C

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3. Number of  $\pi$  bonds and  $\sigma$  bonds in the following structure is



- A. 6,19
- B. 4,20
- C. 5,19
- D. 5,20

Answer: C



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4. The bond energy is highest in the molecule



Answer: A

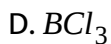


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## Cuq Vsepr Theory

1. The number of electrons in the valence shell of the central atom of a molecule is 8. the molecule is





**Answer: B**

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2. Shape of a molecule having four bond pairs and two lone pairs of electrons will be

A. square planar

B. Tetrahedral

C. Linear

D. octahedral

**Answer: A**



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3. Shape of  $PCl_5$  molecule is

- A. Octahedron
- B. Square pyramid
- C. Trigonal bipyramid
- D. Pyramidal

Answer: C



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

- A.  $CO_2$
- B.  $C_2H_2$

C.  $\text{HCN}$

D.  $\text{H}_2\text{O}$

**Answer: D**

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5. In carbon tetrachloride, four valence of carbon are directed to four corners of

A. Cube

B. Hexagon

C. Prism

D. Tetrahedron

**Answer: D**

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6. The ratio of number of lone pairs on central atom in ammonia, Water and  $XeF_2$  are

A. 3:2:1

B. 2:1:3

C. 1:2:3

D. 2:3:1

**Answer: C**



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7.  $CO_2$  has same geometry as .

A. A and C

B. B and D

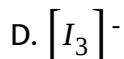
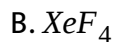
C. A and D

D. C and D

**Answer: C**

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8. Which species has the maximum number of lone pair of electrons on the central atom ? .



**Answer: D**

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1. In which of the following the hybrid orbitals of the central atom have the same s-character

- A. 0.25
- B. 0.75
- C. 0.4
- D. 0.1666

**Answer: D**



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2. Hybrid orbital with least s- character is

- A.  $sp^3d$
- B.  $sp^2$
- C.  $sp^3$

D. sp

**Answer: A**

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3. Bond angle between two hybrid orbitals is  $105^\circ$  Percentage of s-orbital character of hybrid orbital is between

A. 0.5

B. 0.3333

C. 0.166

D. 0.25

**Answer: D**

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4.  $sp^3$  hybrid orbitals have equal s and p character.

A.  $sp$

B.  $sp^3$

C.  $sp^2$

D.  $sp^3d$

**Answer: A**



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5. Hybrid orbital with maximum p-character is

A.  $sp^3d$

B.  $sp^3$

C.  $sp$

D.  $sp^3d^2$



**Answer: B**

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**6. Hybridisation involves**

- A. Addition of an electron pair
- B. Combination and redistribution of atomic orbitals
- C. Removal of an electron pair
- D. Separation of orbitals

**Answer: B**

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**7. One hybridization of one  $s$  and one  $p$  orbital we get**

- A. Two mutually perpendicular orbitals

- B. Two orbital at  $180^\circ$
- C. Four orbitals directed tetrahedrally
- D. Three orbitals in a plane

**Answer: B**

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8. As the s-character of hybridisation orbital increases, the bond angle

- A. Increases
- B. Decreases
- C. Does not change
- D. Becomes zero

**Answer: A**

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9. For which of the following hybridisation the bond angle is maximum

A.  $sp^2$

B.  $sp$

C.  $sp^3$

D.  $dsp^2$

**Answer: B**



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10.  $sp^3d$  hybridisation result in

A. A square planar molecule

B. An octahedral molecule

C. A trigonal bipyramid molecule

D. A tetrahedron molecule

**Answer: C**

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

A.  $sp^3$

B.  $sp^2$

C.  $sp$

D.  $sp^3d^2$

**Answer: A**

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**Cuq Dative Bond**

**1.** A covalent bond is formed between

- A. Transfer of electron
- B. Sharing of electrons
- C. donation of electrons
- D. None of these process.

**Answer: C**

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2. Give examples of two compounds in which there exists electrovalency, covalency and coordinate covalency.

- A. Electrons are equally shared by the atoms
- B. Electrons of one atom are shared between the two atoms
- C. Hydrogen bond is formed
- D. None of the above

**Answer: B**



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3. Which one of the following statement is true for Ammonium ion?

- A. All bonds are ionic
- B. All bonds are coordinate covalent
- C. H atoms are situated at the comers of a square
- D. H atoms are situated at the corners of a tetrahedron

**Answer: D**



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## Cuq Molecular Orbital Theory

1. Anti-bonding molecule orbital is formed by

- A. Addition of wave functions of atomic orbitals

- B. Substraction of wave functions of atomic orbitals
- C. Multiplication of wave functions of atomic orbitals
- D. Fiunding the arthemetic mean

**Answer: B**

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## 2. Molecular orbital theory

- A. Monocentric
- B. Bicentric
- C. Polycentric
- D. None

**Answer: C**

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3. A bonding molecule orbital is produced by

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

**Answer: B**



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4. Oxygen molecule is

- A. diamagnetic with no unpaired electrons
- B. diamagnetic with two unpaired electrons
- C. paramagnetic with two unpaired electrons
- D. paramagnetic with no unpaired electrons



**Answer: C**

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5. The paramagnetic property of the oxygen molecule is due to the presence of unpaired electrons present in .

A. M.O.T

B. Resonance theory

C. V.B.T

D. VSEPR theory

**Answer: A**

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6. Which of the following orbitals of a diatomic molecule AB will not have positive overlap ?

A.  $2s(A)$  and  $2s(B)$

B.  $2s(A)$  and  $2P_z(B)$

C.  $2P_z(A)$  and  $2P_z(B)$

D.  $2P_x(A)$  and  $2P_z(B)$

**Answer: D**

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7. Which of the following is miscible with water

A.  $CS_2$

B.  $C_2H_5OH$

C.  $CCl_4$

D.  $CHCl_3$

**Answer: B**

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## Cuq Hydrogen Bonding

1. The coupling between base units of DNA is through

- A. Hydrogen bonding
- B. Electrostatic bonding
- C. Covalent bonding
- D. Vander Waal's forces

**Answer: A**

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2. Which of the following exists as a liquid at room temperature due to the formation of associated molecules

- A. Benzene

B. Water

C. Bromine

D. Carbon disulphide

**Answer: B**

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

A. Electrovalent and Covalent

B. Electrovalent and co-ordinate covalent

C. Electrovalent, covalent, co-ordinate covalent and hydrogen bond

D. Covalent and co-ordinate covalent

**Answer: C**

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4. Ethyl alcohol is highly miscible with water because it forms the following bond with water

- A. Covalent bond
- B. Ionic bond
- C. Hydrogen bond
- D. Dative bond

**Answer: C**

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5. Water is a liquid, while  $H_2S$  is a gas at ordinary temperature. Explain.

- A. Water has higher molecular weight
- B. Hydrogen sulphide is a weak acid
- C. electronegativity of S > O

D. Water molecules associate through hydrogen bonding

**Answer: D**

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

A. Dipole - dipole interaction

B. Vanderwaals forces

C. Hydrogen bond formation

D. Covalent attraction

**Answer: C**

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7. Most volatile compound is

- A. HF
- B. HBr
- C. HCl
- D. HI

**Answer: C**



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8. Which of the following substances is covalently bonded ?

- A. Silica
- B. Diamond
- C. Glucose
- D. SiC

**Answer: C**



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**9.** Among the following the weakest force of interaction is

A. Dative bond

B. Metallic bond

C. Hydrogen bond

D. Vanderwaals forces

**Answer: D**



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**Exercise I C W Valence And Formula Writing**



1. An atom has 2K, 8 L, 11 M, 2N electrons, the total number of s-electrons will be

A. A B

B.  $A_2B_3$

C.  $A_3B_2$

D.  $AB_2$

**Answer: B**

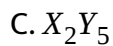
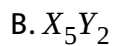
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2. Two elements X and Y have following electronic configurations.

X:  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

Y:  $1s^2 2s^2 2p^6 3s^2 3p^5$

The expected compound formed by combination of X and Y will be expressed as



**Answer: A**

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3. The atomic numbers of four elements, A,B,C and D are 6,8,10 and 12 respectively. The two elements which can react to form ionic bonds (or ionic compounds) are:

A. Coordinate

B. Covalent

C. Ionic

D. Metallic

**Answer: C**



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4. An atom with atomic number 20 is most likely to combine chemically with the atom whose atomic number is

A. 11

B. 16

C. 18

D. 10

**Answer: B**



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5. If stability were attained with 6 electrons rather than with 8 electrons, what would be the formula of the stable fluoride ion

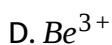


**Answer: B**

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## Exercise I C W Kossel Lewis Theory And Octet Rule

1. Duplet configuration is not found in



**Answer: D**



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2. Which of the following ions has a pseudo-inert-gas configuration?



**Answer: B**



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3. The number of valency electrons and the valency with respect to hydrogen are equal for

- A. Sulphur
- B. Silicon
- C. Phosphorus
- D. Chlorine

**Answer: B**

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4. The element having highest velency with respect to oxygen is

- A. Sodium
- B. Aluminium
- C. Chlorine
- D. Sulphur

**Answer: C**

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5. Metal 'M' forms a peroxide of the type  $MO_2$ . Valency of the metal with respect to oxygen

A. 0

B. 1

C. 2

D. 4

**Answer: C**



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6. Electrovalency of non-metal atom is not equal to that of the metal atom in

A. Sodium bromide

B. Magnesium oxide

C. Aluminium nitride

D. Potassium sulphide

**Answer: D**



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7. the maximum valency of an element with atomic number 7 is

A. 2

B. 5

C. 4

D. 3

**Answer: C**



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8. Valence of sulphur in sulphuric acid is

A. 2

B. 4

C. 6

D. 8

**Answer: C**



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9. The electrons generally involved in bonding

A. Are those that lie closest to the nucleus

B. Are those for which the ionization energies are small

C. Belongs to inner shells

D. Are free electrons

**Answer: B**

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**10.** Most energetic species among the following is

A.  $H_2$

B.  $Ne$

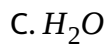
C.  $F$

D.  $F_2$

**Answer: C**

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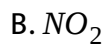
**11.** Which of the following covalent molecule is an exception to octet rule ?



**Answer: A**

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**12.** Odd electron bond is present in



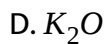
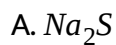
D. All

**Answer: D**

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## Exercise I C W Covalent Bond

1. Covalent bond is present in



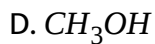
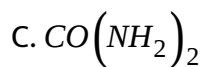
**Answer: B**



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2. Molecule having maximum number of covalent bonds is





**Answer: C**

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3. Number of bonded electrons in ethane molecule are

A. 7

B. 12

C. 10

D. 14

**Answer: D**

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4. Number of lone pairs of electrons in 9 gms. Of water are [N= Avogadro Number]

A.  $2N$

B.  $N/2$

C.  $N$

D.  $N/4$

**Answer: C**



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5. The number of electron pairs involved in the formation of hydrogen cyanide molecule are

A. 2

B. 8

C. 3

D. 4

**Answer: D**

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### Exercise I C W Ionic Bond And Lattice Energy

1. The electronegativities of two elements are 0.7 and 3.0. The bond formed between them would be

- A. Ionic
- B. Covalent
- C. Co-ordinate covalent
- D. Metallic

**Answer: A**

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2. An ionic compound will be formed by the combination of one of the following pairs of elements. This pair of element is :

A. I A group and VII A group

B. II A group VI A group

C. III A group and V A group

D. O' group and VIII A group

**Answer: A**



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3. Which of the following are not ionic compounds?

A.  $CaC_2$

B.  $NaH$

C.  $BaF_2$



D.  $BF_3$

**Answer: D**

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4. Which of the following is a favorable factor for cation formation?

A. Low ionisation potential

B. High electron affinity

C. High electronegativity

D. Small atomic size

**Answer: A**

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5. Lattice energy of an ionic compound depends upon :

- A. Only radius of cation
- B. Only radius of anion
- C. Cation to anion radius ratio
- D. Sum of the radii of cation and anion

**Answer: D**

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6. Which of the following is not a correct statement about an ionic compound

- A. The higher the temperature, the more the solubility
- B. The higher the dielectric constant of the solvent, the more the solubility
- C. the higher the dipole moment of the solvent, the more the solubility

D. The higher the lattice energy, the more the solubility

**Answer: D**

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7. Which one of the following material conducts electricity?

A. Crystalline NaCl

B. Fused NaCl

C. Molten sulphur

D. Diamond

**Answer: B**

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8. Melting point is low for

- A. Calcium fluoride
- B. Calcium iodide
- C. Calcium Chloride
- D. Calcium bromide

**Answer: B**

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### Exercise I C W Fajan S Rules

1. According to Fajan rule, the covalent bond is favoured by :
- A. Small cation and large anion
  - B. Small cation and small anion
  - C. Large cation and large anion
  - D. Large cation and small anion

**Answer: A**

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2. Polarization is the distortion of the anion by an adjacently placed cation. Which of the following statements is correct?

- A. Maximum polarisation is brought about by cation of high charge
- B. Maximum polarisation is brought about by Cation of Low charge
- C. A large cation is likely to bring about a large degree of polarisation
- D. A small anion is likely undergo a large degree of polarisation

**Answer: A**

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3. Polarizing power is

- A. Charge on the cation increases
- B. Size of the cation increase
- C. Charge on the cation decreases
- D. Has no relation to its size or charge

**Answer: A**

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4.  $AlCl_3$  is covalent while  $AlF_3$  is ionic This can be justified on the basic of .

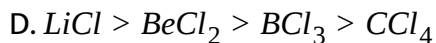
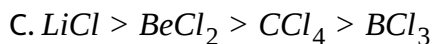
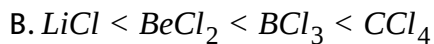
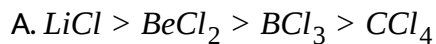
- A. Molecular orbital theory
- B. Valence bond theory
- C. Fajan's rule
- D. Lattice energy

**Answer: C**



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5. Among  $LiCl$ ,  $BeCl_2$  and  $CCl_4$  the covalent bond character varies as .



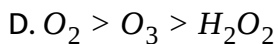
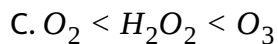
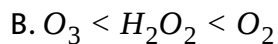
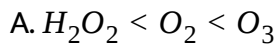
Answer: B



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## Exercise I C W Bond Parameters

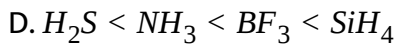
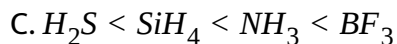
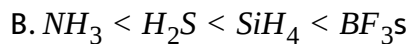
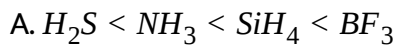
1. The correct order in which the O-O bond length increases in the following is



**Answer: D**

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2. The correct order of bond angles (smallest first) in  $H_2S$ ,  $NH_3$ ,  $BF_3$  and  $SiH_4$  is



**Answer: A**





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## Exercise I C W Polarity And Dipole Moment

1. Pure covalent double bond is present in

- A. Acetylene
- B. Carbon dioxide
- C. Ethylene
- D. Ethane

Answer: C



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2. Which of the following is most polar bond ?

- A.  $H - F$

B.  $H - Cl$

C.  $H - O$

D.  $H - S$

**Answer: D**



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**3. Which contains both polar and non-polar bonds?**

A.  $NH_4Cl$

B.  $HCN$

C.  $H_2O_2$

D.  $CH_4$

**Answer: C**



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4. If the electron pair forming a bond between two atoms and B is not in the center then the bond is ?

- A. Single bond
- B. Polar covalent bond
- C. Non-polar bond
- D. p - bond s

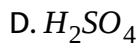
**Answer: B**



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5. Which of the following is non-polar

- A.  $H_2S$
- B.  $NaCl$
- C.  $Cl_2$

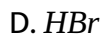


**Answer: C**

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## Exercise I C W Valence Bond Theory

1. The orbital overlapping is maximum in



**Answer: A**

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2. The number of sigma and Pi bonds in a molecule of cyanogen are

A. 4,3

B. 3,4

C. 5,2

D. 3,5

**Answer: B**



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

A. Sigma bond

B. Double bond

C. Co-ordinate covalent bond

D. p-bonds

**Answer: A**

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4. s - p overlapping is present in

A.  $Br_2$

B.  $H_2$

C.  $O_2$

D. HF

**Answer: D**

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5. Which one of the following is an incorrect statement ?

A. A p bond is formed when a sigma already exists

- B. A p bond may be formed by the overlapping of 'p' or 'd' orbitals
- C. A p bond is formed by the overlapping of hybrid orbitals
- D. A p bond is formed by the lateral overlapping of atomic orbitals

**Answer: C**

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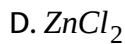
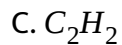
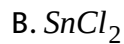
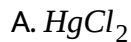
**6.** How many  $\sigma$  and  $\pi$  bonds are present in tetra cyanoethylene ?

- A.  $9\sigma$  and  $9\pi$
- B.  $5\sigma$  and  $9\pi$
- C.  $9\sigma$  and  $7\pi$
- D.  $8\sigma$  and  $8\pi$

**Answer: A**

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1.  $CO_2$  is iso-structural with



**Answer: B**



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2. In  $NO_3^-$  ion, the number of bond pairs and lone pairs of electrons on nitrogen atom are :

A. 2,2

B. 3,1



C. 1,3

D. 3,0

**Answer: D**



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3. In  $OF_2$ , the number of bond pairs and lone pairs of electrons are respectively,

A. 2,6

B. 2,8

C. 2,10

D. 2,9

**Answer: B**



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4. The geometry of  $ClO_3^-$  ion according to valence shell electron pair repulsion (VSEPR) theory will be :

- A. Planar triangular
- B. Pyramidal
- C. Tetrahedral
- D. Square planar

**Answer: B**

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5. VSEPR Theory

- A. Linear
- B. Planar triangle
- C. Pyramid

D. Tetrahedon

**Answer: B**

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6. Which of the following molecule is linear?

A.  $SO_2$

B.  $NO_2^+$

C.  $NO_2^-$

D.  $SCl_2$

**Answer: B**

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1. The number of hybrid orbitals in a molecule of decane are

A. 36

B. 40

C. 38

D. 8

**Answer: B**



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2. The hybridisation of Nitrogen in Nitrate ion is

A.  $sp$

B.  $sp^2$

C.  $sp^3$

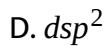
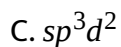
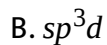
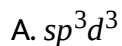
D.  $sp^3d$

**Answer: B**



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**3. Hybridisation of iodine hepta fluoride molecule is**

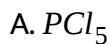


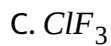
**Answer: A**



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**4. A molecule is formed by  $sp^3d^2$  hybridisation. Bond angle in it is :**

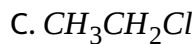
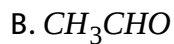
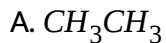




**Answer: B**

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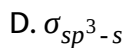
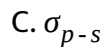
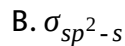
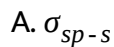
5. The molecule which contains  $\sigma_{sp^3-sp^3}$  and  $\sigma_{sp^3-p}$  bonds in it is



**Answer: C**

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6. The C - H bond in propane is



**Answer: D**



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7. Number of hybrid orbitals present in a molecule of propene are

A. 12

B. 10

C. 9

D. 8

**Answer: B**

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8. Hybridization of carbon in  $C_3O_2$  is :

A.  $sp$

B.  $sp^2$

C.  $sp^3$

D. None

**Answer: A**

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9. The type of hybrid orbitals used by the oxygen atom in  $Cl_2O$  molecule is



A.  $sp^3$

B.  $sp^2$

C.  $sp$

D. None

**Answer: A**

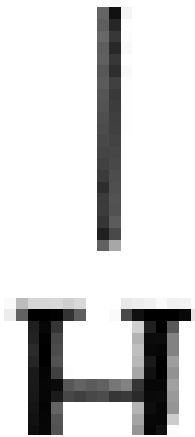


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10.

In

piperidine



, the hybrid

state assumed by N is

A.  $sp$

B.  $sp^2$

C.  $sp^3$

D.  $dsp^2$

**Answer: C**



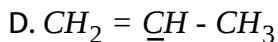
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11. In which of the following species, is the underlined carbon has  $sp^3$  - hybridisation ?

A.  $CH_3 - \underline{C}OOH$

B.  $CH_3\underline{C}H_2OH$

C.  $CH_3\underline{C}OCH_3$



**Answer: B**

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12. Carbon atoms in  $C_2(CN)_4$  are :

A.  $sp$  hybridized

B.  $sp^2$  hybridized

C.  $sp$  and  $sp^2$  hybridized

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

**Answer: C**

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13. H-B- H bond angle in  $BH_4^-$  is :

A.  $180^\circ$

B.  $120^\circ$

C.  $109^\circ$

D.  $90^\circ$

**Answer: C**

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**14.** A square planar complex is formed by hybridization of which atomic orbitals?

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

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

C.  $s, p_x, p_y, d_z^2$

D.  $s, p_x, p_z, d_{xy}$

**Answer: B**



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## Exercise I C W Dative Bond

1. When a cation gets hydrated, normally the bond formed between cation and water molecule is

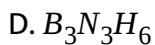
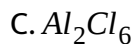
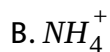
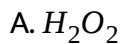
- A. Dative bond
- B. Ionic bond
- C. Covalent bond
- D. Hydrogen bond

**Answer: A**



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2. Molecule having maximum number of dative bonds is



**Answer: D**

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3.  $NH_3$  and  $BF_3$  form adduct readily because they form

A. A co-ordinate covalent bond

B. A covalent bond

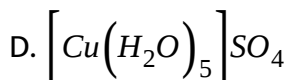
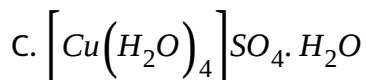
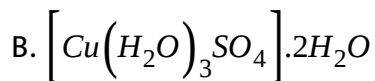
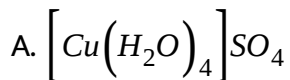
C. An ionic bond

D. A hydrogen bond

**Answer: A**

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4.  $CuSO_4 \cdot 5H_2O$  is represented as :

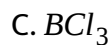
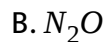
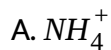


**Answer: C**

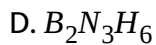


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5. Dative bonds are not present in :







**Answer: C**

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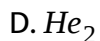
6.  $NH_4CN$  contains

- A. Ionic bond
- B. Covalent bond
- C. Dative bond
- D. All

**Answer: D**

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1. Which of the following cannot be formed ?

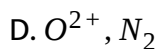
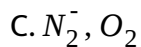
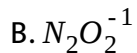
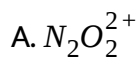


**Answer: D**



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2. Which of the following pairs have identical bond order?



**Answer: A**

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3. The number of antibonding electron pairs in  $O_2^{2-}$  molecular ion on the basis of molecular orbital theory is

A. 2

B. 3

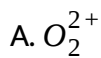
C. 4

D. 5

**Answer: C**

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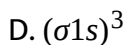
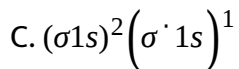
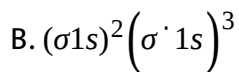
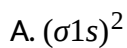
4. Which of the following has fractional bond order



**Answer: D**

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5. The molecular electronic configuration of  $H_2^-$  ion is



**Answer: C**

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6. Which of the following molecules/ions does not contain unpaired electrons?

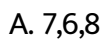


**Answer: C**



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7. In  $O_2^-$ ,  $O_2$  and  $O_2^{2-}$  molecular species, the total number of antibonding electrons respectively are



B. 1,0,2

C. 6,6,6

D. 8,6,8

**Answer: A**

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**8. Match List I (Molecules) with List II (Bond order) and select the correct answer using the codes.**

**List - I**

**I.  $Li_2$**

**II.  $N_2$**

**III.  $Be_2$**

**IV.  $O_2$**

**List - II**

**A. 3**

**B. 1.5**

**C. 1.0**

**D. 0**

**E. 2**

A. I - B, II - C, III - A, IV - E

B. I - C, II - A, III - D, IV - E

C. I - D, II - A, III - E, IV - C

D. I - C, II - B, III - E, IV - A

**Answer: B**



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9. Number of paired electrons in  $O_2$  molecules is :

A. 7

B. 8

C. 16

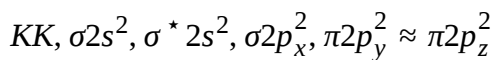
D. 14

**Answer: D**



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10. The ground state electronic configuration of valence shell electrons in nitrogen molecule ( $N_2$ ) is written as



Bond order in nitrogen molecule is

A. 2

B. 3

C. 0

D. 1

**Answer: B**



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## Exercise I C W Hydrogen Bonding

1. Which of the following is a normal liquid



A.  $NH_3$

B.  $H_2O$

C.  $HF$

D.  $Br_2$

**Answer: D**

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2. Among the following, the bonding point is high for

A. Ethyl alcohol

B. Dimethyl ether

C. Acetone

D. Chloroform

**Answer: A**

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3. Strongest hydrogen bonding is present in

- A. Ammonia
- B. Water
- C. Hydrogen fluoride
- D. Ethyl alcohol

**Answer: C**



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4. Intermolecular hydrogen bonding is not present in :

- A. Ammonia
- B. Water
- C. Hydrofluoric acid

D. Salicylaldehyde

**Answer: D**

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5. Which of the following is steam volatile

A. Phenol

B. o-Nitrophenol

C. m - Nitrophenol

D. p - Nitrophenol

**Answer: B**

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6. Which of the following compounds shows evidence of the strongest hydrogen bonding?

- A. Propane -1-ol
- B. Propane - 2- ol
- C. Propane - 1,2 - diol
- D. Propane -1,2,3 - triol

**Answer: D**



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7. The compound containing hydrogen bond is-

- A.  $NH_3$
- B.  $H_2S$
- C.  $HCl$

D.  $\text{PH}_3$

**Answer: A**

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8. Intramolecular hydrogen bonding is not present in :-

A. o-Fluoro phenol

B. Salicylaldehyde

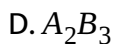
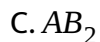
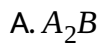
C. o-Nitro phenol

D. p-Nitro phenol

**Answer: D**

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1. An element A is tetravalent and another element B is divalent. The formula of the compound formed from these elements will be:

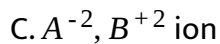
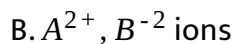
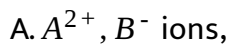


**Answer: C**



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2. An element A belongs to IIA group and another element B belongs to VIA group. The compound formed between A and B contains



D.  $A^+$ ,  $B^{-2}$  ions

**Answer: B**

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3.  $Cl + Cl \rightarrow Cl_2$ , this is an example for

- A. Endothermic reaction
- B. Exothermic reaction
- C. Either exothermic or endothermic
- D. Neither exothermic nor endothermic

**Answer: B**

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4. The compound in which cation is isoelectronic with anion is.

- A. Sodium chloride
- B. Potassium Bromide
- C. Lithium fluoride
- D. Rubidium bromide

**Answer: D**



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**5. Ammonium ion is**

- A. 2
- B. 3
- C. 4
- D. 5

**Answer: C**

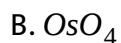
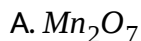


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## Exercise I H W Kossel Lewis Theory And Octet Rule

1. Valence of the metal atom with respect to oxygen is maximum in



**Answer: B**



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2. The maximum number of valency electrons possible for atom in the second period of the periodic table is :

A. 2

B. 8

C. 18

D. 32

**Answer: B**

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3. Which of the following molecule does NOT obey octet rule?

A.  $PCl_3$

B.  $BeCl_2$

C.  $MgO$

D.  $NH_3$

**Answer: D**

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4. Nucleus of an element contains 9 protons Its valency would be :

A. 1

B. 3

C. 2

D. 5

**Answer: A**



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5. Which of the following molecule does NOT obey octet rule?

A. NaCl

B.  $BeCl_2$

C. MgO

D.  $NH_3$

**Answer: B**

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6. How many electrons are present in the valence shells of the central atoms in the molecules of  $BeCl_2$ ,  $BF_3$  and  $PCl_5$ ?

A.  $NH_3$

B.  $CH_4$

C.  $PCl_5$

D.  $BeCl_2$

**Answer: C**

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1. Triple bond is not present in

A. Cyanogen

B. Propyne

C. Nitrous Oxide

D. Nitrogen dioxide

**Answer: D**



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2. Molecule which contains only bonded pairs of electrons on the central atom is

A.  $H_2O$

B.  $NH_3$

C.  $BeCl_2$

D.  $\text{BeF}_3$

**Answer: C**

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3. Compound having maximum number of bonded pairs of electrons in its molecule is

A. Ethane

B. Ammonia

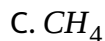
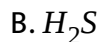
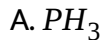
C. Sulphur hexafluoride

D. Bromine Pentafluoride

**Answer: A**

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4. Which species has the maximum number of lone pair of electrons on the central atom ? .



**Answer: B**



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5. A solid substance is soft, has a low melting point and is a poor conductor of electricity it is

A. An ionic solid

B. A net work solid

C. A metallic solid

D. A molecular solid

**Answer: D**

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## Exercise I H W Ionic Bond And Lattice Energy

1. Most favourable conditions for electrovalent bonding are

- A. Low charge on ions, large cation and small anion
- B. High charge on ions, small cation and large anion
- C. High charge on ions, large cation and small anion
- D. Low charge on ions, small cation and large anion

**Answer: A**

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2. In which of the following ionic bond is present

A. LiH

B. HF

C. CsH

D. HI

**Answer: C**



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3. Sodium chloride is an ionic compound whereas hydrogen chloride is

Mainly covalent because

A. Sodium is less reactive

B. Hydrogen is non-metal

C. Hydrogen chloride is a gas

D. Electronegativity difference in the case of Hydrogen and chlorine is more than 2.1

**Answer: B**

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4. Lattice energy of an ionic compound depends upon :

A. Charge on the ion and size of the ion

B. Packing of ions only

C. Size of the ion only

D. Charge on the ion only

**Answer: A**

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5. Least ionic compound among the following is

A. NaCl

B. KCl

C. CsI

D. LiI

**Answer: D**



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6. The compound with high lattice energy is

A. KBr

B. NaBr

C. LiBr

D. RbBr

**Answer: C**

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7. Among the following cations, the one present in a least ionic halide salt is

- A. Calcium ion
- B. Barium ion
- C. Caesium ion
- D. Potassium ion

**Answer: A**

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8. For the ionic solids, CaO and KI. Identify the wrong statement among the following

- A. Lattice energy of CaO is much larger than that of KI
- B. KI is soluble in benzene
- C. CaO has higher melting point
- D. KI has lower melting point

**Answer: B**

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9. As compared to covalent compounds, electrovalent compounds, generally have

- A. Low melting points and low boiling points
- B. Low melting points and high boiling points
- C. High melting points and low boiling points
- D. High melting points and high boiling points

**Answer: D**



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10. Melting point is very high for

- A. KCl
- B. KBr
- C. KI
- D. KF

**Answer: D**



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### Exercise I H W Fajan S Rules

1. Which of the following factor generally favours electrovalence

- A. Cation with pseudo inert gas configuration

- B. High charge on ions
- C. Large cation and small anion
- D. Small cation and large anion

**Answer: C**

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2. Covalent nature of a compound increases with

- A. Decrease in cation size
- B. Increase in cation size
- C. Decrease in anion size
- D. Decrease in both cation and anion size

**Answer: A**

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3. Maximum covalent character is shown by

A. CsCl

B. RbI

C.  $MgF_2$

D. LiI

**Answer: D**



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4. The compound having more covalent nature is

A.  $BaCl_2$

B.  $MgCl_2$

C.  $SrCl_2$

D.  $BeCl_2$

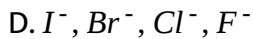
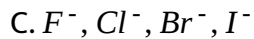
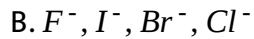


**Answer: D**



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5. The correct order of decreasing polarisability of ion is



**Answer: D**



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6. The polarisation power is maximum of which of the following ion



B.  $K^+$

C.  $Cs^+$

D.  $Al^{3+}$

**Answer: D**



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## Exercise I H W Bond Parameters

1. The bond length in LiF will be

A. Less than that of NaF

B. Equal to that of KF

C. More than that of KF

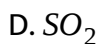
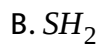
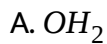
D. Equal to that of NaF

**Answer: A**



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



Answer: B



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## Exercise I H W Polarity And Dipole Moment

1. Which of the following bonds has the most polar character ?

A. C -O

B. C-Br

C. C-F

D. C-S

**Answer: C**



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2. The electronegativity values of C,H,O,N and S are 2.5, 2.1, 3.5, 3.0 and 2.5 respectively. Which of the following is the most polar?

A. S - H

B. O - H

C. N -H

D. C - H

**Answer: B**



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3. Dipole moment of  $CO_2$  is zero 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.

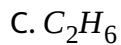
Answer: C



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4. The molecule having non-zero dipole moment is

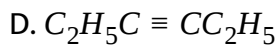
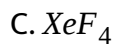
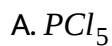
- A.  $H_2O_2$
- B.  $CH_4$



**Answer: A**

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5. Dipole moment is not zero for



**Answer: B**

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1. Molecule which contains only sigma bonds in it is

- A. Pentene
- B. Pentane
- C. Pentadiene
- D. Pentyne

**Answer: B**



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2. Pi ( $\pi$ ) bond is formed by the overlap of

- A. p - p orbitals along their axis
- B. s-p orbitals along the axis of p - orbital
- C. p - p orbitals perpendicular to their axis

D. s - s orbitals

**Answer: C**

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3. Which of the following is not correct ?

A. A sigma bond is weaker than pi bond

B. A sigma bond is stronger than pi bond

C. A double bond is stronger than a single bond

D. A double bond between two atoms is shorter than a single bond between the same atoms.

**Answer: A**

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4. The strongest covalent bond is formed by the overlap of

- A. 2s and 2p orbitals
- B. 2p and 2p orbitals
- C. 2s and 2s orbitals
- D. All of these

**Answer: B**



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## Exercise I H W Vsepr Theory

1. The hydronium ion is

- A. Tetrahedron
- B. Square planar

C. Planar triangle

D. Pyramidal

**Answer: D**

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

A.  $H_2S$

B.  $C_2H_2$

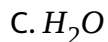
C.  $BeH_2$

D.  $CO_2$

**Answer: A**

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3. Which of the following has distorted tetrahedron shape



**Answer: D**



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4. Ammonium ion is

A. Tetrahedron

B. Pyramid

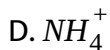
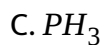
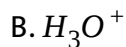
C. Square planar

D. Square pyramid

**Answer: A**

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5. Which of the following species are pyramidal in shape?

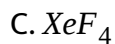


**Answer: D**

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6. Which of the following set of species have planar structure?

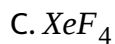
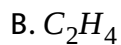




**Answer: C**

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7. Which of the following is not a planar molecule?

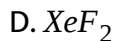
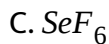
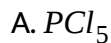


**Answer: D**

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## Exercise I H W Hybridisation

1. In which of the following molecules, the central atom does not have  $sp^3$  hybridization ?

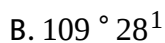


**Answer: C**



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2. A molecule is formed by  $sp^3d^2$  hybridisation. Bond angle in it is :



C.  $120^\circ$

D.  $72^\circ$

**Answer: A**



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3. Which of the following molecule contain  $sp^2$  hybrid carbon atom?

A.  $BeCl_2$

B.  $CO_2$

C.  $HCHO$

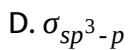
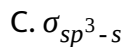
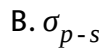
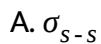
D.  $NH_3$

**Answer: C**



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4. N- H Bond in Ammonia molecule is

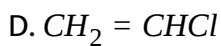
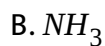


**Answer: C**



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5.  $\sigma_{sp^2-s}$  bond is present in





**Answer: D**

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6. The type of overlapping in Br-F bond in  $BrF_3$  molecule is

A.  $sp^3 - p$

B.  $sp^2 - p$

C.  $sp^3d - p$

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

**Answer: C**

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7. Beryllium atom in beryllium fluoride is

A.  $sp^3$  hybridised

B.  $sp^2$  hybridised

C.  $sp$  hybridised

D. Unhybridised

**Answer: C**

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8. Hybridisation in  $SO_2$  molecule is

A.  $sp$

B.  $sp^2$

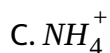
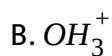
C.  $sp^3$

D.  $sp^3d$

**Answer: B**

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9. In which of the following the central atoms does not use  $sp^3$  hybrid orbitals in its bonding

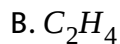
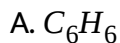


**Answer: A**



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10. Which of the following does not exhibit  $sp^3$ - hybridisation ?



D.  $NF_3$

**Answer: D**

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11. Which of the following has been arranged in increasing order of size of the hybrid orbitals ?

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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12. The structural formula of a compound is  $CH_3 - CH = C = CH_2$ . The type of hybridization at the four carbons from left to right are

A.  $sp^3, sp, sp^2, sp^3$

B.  $sp^2, sp^3, sp^2, sp$

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

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

**Answer: C**



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13. The shape of gaseous  $SnCl_2$  is

A. Tetrahedral

B. Linear

C. Angular

D. T - shape

**Answer: C**

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## Exercise I H W Dative Bond

1. Dative bond is present in :-

A. Carbon monoxide

B. Carbon dioxide

C. Nitric oxide

D. Chlorine monoxide

**Answer: A**

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2. The bond present in NaNC are

- A. Ionic bond
- B. Covalent bond
- C. Co-ordinate covalent bond
- D. All

**Answer: D**



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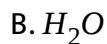
3. Potassium ferrocyanide is a

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

**Answer: C**

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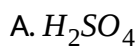
4. The compound which contains both ionic and covalent bonds is



**Answer: C**

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5. The compound containing coordinate bond is





B.  $O_3$

C.  $SO_3$

D. All

**Answer: D**

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6. Which of the following does not contain coordinate bond?

A.  $BH_4^-$

B.  $NH_4^+$

C.  $CO_3^{2-}$

D.  $H_3O^+$

**Answer: C**

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



**Answer: C**



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2. The bond order in  $O_2^+$  is

A. 1

B. 1.5

C. 2.5

D. 3

**Answer: C**

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3. Which of the following species exhibits the diamagnetic behaviour ?

A.  $NO$

B.  $O_2^{2-}$

C.  $O_2^+$

D.  $O_2$

**Answer: B**

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4. The calculated bond order in  $H_2^-$  ion is

A. 1

B. 43832

C.  $-1/2$

D. 1

**Answer: B**

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5. The bond order in  $He_2^+$  ions is :

A. 1

B. 2

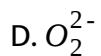
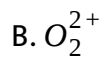
C.  $1/2$

D.  $1/4$

**Answer: C**

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6. The bond order is of three for



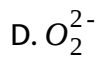
**Answer: A**



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7. Which of the following species have maximum number of unpaired electrons ?





**Answer: A**



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**8.** The higher number of unpaired electrons are in

A. 16

B. 12

C. 2

D. 8

**Answer: C**



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



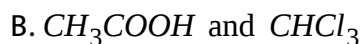
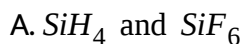
**Answer: A**



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## Exercise I H W Hydrogen Bond

1. The pair of molecules forming strongest hydrogen bonds are



C.  $\text{HCOOH}$  and  $\text{CH}_3\text{COOH}$

D.  $\text{H}_2\text{O}$  and  $\text{H}_2$

**Answer: C**

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2. Strongest hydrogen bonding is present in

A.  $\text{H}_2\text{O}$

B.  $\text{NH}_3$

C.  $\text{H}_2\text{S}$

D.  $\text{C}_2\text{H}_5\text{OH}$

**Answer: A**

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### 3. Hydrogen bond

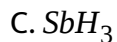
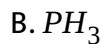


**Answer: C**



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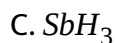
4. Of the following hydrides the boiling point is very low for



**Answer: B**

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5. In which of the following compounds does hydrogen bonding occur



**Answer: D**

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6. Bond energy of covalent  $\text{O} - \text{H}$  bond in water is

A. Greater than bond energy of hydrogen bond

- B. Equal to bond energy of hydrogen bond
- C. Less than bond energy of hydrogen bond
- D. Half of the bond energy of hydrogen bond

**Answer: A**

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7. The boiling point of ethanol is higher as compared to the boiling of diethyl ether though both have the same molecular formula. This is due to ,

- A. Hydrogen bonding
- B. Ionic bonding
- C. Co-ordinate covalent bonding
- D. Resonance

**Answer: A**

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## Exercise II C W Octet Rule Formal Charge

1. According to octet rule  $SO_3$  contains \_\_\_\_\_ number of dative bonds

A. 1

B. 2

C. 3

D. 4

**Answer: B**

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2. Example of super octet molecule is :

A.  $ClF_3$

B.  $PCl_5$

C.  $IF_7$

D. All

**Answer: D**

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3. Molecule having an incomplete octet in the central atom is

A.  $PCl_5$

B.  $NH_3$

C.  $BCl_3$

D.  $H_2O$

**Answer: C**

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4. Octet rule 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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5. The formal charges on the three O atoms in the  $O_3$  molecule are

- A. 0,0,0
- B. 0,0,-1
- C. 0,0,+1
- D. 0, + 1, -1

**Answer: D**

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## Exercise II C W Ionic Bond And Lattice Energy

1. Number of electrons transferred from one atom to another during bond formation in SrS (Strontium Sulphide)

A. 1

B. 2

C. 3

D. 4

**Answer: B**

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2. \_\_\_\_\_ HCl is bad conductor of electricity but \_\_\_\_\_ HCl is good conductor

- A. Solid, aqueous
- B. Aqueous, Solid
- C. Anhydrous, Solid
- D. Anhydrous, aqueous

**Answer: D**

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3. NaCl does not exhibit space isomerism due to

- A. Presence of ions
- B. High melting point
- C. Strong electrostatic forces between the constituent ions



D. Non directional nature of electrovalent bond.

**Answer: D**



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4. 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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5. How many unit cell are present in a cubic-shaped ideal crystal of  $\text{NaCl}$  of mass  $1.0\text{g}$ ?

- A.  $1.7 \times 10^{21}$  unit cell
- B.  $2.5 \times 10^{21}$  unit cell
- C.  $5.14 \times 10^{21}$  unit cell
- D.  $1.28 \times 10^{21}$  unit cell

**Answer: B**



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6. Which of the following has the lowest Lattice energy ?

- A.  $\text{LiF}$
- B.  $\text{LiCl}$
- C.  $\text{LiBr}$

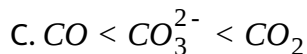
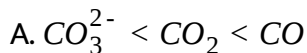
D. Lil

Answer: D

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### Exercise II C W Bond Parameters

1. The correct order of increasing C - O bond length of  $CO$ ,  $CO_3^{2-}$ ,  $CO_2$  is



Answer: D

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2. The  $H - O - H$  bond angle in water is

A.  $< xA^0$

B.  $xA^0$

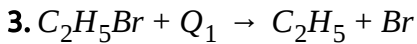
C.  $> xA^0$

D.  $2x$

**Answer: B**



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$C_2H_5Br + Q_2 \rightarrow C_2H_5^{(+)} + Br^{(-)}$ , then relation between  $Q_1$  and  $Q_2$  is

A.  $Q_1 > Q_2$

B.  $Q_1 < Q_2$

C.  $Q_1 = Q_2$

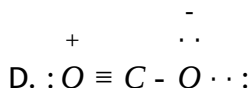
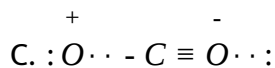
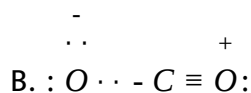
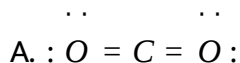
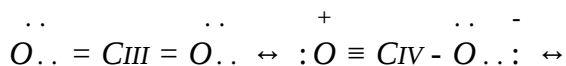
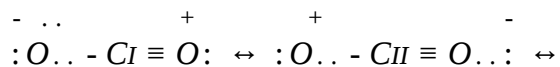
D.  $Q_1 + Q_2 = 0$

Answer: B

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## Exercise II C W Resonance

1. Which of the following resonating structures is not correct for  $CO_2$ ?



Answer: C

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

A. -0.75, 0.6

B. -0.75, 1.0

C. -0.75, 1.25

D. -3, 1.25

**Answer: C**

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3. In the anion  $HCOO^-$  , the two carbon-oxygen bonds are found to be of equal length. What is the reason for it ?

A. Electronic orbitals of carbon atom are hybridised.

B. The  $C = O$  bond is weaker than the  $C - O$  bond

C. The anion  $\text{HCOO}^-$  has two resonating structures

D. The anion is obtained by removal of a proton from the acid molecule.

**Answer: C**

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## Exercise II C W Bond Polarity And Dipole Moment

1. The dipole moment of hydrogen chloride with bond distance 127 pm is

1.03 D. The percentage ionic character of its bond is

A. 15

B. 17

C. 19

D. 21

**Answer: B**



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2. Which bond angle,  $\theta$  would result in the maximum dipole moment for the triatomic molecule  $XY_2$  ?

A. =  $90^\circ$

B. =  $120^\circ$

C. =  $150^\circ$

D. =  $180^\circ$

**Answer: A**



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3. The electronegativity difference between  $N$  and  $F$  is greater than that between  $N$  and  $H$  yet the dipole moment of  $NH_2$  ( 1.5 D) is larger than



that of  $NF_3$  (0.2D). This is because :

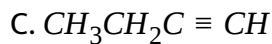
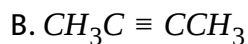
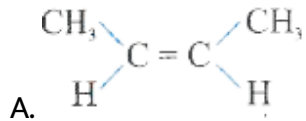
- A. In  $NH_3$  as well as  $NF_3$ , the atomic dipole and bond dipole are in opposite direction
- B. In  $NH_3$ , the atomic dipole and bond dipole are in the opposite direction, where as in  $NF_3$  these are in same direction
- C. In  $NH_3$ , as well as in  $NF_3$  the atomic dipole and bond dipole are in same direction.
- D. In  $NH_3$ , the atomic dipole and bond dipole are in same direction where as in  $NF_3$  these are in opposite direction.

**Answer: D**



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4. Which of the following hydrocarbons has the lowest dipole moment ?



**Answer: B**

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5. Dipole moment is shown by

A. 1,4-dichlorobenzene

B. C is 1,2- dichlorobenzene

C. Trans 1,3- dichlorobenzene

D. Trans 2, 3 - dechloro - 2 butene

**Answer: B**

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6. Statement : The dipole moment of  $NH_3$  is less than  $NF_3$ .

Explanation : The lone pair present on  $N$  shows additive nature to  $N - H$  vector whereas it is subtractive to  $N - F$  vector.

- A. Less than dipole moment of  $NCl_3$
- B. higher than dipole moment of  $NCl_3$
- C. Equal to the dipole moment of  $NCl_3$
- D. None of these

**Answer: C**

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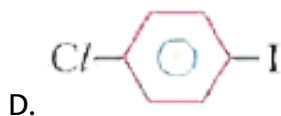
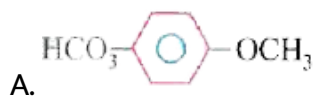
7. The critical temperature of water is higher than that of  $O_2$  because the  $H_2O$  molecule has

- A. Fewer electron than  $O_2$
- B. Two covalent bond
- C. V - shape
- D. Dipole moment & H - bonding

**Answer: D**

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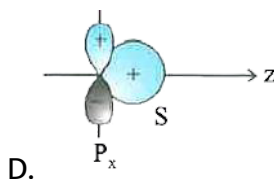
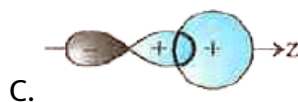
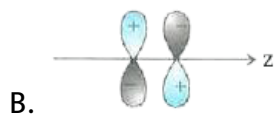
8. In which of the following bonds are polar but molecule is non-polar



**Answer: B**

## Exercise II C W Valence Bond Theory

1. Which of the following is a zero overlap which leads to non-bonding?



**Answer: D**

## 2. VALENCE BOND THEORY

A. Directional

B. Ionic

C. Strength

D. Hybrid

**Answer: A**



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3. The shape of water molecule is same as that of

A. Sigma bonds

B. pi bonds

C. Both sigma and pi bonds

D. Neither sigma nor pi bonds

**Answer: A**

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4. The strength of bonds by  $2s-2s$ ,  $2p-2p$  and  $2p-2s$  overlap has the order

- A.  $1s-1s$  gt  $2p-2p$  gt  $2s-2p$  gt  $2s-2s$
- B.  $2p-2p$  gt  $2s-2p$  gt  $2s-2s$  gt  $1s-1s$
- C.  $2s-2s$  gt  $1s-1s$  gt  $2s-2p$  gt  $2p-2p$
- D.  $2s-2p$  gt  $2s-2s$  gt  $2p-2p$  gt  $1s-1s$

**Answer: A**

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5. For compounds ,

A : Tetracyanoethene

B : Carbon dioxide

C: Benzene

D : 1, 3-Butadiene .

Ratio of  $\sigma$  and  $\pi$  bonds is in order :

A.  $A = B < C < D$

B.  $A = B < D < C$

C.  $A = B = C = D$

D.  $C < D < A < B$

**Answer: A**



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## 6. VALENCE BOND THEORY

A.  $90^\circ$

B.  $109^\circ 28'$

C.  $107^\circ 18'$



D.  $104^\circ 28'$

**Answer: A**

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7. According to VBT any covalent bond will be formed by overlapping of atomic orbitals of bonded atoms provided atomic orbitals must be half-filled and electrons be in opposite spin. According to type of overlapping covalent bonds can be classified as (a)  $\sigma$ -bond (b)  $\pi$ -bond (c)  $\delta$ -bond :

The combination of orbital that can not produce non-bonding molecular orbital is (internuclear axis is z-axis) :

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

B.  $1s - p, 3s - s$

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

D.  $4sp^3 - s$

**Answer: A**



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8. The bond between chlorine and bromine in  $\text{BrCl}$  is

- A. Ionic
- B. Non-polar
- C. Polar with negative end on Br
- D. Polar with negative end on Cl

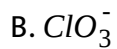
**Answer: D**



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### Exercise II C W Vsepr Theory

1. In which of the following orientation of electron pairs and shape of the ion is similar



**Answer: A**

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2. Total number of lone pair of electrons in  $\text{XeOF}_4$  is :

A. 0

B. 1

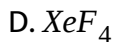
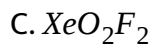
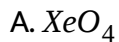
C. 2

D. 3

**Answer: B**

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3. Which of the following is planar ?



**Answer: D**



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4.  $\text{H}_2\text{O}$  and  $\text{Cl}_2\text{O}$  have different bond angles due to

A. Number of lone pairs on central atom in  $\text{H}_2\text{O}$  and  $\text{Cl}_2\text{O}$  are different

B. Hybridisation is different

C. Repulsions are more among bulky chlorine atoms in  $Cl_2O$

D. DEN between central atom and bonded atoms is different .

**Answer: C**

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

- 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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7. The shape of  $AB_3E$  molecule (B = bond pair, E = lonepair)

- A. Tetrahedral
- B. pyramidal
- C. Angular

D. T - shape

**Answer: B**

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### Exercise II C W Hybridisation

1. What is the hybridisation state of the central atom in the conjugate base of  $NH_4^+$  ion?

A. sp

B.  $sp^3$

C.  $sp^2$

D.  $dsp^2$

**Answer: B**

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2. For which hybridization, there are two unequal bond angles

A.  $sp^3$

B.  $sp^2$

C.  $sp$

D.  $sp^3d$

**Answer: D**



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3. The shape of  $CH_4$ ,  $SO_4^{2-}$ ,  $PO_4^{-3}$  is

A. Trigonal planar

B. Angular

C. Tetrahedral

D. Trigonal bipyramidal

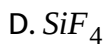
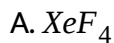


Answer: C



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



Answer: C



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5. The compounds in which C uses its  $sp^3$ - hybrid orbitals for bond formation are:

A.  $H - COOH$

B.  $(NH_2)_2C = O$

C.  $H - CHO$

D.  $CH_3CH_2OH$

**Answer: D**

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6. On catalytic hydrogenation, ethylene gives ethane during this reaction

A. Hybridization of carbon atoms changes from  $sp^2$  to  $sp^3$

B. Bond angle decreases from  $120^\circ$  to  $109.5^\circ$

C. C - C bond length increases from  $1.34A^0$  to  $1.54A^0$

D. All of these

**Answer: D**

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7. The ration of pure orbitals to hybridized orbitals in ethylene is

A. 2:3

B. 3:1

C. 1:1

D. 1:3

**Answer: C**



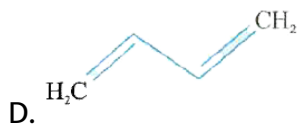
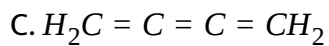
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8. Which of the following represents the given mode of hybridisation

$sp^2$  -  $sp^2$  -  $sp$  -  $sp$  from left to right ?

A.  $H_2C = CH - C \equiv N$

B.  $HC \equiv C - C \equiv CH$



**Answer: A**

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## Exercise II C W Dative Bond

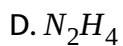
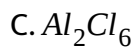
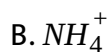
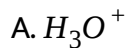
### 1. LEWIS ACID AND BASE

- A. ionic bond
- B. covalent bond
- C. Dative bond
- D. hydrogen bond

**Answer: C**

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2. Dative bond is present in :-



Answer: D

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## Exercise II C W Molecular Orbital Theory

1. Which of the following atoms has the lowest ionization potential ?





**Answer: D**

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2. The diamagnetic molecules are :

A. Super oxide ion

B. Oxygen molecule

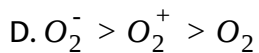
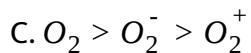
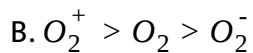
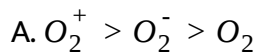
C. Carbon molecule

D. Uni positive ion of nitrogen molecule

**Answer: C**

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3. What is the correct sequence of bond order ?



**Answer: B**



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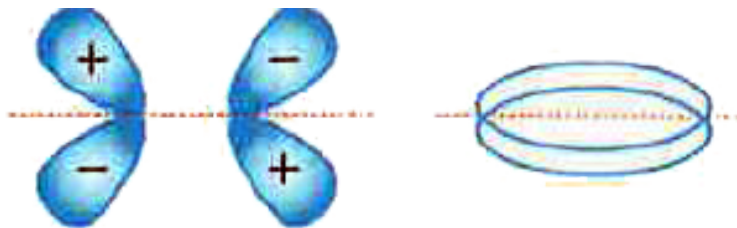
4. Which of the following species is paramagnetic ?



Answer: B

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5. The molecular orbital shown below can be described respectively as



A.  $\sigma, \sigma^*$

B.  $\pi, \pi^*$

C.  $\pi^*, \pi$

D.  $\pi^*, \sigma^*$

Answer: C

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6. Which statement is correct about  $O_2^+$ ?

- 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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7. While filling electrons in  $\pi 2p_x$  and  $\pi 2p_y$  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
- D. All

**Answer: C**



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8. In the formation of 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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9. 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: A**



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

- A.  $2s$
- B.  $2p_y$
- C.  $*_{2p_y}$

D.  $*_{2px}$

**Answer: C**

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11.  $N_2$  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.  $O_2^-$ ,  $O - O$  bond order increases
- C. In  $O_2^-$ ,  $O - O$  bond order decreases
- D.  $N_2^-$  becomes paramagnetic

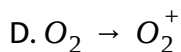
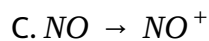
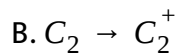
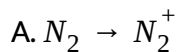
**Answer: B**

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## 12. Atomic orbitals of bonded atoms combine to form molecular orbitals.

The number of molecular orbitals formed is equal to the number of atomic orbitals taking part in the bond formation. When two atomic orbitals combine, two molecular orbitals are formed one of which has lower energy than the combining orbitals and is called bonding Molecular Orbital (MO). Whereas the other having higher energy than the two combining atomic orbitals is called Anti Bonding Molecular orbitals (ABMO) The two combining atomic orbitals must have comparable energies and should be properly oriented to allow considerable overlapping. If the overlapping is end to end along internuclear axis, the molecular orbital is called sigma and if the overlapping is lateral i.e., sidewise the molecular orbital is called pie. Just like atomic orbitals, the molecular orbitals also have varying energy levels. Filling of electrons in molecular orbitals takes place following the same rules as followed for filing of atomic orbitals. The order of filling may not be same for all the molecules or their ions. Bond order is a useful parameter for comparing the various characteristics of molecules.

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



**Answer: C**



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## Exercise II C W Hydrogen Bonding

### 1. Hydrogen bond

A. Cander Waal forces and covalent bond

B. Ionic bond and covalent bond

C. Ionic bond and metallic bonding

D. Resonance

**Answer: A**

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2.  $NH_3$  has a much higher b.p. than  $PH_3$  because

A.  $NH_3$  has a larger molecular weight

B.  $NH_3$  undergoes umbrella inversion

C.  $NH_3$  contains hydrogen bonds

D.  $NH_3$  contains ionic bonds whereas  $PH_3$  contains covalent bonds

**Answer: C**

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

A. 2

B. 4

C. 6

D. 8

**Answer: B**



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4. The high density of water compared to ice is due to

A. H - bonding interactions

B. Dipole - dipole interactions

C. Dipole - induced dipole interactions



D. Induced dipole- induced dipole interactions

**Answer: A**

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5. The force responsible for the union of two ice blocks as a single block is

A. Vanderwaals force

B. Hydrogen bonds

C. dipole interaction

D. vanderwaals repulsion

**Answer: B**

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6. Hydrogen bonding is maximum in

- A. Ethyl chloride
- B. Triethylamine
- C. Ethanol
- D. Diethyl ether

**Answer: C**



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7. The electronegativity of an element is low. The bond formed between two identical atoms of the above element is most likely to be

- A. O, O
- B. N, N
- C. O, N

D. Both O, O & N,N

**Answer: C**



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8. Ionic, covalent, dative and hydrogen bonds are present in

A. Ice

B.  $\text{BeSO}_4, 4\text{H}_2\text{O}$

C.  $\text{CuSO}_4, 5\text{H}_2\text{O}$

D.  $\text{BaCl}_2, 2\text{H}_2\text{O}$

**Answer: C**



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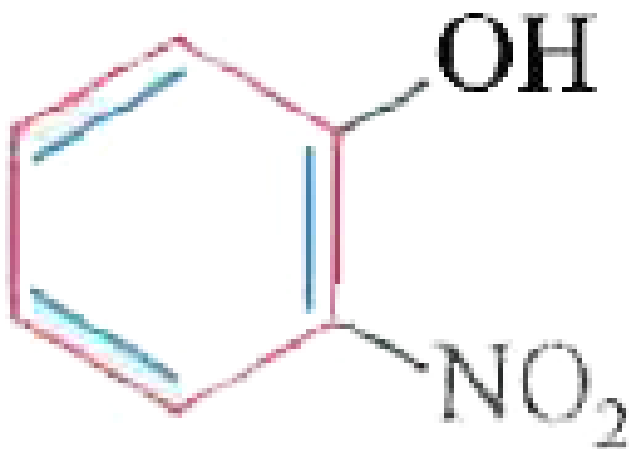
9. Which of the following exists ?



Answer: C

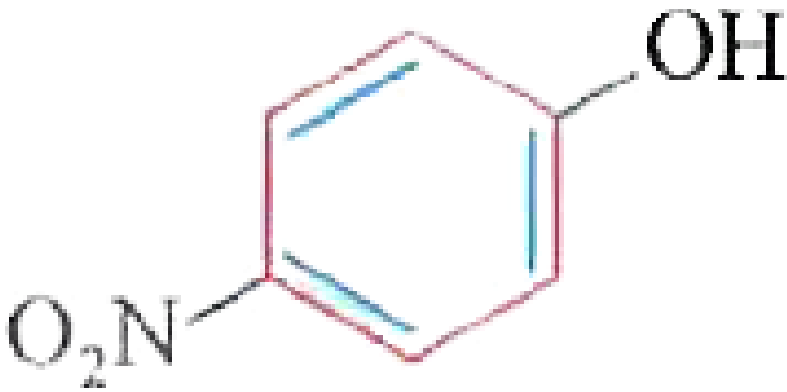
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10. The vapour pressure of



is

is higher than



due to

- A. Dipole moment
- B. Dipole - dipole interactions
- C. Intra molecular hydrogen bonding
- D. Inter molecular hydrogen bonding

**Answer: C**



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**11.** Chelates are used in

- A. p-nitrophenol

B. o-Nitrophenol

C. Benzaldehyde

D. HF

**Answer: B**

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12. Which of the following molecule forms linear polymeric structure due to H-bonding ?

A. HCl

B. HF

C.  $H_2O$

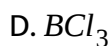
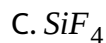
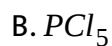
D.  $NH_3$

**Answer: B**

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## Exercise II H W Octet Rule

1. Among the following electrons-deficient compound is .

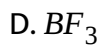


**Answer: D**

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2. The octer rule is not valid for the molecule .

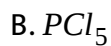




**Answer: D**

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3. Which of the following molecule deviates from Octet rule with respect to central atom



D. All

**Answer: D**

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## Exercise Ii H W Ionic Bond And Lattice Energy

1. When sodium and chlorine react energy is

- A. Released and ionic bond is formed
- B. Released and covalent bond is formed
- C. Absorbed and covalent bond is formed
- D. Absorbed and ionic bond is formed

**Answer: A**



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2. Coordinating number of  $Na^+$  in  $NaCl$  is

- A. IP of Cs is less than Na
- B. size of  $Na^+$  is less than  $Cs^+$
- C. Attraction of  $Na^+$  is higher than  $Cs^+$

D. None

**Answer: B**

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3. Among NaF, RbF, CsF more ionic and strong ionic are

A. CsF, CsF

B. CsF, NaF

C. NaF, NaF

D. KF, CsF

**Answer: B**

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4. The compound with high lattice energy is

A. LiCl

B. MgO

C. NaCl

D. KF

**Answer: B**

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5. Water acts as a powerful ionizing solvent due to its high

A. Polar nature

B. Ionic nature

C. Dielectric constant

D. Covalent nature

**Answer: C**

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6. Ionic reactions takes place in

- A. Liquid state
- B. Solid state
- C. Solution state
- D. Gaseous state

**Answer: C**



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## Exercise II H W Bond Parameters

1. Bond energy is highest in the molecule

- A.  $F_2$

B.  $Br_2$

C.  $I_2$

D.  $Cl_2$

**Answer: D**

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2. Which one of the following has longest covalent bond distance ?

A. C - H

B. C - N

C. C - O

D. C - C

**Answer: D**

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## Exercise Ii H W Resonance

1. Cl-O bond order in perchlorate ion is

- A. 1
- B. 2
- C. 1.75
- D. 2.5

**Answer: C**



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2. Resonance in a molecule results in

- A. Bond length
- B. Bond Strength
- C. Bond polarity

D. All

**Answer: D**

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3. Which of the following conditions is not correct for resonating structures?

- A. Contributing structures should have similar energy
- B. Position of atomic nuclei is similar in all resonating structures
- C. The number of bonding and non-bonding pairs of electrons in canonical structures should be similar
- D. Resonance hybrid has more energy than cononical form

**Answer: D**

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4. Write the resonance structure of  $\text{CO}_3^{2-}$  and  $\text{HCO}_3^-$ .

A. 2

B. 3

C. 6

D. 9

**Answer: B**



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## Exercise II H W Bond Polarity And Dipole Moment

1. The bond length of HCl molecule is  $1.275 \text{ \AA}$  and its dipole moment is  $1.03 \text{ D}$ . The ionic character of the molecule (in per cent) is

(Charge of the electron =  $4.8 \times 10^{-10} \text{ esu}$ )

A. 100% ionic



B. 83% covalent

C. 50% covalent

D. 40% ionic

**Answer: B**

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2. The geometry of  $H_2S$  and its dipole moment are :

A. Angular and non zero

B. Angular and zero

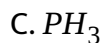
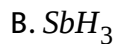
C. Linear and non zero

D. Linear and zero

**Answer: A**

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3. Which of the following has the highest dipole moment ?



**Answer: D**



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4. The dipole moment of HBr is  $0.78 \times 10^{-18}$  esu cm. The bond length of HBr is 1.41 Å. The % ionic character is

A. 7.5

B. 11.52

C. 15

D. 27

**Answer: B**

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5. Which of the following has zero dipole moment ?

A.  $\text{ClF}$

B.  $\text{PCl}_3$

C.  $\text{SiF}_4$

D.  $\text{CFCl}_3$

**Answer: C**

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6. A diatomic molecule has dipole moment of  $1.2D$ . If the bond distance is  $1\text{\AA}$  what percentage of covalent in the molecule is

- A. 25% of e
- B. 29% of e
- C. 19% of e
- D. 12% of e

**Answer: A**

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## Exercise II H W Valence Bond Theory

1. Pi ( $\pi$ ) bond is formed by the overlap of

- A. s-s orbitals
- B. p-p orbitals

C. d-d orbitals

D. both 2 and 3

**Answer: D**



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2. Which is not the characteristic of Pi- bond

A. pi bond are formed when a sigma bond already exists

B. pi bonds are formed from hybrid orbitals

C. pi bond may be formed by the overlapping fo p-orbitals

D. pi bond results from lateral overlap of atomic orbitals

**Answer: B**



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3. In the ethylene molecule the two carbon atoms have the oxidation numbers:

- A. One s and two p
- B. One s and one p
- C. Two s and one p
- D. Two s and no p

**Answer: A**



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4. The number of sigma bonds formed in ethane by the overlapping of  $sp^3 - sp^3$  orbitals

- A. 5
- B. 6
- C. 7

D. 4

**Answer: B**

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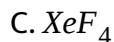
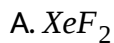
5. The carbon-carbon link in acetylene contains

- A. One sigma, two pi bonds
- B. Two sigma ,three pi bonds
- C. two sigma , two pi bonds
- D. Three sigma bonds

**Answer: A**

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1. Molecule which contains 4 bond pairs and 2 lone pairs of electrons on the central atom is



**Answer: C**



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2. The effect of repulsion between the two lone pairs of electrons present on oxygen in water molecule is

A. No Change in H - O - H bond angle

B. Decrease in H - O - H bond angle

C. Increase in H - O - H bond angle



D. All atoms will be in one plane.

**Answer: A**

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3.  $BCl_3$  molecule is planar while  $NCl_3$  is pyramidal because

A.  $BCl_3$  does not have lone pair on B but  $NCl_3$  has one lone pair on

N.

B. B - Cl bond is more polar than N - Cl bond

C. N atom is smaller than B

D. N-Cl bond is more covalent than B - Cl bond

**Answer: A**

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4. A molecule having 3 bond pairs and 2 lone pairs will have ?

- A. T - shape geometry
- B. Trigonal planar geometry
- C. Linear geometry
- D. Square pyramidal geometry

**Answer: A**

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5. The pair of species having identical shape is :

- A.  $XeF_2$ ,  $CO_2$
- B.  $BF_3$ ,  $PCl_3$
- C.  $PF_5$ ,  $IF_5$
- D.  $CF_4$ ,  $SF_4$

**Answer: A**



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**6.** The shape of  $IF_7$  molecule is

- A. Pentagonal bipyramidal
- B. Trigonal bipyramidal
- C. Octagonal
- D. T - shape

**Answer: A**



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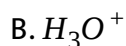
**7.** Molecular shape of  $SF_4$ ,  $CF_4$  and  $XeF_4$  are :

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

**Answer: A**

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8. Which of the following is a planar molecule ?



C.  $BCl_3$

D.  $PCl_3$

**Answer: C**

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9. The shape of  $[OH_3]^+$  is

A. Tetrahedral

B. Angular

C. Pyramidal

D. Trigonal planar

**Answer: C**

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## Exercise II HW Hybridization

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

- A.  $\text{BeCl}_2$ ,  $sp^2$ , linear
- B.  $\text{BeCl}_2$ ,  $sp^2$ , triangular planar
- C.  $\text{BCl}_3$ ,  $sp^2$  triangular planar
- D.  $\text{BCl}_3$ ,  $sp^3$ , tetrahedral

**Answer: C**

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2. Which of the following statement is true?

- A. Hybridisation of the central atom in  $\text{NH}_3$  and  $\text{CH}_4$  is  $SP^2$
- B.  $\text{BeCl}_2$  has "V" shape while  $\text{SO}_2$  is linear

C.  $SF_6$  is octahedral and F - S - F bond angle is  $90^\circ$

D.  $CO_2$  has dipole moment

**Answer: C**



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3. Which of the following statement is correct ?

A. Energy difference should be more between orbitals which undergo hybridization.

B. Number of hybrid orbitals formed should be same as the number of atomic orbitals involved in hybridization

C. Hybrid orbitals arrange around the centre of the atom unsymmetrically

D. Hybrid orbitals can form  $\pi$  bond

**Answer: B**



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4. Which of the following will provide the most efficient overlap?

A.  $sp^3 - sp^3$

B.  $sp - sp$

C.  $sp^3 - sp^2$

D. All

**Answer: A**



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5. Hybridisation noticed in  $CO_2$  and  $CO$  is

A.  $sp^3$

B.  $dsp^2$



C.  $sp$

D.  $sp^2$

**Answer: C**



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

A.  $dsp^2$

B.  $sp^3d$

C.  $dsp^3$

D.  $sp^3d^2$

**Answer: D**



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7. Ratio of pure and hybrid orbitals in benzene

A. 3:2

B. 1:1

C. 3:1

D. 1:3

**Answer: A**



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8. The  $AsF_5$  molecule is trigonal bipyramidal. The orbitals used by As for hybridisation are

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

B.  $d_{xy}$ ,  $s$ ,  $p_x$ ,  $p_y$ ,  $p_z$

C.  $s$ ,  $p_x$ ,  $p_y$ ,  $p_z$ ,  $d_z^2$

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

**Answer: C**

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9. A square planar complex is formed by hybridization of which atomic orbitals?

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

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

C.  $s$ ,  $p_x$ ,  $p_y$ ,  $d_{z^2}$

D.  $s$ ,  $p_x$ ,  $p_z$ ,  $d_{xy}$

**Answer: B**

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1. Substances which can donate lone pairs of electrons to form a coordinate covalent bonds are called

- A. Acids
- B. Bases
- C. Non-polar
- D. Amphiprotic

**Answer: B**



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2. Co-ordinate covalent compounds dissolve more in

- A. Polar solvents
- B. Non-polar solvents
- C. Both 1 and 2

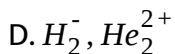
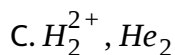
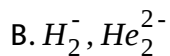
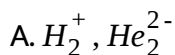
D. Water only

**Answer: B**

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## Exercise II H W Molecular Orbital Theory

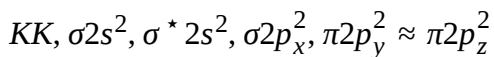
1. In which of the following pairs of molecules/ions, both the species are not likely to exist?



**Answer: C**

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2. The ground state electronic configuration of valence shell electrons in nitrogen molecule ( $N_2$ ) is written as



Bond order in nitrogen molecule is

A. 2

B. 3

C. 0

D. 1

**Answer: B**



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3.  $N_2$  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  $O_2^+$ , the O - O bond order increases
- C. IN  $O_2^+$ , paramagnetism decrease
- D.  $N_2^+$  becomes diamagnetic

**Answer: B**

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4. Which among the following have bond order 2.5?

- A.  $O_2^-$
- B.  $O_2^+$
- C.  $N_2^+$
- D.  $N_2^-$  becomes paramagnetic

**Answer: A**

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

**Answer: D**



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6. Which among the following compounds is paramagnetic ?

- A.  $He_2$
- B.  $O_2$





**Answer: B**

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7. If x-axis is the molecular axis, the  $\pi$ -molecular orbitals are formed by the overlap of

A. s-atomic orbital

B. s and  $p_x$  atomic orbitals

C.  $p_y$  and  $p_y$ - atomic orbitals

D.  $p_x$  and  $p_z$  - atomic orbitals

**Answer: C**

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8. The bond order in  $NO$  is 2.5 while that in  $NO^{\oplus}$  is 3 Which of the following statement is true for these two species ? .

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

**Answer: B**



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## Exercise II H W Hydrogen Bonding

1. Hydrogen bond energy is equal to

- A. 10 K. cal
- B. 10 Joules

C. 10 ergs

D. 10 e.v.

**Answer: A**

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2. Which of the following is soluble in water?

A.  $C_2H_5OC_2H_5$

B.  $C_2H_5OH$

C.  $C_2H_5COOC_2H_5$

D.  $C_2H_6$

**Answer: B**

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3. Acetic acids exists in dimer state in benzene due to

- A. Condensation reaction
- B. hydrogen bonding
- C. presence of carboxyl group
- D. presence of hydrogen atom at  $\alpha$  carbon

**Answer: B**

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4. Even though electronegativity of chlorine is equal to that of nitrogen, chlorine is unable to form hydrogen bonds. It is due to

- A. Cl has three lone pairs on it
- B. Atomic size of Chlorine is comparatively large.
- C. Atomic size of nitrogen is comparatively large

D. Electron affinity of chlorine is highest

**Answer: B**

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5. Which of the following does not exhibit hydrogen bonding in liquid phase

A. Phenol

B. liq.  $NH_3$

C. water

D. liq.  $HCl$

**Answer: D**

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6. In which of the following substance, hydrogen bonding is absent ?

A. HF

B.  $H_2O$

C.  $CCl_4$

D. Salicylaldehyde

**Answer: C**



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7. Which of the following property is not related to the hydrogen bonding ?

A. High boiling point of water

B. Solubility of  $NH_3$  in  $H_2O$

C. Polar nature of halogen acid

D. High viscosity of  $H_3PO_4$

**Answer: C**

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8. In which of the following compounds H - bonding is strongest in the liquid phase

A. HF

B.  $CH_4$

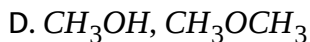
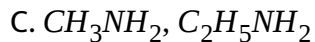
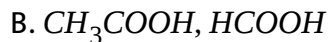
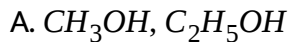
C. HI

D.  $PH_3$

**Answer: A**

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9. Which of the following pair of compounds is expected to exhibit same colour in aqueous solution?



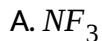
Answer: D



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### Exercise 3

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



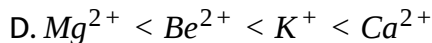
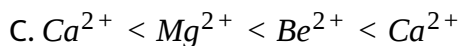
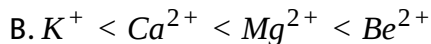
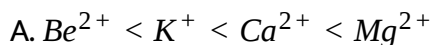




**Answer: B**

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



**Answer: B**

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3. Which of the following species exhibits the diamagnetic behaviour ?

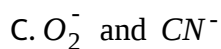


Answer: D



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



D.  $NO^+$  and  $CN^+$

**Answer: A**

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5. The angular shape of none molecule ( $O_3$ ) consists of

A. 2 sigma and 1 pi bonds

B. 1 sigma and 2pi bonds

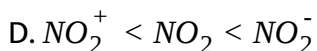
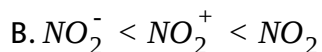
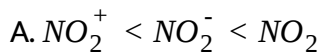
C. 2 sigma and 2 pi bonds

D. 1 sigma and 1 pi bonds

**Answer: A**

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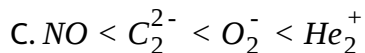
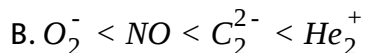
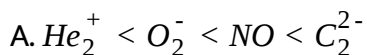
6. The correct order of increasing bond angles in the following triatomic species is

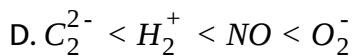


**Answer: C**

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

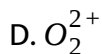




**Answer: A**

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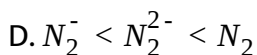
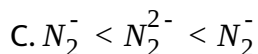
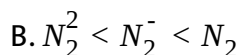
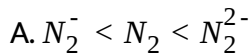
8. Using *MO* theory predict which of the following species has the shortest bond length ?



**Answer: D**

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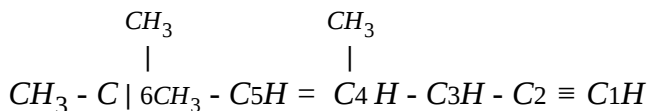
9. According to MO theory which of the following lists makes the nitrogen species in terms of increasing bond order?



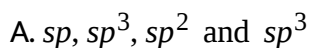
Answer: B

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10. The state of hybridization of  $C_2$ ,  $C_3$ ,  $C_5$ , and  $C_6$  of the hydrocarbon



is in the following sequence:



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

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

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

**Answer: A**

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

A.  $MCl > MI > MBr > MF$

B.  $MF > MCl > MBr > MI$

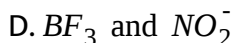
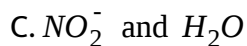
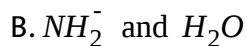
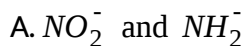
C.  $MF > MCl > MI > MBr$

D.  $MI > MBr > MCl > MF$

**Answer: D**

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12. In which of the following molecules/ions  $BF_3$ ,  $NO_2^-$ ,  $NH_2^-$  and  $H_2O$ , the central atom is  $sp^2$  hybridized ?



**Answer: D**

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13. The values of electronegativity of atom A and B are 1.20 and 4.0 respectively. The percentage of ionic character of A-B bond is nearly

A. 0.5

B. 0.7224



C. 0.553

D. 0.43

**Answer: B**

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**14.** The common features among the species  $CN^-$ ,  $CO$  and  $NO^+$

A. Bond order is three and are iso-electronic

B. Bond order three and weak-field ligands

C. Bond order two and p-acceptor

D. Iso-electronic and weak -field ligands

**Answer: A**

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15. If  $I_2$  is dissolved in aqueous KI, the intense yellow species  $I_3^-$  is formed. The structure of  $I_3^-$  ion is

- A. Square pyramidal
- B. Trigonal bipyramidal
- C. Octahedral
- D. Pentagonal bipyramidal

**Answer: B**

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16. During change of  $NO^+ \rightarrow NO$ , the electron is added to

- A. s orbital
- B. p orbital
- C. s\*orbital

D.  $p^*$  orbital

**Answer: D**

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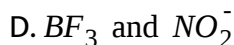
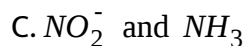
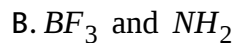
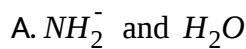
17. When two ice cubes are pressed over each other, they unite to form one cube. Which of the following forces is responsible to hold them together ?

- A. Dipole forces
- B. van der Waal forces
- C. Covalent forces
- D. Hydrogen bond forces

**Answer: D**

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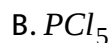
18. In which of the following pairs of molecules/ ions, the central atoms have  $sp^2$ -hybridization ?



Answer: D

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



D.  $I_3$

**Answer: A**

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20. Which of the following species does not exist under normal condition ?

A.  $B_2$

B.  $PCl_5$

C.  $SF_4$

D.  $I_3^-$

**Answer: D**

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21. Some of the properties of the two species,  $\text{NO}_3^-$  and  $\text{H}_3\text{O}^+$  are described below. Which one of them is correct?

- A. Isostructural with different hybridization for the central atom
- B. Similar in hybridization for the central atom with different structures
- C. Dissimilar in hybridization for the central atom with different structures.
- D. Isostructural with same hybridization for the central atom

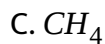
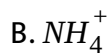
**Answer: C**



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22. In which of the following molecules the central atom does not have  $sp^3$  hybridization ?

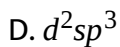
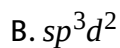
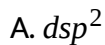
A.  $\text{BF}_4^-$



**Answer: D**

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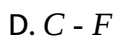
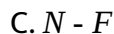
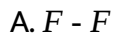
23. The hybridization in  $[CO(NH_3)_6]^{3+}$  is :



**Answer: D**

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24. The polarity of the covalent bond among the following is maximum in

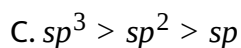
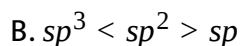
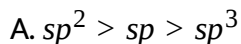


**Answer: D**



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25. The bond angle formed by different hybrid orbitals are in the order



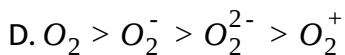
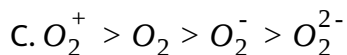
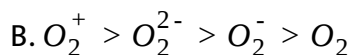
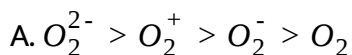


D.  $sp > sp^2 > sp^3$

Answer: D

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26. Choose the correct order regarding the bond order :



Answer: C

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27. How many bridging oxygen atom are present in  $P_4O_{10}$  ?

A. 4

B. 2

C. 5

D. 6

**Answer: D**

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**28.** The correct order of increasing bond length of C - H, C - O, C - C and C = C is

A. C - H  $\lt$  C = C  $\lt$  C - O  $\lt$  C - C

B. C - C  $\lt$  C = C  $\lt$  C - O  $\lt$  C - H

C. C - O  $\lt$  C - H  $\lt$  C - C  $\lt$  C = C

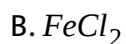
D. C - H  $\lt$  C - O  $\lt$  C - C  $\lt$  C = C

**Answer: A**



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29. Among the following the maximum covalent character is shown by the compound



Answer: C



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30. The shape of  $IF_7$  molecule is

A. Trigonal bipyramid

B. Hexagonal pyramid

C. Pentagonal bipyramid

D. Square bipyramid

**Answer: C**



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**31.** The hybridisation of atomic orbitals of nitrogen in  $NO_2^+$ ,  $NO_3^-$  and  $NH_4^+$  are :

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

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

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

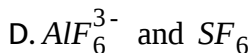
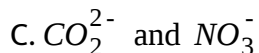
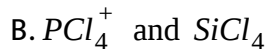
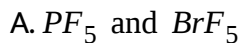
D.  $sp^2$ ,  $sp^3$  and  $sp$  respectively

**Answer: B**



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32. In which of the following pairs, the two species are not isostructural?

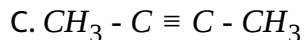
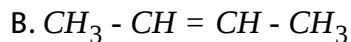
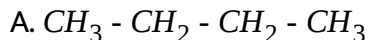


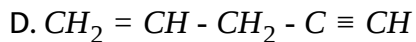
Answer: A



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33. Considering the state of hybridization of carbon atoms, find out the molecule among the following which is linear?

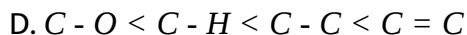




Answer: C

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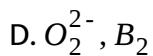
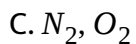
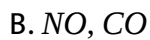
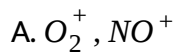
34. The correct order of increasing bond length of C - H, C - O, C - C and C = C is



Answer: B

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35. The pair of species with the same bond order is :



Answer: D



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36. Bond order of 1.5 is shown by:



**Answer: A**

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37. In  $O_2^-$ ,  $O_2$  and  $O_2^{-2}$  molecular species, the total number of antibonding electrons respectively are

A. 6

B. 8

C. 4

D. 2

**Answer: A**

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38. In  $CuSO_{4.5}H_2O$  all Cu- O bond length are not equal. The total number of shorter Cu - O bonds will be



A. 4

B. 1

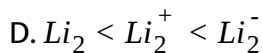
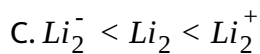
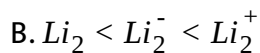
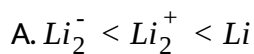
C. 2

D. 3

**Answer: A**

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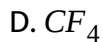
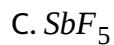
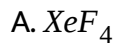
39. Stability of the species  $Li_2$ ,  $Li_2^-$ ,  $Li_2^+$  increases in the order of



**Answer: A**

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40. Which of the following molecule is polar ?

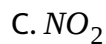
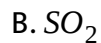
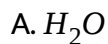


**Answer: B**



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41. Which one of the following molecules contains no  $\pi$  - bond ?



D.  $\text{CO}_2$

**Answer: A**

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**42.** Which of the following is a polar molecule

A.  $\text{SF}_4$

B.  $\text{SiF}_4$

C.  $\text{XeF}_4$

D.  $\text{BF}_3$

**Answer: A**

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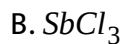
**43.** Which of the following is paramagnetic



**Answer: A**

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**44.**  $XeF_2$  is isostructural with



**Answer: A**

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

- A.  $Cl_2$  and  $CCl_4$
- B. HCl and He atoms
- C.  $SiF_4$  and He atoms
- D.  $H_2O$  and alcohol

**Answer: B**



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46. The correct statement for the molecule  $CsI_3$  is

- A. It contains  $Cs^+$  and  $I_3^-$  ions
- B. It contains  $Cs^{3+}$  and  $I^-$  ions

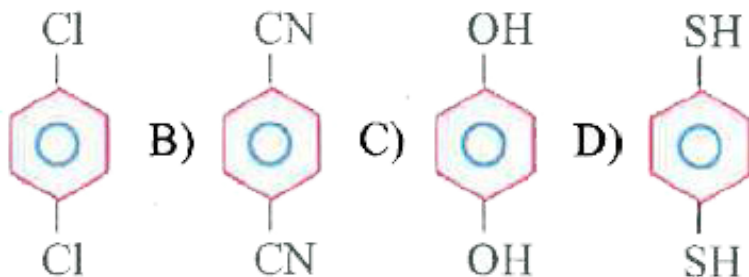
C. It contains  $Cs^+$ ,  $I^-$  and lattice  $I_2$  molecule

D. It is covalent molecule

Answer: A

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47. For which of the following molecule significant  $\mu \neq 0$  ?



A. A and B

B. Only C

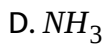
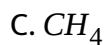
C. C and D

D. Only A

**Answer: C**

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**48.** Which of the following molecules has the maximum dipole moment ?

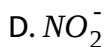
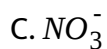


**Answer: D**

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**49.** Which of the following species has plane trigonal shape ?





**Answer: C**

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50. Which of the following organic compounds has same hybridization as its combustion product ( $CO_2$ )?

A. Ethanol

B. Ethane

C. Ethyne

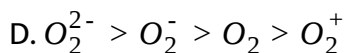
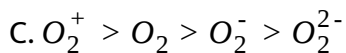
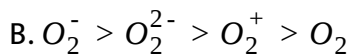
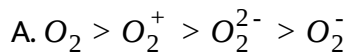
D. Ethene

**Answer: C**

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51. The bond length in  $O_2^+$ ,  $O_2$ ,  $O_2^-$  and  $O_2^{2-}$  follows the order :

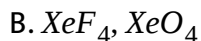
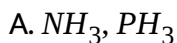


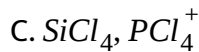
**Answer: C**



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52. In which of the following pairs, both the species are not isostructural?



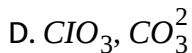
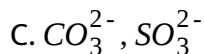
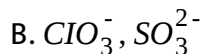
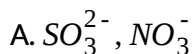


D. diamond, silicon carbide

**Answer: B**

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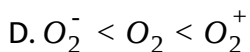
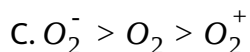
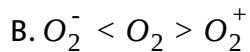
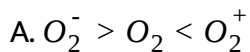
53. Which of the following pairs of ions are isoelectronic and isostructural?



**Answer: B**

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54. Which of the following options represents the correct bond order ?

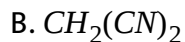
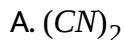


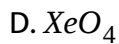
**Answer: D**



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55. Which of the following species contains equal number of pi and pi bonds ?

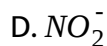
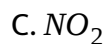
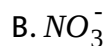




**Answer: D**

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56. Maximum bond angle at nitrogen is present in which of the following ?



**Answer: A**

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57. Which one of the following compounds shows the presence of intramolecular hydrogen bond ?

A. Concentrated acetic acid

B.  $H_2O_2$

C.  $HCN$

D. Cellulose

**Answer: D**



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58.  $AlF_3$  is soluble in  $HF$  only in presence of  $KF$ . It is due to the formation of

A.  $K[AlF_3H]$

B.  $K_3[AlF_3H_3]$

C.  $K_3[AlF_6]$

D.  $AlH_3$

**Answer: C**

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59. The hybridisation of atomic orbitals of nitrogen in  $NO_2^+$ ,  $NO_3^-$  and  $NH_4^+$  are :

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

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

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

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

**Answer: D**

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

- A. The H - C - H bond angle in  $CH_4$ , the H - N - H bond angle in  $NH_3$ , and H - O - H bond angle in  $H_2O$  are all greter than  $90^\circ$
- 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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61. Predicted the correct order among the following

A. lone pair - lone pair gt lone pair - bond pair gt bond pair - bond pair

B. lone pair - lone pair gt bond pair - bond pair gt lone pair - bond pair

C. bond pair - bond pair gt lone pair - bond pair gt lone pair gt lone pair

D. lone pair - bond pair gt bond pair - bond pair gt lone pair - lone pair

**Answer: A**

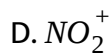
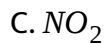
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62. The species in which the N-atom is in a state of  $sp$  hybridisation is

A.  $NO_2^-$

B.  $NO_3^-$



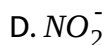
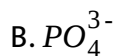
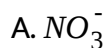


**Answer: D**

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#### Exercise 4

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



**Answer: B**

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2. Nitrogen forms  $N_2$  but phosphorous when forms  $P_2$  gets readily converted into  $P_4$  because

- A. Triple bond present between phosphorous atom
- B.  $p_\pi = p_\pi$  bonding is weak
- C.  $p_\pi - p_\pi$  bonding is strong
- D. Multiple bond form easily

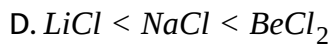
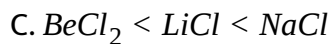
**Answer: B**



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3. The correct sequence of increasing covalent character is represented by

- A.  $BeCl_2 < NaCl < LiCl$
- B.  $NaCl < LiCl < BeCl_2$



**Answer: B**

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4. Which of the following will no give a precipate with  $\text{AgNO}_3$ ?



**Answer: C**

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5.  $AlCl_3$  anhydrous is covalent but  $AlCl_3 \cdot 6H_2O$  is ionic because

A.  $AlCl_3$  dissolves in  $CS_2$

B.  $AlCl_3$  has planar structure

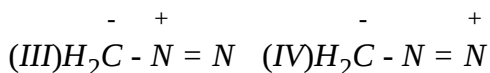
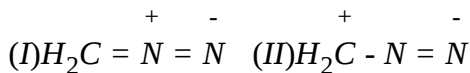
C. IE of Al is low

D. Hydration energy of Al compensates the IE

Answer: D

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6. The correct stability order of the following resonance structures is



A. i gt ii gt iv gt iii

B. i gt iii gt ii gt iv

C. i gt ii gt iiigt iv

D. iii gt i gt iv gt ii

**Answer: B**

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

A. +1

B. -1

C. -0.75

D. +0.75

**Answer: B**

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8. Arrange LiF, NaF, KF, RbF and CsF in order of increasing lattice energy.

A.  $RbF, CsF$

B.  $NaF, NaF$

C.  $CsF, NaF$

D.  $CsF, CsF$

Answer: C



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9. Which of the following are arranged in the decreasing order of dipole moment ?

A.  $CH_3Cl, CH_3Br, CH_3F$

B.  $CH_3Cl, CH_3F, CH_3Br$

C.  $CH_3Br, CH_3Cl, CH_3F$

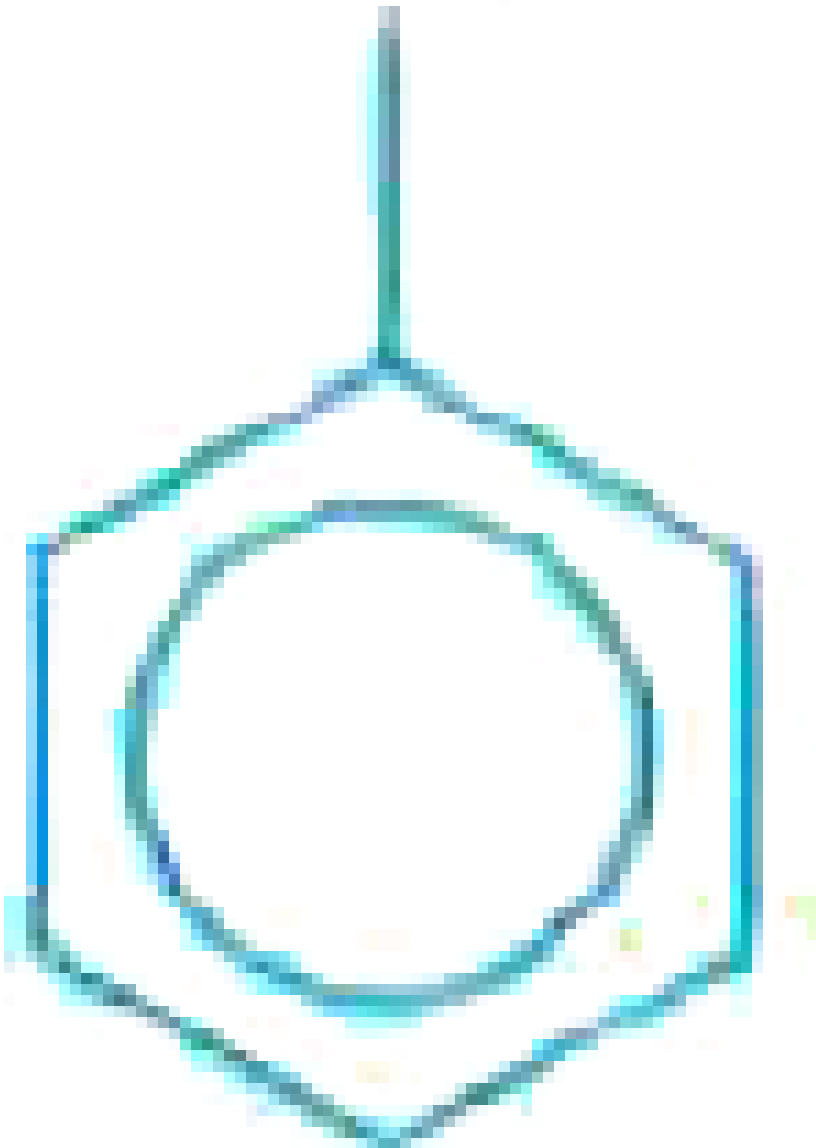
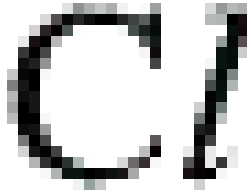
D.  $CH_3Br$ ,  $CH_3F$ ,  $CH_3Cl$

**Answer: B**



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10. The dipole moment of



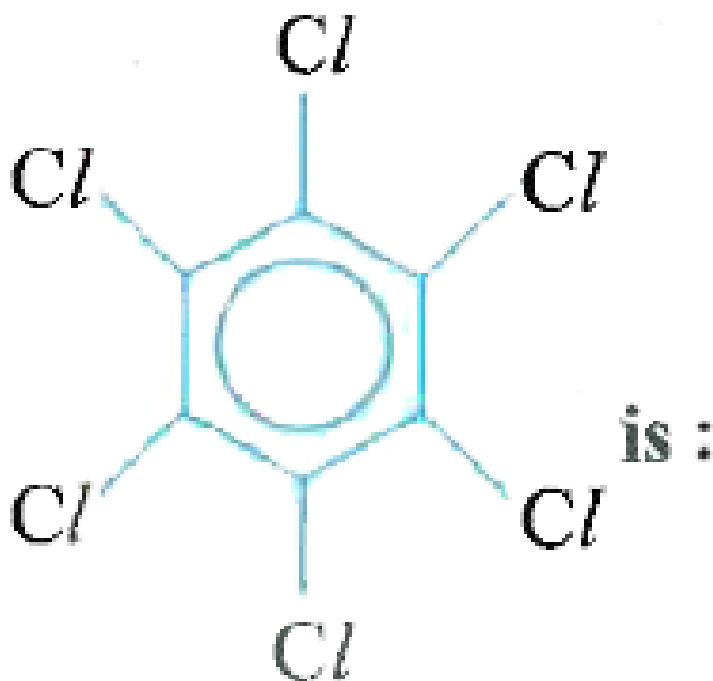
is 1.5 D. The



dipole

moment

of



is:

- A. 0 D
- B. 1.5 D
- C. 2.86 D
- D. 2.25 D

**Answer: A**

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11. The bond angle in  $H_2S$  is

A.  $0.51^\circ$

B.  $1.24^\circ$

C.  $0.72^\circ$

D.  $1.44^\circ$

**Answer: C**



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12. If H - X bond length is  $2\text{\AA}$  and H - X has dipole moment  $5.12 \times 10^{-30}$

coloumb.calculate the % of covalent character of molecule is

A. 1

B. 16

C. 18

**Answer: D**

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**13.** Arrange the following compounds in order of increasing dipole moment .

Toluene (*I*) m-dichlorobenzene (*II*)

o-dichlorobenzene (*III*) . P-dichlorobenzene (*IV*) .

A.  $I < IV < II < III$

B.  $IV < I < II < III$

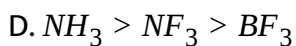
C.  $IV < I < III < II$

D.  $IV < II < I < III$

**Answer: B**

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



**Answer: D**



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15. Which of the following molecule has highest bond energy ?



D. O - O

**Answer: C**

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**16.** In  $\text{NO}_3^-$  ion, the number of bond pair and lone pair of electrons on nitrogen atom are:

A. 2,2

B. 3,1

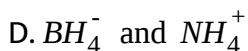
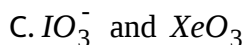
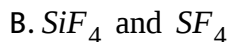
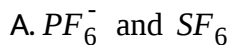
C. 1,3

D. 4,0

**Answer: D**

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



**Answer: B**



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18. In a regular octahedral molecule  $MX_6$  the number of  $X - M - X$  bonds at  $180^\circ$  is

A. Four

B. Three

C. Two

D. Six

**Answer: B**

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19. In an octahedral structure , the pair of d orbitals involved in  $d^2sp^2$  hybridization is

A.  $d_{xy}$ ,  $d_{yz}$

B.  $d_{x^2-y^2}$ ,  $d_{z^2}$

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

D.  $d_{x^2}$ ,  $d_{xz}$

**Answer: B**

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20. In correct statement about the structure of  $PCl_5$

- A. axial P - Cl bonds have more bondlength than equatorial P -Cl bonds
- B.  $d_z^2$  orbital is involved in  $Sp^3d$  hybridization.
- C. The no. of planar atoms in  $PCl_5$  is 4
- D. Phosphorous is in 2nd excited state.

Answer: D



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21. Which statement is incorrect for  $OSF_4$  ?

- A. S atom has  $sp^3d$  hybridization
- B.  $OSF_4$  have distorted trigonal pyramidal geometry
- C. O atom at one of the two axial positions having S = O bond
- D. O atom at one of the equatorial position having S = O bond



**Answer: C**



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**22.** Which of the following statement is/are true

- 1)  $PH_5$  and  $BiCl_5$  donot exist
- 2) p - d bond is present in  $SO_2$
- 3)  $I_3^+$  has geometry
- 4)  $SeF_4$  and  $CH_4$  have same shape

A. 1,2,3

B. 1,3

C. 1 and 2

D. 1,2,4

**Answer: A**



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23. The states of hybridisation of boron and oxygen atoms in boric acid ( $H_3BO_3$ ) are respectively :

A.  $sp^3$  and  $sp^2$

B.  $sp^2$  and  $sp^3$

C.  $sp^2$  and  $sp^2$

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

**Answer: B**



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24. The d-orbital involved in  $sp^3d$  hybridisation is

A.  $3d_{x^2-y^2}$

B.  $3d_{z^2}$

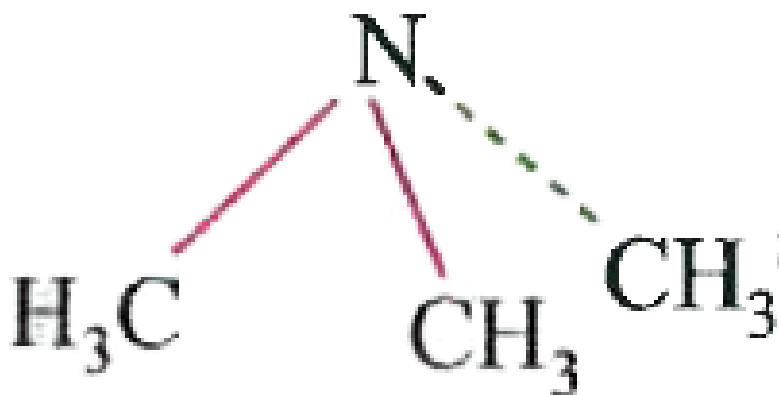
C.  $3d_{xy}$

$$D. 4d_{x^2-y^2}$$

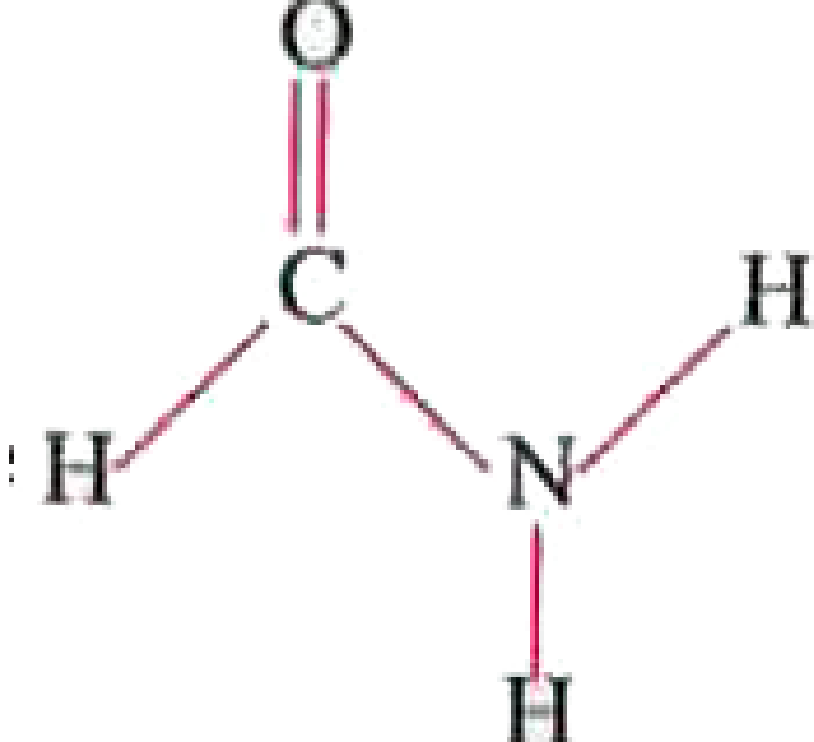
Answer: B

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25. Trimethylamine is a pyramidal molecule



formamide is a planar molecule



the

hybridisation of Nitrogen in both is

A.  $sp^2, sp^2$

B.  $sp^3, sp^2$

C.  $sp^3, sp^3$

D.  $sp^2, sp$

**Answer: B**

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26. Which statement is correct about  $HCHO$  ?

A. It has  $sp^2$  hybridized carbon

B. The bond angles  $\angle HCH$  and  $\angle HCO$  are  $116^\circ$  and  $122^\circ$  respectively

C. It involves multiple bond pair - Bond pair repulsion

D. All of these

Answer: D



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

A.  $dsp^2$ ,  $dsp^3$ ,  $sp^2$  and  $sp^3$

B.  $sp^3$ ,  $dsp^2$ ,  $sp^3d$ ,  $sp^2$

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

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

**Answer: B**

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**28.** Specify the coordination geometry around and the hybridisation of *N* and *B* atoms in 1 : 1 complex of  $BF_3$  and  $NH_3$ .

A. N : tetrahedral,  $sp^3$ , B , tetrahedral,  $sp^3$

B. N : pyramidal,  $sp^3$  , B : pyramidal,  $sp^3$

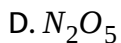
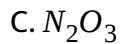
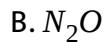
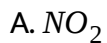
C. N : pyramidal , $sp^3$  , B : planar,  $sp^3$

D. N : pyramidal,  $sp^3$ , B : tetrahedral,  $sp^3$

**Answer: A**

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29. Which of the following is paramagnetic ?



**Answer: A**



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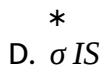
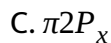
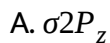
30. The least stable ion among the following is



Answer: B

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31. Which of the following molecular orbital has two nodal planes perpendicular to each other?

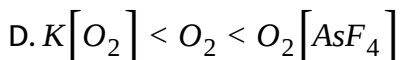
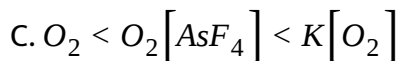
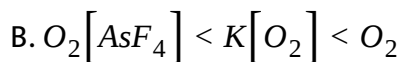
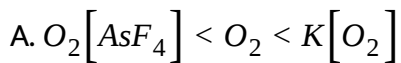


Answer: D

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32. The O - O bond length in  $O_2$ ,  $O_2[AsF_4]$  and  $K[O_2]$  is :

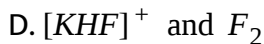
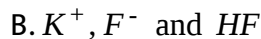
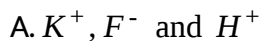




**Answer: A**

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**33.** KF combines with HF to form  $KHF_2$ . The compound contains the species



**Answer: C**



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34. Among the following mixture dipole-dipole as the major interaction is present is

- A. KCl and water
- B. benzene and carbon tetrachloride
- C. benzene and ethanol
- D. acetonitrile and acetone

**Answer: D**



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35. The nodal plane in the  $\pi$ -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 - bond.

**Answer: A**

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**36.** In the dichromate dianion,

A. 4 Cr - O bonds are equivalent

B. 6Cr - O bonds are equivalent

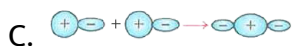
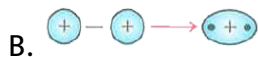
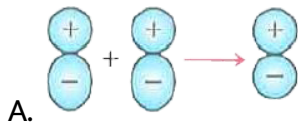
C. All Cr - O bond are equivalent

D. All Cr - O bonds are non equivalent

**Answer: B**

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37. Which of the following overlap is correct?



D. None of these

Answer: A

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38. The values of electronegativity of atom A and B are 1.20 and 4.0 respectively. The percentage of ionic character of A-B bond is nearly

A. 0.5

B. 0.7224

C. 0.553

D. 0.42

**Answer: B**

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

A.  $NF_3$  and  $BF_3$

B.  $BF_4^-$  and  $NH_4^+$

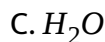
C.  $BCl_3$  and  $BrCl_3$

D.  $NH_3$  and  $NO_3^-$

**Answer: B**

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



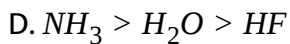
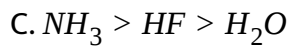
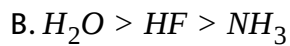
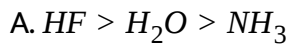
Answer: C



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41. Hydrogen bonds are formed in many compounds e.g.  $H_2O$ ,  $HF$ ,  $NH_3$ .

The boiling point of such compounds depends to a extent on the strength of hydrogen bond and the number of hydrogen bonds. The correct decreasing order of the boiling points above compounds is



**Answer: B**

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

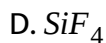
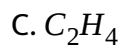
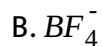
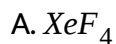


**Answer: C**



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

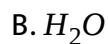


Answer: C



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





C. HI

D. H<sub>2</sub>S

**Answer: B**

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45. Which of the following order of energies of molecular orbitals of N<sub>2</sub> is correct?

A.  $(\pi 2p_y) < (\sigma 2p_z) < (\pi * 2p_x) \approx (\pi * 2p_y)$

B.  $(\pi 2p_y) > (\sigma 2p_z) > (\pi * 2p_x) \approx (\pi * 2p_y)$

C.  $(\pi 2p_y) < (\sigma 2p_z) > (\pi * 2p_x) \approx (\pi * 2p_y)$

D.  $(\pi 2p_y) > (\sigma 2p_z) < (\pi * 2p_x) \approx (\pi * 2p_y)$

**Answer: A**

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

A.  $Be_2$  is not a stable molecule

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

C. Bond strength of  $N_2$  is maximum amongst the homonuclear diatomic molecules belonging to the second period.

D. The order of energies of molecular orbital in  $N_2$  molecule is

$$\sigma 2s < \sigma^* 2s < \sigma 2p_z < (\pi 2p_x = \pi 2p_y) < (\pi^* 2p_x = \pi^* 2p_y) < \sigma^* 2p_z$$

Answer: D



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

A. The hybridisation of central atom is  $sp^2$ .

- B. Its resonance structure has one C - O single bond and two C = O double bonds.
- C. The average formal charge on each oxygen atom is 0.67 units.
- D. All C - O bond lengths are equal.

**Answer: B**

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**48.** Which of the following statement is not correct ?

- A. NaCl being an ionic compound is a good conductor electricity in the solid state.
- B. In canonical structures there is no difference in the arrangement of atoms.
- C. Hybrid form stronger bonds than pure orbitals.
- D. VSEPR Theory can explain the square planar geometry of  $XeF_4$

**Answer: A**

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

A.  $\sigma^* 1s$

B.  $\sigma 2p_z$

C.  $\pi 2p_x$

D.  $\pi^* 2p_y$

**Answer: B**

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**50.** Molecular axis is Z axis , then which of the following combination of orbitals will result in formation of  $\sigma$  molecular orbitals ?



Answer: C

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51. Match the species in Column I with the type of hybrid orbitals in Column II.

Column I	Column II
A. $SF_4$	1. $sp^3d^2$
B. $IF_5$	2. $d^2sp^3$
C. $NO_2^+$	3. $sp^3d$
D. $NH_4^+$	4. $sp^3$
	5. $sp$

A. i-c, ii-a,iii-e, iv-d

B. i-a,ii-b,iii-c,iv-d

C. i-a,ii-b,iii-d,iv-c

D. i-a,ii-c,iii-e,iv-d

**Answer: A**

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

Column I	Column II
A. $\text{H}_3\text{O}^+$	1. Linear
B. $\text{HC}\equiv\text{CH}$	2. Angular
C. $\text{ClO}_2^-$	3. Tetrahedral
D. $\text{NH}_4^+$	4. Trigonal bipyramidal
	5. Pyramidal

A. i-e,ii-a,iii-b,iv-c

B. i-a,ii-b,iii-c,iv-d

C. i-a,ii-b,iii-d,iv-c

D. i-a,ii-c,iii-e,iv-d

**Answer: A**



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**53.** Match the species in Column I with the bond order in Column II.

**Column I**

i) NO

ii) CO

iii)  $O_2^-$

iv)  $O_2$

**Column II**

a) 1.5

b) 2.0

c) 2.5

d) 3.0

A. i-c,ii-d,iii-a,iv-b

B. i-a,ii-b,iii-c,iv-d

C. i-a,ii-b,iii-d,iv-c

D. i-a,ii-c,iii-e,iv-d

Answer: A

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54. Match the items given in column i with example given in Column II

Column I	Column II
A. Hydrogen bond	1. C
B. Resonance	2. LiF
C. Ionic solid	3. H <sub>2</sub>
D. Covalent solid	4. HF
	5. O <sub>3</sub>

A. i-d,ii-e,iii-b,iv-a

B. i-a,ii-b,iii-c,iv-d

C. i-a,ii-b,iii-d,iv-c

D. i-a,ii-c,iii-e,iv-d



**Answer: A**



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