CHEMISTRY

BOOKS - BRILLIANT PUBLICATION

CHEMICAL BONDING AND MOLECULAR STRUCTURE

Question Level I Homework

1. Which of the following molecule/ion violates octect rule ?

A. BF_4^-

B. NCl_3

C. PCl_4^+

D. SF_4

Answer:

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2. In an ionic compound A^+X^- the degree of covalent bonding is greatest when

A. A^+ and X^- are small

B. A^+ and X^- are approximately of the same size

C. A^+ is small and X^- is large

D. A^+ is large and X^- is small

Answer:

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3. The melting points of sodium halides decrease in the order

A. $NaF > NaCl > NaBr > NaI$

B. $NaI > NaBr > NaCl > NaF$

C. $NaF > NaCl > NaI > NaBr$

D. $NaBr > NaF > NaCl > NaI$

Answer:

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4. Which pair is not correct order of lattice energy ?

A. $AlN > MgO$

B. $CaO > BaO$

C. $MgCO_3 > CaCo$

D. $KCl > MgO$

Answer:

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5. Which is the correct statement ? (1) A σ bond has no free rotation around its axis. (2) p orbitals always have only side wise overlap (3) s orbitals cannot form π bonds. (4) There can be more than one σ bond between two atoms.

A. A σ bond has no free rotation around its axis

B. p orbitals always have only sldewise overlap

C. orbitals cannot form π bonds

D. There can be more than one σ bond between two atoms

Answer:

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6. Assume that the internuclear axis is z-axis . What type of bonds can be formed by P_x orbitals ?

A. π bond

B. σ bond

C. δ bond

D. no bond will be formed

Answer:

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7. The hybridisation of central iodine atoms in lF_5, l_3^- and l_3^+ are

A. sp^3d^2, sp^3d, sp^3

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

C. sp^3d, sp^3d, sp^3

D. sp^3d^2, sp^3d, sp^3d

Answer:

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8. Choose the molecules in which hybridisation occurs in ground state

(I) BCl_3

(II) NH_3

(III) PCl_3

(IV) BeF_2 [a] I,II,IV [b] I,II,III [c] II,III [d] III,IV

A. I,II,IV

B. I,II,III

C. II,III

D. III,IV

Answer:

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9. Which of the following is a planar molecule/ion ?

A. $XeOF_4$

B. XeO_4

C. XeO_2F_2

D. CO_3^{2-}

Answer:

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10. Molecular shapes of SF_4, CF_4 and XeF_4 are

A. the same with 2,0 and 1 lone pairs of electrons respectively

B. the same with 1,1 and 1 lone pairs of electrons respectively

C. different with 0,1 and 2 lone pairs of electrons respectively

D. different with 1,0 and 2 lone pairs of electrons respectively

Answer:

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11. The geometrical shape of BrF_5 is similar of that of

A. PCl_5

B. XeF_4

C. PCl_4^+

D. $XeOF_4$

Answer:

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12. In ICl_4^- the shape is square planar.The number of lone pair-bond pair repuision at 90° are

A. 8

B. 6

C. 12

D. 4

Answer:

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13. The bent or V shape of a molecule can be resulted from the hybridisation

A. sp^3

B. sp^2

C. both 1 and 2

D. sp^3d

Answer:

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14. The highest amount of s character is observed in

A. N-H bond of NH_3

B. N-H bond of NH_4^+

C. N-H bond in $H_2N - NH_2$

D. N-H bond HN=NH

Answer:

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15. Which statement is true about the most stable Lewis structure of CS_2 ?

A. There are no lone pairs in the molecule

B. All the bonds are double bonds

C. The central atom does not have octect of electrons

D. Sulphur is the central atom

Answer:

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16. Which of the following has the smallest bond angle?

A. H_2O

B. H_2S

C. NH_3

D. SO_2

Answer:

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17. Which has the maximum bond energy of C-H bond ?

A. $HC \equiv C - H$

B. $H_2C = CH_2$

C. $H - \overset{H}{\underset{H}{C}} - \overset{H}{\underset{H}{C}} - H$

D. CH_3 free radical

Answer:

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18. Which of the following molecules has polar bonds but zero dipole moment ?

A. O_2

B. $CHCl_3$

C. CCl_4

D. O_3

Answer:

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19. If a molecule MX_3 has zero dipole moment, the σ bonding oritals used by Mere

A. pure P

B. sp hybridised

C. sp^2 hybridised

D. sp^3 hybridised

Answer:

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20. Resonance structures can be written for

A. O_3

B. NH_3

C. CH_4

D. H_2O

Answer:

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21. A molecule has 3 reasonating structures with energles E_1, E_2 and E_3 in the order $E_3 < E_2 < E_1$. The experimental energy of the moelcule is E_0. Its resonance energy is

A. $(E_1 + E_2 + E_3) - E_0$

B. $E_0 - E_3$

C. $E_0 - E_1$

D. $E_0 - E_2$

Answer:

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22. The common features of the speces N_2^{2-}, O_2 and NO^- are

A. bond order 3 and isoelectronic

B. bond order 2 and isoelectronic

C. bond order 3 but not isoelectronic

D. bond order 2 but not isoelectronic

Answer:

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23. Which of the following molecule/ion exhibits s-p mixing of orbitals ?

A. B_2

B. C_2^{2-}

C. O_2^+

D. both 1 and 2

Answer:

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24. Which of the following is paramagnetic ?

A. NO^-

B. O_2^{2-}

C. CN^-

D. CO

Answer:

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25. Which of the following has non integral bond order ?

A. O_2^+

B. O_2^-

C. NO

D. all of these

Answer:

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26. Which of the following statements is incorrect ? (1) Decreasing order of stability of O_2, O_2-, O_2+ is $O_2+ > O_2 > O_2-$.(2) He_2 molecule does not exist as the bonding and antibonding effects cancel each other. (3) $C_2, O_2^2-,$ and Li_2 are diamagnetic. (4) In F_2 molecule the energy of σ_{2p_z} is greater than that of $\pi_{2p_x},$ and π_{2p_y}

A. $O_2^+ > O_2 > O_2^-$ decreasing order of bond energy

B. He_2 molecule does not exist as the bonding and antibonding efects cancel each other

C. C_2, O_2^{2-} and Li_2 are diamagnetic

D. In F_2 molecule, the energy of $\sigma_{2_{p_s}}$ is greater than that of π_{2p}, and $\pi_{2_{p_y}}$

Answer:

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27. The decreasing order of boiling points among the following compounds is

A. $SbH_3 > NH_3 > AsH_3 > PH_3$

B. $SbH_3 > AsH_3 > NH_3 > PH_3$

C. $NH_3 > SbH_3 > AsH_3 > PH_3$

D. $PH_3 > NH_3 > SbH_3 > AsH_3$

Answer:

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28. Which of the following properties is not due to hydrogen bond ? (1) High boiling point of water (2) High viscosity of glycerol (3) Solubility of sugar in water (4) Polar nature of HF molecule

A. high boiling point of water

B. high viscosity of glycerol

C. solubility of suger in water

D. polar nature of HF molecule

Answer:

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29. Which of the following molecule is polar and has the central atom with sp^2 hybridisation ?

A. SiF_4

B. BF_3

C. $HClO_4$

D. H_2CO_3

Answer:

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30. Formula of the oxide of a metal M is MO. The formula of its phosphate is

A. M_2PO_4

B. MPO_4

C. $M_2(PO_4)_5$

D. $M_3(PO_4)_2$

Answer:

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Question Level LI

1. Which of the following species are hypervalent ?

(I) ClO_4^-

(II) BF_3

(III) SO_4^{2-}

(IV) CO_3^{2-}

A. I,II and IIII

B. I and III

C. III and IV

D. I and II

Answer:

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2. Pick out the most covalent compound among the following

A. NaCl

B. $PbCl_2$

C. $SnCl_4$

D. $SnCl_2$

Answer:

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3. Give the correct order of initials T or F for the given statements. Use T for true statement and F for false statement:

S1: AgI is less water soluble than AgF due to

more polarisation of l^- compared to F^-

S:2 Melting point of $BaCl_2$ is higher than that of $BeCl_2$ due to higher ionic nature of $BaCl_2$

S3: Order of lattice energy $-NaF < MgO < AlN < SiC$: TTT, TTF, TFT, FTT,

A. TTT

B. TTF

C. TFT

D. FTT

Answer:

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4. Choose the correct order of thermal stability among the following compounds

A.

$$BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$$

B.

$$MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$$

C.

$$CaCO_3 < SrCO_3 < BaCO_3 < MgCO_3$$

D.

$$BaCO_3 < MgCO_3 < CaCO_3 < SrCO_3$$

Answer:

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5. The electronegativities of a atoms D,E,F and G are as follows: D=3.8, E=3.3,F=2.8and G=1.3 If the atoms form molecules DE, DG,EG and DF, the increasing order of covalent character in them is

A. $DG < EG < DF < DE$

B. $DF < DG < DE < EG$

C. $DG < DF < EG < ED$

D. $DE < EG < DG < DF$

Answer:

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6. Formal charges on the three oxygen atoms in ozone molecule are

A. $0, 0+1$

B. $0, +1-1$

C. $-1, +1-2$

D. $0, 0, +2$

Answer:

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7. On decreasing the internuclear distance below the optimum distance (where potential

energy is minimum) there is steep increase in potential energy of a molecule due to

A. increase in force of attraction between electrons and nuclei

B. increase in stability of the bonded atoms

C. equal probability of finding bonding electrons near to either of the nuclei

D. increase in net repulsions in the molecule

Answer:

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8. Allyl cyanide has

A. 9σ bonds and 4π bonds

B. 9σbonds 3π bonds and one lone pair of electrons

C. 8σ bonds and 5π bonds

D. 8σ bonds and 4π bonds

Answer:

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9. A π bond is formed by the overlap of P_x orbitals of two atoms. The atoms can approach along

A. X-axis

B. Y-axis

C. Z-axis

D. Y or Z axes

Answer:

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10. The order of increasing s character (in percentage) in the hybrid orbitals of the following molecules/ions is

I CO_3^{2-}

II XeF_4

III l_3^-

IV NCl_3

(V) $BeCl_2$

A. $l < ll < lll < lV < V$

B. $V < lV > lll < ll < l$

C. $ll < lll < lV < l < V$

D. $lV < l < lll < ll < V$

Answer:

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11. Which of the following represents the given mode of hybridisation of carbon atoms sp^2, sp^2, sp from left to right ?

A. $H_2C = C = C = CH_2$

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

C. $H_2C = CH - CH = CH_2$

D. $H_2C = CH - C \equiv CH$

Answer:

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12. Specify the hybridisation of the central atom in the following species respectively $N_3^-, NOCl, N_2O$

A. sp, sp^2, sp

B. $sp, spsp^3$

C. sp^2, sp, sp^2

D. sp^2, sp^2, sp

Answer:

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13. In which of the following molecules, the central atom uses unhybridised atomic orbitals of bonding ?

A. NH_3

B. H_2O

C. SbH_3

D. BF_3

Answer:

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14. Choose the correct code of characteristics for the given order of hybrid orbitals of the same atom $sp < sp^2 < sp^3$

i. Electronegativity

ii. Bond angles between same hybrid orbitals

iii. Size

iv. Energy

A. I,iii and iv

B. iii,and iv

C. ii and iv

D. I,ii and iii

Answer:

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15. Which of the following is the correct set with respect to molecule, hybridisation and shape ?

A. $BeCl_2$, sp^2 linear

B. $BeCl_2$, sp^2, bent

C. BCl_3, sp^2, trigonal planar

D. BCl_3, sp^3, trigonal pyramidal

Answer:

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16. Which of the following xenon compound has the same number of lone pairs on the central atom as in l_3^- ?

A. XeO_4

B. XeF_4

C. XeF_2

D. XeO_3

Answer:

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17. Choose the pair of compounds which have different hybridisation but same molecular geometry ?

A. Bf_3, BrF_3

B. $lCl_2^-, BeCl_2$

C. BCl_3, PCl_3

D. PCl_3, NCl_3

Answer:

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18. A molecule XY_2 contains 2σ bonds.2π. bonds and one lone pair of electrons in the valence shell of X. The arrangement of bond pairs and lone pairs is

A. Square pyramidal

B. linear

C. trigonal planar

D. trigonal bipyramidal

Answer:

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19. What is the shape of the anion formed when iodine is dissolved in potassium iodide ?

A. linear

B. angular

C. trigonal planar

D. see saw

Answer:

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20. Which of the following statements regarding the structure of $SOCl_2$ is not correct ?

A. Sulphur is in sp^3 hybridisation and $SOCl_2$ has trigonal pyramidal shape

B. The O-S bond has a $p\pi - d\pi$ bond

C. It contains one lone pair of electrons in sp^3 hybride orbital of sulphur

D. Sulphur is in sp^3 hybrid state and $SOCl_2$ is tetrahedral in shape

Answer:

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21. The orbitals used in the hybridisatino of AsF_5 are

A. $dx^2 - y^2, s, Px, Py, Pz$

B. dxy, s, Px, Py, Pz

C. s, Px, Py, Pz, dz^2

D. $s, Px, Py, Pz, dx^2 - y^2$

Answer:

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22. Which among the following molecules cannot produce chlorine on heating ?

A. PCl_5

B. PBr_2Cl_3

C. PF_3Cl_2

D. PBr_3Cl_2

Answer:

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23. The correct order of increasing bond lengths of the following bonds is $C-H$, $C-O$, $C-C$,$C=C$

A. $C-H<C-O<C-C<C=C$

B. $C-H<C=C<C-O<C-C$

C. $C-C<C=C<C-O<C-H$

D. $C-O<C-H<C-C<C=C$

Answer:

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24. bond angle is maximum in?

A. NH_3

B. NH_4^-

C. PCl_3

D. SCl_2

Answer:

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25. The bond having highest bond energy is

A. $C = O$

B. $C = C$

C. $C = S$

D. $P = N$

Answer:

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

A. BF_3

B. NH_3

C. NF_3

D. CH_4

Answer:

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27. Which of the followng is a polar molecule

A. 1,4-dichlorobenzene

B. cis-1,2-dichloro ethene

C. trans 1,2-dichloro ethene

D. Benzene

Answer:

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28. A diatomic molecule has dipole moment 1.2 D and its bond length is $1A^{\circ}$ the percentage of electronic charge on each atom will be

A. $10\ \%$

B. $35\ \%$

C. 25 %

D. 50 %

Answer:

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29. Which of the following is not true about resonance?

A. The resonance structures are hypothetical

B. The number of unpaired electrons in various resonating structures of a molecule should be the same

C. Hybrid structure is more energetic than any one of the resonating structures

D. Hybrid structure is more stable than anyone of the resonating structures

Answer:

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30. Which of the following canonical structures cannot represent resonance forms of N_2O molecule ?

(I) : $\dot{\dot{N}} = N = \dot{\dot{O}}$:

(II) : $N \equiv N - \underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}$:

(III) : $\underset{\cdot\cdot}{\overset{\cdot\cdot}{N}} - N \equiv O$:

(IV) : $\dot{\dot{N}} = O = \dot{\dot{N}}$: (A) I and II (B) II, III and IV

(C) IV (D) III and IV

A. I and III

B. II, III and IV

C. IV and V

D. III and IV

Answer:

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31. The species haing no $p\pi - p\pi$ bond but has bond order equal to that of O_2^- is

A. ClO_3^-

B. PO_4^{3-}

C. SO_4^{2-}

D. XeO_3

Answer:

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32. Pick out the incorrect statemnet ?

A. N_2 has higher dissociation energy than N_2^+

B. O_2 has lower dissociation energy than O_2^+

C. Bond length in N_2^+ is less than that in N_2

D. Bond length in NO^+ is less than that in NO

Answer:

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33. Two π and half sigma bonds are present in

A. N_2^+

B. N_2

C. O_2^+

D. O_2

Answer:

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34. In which of the following processes, the bond order has increased and paramagnetic character has changed to diamagnetic ?

A. $N_2 \rightarrow N_2^+$

B. $NO \rightarrow NO^+$

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

D. $O_2 \rightarrow O_2^+$

Answer:

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35. Assuming $2s - 2p$ mixing is not operative, the paramagnetic specles among the following is

A. Be_2

B. B_2

C. C_2

D. N_2

Answer:

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36. Which of the following statements is/are correct on the basis of hydrogen bond ? (1) KHF2 exists but KHCl2 does not. (2) Boiling

point order of hydrogen halides is HF>HI>HBr>HCl (3) CCl3 CH (OH) 2 and o-nitrophenol show intermolecular hydrogen bond (4) All are correct

A. KHF_2 exists but $KHCl_2$ does not

B. Boiling point order of hydrogen halides is $HF > Hl > HBr > HCl$

C. $CCl_3CH(OH)_2$ and o-nitrophenol show intermolecular hydrogen bond

D. All are correct

Answer:

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37. Which of the following statements is/are correct ?

A. OF_4 molecule and F_3^- ion do not exist

B. C-C bond length in $FH_2C - CH_2F$ is longer than in $F_2HC - CHF_2$

C. Among $O_2, O_2^+, O_2^-, O_2^{2-}$ the stability is in the order $O_2^+ > O_2 > O_2^- > O_2^{2-}$

D. All are correct

Answer:

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38. Assertion: H_2 molecule is more stable than $He - H$molecule.

Reason: The antibonding electron in $He - H$

molecule decreases the bond order and thereby stability

A. If both asssertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer:

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39. Assertion: CCl_4 molecule is not hydrolysed by water

Reason Carbon atom is sp3 hybridised in CCl_4

A. If both asssertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer:

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40. Assertion : Statement -1 : The direction of dipolemoment in CO molecule is from oxygen to carbon

Reason : Statement - 2 : The contribution of co-ordinate π bond is more compared to electronegativity factor in the overall polarity of the molecule. (1) Statement-1 is true , statement -2 is true and statement-2 is the correct explanation for statement - 1. (2) Statement-1 is true, statement -2 is not the correct explanation for statement -1 . (3)

Statement -1 is true, statement 2- is false (4)

Statement -1 is false , statement-2 is true

A. If both asssertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer:

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41. Assertion : Both PCl_5 and BrF_5 molecules have identical shape.

Reason : P in PCl_5 and Br in BrF_5 are in same hybridisation.

A. If both asssertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer:

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42. Assertion: Density of ice is less than that of water.

Reason: In ice H_2O molecules are more closely packed than in water.

A. If both asssertion and reason are true and reason is the correct explanation of assertion

B. If both assertion and reason are true but reason is not the correct explanation of assertion

C. If assertion is true but reason is false

D. If both assertion and reason are false

Answer:

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